Typact TPD32

DC Driver

Instruction Manual

Thank you for choosing this SIEI product.

We will be glad to receive any possible information which could help us improving this manual. The e-mail address is the following: techdoc@siei.it.

Before using the product, read the safety instruction section carefully.

Keep the manual in a safe place and available to engineering and installation personnel during the product functioning period.

SIEI S.p.A has the right to modify products, data and dimensions without notice.

The data can only be used for the product description and they can not be understood as legally stated properties.

This manual is updated according the software version V.9.X00.

Variation of the number replacing "X" have no influence on the functionality of the device.

The identification number of the software version can be read on the converter nameplate or on the label on the EPROM memories mounted on the regulation card.

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1. SAFETY PRECAUTIONS

According to the EEC standards the converters of the series TPD32 and accessories must be used only after checking that machine has been produced using those safety devices required by the 89/392/EEC set of rules, as far as the machine industry is concerned.

- Systems used during automation procedures cause mechanical movements. The user must make sure that such mechanical movements do not create any unsafety condition. He has therefore to foresee safety blocks and operative limits which can not be bypassed or overcome.

WARNING - FIRE AND SHORT CIRCUIT DANGER

By using devices such as oscilloscopes which have to be connected to under voltage equipments, the oscilloscope chassis has to be grounded and a differential amplifier has to be used. In order to obtain precise reading procedures, choose your probes and pins with care and pay attention to the oscilloscope regulation.

As for a correct use of the device and the equipment regulation see the producer instruction manual.

WARNING - FIRE AND EXPLOSION DANGER

The installation of a converter in explosion-risk areas, where inflammable materials, fuel vapors or powders are present, could cause fires or explosions. The converters have to be placed far from such risk areas even though their motors are suitable to be used in such conditions.

WARNING - DANGER OF PERSONAL INJURIES

If the devices are not transported or lifted with suitable means, they can cause severe or fatal damages. The device has to be lifted by a trained staff using suitable tools.

WARNING - DANGER OF ELECTRIC SHOCK

Motors and converters have to be ground connected according to the national electric rules.

WARNING:

Place all the covers before applying voltage to the device. The non-fulfillment of such warning may cause severe personal injuries or death.

WARNING:

Do not connect power supply voltages exceeding the allowed voltage field. If exceeding voltages are applied to the converter, some internal components will be damaged.

WARNING:

Converter are electrical appliances for use in heavy current installations. Parts of the converter are energized during operation.

The electrical installation and the opening of the device should therefore only be carried out by qualified personnel. Improper installation of motor or converters may therefore cause the failure of the device as well as serious injury to people or material damage.

Follow the instructions given in this manual and observe the local and national safety regulations applicable.

WARNING:

The converter can not be started without the ground connection. In order to prevent any noise, the motor chassis has to be grounded with a ground cable different from all the others.

The ground cable has to be dimensioned according to the national electric rules and it must be fixed using the pliers suggested by the cable producer.

WARNING:

Do not carry out the isolation test among the converter or control circuit terminals.

WARNING:

Do not install the converter in places where the temperature is higher than the one allowed by the specifications: the ambient temperature has a great influence on the duration and the reliability of the device.

WARNING:

When the converter shows an alarm condition, refer to the chapter TROUBLESHOOTING and start the operation again only when the alarm cause has been removed. Do not reset the alarm automatically via an external sequence etc.

WARNING:

Remove the bags containing anti-drying agents while unpacking the device (if such bags are not removed, they could end up into the fans or they could obstruct the cooling openings, thus causing the converter overheating).

The device has to be fixed to a wall built with warm-resistant materials. During its functioning the temperature of the cooling heatsinks can reach 90°C.

NOTES: In the industrial sector the words "Converter", "Drive" and "Device" are often interchanged.

1. Never open the device while the AC input supply is switched on. Wait for at least one minute before working on the terminals or inside the device.
2. Do not touch or damage any components when handling the device. The changing of the isolation gaps or the removing of the isolation and covers is not permissible. If the front plate has to be removed because of a room temperature between 40° - 50° C, the user has to check that no occasional contact with energized parts may occur.
3. Protect the device from impermissible environmental conditions (temperature, humidity, shock etc.)
4. No voltage should be connected to the output of the converter (terminals C and D). The parallel connection of several motors on a converter output is not permissible.
5. When engaging a running motor, the Auto capture function (Auto capture in the ADD SPEED FUNCT menu) must be activated.
6. A capacitative load (e.g. phase compensation capacitors) should not be connected to the output of the converter (terminals C and D).
7. Always connect the converter to the protective earth ground (PE ground) via the connection terminals marked and the housing. The discharge current to earth ground is greater than 3.5 mA. According to EN 50178 the ground connection has to be a fixed one (it can not be sectioned).
8. The electrical commissioning should only be carried out by qualified personnel, who are also responsible for the provision of a suitable earth ground and a cable protection for the power supply in accordance with the local and national regulations. The motor must be protected against overloads.
9. No discharge current tests should be carried out on parts of the converter. A suitable measuring instrument (internal resistance of at least 10 kΩ/V) should be used for measuring the signal voltage.
10. When the drive is stopped, but it has not been disconnected from the main via the main contactor, it is not possible to exclude the accidental movement of the motor shaft when a failure occurs.
11. The installer must provide overload protection for the motor.

WARNING!

This equipment is suitable for use on a circuit capable of delivering not more than the rms symmetrical amperes, 500 volts maximum, shown in the table below

Converter size	Short circuit current
20 ... 70 A	5 kA
110 ... 280 A	10 kA
350 ... 650 A	18 kA
770 A	30 kA
1000 ... 1050 A	42 kA

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2. COMPONENT IDENTIFICATION AND SPECIFICATIONS

2.1. GENERAL

A converter transforms the constant voltage of an existing three-phase power supply into a direct voltage, in order to regulate the speed and/or the torque of a direct current motor with a separate excitation.

The available TPD32 converters are of two types:

TPD32...2B	for a two quadrant functioning
TPD32...2B	for a four quadrant functioning

The default version of a converter includes the presence of a power supply circuit for the adjustable field; in this way the motors can operate with a mixed armature or field regulation, without adding other devices.

Each type includes three series of devices, which differ the one from the other because of the max. power supply voltage:

TPD32-400/...;	AC input supply voltage up to 400 V, 3Ph
TPD32-500/...;	AC input supply voltage up to 500 V, 3Ph
TPD32-690/...;	AC input supply voltage up to 690 V, 3Ph

The basic technical data of a converter are stated in the type code and on the identification nameplate.

Example: **TPD32-400/470-280-2B**

TPD32	TYPACT converter, three phase supply	
400	Mains voltage	U_{LN} in Volt
470	Rated armature voltage	U_{dN} in Volt
280	Rated armature current	I_{dN} in Ampere
2B	Functioning	2B = two quadrant 4B = four quadrant

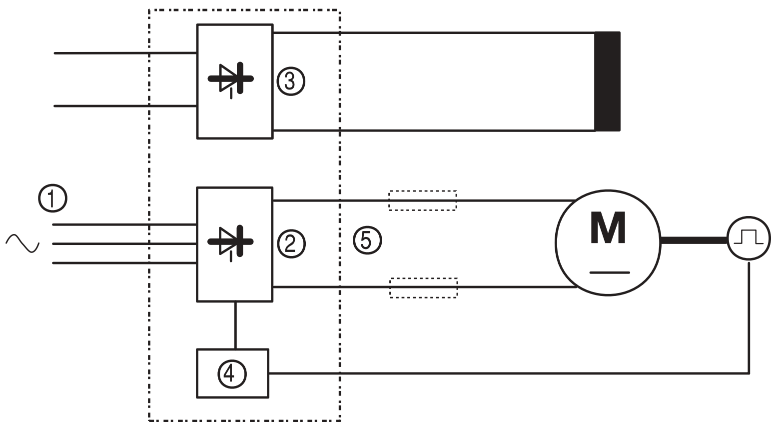

Figure 2.1: Base diagram of a converter

① AC input supply voltage (U_{LN}):	230 V, 3Ph, 50/60 Hz 400 V, 3Ph, 50/60 Hz 460 V, 3Ph, 50/60 Hz 500 V, 3Ph, 50/60 Hz 690 V, 3Ph, 50/60 Hz
② Armature converter:	Totally controlled three-phase bridge. It converts the alternating voltage into a direct voltage. (Double bridge for TPD32...4B...)
③ Field converter:	Semi-controlled single-phase bridge
④ Programmable control section:	Control and regulation cards of the power section. Commands, references and feedbacks are connected to them.
⑤ Output voltage (U_{dN}):	Direct voltage changing from 0 to U_{dN}
Output rated current (I_{dN}):	20.... 3300 A [for a max. ambient temperature of 40°C]

The converters of TPD32 series are available in the following versions:

TPD32-400/420-...-4B	Four quadrant converter for AC input voltage up to 400 V
TPD32-400/470-...-2B	Two quadrant converter for AC input voltage up to 400 V
TPD32-500/520-...-4B	Four quadrant converter for AC input voltage up to 500 V
TPD32-500/600-...-2B	Two quadrant converter for AC input voltage up to 500 V
TPD32-690/720-...-2B	Four quadrant converter for AC input voltage up to 690 V
TPD32-690/890-...-4B	Two quadrant converter for AC input voltage up to 690 V

The available size are listed in the following table:

Table 2.1.1: Converter sizes

Description	Type		Rated dc current
	4B	2B	[A]
TPD32-.../...-20-..	•	•	20
TPD32-.../...-40-..	•	•	40
TPD32-.../...-70-..	•	•	70
TPD32-.../...-110-..	•	•	110
TPD32-.../...-140-..	•	•	140
TPD32-.../...-185-..	•	•	185
TPD32-.../...-280-..	•	•	280
TPD32-.../...-350-..	•	•	350
TPD32-.../...-420-..	•	•	420
TPD32-.../...-500-..	•	•	500
TPD32-.../...-650-..	•	•	650
TPD32-.../...-770-..	•	•	770
TPD32-.../...-1000-..		•	1000
TPD32-.../...-1050-..	•		1050

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NOTE! The converter sizes up to 1000A "B / 1050A 4B are made by compact execution. The drive of higher sizes and with a main power supply at 690V are made by a regulation section and an external bridge.The technical data of those versions are indicated on "Addendum TPD32 External Bridge" manual.

The converter choice is made on the basis of the motor rated current and of the available AC input voltage. The output rated current must be higher or equal to the one required by the used motor.

Functions and features (Overview)

The devices of the TPD32 series are developed as converters with excellent regulation features and a wide function range.

Integrated field converter.

Galvanic separation and high impedance between the power and the regulation section.

Galvanic separation between the regulation section and the digital I/O terminals.

Differential analog inputs.

Diagnostic LED module (KC) supplied as a standard and mounted an the drive front cover

Removable optional Keypad (KB)

START UP menu which makes set-up easier.

Simple operation of the device
- via terminal strip
- via keypad with a back-lit keypad
- via a default set PC program and RS485 serial interface
- via a connection with a Field Bus (option), INTERBUS S with a DRIVECOM profile, and PROFIBUS DP.

Stored messages concerning the last 10 faults and indication of the operation time.

Separate configuration of the drive behaviour for each message in an alarm situation.

Automatic change into an armature feedback because of the interruption of the feedback signal (only in constant torque mode).

Overload control

Three freely configurable analog inputs on the standard device.

Widening of digital inputs and of digital, analog outputs via a option card.

Reference assignation and display of the feedback values as a percentage or in a dimension which can be defined by the user.

Possibility of a speed and torque regulation

Adaptive of the speed regulator

Current predictive regulator with an automatic adaptation.

Motor potentiometer function (increase / decrease speed command).

Jog function.

8 internal speed references.

5 internal linear or S-shaped ramps.

Internal signal conditioning (gains, min/max limits, offset ...).

Function widening available for specific applications (option).

2.2. STORAGE, TRANSPORT

A high degree of care is taken in packing the converters of the TPD32 series and preparing them for delivery. They should only be transported with suitable transport equipment (see weight data). Observe the instructions printed on the packaging.

This also applies when the device is unpacked up to when it is installed in the control cabinet.

On delivery check the following:
- the packaging for any external damage
- whether the delivery note matches your order.

Open the packaging with suitable tools. Check whether
- any parts were damaged during transport
- the device type corresponds to your order

In the event of any damage or of an incomplete or incorrect delivery please notify the sales offices responsible immediately.

The devices should only be stored in dry rooms within the temperature ranges specified.

NOTE! A certain degree of moisture condensation is permissible if this arises from changes in temperature (see section 3.1, “Permissible Ambient Conditions”) This does not, however, apply when the devices are in operation. Ensure always that there is no moisture condensation in devices that are connected to the power supply!

2.2.1. Device setting

The converters of the TPD32 series can operate connected to an AC input three-phase voltage from 230V to 690V. Inside this voltage range the device setting is carried out on the basis of the motor rated current.

Therefore the converter rated current must be higher or the same as the motor rated one.

If an overload is necessary, the setting is carried out according to the example mentioned in section 6.14.5, “Overload control”, so that the overcurrent must not be supplied in a continuative way from the type of the chosen converter.

NOTE! A reduction factor should be considered if the converter is installed at altitudes of over 1000 m above sea level and at higher temperatures (see section 3.1, “Permissible ambient conditions”).

Example for a 15 kW motor

AC input voltage: 400 V, 3Ph

<u>1. Two quadrant functioning</u>

Nameplate data:	Power	15 kW
	Armature Voltage	470 V_{DC}
	Armature Current	37,6 Amps
	Field Voltage	310 V_{DC}
	Field Current	0,8 Amps
Choice criteria:	400 V, 3Ph	see section “AC Input”
	37,6 A < 40 A	see section “AC Output”
	0,8 A < 10 A	see section “AC Output”
Chosen converter:	TPD32-400/460-40-2B	

The converter can supply 1,06 of motor rated current continously. If higher overload values are required, see section “Overload control”.

2. Four quadrant functioning

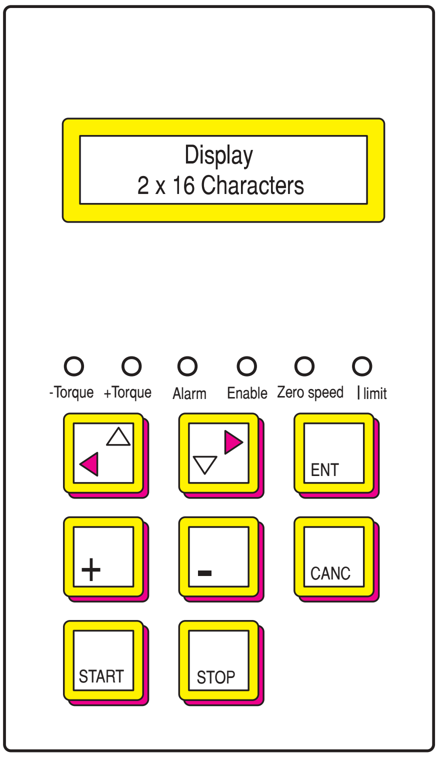
Nameplate data:	Power	15 kW
	Armature Voltage	420 V_{DC}
	Armature Current	42 Amps
	Field Voltage	310 V_{DC}
	Field Current	0,8 Amps
Choice criteria:	400 V, 3Ph	see section “AC Input”
	42 A < 70 A	see section “AC Output”
	0,8 A < 10 A	see section “AC Output”
Chosen converter:	TPD32-400/460-70-4B	

The converter can supply 1,66 of motor rated current continously. If higher overload values are required, see section “Overload control”.

2.3. DRIVE KEYPAD DESCRIPTION

Programming keypad KB

The keypad is made of a LCD display with two 16- digit lines, of 8 function buttons and contains six leds for an easy monitoring of the converter status.



It is used:

- to command the drive when this system has been selected
- to display the speed, the voltage ..... during the operating time
- to set parameters

LED module KC

In the standard delivery the convert is supplied with the led module mounted on the front cover.

It contains six leds for an easy monitoring of the converter status.

The KC module can be manually removed and replaced with the Keypad, which is connected to the regulation board through the dedicated connector.

On the Keypad, which is supplied as optional, the same leds at the KC module are mounted.

Table 2.3.1: Diagnostics LEDs

Designation	Color	Function
- Torque	yellow	The LED is lit, when the drive operates with a negative torque (counter-clockwise rotation or clockwise braking). Only for TPD32-...-4B
+ Torque	yellow	The LED is lit, when the drive operates with a positive torque (clockwise rotation or counter-clockwise braking). Braking only forTPD32-...-4B
Alarm	red	The LED is lit, it signals the intervention and the alarm condition
Enable	green	The LED is lit, when the converter is enabled
Zero speed	yellow	The LED is lit, when the speed is lower than the threshold set by Speed zero level
I limit	yellow	The LED is lit, when the converter operates at a current limit

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2.4. SPECIFICATIONS

2.4.1. Standards

General norms:	EN 61800-1, EN 50178
Climatic conditions:	IEC 68-2 Part 2 and 3 (EN 60068-2-2, test Bd)
Isolations distances:	IEC 664, IEC 664 A; degree of pollution 2
Interference immunity:	EN 61000-4-4 Interference immunity level 4
	EN 61000-4-2 Interference immunity level 6 kV CD / 8 kV AD.
Oscillation test:	EN 60068-2-6, test Fc
EMC compatibility:	EN 68100-3, following the instructions contained in the attached “Guide to the electromagnetic compatibility”
Safety:	EN 50178
Protection degrees:	According to EN 60529
UL Approval:	According to file N. E183859 for the series of the approved devices.

2.4.2. AC Input

Table 2.4.2.1: AC input voltages

<table>
<tr><th>Devices series</th><th>Power section
(Terminals U/V/W)</th><th>Field circuit
(Terminals U1/V1)</th><th>Power supply regulation
(Terminals U2/V2)</th></tr>
<tr><td>TPD32-400/...</td><td>230 V ±10 %*, 3Ph
400 V ±10 %*, 3Ph
50/60 Hz ±5 %</td><td rowspan="2">230 V ±10 %*, 1Ph
400 V ±10 %*, 1Ph
460 V ±10 %, 1Ph
50/60 Hz ±5 %</td><td rowspan="2">115 V ±15 %**, 1 Ph
or
230 V ±15 %**, 1Ph
50 / 60 Hz ±5 %</td></tr>
<tr><td>TPD32-500/...</td><td>230 V ±10 %*, 3Ph
400 V ±10 %*, 3Ph
440 V ±10 %, 3Ph
460 V ±10 %, 3Ph
480 V ±10 %, 3Ph
500 V ±10 %, 3Ph
50/60 Hz ±5 %</td></tr>
</table>

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* With the indicated tolerance values the output voltage complies the DIN40030 standard. With wider tolerances the max output voltage changes accordingly.

**** To work at 115 V with drives from 280 A a jumper between terminals SA-SB (placed on the rear size of the drive) must be inserted.**

During start-up the threshold for the undervoltage message of the power section can be set via the **Undervolt thr** parameter (standard: 230 V).

NOTE! According the input voltage the switch S8 on the regulation board must be set as follows:

TPD32-400/...	S8.7 = OFF	S8.8 = OFF
TPD32-500/...	S8.7 = ON	S8.8 = OFF
TPD32-690/...	S8.7 = OFF	S8.8 = ON

NOTE! As for the operation of the TPD32 converters AC input reactors and interference suppression filters are required. See section 4.9, “Reactors/Filters”.

The converters above 770 A and the AC input reactors have a discharge currents to earth ground higher than 3.5 mA. For leakage currents higher than 3.5 mA, the norms EN 50178 require a fixed connection not to be sectioned.

CAUTION! Due to the increased discharge current involved a fixed ground connection (without connectors) for the filters of the TPD32 converter is required.

Current / Power on the AC input

NOTE! The values showed on table below are refered to a converter functioning at nominal current I_{dN} (armature) and I_{FN} (field).

Table 2.4.2.2: AC input currents

Device	Current on the AC Input	Current on the field AC Input	Regulation Power Supply			
			Card	Power	Input current	
					115 V	230 V
TPD32-.../...-20-..	17,2 A	10 A	SW1-31	70 W	1 A	0,5 A
TPD32-.../...-40-..	34,4 A	10 A				
TPD32-.../...-70-..	60,2 A	10 A				
TPD32-.../...-110-..	94,6 A	14 A				
TPD32-.../...-140-..	120,4 A	14 A				
TPD32-.../...-185-..	159,1 A	14 A				
TPD32-.../...-280-..	240,8 A	20 A	SW2-32	110 W	1,2 A	0,7 A
TPD32-.../...-350-..	301 A	20 A				
TPD32-.../...-420-..	361,2 A	20 A				
TPD32-.../...-500-..	430 A	20 A				
TPD32-.../...-650-..	559 A	20 A				
TPD32-.../...-770-..	662,2 A	25 A	SW3-32	110 W	1,2 A	0,7 A
TPD32-.../...-1000-..	860 A	25 A				
TPD32-.../...-1050-..	903 A	25 A				

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2.4.3. Output

NOTE! It is not possible to connect an external voltage to the converter output terminals! It is not even possible to disconnect the motor from the device output while the drive is active.

In normal cases no leveling choke is necessary. It must be taken into account, anyway, that some motor producers prescribe such a choke according to the type of the motor used. In this case it must inserted on the motor cable.

The stated currents refer to the continuative operation with an ambient temperatrue of 40° C.

Output current

Armature circuit

Table 2.4.3.1: Output currents

Device	Armature converter (Terminals C / D)		Field converter (TerminalsC1 / D1)
	Continuous current with Ambient temp 40°C*	Max. current (with overload) **	Continuous current with Ambient temp 40°C*
TPD32-.../...-20-..	20 A	40 A	10 A
TPD32-.../...-40-..	40 A	80 A	10 A
TPD32-.../...-70-..	70 A	140 A	10 A
TPD32-.../...-110-..	110 A	220 A	14 A
TPD32-.../...-140-..	140 A	280 A	14 A
TPD32-.../...-185-..	185 A	370 A	14 A
TPD32-.../...-280-..	280 A	560 A	20 A
TPD32-.../...-350-..	350 A	700 A	20 A
TPD32-.../...-420-..	420 A	840 A	20 A
TPD32-.../...-500-..	500 A	1000 A	20 A
TPD32-.../...-650-..	650 A	1300 A	20 A
TPD32-.../...-770-..	770 A	1540 A	25 A
TPD32-.../...-1000-..	1000 A	2000 A	25 A
TPD32-.../...-1050-..	1050 A	2100 A	25 A

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* Current reduction for highter temperatures (see “Permissible ambient condition”)

** The overload size and duration depend an the overload cycle, (see section “Overload control”)

NOTE! The field motor current can sometimes be very small compared with rated field current of the converter. In order to provide regulation during field weakening of the motor, follow the described instructions to change the max field current of the converter. In this case the **Nom Flux curr** parameter must be set with the new rated field current value.

Field circuit

The regulation card of the TPD32 converter is supplied with a field circuit setting equal to the rated size of the internal field converter (see table 2.4.2.2.). Via the switch S14 it is possible to select different maximum setting values of the field current.

Compare the field current value of the connected motor to the rated value of the internal field converter of TPD32 (see table 2.4.3.1); set afterwards the best value according to the following prescriptions.

- By acting with a stable field current, if the motor rated field current is £ 10%, it is necessary to adapt the field current via the switch S14.
- By acting with a field weakening control, it is also necessary to refer to the CEMF value or to the crossover datum. If the maximum field current is £ 10% of the maximum value of the internal field converter, it is necessary to adapt the feedback via the switch S14.

In the above mentioned conditions the precise calibration of the field current is not required.

The calibration is not required if the field control on the motor is carried out externally to the internal field converter of TPD32.

In order to obtain a current setting value different from those stated in the table, use the following formula to calculate the resistance to be used between the terminals LA and LB on the regulation card. In this case all the switches have to be set to zero (OFF).

TPD32 Rev. 7.1 and higher; resistance for the field current calibration.

For sizes TPD32-.../...-20... up to TPD32-.../...-1050... : Resistance = 1667 / field current (A)

Table 2.4.3.2: Field current resistors

Switch ohms	148 ohm	330 ohm	182 ohm	36.4 ohm	845 ohm	1650 ohm	**Equivalent resistance**
Field curr scale	**S14-1**	**S14-2**	**S14-3**	**S14-4**	**S14-5**	**S14-6**	
1.0 A	OFF	OFF	OFF	OFF	OFF	ON	1650 ohm
2.0 A	OFF	OFF	OFF	OFF	ON	OFF	845 ohm
3.0 A	OFF	OFF	OFF	OFF	ON	ON	558.8 ohm
5.0 A	OFF	ON	OFF	OFF	OFF	OFF	330 ohm
10.0 A	ON	OFF	OFF	OFF	OFF	OFF	168 ohm
12.9 A	ON	OFF	OFF	OFF	ON	ON	129.2 ohm
17.2 A	OFF	ON	ON	OFF	ON	ON	97 ohm
20.0 A	ON	OFF	ON	OFF	OFF	ON	83 ohm
24.1 A	ON	ON	ON	OFF	OFF	OFF	69 ohm

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Output voltage

The below mentioned output voltages take into account an AC input undervoltage within the stated tolerance limits and a voltage drop of 4% due to the inserted AC input reactors. It is the same as the rated armature voltage suggested for the connected motor.

Armature circuit

Table 2.4.3.3: Armature circuit output voltages

AC Input voltage (Terminals U / V / W)	**Output Armature voltage (Terminals C / D)**	
	Two quadrant converter	**Four quadrant converter**
230 V ±10 %, 3Ph	260 V	240 V
400 V ±10 %, 3Ph	470 V *	420 V *
440 V ±10 %, 3Ph	530 V	460 V
460 V ±10 %, 3Ph	560 V	480 V
480 V ±10 %, 3Ph	580 V	500 V
500 V ±10 %, 3Ph	600 V *	520 V *

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* Voltage measured as per DIN 40 030 (09/93)

Field circuit

Table 2.4.3.4: Field circuit output voltages

AC input voltage (Terminals U1 / V1)	**Output field voltage** (Terminals C1 / D1)**	
	Fixed field	**Adjustable field**
230 V ±15 %, 1Ph	200 V *	200 V *
400 V ±15 %, 1Ph	310 V *	310 V *
460 V ±10%, 1Ph	360 V	360 V

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* Voltage measured as per DIN 40 030 (09/93)

** The max field voltage is equal to 0.85 x AC input line voltage

2.4.4. Control section

Enables		0 / 15...30 V	3.2...6.4 mA	(approx. 5 mA at 24 V)
Analog inputs	option	0... ± 10 V	0.25mAmax	
		0...20 mA	10 V max	
		4...20 mA	10 V max	
Analog outputs [1]		0...± 10 V	5 mA max each output	
Digital inputs [1]		0 / 15...30 V	3.2...6.4 mA	(approx. 5 mA at 24 V)
Digital outputs [1]	supply	+ 15...35 V		
	signal	+ 15...35 V	20 mA max each output	

Encoder inputs

Sinusoidal	voltage	1 V pp	
	current	8.3 mA pp each channel (input resistance = 124 ohm)	
	pulses per rev	min 600	max 9999
	max frequency	150 kHz	
	max cable lenght	screened, 150m (0.75 mm^2) / 125m (0.5 mm^2) / 55m (0.22 mm^2)	
Digital	voltage	5V TTL / 15...24V HTL (H logic)	
	current	4.5 mA / 6.8 ... 10.9 mA each channel with H logic	
	pulses per rev	min 600	max 9999
	max frequency	150 kHz	
	max cable lenght	screened, 150m (0.75 mm^2) / 125m (0.5 mm^2) / 55m (0.22 mm^2)	

Analog tachogenerator input

voltage	22,7 / 45,4 / 90,7 / 181,6 / 302,9 V max, depending on the switch S4 setting
current	8 mA full scale
max cable lenght	screened, the max length depends on the installation, typical 150m

Internal supply voltage

max load	+ 5 V	160 mA	encoder connector, PIN 7/9 (only for sinusoidal encoder)
	+ 10 V	10 mA	terminal 7
	- 10 V	10 mA	terminal 8
	+ 24 V	200 mA	terminal 19 encoder connector, PIN 2/9 (only for digital encoder)
tolerance	+ 10 V	± 3 % [2]	
	- 10 V	± 3 % [2]	
	+ 24 V	+ 20 ... 30 V, not stabilized	

[1] Available only with the option card TBO.

[2] The values of the voltages + 10V and -10V are the same. The stated tolerance refers to the voltage width.

2.4.5. Accuracy

Internal reference voltage (± 10V, terminals 7 e 8):

temperature dependent stability error	100 ppm/°C

References

via keypad/serial line/Bus	
resolution:	16 Bit or 15 Bit+sign
via terminals (1/2, 3/4, 5/6)	
resolution:	11 Bit + sign
linearity	±0.1% of the full range value

Analog outputs (TBO only)

resolution:	11 Bit + sign
linearity:	±0.5% of the full range value

Speed regulation

for all the operation mode	
max speed	8000 rpm
digital reference resolution:	0.25 rpm
analog reference resolution:	≥ 0.25 rpm
with sinusoidal encoder	
speed feedback resolution:	0.25 rpm
accuracy	typical 0.01%
regulation field	better than 1:10000
with digital encoder	
speed feedback resolution	0.5 rpm
accuracy	typical 0.02%
regulation field	better than 1:1000
with tachogenerator	
speed feedback resolution	better than 1:2000
accuracy	typical 0.1%
regulation field	better than 1:1000

Torque regulation

resolution	better than 1:2000
accuracy	typical 0.2%
regulation field	better than 1:500

2.5. DIMENSIONS AND WEIGHTS

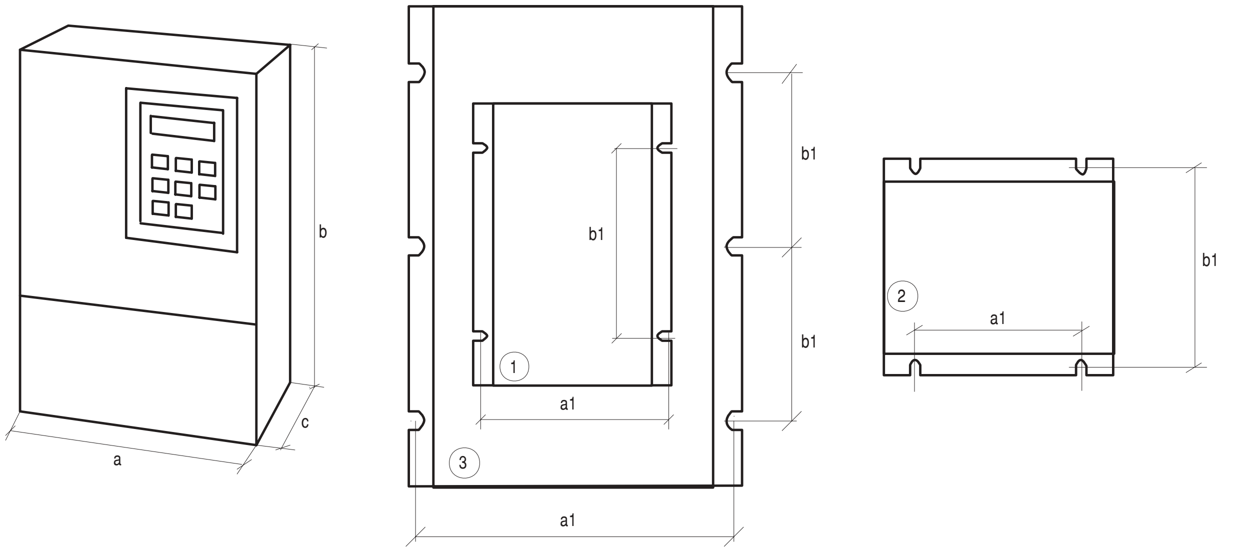

Figure 2.5.1: Drive dimensions for the sizes from to 20 A ... 1050 A

Table 2.5.1: Drive dimensions for the sizes from to 20 A ... 1050 A

Type	Form	a [mm]	b [mm]	c [mm]	a1 [mm]	b1 [mm]	Ø	Weight [kg]
TPD32-.../...-20-..	1	263	360	274	250	275	M6	8,4
TPD32-.../...-40-..		263	360	274	250	275	M6	8,4
TPD32-.../...-70-..		263	360	274	250	275	M6	8,8
TPD32-.../...-110-..		263	360	274	250	275	M6	10,8
TPD32-.../...-140-..		263	360	274	250	275	M6	10,8
TPD32-.../...-185-..		263	360	274	250	275	M6	10,8
TPD32-.../...-280-..	2	311	388	338	275	375	M6	25,5
TPD32-.../...-350-..		311	388	338	275	375	M6	24,5
TPD32-.../...-420-..		311	388	338	275	375	M6	29,5
TPD32-.../...-500-..		311	388	338	275	375	M6	29,5
TPD32-.../...-650-..		311	388	368	275	375	M6	32
TPD32-.../...-770-..	3	521	510	402	500	200	M6	61
TPD32-.../...-1000-..		521	510	402	500	200	M6	65
TPD32-.../...-1050-..		521	510	402	500	200	M6	65

T0090g

2.6. WATT LOSS

The converter dissipated power depends mainly on the delivered current. The values of the dissipated powers stated in the following table refer to the functioning with rated current.

NOTE! The mounting should take into consideration a free space above and below the device of at least 150 mm. (Air circulation).

Starting from the type 770 A, the fans must be supplied from the outside with a single-phase voltage of 230V 50/60 Hz (terminals U3 & V3).

Table 2.6.1: Power Dissipation

Device	Power loss P_V [W]	Fans			Enclosure ventilation area [mm^2]
		Voltage [V]	Rated current [A]	Air capacity [m^3/h]	
TPD32-.../...-20-..	131	-	-	-	2 x 5100
TPD32-.../...-40-..	186	-	-	-	2 x 5100
TPD32-.../...-70-..	254	Internal power supply		80	2 x 5100
TPD32-.../...-110-..	408			160	2 x 11300
TPD32-.../...-140-..	476			160	2 x 11300
TPD32-.../...-185-..	553			160	2 x 11300
TPD32-.../...-280-..	781			320	2 x 22600
TPD32-.../...-350-..	939			320	2 x 22600
TPD32-.../...-420-..	1038			320	2 x 22600
TPD32-.../...-500-..	1248			320	2 x 22600
TPD32-.../...-650-..	1693			680	2 x 35400
TPD32-.../...-770-..	2143	230	0,75	1050	2 x 53100
TPD32-.../...-1000-..	2590	230	0,75	1050	2 x 53100
TPD32-.../...-1050-..	2590	230	0,75	1050	2 x 53100

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* Enclosure ventilation area must be realized according UL508C 5.9.3 and UL508C 5.10.2

2.7. MOTORS, ENCODER, TACHOMETER

The converters of the TPD32 series are provided for the regulation of DC motors with an independent excitation. As for speed feedback there is the use of a sinusoidal incremental encoder, a digital encoder or an analog tachometer generator. In case of limited precision needs it is possible to use as feedback the armature voltage without defluxing.

2.7.1. Motors

The electrical and mechanical data of the dc motors with an independent excitation refer to a particular functioning field. The following points have to be taken into consideration in order to operate these motors:

Motor data necessary to connect it to a converter

The data on the motor nameplate:

- Armature rated voltage
- Armature rated current
- Field rated current
- Motor rated speed

Motor protection

Thermo relay of the motor

- Placed above the converter: dimensioning $I_{dN} \cdot 0{,}82 \cdot 1{,}05$
- The relay contact can stop the drive through a control circuit or it can signal to the converter as an external failure (terminal 15).

NOTE! Remember that with a thermo relay it is possible only to control the heating of the motor due to an overload, but not the one due to an insufficient ventilation. For this purpose some PTC thermistors or thermal switches should be inserted in the motor windings.

Thermistors and thermal switches

On terminals 78 and 79 it is possible to connect a thermistor or thermal switch in order to detect motor overheating. When no temperature sensors are present an external resistor (R = 1 kohm) has to be connected to these terminals. The connection of the sensor has to be done according the following instructions.

Thermistors **(PTC)**

PTC thermistors according to DIN 44081 or 44082 fitted in the motor can be connected directly to the converter vie terminals 78 and 79. In this case the resistor (1 kohm) mounted between the terminals 78, 79 has to be removed.

Thermal switches (clixons) in the motor windings

Temperature-dependent contacts "clixon" type can disconnect the drive via the external control or can be reported as an external error on the converter (terminal 15). They can also be connected to the terminals 78 and 79 in order to have a specific error signal. In this case remove the 1 kohm resistor from these terminals and connect it in series to the wiring.

Limitation of the converter current

The current limitation can protect the motor from unwanted overloads. To this purpose it is necessary to parameterize the current limitation and the control function of the converter overload, so that the current reAC input within the values allowed for the motor.

NOTE! Remember that with a current limitation it is possible to control only the motor heating due to an overload, but not the one due to an insufficient ventilation. For this purpose some PTC thermistors or thermal switches should be inserted in the motor windings.

2.7.2. Encoder / Tachometer

The encoders and the tachometers give the speed feedback to the regulation. They have to be mounted on the motor shaft with joints without gaps.

The best regulation results are possible by using incremental sinusoidal encoders; it is also possible to use digital incremental encoders or tachogenerators, see section, “Accuracy”.

Features:

Sinusoidal encoder

max frequency	150 kHz
number of pulses per revolution	min 600 max 9999
channel	two-channel
supply	+ 5V
load capacity	> 8.3 mA pp each channel

Digital encoder

max frequency	150 kHz
number of pulses per revolution	min 600 max 9999
channels	two-channel, with complementary outputs
supply	+ 5V / 15 ... 30V
load capacity	> 4.5 mA / 10 ... 20 mA each channel

Analog tachometer

for TPD32-...-2B	DC tacho
for TPD32-...-4B	DC tacho (for the reversal of the rotation direc tion; the given voltage polarity must reverse)
max voltage at a max speed	22,7 / 45,4 / 90,7 / 181,6 / 302,9 V max, depending on the switch S4 setting
load capacity	8 mA, full scale

Tacho voltage input (V)	S4-1 S4-8	S4-2 S4-7	S4-3 S4-6	S4-4 S4-5
22.7	ON	ON	ON	ON
45.4	ON	ON	ON	OFF
90.7	ON	ON	OFF	OFF
181.6	ON	OFF	OFF	OFF
302.9	OFF	OFF	OFF	OFF

DV0033g

3. INSTALLATION GUIDELINES

3.1. PERMISSIBLE AMBIENT CONDITIONS

Protection degree:		IP 20 at operating temperatures of 0 ... 55° C. UL enclosure type 1.
Altitude:		Up to 1000 m above sea level; higher altitudes a current reduction of 1.2 % for every 100 m of additional altutude.
Temperature :	Operation	Ambient temperature = 0 ... 55° C. Over 40 °C: current reduction of 1.25 % for every 1.8 ° F over 1 °C over 40 °C (better than the 3K3 class per EN50178)
	Storage	Ambient temperature = -25 ... +55° C (1K4 class as per EN50178) Ambient temperature = -20 ... +55° C for devices with keypad
	Transport	Ambient temperature = -25 ... +55° C (2K3 class as per EN50178) Ambient temperature = -20 ... +60° C for devices with keypad
Air humidity:	Operation	5% up to 85%, 1 g/m^3 up to 25 g/m^3 without moisture condensation or icing (3K3 class as per EN50178)
	Storage	5% up to 95%, 1 g/m^3 up to 29 g/m^3 (1K3 class as per EN50178)
	Transport	95% 1) 60 g/m 2) A light condensation of moisture may occur for a short time occasionally when the device is not in operation. (2K3 class as per EN50178)
Air pressure:	Operation	From 86 kPa up to 106 kPa (3K3 class per EN50178)
	Storage	From 86 kPa up to 106 kPa (1K4 class per EN50178)
	Transport	From 70 kPa up to 106 kPa (2K3 class per EN50178)

1) Greatest relative air humidity occurs with the temperature 40° C or if the temperature of the device is brought immediately from -25° C to +30° C.

2) Greatest absolute air humidity if the device is brought immediately from +70° C to +15° C.

3.2. DISPOSAL OF THE DEVICE

The converters of the TPD32 series can be disposed as electronic scraps in accordance with the currently valid national regulations for the disposal of electronic parts.

The plastic covering of the converters up to type 185 A are recyclable: the material used is >ABS+PC< "-FR"

3.3. MOUNTING THE DEVICE

NOTE! The dimensions and weights specifed in this manual should be taken into consideration when the device is mounted. The technical equipment required (carriage or crane for large weights) should be used. Improper handling and the use of unsuitable tools may cause damage.

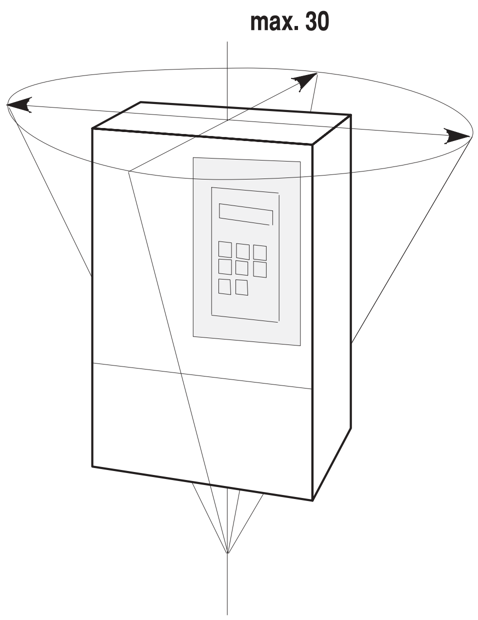


Figure 3.3.1: max Angle of Inclination

- The maximum angle of inclination is 30°.
- The converters must be mounted in such a way that the free flow of air is ensured.
- The clearance to the device must be at least 150 mm.
- A space of at least 50 mm must be ensured at the front.
- Devices that generate a large amount of heat must not be mounted in the direct vicinity of the frequency inverter.

NOTE! Mounting screws should be re-tightened after a few days of operation.

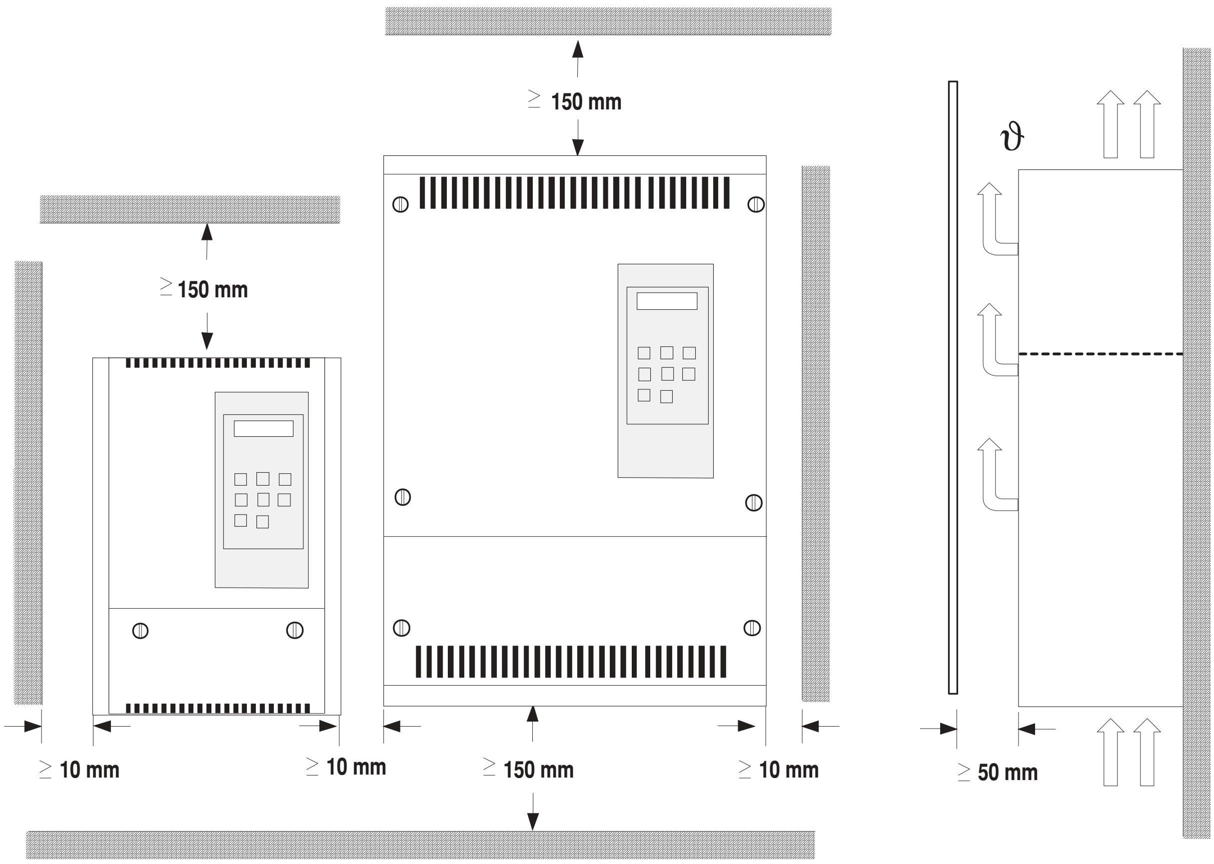


Figure 3.3.2: Mounting Clearance

4. WIRING PROCEDURES

4.1. REMOVING THE FRONT COVER

The front cover of the device must be removed to make the electrical connections and to mount the option card.

WARNING! Observe the safety instructions and warnings given in this manual. The devices can be opened without the use of force. Only use the tools specified.

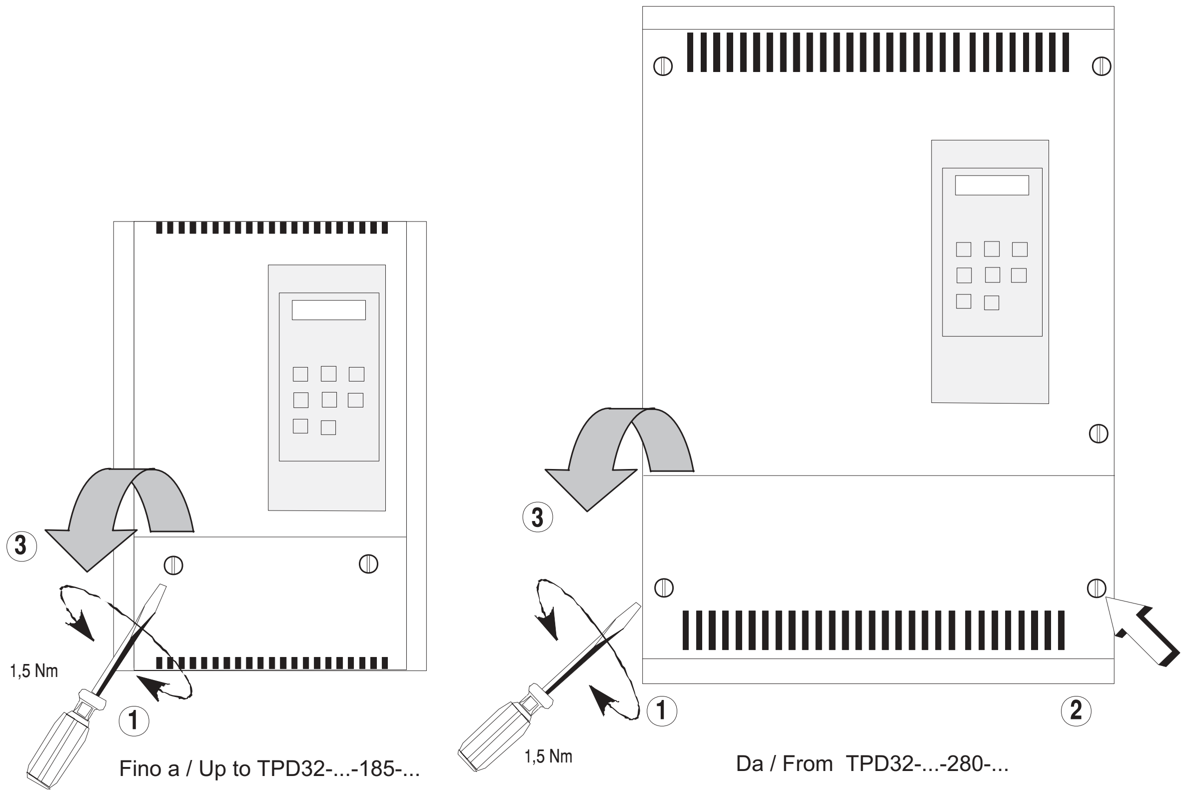


Figure 4.1.1: Removing the Front Panel

To remove the lower cover of devices, use a phillips screwdriver. Remove the screws, lift cover, and open out to the front.

4.2. WIRING THE DRIVE

Wire the drive in accordance with the standard connection diagrams, Figures 4.8.1 and 4.8.2.

4.3. POWER SECTION

NOTE!

Use copper conductors only

Table 4.3.1: Terminals description

Designation	Function	I/Q	max voltage	max current
U, V, W	Connection to the main of the armature circuit	I	500V AC +10%, 3Ph	see 2.4.2
C, D	Armature connection	Q	see 4.3	see 2.4.3
U1, V1	Connection to the main of the field circuit	I	460V AC + 10%, 1Ph	see 2.4.2
C1, D1	Field connection	Q	0.87 U_{LN}	see 2.4.3
U2, V2	Supply regulation	I	115V ±15%, 1Ph or 230V ±15%, 1Ph	see 2.4.2
U3, V3	Connection for internal fan (for types with armature current ≥ 770A)	I	230V AC, 1Ph	1A
35 / 36	Contact without potential of OK relay, function as per the OK relay func parameter in the CONFIGURATION / digital output menu	Q	250 VAC	1A AC11
75 / 76	Contact without potential of relay 2, function as per Relay 2 parameter in the I/O CONFIGURATION / digital outputs menu	Q	250 VAC	1A AC11
78 / 79	Thermistor connection	I	—	—
81 / 82	Internal fuses intervention signalling (sizes ≥770 A)	Q	250 VAC	1A AC11

T0110g

Table 4.3.2: Cale size for power terminals U, V, W, C, D, PE

Device	max cable section [mm2]	AWG	Tightening torque [Nm]
TPD32-.../...-20-..	...4	...12	2...3
TPD32-.../...-40-..	...10	...8	2.5...3
TPD32-.../...-70-..	...16	...6	
TPD32-.../...-110-..	6...50	10...1	
TPD32-.../...-140-..	16...95	6...000	12
TPD32-.../...-185-..			
TPD32-.../...-280-..			
TPD32-.../...-350-..	Cu-Band 10 x 16 x 0.8	-	
TPD32-.../...-420-..			
TPD32-.../...-500-..	Cu-Band 11 x 21 x 1	-	
TPD32-.../...-650-..			20...25
TPD32-.../...-770-..	Cu-Band 50 x 8 or 2x Cu-Band 10 x 16 x 0.8	-	
TPD32-.../...-1000-..	Cu-Band 50 x 8 or		
TPD32-.../...-1050-..	2x Cu-Band 11 x 21 x 1		

T0120g

Table 4.3.3: Cable section required for applications in accordance with the UL norm

Device type	Terminals	Wire AWG /kcmils	Terminal bolt metric size mm	Tightening torque, Nm
TPD32-…/…-20-…	U, V, W	10	5	6
	C, D	10	5	6
	PE	10	5	6
TPD32-…/…-40-…	U, V, W	8	5	6
	C, D	8	5	6
	PE	8	5	6
TPD32-…/…-70-…	U, V, W	4	5	6
	C, D	4	5	6
	PE	4	5	6
TPD32-…/…-110-…	U, V, W	1/0	terminal block	12
	C, D	1/0	terminal block	12
	PE	2	terminal block	12
TPD32-…/…-140-…	U, V, W	2/0	terminal block	12
	C, D	2/0	terminal block	12
	PE	2	terminal block	12
TPD32-…/…-185-…	U, V, W	3/0	terminal block	12
	C, D	4/0; kit required	terminal block	12
	PE	2	terminal block	12
TPD32-…/…-280-…	U, V, W	2 x 2/0	10	50
	C, D	2 x 2/0	10	50
	PE	2/0	8	25
TPD32-…/…-350-	U, V, W	2 x 4/0	10	50
	C, D	2 x 4/0	10	50
	PE	2/0	8	25
TPD32-…/…-420-…	U, V, W	2 x 4/0	10	50
	C, D	2 x 300	10	50
	PE	2/0	8	25
TPD32-…/…-500-…	U, V, W	2 x 300; kit required	10	50
	C, D	2 x 350; kit required	10	50
	PE	2/0	8	25
TPD32-…/…-650-…	U, V, W	2 x 500; kit required	10	50
	C, D	2 x 600; kit required	10	50
	PE	2/0	8	25
TPD32-…/…-770-…	U, V, W	4 x 4/0	10	50
	C, D	4 x 250	10	50
	PE	2/0	8	25
TPD32-…/…-1000-…	U, V, W	4 x 300; kit required	10	50
	C, D	4 x 350; kit required	10	50
	PE	2/0	8	25
TPD32-…/…-1050-…	U, V, W	4 x 300; kit required	10	50
	C, D	4 x 400; kit required	10	50
	PE	2/0	8	25

T0121i

Table 4.3.4: Kit for the adjustment of cables and lugs for applications with the UL norm

Device type	Terminals	Wire adapter kit			Recommended lugs	
		type	Kit bolt size mm	Tightening torque Nm	ILSCO type	Burndy type
TPD32-…/…-185-…	U, V, W	-	-	-	-	-
	C, D	EAM 1578	8	25	CCL-4/0-516	YA28-L3
	PE	-	-	-	-	-
TPD32-…/…-280-…	U, V, W	-	-	-	CCL-2/0-12	YA26-L6BOX
	C, D	-	-	-	CCL-2/0-12	YA26-L6BOX
	PE	-	-	-	CRA-2/0, CCL-2/0-38	YA26-LBOX
TPD32-…/…-350-	U, V, W	-	-	-	CCL-4/0-12	YA28-LBOX
	C, D	-	-	-	CCL-4/0-12	YA28-LBOX
	PE	-	-	-	CRA-2/0, CCL-2/0-38	YA26-LBOX
TPD32-…/…-420-…	U, V, W	-	-	-	CCL-4/0-12	YA28-LBOX
	C, D	-	-	-	CRA-300, CRA-300L	YA30-L
	PE	-	-	-	CRA-2/0, CCL-2/0-38	YA26-LBOX
TPD32-…/…-500-…	U, V, W	EAM 1579	10	50	-	YA30-L
	C, D		10	50	-	YA31-L
	PE	-	-	-	CRA-2/0, CCL-2/0-38	YA26-LBOX
TPD32-…/…-650-…	U, V, W	EAM 1580	14	140	-	YA34-L
	C, D		14	140	-	YA36-L
	PE	-	-	-	CRA-2/0, CCL-2/0-38	YA26-LBOX
TPD32-…/…-770-…	U, V, W	-	-	-	CCL-4/0-12	YA28-LBOX
	C, D	-	-	-	CRA-250, CRA-250L	YA29-LBOX
	PE	-	-	-	CRA-2/0, CCL-2/0-38	YA26-LBOX
TPD32-…/…-1000-…	U, V, W	EAM 1581	10	50	-	YA30-L
	C, D		10	50	-	YA31-L
	PE	-	-	-	CRA-2/0, CCL-2/0-38	YA26-LBOX
TPD32-…/…-1050-…	U, V, W	EAM 1581	10	50	-	YA30-L
	C, D		10	50	-	YA32-L1
	PE	-	-	-	CRA-2/0, CCL-2/0-38	YA26-LBOX

T0122i

NOTE! The cable cross section to be connected must be dimensioned and determined by the designer that has to take into account the current, the temperature and the cable position. The values indicated on the table are referred to the maximum cross section accepted by its terminals; they are not the indication about the cable dimension to be connected!

CAUTION! The current in the protective conductor of the motor cable can be up to twice the value of the rated current if there is an earth fault at the output of the TPD32 converter.

Table 4.3.5: Cable size for power terminals U1, V1, C1, D1

Device	max cable section [mm2]	AWG	Tightening torque [Nm]
TPD32-.../...-20-..	0.2...4	24...10	0.5...0.8
TPD32-.../...-40-..			
TPD32-.../...-70-..			
TPD32-.../...-110-..			
TPD32-.../...-140-..			
TPD32-.../...-185-..			
TPD32-.../...-280-..			
TPD32-.../...-350-..			
TPD32-.../...-420-..			
TPD32-.../...-500-..			
TPD32-.../...-650-..			
TPD32-.../...-770-..			
TPD32-.../...-1000-..			
TPD32-.../...-1050-..			

T0130g

Table 4.3.6: Cable size for fans, signals, and thermistors

Terminals	Max connection cable section			Tightening torque
	flexible [mm^2]	multi-core [mm^2]	AWG	[Nm]
PE	2.5...10	2.5...10	12...8	2
U3, V3, 35, 36, 75, 76, 78, 79	0.14...1.5	0.14...2.5	26...14	0,5

T0140g

4.4. REGULATION SECTION - R-TPD3G REGULATION CARD

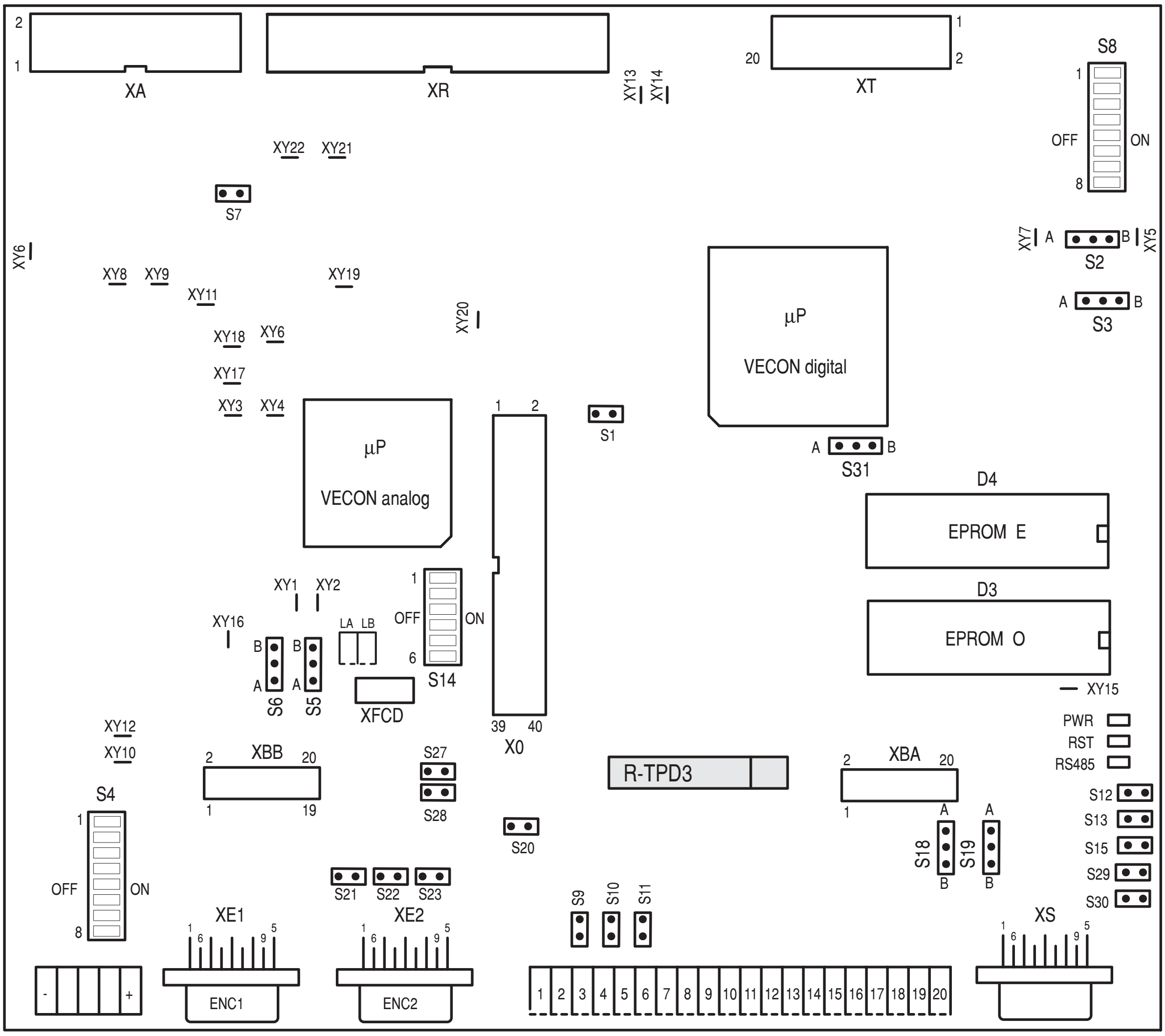


Figure 4.4.1: R-TPD3G regulation card

Table 4.4.1: LEDs on the R-TPD3 card

Designation	Function
PWR	On when the +5 V voltage is present at the right value
RST	On when the signal RST is active
RS485	On when the RS485 interface is supplied

T0170g

The devices are factory set accordingly. When the regulation card has been supplied as a spare part, set the switch S8 according to the desired size and S4 to adapt the reaction voltage of the tachogenerator!

Table 4.4.2: Dip-switch S8 adaptation of the regulation card to the device type

Converter type	S8-1	S8-2	S8-3	S8-4	S8-5	S8-6	S8-7	S8-8
TPD32-400/…-20-..	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
TPD32-400/…-40-..	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF
TPD32-400/…-70-..	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF
TPD32-400/…-110-..	ON	ON	OFF	OFF	OFF	OFF	OFF	OFF
TPD32-400/…-140-..	OFF	OFF	ON	OFF	OFF	OFF	OFF	OFF
TPD32-400/…-185..	ON	OFF	ON	OFF	OFF	OFF	OFF	OFF
TPD32-400/…-280-..	OFF	ON	ON	OFF	OFF	OFF	OFF	OFF
TPD32-400/…-350..	ON	ON	ON	OFF	OFF	OFF	OFF	OFF
TPD32-400/…-420..	OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF
TPD32-400/…-500-..	ON	OFF	OFF	ON	OFF	OFF	OFF	OFF
TPD32-400/…-650..	OFF	ON	OFF	ON	OFF	OFF	OFF	OFF
TPD32-400/…-770-..	ON	ON	OFF	ON	OFF	OFF	OFF	OFF
TPD32-400/…-1000-..	OFF	OFF	ON	ON	OFF	OFF	OFF	OFF
TPD32-400/…-1050-..	OFF	OFF	ON	ON	OFF	OFF	OFF	OFF

T1050g

Converter type	S8-1	S8-2	S8-3	S8-4	S8-5	S8-6	S8-7	S8-8
TPD32-500/...-20-..	OFF	OFF	OFF	OFF	OFF	OFF	ON	OFF
TPD32-500/...-40-..	ON	OFF	OFF	OFF	OFF	OFF	ON	OFF
TPD32-500/...-70-..	OFF	ON	OFF	OFF	OFF	OFF	ON	OFF
TPD32-500/...-110-..	ON	ON	OFF	OFF	OFF	OFF	ON	OFF
TPD32-500/...-140-..	OFF	OFF	ON	OFF	OFF	OFF	ON	OFF
TPD32-500/...-185-..	ON	OFF	ON	OFF	OFF	OFF	ON	OFF
TPD32-500/...-280-..	OFF	ON	ON	OFF	OFF	OFF	ON	OFF
TPD32-500/...-350-..	ON	ON	ON	OFF	OFF	OFF	ON	OFF
TPD32-500/...-420-..	OFF	OFF	OFF	ON	OFF	OFF	ON	OFF
TPD32-500/...-500-..	ON	OFF	OFF	ON	OFF	OFF	ON	OFF
TPD32-500/...-650-..	OFF	ON	OFF	ON	OFF	OFF	ON	OFF
TPD32-500/...-770-..	ON	ON	OFF	ON	OFF	OFF	ON	OFF
TPD32-500/...-1000-..	OFF	OFF	ON	ON	OFF	OFF	ON	OFF
TPD32-500/...-1050-..	OFF	OFF	ON	ON	OFF	OFF	ON	OFF

T0150bg

Table 4.4.3: Dip-switch S4 Matching of the input voltage of the tachogenerator reaction

Tacho voltage input (V)	S4-1 S4-8	S4-2 S4-7	S4-3 S4-6	S4-4 S4-5
22.7	ON	ON	ON	ON
45.4	ON	ON	ON	OFF
90.7	ON	ON	OFF	OFF
181.6	ON	OFF	OFF	OFF
302.9	OFF	OFF	OFF	OFF

DV0033g

Table 4.4.4: Jumpers on the regulation card

Designation	Function	Factory
S1	Only for test purposes, the setting must not be changed!	OFF
S2	Only for test purposes, the setting must not be changed!	A
S3	Only for test purposes, the setting must not be changed!	A
S5,S6	Adaptation of the speed feedback type: Pos. A Sinusoidal encoder Pos. B Tachogenerator Any position: digital encoder, armature feedback	
S9	Adaptation to the signal of the analog input Input 1 (terminals 1 and 2) ON 0 ... 20 mA / 4 ... 20 mA OFF 0 ... 10V / -10 ... +10V	OFF
S10	Adaptation to the signal of the analog input Input 2 (terminal 3 and 4) ON 0 ... 20 mA / 4 ... 20 mA OFF 0 ... 10V / -10 ... +10V	OFF
S11	Adaptation to the signal of the analog input Input 3 (terminals 5 and 6) ON 0 ... 20 mA / 4 ... 20 mA OFF 0 ... 10V / -10 ... +10V	OFF
S12 / S13	Terminating resistor for the serial interface RS485 ON Interface terminated with resistor OFF Interface not terminated	OFF
S15	Enabling of the RX channel. The jumper has to be removed when the PCI232 interface is used.	ON
S 18 / S 19	Selection of the internal/external supply of the RS485 serial interface Pos. A Serial interface supplied from the outside (PIN 5 and 9) and galvanic divided form the regulation section. Pos. B Serial interface supplied from the inside and connected to the potential reference point of the regulation. PIN 5 and 9 are used to supply the adaptor of the serial interface.	A
S20	Monitoring of the C channel of the digitall encoder on connector XE2 ON C-channel monitored OFF C-channel not monitored	OFF
S21 / S22 / S23	Encoder supply voltage selection ON 5 V encoder supply voltage OFF 15...30 V encoder supply voltage	OFF
S27	Monitoring of a digital encoder, to the XE2 by option card DEII ON Encoder monitored OFF Encoder not monitored	OFF
S28	Monitoring of the channels A and B of a digital encoder on XE2 ON Channels A and B monitored OFF Channels A and B not monitored	ON
S29, S30	Tx / Rx serial line. ON Serial line not active OFF Serial line active	OFF
S31	The setting must not be changed!	A

T 0160g

ON Mounted Jumper OFF Non mounted Jumper

Table 4.4.5: Point test on the regulation card

Test point	Function	Test point	Function
XY20	Monitoring (± 10VDC) of the **Select output** parameter setting (using this test point set all the **Select output 1**, **2**, **3**, **4** to the variable that has to be measured)	**XY17**	Output current signal (0.61 V = nominal drive output current)
XY10	Reference point	**XY18**	Reference point

T0165g

Table 4.4.6: Terminal Assignment

Terminal Designation	Function	I/Q	Max voltage	Max current
1 +2 Analog input 1	Configurable analog differential input Signal: Term. 1, Reference point Term. 2 Factory set for Ramp ref 1*	I	±10V	0.25mA (20mA at current ref. value)
3 +4 Analog input 2	Configurable analog differential input Signal: Term. 3, Reference point Term. 4 Not factory set	I	±10V	0.25mA (20mA at current ref. value)
5 +6 Analog input 3	Configurable analog differential input Signal: Term. 5, Reference point Term. 6 Not factory set	I	±10V	0.25mA (20mA at current ref. value)
7 +10V	Reference voltage +10V Reference point: Term. 9	Q	+10V	10mA
8 -10V	Reference voltage -10V Reference point: Term. 9	Q	-10V	10mA
9 0V 10	Reference point for the reference voltages on terminal 7 and 8	—	—	—
10	Screen connection (PE) (connected with housing)	—	—	—
11	Internal 0V	—	—	—
12 Enable drive	Converter enable 0V Disabled converter +15...30V Enabled converter	I	+30V	15V/3.2mA 24V/5mA 30V/6.4mA
13 Start	Start command 0V No start command +15...30V Start	I	+30V	15V/3.2mA 24V/5mA 30V/6.4mA
14 Fast stop	Fast stop 0V Fast stop +15...30V No Fast stop	I	+30V	15V/3.2mA 24V/5mA 30V/6.4mA
15 External fault	External fault 0V External fault present +15...30V No external fault present	I	+30V	15V/3.2mA 24V/5mA 30V/6.4mA
16 COM ID	Reference point of the digital inputs, terminals 12 to 15	—	—	—
18 0V 24	Reference point of the 24V voltage on terminal 19	—	—	—
19 +24V	Voltage +24V Reference point Terminal 18	Q	+20...30V	200 mA**
20	Screen connection (PE) (connected w/housing)	—	—	—

T0180g

* The user can adapt the configuration to the requirements of the application concerned via the keypad, the serial interface or a bus connection.

** Total value including Terminal 19, Pin 2 of connector XE2 and the digital outputs on the card TBO.

Table 4.4.7: Cable size for fans, signals, and thermistors

Terminals	Max connection cable section			Tightening torque
	flexible [mm²]	multi-core [mm²]	AWG	[Nm]
1...20, +, -, A, B, C	0.14...1.5	0.14...1.5	26...16	0,4

T0200g

The use of a 75 x 2.5 x 0.4 mm flat screwdriver is recommended. Remove 6.5mm of the insulation at the cable ends. Only one unprepared wire (without ferrule) should be connected to each terminal.

Table 4.4.8: Terminal strip for the connection of an analog tachometer

Designation	Function	I/Q	max volt.	max curr.
—	Negative tachometer input	I	—	—
+	Positive tachometer input Clockwise rotation: positive / counterclockwise: negative.	I	22.7 / 45.4 / 90.7 / 181.6 / 302.9 V *	8 mA

* It depends on the section set via the Dip switch S4 (see table 4.4.3).

T0190g

Table 4.4.9: Assignment of an XE1 connector for a sinusoidal encoder

Designation*	Function	I/Q	max volt.	max curr.
PIN 1	Channel B-	I	1 V pp	8.3mA pp
PIN 2	Not connected			
PIN 3	Channel C+ (zero pulse)	I	1 V pp	8.3mA pp
PIN 4	Channel C- (zero pulse)	I	1 V pp	8.3mA pp
PIN 5	Channel A+	I	1 V pp	8.3mA pp
PIN 6	Channel A-	I	1 V pp	8.3mA pp
PIN 7	Reference point for 5V	Q		
PIN 8	Channel B+	I	1 V pp	8.3mA pp
PIN 9	Supply voltage + 5V for the encoder	Q	+5 V	160mA

T0210g

* 9-pole socket connector, fitted on device.
A plug connector according DIN 41 652 is required for the connection.

Table 4.4.10: Assignment of the XE2 connector.

Designation*	Function	I/Q	max volt.	max curr.
PIN 1	Channel B-	I	30 V pp**	17mA pp
PIN 2	Supply voltage +24V for the encoder	Q	24 V	200mA***
PIN 3	Channel C+ (zero pulse)	I	30 V pp**	17mA pp
PIN 4	Channel C- (zero pulse)	I	30 V pp**	17mA pp
PIN 5	Channel A+	I	30 V pp**	17mA pp
PIN 6	Channel A-	I	30 V pp**	17mA pp
PIN 7	Reference point for 24V	Q	—	—
PIN 8	Channel B+	I	30 V pp**	17mA pp
PIN 9	Not connected	—	—	—

T0220g

* 9-pole socket connector, fitted on device. A plug connector acc. DIN 41 652 is required for the connection
** The max voltage is 30V when the S21, S22, S23 jumpers are not mounted (Encoder 15...30 V).
If these jumpers are mounted the max voltage at these P ins is 5V!
*** Total value including Terminal 19, Pin 2 of connector XE2 and the digital outputs on the option card TBO.

4.5. SERIAL INTERFACE

4.5.1. Description

The RS 485 serial interface enables data transfer via a loop made of two symmetrical, spiral conductors with a common shield. The maximum transmission distance is 1200 m with a transfer rate of 9.6 KBaud.

The transmission is carried out via a differential signal. RS 485 interfaces are bus-compatible in half-duplex mode, i.e. sending and receiving take place in succession. Up to 128 devices can be networked together via the RS 485 interface.

Address setting is carried out via the **Device address** parameter. Further information concerning the parameters to be transfered, their type and value range is given in the table contained in section 10, “Parameter List” (RS485 column).

On the converters of the TPD32 series, the RS485 serial interface is located via a 9-pole SUB-D (XS) connector on the R-TPD32 regulation card. The communication can be carried out with or without a galvanic separation: by using the separation it is necessary to have an external power supply of +5V and the jumpers S18 and S19 must be in a C/A position. The differential signal is transmitted to the PINS 3 (TxA/RxA) and 7 (TxB/RxB). At the beginning and at the end of the physical connection of the RS485 serial interface the terminating resistors must be present in order to avoid the reflexion on the cable. In the devices of the TPD32 series, the terminating resistors are activated via the insertion of both jumpers S12 and S13. This enables a point to point connection with a PLC or a PC.

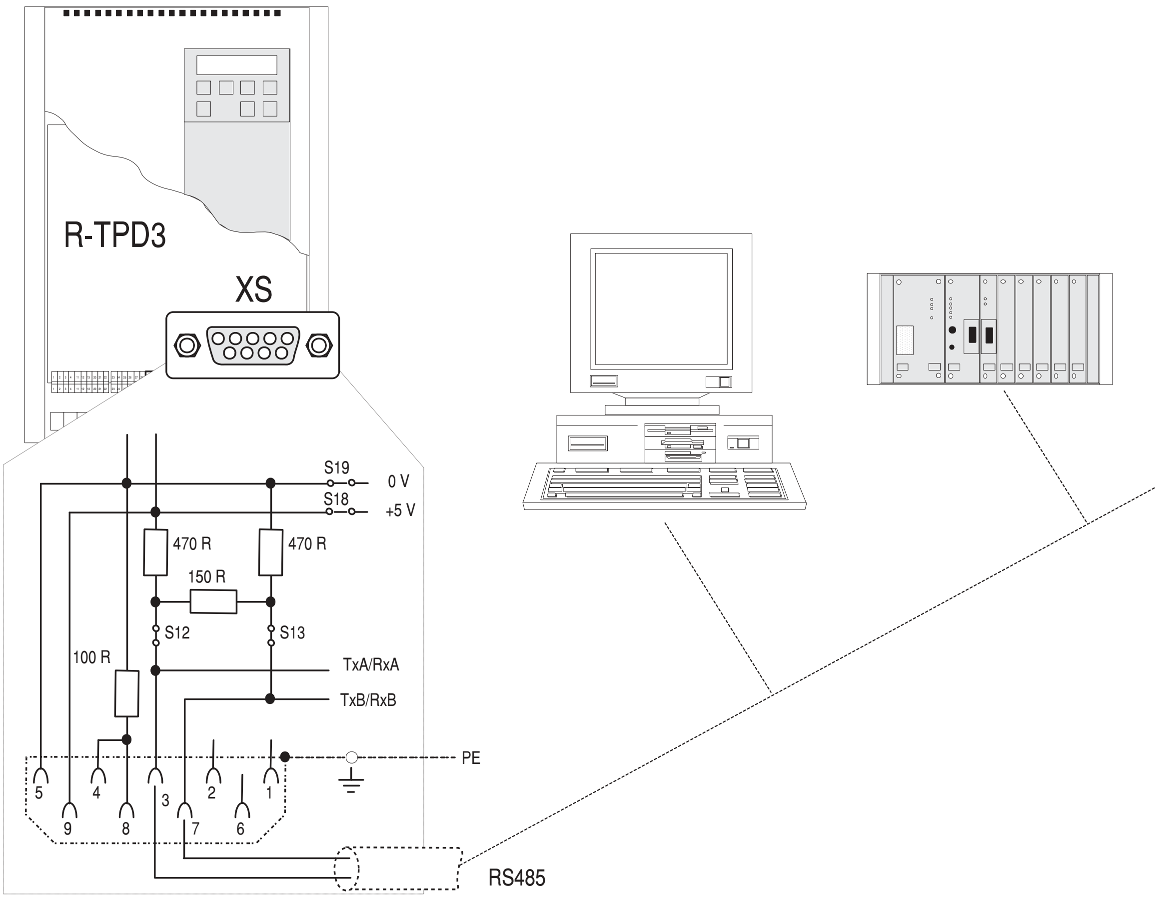


Figure 4.5.1.1: RS485 serial interface

NOTE! Remember that only the first and the last component of a RS485 serial interface chain must have active terminating resistors. In all other cases (inside a chain) the jumpers S12 and S13 must not be active.

As for the connection to a serial interface it must be remembered that:
- only shielded cables can be used
- the power and command cables of the contactors and of the relays must be placed in different channels, or conduits.

4.5.2. RS485 serial interface connector

Table 4.5.2.1: Description of the XS connector for the RS485 serial interface

Designation*	Function	I/Q	max volt.	max curr.
PIN 1				
PIN 2				
PIN 3	RxA/Ta	I/Q		
PIN 4	Equipotentially reference point (connected to 100 ohm)			
PIN 5	O V (reference point 5V)	I/Q		
PIN 6				
PIN 7	RxB/TxB	I/Q		
PIN 8	Equipotentially reference point (connected to 100 ohm)			
PIN 9	+5V	I/Q	+5V	120 mA (S18=S19=C/A)

T0230g

* 9-pole socket connector, fitted on device. A plug connector acc. DIN 41 652 is required for the connection

The function of the pins 5 and 9 depends on the position of the jumpers S18 and S19 which state if the serial line is divided or not from the converter reference potential.

S18 / S19 in position C/A — The serial interface is divided from the regulation section. The power supply of the serial interface is provided from the outside via the PIN 5 (0 V) and 9 (+ 5 V) of the XS connector (default factory setting).

S18 / S19 in position C/B — The serial interface and the regulation have the some ground potential. The PIN 5 and 9 are used to supply the serial interface adapter. They must not be used for different pourpose!

4.6. INPUT/OUTPUT EXPANSION CARD TBO

Up to two input/output expansion cards TBO can be fitted in a converter of the TPD32 Series. The card provides analog outputs and digital inputs/outputs. Option A is addressed by the device if the card is fitted on the right socket. Option B is addressed if the card is fitted in the left socket.

In standard conditions a TBO option card is already installed.

The designations used in the following table refer to Option A. The values in parantheses refer to Option B (see section 4.6.2.1, “Fitting the option cards”).

4.6.1. Assignment of the plug-in terminal strip for Option Card TBO

Table 4.6.1.1: Terminal strip connections

Designation	Function	I/Q	Max voltage	Max current
1 Analog out 1 3	Analog output 1 (3) Reference point: Terminal 2 Factory set for T current (motor current)	Q	±10V	5mA
2 COM analog output 1	Reference point of analog output 1 (Terminal 1)	—	—	—
3 Analog out 2 (-4)	Analog output 2 (4) Reference point: Terminal 4 Factory set for motor speed (Current U)	Q	±10V	5mA
4 COM analog output 2	Reference of analog output 2 (Terminal 3)	—	—	—
5 COM digital outputs	COM digital outputs (Terminals 6...9)	—	—	—
6 Digital output 1 (5)	Digital output 1 (5) COM: Terminal 5 Factory set for Ramp + (Curr limit state)	Q	+30V	50mA
7 Digital output 2 (6)	Digital output 2 (6) COM: Terminal 5 Factory set for Ramp - (Overvoltage)	Q	+30V	50mA
8 Digital output 3 (7)	Digital output 3 (7) COM: Terminal 5 Factory set for Spd threshold (Undervoltage)	Q	+30V	50mA
9 Digital output 4 (8)	Digital output 4 (8) COM: Terminal 5 Factory set for Overload available (Overcurrent)	Q	+30V	50mA
10 Supply digital output	Supply voltage for digital outputs	I	+30V	depends on the load max 80mA
11 Digital input 1 (5)	Digital input 1 (5) COM: Terminal 15 Not Factory set	I	+30V	15V/3.2mA 24V/5mA 30V/6.4mA
12 Digital input 2 (6)	Digital input 2 (6) COM: Terminal 15 Not Factory set	I	+30V	15V/3.2mA 24V/5mA 30V/6.4mA
13 Digital input 3 (7)	Digital input 3 (7) COM: Terminal 15 Not Factory set	I	+30V	15V/3.2mA 24V/5mA 30V/6.4mA
14 Digital input 4 (8)	Digital input 4 (8) COM: Terminal 15 Not Factory set	I	+30V	15V/3.2mA 24V/5mA 30V/6.4mA
15 COM digital inputs	COM of the digital inputs (Terminals 11...14)	—	—	

T0240g

Table 4.6.1.2: Cable size for terminals of the option card TBO

Terminals	Max cable connection section			Tightening torque
	flexible (mm)	multi-core (mm)	AWG	(Nm)
1...15	0.14...1.5	0.14...1.5	28...16	0,4

T0250g

The use of a 75 x 2.5 x 0.4 mm flat screwdriver is recommended. Strip the ends of the cables to a length of 6.5 mm. Only one unprepared wire (without ferrule) should be connected to each terminal.

4.6.2. Fitting the option cards

The device is provided with two sockets for mounting option cards. Option A should be fitted on the right and option B on the left.

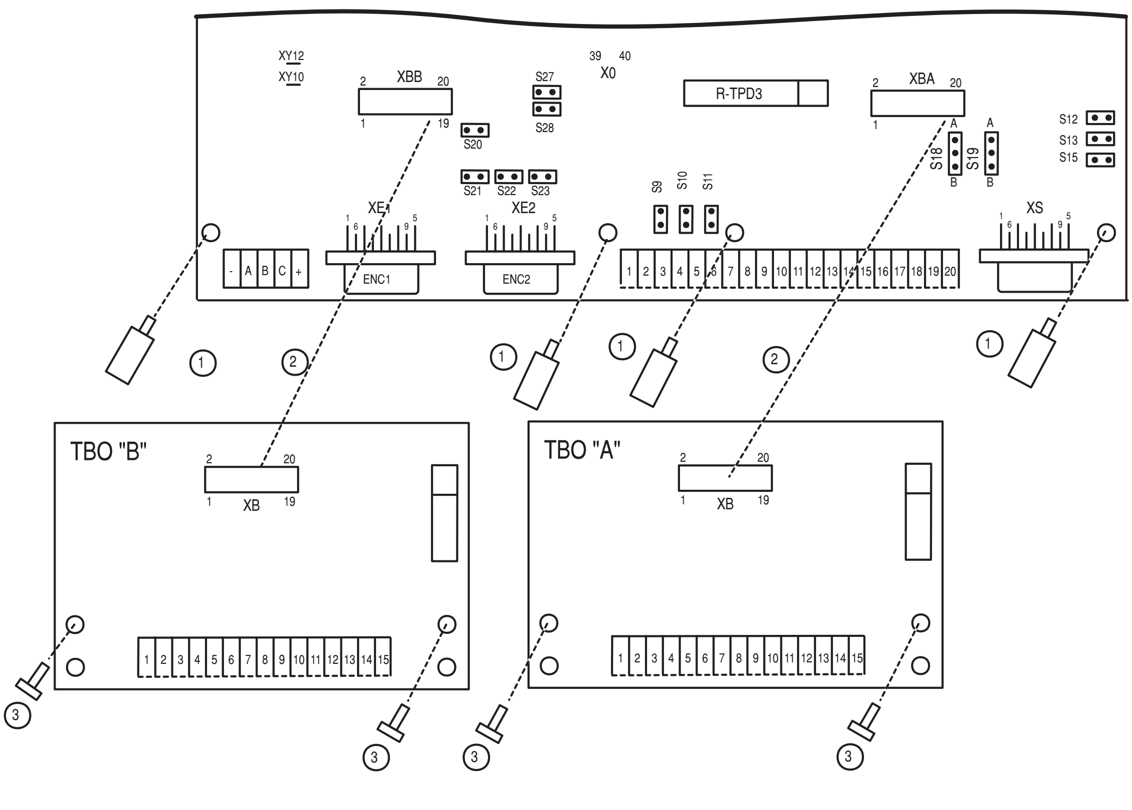


Figure 4.6.2.1: Installing the option cards

1 Unscrew the existing fixing screws and screw the spacers in the threaded holes
2 Fix the option card
   Option A: connector XB of the option in the connector XBA of the device
   Option B: connector XB of the option in the connector XBB of the device
3 Fix the option cards on the spacers with the screws.

4.7. DIGITAL ENCODER INTERFACE DEII

4.7.1. Description

The option card DEII has been projected to adapt, to separate galvanically and to connect a digital encoder to the input XE1 of the converters TPD32 regulations boards. As standard, this input is arranged for the connection of an analog encoder.

The card DEII will be fixed externally to the drive by the mounting rail DIN EN 50 022-35. The input female connector **XS1** must be connected to the digital encoder using a 9-pole male connector, through a shielded cable, Tasker c/186 (6 x 2 x 0.22) with a maximal length of 150 m.

The output male connector **XS2**, provided with shielded cable of 1.5 m, must be connected to the 9-pole connector fitted on the TPD32 regulation card.

Terminals **+Venc** and **0Venc** are needed for the external supply of the digital encoder: the input voltage can be 15V...24V with open Jumpers S1, S2, S3 (standard delivery conditions), or 5V with closed Jumpers S1, S2, S3.

S4 jumper is used to cut out the canal C (no impulse) from the test of encoder loss:

S4 closed = canal C included, S4 open = canal C cut out.

The jumper SH is mounted on condition of standard delivery; it must be cut only in case of the shield side encoder is connected to the chassis of the motor, to avoid the moulding of ground ring.

For converter operation with the DEII card it is necessary to set the jumper S5, S6 on the regulation board in position A.

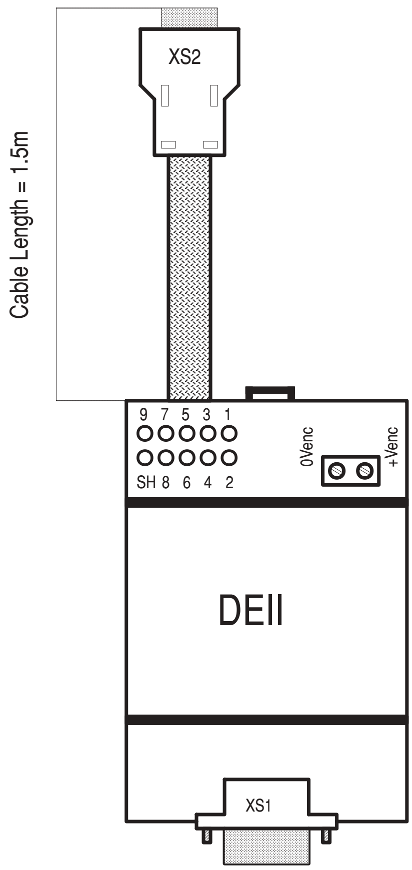


Figure 4.7.1.1: DEII card

4.7.2. Terminal Assignment

Table 4.7.2.1: Terminal assignment (Terminals 0Venc and +Venc)

Designation	Function	I/Q	max volt.	max curr.
0Venc	0V supply to the encoder	I	-	-
+Venc	+15 ... 24 V supply to the encoder (S1, S2, S3 open) +5V supply to the encoder (S1, S2, S3 closed)	I	+24V	depending on encoder

T0260g

I = Input Q = Output

Table 4.7.2.2: Permissible cable cross section on the terminals of option card DEII

Terminals	Max cable connection section			Tightening torque
	flexible (mm^2)	multi-core (mm^2)	AWG	(Nm)
0Venc and +Venc	0.14...1.5	0.14...1.5	26...14	0,5

T0270g

The use of a 75 x 2.5 x 0.4 mm flat screwdriver is recommended. Strip the ends of the cables to a length of 6.5 mm. Only one unprepared wire (without ferrite) should be connected to each terminal.

Table 4.7.2.3: XS1 9-pole connector

Designation	Function	I/Q	max volt.	max curr.
PIN 1	Channel B-	I	+24V	10.9mA
PIN 2	Supply voltage for the encoder (the allowed level depends on the jumper position, see chapter 4.7.1)		+24V	depending on ext. power supply unit
PIN 3	Channel C+ (zero pulse)	I/Q	+24V	10.9mA
PIN 4	Channel C- (zero pulse)		+24V	10.9mA
PIN 5	Channel A+	I/Q	+24V	10.9mA
PIN 6	Channel A-		+24V	10.9mA
PIN 7	Reference point for supply voltage	I/Q	-	-
PIN 8	Channel B+		+24V	10.9mA
PIN 9	not connected	I/Q	-	-

T0280g

I = Input Q = Output

4.8. STANDARD CONNECTION DIAGRAMS

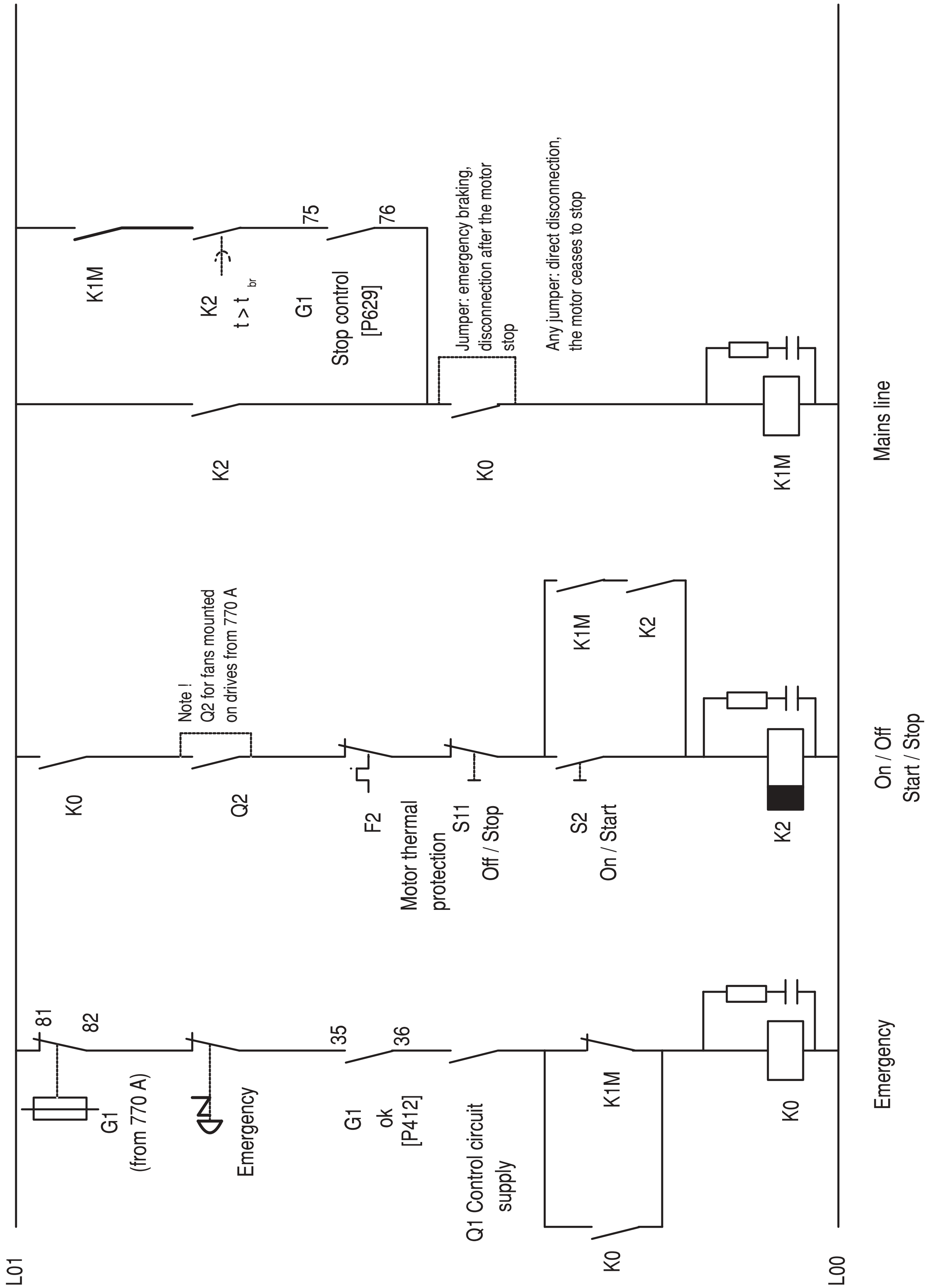


Figure 4.8.1: Control sequencing

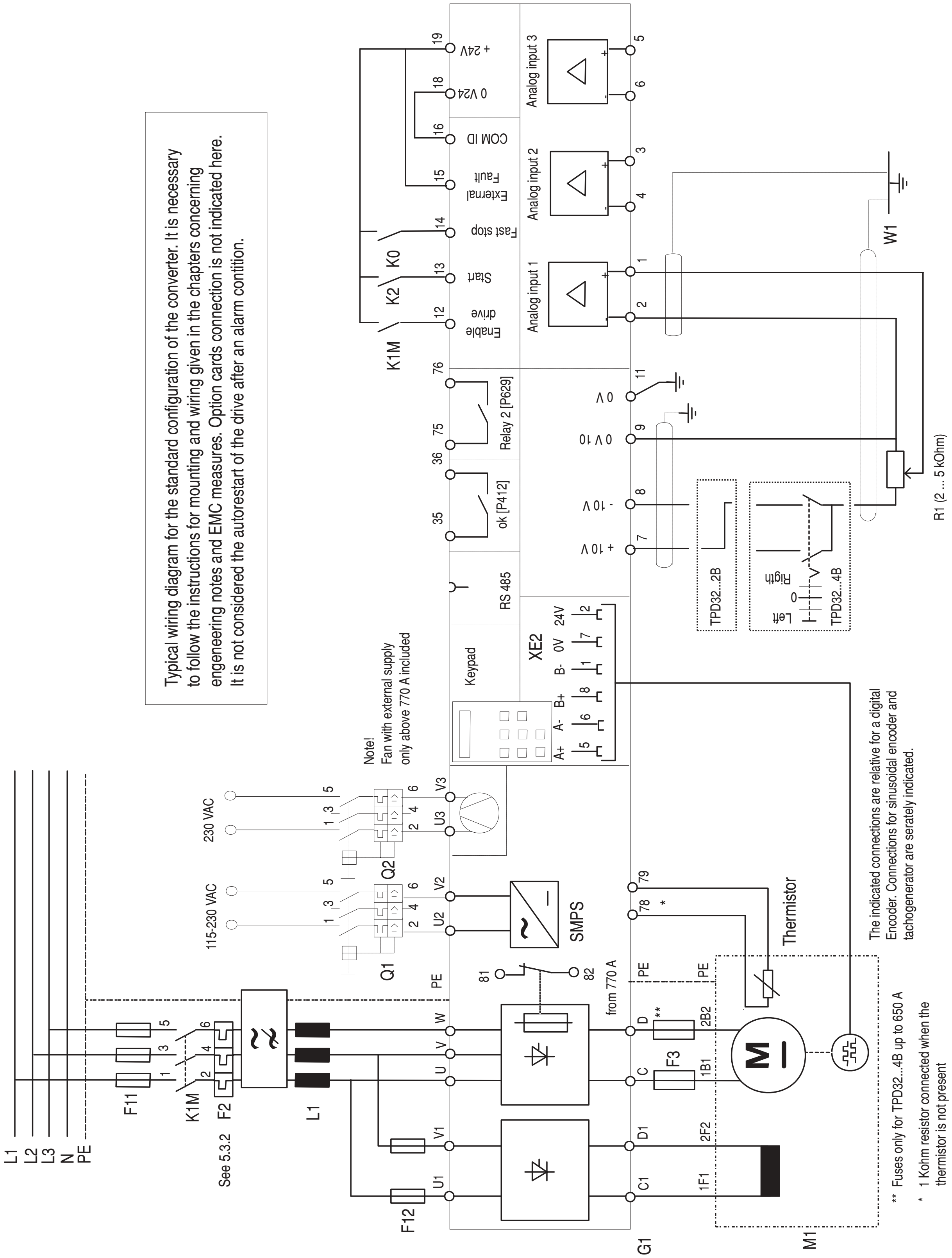


Figure 4.8.2: Typical connections

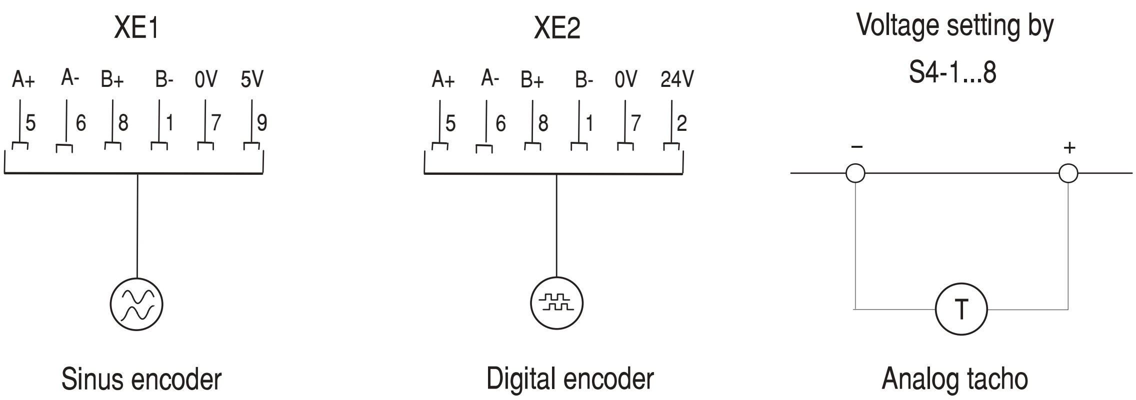


Figure 4.8.3: Encoder and Tachometer Connections

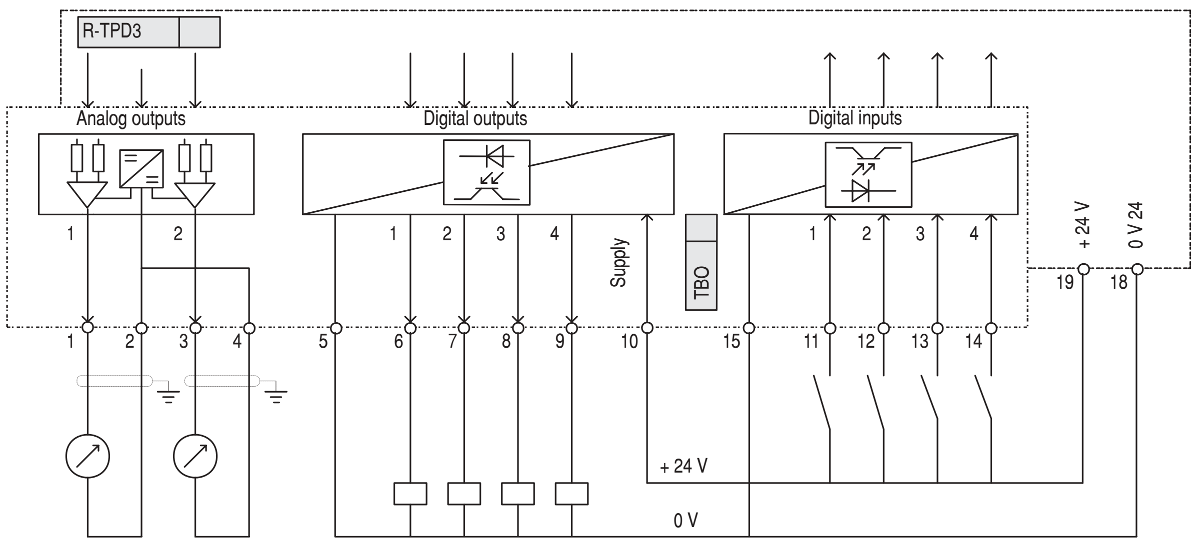


Figure 4.8.4: Programmable Inputs/outputs (option TBO) with relay and contacts

NOTE! To improve the noise immunity it is advisable to connect the common of the outputs (terminals 2/4, S/15 of TBO) with the ground (terminals 10 or 20 of the regulation board). It is not possible, the above mentioned common have to be grouded by means of a 0,1 μF/250V capacitor.

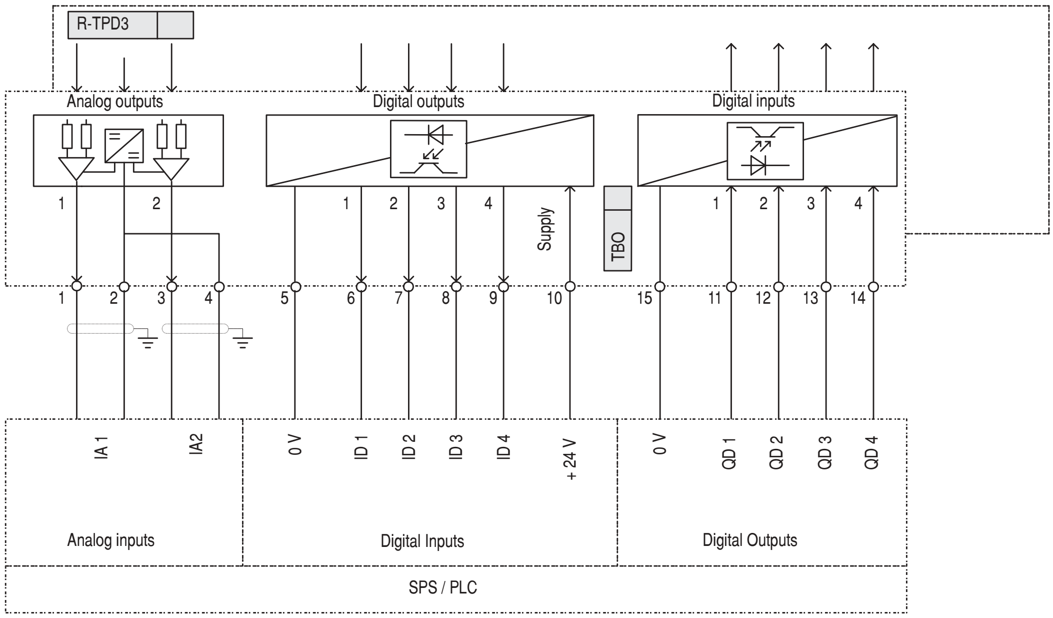


Figure 4.8.5: Programmable Inputs/outputs (option TBO) with PLC

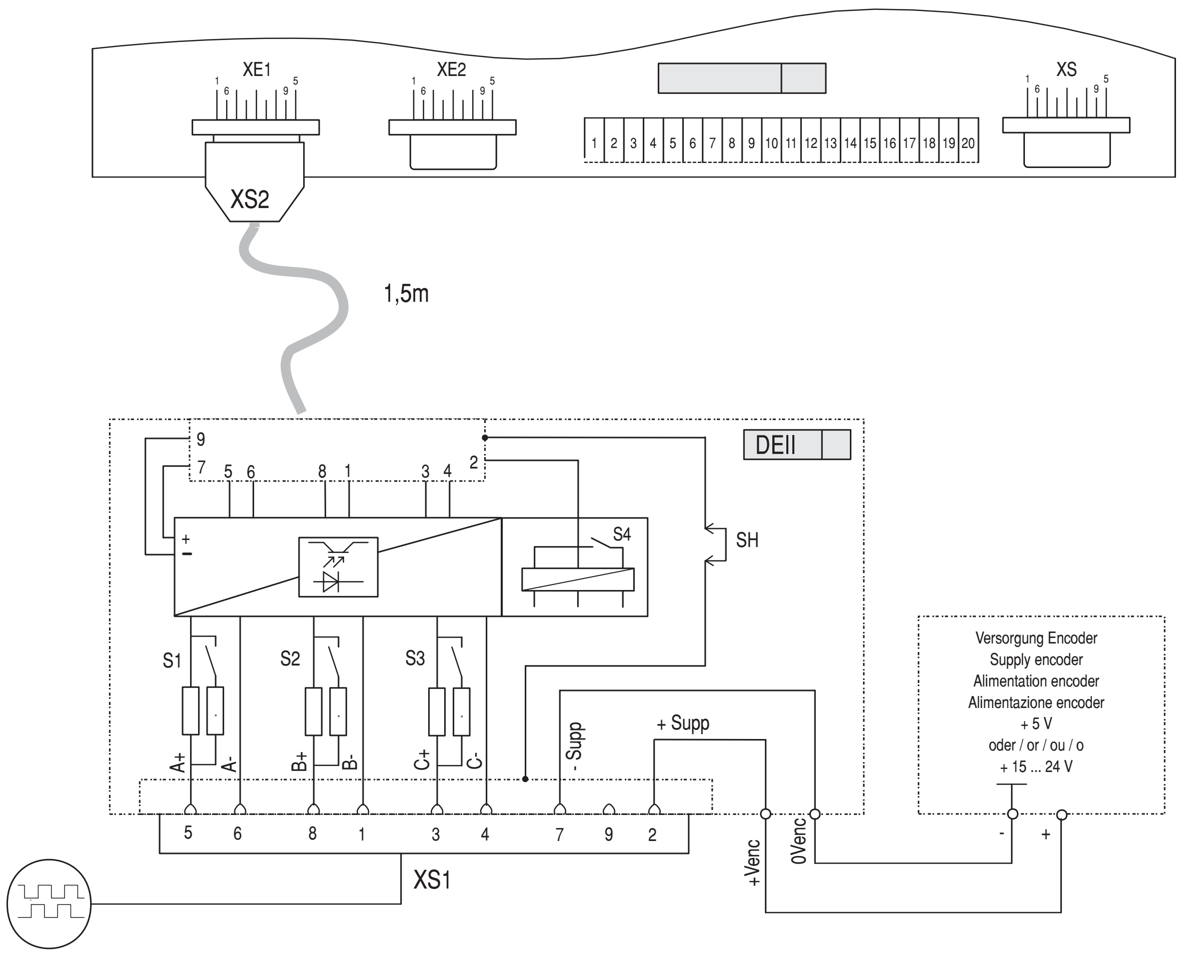


Figure 4.8.6: DEII connection

4.9. CIRCUIT PROTECTION

4.9.1. Fuses of the power section

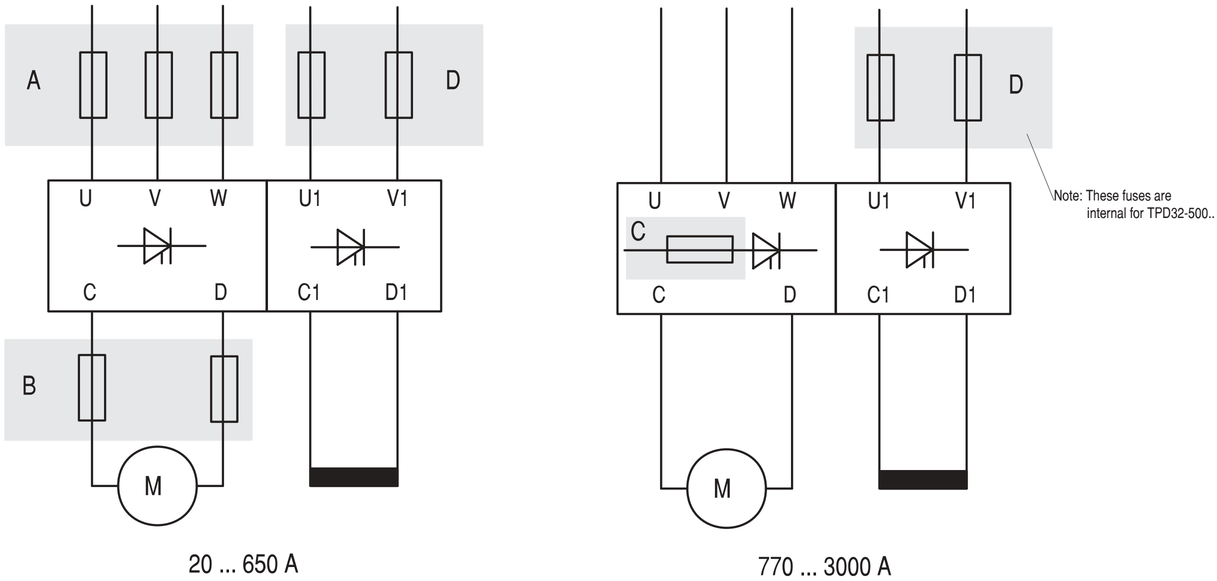


Figure 4.9.1.1: Position of the super fast fuses

For protection of the bridge thristors use fast acting fuses. The following recommended fuses are externally mounted. Models TPD32-.../...-770-.. and higher, HAVE internally mounted fuses provided (Code C on table 4.8.1.1).

NOTE! The TPD32...2B.... and TPD32...4B... Drives (500V AC input supply) have the field converter fuses internally mounted. The fuses type for the different sizes of converter are the following:

TPD32 size up to 70 A	Bussman	FWH-015A6F
TPD32 size 110 ... 1050 A	Bussman	FWC 25A10F
	Gould Shawmut	A60Q25-2

Table 4.9.1.1: Recommended fuses (externally mounted)

Converter	Code	Pieces	Europan	American
TPD32-.../...-20-..	A	3	Z14gR20 (GRD2/20)	A70P25
		3	Nr. 10 005 07.25	FWP25
	B*	2	Z14gR20 (GRD2/20)	A70P25
		2	Nr. 10 005 07.30	FWP25
	D	2	Z14gR20 (GRD2/20)	A70P20
		2	Nr. 10 005 07.20	FWP20
TPD32-.../...-40-..	A	3	Z22gR50 (GRD3/50)	A70P40
		3	Nr. 10 005 07.50	FWP40
	B*	2	Z22gR63 (GRD3/63)	A70P50
		2	Nr. 10 005 07.63	FWP50
	D	2	Z14gR20 (GRD2/20)	A70P20
		2	Nr. 10 005 07.20	FWP20
TPD32-.../...-70-..	A	3	Z22gR63 (GRD3/63)	A70P80
		3	Nr. 10 007 07.63	FWP80
	B*	2	S00UF01/80/100A/660V	A70P80
		2	Nr. 20 189 20, 80 A	FWP80
	D	2	Z14gR20 (GRD2/20)	A70P20
		2	Nr. 10 005 07.20	FWP20
TPD32-.../...-110-..	A	3	SOOUF1/80/100A/660V	A70P100
		3	Nr. 20 189 20.100	FWP100
	B*	2	SOOUF1/80/125A/660V	A70P150
		2	Nr. 20 189 20.125	FWP150
	D	2	Z14gR20 (GRD2/20)	A70P20
		2	Nr. 10 005 07.20	FWP20
TPD32-.../...-140-..	A	3	SOOUF1/80/125A/660V	A70P150
		3	Nr. 20 189 20.125	FWP150
	B*	2	SOOUF1/80/160A/660V	A70P175
		2	Nr. 20 189 20.160	FWP175
	D	2	Z14gR20 (GRD2/20)	A70P20
		2	Nr. 10 005 07.20	FWP20
TPD32-.../...-185-..	A	3	SOOUF1/80/200A/660V	A70P175
		3	Nr. 20 189 20.200	FWP175
	B*	2	SOOUF1/80/200A/660V	A70P200
		2	Nr. 20 189 20.200	FWP200
	D	2	Z14gR20 (GRD2/20)	A70P20
		2	Nr. 10 005 07.20	FWP20
TPD32-.../...-280-..	A	3	S1UF1/110/250A/660V	A70P300
		3	Nr. 20 458 20.250	FWP300
	B*	2	S1UF1/110/315A/660V	A70P350
		2	Nr. 20 458 20.315	FWP350
	D	2	Z14gR32 (GRD2/30)	A70P30
		2	Nr. 10 005 07.30	FWP30
TPD32-.../...-350-..	A	3	S1UF1/110/315A/660V	A70P350
		3	Nr. 20 458 20.315	FWP350
	B*	2	S2UF1/110/400A/660V	A70P400
		2	Nr. 20 459 20.400	FWP400
	D	2	Z14gR32 (GRD2/30)	A70P30
		2	Nr. 10 005 07.30	FWP30

T0290-1g

Device	Code	Pieces	Europe	American
TPD32-.../...-420-..	A	3	S2UF1/110/400A/660V	A70P400
		3	Nr. 20 459 20.400	FWP400
	B*	2	S2UF1/110/500A/660V	A70P500
		2	Nr. 20 459 20.500	FWP500
	D	2	GRD2/30	A70P30
		2	Nr. 10 005 07.30	FWP30
TPD32-.../...-500-..	A	3	S2UF1/110/500A/660V	A70P500
		3	Nr. 20 459 20.500	FWP500
	B*	2	S2UF1/110/630A/660V	A70P600
		2	Nr. 20 459 20.630	FWP600
	D	2	GRD2/30	A70P30
		2	Nr. 10 005 07.30	FWP30
TPD32-.../...-650-..	A	3	S2UF1/110/630A/660V	A70P600
		3	Nr. 20 4595 20.630	FWP600
	B*	2	S3UF1/110/710A/660V	A70P700
		2	Nr. 20 460 20.710	FWP700
	D	2	GRD2/30	A70P30
		2	Nr. 10 005 07.30	FWP30
TPD32-.../...-770-2B	C**	3	G2MUF02/800A/660V	170M5464/800A/660V
	D	2	GRD2/30	A70P30
		2	Nr. 10 005 07.30	FWP30
TPD32-.../...-770-4B	C**	6	G2MUF02/630A/660V	170M5462/630A/660V
	D	2	GRD2/30	A70P30
		2	Nr. 10 005 07.30	FWP30
TPD32-.../...-1000-2B	C**	3	G2MUF02/1000A/660V	170M5466/1000A/660V
	D	2	GRD2/30	A70P30
		2	Nr. 10 005 07.30	FWP30
TPD32-.../...-1050-4B	C**	6	G2MUF02/800A/660V	170M5464/800A/660V
	D	2	GRD2/30	A70P30
		2	Nr. 10 005 07.30	FWP30

T0290-2g

*	Necessary only for the four quadrant functioning
**	These fuses are internally mounted and are provided on the delivery
A	External fuses for the armature converter on the AC input side
B	External fuses for the armature circuit on the direct current side
C	Internal armature fuses for the device starting from type 770A.
D	External fuses for the field circuit on the AC input side

NOTE! These fuses are necessary only for TPD32-400... Internal fuses are provided for TPD32-500...

NOTE! When with the same letter different fuses are stated, it means that they can be used alternatively. The different types differ for the building forms and for the production house. See the following indications.

Fuses producer:	Type GRD2... (E27), GRD3... (E33)	
	S... (screw fuses with a distance 80 or 110 mm)	Jean Müller, Eltville
	A70P...	Gould Shawmut
	FWP..., 170M	Bussmann

NOTE! The fuse technical data (dimensions, weights, dissipated powers, fuses carrier etc.), can be derived from the relative data sheets.

4.9.2. Fuses selection when the Overload function is activated

Different fuses must be used when the current is higher than the rated one (overload current). Maximum values allowed for each type are listed on the next table. Be carefully to coordinate the right dimension. Example: the 1st fuse type on power section A (see figure 4.9.1.1) have to be coordinated with the 1st fuse type on section B and so on.

Table 4.9.2.1: Overload fuses

Converter	Code	Pieces	400 VAC Input supply	500 VAC Input supply
TPD32-.../...-20-..	A	3	Z14gR25 (GRD2/25)	Z14gR25 (GRD2/25)
		3	Nr. 10 005 07.25	Nr. 10 005 07.25
	B*	2	Z14gR32 (GRD2/30)	Z14gR32 (GRD2/30)
		2	Nr. 10 005 07.30	Nr. 10 005 07.30
TPD32-.../...-40-..	A	3	Z22gR50 (GRD3/50)	Z14gR40 (GRD3/35)
		3	Nr. 10 005 07.50	Nr. 10 005 07.35
	B*	2	Z22gR63 (GRD3/63)	Z22gR50 (GRD3/50)
		2	Nr. 10 005 07.63	Nr. 10 005 07.50
TPD32-.../...-70-..	A	3	Z22gR80 (GRD4/80)	S00UF01/80/100A/660V
		3	S00UF1/80/80A/660V	S00UF01/80/100A/660V
		3	S00UF01/80/100A/660V	
		3	Nr. 20 189 20, 80 A	Nr. 20 189 20, 80 A
	B*	2	Z22gR100 (GRD4/100)	Z22gR100 (GRD4/100)
		2	S00UF1/80/100A/660V	S00UF1/80/100A/660V
		2	S00UF1/80/125A/660V	
		2	Nr. 20 189 20,100 A	Nr. 20 189 20,100 A
TPD32-.../...-110-..	A	3	S00UF1/80/100A/660V	S00UF1/80/100A/660V
		3	Nr. 20 189 20.100	Nr. 20 189 20.100
	B*	2	S00UF1/80/125A/660V	S00UF1/80/125A/660V
		2	Nr. 20 189 20.125	Nr. 20 189 20.125
TPD32-.../...-140-..	A	3	S00UF1/80/160A/660V	S00UF1/80/160A/660V
		3	Nr. 20 189 20.160	Nr. 20 189 20.160
	B*	2	S00UF1/80/200A/660V	S00UF1/80/200A/660V
		2	Nr. 20 189 20.200	Nr. 20 189 20.200
TPD32-.../...-185-..	A	3	S00UF1/80/200A/660V	S00UF1/80/200A/660V
		3	Nr. 20 189 20.200	Nr. 20 189 20.200
	B*	2	S00UF1/80/200A/660V	S00UF1/80/200A/660V
		2	Nr. 20 189 20.200	Nr. 20 189 20.200
TPD32-.../...-280-..	A	3	S1UF1/110/315A/660V	S1UF1/110/315A/660V
		3	S1UF01/110/350A/660V	S1UF01/110/350A/660V
		3	Nr. 20 458 20.315	Nr. 20 458 20.315
	B*	2	S2UF1/110/400A/660V	S2UF1/110/400A/660V
		2	S2UF1/110/400A/660V	S2UF1/110/400A/660V
		2	Nr. 20 459 20.400	Nr. 20 459 20.400

T0300-1g

Converter	Code	Pieces	400 VAC Input supply	500 VAC Input Supply
TPD32-.../...-350-..	A	3	S1UF1/110/400A/660V	S1UF1/110/400A/660V
		3	S1UF01/110/450A/660V	S1UF01/110/450A/660V
		3	Nr. 20 459 20.400	Nr. 20 459 20.400
	B*	2	S2UF1/110/500A/660V	S2UF1/110/500A/660V
		2	S2UF1/110/500A/660V	S2UF1/110/500A/660V
		2	Nr. 20 459 20.500	Nr. 20 459 20.500
TPD32-.../...-420-..	A	3	S2UF1/110/500A/660V	S2UF1/110/500A/660V
		3	Nr. 20 459 20.500	Nr. 20 459 20.500
	B*	2	S2UF1/110/630A/660V	S2UF1/110/630A/660V
		2	Nr. 20 459 20.630	Nr. 20 459 20.630
TPD32-.../...-500-..	A	3	S2UF1/110/630A/660V	S2UF1/110/630A/660V
		3	S2UF01/110/710A/660V	
		3	Nr. 20 459 20.630	Nr. 20 459 20.630
	B*	2	S3UF1/110/710A/660V	S3UF1/110/710A/660V
		2	S3UF1/110/710A/660V	S3UF1/110/710A/660V
		2	Nr. 20 460 20.710	Nr. 20 460 20.710
TPD32-.../...-650-..	A	3	S2UF1/110/630A/660V	S2UF1/110/630A/660V
		3	S2UF01/110/710A/660V	
		3	Nr. 20 459 20.630	Nr. 20 459 20.630
	B*	2	S3UF1/110/710A/660V	S3UF1/110/710A/660V
		2	S3UF1/110/710A/660V	
		2	Nr. 20 460 20.710	Nr. 20 460 20.710

T0300-2g

* Necessary only for the four quadrant functioning

A External fuses for the armature circuit on the DC side

B External fuses for the armature converter on the AC input side

Note for sizes 770 ... 1050A: the armature fuses are internally mounted (see table 4.9.1.1)

4.9.3. Internal Fuses

Table 4.9.3.1: Internal fuses

Converter	Designation	Fuses for	Fuse	Mounted on
TPD32-.../...-20...185-..	F1	+ 24V	1 A, 250 V slow 0.2"x0.8" (5x20mm)	SW1-31
TPD32-.../...-280...1050-..	F1	+ 24V	3 A, 250 V slow 0.2"x0.8" (5x20mm)	SW2-31
	F2	Main section	2.5 A, 250 V fast 0.2"x0.8" (5x20mm)	SW2-31
	F1/F2/F3	Varistors	4 A, 500 V fast 0.24"x1.3" (6x32mm)	FIR2-31/ FL31

T0310g

4.9.4. AC input contactors

NOTE! The contactor sizes must be selected based on the converter rated current. The dimensions basis is the thermo current AC1, which is absorbed by the input during the rated functioning.

4.9.5. Control power protection

The 115 VAC/230 VAC control power input, U2 & V2, for the TPD32 are required to be short circuit protected.

This protection can be provided by using standard time delay fuses, or circuit breaker.

The circuit breaker and/or time delay fuses must be selected to survive the short circuit available current of the feeder source for this circuit, and the inrush current of the drive power supply.

The rating of the fuses or circuit breaker should be sized mainly to protect the wiring from the fuses/circuit breaker connections to U2 & V2, and not nuisance trip or blow from the inrush current.

The table below, Table 4.9.5, lists the input current characteristics of the control power.

Table 4.9.5: Control power protection

Device	Regulation Power Supply					
	Card	Power	Rated input current		Inrush input current	
			115 V	230 V	115 V	230 V
TPD32-.../...-20-.. ... TPD32-.../...-185-..	SW1-31	60 W	1 A	0,5 A	20 A	10 A
TPD32-.../...-280-.. ... TPD32-.../...-1050-..	SW2-32	110 W	1,2 A	0,7 A	15 A	7,5 A

T0315g

The control power input is best served by a power source that is stabilized and buffered from the power system transients. The control power of many drives can be fed from a single source, as long as proper distribution protection is provided.

4.10. REACTORS / FILTERS

In order to improve the safety degree of the converters series TPD32 and to grant the observance of the functioning conditions required by the norms (EN 60146-1-1, IEC 146-1-2, EN 61136-1), a three-phase main inductance has to be installed on the device upper part. As in the majority of the cases it is possible to assume the presence of a 100 relative short-circuit power and of a 1 contemporaneity factor (EN 50178, A 6.3.6), the use of a switching inductance (or a transformer) with u_k = 4% grants that the switching holes on the common connection point (PCC) are less wide than 20%.

4.10.1. Line reactors

The type of the required line reactors depends on

- the current absorbed by the AC input
- the AC input voltage
- the relative short circuit voltage
- the AC input frequency

The values stated in the following tables refer to a functioning with the connected converter rated current and with a relative short circuit voltage of uk = 4 %. The saturation current of the reactors is 200% of the full load current rating of the reactor.

In case of functioning with a motor having a rated current lower than the converter one it is possible to choose the main reactor on the basis of the motor current stated on the AC input side (armature current x 0.82 x 1.05).
The reactor saturation current can also be calculated according the required motor overload.

Example: calculating the AC input choke

Motor: Va = 400V Ia = 80 A P = 29.4 kW Overload 150% Ia

Converter: TPD32-400/420-110-4B

Mains volatage: V_{mains} = 400 V f_{mains} = 50 Hz

AC input current: $I_{mains} = Ia \cdot 08.2 \cdot 1.05 = 80 \cdot 0.82 \cdot 1.05 = 68.9$ A

AC input inductance: $$L = \frac{0.04V_{mains}}{\sqrt{3}\, 2\pi F_{mains}\ I_{mains}} = \frac{0.04 \text{ x } 400}{\sqrt{3} \text{ x } 2\pi \text{ x } 50 \text{ x } 68.9} = 0.427\ \text{mH}$$

Tfor09

Choke saturation current: $I_{sat} = 1.5\ I_{mains} = 103.3$ A

Table 4.10.1.1: Line reactors

Main 400 V, 3Ph, 50 Hz				
Converter	**Main three-phase inductance**			
	Rated choke [mH]	**Rated ac current [A]**	**Saturation current [A]**	**Freq. [Hz]**
TPD32-.../...-20-..	1,71	17,2	34,4	50
TPD32-.../...-40-..	0,855	34,4	68,8	50
TPD32-.../...-70-..	0,488	60,2	120,4	50
TPD32-.../...-110-..	0,311	94,6	189,2	50
TPD32-.../...-140-..	0,244	120,4	240,8	50
TPD32-.../...-185-..	0,185	159	318	50
TPD32-.../...-280-..	0,122	241	482	50
TPD32-.../...-350-..	0,098	301	602	50
TPD32-.../...-420-..	0,081	361	722	50
TPD32-.../...-500-..	0,068	430	860	50
TPD32-.../...-650-..	0,053	559	1118	50
TPD32-.../...-770-..	0,044	662	1324	50
TPD32-.../...-1000-..	0,034	860	1720	50
TPD32-.../...-1050-..	0,033	903	1806	50

T0320g

Main 460 V, 3Ph, 60 Hz				
Converter	**Main three-phase inductance**			
	Rated choke [mH]	**Rated ac current [A]**	**Saturation current [A]**	**Freq. [Hz]**
TPD32-.../...-20-..	1,638	17,2	34,4	60
TPD32-.../...-40-..	0,819	34,4	68,8	60
TPD32-.../...-70-..	0,468	60,2	120,4	60
TPD32-.../...-110-..	0,298	94,6	189,2	60
TPD32-.../...-140-..	0,234	120,4	240,8	60
TPD32-.../...-185-..	0,177	159	318	60
TPD32-.../...-280-..	0,117	241	482	60
TPD32-.../...-350-..	0,094	301	602	60
TPD32-.../...-420-..	0,078	361	722	60
TPD32-.../...-500-..	0,066	430	860	60
TPD32-.../...-650-..	0,050	559	1118	60
TPD32-.../...-770-..	0,043	662	1324	60
TPD32-.../...-1000-..	0,033	860	1720	60
TPD32-.../...-1050-..	0,031	903	1806	60

T0330g

Main 500 V, 3Ph, 50 Hz				
Converter	Main three-phase inductance			
	Rated choke [mH]	Rated ac current [A]	Saturation current [A]	Freq. [Hz]
TPD32-.../...-20-..	2,137	17,2	34,4	50
TPD32-.../...-40-..	1,068	34,4	68,8	50
TPD32-.../...-70-..	0,611	60,2	120,4	50
TPD32-.../...-110-..	0,389	94,6	189,2	50
TPD32-.../...-140-..	0,305	120,4	240,8	50
TPD32-.../...-185-..	0,231	159	318	50
TPD32-.../...-280-..	0,153	241	482	50
TPD32-.../...-350-..	0,122	301	602	50
TPD32-.../...-420-..	0,102	361	722	50
TPD32-.../...-500-..	0,085	430	860	50
TPD32-.../...-650-..	0,066	559	1118	50
TPD32-.../...-770-..	0,056	662	1324	50
TPD32-.../...-1000-..	0,043	860	1720	50
TPD32-.../...-1050-..	0,041	903	1806	50

T0340g

4.10.2. Interference suppression filters

The converters of TPD32 series must be equipped with an external EMI filter in order to reduce the radiofrequency emissions on the mains line. The filter selection is depending on the drive size and the installation environment. For this purpose see the Guide to the electromagnetic compatibility supplied with the drive.

In the Guide it is also indicated how to install the cabinet (connection of filter and mains reactors, cable shields, grounding, etc.), in order to make it EMC compliant according the EMC Directive 89/336/EEC.

The document describes the present situation concerning the EMC standards and the compliance tests made on the SIEI drives.

4.11. ENGINEERING NOTES

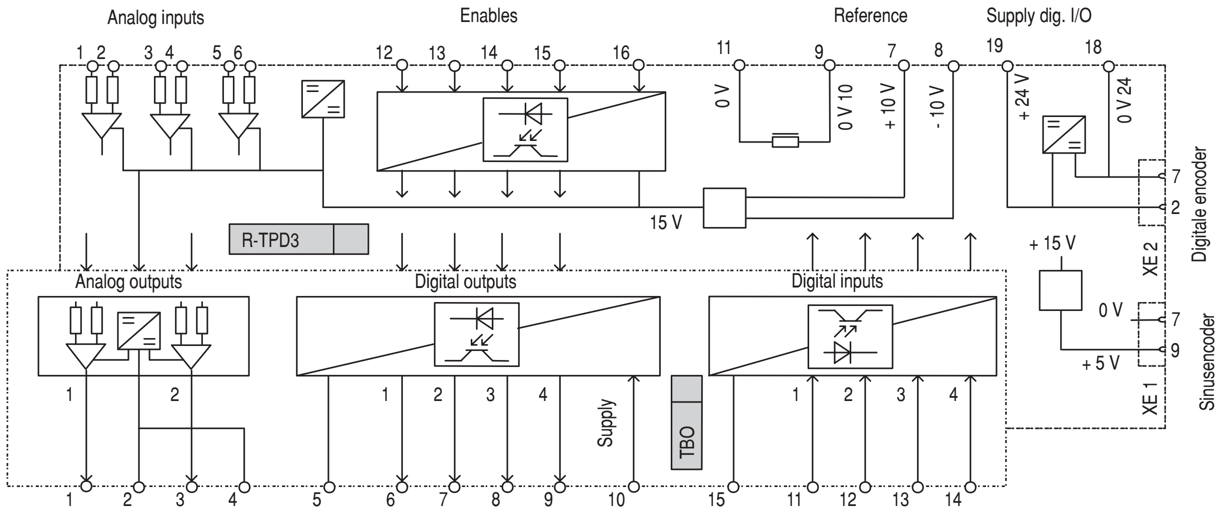


Figure 4.11.1: Potentials of the regulator section

Potentials of the regulator section

The potentials of the regulator section are galvanic divided from the power section. Figure 4.11.1 shows their connection.

- The analog inputs are designed as differential.
- The enables are isolated from the regulation via optoisolators. The terminals 12 to 15 have terminal 16 as a common reference potential.
- The terminal 11 is connected to the 0V internal voltage while the terminal 10 is ground connected. In order to obtain a better noise immunity, connect the terminal 10 to the terminal 11. If it is not possible, use a 0.1 µF capacitor.
- The regulation card puts at your disposal the following power supplies, which have a common reference point:
  + 10V and - 10V for the reference
  + 24V for the power supply of the digital inputs and outputs
  + 5V for the encoder power supply

The following data refers to the option card TBO:

- The analog outputs are divided from the internal potential through a differential amplifier. The two outputs of the option card have the same potential (terminal 2 and 4 of TBO option cards). When two TBO option cards are used, the potential of the digital outputs of the two cards are divided. For a better interference suppression and for the “cleaning” of the output signals, the terminals 2 and 4 of the TBO option card are directly ground connected (terminal 10 and /or 20 of the R-TPD3G card) or via a 0.1µF/250V capacitor.

- The digital outputs have the same potential (terminal 5) but they are divided from the regulator internal potential via optoisolators. In order to use the outputs, it is necessary to connect a power supply voltage to the terminal 10.

- The digital inputs are divided from the regualtor through optoisolators. The terminals 11 to 14 have terminal 15 as a common potential.

External devices

As for the installation of contactors, protection devices, chokes, filters and other external devices it is necessary to follow the indication given in the previous chapters. The same theory is valid for motors, encoders and tachometers.

Connection cables

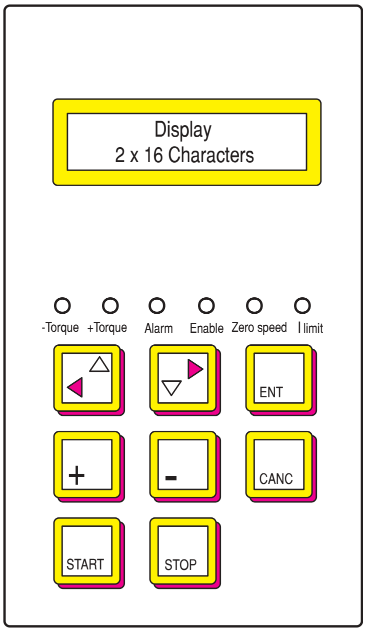
The encoder connection cables, if possible, should be connected directly to the device without passing through supporting terminal strips.

The shieldings of the signal conductors have to be ground connected on both sides. Anyway, for all analog and digital signals with very long connections (outside the electric board), it is suggested to have a ground connection only on the converter side, in order to avoid possible noises caused by the closing of the ground loops. In particular cases it could be necessary to connect the shielding on both sides, thus granting the point equipotentiality via suitable connection cables.

The encoder cable has to be made up of twisted loops with the global shielding connected to the ground on the converter side. Avoid to connect the shielding on the motor side connector. In particular cases (cable longer than 100 meters, strong electromagnetic noise), it could be necessary to use a cable with a shielding on every loop to be connected to the power supply ground. The global shielding has always to be ground connected.

5. CONVERTER OPERATION

5.1. KEYPAD



The keypad is made of a LCD display with two 16-digit lines and 8 function buttons. It is used

- to command the drive when this system has been selected
- to display the speed, the voltage and diagnostics during the operating time
- to set parameters

5.1.1. LEDs

The leds present on the keypad are used to diagnose in a fast way the functioning situation of the converter.

Table 5.1.1.1: Diagnostic LEDs

Designation	Color	Function
- Torque	yellow	The LED is lit, when the drive operates with a negative torque (counter-clockwise rotation or clockwise braking). Only for TPD32-...-4B
+ Torque	yellow	The LED is lit, when the drive operates with a positive torque (clockwise rotation or counter-clockwise braking). Braking only forTPD32-...-4B
Alarm	red	The LED is lit, it signals the intervention and the alarm condition
Enable	green	The LED is lit, when the converter is enabled
Zero speed	yellow	The LED is lit, when the speed is lower than the threshold set by Speed zero level
I limit	yellow	The LED is lit, when the converter operates at a current limit

T0020g

5.1.2. Moving inside a menu

- The DRIVE STATUS always appears when the converter is switched on.
- Use the ▲ and ▼ keys to select the individual points within the same menu level.
- Press the ENT key to enter the next menu level.
- Use the CANC key to return to the next higher menu level, irrespective of which menu point was selected. The appropriate menu of the next higher level will appear once the return has been made.

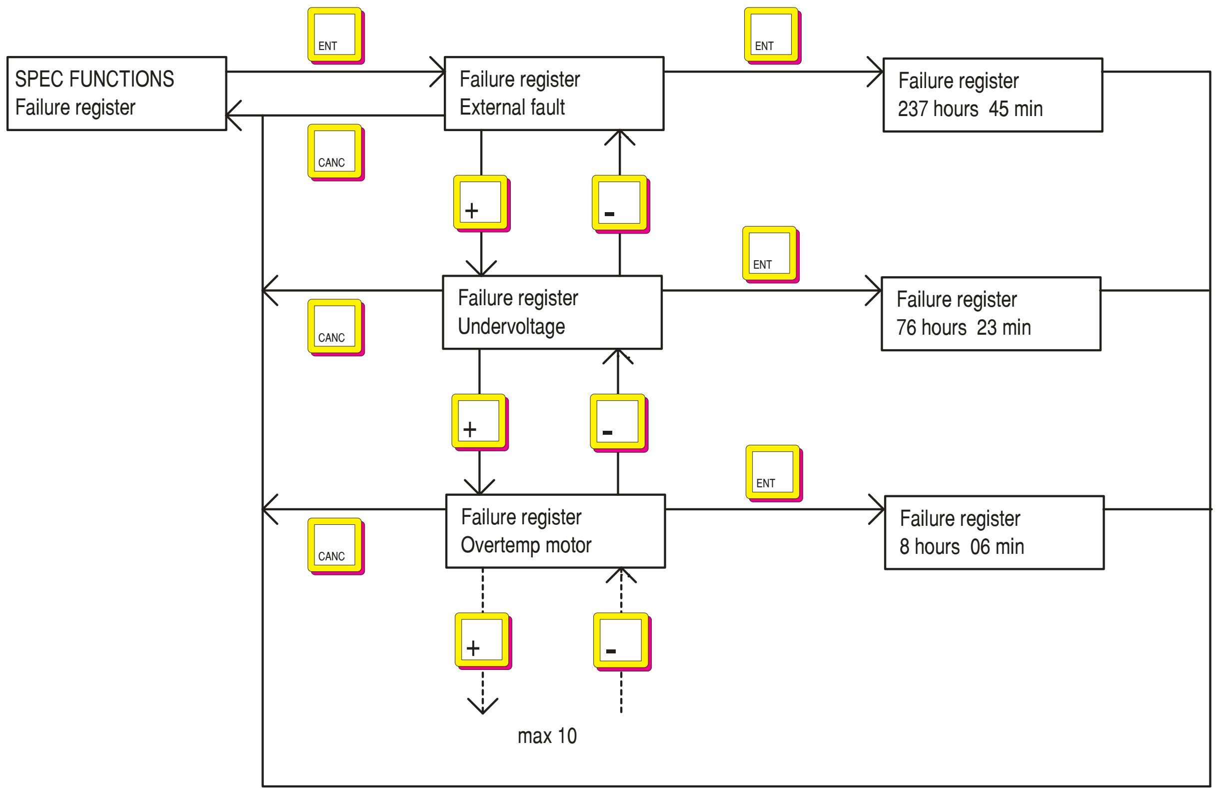
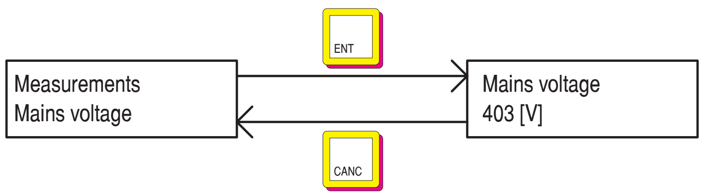


Figure 5.1.2.1: Moving inside a menu

5.1.3. Displaying parameters



- Select the parameters within the menu
- Press ENT. The parameter with its relative value will appear.
- Return to the menu using CANC.

5.1.4. Changing / Saving parameters / Password

The parameters with changeable values are divided into three groups:

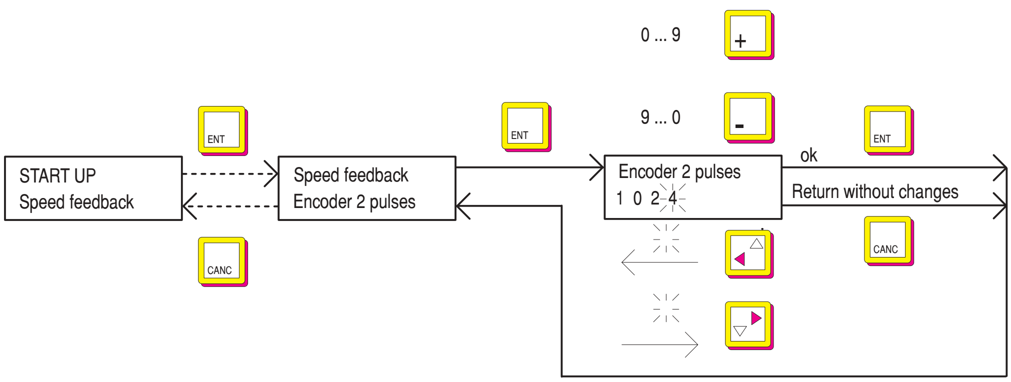
- Parameters whose content is either selected as a number or as text within a defined range e.g. ramp times and reference values
- Parameters whose contents are fixed values that can be selected.

  e.g. **Jog selection** with the "speed input" and "Ramp input" alternatives.
- Parameters that are automatically scaled by the keypad

  e.g. **Auto tune inp XX**

NOTE! Only those parameters that are not assigned to a digital or analog input/output can be changed with the keypad. The changed parameters must be saved otherwise the previous values will be loaded the next time the device is switched on.

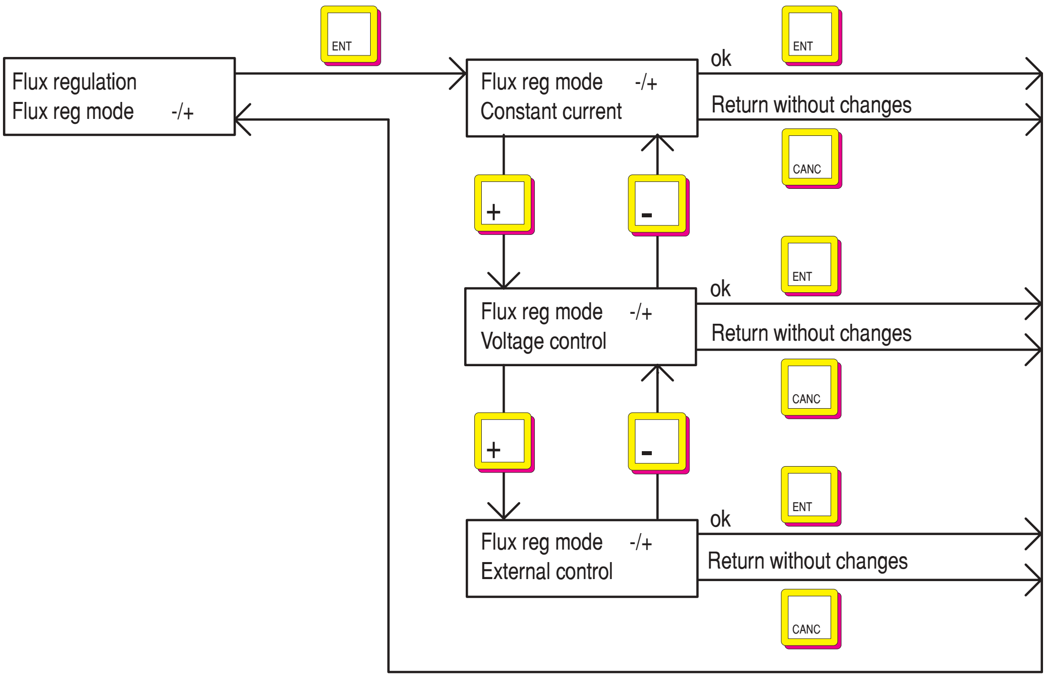
Changing numerical values and text



- Select within the menu the parameters to be changed.
- Press ENT. The value of the parameter will appear and the last digit will flash. The value of the flashing digit is always the one that can be changed.
- Increase the value with +
- Reduce the value with -
- Select the next digit left with ◀
- Select the next digit right with ▶
- Confirm the new value and return to the previous display by pressing ENT.
- Press CANC to return without changes.

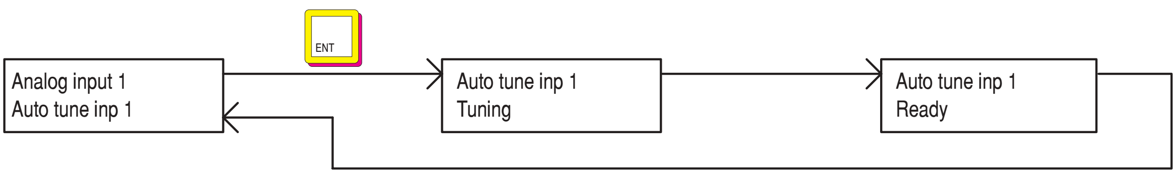
NOTE! When setting the **Dim factor text** parameter, the following characters are also available in addition to the numbers: / % & + , - . : < = > ? A...Z [ ] a...z

Selection from predefined values



- The parameters that can be selected among the several possiblities are marked with **-/+** on the keypad display.
- To change a value press ENT. The current value is shown in the display. This can be changed with the + and - keys.
- Confirm the new value and return to the previous display by pressing ENT.
- Return without changes via CANC

Autotuning

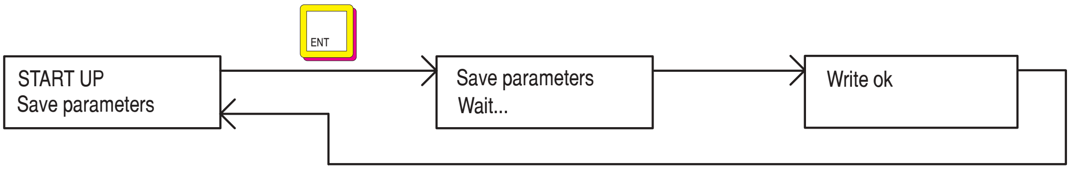


- Select the parameter **Auto tune input XX**.
- Press ENT
- The tuning procedure will run automatically. The messages “Tuning” and “Ready” will appear in succession before the original parameter is shown.

NOTE! The maximum signal possible must be present on the analog input concerned during the tuning procedure.

Saving

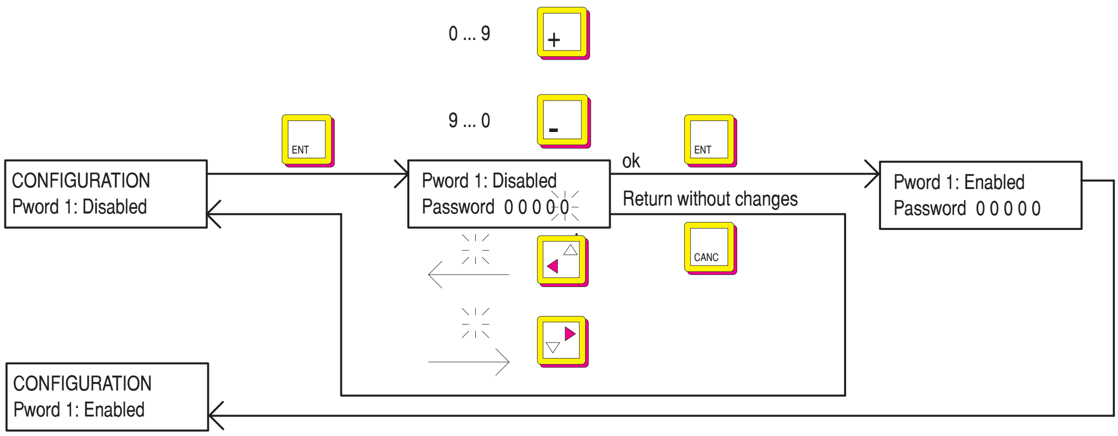
The parameters must be saved, otherwise the previous values will be loaded the next time the device is switched on.



- Select **Save parameters** in the BASIC MENU or in the SPEC FUNCTIONS menu.
- Press ENT
- The saving operation is automatic. The messages "Wait ..." and "Write ok" will appear in succession before the original parameter is shown.

Entering a password

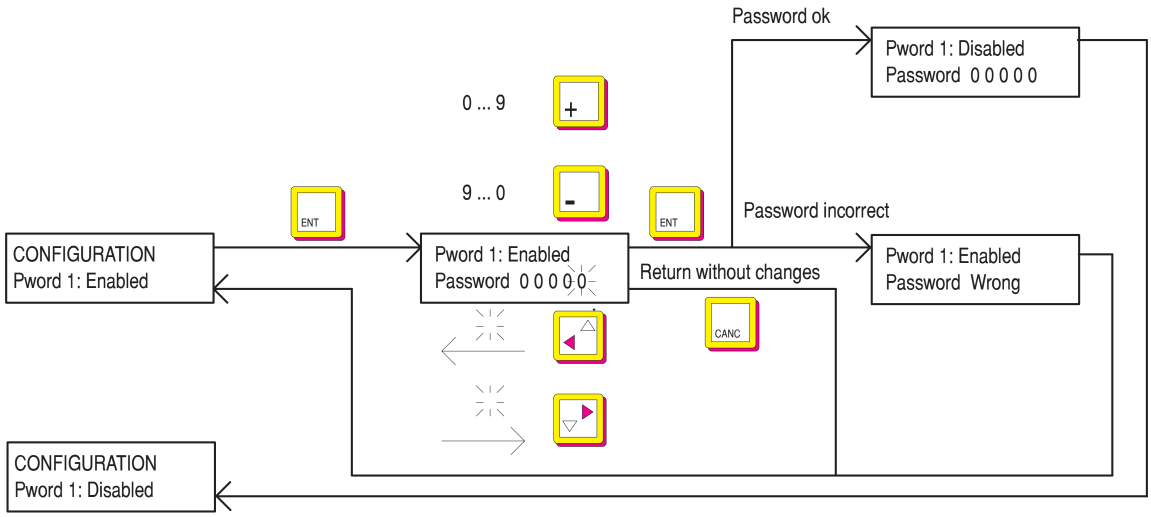
The operator can define a password consisting of a freely selectable five-digit number combination in order to protect the keypad from unauthorized access. This is carried out via the **Pword 1** parameter.



- Select **Pword1** (= Password 1) in the CONFIGURATION menu.
- Press ENT. The value 00000 will appear with the last digit flashing. The value of the flashing digit is changed.
- Increase the numerical value with +
- Reduce the numerical value with -
- Select the next digit left with ◀
- Select the next digit right with ▶
- Confirm the password by pressing ENT. The message: Pword1: Enabled will then appear shortly with the currently valid password displayed.
- The existing password is indicated in the CONFIGURATION via the "Pword 1: Enabled" message.
- Press the CANC key in order to abort the entry of the password.

NOTE! The password must be saved with **Save parameters** so that it is also active the next time the device is switched on.

General unlocking of the password



- Select the parameter **Pword1** (= Password 1) in the CONFIGURATION menu.
- When the password is enabled, the message “Pword 1: Enabled” appears
- Press ENT to call the value 00000 with the last digit flashing. The value changed is always the digit that is flashing. The valid password must be re-entered in order to unlock it.
- Increase the numerical value with +
- Reduce the numerical value with -
- Select the next digit left with ◀
- Select the next digit right with ▶
- Confirm the password by pressing ENT. The message: Pword1: Enabled will then appear for a short time.
- The existing password is indicated in the CONFIGURATION via the “Pword 1: Enabled” message.
- Press the CANC key in order to abort the entry of the password if required.
- If the incorrect password is entered and then the ENT key pressed, the message “Password wrong” will appear and the keypad will return to the CONFIGURATION menu with the display “Pword1: Enabled”

NOTE! The **Save parameter** function must be used to save the password if the password itself must not only be disabled but completely unlocked.

5.1.5. Operating the drive via the Keypad

In order to operate the drive via the keypad, the following settingss must be made in the CONFIGURATION menu:

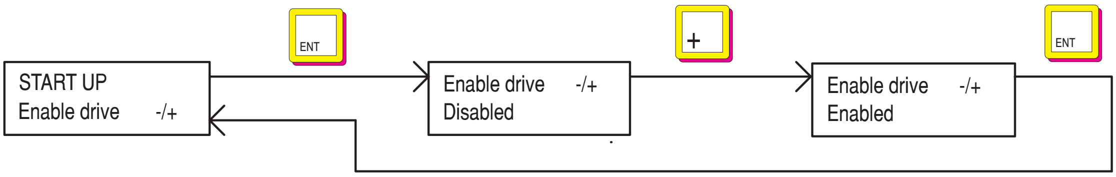
START UP and CONFIGURATION menu	**Main commands** = Digital
MENU CONFIGURATION	**Control Mode** = Local

- The hardware enables on terminals 12...15 are also active when the drive is operated via the keypad. This means, for example, that the signal at terminal 13 must also be present for starting the drive in adddition to the command via the keypad.

- If the drive is stopped via the keypad, it can be restarted simply by pressing the Start Key.
- If the stop was caused by removing the voltage signal on terminal 13, both the signal at terminal 13 and the command via the keypad are necessary to restart the drive. The signal at the terminals must be present before giving the keypad command.
- The same applies accordingly to the enabling of the drive via the **Enable drive** parameter.

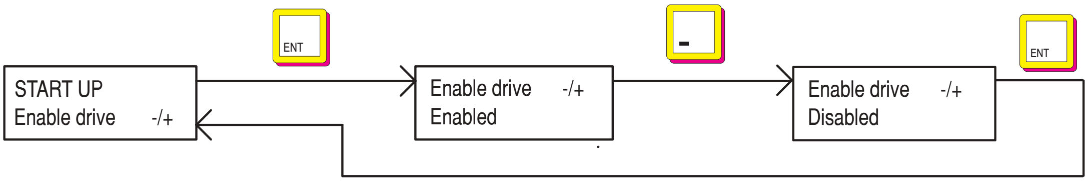
5.1.5.1. Starting and stopping the drive

Enabling the converter



- Select the parameter Enable drive in the DRIVE STATUS or START UP or MONITOR menu.
- Press ENT
- Use the key + to choose "Disabled" or "Enabled".
- Press ENT to confirm your entry.

Disabling the converter



- Select the parameter Enable drive in the DRIVE STATUS or START UP or MONITOR menu.
- Press ENT
- Use the key - to change the display from "Enabled" into "Disabled".
- Press ENT to confirm your entry.

Start / Stop

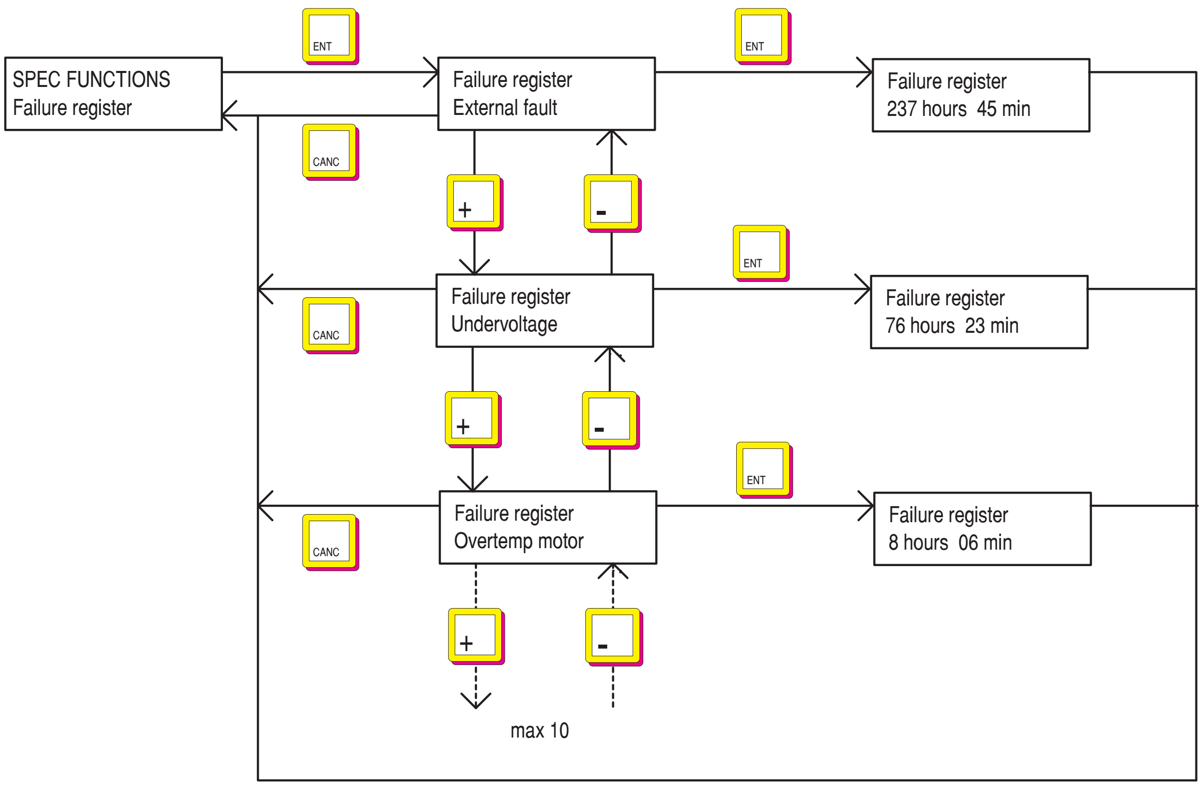
WARNING: This keypad control can be used only when the parameter **Main commands** = Digital.

- Start: press the Start key.
- Stop: press the STOP key.

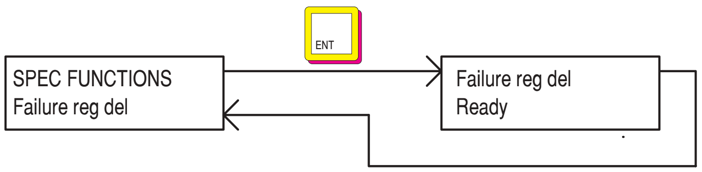
5.1.5.2. Failure register / Acknowledging alarms

Display of the failure register

- Select the parameter **Failure register** in the SPEC FUNCTIONS menu.
- Press ENT. The last error that has occurred will be displayed.
- Using the key **+** it is possible to display the previous alarm.
- The failure register can take up to 10 values. If a new failure is reported, the oldest entry in the failure register is overwritten.
- The entries in the failure register are retained until the register is cleared.
- Pressing ENT the time when the alarm occurred will be displayed. The time refers to the converter functioning period (presence of the supply voltage).
- After displaying, the menu goes back automatically to the **Failure register point**.
- By pressing the key CANC during the alarm display, the intervention time is not shown but on the contrary you go back to the **Failure register menu.**

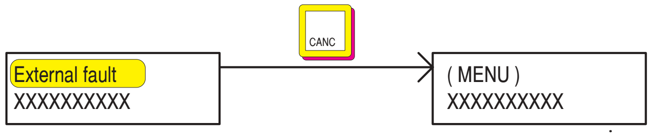


Clearing the failure register



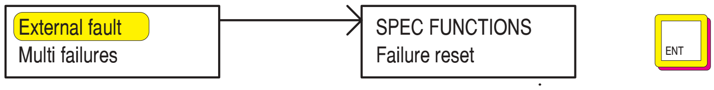
- Select the parameter **Failure reg del** in the SPEC FUNCTIONS menu.
- Press ENT. The failure register is cleared.

Acknowledging a failure alarm



- If a failure occurs, the appropriate failure alarm will appear in the display and the message will flash.
- Acknowledge or reset the failure by pressing the CANC key. The converter must be disabled for this and a Start command must not be present.

Acknowledging when several failure alarms occur at the same time

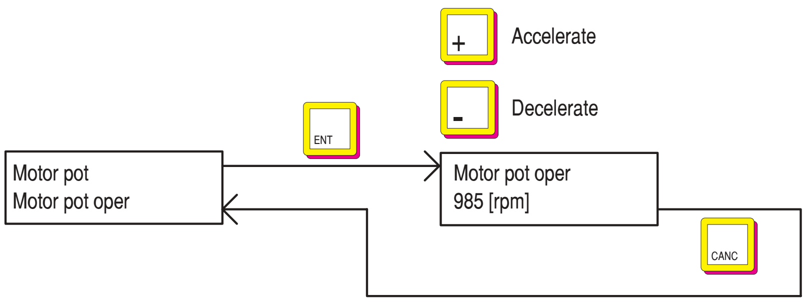


- When several failure alarms occur at the same time, the blinking message “Multi failures” will appear in the display.
- Select the parameter **Failure reset** in the SPEC FUNCTIONS menu.
- Press the CANC key to acknowledge or reset the failure alarm. The converter must be disabled for this and there should be no Start command present.

5.1.5.3. Motor potentiometer function

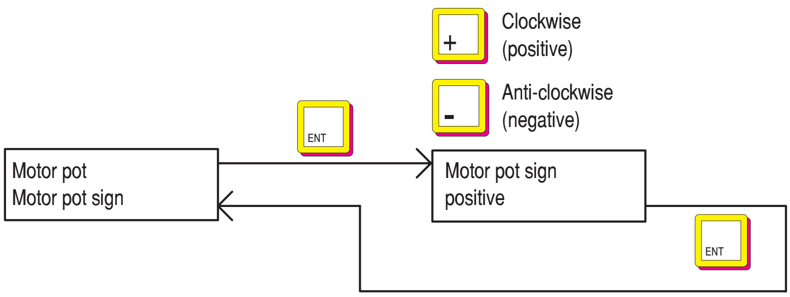
NOTE! To use the motor potentiometer function, this must be enabled with the **Enable motor pot** parameter!

Acceleration, Deceleration



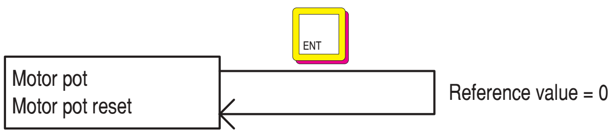
- Select the Motor pot oper parameter in the "Motor pot" submenu.
- Pressing ENT the current reference value is displayed.
- Press the + key to increase the reference value and accelerate the drive.
- Press the - key to decrease the reference value and decelerate the drive. This applies to both rotation directions.
- Press CANC to return to the "Motor pot" submenu.

Changing rotation direction



- Select the **Motor pot sign** parameter in the "Motor pot" submenu.
- Pressing ENT the current rotation direction is displayed.
- Press the + key to select clockwise rotation and the - key for counterclockwise rotation.
- Confirm by pressing ENT.
- Changing the **Motor pot sign** parameter during operation causes the drive to reverse rotation according to the ramp times set.

Resetting the speed reference value

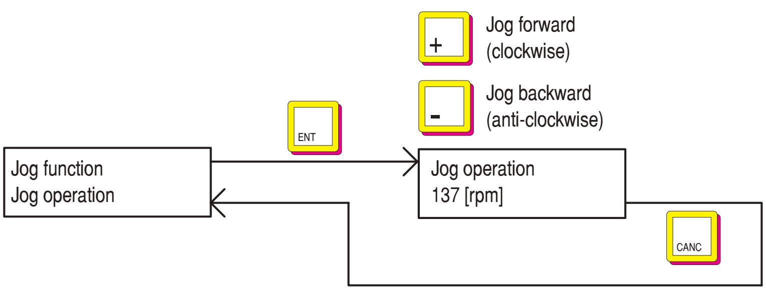


- Select the **Motor pot reset** parameter in the "Motor pot" submenu.
- Press ENT. The reference speed is set to zero.

NOTE! The speed reference value can only be reset when the drive is switched off.

5.1.5.4. Jog function

NOTE! The Jog function must be enabled via the Enable jog parameter!



- Select the **Jog operation** parameter in the "Jog function" submenu.
- Press ENT. The selection Jog function is displayed.
- Press the + key to select clockwise rotation and the - key for counterclockwise rotation.
- Press CANC to return to the "Jog function" submenu.

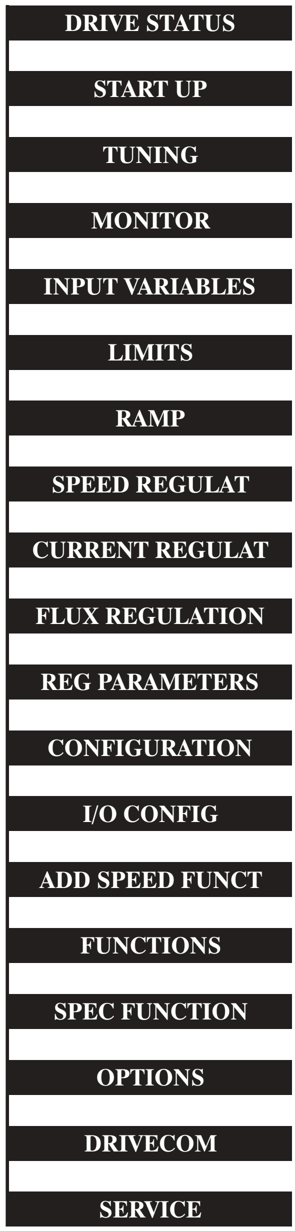
5.2. MENU STRUCTURE

The menu consists of a main menu with submenus and parameters. The structure can be compared to the organization of files and subdirections on a PC.

TPD32	main menu	corresponds PC main menu (main menu = Root)
TPD32	submenu	corresponds to PC submenu
TPD32	parameter	corresponds to individual parameters

The menu structure is described in the function description given in section 6, “Function description”. The following conventions apply:

Main menu: Black field, text in capitals
Submenu: Black field
Parameter White field



T0360i

DRIVE STATUS

[44]	Ramp ref 1
[314]	Enable drive
[315]	Start/Stop
[233]	Output voltage
[199]	Motor current
[122]	Actual spd (rpm)
[118]	Speed ref (rpm)
[1052]	Output power
[351]	Flux current (A)
[466]	Mains voltage
	Digital I/Q

START UP

[45]	Speed base value
[374]	Nom flux curr
[499]	Speed-0 f weak
[21]	Acc delta speed
[22]	Acc delta time
[29]	Dec delta speed
[30]	Dec delta time

Motor data

[280]	Motor nom flux
[469]	Flux reg mode
[179]	Full load curr
[162]	Motor max speed
[175]	Max out voltage
[456]	Flux weak speed

Limits

[7]	T current lim
[467]	Flux current max
[468]	Flux current min
[1]	Speed min amount
[2]	Speed max amount

Speed feedback

[414]	Speed fbk sel
[562]	Tacho scale
[563]	Speed offset
[169]	Encoder 2 pulses
[457]	Enable fbk contr
[652]	Refresh enc 2

T0370-ai

Alarms

[481]	Undervolt thr
[584]	Overcurrent thr

Overload contr

[309]	Enable overload
[318]	Overload mode
[312]	Overload current
[313]	Base current
[310]	Overload time
[311]	Pause time

Analog inputs

Analog input 1

[70]	Select input 1
[72]	Scale input 1
[259]	Auto tune inp 1
[74]	Offset input 1

Analog input 2

[75]	Select input 2
[77]	Scale input 2
[260]	Auto tune inp 2
[79]	Offset input 2

Analog input 3

[80]	Select input 3
[82]	Scale input 3
[261]	Auto tune inp 3
[84]	Offset input 3

[452]	R&L Search
[314]	Enable drive
[315]	Start/Stop

Speed self tune

[1029]	Fwd-Rev spd tune
[1048]	Test T curr lim
[1027]	Start
[1014]	Inertia
[1030]	Inertia Nw
[1015]	Friction
[1031]	Friction Nw
[87]	Speed P
[1032]	Speed P Nw
[88]	Speed I
[1033]	Speed I Nw
[1028]	Take val

T0370-a2i

[252]	Main commands
[253]	Control mode
[256]	Save parameters

TUNING

[452]	R&L Search
[314]	Enable drive
[315]	Start/Stop

Speed self tune

[1029]	Fwd-Rev spd tune
[1048]	Test T curr lim
[1027]	Start
[1014]	Inertia
[1030]	Inertia Nw
[1015]	Friction
[1031]	Friction Nw
[87]	Speed P
[1032]	Speed P Nw
[88]	Speed I
[1033]	Speed I Nw
[1028]	Take val

[87]	Speed P
[88]	Speed I
[444]	Prop filter
[91]	Flux P
[92]	Flux I
[493]	Voltage P
[494]	Voltage I
[256]	Save parameters

T0370-a3i

MONITOR

[314]	Enable drive
[315]	Start/Stop

Measurements

Speed

Speed in DRC [ ]

[109]	Ramp ref (d)
[112]	Ramp output (d)
[115]	Speed ref (d)
[119]	Actual spd (d)
[925]	F act spd (d)
[923]	Act spd filter

Speed in rpm

[110]	Ramp ref (rpm)
[113]	Ramp outp (rpm)
[118]	Speed ref (rpm)
[122]	Actual spd (rpm)
[427]	Enc 1 speed
[420]	Enc 2 speed
[924]	F act spd (rpm)
[923]	Act spd filter

Speed in %

[111]	Ramp ref (%)
[114]	Ramp output (%)
[117]	Speed ref (%)
[121]	Actual spd (%)

[466]	Mains voltage
[588]	Mains frequency
[1052]	Output power
[233]	Output voltage
[199]	Motor current
[928]	F T curr (%)
[926]	T curr filter
[41]	T current ref
[500]	Flux reference
[234]	Flux current
[351]	Flux current [A]

I/O

	Digital I/O
[582]	Virtual dig inp
[583]	Virtual dig out

T0370-bi

- **INPUT VARIABLES**
  - **Ramp ref**
    - **Ramp ref 1**
      - [44] Ramp ref 1
      - [47] Ramp ref 1(%)
    - **Ramp ref 2**
      - [48] Ramp ref 2
      - [49] Ramp ref 2 (%)
  - **Speed ref**
    - **Speed ref 1**
      - [42] Speed ref 1
      - [378] Speed ref 1(%)
    - **Speed Ref 2**
      - [43] Speed ref 2
      - [379] Speed ref 2(%)
  - **T current ref**
    - [39] T current ref 1
    - [40] T current ref 2
- **LIMITS**
  - **Speed limits**
    - **Speed amount**
      - [1] Speed min amount
      - [2] Speed max amount
    - **Speed min/max**
      - [5] Speed min pos
      - [3] Speed max pos
      - [6] Speed min neg
      - [4] Speed max neg
  - **Current limits**
    - [715] T curr lim type
    - [7] T current lim
    - [8] T current lim +
    - [9] T current lim -
    - [10] In use Tcur lim+
    - [11] In use Tcur lim-
    - [13] Current lim red
    - [342] Torque reduct
  - **Flux limits**
    - [467] Flux current max
    - [468] Flux current min

T0370-ci

RAMP

Acceleration

[21]	Acc delta speed
[22]	Acc delta time

Deceleration

[29]	Dec delta speed
[30]	Dec delta time

Quick stop

[37]	QStp delta speed
[38]	QStp delta time

[18]	Ramp shape
[19]	S shape t const
[663]	S acc t const
[664]	S dec t const
[20]	Ramp +/- delay
[673]	Fwd-Rev
[245]	Enable ramp
[344]	Ramp out = 0
[345]	Ramp in = 0
[373]	Freeze ramp

SPEED REGULAT.

[118]	Speed ref
[236]	Speed reg output
[322]	Lock speed reg
[242]	Enable spd reg
[348]	Lock speed I
[1016]	Aux spd fun sel
[444]	Prop. filter

Self tuning

[1029]	Fwd-Rev spd tune
[1048]	Test T curr lim
[1027]	Start
[1014]	Inertia
[1030]	Inertia Nw
[1015]	Friction
[1031]	Friction Nw
[87]	Speed P
[1032]	Speed P Nw
[88]	Speed I
[1033]	Speed I Nw
[1028]	Take val

T0370-d1i

Spd zero logic

[123]	Enable spd=0 I
[124]	Enable spd=0 R
[125]	Enable spd=0 P
[126]	Spd=0 P gain
[106]	Ref 0 level

Speed up

[445]	Speed up gain
[446]	Speed up base
[447]	Speed up filter

Droop function

[696]	Droop gain
[697]	Droop filter
[698]	Load comp
[700]	Droop limit
[699]	Enable droop

Inertia/loss cp

[1014]	Inertia
[1015]	Friction
[1013]	Torque const
[1012]	Inertia c filter

CURRENT REGULAT

[41]	T current ref
[199]	Motor current
[453]	Arm resistance
[454]	Arm inductance
[587]	E int
[452]	R&L search
[353]	Zero torque

T0370-d2i

FLUX REGULATION

[497]	Enable flux reg
[469]	Flux reg mode
[498]	Enable flux weak
[499]	Speed-0 f weak
[500]	Flux reference
[234]	Flux current
[921]	Out vlt level

Flux / if curve

[916]	Ifield cnst 40
[917]	Ifield cnst 70
[918]	Ifield cnst 90
[919]	Set flux / if
[920]	Reset flux / if

[374]	Nom flux curr
[280]	Motor nom flux

REG. PARAMETERS

Percent values

Speed regulator

[87]	Speed P
[88]	Speed I
[459]	Speed P bypass
[460]	Speed I bypass

Flux regulator

[91]	Flux P
[92]	Flux I

Voltage reg

[493]	Voltage P
[494]	Voltage I

Base values

Speed regulator

[93]	Speed P base
[94]	Speed I base

Flux regulator

[97]	Flux P base
[98]	Flux I base

Voltage reg.

[495]	Voltage P base
[496]	Voltage I base

In use values

[99]	Speed P in use
[100]	Speed I in use

T0370-ei

CONFIGURATION

[252]	Main commands
[253]	Control mode
[45]	Speed base value
[179]	Full load curr
[175]	Max out voltage
[412]	Ok relay funct

Speed feed-back

[162]	Motor max speed
[414]	Speed fbk sel
[457]	Enable fbk contr
[458]	Enable fbk bypas
[456]	Flux weak speed
[455]	Speed fbk error
[562]	Tacho scale
[563]	Speed offset
[416]	Encoder 1 pulses
[169]	Encoder 2 pulses
[649]	Refresh enc 1
[652]	Refresh enc 2
[911]	Enable ind store

Drive type

[465]	Drive size
[201]	2B + E
[464]	Size selection
[331]	Software version

Dimension fact

[50]	Dim factor num
[51]	Dim factor den
[52]	Dim factor text

Face value fact

[54]	Face value num
[53]	Face value den

T0370-fi

Prog alarms

Failure supply

[194]	Latch
[195]	Ok relay open

Undervoltage

[481]	Undervolt thr
[357]	Latch
[358]	Ok relay open
[470]	Hold off time
[359]	Restart time

Overvoltage

[203]	Activity
[361]	Latch
[362]	Ok relay open
[482]	Hold off time
[483]	Restart time

Heatsink

[368]	Activity
[370]	Ok relay open

Overtemp motor

[365]	Activity
[367]	Ok relay open

External Fault

[354]	Activity
[355]	Latch
[356]	Ok relay open
[502]	Hold off time
[501]	Restart time

Overcurrent

[584]	Overcurrent thr
[212]	Activity
[363]	Latch
[364]	Ok relay open
[586]	Hold off time
[585]	Restart time

T0370-gi

Field loss

[473]	Activity
[471]	Latch
[472]	Ok relay open
[475]	Hold off time
[474]	Restart time

Speed fbk loss

[478]	Activity
[477]	Ok relay open
[480]	Hold off time

Opt2 failure

[639]	Activity
[640]	Ok relay open

Bus loss

[634]	Activity
[633]	Latch
[635]	Ok relay open
[636]	Hold time off
[637]	Restart time

Hw opt1 failure

[386]	Activity
[387]	Ok relay open

Enable seq err

[728]	Activity
[729]	Latch
[730]	OK relay open

Set serial comm

[319]	Device address
[408]	Ser answer delay
[323]	Ser protocol sel
[326]	Ser baudrate sel

[85]	Pword1:

T 0370-hi

I/O CONFIG

- **Analog outputs**
  - **Analog output 1**
    - [66] Select output 1
    - [62] Scale output 1
  - **Analog output 2**
    - [67] Select output 2
    - [63] Scale output 2
  - **Analog output 3**
    - [68] Select output 3
    - [64] Scale output 3
  - **Analog output 4**
    - [69] Select output 4
    - [65] Scale output 4
- **Analog inputs**
  - **Analog input 1**
    - [70] Select input 1
    - [295] An in 1 target
    - [71] Input 1 type
    - [389] Input 1 sign
    - [72] Scale input 1
    - [73] Tune value inp1
    - [259] Auto tune inp 1
    - [792] Input 1 filter
    - [1042] Input 1 compare
    - [1043] Input 1 cp error
    - [1044] Input 1 cp delay
    - [74] Offset input 1
  - **Analog input 2**
    - [75] Select input 2
    - [296] An in 2 target
    - [76] Input 2 type
    - [390] Input 2 sign
    - [77] Scale input 2
    - [78] Tune value inp 2
    - [260] Auto tune inp 2
    - [79] Offset input 2
  - **Analog input 3**
    - [80] Select input 3
    - [297] An in 3 target
    - [81] Input 3 type
    - [391] Input 3 sign
    - [82] Scale input 3
    - [83] Tune value inp 3
    - [261] Auto tune inp 3
    - [84] Offset input 3

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Digital outputs

[145]	Digital output 1
[1267]	Inversion out 1
[146]	Digital output 2
[1268]	Inversion out 2
[147]	Digital output 3
[1269]	Inversion out 3
[148]	Digital output 4
[1270]	Inversion out 4
[149]	Digital output 5
[1271]	Inversion out 5
[150]	Digital output 6
[1272]	Inversion out 6
[151]	Digital output 7
[1273]	Inversion out 7
[152]	Digital output 8
[1274]	Inversion out 8
[629]	Relay 2
[1275]	Inversion relay 2

Digital inputs

[137]	Digital input 1
[1276]	Inversion in 1
[138]	Digital input 2
[1277]	Inversion in 2
[139]	Digital input 3
[1278]	Inversion in 3
[140]	Digital input 4
[1279]	Inversion in 4
[141]	Digital input 5
[1280]	Inversion in 5
[142]	Digital input 6
[1281]	Inversion in 6
[143]	Digital input 7
[1282]	Inversion in 7
[144]	Digital input 8
[1283]	Inversion in 8

Encoder inputs

[1020]	Select enc 1
[1021]	Select enc 2
[416]	Encoder 1 pulses
[169]	Encoder 2 pulses
[649]	Refresh enc 1
[652]	Refresh enc 2

T 0370-k1i

ADD SPEED FUNCT

[388]	Auto capture

Adaptive speed reg

[181]	Enable spd adap
[182]	Sel adap type
[183]	Adap reference
[184]	Adap speed 1
[185]	Adap speed 2
[186]	Adap joint 1
[187]	Adap joint 2
[188]	Adap P gain 1
[189]	Adap I gain 1
[190]	Adap P gain 2
[191]	Adap I gain 2
[192]	Adap P gain 3
[193]	Adap I gain 3

Speed control

[101]	Spd threshold +
[102]	Spd threshold -
[103]	Threshold delay
[104]	Set error
[105]	Set delay

Speed zero

[107]	Speed zero level
[108]	Speed zero delay

T0370-k2i

FUNCTIONS

Motor pot

[246]	Enab motor pot
[247]	Motor pot oper
[248]	Motor pot sign
[249]	Motor pot reset

Jog function

[244]	Enable jog
[265]	Jog operation
[375]	Jog selection
[266]	Jog reference

Multi speed fct

[153]	Enab multi spd
[154]	Multi spd 1
[155]	Multi spd 2
[156]	Multi spd 3
[157]	Multi spd 4
[158]	Multi spd 5
[159]	Multi spd 6
[160]	Multi spd 7
[208]	Multi speed sel

Multi ramp fct

[243]	Enab multi rmp
[202]	Ramp selector

Ramp 0

Acceleration 0

[659]	Acc delta speed 0
[660]	Acc delta time 0
[665]	S acc t const 0

Deceleration 0

[661]	Dec delta speed 0
[662]	Dec delta time 0
[666]	S dec t const 0

Ramp 1

Acceleration 1

[23]	Acc delta speed 1
[24]	Acc delta time 1
[667]	S acc t const 1

Deceleration 1

[31]	Dec delta speed 1
[32]	Dec delta time 1
[668]	S dec t const 1

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Ramp 2

Acceleration 2

[25]	Acc delta speed 2
[26]	Acc delta time 2
[669]	S acc t const 2

Deceleration 2

[33]	Dec delta speed 2
[34]	Dec delta time 2
[670]	S dec t const 2

Ramp 3

Acceleration 3

[27]	Acc delta speed 3
[28]	Acc delta time 3
[671]	S acc t const 3

Deceleration 3

[35]	Dec delta speed 3
[36]	Dec delta time 3
[672]	S dec t const 3

Speed draw

[1017]	Speed ratio
[1018]	Spd draw out (d)
[1019]	Spd draw out (%)

Overload contr

[309]	Enable overload
[318]	Overload mode
[312]	Overload current
[313]	Base current
[310]	Overload time
[311]	Pause time

Stop control

[626]	Stop mode
[627]	Spd 0 trip delay
[628]	Trip cont delay
[630]	Jog stop control
[1264]	Brake control
[1265]	Enable ramp W=0
[1262]	Closing speed
[1263]	Opening delay
[1266]	Actuator delay

Brake control

[1265]	Enable ramp in=0
[1262]	Closing speed
[1263]	Opening delay
[1266]	Actuator delay

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I/n curve

[750]	I/n curve
[751]	I/n lim 0
[752]	I/n lim 1
[753]	I/n lim 2
[754]	I/n lim 3
[755]	I/n lim 4
[756]	I/n speed

SPEC FUNCTIONS

Test generator

[58]	Gen access
[59]	Gen frequency
[60]	Gen amplitute
[61]	Gen offset

[256]	Save parameters
[258]	Load default
[235]	Life time
[330]	Failure register
[262]	Failure reset
[263]	Failure reg del

Links

Link 1

[484]	Source
[485]	Destination
[486]	Mul gain
[487]	Div gain
[488]	Input max
[489]	Input min
[490]	Input offset
[491]	Output offset
[492]	Inp absolute

Link 2

[553]	Source
[554]	Destination
[555]	Mul gain
[556]	Div gain
[557]	Input max
[558]	Input min
[559]	Input offset
[560]	Output offset
[561]	Inp absolute

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Link 3

[1218]	Source
[1219]	Destination
[1220]	Mul gain
[1221]	Div gain
[1222]	Input max
[1223]	Input min
[1224]	Input offset
[1225]	Output offset
[1226]	Inp absolute

Link 4

[1227]	Source
[1228]	Destination
[1229]	Mul gain
[1230]	Div gain
[1231]	Input max
[1232]	Input min
[1233]	Input offset
[1234]	Output offset
[1235]	Inp absolute

Link 5

[1236]	Source
[1237]	Destination
[1238]	Mul gain
[1239]	Div gain
[1240]	Input max
[1241]	Input min
[1242]	Input offset
[1243]	Output offset
[1244]	Inp absolute

Link 6

[1245]	Source
[1246]	Destination
[1247]	Mul gain
[1248]	Div gain
[1249]	Input max
[1250]	Input min
[1251]	Input offset
[1252]	Output offset
[1253]	Inp absolute

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OPTIONS (continued)

Pad parameters

[503]	Pad 0
[504]	Pad 1
[505]	Pad 2
[506]	Pad 3
[507]	Pad 4
[508]	Pad 5
[509]	Pad 6
[510]	Pad 7
[511]	Pad 8
[512]	Pad 9
[513]	Pad 10
[514]	Pad 11
[515]	Pad 12
[516]	Pad 13
[517]	Pad 14
[518]	Pad 15
[519]	Bitword pad A
[536]	Bitword pad B

OPTIONS

Option 1

Option 2

	Menu
[425]	Enable OPT2

PID

[769]	Enable PI PID
[770]	Enable PD PID

PID source

[786]	PID source
[787]	PID source gain

[758]	Feed-fwd PID

PID references

[759]	PID error
[1194]	Act tension ref
[763]	PID feed-back
[762]	PID offs. sel
[760]	PID offset 0
[761]	PID offset 1
[1046]	PID acc time
[1047]	PID dec time
[1254]	PID err gain
[757]	PID clamp

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PI controls

[765]	PI P gain PID
[764]	PI I gain PID
[695]	PI steady thr
[731]	PI steady delay
[793]	P init gain PID
[734]	I init gain PID
[779]	PI central v sel
[776]	PI central v 1
[777]	PI central v 2
[778]	PI central v 3
[784]	PI top lim
[785]	PI bottom lim
[783]	PI integr freeze

[771]	PI output PID
[418]	Real FF PID

PD controls

[768]	PD P gain 1 PID
[766]	PD D gain 1 PID
[788]	PD P gain 2 PID
[789]	PD D gain 2 PID
[790]	PD P gain 3 PID
[791]	PD D gain 3 PID
[767]	PD D filter PID

[421]	PD output PID
[772]	PID out.sign PID
[774]	PID output

PID target

[782]	PID target
[773]	PID out scale

Diameter calc

[794]	Diameter calc
[795]	Positioning spd
[796]	Max deviation
[797]	Gear box ratio
[798]	Dancer constant
[799]	Minimum diameter

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TORQUE WINDER

[1209]	Torque winder En

Diam Calculatio

[1154]	Roll diameter
[1160]	Line speed
[1286]	Ref line speed
[1161]	Diam calc Dis
[1205]	Diam inc/dec En
[1187]	Wind/unwind
[799]	Minimum diameter
[1153]	Maximum diameter
[1204]	Line spd source
[1284]	Ref spd source
[1156]	Line speed gain
[1285]	Ref speed gain
[1163]	Base omega
[1155]	Ref speed thr
[1162]	Diam filter
[1206]	Diam init filter
[1207]	Diam stdy delay
[1157]	Diam reset
[1158]	Diam thr
[1159]	Diam reached
[1168]	Diam preset sel
[1164]	Diam preset 0
[1165]	Diam preset 1
[1166]	Diam preset 2
[1167]	Diam preset 3

Torque calculat

[1180]	Tension ref
[1181]	Tension scale
[1194]	Act tension ref
[1193]	Torque current

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Comp calculat

[1183]	Int acc calc En
[1182]	Time acc/dec min
[1212]	Acc/dec filter
[1184]	Line acc %
[1185]	Line dec %
[1186]	Line fast stop %
[1188]	Line acc status
[1189]	Line dec status
[1190]	Line fstp status
[1171]	Variable J comp
[1172]	Constant J comp
[1192]	Act var J comp
[1291]	Act const J comp
[1173]	Mat width
[1174]	Static f
[1175]	Dinamic f
[1287]	Static f Zero
[1213]	Actual comp
[1214]	Closed loop En
[1208]	Close loop comp

Taper function

[1176]	Taper enable
[1177]	Init diameter
[1178]	Final diameter
[1180]	Tension ref
[1179]	Tension red
[1194]	Act tension ref

Speed demand

[1215]	Speed demand en
[1201]	Winder side
[1202]	W gain
[1195]	Speed match
[1200]	Spd match gain
[1196]	Spd match acc
[1197]	Spd match dec
[1203]	Spd match compl
[1216]	Spd match torque
[1199]	W offset
[1198]	Offset acc time
[1210]	W target
[1217]	W reference
[1256]	Jog TW enable
[1255]	Jog TW speed

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DRIVECOM

[57]	Malfunction code
[55]	Control-Word
[56]	Status word
[44]	Speed input var
[115]	Speed ref var
[119]	Act speed value

Speed amount

[1]	Speed min amount
[2]	Speed max amount

Speed min/max

[5]	Speed min pos
[3]	Speed max pos
[6]	Speed min neg
[4]	Speed max neg

Acceleration

[21]	Acc delta speed
[22]	Acc delta time

Deceleration

[29]	Dec delta speed
[30]	Dec delta time

Quick stop

[37]	QStp delta speed
[38]	QStp delta time

Face value fact

[54]	Face value num
[53]	Face value den

Dimension fact

[50]	Dim factor num
[51]	Dim factor den
[52]	Dim factor text

[45]	Speed base value
[46]	Speed input perc
[116]	Percent ref var
[120]	Act percentage

SERVICE

Password 2

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5.3. COMMISSIONING

WARNING! The safety instructions, danger warnings and technical data in Section 1 and 2 of this manual must be observed!

Definitions:

Positive speed is clockwise rotation seen from the motor shaft end side.

Negative Speed is counter-clockwise rotation seen from the motor shaft end side.

Positive torque is torquw in clockwise directionseen from the motor shaft end side.

Negative torque is torque in counter-clockwise direction seen from the motor shaft end side.

5.3.1. Setting jumpers and switch

The hardware configuration set via the jumpers and switches on the R-TPD3 regulator card must be adapted to the application at hand and checked **before switching on the device**.

- Analog inputs 1/2/3

Voltage input 0... 10V	Jumper S9/S10/S11 = OFF
Current voltage 0...20 mA / 4...20 mA	Jumper S9/S10/S11 = ON
Mixed possible configuration	

- Adaptation for the speed reaction type

Sinusoidal Encoder	Jumper S5/S6 in position A
Digital Encoder	Jumper S5/S6 any position
Analog tachometer generator	Jumper S5/S6 in position B
Armature reaction	Jumper S5/S6 any position

- Adaptation for the digital encoder voltage

Voltage = 5 V	Jumper S21/S22/S23 = ON
Voltage = 15...30 V	Jumper S21/S22/S23 = OFF

- Control of a digital encoder connected to the connector XE2

Channel C controlled	Jumper S20 = ON
Channel C not controlled	Jumper S20 = OFF
Channels A and B controlled	Jumper S28 = ON
Channels A and B not controlled	Jumper S28 = OFF

- Control of a digital encoder connected to the connector XE1 via the option card DEII

Encoder controlled	Jumper S27 = ON
Encoder not controlled	Jumper S27 = OFF

- Adaptation of the max voltage using a tachometer generator:
  22.7 / 45.4 / 90.7 / 181.6 / 302.9 — Depending on the dip switch S4 setting (See table 4.4.1.1)
- Serial interface RS485
  On the first and last device of a line: — Jumper S12 / S13 = ON
  On the other converters — Jumper S12 / S13 = OFF
- RS485 serial interface
  - divided from the regulation — Jumper S18 / S19 in position C/A
    (An external 5 Vpower supply is needed on the PINs 5 and 9) see section 4.4.2
  - with a common potential 0 V of the regulation (Internal power supply) — Jumper S18 / S19 in position C/B

For further information see section 4.4, “Regulation section”.

5.3.2. Checking the wiring and the auxiliary voltages

The following should be checked **before switching on the device**:

- Proper connection of cables (Section 4.8)
- Compliance with Section 4.10, “Engineering notes”
- Compliance with “EMC installation and wiring”
- **When the device current limit is not set according to the rated current value of the connected motor, a protection thermal relay must be inserted in the upper part of the converter, which has to be scaled according to the motor rated current times 0.86.**

CAUTION! **It is not allowed to connect an external voltage on the converter output**

- blocked converter (disconnect the terminal 12)

- The following voltages must be present:
  - terminal 7 + 10V to terminal 9
  - terminal 8 - 10V to terminal 9
  - terminal 19 + 24 ... 30V to terminal 18

- Select the **Actual spd (rpm)** parameter in the DRIVE STATUS menu.
  - With a disabled regulator turn the motor in a clockwise direction (view facing the shaft). The displayed value must be positive.
  - If the value does not change or if wrong values are shown, check the power supply and the cabling of the encoder/tachometer.
  - If the displayed value is negative, the connections of the encoder or of the tachometer generator must be changed: channel A+ with A- or B+ with B- of the encoder, change the connections of the tachometer signal.

5.3.3. Basic settings of the converter

NOTE! It is assumed that the device has the default configuration and is connected and tested according to the diagrams provided in section 4.8, “Standard connection diagrams”. The default setting can be loaded via the **Load default** parameter in the SPEC FUNCTIONS menu. Laoding this parameter will mean that all modifications carried out by the user will be overwritten. An exception is represented by the **Tacho scale** and **Speed parameters.**. These are not overwritten when the factory set values are loaded and it is not necessary to scale again the input signal of the tachometer section. The same is valid for the **Size selection** parameter.

The factory setting allows a speed regulation with the cascade current regulation for a DC motor, with an independent excitation and provided with a digital encoder. The drive, in this case, does not operate with a field weakening. Independently of the desired configuration, it is advised to carry out all the basic settings described in order to avoid possible mistakes. After the commissioning all other available functions can be activated. Their setting is described in the following pages.

The possible values set for each parameter can be found in section 10, “Parameter lists”.

The following settings must be carried out with a disabled converter.
Enable drive = disabled (no voltage on the terminal12).
See section 5.1, “Keypad”, for information about operating the keypad.

Functioning selection

- When the converter has to be controlled exclusively via the terminal strip, set the parameter **Main commands** = “Terminals”.
- When the keypad is used **Main commands** = Digital.

Setting storage

- Use the parameter **Save parameters** in the START UP menu.
- In order to keep the parameter setting even after switching the converter off and on, it is necessary to save the parameters by storing them.
- When the keypad is used: press ENT.

In the standard deliveries the paramater **Main commands** has been set with “digital” in order to carry out the automatical calibration of the current regulatorwhile commissioning.

5.3.4. Commissioning procedure

Following the list stated in the START UP menu, it is possible to set the converter for the most common uses, thus limiting its movement among the menus.

Speed base value	It sets the rpm number corresponding to 10V on the analog input.
Nom flux curr	In case the exciter rated current has been modified through the resistances and the dip switches, the new value has to be set here. See table 2.4.3.2.
Speed-0 f weak	It enables the field saving at a zero speed.
Acc delta …	It allows to set the ramp time (acceleration).
Dec delta ...	It allows to set the ramp time (deceleration).

Motor data

All the motor referring data are entered into this submenu.

In case the speed self-tuning has to be carried out, such values must correspond to the motor nameplate data, as the motor torque constant derives right from them.

Motor nom flux	Field current of the motor in A.
Flux reg mode	Field control mode, steady current or field weakened '*Voltage control*'.
Full load curr	Motor armature current. 100% of the converter current corresponds to this value. The default datum is the converter rated current. The current can be limited via the parameter **T current limit**.
Motor max speed	Motor maximum speed. Set the nameplate datum.
Max out voltage	Maximum armature voltage. It is the set point controlling the output voltage.
Flux weak speed	Percentage of **Motor max speed** where the field weakening range starts.

NOTE! As for the speed self-tuning procedure, it is necessary to set such data according to the motor nameplate data. Only at the end of the procedure such data can be modified by entering the user desired values.

Limits

This submenu lists the speed, current and field limits used when they have to be different from the submenu *Motor data*.

T current limit	Limit of the armature current as a percentage of **Full load curr**. In case an overload occurs, it must be higher or equal to **Surge current**.
Flux current max	Maximum field current as a percentage of **Motor flux curr**.
Flux current min	Minimum delivered field current as a percentage of **Motor flux curr**. It corresponds to the supplied current with an active field saving; it corresponds also to the lower limit in case of field weakening range.
Speed min amount	Minimum limit for the speed reference; it is useful in case some references have to be summed up.
Speed max amount	Maximum limit for the speed reference; it is useful in case some references have to be summed up.

Speed feedback

Setting of the speed reaction.

Speed fbk sel	Selection of the reaction type: encoder 1, encoder 2, tachogenerator, armature.
Tacho scale	Value for the tachogenerator fine tuning.
Encoder 2 pulses	Pulse number of the digital encoder (2).
Enable fbk contr	Enabling of the speed reaction test. It requires the right setting of **Motor max speed**, **Max out voltage**, **Flux weak speed**.
Refresh enc 2	Enabling of the test stating the presence of the signals A, B, Aneg, Bneg on the digital encoder. It is enabled only if **Enable fbk contr** is active.

Alarms

Under voltage	Alarm threshold for the main undervoltage.
Overcurrent thr	Intervention threshold of the protection against any overcurrent.

Overload control

The overload control allows, for a short period of time, to deliver an overcurrent which can be higher than the converter armature rated current. It is used to supply the drive with a higher torque reaction or, for example, to allow particular load peaks on machines subject to cyclical loadings.

Analog inputs 1, 2 ,3

The converters of the series TPD32 are in a position to combine specific functions with three programmable analog inputs, configured as differential inputs (terminals 1-2, 3-4, 5-6).

In standard conditions the input 1 (terminals 1 and 2) is connected to **Ramp ref 1**.

5.3.5. Converter tuning

5.3.5.1. Self-tuning of the current regulator

This operation has to be carried out before enabling the converter for the first time.

The current regulator is automatically optimized via the parameter **R & L Search**. The resistance and armature inductance values are stored as parameters **Arm resistance** and **Arm inductance** in the CURRENT REGULAT menu. If needed, the user can change such parameters by hand.

- In case the motor field is not power supplied by the converter, disconnect the field terminals. The internal field circuit is automatically blocked during the optimization phase, therefore the field has not to be disconnected.
- The user must make sure that during the optimization procedure, the drive does not start rotating in spite of the field lack (remanent magnetization, field series ....). If needed block the motor shaft mechanically.
- Power supply voltage on the terminals U2 and V2
- Blocked converter (voltage lack on the terminal 12)

- The parameter **Main commands** (START UP or CONFIGURATION menu) must be "Digital".
- Before the optimization procedure, set the limit of the armature current.
- Disable the function "Overload control" during the optimization procedure (**Enable overload** = Disabled).
- Parameter **R&L search** in the START UP menu= Enabled
- Insert the drive (power supply of the power section to the terminals U, V, W, presence of the unblocking signals on the terminals 12 and 13).
- Enable the drive via the parameter **Enable drive** in the START UP menu.

NOTE! In case the parameter **Stop mode** has not been selected with "OFF", it is necessary to press the key START on the keypad.

- Starting of the self-tuning procedure, which could last some minutes.
- At the end of the self-tuning procedure, the converter is automatically disabled and the parameter **R&L search** in the START UP menu is configured as = Disabled.
- Switch off the drive = no voltage on the terminal 12 .
- Set the parameter **Main commands** with the desired value.
- If you want, the overload control function can be started: (**Enable overload** = Enabled).
- Save the settings.

NOTE! After it has been started, the self-tuning procedure can be stopped by **Enable drive** = Disabled. The parameters set before the optimization procedure are therefore valid. No self-tuning is possible if the drive is active.

5.3.5.1.1 Control of the current regulator performances via the parameter Eint

During the converter functioning phase, the "Current Regulator" menu shows the parameter **Eint**, which measures a current medium internal error.

Such value has to be closed to zero, but values changing dynamically and included between -40 and +40 are also accepted. **In order to consider such reading procedure as valid , the converter must have at least 30% of its load.** If some changes are required, change slightly the parameter **Arm inductance** (in the Current regulator menu) in order to carry out a fine tuning and bring back the parameter **Eint** to an acceptable value.

- If the reading of **Eint** is positive, increase the value of **Arm inductance**.
- If the reading of **Eint** is negative, decrease the value of **Arm inductance**.

5.3.5.2. Self-tuning of the speed regulator

The ***Self tuning*** procedure detects the total inertia value of the motor shaft (Kg*m^2), the friction value in N*m and the calculation of the Proportional and Integral gain of the speed regulator.

DANGER ! Such procedure requires the free rotation of the motor shaft combined with the load. The self tuning procedure of the speed loop can not be carried out on machines with a limited stroke.

WARNING ! The test is carried out by using the torque limit value set in the parameter **Test T curr lim**. The torque reference is applied via a step reference (without ramp); the mechanical transmission must not have any “allowance” and it must be compatible with those operations using the torque limit value set in the parameter **Test T curr lim**. Via this parameter the user can modify the torque limit value.

NOTE ! In applications where the system total inertia value is very high, it is necessary to increase the value of the parameter **Test T curr lim** in order to avoid “Time out” errors.

The self tuning procedure of the speed loop is not suitable for converters used in applications such as “elevators” and lifting systems.

In order to obtain a precise calculation of the torque constant **Torque const** and therefore a precise self tuning procedure, it is necessary to enter the values of the motor nameplate for the following parameters:

Motor max speed	Equal to the maximum speed of the motor nameplate
Flux weak speed	Equal to the nameplate per cent value at the beginning of the field weakening as compared to the motor maximum speed
Current limit	Equal to the motor nameplate datum
Motor flux curr	Equal to the motor nameplate datum
Max out voltage	Equal to the motor nameplate datum

These parameters can be modified after the self tuning procedure has been carried out in accordance with the machine application needs, without modifying the value of **Torque const** identified during this self tuning procedure.

Set the motor shaft rotation direction: clockwise (FWD) or anti-clockwise (REV) via the parameter **Fwd-Rev spd tune**

Select the value of the torque current to be used during the self tuning procedure of the speed loop via the parameter **Test T curr lim .**

Select the START UP \ Self tuning menu.

Carry out the procedure with the command **Start**.

During the procedure an acceleration test with the torque limit value set in the parameter **Test T curr lim** is carried out and afterwards a deceleration test without any motor control and any applied torque till the zero speed has been reached.

The test threshold speed is 33% of the lowest value set in the following parameters:

- **Speed base value**
- **Speed max pos** or **Speed max neg** in accordance with the rotation direction.

The procedure will last some minutes, according to the inertia values and the frictions.

According to the inertia and friction values, the converter will detect the speed loop gains (parameters **Speed P** and **Speed I**).

In case some manual regulations are required (with vibrations, etc.), these should be carried out according to the value of the integral gain **Speed I [%]** . If the regulator self tuning procedure is not satisfactory, refer to the chapter 5.4.6 for the manual procedure of “Tuning of the speed regulator”.

At the end of the procedure, the new values of the obtained parameters (suffix “Nw”) can be compared with the values preceding the self tuning procedure by examining the ***Self tuning menu***. This menu contains only reading parameters.

The new parameters can be activated using the command **Take val** after the converter has been disabled. In this case, the values preceding the self tuning procedure are overwritten. ***Self tuning*** can be repeated even though the values of the previous attempt have not been confirmed.

NOTE! ***Self tuning*** does not store permanently the calculated values, which get lost if the converter is disabled. In order to store permanently the obtained values, it is necessary to use the command **Save parameters**.

In case the extreme values of some parameters are detected, some error messages could appear. Repeat the speed self tuning procedure. If the error message does not disappear, keep the default values and tune the speed regulator by hand (chapter 5.3.6. "Tuning of the speed regulator").

List of the error messages during the self tuning procedure

Generic messages

"Drive disabled":	Power supply the terminal 12 (ENABLE) with a voltage equal to +24V
"Not ready":	**Take val** can not be carried out as the test has not been completed in the right way. Repeat the self tuning procedure.
"Time out":	The self tuning procedure has not been ended within the available time.
"Start ?":	Press ENT in order to confirm the starting of the self tuning test
"Tuning aborted":	The self tuning test has been disabled by the user (the key CANC has been pressed).
"Set Main cmd=Dig":	Select the CONFIGURATION and set the parameter **Main commands = digital.**
"Set Ctrl=Local":	Select the CONFIGURATION menu and set **Control mode** = Local.

Measure error messages

These error messages can appear when the parameter extreme values have been detected. It could be useful to repeat the self tuning procedure when one of the following messages appears. If the message does not disappear, it is necessary to use some manual tuning procedure.

"Over speed"	
"Drive stalled":	Increase the value of the parameter **Test T curr lim** and repeat ***Self tuning***
"Load applied":	It has been detected a too high loading torque value at zero speed. No *Self tuning* is possible with this sort of load.
"T curr too high":	Decrease the value of the parameter **T curr lim** for ***Self tuning***
"Friction null":	The friction value is zero or lower than the control precision limit.

5.3.5.3. Field converter

In standard conditions the TPD32 converters are configured to operate without any field weakening. The following settings have to be used only when a functioning with a weakened field is required or when the field of the connected motor is not power supplied via the converter.

All the settings described in this chapter have to be carried out with a blocked converter (no voltage on terminal 12).

Functioning method

- With a constant field current: **Flux reg mode** = Constant current
  Enable flux reg = Enabled
- With a field weakening: **Flux reg mode** = Voltage control.
  Set the maximum output voltage in the CONFIGURATION menu with the parameter **Max out voltage**.
  Enable flux reg = Enabled
- Field not power supplied by TPD32 **Flux reg mode** = External control
  Enable flux reg = Disabled.

Setting of the field rated current

- Set the motor field rated current with the parameter **Motor nom flux**.
- When the motor field current is lower than the rated current of the field converter, the current of the field converter can be adjusted via the switch S14. It must be configured according to the prescriptions of the table 5.3.5.3.1. The parameter **Nom flux curr** allows to select the new rated field current.
- Acting with a fixed field current, if the rated field current of the motor is £ 10%, it is necessary to adjust the field current via the switch S14.
- Acting with a field weakening control, it is also necessary to refer to the CEMF value or to the crossover datum. If the maximum field current is £ 10% of the maximum value of the internal field converter, it is necessary to adapt the feedback via the switch S14.

Table 5.3.5.3.1: Tuning resistances of the field current

Switch ohms	148 ohm	330 ohm	182 ohm	36.4 ohm	845 ohm	1650 ohm	**Equivalent resistance**
Field curr scale	**S14-1**	**S14-2**	**S14-3**	**S14-4**	**S14-5**	**S14-6**	
1.0 A	OFF	OFF	OFF	OFF	OFF	ON	1650 ohm
2.0 A	OFF	OFF	OFF	OFF	ON	OFF	845 ohm
3.0 A	OFF	OFF	OFF	OFF	ON	ON	558.8 ohm
5.0 A	OFF	ON	OFF	OFF	OFF	OFF	330 ohm
10.0 A	ON	OFF	OFF	OFF	OFF	OFF	168 ohm
12.9 A	ON	OFF	OFF	OFF	ON	ON	129.2 ohm
17.2 A	OFF	ON	ON	OFF	ON	ON	97 ohm
20.0 A	ON	OFF	ON	OFF	OFF	ON	83 ohm
24.1 A	ON	ON	ON	OFF	OFF	OFF	69 ohm

DV0032g

In the above mentioned cases the precise tuning of the field current is not required.

The calibration is not required if the field control on the motor is carried out externally to the internal field converter of TPD32.

Maximum/minimum field current flux

- Setting of the LIMITS / Flux limits menu where the parameters **Flux current max** and **Flux current min** are given as a percentage of **Motor nom flux**.

5.3.6. Regulator manual tuning

The tuning of the regulators of the TPD32 converters has some predefined values. In this way it is usually possible to obtain a satisfactory behavior of the regulators. The tuning of the armature current regulator must always be carried out. When the regulation meets the needed requirements, the optimization procedure of the other regulators is not necessary.

The converter contains the following regulation circuits:

- Regulator of the armature current. The self tuning procedure is obtained via the parameter **R&L search**
- Speed regulator: self tuning procedure available.
- Field current regulator: manual tuning.
- Armature voltage regulator: manual tuning.

Here following you will find a description of the optimization procedure, if required. In order to obtain a step function, the internal "Test generator" is used ("SPEC FUNCTIONS" menu). The aim is to obtain an optimal step response. As for current, we suggest, for example, to measure directly the step response.

The analog output can be brought back to the terminal strip by using the TBO option card, with a sampling time of two milliseconds.

The TBO card has to be used when several signals have to be measured simultaneously (for example motor current and speed).

Use of the Test generator

This function creates some signals with a rectangular weave form and a frequency and an amplitude to be set. They can be added to an offset which can be set too. The parameter **Gen access** states on which regulator input the signal must be active. Further information can be found in chapter 6.15.1 "Test generator" .

Manual tuning of the speed regulator

- Blocked drive = no voltage on terminal 12
- Choose the following settings for the Test generator :
  - **Gen access** = Ramp ref
  - **Gen frequency** = 0.2 Hz
  - **Gen amplitude** = 10 %
  - **Gen offset** = 10 %
- Measuring of the reaction on an analog output (the TBO option is necessary). To this purpose the variable "Actual Spd" has to be parameterized on one output and the variable "Motor current" on another (see "Input/Output programming").
- Set in the START UP menu the parameter **Acc delta speed** with the highest possible value and the parameter **Acc delta time** at 1 second.
- Set at 0.00 the parameters **Speed P** and **Speed I** in the REG PARAMETERS / .... menu.
- Trigger the drive (voltage on terminal 12) and give the Start (voltage on terminal 13)
- Increase **Speed P** till the overshoot is lower than 4% with the shortest possible reaction time.
- Increase **Speed I** till the overshoot is higher than 4%. Decrease it, till its value becomes slightly lower than 4%.

- Stop the drive and block it.
- **Gen access** = Not connected
- Save the settings.

NOTE! When the “Bypass” function is enabled (**Enable fbk bypas** = Enabled) the converter is automatically switched to an armature reaction when no reaction signal is present. In this condition, when the reaction signal is disabled, it is necessary to carry out again the above mentioned optimization procedure of the speed regulator. The P section of the speed regulator is set with the parameter **Speed P bypass** while the I section with **Speed I bypass**.

In some cases it is necessary to have different gains for the speed regulator, above the speed range. For this reason the converters of the series TPD32 have at their disposal an adaptive speed regulator. For further information about this function see the chapter 6.13.2. The tuning procedure is described on the following pages.

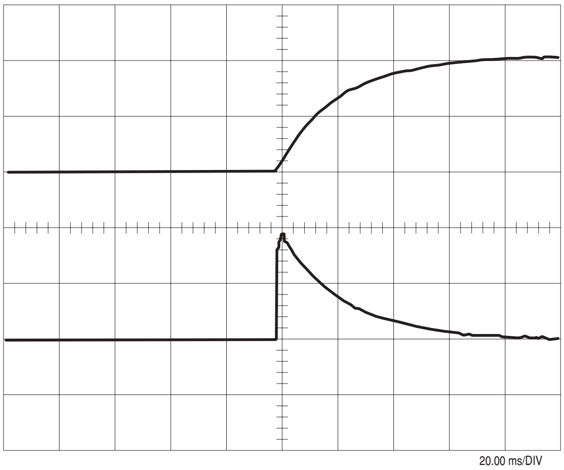

Figure 5.3.6.1: ***Speed P*** *too small*
Above: Actual spd, below: Motor current

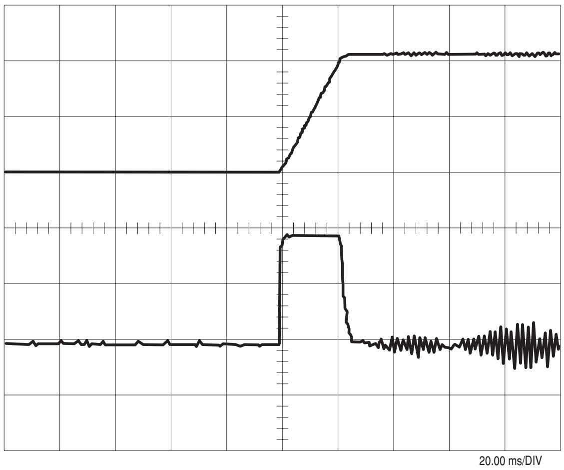

Figure 5.3.6.2: ***Speed P*** *too high*
Above: Actual spd, below: Motor current

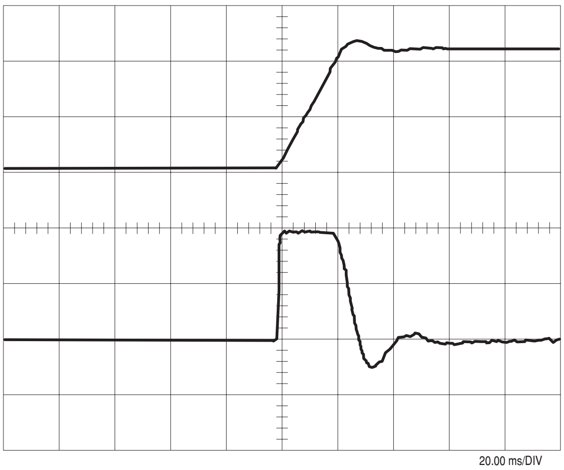

Figure 5.3.6.3: ***Speed I*** *too high*
Above: Actual spd, below: Motor current

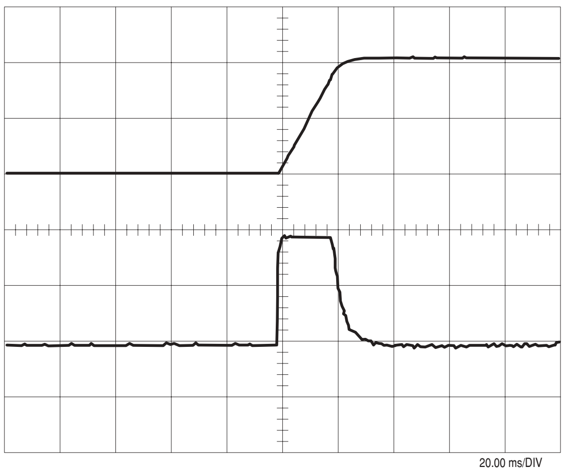

Figure 5.3.6.4: ***Speed P*** *and* ***Speed I*** *correct*
Above: Actual spd, below: Motor current

Manual tuning of the field current regulator

NOTE! In most of the cases the motors with a direct current and an independent excitation work with a constant field (**Flux reg mode** = Constant current). In this case it is not necessary to optimize the regulator of the field current and the one of the armature voltage.

The below optimization procedure refers to drives working with a constant torque and power (mixed armature and field regulation). In these cases it is necessary, first of all, to configure the field converter according to this functioning method. See the following pages.

NOTE! During the optimization procedure of the field current regulator, the converter can not receive any Start command.

- Blocked converter (no voltage on the terminal 12)
- LIMITS / Flux limits menu: **Flux current max** = 100% equal to the field rated current of the connected motor; **Flux current min** = 0
- Set at 0.00 the parameters **Flux I** and **Flux P** in the REG PARAMETERS / ... menu
- Measure the field current via an analog output (the TBO option is necessary). To this purpose the variable “Flux current” has to be parameterized on one output and the variable “Flux reference” on another (see “Input/Output programming”).
- Select the FLUX REGULATION menu
- **Enable flux reg** = Enabled (standard)
- **Flux reg mode** = Voltage control
- **Enable flux weak** = Enabled
- Set **Gen access** = Flux reference and **Gen amplitude** to 70% of the field rated current of the motor (it allows the system overshoot).
- Increase the value of the parameter **Flux P** till the overshoot of the field current (Flux current) is lower than 4% .
- Increase the value of **Flux I** till the overshoot is higher than 4%; afterwards decrease it till its value becomes slightly lower than 4%.

NOTE! Because of the relative high field time constant, the field current rising speed is limited. The rising time with optimal tuning conditions could be hundred milliseconds.

- **Gen access** = Disconnected
- **Enable flux weak** = Disabled
- Set **Flux current min** with the desired value
- Configure the analog outputs according to the different needs.
- Save the settings.

The figures 5.3.6.5 ... 5.3.6.7 show some tuning examples for the field current regulator.

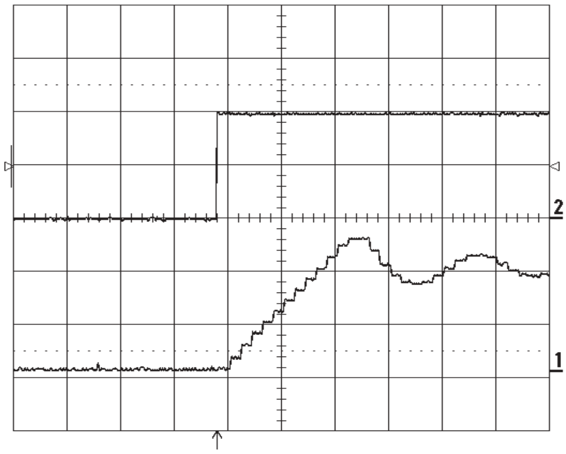

Figure 5.3.6.5: Increase in the field current with oscillations

Non optimal behavior of the regulator.
Above: Flux reference, below: Flux

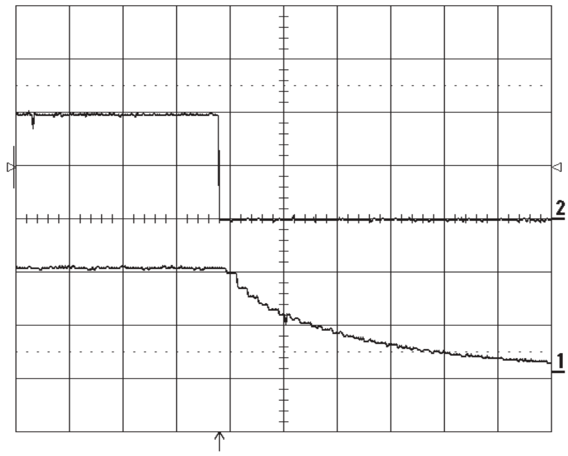

Figure 5.3.6.6: Too high time constant of the field

The reduction of the field current depends too much on the field time constant. The regulation has therefore no influence.

Above: Flux reference, below: Flux

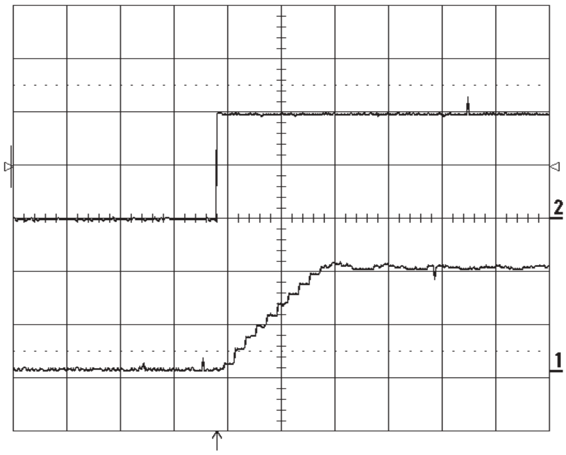

Figure 5.3.6.7: Increase in the field current without oscillations

Variation as compared to Fig. 5.3.6.5: increase of Flux P from 2 to 10%. Flux I = 5%

Above: Flux reference, below: Flux current

Voltage regulator in the field converter

NOTE! In most cases of use, the d.c. motors with independent excitation, work with constant field **(**Flux reg mode **= Constant current).** In this case it is not necessary to optimize the regulator of the field current and the regulator of the armature voltage.

When a field weakening occurs, the voltage regulator keeps the armature voltage at a constant level. The critical point for this regulator is given at the beginning of the field weakening, because with the saturation of the motor field the system requires more consistent changes in the field current in order to carry out a flux change. Tune the regulator so that the armature voltage undergoes very small changes.

NOTE! Before the optimization of the voltage regulator, the other converter regulators must have been already set.

- Blocked drive = voltage lack on terminal 12
- Choose the following settings for the Test generator :
  - **Gen access** = Ramp ref
  - **Gen frequency** = 0.2 Hz
  - **Gen amplitude** = 10 %
  - **Gen offset** = According to the switching point from the armature to the field regulation. Example: **Motor max speed** = 2000 rpm, the field weakening starts at 1500 rpm. **Gen offset** = 75 %
- Measure the field current and the armature voltage on an analog output (the TBO option is needed). To this purpose the variable “Flux” has to be parameterized on one output and the variable “Output voltage” on another (see “Input/Output programming”).
- Trigger the drive and give the Start command (voltage on terminals 12 and 13)
- Check the armature voltage. After a possible short oscillation, the voltage has to remain constant. As an example see the figures 5.3.6.8 ... 5.3.6.10. In the REG PARAMETER \ ... menu it is possible to change the sections P and I with the parameters **Voltage P** and **Voltage I**.
- Stop the drive and block it.
- **Gen access** = Not connected
- Save the settings.

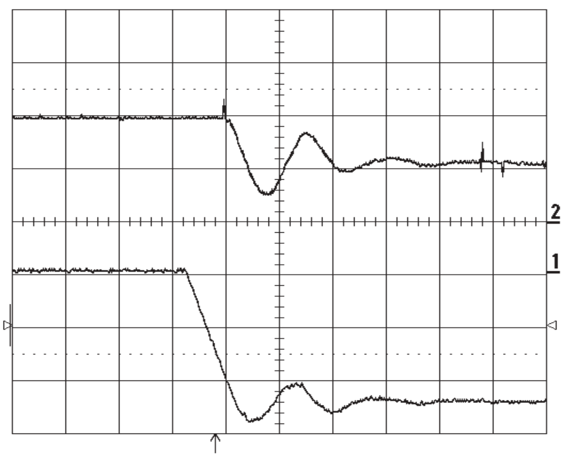

Figure 5.3.6.8: Oscillations of the field voltage

After a speed change oscillations
Voltage P = 10 %, Voltage I = 80 %
Above: Flux, below: Output voltage

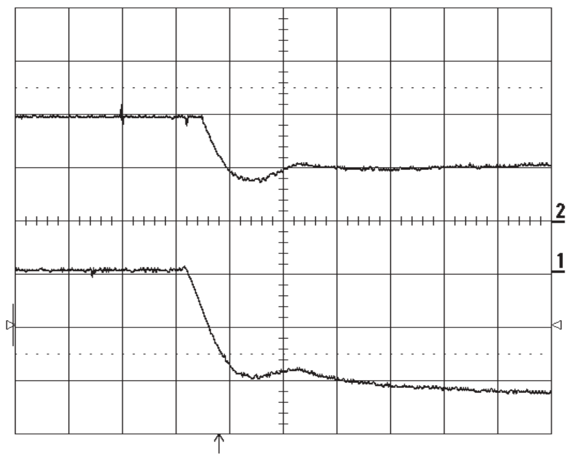

Figure 5.3.6.9: Too small gain

The armature voltage increases
Voltage P = 3 %, Voltage I = 5 %
Above: Flux, below: Output voltage

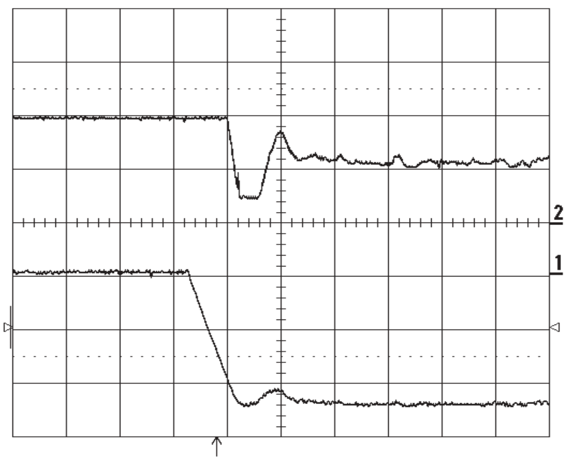

Figure 5.3.6.10: Field regulator optimal

After a short transient, the field current and armature voltage are constants.
Voltage P=40% Voltage I=50%
Above: Flux curr., below Output volt.

5.3.7. Other tunings

Flux / if curve tuning (Flux / if curve)

The function of this curve is the one of carrying out, in defluxing conditions, a control of the real flux of the motor and so the possibility of controlling the torque. The figure below describes the relation between flux and flux current in conditions of Flux /if curve defined and not defined.

NOTE! The tuning of the field current (previous section) and of the output voltage (next section) must be carried out when a deflux working is required, either the interested flux curve has been defined or not.

The tunings scale is the following:
- ***Field current regulator***
- ***Flux/ if curve tuning (Flux / if curve)***
- ***Voltage regulator in the field converter***

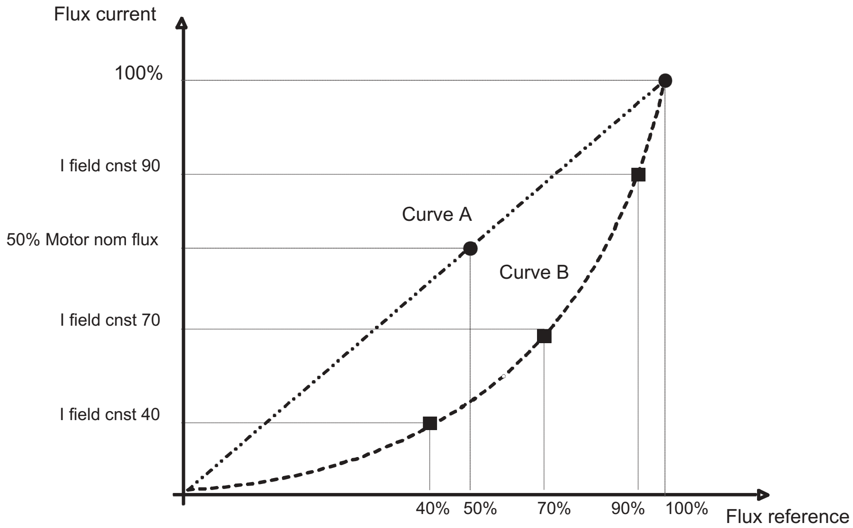

Figure 5.3.7.1: Curve convertion flux/current

Example:

A - keeping unchanged the curve tuning compared to the default setting of the converter, it will be obtained a linear characteristic (Curve A) of the flux current (**Flux current**) when the parameter **Flux reference** changes. Then:

Flux current max/Flux reference = 100% **Flux current/Flux reference** = Motor nom flux
Flux current max/Flux reference = 50% **Flux current/Flux reference** = 50% Motor nom flux

B- Carrying out the tuning of the flux curve (see below tuning procedure) the result will be emphasized by the curve B. The values of **Flux current** will follow a characteristic determined by the real flux percentage **Flux reference**, necessary to determinate the circulation of that field current for the connected system.

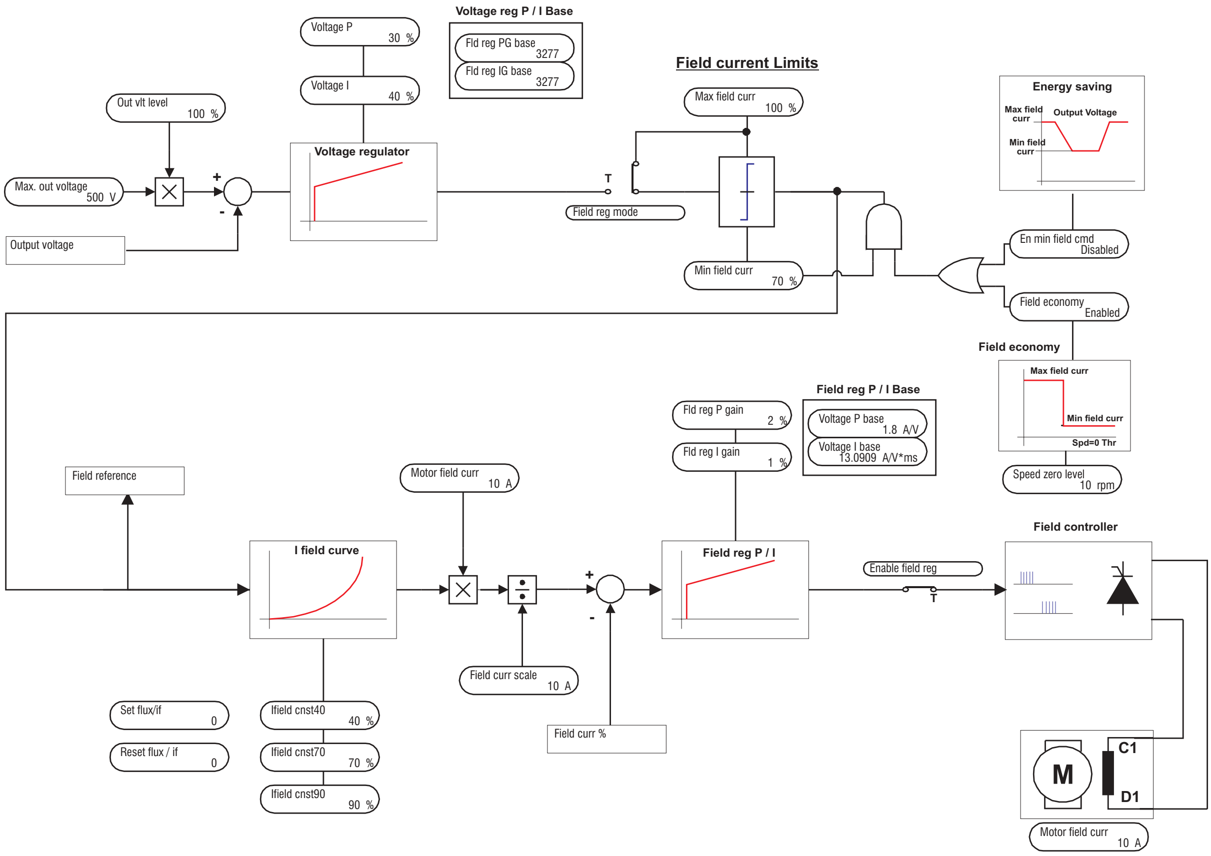

Figure 5.3.7.2: Blocks diagrams of flux regulation

Tuning procedure:

- Reset the curve flux/current through the command **Reset flux / if** (menu FLUX REGULATION/Flux / if curve)
- Set the motor field current in the parameter **Motor nominal flux** (menu FLUX REGULATION)
- Set the desired output voltage through the parameter **Max out voltage** (menu CONFIGURATION) and the correspondent percentage (100%) in the parameter **Out vlt level** (menu FLUX REGULATION)
- Set as constant current the field regulator **Flux reg mode** = Constant current (menu FLUX REGULATION)
- Set the flux percentage at 100% through **Flux current max** (menu FLUX REGULATION)
- Bring the motor to such a speed, so that the electromotive force displayed in **Armature voltage** (menu MONITOR\Measurements) corresponds to the value previously set in **Max out voltage**
- Acting on **Flux current max** decrease the speed displayed in **Armature voltage**, up to obtain an output voltage equal to the 90% of **Max out voltage**.

  Carry out the reading of the current circulating in the parameter **Flux current** (menu FLUX REGULATION) and insert it in the parameter **I field cnst 90** (menu FLUX REGULATION\Flux if curve).
- Acting on **Flux current max** decrease the voltage displayed in **Armature voltage**, up to obtain an output voltage equal to the 70% of **Max out voltage**.

Carry out the reading of the current circulating in the parameter **Flux current** (menu FLUX REGULATION) and insert it in the parameter **I field cnst 70** (menu FLUX REGULATION\Flux if curve).

- Acting on **Flux current max** decrease the voltage displayed in **Armature voltage**, up to obtain an output voltage equal to the 40% of **Max out voltage**.

  Carry out the reading of the current circulating in the parameter **Flux current** (menu FLUX REGULATION) and insert it in the parameter **I field cnst 40** (menu FLUX REGULATION\Flux if curve).
- Block the converter
- Through the parameter **Set flux / if** (menu FLUX REGULATION) it will be carried out the calculation of the parameters of the curve. So move on that parameter and push buttone ENT.

  The operation requires some seconds.
- Then set the operating way of the wished field control (Constant current / Voltage control), bring back the value of Flux current max at 100% and carry out a saving of parameters.
- Changing of **Max out voltage** or **Motor nom flux** need a new tuning of the curve .

Speed-up function

Oscillations may occur during a speed change with loads presenting a high moment of inertia. Such oscillations could be reduced by starting the function "Speed-up". Figures 5.3.7.3 and 5.3.7.4 show the influence of this function.

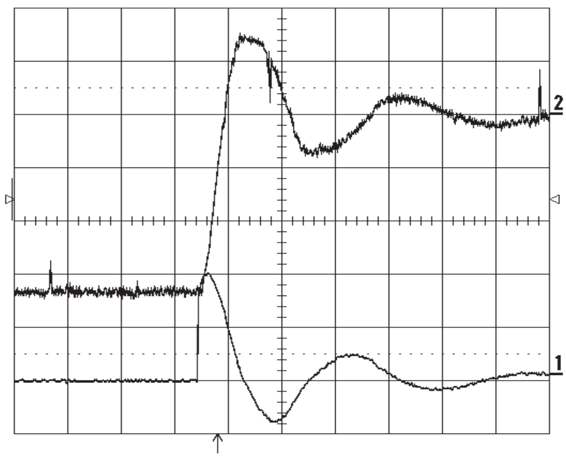

Figure 5.3.7.3: Speed-up function not active

Oscillations during a speed change due to a high moment of inertia.
Above: Actual spd, below: Motor current

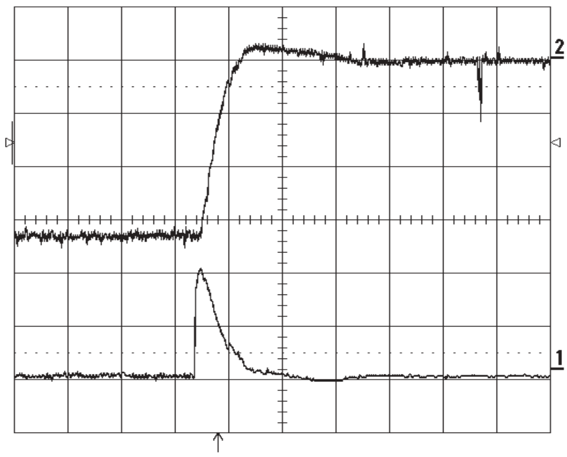

Figure 5.3.7.4: Speed-up active

The same drive with Speed-up function active
Above: Actual spd, below: Motor current

Parameters used in the example:	**Speed up base**	14 rpm/ms
	Speed up gain	50 %
	Speed up filter	20 ms

Setting of the speed zero logic

- The speed zero logic is factory set as disabled. See section 6.7.2, “Speed zero logic”, for a description of the drive behavior.
- Block of the I-section of the speed regulator with n=0:
  I-section disabled: **Enable spd=0** I = Enabled
  I-section enabled: **Enable spd=0 I** = Disabled

NOTE! When the motor is at a stop, it is possible to avoid the creep of the drive disabling the I section. In this case when the motor is at a stop, it can not receive any load and therefore this function is not suitable for all applications!

- Suppression of the P-gain set via **Spd=0 P gain**:
- If the reference is above **Ref 0 level**: **Enable spd=0 R** = Enabled
- If the ref.and/or the reaction are above **Ref 0 level**: **Enable spd=0 R** = Disabled

NOTE! **Enable spd=0 R** is active only when **Enable spd=0 P** is enabled.

- Choice of the proportional gain for zero speed:
  The P-gain corresponds to **Spd=0 P gain** **Enable spd=0 P** = Enabled
  The P-gain corresponds to the normal P-gain **Enable spd=0 P** = Disabled

- The P-gain at a zero speed is set via **Spd=0 P gain**, when **Enable spd=0 P** is enabled.
- The intervention threshold for the recognition of zero speed is determined with **Ref 0 level**. It is expressed in the dimension set by the factor function.

Adaptive of the speed regulator

NOTE! The adaptive of the speed regulator is factory set as disabled. It must be used only when the gain of the speed regulator has to get higher than the speed range or it has to be replaced with another unit. As for the interaction among the parameters see section 6.13.2, “Adaptive spd reg”.

- Enable of the adaptive with a blocked drive. **Enable spd adap** = Enabled.
  In this way the settings of **Speed P** and **Speed I** are disabled.
- Determine on the basis of which unit the gain of the speed regulator has to be changed. It normally depends on the speed (**Select adap type** = Speed).
- If the gain has to be changed on the basis of another unit, set **Select adap type** = Adap reference. This unit is connected to the device as an analog value via an analog input. For this reason the **Adap reference** variable must be assigned to an analog input (see in the following pages the configuration of the analog inputs). The other possibility is to insert **Adap reference** via the serial interface or a Bus. In this case the insertion via the terminal strip is not necessary.
- Entering **Adap speed 1** and **Adap speed 2** three different speed ranges are available with several gains. Value expressed as a percentage of **Speed base value** and respectively of the max value of **Adap reference**.

- With **Select adap type** = Speed: the optimization is carried out as described for the “Speed regulator”. To this purpose the following points must be taken into consideration:
  - Enter with **Gen offset** a value which is at the beginning of the range to be optimized but which at the same time is outside the range set with **Adap joint XX**.
  - Enter with **Gen amplitude** the step, so that the speed remains inside the range to be optimized.
  - The optimization is carried out separately for each range and the paramters of the regulator are set for each range with **Adap P gain XX** and **Adap I gain XX**.
  - After the optimization of the different phases look over the whole speed range.
  - By changing the value of **Adap joint XX** it is possible to reduce the instabilities present in the transients during the changes from one range to the other. Increasing the values the transients are slighter.

- With **Select adap type** = Adap reference: the optimization depends on the system and it is impossible to state here the general information needed.
- When the speed zero logic is disabled (factory setting) with a blocked drive the gains of the speed regulator are active. These are set via **Adap P gain 1** and **Adap I gain 1** . When the speed zero logic is enabled, the values set for a motor at a stop are valid.

6. FUNCTION DESCRIPTION

The converters of the TPD32 series feature a number of functions that can be set and assigned parameters in order to meet the requirements of the application at hand.

The device can be controlled in different ways:
- via the terminal strip
- via the keypad
- via the RS 485 serial interface
- via a bus connection (option)

The settings required are made via the **Main commands** and **Control mode** parameters in the CONFIGURATION menu.

The device is supplied with a Windows-based user interface software for the MS- WINDOWS™ field for controlling the inverter and setting parameters via the RS 485 serial interface.

The device is factory set for speed regulation with a cascade current regulation and is connected according to the connection diagram shown on in section 4.8, “Standard connection diagrams”. Only the entry of parameters in the START UP menu of the software is required for the initial commissioning of the drive. The inverter is thus controlled via the terminal strip with all parameters set via the keypad (START UP/ Main commands).

If functions are required that are not in the standard configuration, these can be selected and their parameters set accordingly via the appropriate menu.

The TBO option card is required for expanding the standard device with programmable inputs/outputs. Up to 2 TBOs can be fitted, each providing 4 digital inputs, 4 digital outputs and 2 analog outputs. Three analog inputs are provided on the standard device.

The converters of the TPD32 series enable reference values for the ramp and for the speed regulator to be set in different units of measure:
- in percentages of the **Speed base value**
- in a unit of measure (dimension) that the user can define using the factor function, e.g. as speed in m/s.

According to which one is set as last the other will be updated. This means that the other reference value is overwritten with the current value.

A freely selectable password 1 prevents the operation of the frequency inverter by unauthorized persons. It is entered in the form of a five-digit number combination. A Password 2 is also provided by the manufacturer. This password enables the service personnel to access the Service menu which is not accessible for the user.

NOTE! All parameter settings must be saved otherwise the last settings saved will be loaded the next time the device is switched on.

Explanation of parameter tables

In the following pages the parameters list of each menu is shown. For each table the following notes are valid:

"No." column	Parameter number (decimal). In order to address parameters when a serial line/ bus or the DGFC card are used, the user **must** add 2000H (= decimal 8192) to the indicated value.
"Value" field	S = value depending on the size of the device.

DRIVE STATUS	Start up parameters status
START UP	Basic commissioning of the drive
TUNING	Drive regulators tuning
MONITOR	Display of reference values, speeed, voltage, current, frequency...
INPUT VARIABLES	Ramp reference, speed reference, current reference
LIMITS	Speed limits, current limits, flux limits
RAMP	Acceleration, deceleration, quick stop, ramp shape
SPEED REGULAT	Configuration of the speed regulator, speed zero logic, speed up function, droop function
CURRENT REGULAT	Configuration of the current regulator
FLUX REGULATION	Functioning of the field current regulator
REG PARAMETERS	Parameters for speed, current, flux and voltage regulation
CONFIGURATION	Functioning, regulation, encoder type, function factor, programmable alarms, address, password
I/O CONFIG	Configuration of programmable digital and analog input and output
ADD SPEED FUNCT	Motor capture, adaptive speed regulation, speed control, speed zero
FUNCTIONS	Motopotentiometer, jog function, multi-speed, multi-ramps, overload, stop control, I/n curve
SPEC FUNCTION	Test generator, saving parameters, loading factory settings, signal adaptation, PAD parameters
OPTIONS	Access to the optional field bus card (Option 1), and the DGFC (Option 2), PID function
DRIVECOM	Parameter setting for the DRIVECOM profile
SERVICE	Menu, only accessible to service personnel of the manufacturer

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6.1. ENABLES

The following hardware enables are always required irrespective of whether the device is to be controlled via the terminal strip, the keypad or the serial interface.

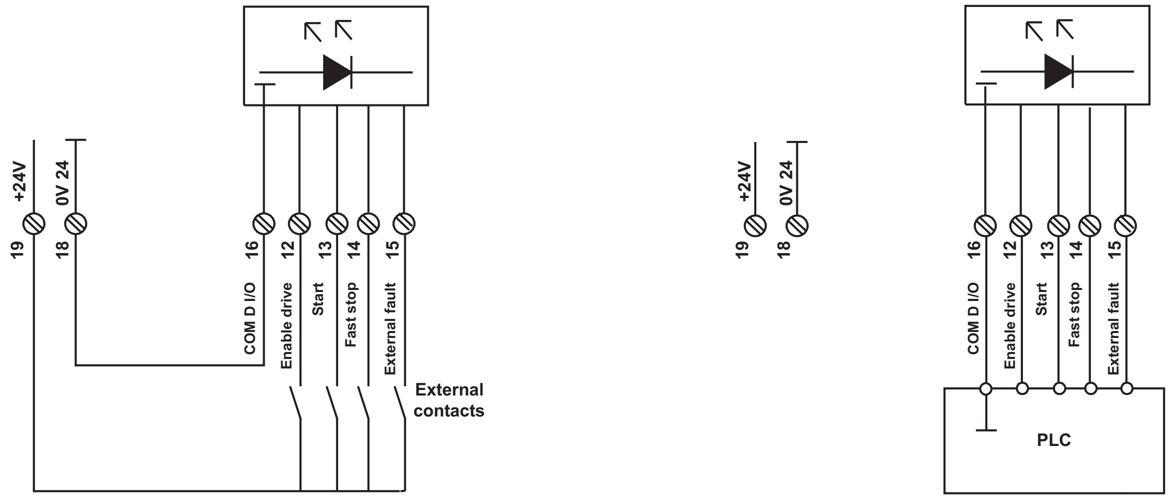


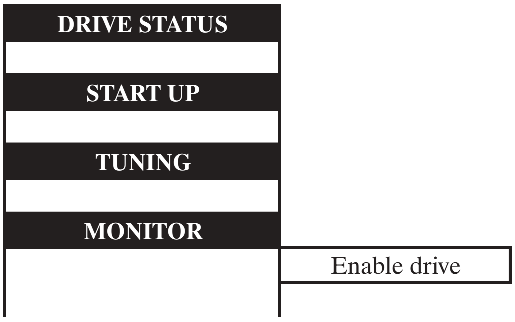
Figure 6.1.1: Enables via potential free contacts and PLC

- Figure 6.1.1 show the connection principle
- The enable signals are activated via a +15 ... 30 V voltage at the appropriate terminals.The inputs are protected against reverse polarity.
- Negative voltage, 0 V and a missing signal are interpreted as disable signals.
- The reference point for the enable signals is terminal 16.
- When using an operator keypad/serial interface (Mains Command=Digital), both the signals on the appropriate terminals and the corresponding commands on the keypad/serial interface are necessary. If an enable is removed via a signal on the terminals, the appropriate command must be sent via the keypad/serial interface in addition to the signal on the terminal in order to restart the drive.

There are four types of enable signals that have a different effect on the behavior of the TPD32 converter.

- Enable drive	enables the entire converter
- Start	enables the regulation
- Fast stop	sets the speed reference value immediately to zero so that the drive is stopped as quickly as possible
- External fault	incorporates external error messages into the enable

6.1.1. Enable drive



T0410i

Parameter Description	N.	Value			Standard
		min	max	factory	Configuration
Enable drive	314	0	1	Disabled	Terminal 12
Enable					+15...30 V
Disable				(0)	0 V

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The **Enable drive** command activates the converter.

An auxiliary contact of the AC input contactor must be incorporated in the converter enable (terminal 12).

When the converter enable command is not present, no other control commands (e.g. **Jog +**, **Jog -** or **Start**) are accepted.

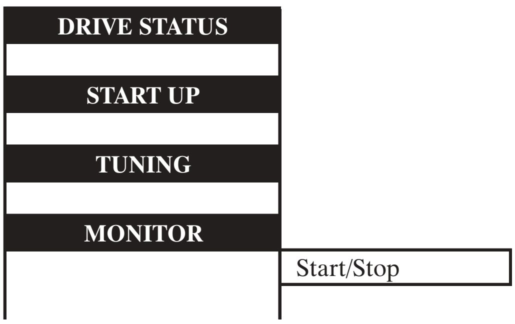
Removal of the Enable command while the drive is starting causes the motor to coast to a halt. Neither electrical braking nor controlled deceleration of the motor within the selected ramp time are possible.

When operated via the keypad the **Enable drive** command is provided in the DRIVE STATUS, START UP, TUNING and in the MONITOR menu.

When the command **Enable drive** is used via the keypad (**Mains command = digital**) the voltage on terminal 12 is required.

Set **Main command = terminals** when the command **Enable drive** is used via the terminal 12. **Enable drive** is an only-reading parameter.

6.1.2. Start / Stop



T0420i

Parameter Description	N.	Value			Standard
		min	max	factory	Configuration
Start / Stop	315	-	-	-	Terminal 13
Start					+15...30 V
Stop					0 V

T6015g

When the command **Main commands** is set on **digital**, the parameter **Start/Stop** is used to start the converter and the key STOP on the keyboard is enabled to block the converter.

When the command **Main commands** is set on **terminals, Start/stop** becomes an only-reading parameter.

NOTE: The following signals are required for operating the drive in addition to the **Start** command:

Enable drive

Fast stop

External fault

The behavior of the drive after the **Start** command is given or removed depends on the parameter setting at hand:

- When using the ramp (**Enable ramp** = Enabled and **Enable spd reg** = Enabled) the drive accelerates to the required speed according to the ramp specified. If the Start command is removed, the drive runs down to zero according to the ramp defined. If the Start command is selected once more during the deceleration time, the drive accelerates once more to the required speed.

- If the Speed **ref 1 valu**e reaches the input of the speed regulator directly without a ramp (**Enable ramp** = Disabled and **Enable spd reg** = Enabled), the drive accelerates to the required speed in the shortest possible time once the Start command has been given. When the Start command is removed, the **Speed ref 1** value is set to zero immediately.

- When using torque regulation (**Enable spd reg** = Disabled) the **Start** command enables the torque reference value (**T current ref 1**) or disables it after the **Start** command is removed. The Start command has no effect on the correction value Speed ref2 (with speed regulation) or Torque ref2 (with torque regulation).

The **Start** command is not required for Jog function mode.

If the **Start** command and **Jog +** or **Jog -** are given at the same time, the **Start** command is given priority.

If the **Start** command is given during Jog operation, the Jog operation is aborted.

The Start parameter status is shown in the DRIVE STATUS and MONITOR menus.

6.1.3. Fast stop

Parameter Description	N.	Value			Standard configuration
		min	max	factory	
Fast stop	316	0	1	No fast stop	Terminal 14
No Fast stop				(1)	+15 … 30V
Fast stop					0 V

T6020g

NOTE: **The function <u>cannot be actuated</u> via the keypad!**

Application: **Fast stop** is actuated in emergencies and hazardous situations, in order to stop the drive in the shortest possible time. This method of stopping has the advantage over disconnection in that with a four quadrant drive (TPD32...4B) energy can be recovered in the AC input and the motor can be brought to a halt in a shorter time than when it coastes down.

The **Fast stop** command is always required for operation of the converter. A removal of the command when the drive is running initiates braking with the ramp specified by the parameters **Qstp delta speed** and **Qstp delta time**.

When the drive is brought to a halt, it is still enabled and has torque. The **Start** command or **Enable drive** command must be removed for it to be disconnected.

The drive behavior after the Fast stop command has been given depends on the type of operating mode selected:

- Operation via the terminal strip (**Main commands** = Terminals):
  The drive executes braking until there is no voltage on terminal 14. When voltage is restored, the drive automatically accelerates to the required reference value (precondition: the other enable commands are still active).

- Operation via serial line with commands given via terminals too (**Main commands** = Digital):
  The drive executes braking until it has come to a halt. When voltage is restored on terminal 14, there is no automatic start. This requires the entry of the **Start** command.

- If the **Fast stop** command is actuated via the serial interface while there is a voltage present on terminal 14, the fast stop is executed until the drive is at a halt. The **Start** command must be entered for the drive to be restarted.

6.1.4. Quick Stop

NOTE: This function cannot be executed via the terminal strip or the keypad but can only be actuated via the serial interface or a bus connection!

APPLICATION:

Quick stop is actuated in emergencies or hazardous situations in order to bring the drive to a halt in the shortest possible time. This method of stopping has the advantage over disconnection in that with a tetraquadrant drive (TPD32...4B) energy can be recovered in the main and the motor can be brought to a halt in a shorter time than when it coastes down.

- If the **Quick stop** command is given when the drive is running, this initiates braking with the ramp specified by the **Qstp delta speed** and **Qstp delta time** parameters.

- When the drive is at a halt, it is disabled and thus has no torque. The **Start** command must be given again for the drive to be started.

6.1.5. External fault

Parameter Description	N.	Value			Standard
		min	max	factory	Configuration
External fault		-	-	-	Terminal 15
No External fault					+15...30 V
External fault					0 V

T6025g

The **External fault** command enables an external signal to be incorporated in the failure alarms of the converter.

APPLICATION EXAMPLE

The converter is being used for closed-loop control of a single drive without contactors. A temperature-dependent contact, which opens under excessive temperature, is located within the motor. Connect this contact between 24 V and terminal 15. When the contact opens (= overtemperature) the converter will be disabled.

- During operation a signal is always required on terminal 15, irrespective of whether the commands are transmitted via the terminal strip or not.

- In the event of an external fault, the drive will behave according to the configuration set in the “Programmable Alarms, 6.11.7.”.

6.2. STARTING OPERATIONS FOR THE COMMISSIONING PROCEDURE

The operations required for the first device commissioning are listed in the DRIVE STATUS, START UP and TUNING menus.

These menus gather and repeat several parameters listed also in other menus and introduced in the following pages.

The explanation for the commissioning procedure is explained in chapter 5.3. The tables of chapter 5.2 show the menu structure, while the values of the single parameters can be seen in the tables of chapter 10.

DRIVE STATUS

It is the first menu to be displayed on the keypad every time the converter is switched on.

It is used to read the converter basic parameters before starting the commissioning procedure and also to set the main speed reference **Ramp ref 1** for the ramp input.

START UP

The menu shows one after the other the operations to be carried out during the first commissioning. They are grouped according to the different phases and they are developed also with the help of some submenus.

Starting

Some basic parameters are defined:

Speed base value	**Speed base value** is shown in the dimension set by the function Factor. It is the value which all the speed per cent data make reference to (References, Adaptive of the speed regulator ...), and it corresponds to 100% of the speed. This parameter can be changed only if the drive is in a blocked condition (**Enable drive** = Disabled). **Speed base value** does not define the maximum possible speed, which is given through the sum of different references.
Nom flux curr	Field rated current.
Speed-0 f weak	Control of the field current at a zero speed.
Acc / Dec ...	Setting of the acceleration and deceleration ramps (see chapter 6.6.1).

Motor data

Setting of the motor data:

Motor nom flux	Field rated current of the connected motor.
Flux reg mode	Functioning method of the field regulation.
Full load curr	Full load current.
Motor max speed	Maximum motor speed.
Max out voltage	Maximum output voltage.
Flux weak speed	Speed value starting the field weakening procedure.

Limits

Setting of the current and speed limits:

T current lim	Symmetric setting of the armature current limit (see chapter 6.5.2).
Flux current max	Maximum percentage of the field current (see chapter 6.5.3).
Flux current min	Minimum percentage of the field current (see chapter 6.5.3).
Speed min amount	Minimum speed for both rotation directions (see chapter 6.5.1).
Speed max amount	Maximum speed for both rotation directions (see chapter 6.5.1).

Speed feedback

Speed reaction setting (see chapter 6.11.4) :

Speed fbk sel	Selection of the reaction to be used.
Tacho scale	Fine tuning of the tachogenerator reaction.
Speed offset	Offset tuning of the reaction circuit.
Encoder 2 pulses	Number of pulses/rpm of the digital encoder connected to the XE2 connector.
Enable fbk contr	Enabling of the automatic switching to the armature reaction.
Refresh enc 2	It starts the control procedure for the digital encoder on XE2.

Alarms

Setting of the undervoltage and overcurrent thresholds (see chapter 6.11.7) :

Undervolt thr	Intervention threshold stating a main undervoltage condition.
Overcurrent thr	Intervention threshold stating an overcurrent condition.

Overload control

Setting of the overload control (see chapter 6.14.5) :

Enable overload	Enabling of the overload control.
Overload mode	Overload control mode.
Overload current	Armature current allowed during the overload period.
Base current	Armature current allowed during the pause period.
Overload time	Maximum period during which the overload current is allowed.
Pause time	Minimum pause time between two overload cycles.

Analog inputs

Programming of the analog inputs (see chapter 6.12.2).

After setting the parameters and the application specific functions, it is possible to carry out the self tuning of the speed and current regulators.

Self tuning of the current speed

See chapters 5.35.1 and 6.8.

R&L search	Execution of a self tuning cycle for the current regulator.

Enable the converter with the parameter **Enable Drive** = Enabled and start the procedure with the parameter **Start/Stop** = Start.

Self tuning of the speed regulator

Self tuning of the speed regulator (see chapters 5.3.5.2 and 6.7.1.1) :

Fwd-Rev spd tune	Choice of the shaft rotation direction for the self tuning procedure.
Test T curr lim	Value of the torque current limit applied during the self tuning procedure.
Start	Starting of the self tuning procedure for the speed regulator.
Inertia	Inertia value in Kg*m^2 (1 Kg*m^2 = 23.76 lb*ft^2).
Inertia Nw	New inertia value in Kg*m^2 identified during the self tuning procedure.
Friction	Friction value in N*m (1 N*m = 0.738 lb*ft).
Friction Nw	New friction value in N*m identified during the self tuning procedure.
Speed P	Proportional gain of the speed regulator.
Speed P Nw	New proportional gain value of the speed regulator.
Speed I	Integral gain of the speed regulator.
Speed I Nw	New integral gain value of the speed regulator.
Take val	Acquisition of the new parameter values after the self tuning procedure.

Final operations

Before ending the commissioning procedure it is possible to choose different functioning methods (see chapter 6.11.1).

Main commands	It states the method through which the control signals have to be given.
Control mode	It states the control digital channel.
Save parameters	Saving of the entered values and of those obtained during the START UP procedure.

TUNING

This menu can be used after the first commissioning to repeat the self tuning procedures of the speed and current regulators and to modify by hand the tuning of the main regulation loops.

Self tuning of the current regulator

Repetition of the self tuning procedure via the parameter **R&L Search.** It has been already listed in the menu START UP for the device first commissioning.

Speed self tune

Repetition of the self tuning procedure of the speed regulator. It has been already listed in the START UP\Speed self tune menu for the device first commissioning.

Tuning by hand of the speed, flux and voltage loops

Setting by hand of some regulator parameters (see chapter 6.10) :

Speed P	Proportional gain of the speed regulator.
Speed I	Integral gain of the speed regulator.
Prop filter	Filter time constant for the P component of the speed regulator.
Flux P	Per cent proportional coefficient of the flux regulator.
Flux I	Per cent integral coefficient of the flux regulator.
Voltage P	Per cent proportional coefficient of the voltage regulator
Voltage I	Per cent integral coefficient of the voltage regulator.
Save parameters	Saving of the set tunings.

6.3. MONITOR

MONITOR

[314]	Enable drive
[315]	Start/Stop

- **Measurements**
  - **Speed**
    - **Speed in DRC [ ]**

[109]	Ramp ref (d)
[112]	Ramp output (d)
[115]	Speed ref (d)
[119]	Actual spd (d)
[925]	F act spd (d)
[923]	Act spd filter

    - **Speed in rpm**

[110]	Ramp ref (rpm)
[113]	Ramp outp (rpm)
[118]	Speed ref (rpm)
[122]	Actual spd (rpm)
[427]	Enc 1 speed
[420]	Enc 2 speed
[924]	F act spd (rpm)
[923]	Act spd filter

    - **Speed in %**

[111]	Ramp ref (%)
[114]	Ramp output (%)
[117]	Speed ref (%)
[121]	Actual spd (%)

[466]	Mains voltage
[588]	Mains frequency
[1052]	Output power
[233]	Output voltage
[199]	Motor current
[928]	F T curr (%)
[926]	T curr filter
[41]	T current ref
[500]	Flux reference
[234]	Flux current
[351]	Flux current [A]

- **I/O**

	Digital I/O
[582]	Virtual dig inp
[583]	Virtual dig out

T0370-bi

The MONITOR menu shows all current reference and actual values and also the situation of the digital inputs/outputs. The values related to the speed are given in rpm (revolutions per minute), as a percentage (related to the **Speed base value**) and in the dimension specified by the factor function.

Parameter description	No.	Value			Standard
		min	max	factory	configuration
Enable drive (Enable/Disable)	314	0	1	Disabled (0)	Terminal 12
Start	315	0	1	Stop	Terminal 13
Ramp ref (d) [FF]	109	-32768	+32767	-	-
Ramp ref (rpm)	110	-32768	+32767		*
Ramp ref (%)	111	-200,0	+200.0		-
Ramp output (d) [FF]	112	-32768	+32767		-
Ramp output (rpm)	113	-32768	+32767	-	*
Ramp output (%)	114	-200,0	+200.0		-
Speed ref (d) [FF]	115	-32768	+32767		-
Speed ref (rpm)	118	-32768	+32767	-	*
Speed ref (%)	117	-200,0	+200.0		-
Actual spd (d) [FF]	119	-32768	+32767		-
Actual spd (rpm)	122	-8192	8192	-	An output 1 *
Actual spd (%)	121	-200,0	+200.0		-
F act spd (d) [FF]	924	-32768	+32767	-	*
Act spd filter [s]	923	0.001	1.000	0.100	-
Enc 1 speed (rpm)	427	-8192	+8192	-	-
Enc 2 speed (rpm)	420	-8192	+8192	-	-
F act spd (rpm)	924	-32768	+32767	-	*
Main voltage [V]	466	0	999	-	*
Mains frequency [Hz}	588	0,0	70,0	-	-
Output power [Kw]	1052	0.01	9999.99	-	-
Output voltage [V]	233	0,00	999	-	*
Motor current [%]	199	-250	+250	-	*
F T curr (%)	928	-500	+500	-	*
T curr filter [s]	926	0.001	0.250	0.100	-
T current ref [%]	41	-200	+200	-	*
Flux reference [%]	500	0,0	100,0	-	*
Flux [%]	234	0,00	100,00	-	*
Flux current [A]	351	0.1	99.9	-	-
Digital I/O	-	-	-	-	-
Dig input term	564	0	65535	-	-
Dig input term 1	565	0	1	-	-
Dig input term 2	566	0	1	-	-
Dig input term 3	567	0	1	-	-
Dig input term 4	568	0	1	-	-
Dig input term 5	569	0	1	-	-
Dig input term 6	570	0	1	-	-
Dig input term 7	571	0	1	-	-
Dig input term 8	572	0	1	-	-
Dig input term 9	573	0	1	-	-
Dig input term 10	574	0	1	-	-
Dig input term 11	575	0	1	-	-
Dig input term 12	576	0	1	-	-
Dig input term 13	577	0	1	-	-
Dig input term 14	578	0	1	-	-
Dig input term 15	579	0	1	-	-
Dig input term 16	580	0	1	-	-
Dig output term	581	0	65535	-	-
Virtual dig input	582	0	65535	-	-
Virtual dig output	583	0	65535	-	-

T6030g

* This function can be assigned to a programmable analog output.

Enable drive	When the converter is controlled via the keypad, it is activated via the **Enable drive** parameter. A voltage is also required on terminal 12. The **Start** command is required for starting the drive. Enabled Enable drive Disable Drive disabled
Start/Stop	When the menu point **Start/Stop** is selected, it is possible to starting the drive by pressing the ENTER button. The motor running to the chose speed with the setted ramp time.
Ramp red (d)	Total reference value for the ramp in units specified by the factor function.
Ramp ref (rpm)	Total reference value for the ramp in rpm
Ramp ref (%)	Total reference value for the ramp as a percentage of the **Speed base value.**
Ramp output (d)	Ramp output in units specified by the factor function.
Ramp outp (rpm)	Ramp output in rpm
Ramp output (%)	Ramp output as a percentage of the **Speed base value**
Speed ref (d)	Total speed reference value in units specified by the factor function.
Speed ref (rpm)	Total speed reference value in rpm
Speed ref (%)	Total speed reference value as a percentage of the **Speed base value**
Actual spd (d)	Actual speed in units specified by the factor function.
Actual spd (rpm)	Actual speed in rpm (revolutions per minute).
Actual spd (%)	Actual speed as a percentage of the **Speed base value**
F act spd (d)	Filtered value of **Actual speed** in units specified by the facto function
F act spd (rpm)	Filtered value of **Actual speed** in rpm
Act spd filter	1^{st} order low pass filter time constant on **Actual speed**
Enc 1 speed (rpm)	Actual speed measured by the encoder 1. The parameter is accessible only if the **Speed fbk sel** = encoder 2 and a digital encoder is used as encoder 1 (interfacing with the drive by means of the DEII card).

Enc. 2 speed (rpm)	Actual speed measured by the encoder 2. The parameter is accessible only if **Spees bfk sel** = encoder 2.
Mains voltage	Mains voltage in V
Mains frequency	AC input frequency in Hz
Output power	Output power in Kw
Output voltage	Armature Voltage U_{dA} in V_{AV}
Motor current	Armature current in % of **Full load curr**.
F T curr (%)	Per cent filtered value of **Torque current**
T curr filter	First rate low-pass filter on the parameter **Torque current**.
T current ref	Total current reference value as a percentage of the **Full load current**
Flux reference	Field current (reference) as a percentage of **Motor nom flux**
Flux current	Field current (present value) as a percentage of **Motor nom flux**
Flux current (A)	Field current (present value) in Ampere
Digital I/O	Status of the digital input and output of the base converter and the card TBO. Display: I 1 2 3 4 5 6 7 8 E S F Q 1 2 3 4 5 6 7 8 An I/O is displayed only if a voltage is present on the corresponding terminal. E.g., if the inputs 4 and 6 are displayed, that means that the digital inputs 4 and 6 on the TBO card are to High level E= Enable drive (terminal 12) S= Start (terminal 13) F= Fast stop (terminal 14) When a serial line or a Bus is used, the status of the digital I/O can be read by means of the **Dig input term** and **Dig output term** parameters.
Dig input term	Status of the digital inputs on the device and TBO option card to be read by serial line or field bus. The information is contained in a word, where each bit is 1 if voltage is present on the corresponding input terminal.

Bit n.	output	Bit n.	Input
0	TBO "A", Term. 11 (Digital input 1)	8	TPD, Term 12 (Enable drive)
1	TBO "A", Term. 12 (Digital input 2)	9	TPD, Term 13 (Start)
2	TBO "A", Term. 13 (Digital input 3)	10	TPD, Term 14 (Fast stop)
3	TBO "A", Term. 14 (Digital input 4)		
4	TBO "B", Term. 11 (Digital input 5)		
5	TBO "B", Term. 12 (Digital input 6)		
6	TBO "B", Term. 13 (Digital input 7)		
7	TBO "B", Term. 14 (Digital input 8)		

T6035g

Dig input term 1* Status of the digital input 1 (terminal 11, option TBO in a A position)
Dig input term 2* Status of the digital input 2 (terminal 12, option TBO in a A position)
Dig input term 3* Status of the digital input 3 (terminal 13, option TBO in a A position)
Dig input term 4* Status of the digital input 4 (terminal 14, option TBO in a A position)
Dig input term 5* Status of the digital input 5 (terminal 11, option TBO in a B position)
Dig input term 6* Status of the digital input 6 (terminal 12, option TBO in a B position)
Dig input term 7* Status of the digital input 7 (terminal 13, option TBO in a B position)
Dig input term 8* Status of the digital input 8 (terminal 14, option TBO in a B position)
Dig input term 9* Status of the digital input on terminal 12 (Enable drive)
Dig input term 10* Status of the digital input on terminal 13 (Start)
Dig input term 11* Status of the digital input on terminal 14 (Fast stop)
Dig input term 12* Not used
Dig input term 13* Not used
Dig input term 14* Not used
Dig input term 15* Not used
Dig input term 16* Not used
Dig output Status of the digital inputs on the device and TBO option card to be read by serial line or field bus. The information is contained in a word, where each bit is 1 if voltage is present on the corresponding input terminal.

Bit n.	output	Bit n.	Input
0	TBO "A", Term. 6 (Digital output 1)	4	TBO "B", Term. 6 (Digital output 5)
1	TBO "A", Term. 7 (Digital output 2)	5	TBO "B", Term. 7 (Digital output 6)
2	TBO "A", Term. 8 (Digital output 3)	6	TBO "B", Term. 8 (Digital output 7)
3	TBO "A", Term. 9 (Digital output 4)	7	TBO "B", Term. 9 (Digital output 8)

T6040g

Virtual dig inp Status of the virtual digital inputs**

Virtual dig out Status of the virtual digital outputs**

* Available only via RS485 interface line or via a Field Bus.

** The virtual inputs and outputs are used only in connection with a bus interface, in order to allow a faster communication.

For further details see the interface bus documentation.

6.4. INPUT VARIABLES

The converters of the TPD32 series enable reference values for the ramp and regulator to be specified in different dimensions:

- as a percentage of the **Speed base value**
- in a dimension that the user can define himself with the factor-function, i.eg. as a speed m/s. The default factory setting is rpm.

The value processes inside the device is the same irrespective of how it was defined. This means that the other reference is overwritten with the new value.

Example:

A motor has a maximum speed of 1500 rpm. This corresponds to 100% and at the same time the user-defined value of 10,000 bottles per hour.

Changing the reference value to 50% will automatically result in a change of the other value to 5,000 bottles per hour.

The table below shows the relationship of reference values. In the event of a change, the other parameters are overwritten automatically.

Parameters with same value	N.	Dimensions
Ramp ref 1	44	according to the Factor function
Ramp ref 1 (%)	47	%
Speed input var*	44	according to the Factor function
Speed input perc*	46	%
Ramp ref 2	48	according to the Factor function
Ramp ref 2 (%)	49	%
Speed ref 1	42	according to the Factor function
Speed ref 1 (%)	337	%
Speed ref var*	115	according to the Factor function
Percent ref var*	116	%
Speed ref 2	43	according to the Factor function
Speed ref 2 (%)	338	%

T6045g

* Defined in the DRIVECOM menu

6.4.1. Ramp ref

- **INPUT VARIABLES**
  - **Ramp ref**
    - **Ramp ref 1**
      - Ramp ref 1
      - Ramp ref 1(%)
    - **Ramp ref 2**
      - Ramp ref 2
      - Ramp ref 2 (%)

T0450g

The ramp reference value specifies the speed the drive should reach once the acceleration phase has been completed. Modifications to the ramp reference value are therefore transferred to the ramp accordingly. The height of the ramp reference value determines the motor speed. As for the four quadrant drives (TPD32...4B...) the rotation direction is determined by the reference polarity.

NOTE! Two quadrant TPD32...4B... drives accept only positive references. Negative values are not considered!

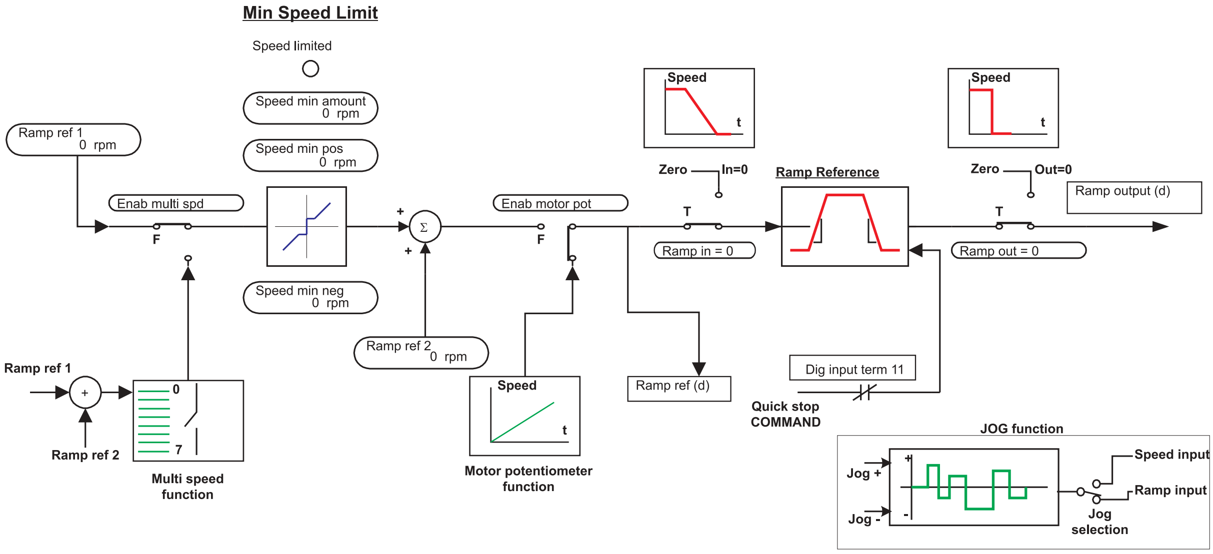


Figure 6.4.1.1: Ramp references

Parameter Description	No.	Value			Standard
		min	max	factory	Configuration
Ramp ref 1 [FF]	44	-2 • SBV***	+2 • SBV***	0	An. Input 1
Ramp ref 1 (%)	47	-200.0%	+200.0%	0,0	(Terminals 1 + 2)*
Ramp ref 2 [FF]	48	-2 • SBV***	+2 • SBV***	0	*
Ramp ref 2 (%)	49	-200.0%	+200.0%	0,0	
Ramp ref (rpm)	110	-2 • SBV***	+2 • SBV***	-	**
Ramp ref (d) [FF]	109	-2 • SBV***	+2 • SBV***	-	
Ramp ref (%)	111	100,0%	0,00%	-	

T6050g

* This function can be assigned to one of the programmable analog inputs. The converter is already factory set for a configuration using the terminals stated. The setting can also be modified to suit the application at hand.

** This parameter can be assigned to a programmable analog output.

*** SBV = **Speed base value** cannot exceed 8192 rpm.

Ramp ref 1 1st reference value for the ramp. The value to be entered depends on the factor function.

Ramp ref 1 (%) 1st reference value as a percentage of the **Speed base value**

Ramp ref 2 2nd reference value for the ramp. The value to be entered depends on the factor function. *

Ramp ref 2 (%) 2nd reference value as a percentage of the **Speed base value**

Ramp ref (rpm) Total reference value for the ramp in rpm (revolutions per minute)

Ramp ref (d) Total reference value for the ramp in the dimension specified by the factor function.

Ramp ref (%) Total reference value of the ramp as a percentage of the **Speed base value**

The total Ramp reference value **Ramp ref** consists of the signed addition of **Ramp ref 1** and **Ramp ref 2** (see Figure 6.4.1.1).

Example 1: **Ramp ref 1** = + 50 % **Ramp ref 2** = + 30 %
Ramp ref = 50 % + 30 % = 80 %

Example 2: **Ramp ref 1** = + 40 % **Ramp ref 2** = - 60 %
Ramp ref = 40 % - 60 %= - 20 %

0 ... 10 V, 0 ... 20 mA and 4 ... 20 mA signals can be used when setting the reference value via terminals. Reference set using input current, usually are with sign positive and they are used with biquadrant drives.

The **Ramp ref (rpm)**, **Ramp ref (d)** and **Ramp ref (%)** are influenced by the minimum speed limits. These are directly applied on the **Ramp ref 1**, as well as the Motor potentiometer and Multispeed references.

6.4.2. Speed ref

- **INPUT VARIABLES**
  - **Speed ref**
    - **Speed ref 1**
      - Speed ref 1
      - Speed ref 1(%)
    - **Speed Ref 2**
      - Speed ref 2
      - Speed ref 2(%)

T0460g

The speed reference value specifies the required speed of the drive. The drive responds to the reference value progression directly, except in cases where the torque available is insufficient for this purpose. In this case, the drive operates at current limit until the selected speed has been reached. The speed reference value determines the speed of the motor, while the polarity determines the directíon of rotation.

NOTE! Two quadrant TPD32...4B drives accept only positive references. Negative values are not considered!

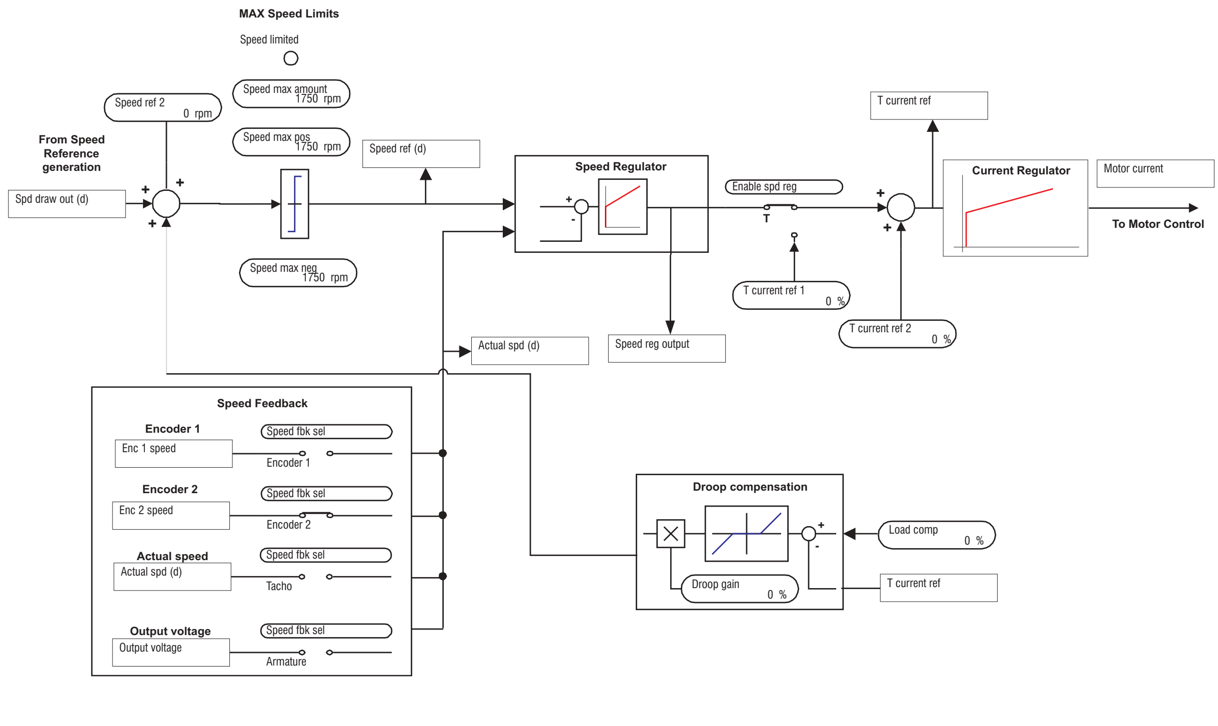


Figure 6.4.2.1: Speed reference

Parameter Description	N.	Value			Standard Configuration
		min	max	factory	
Speed ref 1 [FF]	42	-2 • SBV***	+2 • SBV***	0	Ramp output*
Speed ref 1 (%)	378	-200.0%	+200.0%		
Speed ref 2 [FF]	43	-2 • SBV***	+2 • SBV***	0	*
Speed ref 2 (%)	379	-200.0%	+200.0%		
Speed ref (rpm)	118	-2 • SBV***	+2 • SBV***		**
Speed ref (d) [FF]	115	-2 • SBV***	+2 • SBV***	-	
Speed ref (%)	117	-200	+200		

T6053g

* This function can be assigned to one of the programmable analog inputs.
** This parameter can be assigned to a programmable analog output.
*** SBV = **Speed base value** cannot exceed 8192 rpm.

Speed ref 1 1st reference value for the speed. The value to be entered depends on the factor function.

Speed ref 1 (%) 1st speed reference value as a percentage of the **Speed base value**

Speed ref 2 2nd reference value for the speed. The value to be entered depends on the factor function.

Speed ref 2 (%) 2nd speed reference value as a percentage of the **Speed base value**

Speed ref (rpm) Total speed reference value in rpm.

Speed ref (d) Total speed reference value in the dimension specified by the factor function.

Speed ref (%) Total speed reference value as a percentage of the Speed base value

The total speed reference value consists of the signed addition of **Speed ref 1** and **Speed ref 2**.

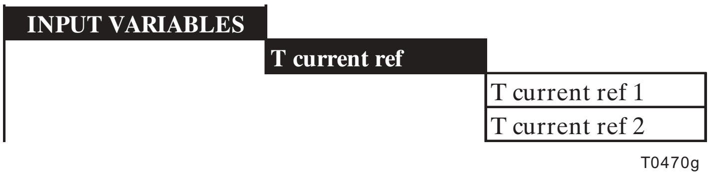
Example 1: **Speed ref 1** = + 50 % **Speed ref 2** = + 30 %
Speed ref = 50 % + 30 % = 80 %

Example 2: **Speed ref 1** = + 40 % **Speed ref 2** = - 60 %
Speed ref = 40 % - 60 % = - 20 %

0 ... 10 V, 0 ... 20 mA and 4 ... 20 mA signals can be used when setting the reference value via terminals. Reference set using input current, usually are with sign positive and they are used with biquadrant drives. The speed reference value has an upper and a lower limit.

If the ramp is selected, **(Enable ramp** parameter= Enabled), the reference value input **Speed ref 1** is automatically linked with the ramp output.

6.4.3. Torque current reference (T current ref)



The current reference value is proportional to the armature current of the motor and determines the torque, the polarity determines the torque direction. For most applications **T current Ref** comes from the speed regulator output. **T current ref 2** can also be used as a correction value.

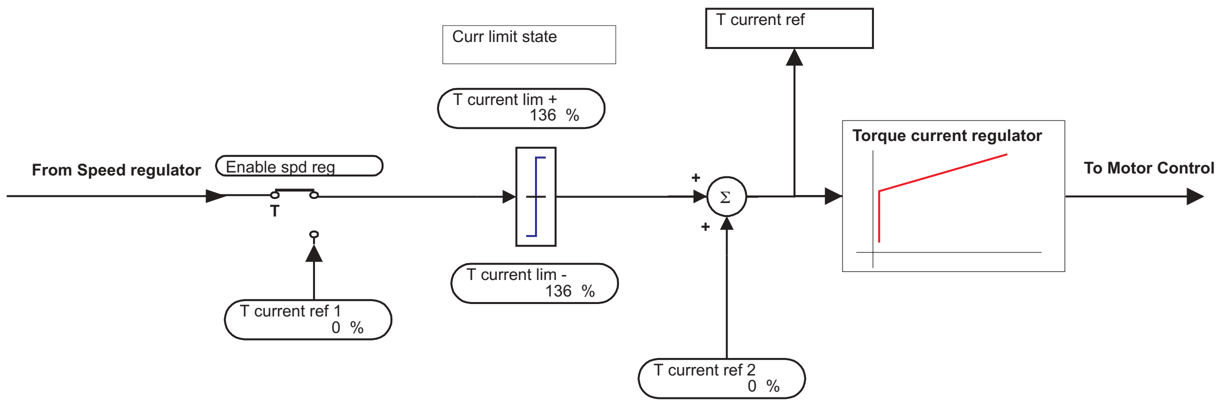


Figure 6.4.3.1: Torque current reference

Parameter Description	N.	Value			Standard Configuration
		min	max	factory	
T current ref 1 [%]	39	-200	+200	0	Speed regulator output*
T current ref 2 [%]	40	-200	+200	0,0	*
T current ref [%]	41	-200	+200		**

T6055g

* This function can be assigned to one of the freely programmable analog inputs.
** This parameter can be assigned to a freely programmable analog output.

T current ref 1 1st current reference value as a percentage of the **Full load curr** . The maximum value possible depends on the **Enable overload** parameter.

Enable overload	disabled	**T current ref 1**	100% max
Enable overload	enabled	**T current ref 1**	200% max

T current ref 2 2nd current reference value as a percentage of the **Full load curr** . The maximum value possible depends on the **Enable overload** parameter.

Enable overload	disabled	**T current ref 2**	100% max
Enable overload	enabled	**T current ref 2**	200% max

T current Ref Total current reference value as a percentage of the **Full load curr** value.

The total current reference value consists of the signed addition of **T current ref 1** and **T current Ref 2**.

Example 1: **T current ref 1** = +50% **T current ref 2-**= +30%

T current ref = 50% + 30% = 80%

Example 2: **T current ref 1** = +40% **T current ref 2** = -60%

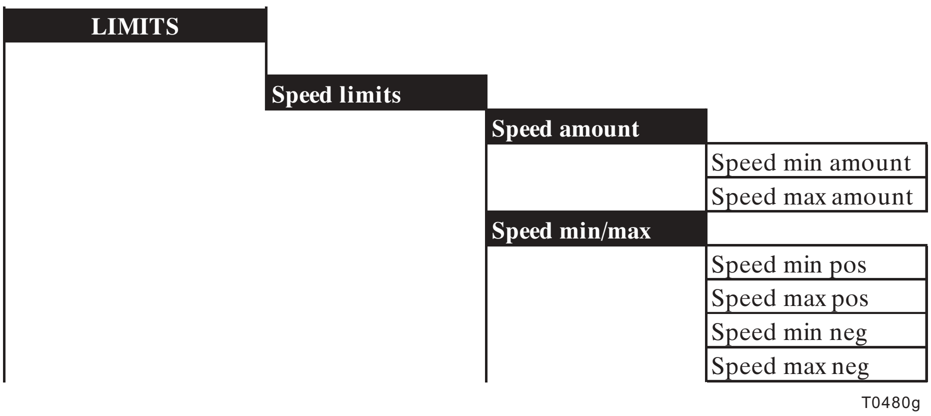
T current ref = 40-60% = -20%

0 ... 10 V, 0 ... 20 mA and 4 ... 20 mA signals can be used when setting the reference value via terminals. Reference set using input current, usually are with sign positive and they are used with biquadrant drives.

The current reference value has an upper limit.

6.5. LIMITS

6.5.1. Speed Limits



Parameter Description	N.	Value			Standard
		min	max	factory	Configuration
Speed min amount [FF]	1	0	2^{32}-1	0	-
Speed max amount [FF]	2	0	2^{32}-1	5000	-
Speed min pos [FF]	5	0	2^{32}-1	0	-
Speed max pos [FF]	3	0	2^{32}-1	5000	-
Speed min neg [FF]	6	0	2^{32}-1	0	-
Speed max neg [FF]	4	0	2^{32}-1	5000	-
Speed limited	372				*

T6060g

* This function can be assigned to a programmable digital output.

Speed min amount It defines the minimum speed for both directions TPD32...4B. A value below minimum is not accepted, regardless of the reference value selected. This parameter effects the ramp input. If the **Speed min amount** parameter is changed, the Parameter **Speed min pos** and **Speed min neg** parameters are set to the same value. If any of these parameters are subsequently changed, the last change is valid. The value to be entered is based on the factor function.

Speed max amount It defines the maximum speed for both directions TPD32...4B.... This parameter affects the speed regulator input and therefore takes into account both the reference values that come from the ramp as well as the direction of rotation (see Figure 6.4.2.1). If the **Speed max amount** parameter is changed, the **Speed max pos** and **Speed max neg** parameters are set to the same value. If any of these values is subsequently changed, the last change is valid. The value to be entered is based on the factor function.

Speed min pos It defines the minimum speed for the clockwise rotation of the motor. A value below minimum is not accepted, regardless of the reference value selected. This function effects the ramp input (see Figure 6.4.1.1). The value of the parameter to be entered is based on the factor function.

Speed max pos It defines the maximum speed for the clockwise rotation of the motor. This function affects the input of the speed regulator and therefore takes into account both the reference values that come from the ramp as well as the direction of rotation (see Figure 6.4.1.1). The value of the parameter entered is based on the factor function.

Speed min neg It defines the minimum speed for the counterclockwise rotation of the motor TPD32...4B.... A value below minimum is not accepted, regardless of the reference value selected. This parameter effects the ramp input (see Figure 6.4.1.1). The value of the parameter entered is based on the factor function.

Speed max neg It defines the maximum speed for the counterclockwise rotation of the motor TPD32...4B.... This parameter effects the input of the speed regulator and therefore takes into account both the reference values that come from the ramp as well as the direction of rotation (see Figure 6.4.1.1).The value of the parameter entered is based on the factor function.

Speed limited Message that indicates that the reference value, is currently limited by the entered minimum and maximum limit values.

High Reference value currently limited since the value entered is out of range of the limit values defined.

Low Reference value within the defined limit values.

NOTE! The **Speed min** amount, **Speed min pos** and **Speed min neg** parameters have an effect on the **Ramp ref 1** reference value, the motor potentiometer function and the multi-speed function. They do not, however, have an effect on the **Ramp ref 2** parameter!

6.5.2. Armature current limits (Current limits)

LIMITS

Current limits

- T current lim type
- T current lim
- T current lim +
- T current lim -
- In use Tcur lim+
- In use Tcur lim-
- Current lim red
- Torque reduct

T0490g

The current effects the input of the current regulator and only take into account the armature current.

Parameter Description	N.	Value			Standard Configuration
		min	max	factory	
T curr lim type (Tlim +/- T% lim mot gen)	715	0	1	T lim +/- 0	-
T current limit [%]	7	0	200	100	**
T current limit + [%]	8	0	200	100	**
T current limit - [%]	9	0	200	100	**
Curr limit state	349	0	1	-	Digital output 5***
In use T curr lim + [%]	10	0	200		-
In use T curr lim - [%]	11	0	200		-
Current limit red [%]	13	0	100		-
Torque reduct	342	0	1	-	*

T6065g

* This function can be assigned to one of the programmable digital inputs.
** This parameter can be assigned to a programmable analog input.
*** This function can be assigned to one of the programmable digital outputs.

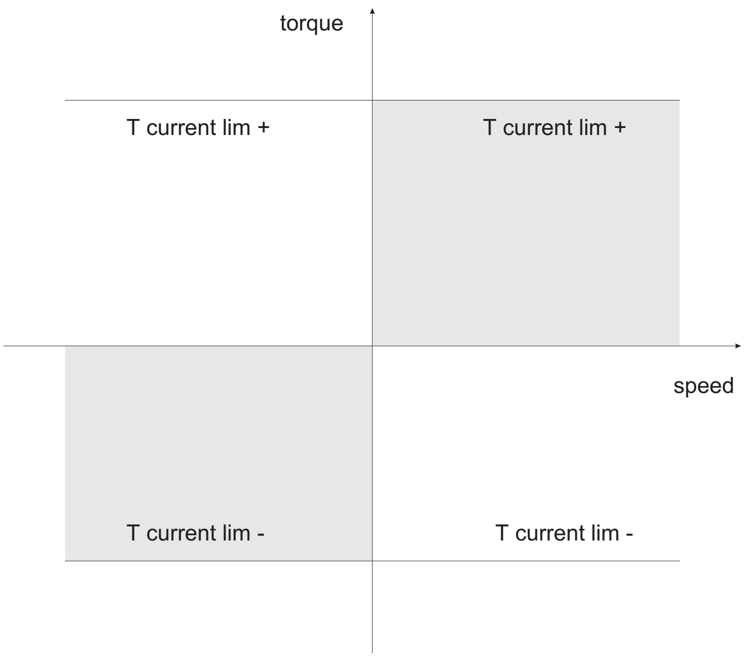


*Figure 6.5.2.1 Torque limits with **T curr lim type** = T lim +/-*

T curr lim type

This parameters determines the behaviour of the drive in current limit condition.

T lim +/- The active positive torque limit is T current lim and the active negative torque limit is T current lim -.

T lim mot/gen With this selection 3 conditions are possible:

1 - If the motor speed > +1% of **Motor nom speed** the active positive torque limit is **T current lim+** and the active negative torque limit is T current lim-.

2 - If the motor speed < -1% of **Motor nom speed** the active positive torque limit is **T current lim-** and the active negative torque limit is T current lim+.

3 - If -1% of **Motor nom speed** < motor speed < +1% of **Motor nom speed** the active positive torque limit is **T current lim+** and the active negative torque limit is T current lim+.

T current lim

Symmetrical current limit for both current directions for TPD32...4B converters. Defined as a percentage of the **Full load curr** parameter. The maximum value depends on the **Enable overload** parameter.

Enable overload	Disabled	**T current limit**	100 % max
Enable overload	Enabled	**T current limit**	200% max

If the T current limit parameter is changed, the Parameter **T current lim +** and **T current lim -** parameters are set to the same value. If both these parameters are subsequently changed, the last change is valid.

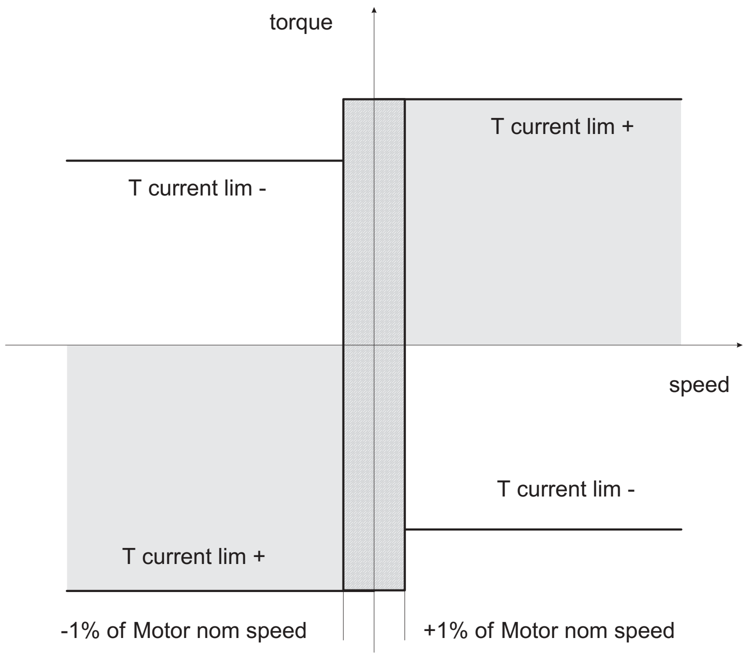


Figure 6.5.2.2: Torque limits with ***T curr lim type*** *= T lim mot/gen*

T current lim +

Setting of the drive current limit for the positive current direction (clockwise drive and counter-clockwise brake). Entered as a percentage of the **Full load curr** value. The maximum value depends on the value of the **Enable overload** parameter.

Enable overload	Disabled	**T current lim+**	100 % max
Enable overload	Enabled	**T current lim+**	200% max

T current lim -

Setting of the drive current limit for the negative current direction (counterclockwise drive and clockwise brake). Entered as a percentage of the **Full load curr** parameter. The maximum value depends on the value of the **Enable overload** parameter. This parameter is not active for the TPD32...2B converters.

Enable overload	Disabled	**T current lim-**	100 % max
Enable overload	Enabled	**T current lim-**	200% max

Curr limit state

Status message, indicating whether the drive is working with the set current limit or not.

High Drive working at the current limit. “I_{LIMIT}” LED lights up.

Low Drive not working at the current limit.

In use Tcur lim +

Status message, indicating the used value of the current limit for the positive torque direction as a percentage of **Full load curr**.

In use Tcur lim -

Status message, indicating the used value of the current limit for the negative torque direction as a percentage of **Full load curr**.

Current lim red Setting of the armature current limit, as % of Full load curr, when the Torque reduct function is active. Maximum value of **Current lim red** is 200% when Overload control is enabled (Enable Overload = Enable). On the contrary this value is 100%.

Torque reduct Selection for torque reduction. This function can be assigned to a freely programmable digital input. When the torque reduction function is active, the current limit changes accordingly by the percentage defined with the **Current lim red** parameter.

High Torque reduction not active

Low Torque reduction active*

Example of the function of the **Current lim red** and **Torque reduct** parameters.

T current limit (or **T current lim +/-**) = 80 %

Current lim red = 70 %

Torque reduct = High (not active) Current limit = 80 %

Torque reduct = Low (active) Current limit = 70 %

The value for **T current limit** can be set in the START UP\Limits.

6.5.3. Field current limits (Flux limits)

LIMITS

Flux limits

Flux current max

Flux current min

T0500g

Parameter	N.	Value			Standard Configuration
		min	max	default	
Flux current max [%]	467	0	100	100	* / **
Flux current min [%]	468	0	Flux curr max	5	-

T6070g

* This parameter can be set on a programmable analogic output

** This parameter can be set on a programmable analogic input

Flux current max Percentage of maximum flux according to the parameter **Motor nom flux**.

The max. value (100%) corresponds to the circulation in the field circuit of the motor , of a current equal to the value set in **Motor nom flux**. If any curve has been set through parameter **I field cnst**, the variation of this parameter influences in a linear way the field current (see Flux /if curve section 5.4.5).

Flux current min Percentage of minimum flux according to the parameter **Motor nom flux**.

Its value states the circulation in the field circuit of the motor, of a minimum current compared to the value set in **Motor nom flux**. The value set here influence the threshold of the alarm indication "Field loss". The threshold is the half of **Flux current min**.

6.6. RAMP

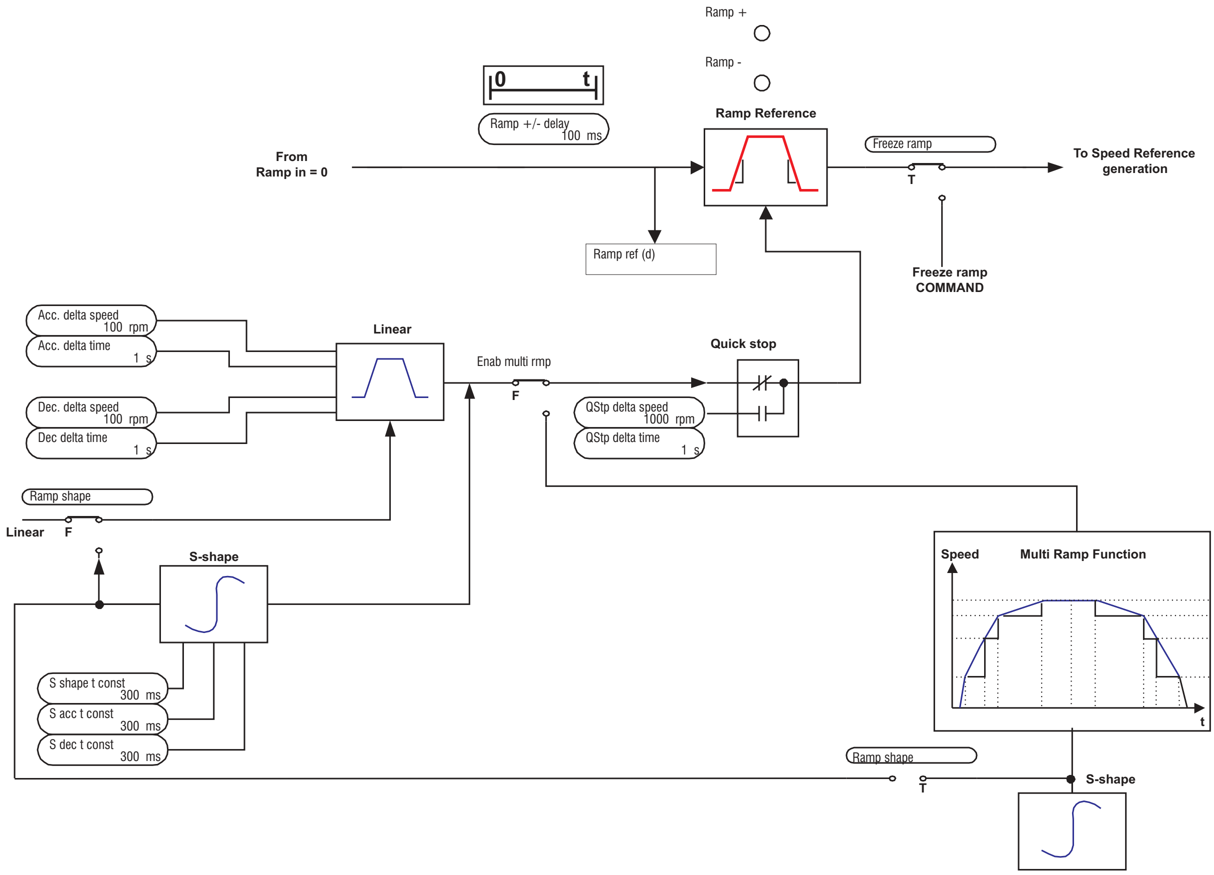


Figure 6.6.1 : Ramp circuit

The ramp (reference value integrator) determines the acceleration and deceleration times of the drive. These times can be set independently of each other.

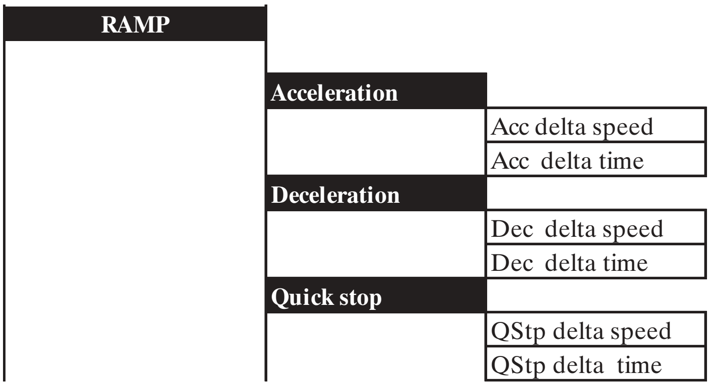
An additional ramp is provided for a quick stop. This ramp can only be activated via the serial interface or a field bus.

The ramp can either be linear or S-shaped..

The reference values can be defined in different ways
- with the **Ramp ref 1** and/or **Ramp ref 2** reference values
- with the multi-speed function
- with the motor potentiometer function
- with the Jog function

The Ramp generator can be used in a stand alone configuration. When the Ramp generator is disabled (**Enable ramp** = disabled), the **Enable drive**, **Start/Stop** and **Fast stop** commands have no more influence on Ramp generator. In such a condition it is free to run and can be used separately.

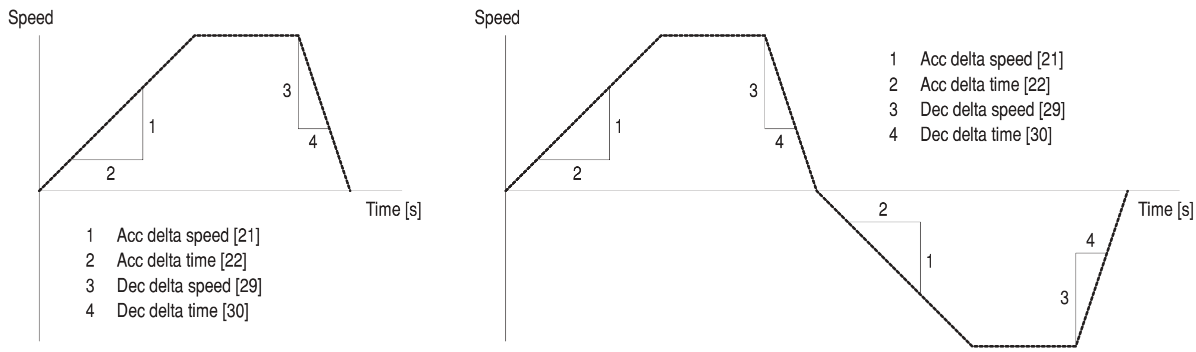
6.6.1. Acceleration, Deceleration, Quick Stop



T0510g

Parameter Description	No.	Value			Standard Configuration
		min	max	factory	
Acc delta speed [FF]	21	0	2^{32}-1	100	-
Acc delta time [s]	22	0	65535	1	-
Dec delta speed [FF]	29	0	2^{32}-1	100	-
Dec delta time [s]	30	0	65535	1	-
Qstp delta speed [FF]	37	0	2^{32}-1	1000	-
Qstp delta time [s]	38	0	65535	1	-

T6075g



TPD32...2B TPD32...4B

Figuge 6.6.1.1: Acceleration and deceleration ramps

Acc delta speed Has the same units as the ramp reference value and is based on the factor function.

Acc delta time Is defined in seconds. If “0 s” is entered,the ramp output directly follows the reference value.

Dec delta speed Has the same units as the ramp reference value and is based on the factor function.

Dec delta time Is defined in seconds. If “0s” is entered, the ramp output directly follows the reference value.

Qstp delta speed Has the same dimension as the ramp reference value and is based on the factor function.

Qstp delta time Is defined in seconds. If “0 s” is entered, the ramp output follows the reference value.

Quick stop Activates the Quick stop ramp

The acceleration of the drive is defined as a quotient of the **Acc delta speed** and Acc delta time parameters (see Figure 6.6.1.1). As for the four quadrant converters (TPD32...4B...) it is the same for both directions of rotation.

The deceleration of the drive is defined as a quotient of the parameters **Dec delta speed** and **Dec delta time** (see Figure 6.6.1.1). As for the four quadrant converters (TPD32...4B...) it is the same for both directions of rotation.

The Quick Stop function provides the possibility of a second deceleration ramp for the emergency braking of the drive. The ramp output in this case is not set to zero immediately but after a set time. The deceleration of the drive via the Quick Stop function is defined as the quotient of the **Qstp delta speed** and **Qstp delta time** parameters. As for the four quadrant converters (TPD32...4B...) it is the same for both directions of rotation. This ramp is activated by the functions **Fast stop** and Quick stop.

6.6.2. Ramp shape and control commands

RAMP	
	Ramp shape
	S shape t const
	S acc t const
	S dec t const
	Ramp +/- delay
	Fwd-Rev
	Enable ramp
	Ramp out = 0
	Ramp in = 0
	Freeze ramp

T0520g

Parameter Description	No.	Value			Standard Configuration
		min	max	factory	
Ramp shade (Linear / S shaped)	18	0	1	Linear (0)	-
S shape t const [ms]	19	100	3000	300	-
S acct t const [ms]	663	100	3000	300	-
S dec t const [ms]	664	100	3000	300	-
Ramp +/- delay [ms]	20	0	65535	100	-
Fwd-Rev	673	0	3	1	-
Forward sign	293	0	1	0	
Reverse sign	294	0	1	0	
Enable ramp (Enabled / Disabled)	245	-	- -	Enabled (1)	-
Ramp out = 0 (Active / Not active)	344	0	1	Not active (1)	*
Ramp in = 0 (Active / Not active)	345	0	1	Not active (1)	*
Freeze ramp (Active / Not active)	373	0	1	Not active (1)	*
Ramp +	346	-	-	-	Digital output 1*
Ramp -	347	-	-	-	Digital output 2*

T6080g

* This function can be assigned to one of the programmable digital inputs.
** This parameter can be assigned to a programmable digital outputs
*** This parameter can be assigned to a programmable analog outputs

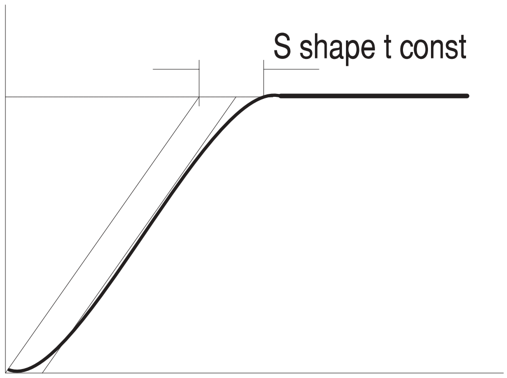


Figure 6.6.2.1: Ramp shape

The shape of the ramp is determined by the **Ramp shape**, **S shape t constant**, **S dec t const** parameters.

Ramp shape Linear — Linear ramp
S shaped — S-shaped ramp

S shape t const Determines the curve for S-shaped ramps (see Figure 6.6.2.1).

S acc t const Determines the curve for S-shaped acceleration ramps.

S dec to const Determines the curve for S-shaped deceleration ramps.

The value of **S shape t constant** is added to the ramp time of linear ramps. The ramp time is thus lengthened by the value degined by the **S shape t const** parameter. This is done regardless of the speed changed involved!

Using very different **S acc t const** and **S dec t const** values it is possible to have a discontinuous behaviour during the changing of the motor direction.

Speed changes (=Active ramp) are indicated by the **Ramp +** and **Ramp -** parameters.

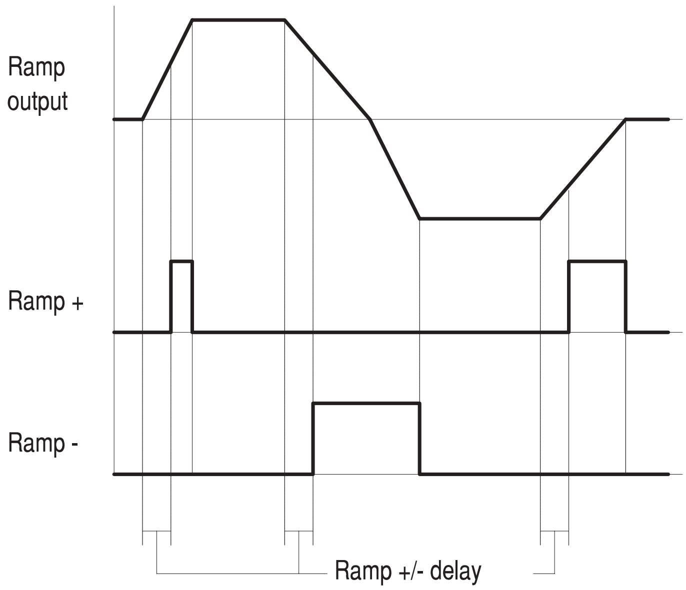


Figure 6.6.2.2: Ramp delay

Ramp +/- delay Defines a delay time. It is only valid if the ramp is active.

Fwd-Rev Changes the sign of the Ramp reference. When Fwd direction is selected the Ramp reference is multiplied by +1. When Rev direction is selected the Ramp reference is multiplied by-1.

Forward sign Set the Fwd direction of the Ramp reference. It can be programmed on a digital input.

Reverse sign Set the Rev direction of the Ramp reference. It can be programmed on a digital input.

When both Fwd and Rev sign are 0 or 1, or **Fwd-Rev** is 0 or 1, the multiplexer is 0.

The behaviour of the ramp circuit is defined by the **Enable Ramp**, **Ramp In = 0**, **Ramp Out = 0** and **Freeze ramp** parameters.

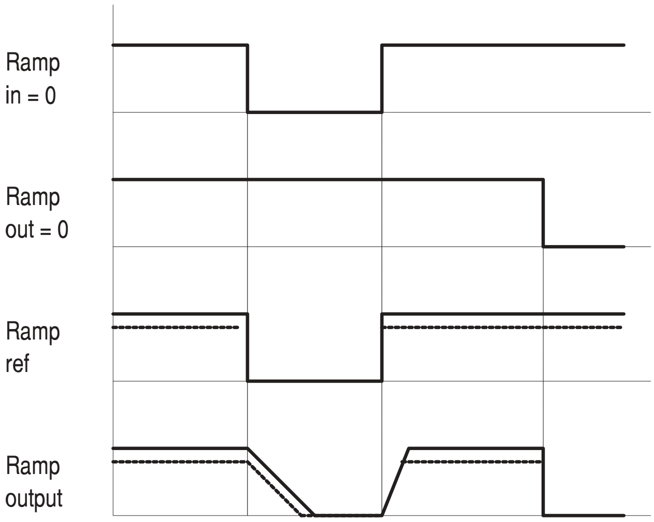


Figure 6.6.2.3: Ramp control

Enable Ramp	This parameter can be changed only with a disabled drive.	
	Enabled	The ramp is enabled.
	Disabled	The ramp is disabled.
Ramp out = 0	Not active (H)	Enabled ramp output.
	Active (L)	The ramp ouput is immediately set to zero.
Ramp in = 0	Not active (H)	Enabled ramp input. The **Ramp Ref** parameter corresponds to the set reference.
	Active (L)	Disabled ramp input. **Ramp Ref** = 0
Freeze ramp	Not active (H)	The value at the ramp ouput is kept, irrespective of any possible reference value changes at the ramp input.
	Active (L)	The ramp output follows the reference value changes at the ramp input according to the times set.
Ramp +	Active if the drive operates with a positive torque (clockwise rotation and counter-clockwise braking).	
Ramp -	Active if the drive operates with a negative torque (counter-clockwise rotation and clockwise braking). Only for TPD32...4B...	

Drive operation is only possible with the ramp functionenabled. **Enable ramp**=Enabled.

When the ramp input is enable via **Ramp in = 0,** the acceleration time of the drive starts. If the input is disabled, the drive slows down according to the decelertion time set until zero speed is reached.

When the ramp output is set to zero via **Ramp out = 0,** the drive brakes through the maximum available torque. With the TPD32...2B converters no braking is possible. The function (also Quick Stop) causes the motor to coast.

6.7. SPEED REGULATION (SPEED REGULAT)

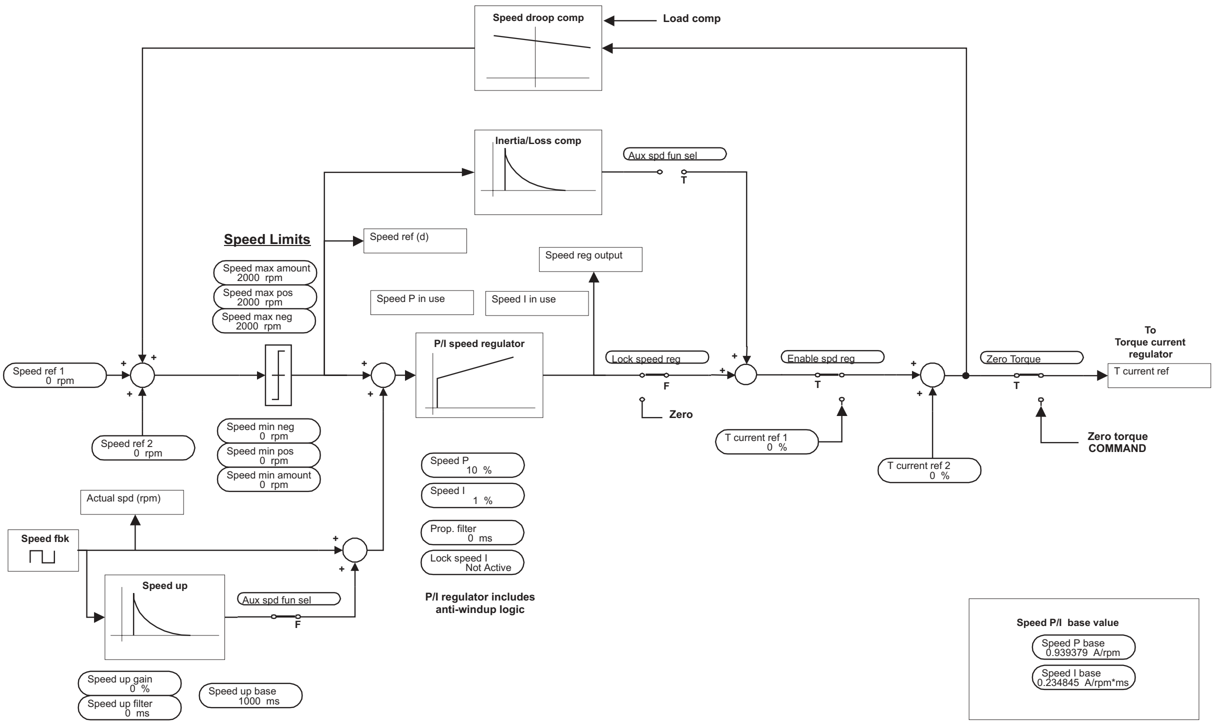


Figure 6.7.1: Block diagram of speed regulator

The converters of the TPD32 series are provided with a speed regulator circuit that can adapt flexibly to the requirements of various applications. The device is factory set for PI regulation and regulator parameters that stay the same throughout the entire speed range.

The following functions are also provided:

- "Speed-up" function in order to avoid oscillations in presence of loads with a high moment of inertia.
- Speed zero logic for regulator behavior when the motor is stopped.
- Speed regulator adaption for optimizing the regulator according to the actual speed or to an external reference (Adap Reference)..
- Auto capture function of a running motor
- Speed signals
- Droop function for current balancing

As for the block diagram of the speed regulator PI see the block "Speed regulator PI part" of the diagram in chapter 9 .

6.7.1. Speed regulator

SPEED REGULAT

- Speed ref
- Speed reg output
- Lock speed reg
- Enable spd reg
- Prop filter
- Lock Speed I

T0530g

Parameter Description	No.	Value			Standard Configuration
		min	max	factory	
Speed ref [rpm]	118	-32768	+32767	-	**
Speed reg output	236	-200	200	-	T current ref 1**
Lock speed reg (ON /OFF)	322	0	1	OFF	*
Enable spd reg (Enabled / Disabled)	242	0	1	Enabled	-
Lock speed I	348	0	1	Not active	*
Aux spd fun sel	1016	0	1	Speed up	*
Prop filter [ms]	444	0	1000	0	

T6085g

* This function can be assigned to one of the programmable digital inputs.

** This parameter can be assigned to a programmable analog output.

Speed ref Total speed reference value in rpm

Speed reg output Output value of the speed regulator, used as the reference for the current regulator

Note! The speed regulator is still active even if disabled (**Enable spd reg** = Disabled), therefore the **Speed reg output** contains valid information also in this case. Such a data can be transferred to the DGFC board to be used for other regulation.

If the speed regulator is enabled (**Enable spd reg** = Enabled) the **Speed reg output** contains the sum of the actual speed regulator output and **T current ref 2**.

Lock speed reg This parameter is used in order to lock the speed regulator. When this happens, it stops to work, the current reference value is set to zero and the drive comes to a stop. This coasting time then depends on the rotating mass and the friction within the system concerned. If the connection between the speed regulator and the current regulator is restored, the drive will restart in the shortest possible time.

ON Speed regulator locked (= 0 V when using a digital input).
OFF Speed regulator unlocked (= 15...30 V when using a digital input).

Enable spd reg This parameter can only be changed when the drive is switched off.

Enabled	The speed regulator is enabled. The regulator output is connected to the input of the current regulator. **Speed reg output** = **T current ref 1**
Disabled	The speed regulator is disabled.

Prop filter Time constant of the filter belonging to the circuit of the speed feedback. Filtering of the high frequency components of speed feedback signal is useful in case of elastic coupling between motor and load (joint or belts).

Aux spd fun sel Selection of the function ***Speed up*** or ***Inertia/loss cp*** (see chapters 6.7.3. Function ***Speed up*** and 6.7.5. ***Inertia/loss cp*** for further details).

Lock speed I

Not active (H)	I component of the speed regulator is enabled
Active (L)	I component of the speed regulator is disabled

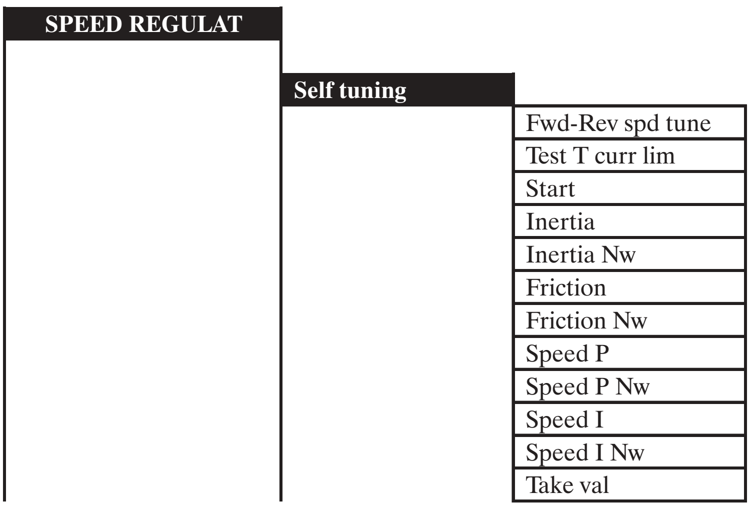
The speed regulator must be enabled with the **Enable spd reg** parameter in order for it to be used.

The reference value for the speed regulator consists of the signed addition of **Speed ref 1** and **Speed ref 2.**

The speed feedback is supplied by an encoder or a tachometer that are mounted to the motor shaft. The higher the resolution of the encoder, the better the control accuracy of the regulator.

The regulator parameters can be set separately.

6.7.1.1 Self tuning of the speed regulator (Self tuning)



T0545i

Parameter description	No.	Value			Standard configuration
		min	max	factory	
Fwd-Rev spd tune Fwd direction Rev direction	1029	1	2	Fwd direction (1)	
Test T curr lim [%]	1048	0	S	20	
Start	1027	0	65535	-	
Inertia [kg*m*m]	1014	0.001	999999	S	
Inertia Nw [kg*m*m]	1030	0.001	999999	-	
Friction [N*m]	1015	0.000	99999	S	
Friction Nw [N*m]	1031	0	99.99	-	
Speed P [%]	87	0	100.00	S	
Speed P Nw [%]	1032	0	100.00	-	
Speed I [%]	88	0	100.00	S	
Speed I Nw [%]	1033	0	100.00	-	
Take val	1028	0	65535	-	

T6087g

Fwd-Rev spd tune Choice of the rotation direction of the motor shaft for the self tuning procedure **Self tuning** (FWD = clockwise rotation or REV = anti-clockwise rotation; rotation seen from the motor shaft side).

Test T curr lim Value of the torque current limit applied during the self tuning procedure.

Start Starting of the self tuning procedure for the speed regulator.

Inertia Inertia value in Kg*m^2 (1 Kg*m^2 = 23.76 lb*ft^2).

Inertia Nw New inertia value in Kg*m^2 identified during the self tuning procedure.

Friction Friction value in N*m (1 N*m = 0.738 lb*ft).

Friction Nw New friction value in N*m identified during the self tuning procedure.

Speed P Proportional gain of the speed regulator.

Speed P Nw New proportional gain value of the speed regulator.

Speed I Integral gain of the speed regulator.

Speed I Nw New integral gain value of the speed regulator.

Take val Acquisition of the new parameter values after the self tuning procedure.

6.7.2. Spd zero logic

SPEED REGULAT
- **Spd zero logic**
  - Enable spd=0 I
  - Enable spd=0 R
  - Enable spd=0 P
  - Spd = zero P gain
  - Ref 0 level

T0540g

The speed zero logic determines the behavior of the drive when the motor is switched off.

Parameter Description	N.	Value			Standard Configuration
		min	max	factory	
Enable spd = 0 I (Enabled / Disabled)	123	0	1	Disabled	-
Enable spd = 0 R (Enabled / Disabled)	124	0	1	Disabled	-
Enable spd =0 P (Enabled / Disabled)	125	0	1	Disabled	-
Spd = zero P gain [%]	126	0,00	100,00	10,00	-
Ref 0 level [FF]	106	1	32767	10	-

T6090g

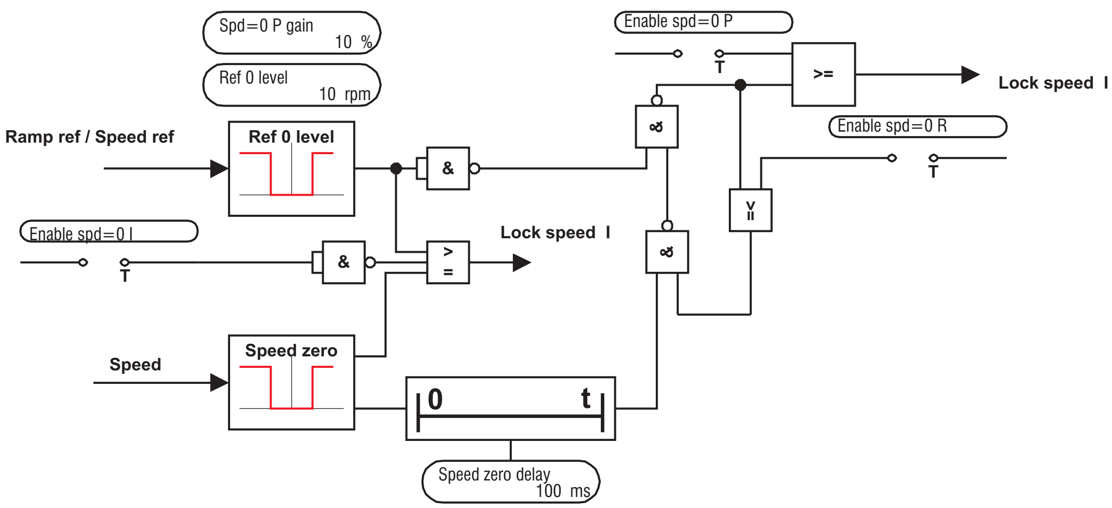


Figure 6.7.2.1: Speed zero logic

Enable spd=0 I	Enabled	The output of the integral section of the speed regulator is set at zero when the reference and the reaction are equal to zero. The control is therefore a proportional one. The I component is enabled when a reference value is entered to restart acceleration.
	Disabled	Disable the function.

Enable spd=0 R Only effective if **Enable spd=0 P** is enabled.

Enabled: The proportional gain, equal to **Spd=0 P** gain at zero speed, is equal to **Speed P** when the speed reference becomes higher than the value defined by **Ref 0** level.

Disabled: The proportional gain, equal to **Spd=0 P** gain at zero speed, is equal to **Speed P** when the speed reference or the actual speed become higher than the value defined by **Ref 0** level.

Enable spd=0 P

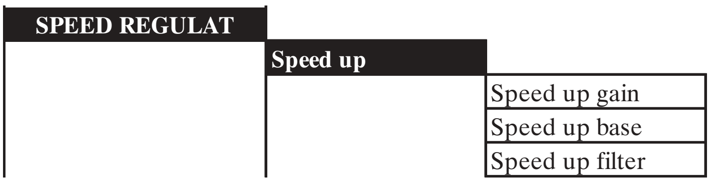
Enabled: When both reference value and actual value = 0, the proportional **Spd=0 P** gain component is active after the delay time defined by Speed zero delay.

Disabled: The speed regulator also keeps its proportional gain component when the drive is at a stop.

Spd=Zero P gain Proportional gain of the speed regulator, that is only active when both reference value and actual value = 0, and if the **Enable spd=0 P** function has been enabled.

Ref 0 level Switch threshold for speed zero logic. Defined in the dimension specified in the factor function. Speeds below this threshold are defined as zero.

6.7.3. Speed up



T0550g

Parameter Description	N.	Value			Standard Configuration
		min	max	factory	
Speed up gain [%]	445	0	100.00	10.00	-
Speed up base [rpm/ms]	446	0	16000	1000	-
Speed up filter [ms]	447	0	1000	0	-

T6095g

The Speed-up function is used in order to avoid oscillations in presence of loads with a high moment of inertia. It is made up of a D derivative part in the speed feedback circuit, which allows to increase the integral gain of the speed regulator. It is also useful in case of cyclical non constant loads on the motor (ex. cams).

The feedback applied to the speed regulator is made of two components:

- the motor speed
- the output signal from the Speed up function

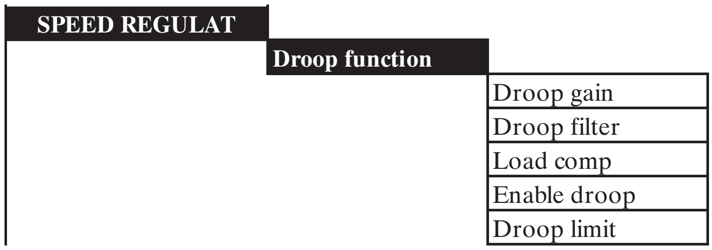
See the examples shown in the figures 5.3.7.3 and 5.3.7.4.

Speed up gain Speed up function gain as a percentage of **Speed up base**

Speed up base Speed up function max. gain. The defined value corresponds to 100% of the **Speed up gain** parameter.

Speed up filter Time constant of the filter belonging to the D part of the Speed up function.

6.7.4. Droop function



T0560g

Parameter Description	No.	Value			Standard Configuration
		min	max	factory	
Droop gain [%]	696	0.00	100.00	0.00	
Droop filter [ms]	697	0	1000	0	
Load comp [%]	698	-200	+200	0	*
Droop limit [FF]	700	0	2*P45	1500	
Enable droop	699	0	1	Disabled	**

T6100g

* This parameter can be assigned to one of the programmable analog inputs

** This parameter can be assigned to one of the programmable digital inputs

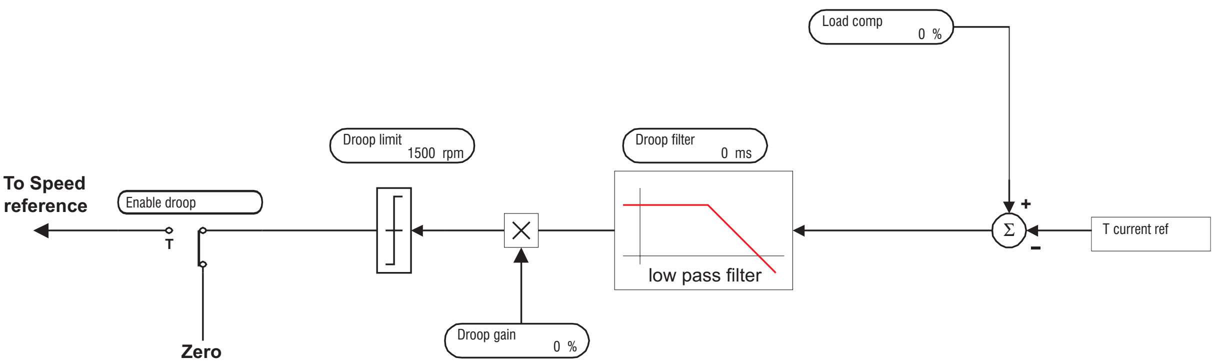


Figure 6.7.4.1: Droop compensation

The Droop function is used when a current balancing between two drives is required.

A typical situation is when two motors are mechanically coupled and have to run at the same speed. If, because of a different characteristic of the two speed regulators, one of the motors is driven to run at a higher speed, it will be overloaded and the second motor will work as a brake.

The Droop function permits to avoid this bad functioning by adding a component in the in the speed reference of the drive, which is proportional to the actual load difference of the drives. The effect is the balancing of the two motor current.

See figure 6.7.2 for a detailed block diagram of the function.

Droop gain Droop function gain. It is defined as a percentage of the ratio between **Speed base value** ant the difference **Load comp - T current ref**. This means that when the difference **Load comp - T current ref** is 100% and **Droop gain** = 100%, the speed reference correction signal is equal to **Speed base value**.

Droop filter Filter time constant

Load comp Load compensation signal. It is typically equal to the “master” drive current, but it can also be assigned to a programmable analog output. It is defined as a percentage of Idn.

Enable droop Enabled Droop function enabled.
Disabled Droop function disabled.

Droop limit It defines the speed reference correction range in which the droop function is active. The value to be entered is based on the factor function.

(For further information see the figure 6.7.1 “Block diagram of the speed regulator”).

EXAMPLE (Steel tube processing machine)

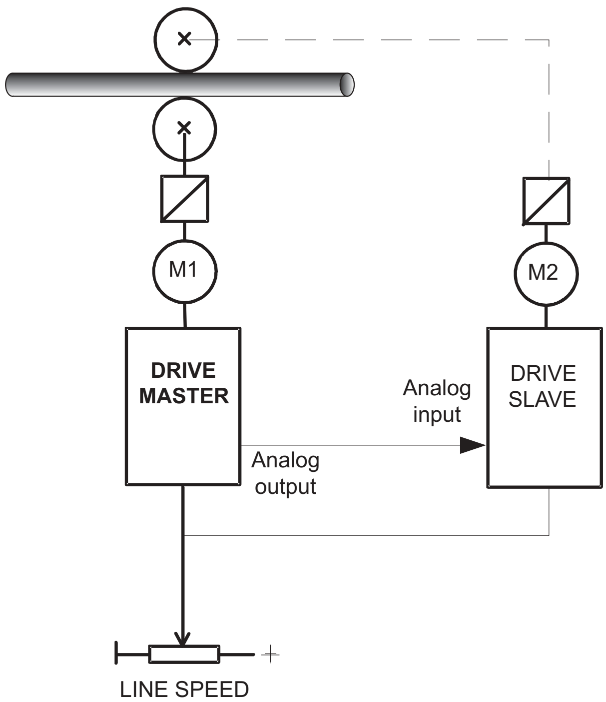


Figure 6.7.4.2: Example of the Droop function

Tuning example: ——> Aim: The torque of motor 1 must be the same as the torque of motor 2

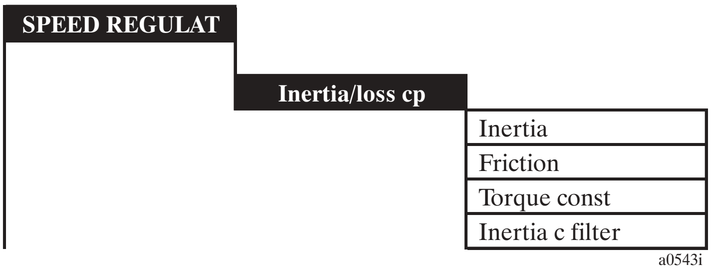
Master converter

Analog input 1 = Speed ref 1
Analog output 1 = T curr ref

Slave converter

Analog input 1 = Speed ref 1
Analog input 2 = Load comp
Enable droop = Enable
Droop gain = 5%
Droop filter = 100 ms
Droop limit = 1000

6.7.5. Inertia and friction compensation (Inertia/loss cp)



Parameter description	No.	Value			Standard configuration
		min	max	Factory	
Inertia [Kg*m*m]	1014	0.001	999.999	S	
Friction [N*m]	1015	0.000	99.999	S	
Torque const [N*m/A]	1013	0.01	99.99	S	
Inertia c filter [ms]	1012	0	1000	0	

A6146g

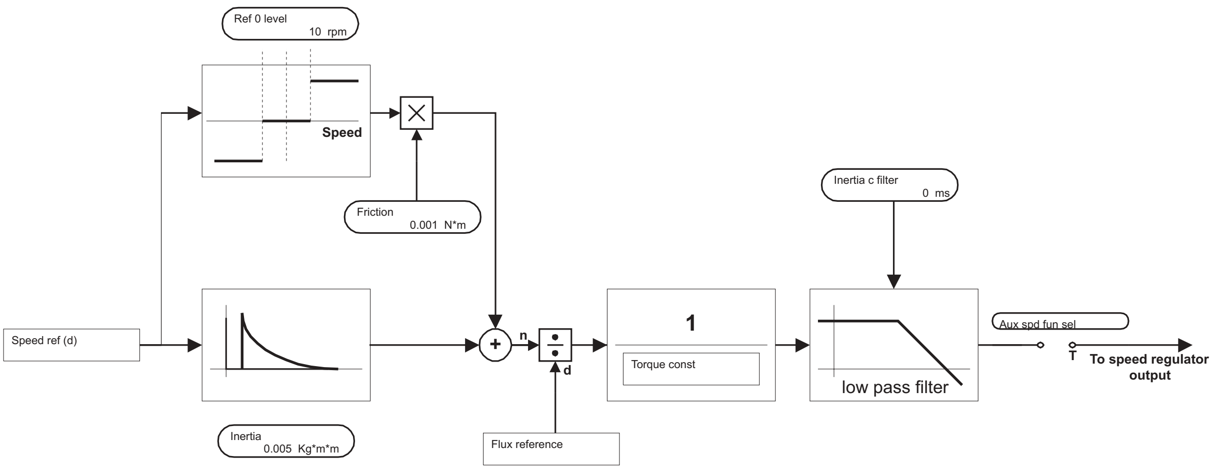


Figure 6.7.5.1: Inertia and friction compensation

An increase of the dynamic response of the speed regulator to a reference change can be modified by changing the current value during the acceleration/deceleration phase in order to contrast the inertia of the applied machine.

Such parameters are identified by the self tuning procedure of the speed loop ***Speed self tune*** (START UP\Speed self tune and SPEED REGULAT\Self tuning) but they can also be set manually by the user.

The enabling of this function does not give the possibility to use the function **Speed up.** This selection has to be set via the parameter **Aux spd fun sel [1016]** (in the SPEED REGULAT menu). See chapter 6.7.1 Speed regulator.

Inertia	Inertia total value on the motor shaft in Kg*m^2 identified during the self tuning procedure (1 Kg*m^2 = 23.76 lb*ft^2).
Friction	Friction value in N*m identified during the self tuning procedure (1 N*m = 0.738 lb*ft).
Torque const	Motor torque constant in N*m/A. It is used to calculate the inertia and friction compensation. It is automatically adapted in the field weakening area. It is internally stated during the speed self tuning procedure (see chapter ....).
Inertia c filter	First rate low-pass filter. The filter reduces the noise caused by the speed differentiation process in the block Inertia/Loss comp

6.8. ARMATURE CURRENT REGULATION (CURRENT REGULAT)

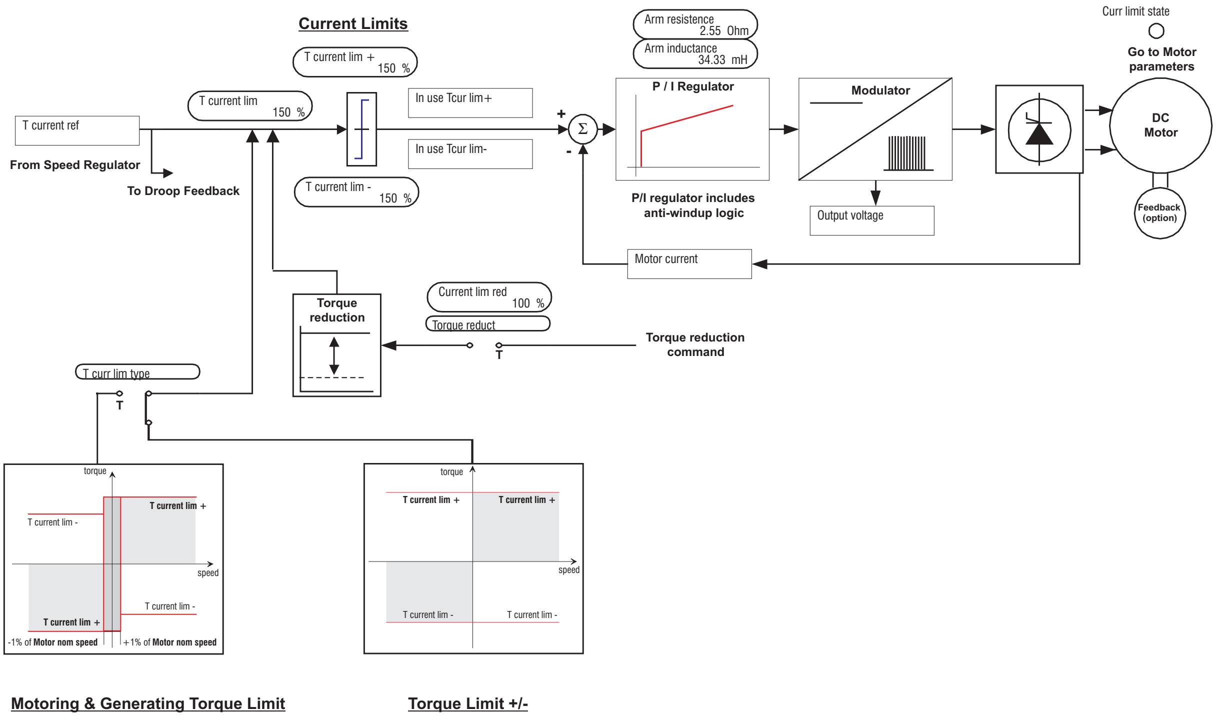


Figure 6.8.1: Torque current regulation

The user defines the full load current of the motor via the **Full load curr** (FLC) parameter in the CONFIGURATION menu. This is at the same time the output current of the inverter when **T current ref** = 100%.

CURRENT REGULAT

- T current ref
- Motor current
- Arm resistance
- Arm inductance
- E int
- R&L search
- Zero torque

T0570g

Parameter Description	N.	Value			Standard Configuration
		min	max	factory	
T current ref [%]	41	-200	+200	-	**
Arm resistance [ohm]	453	S	S	0,500	-
Arm inductance [mH]	454	S	S	4,00	-
E int [V]	587	-80	+80	-	**
R & L search (ON /OFF)	452	0	1	OFF	-
Zero torque	353	0	1	Not active	*

T6105g

*   This function can be assigned to one of the programmable digital inputs
** This parameter can be assigned to a programmable analog output

T current ref Total current reference as a percentage of **Full load curr**. For this parameter the TPD32...2B... converters need a positive value. In this case the negative references are processed and correspond to a zero reference.

Arm resistance Motor armature resistance in Ω. When self-tuning cycle is performed via **R&L search** this parameter is set to the obtained value. Therefore, if necessary, it can be changed.

Arm inductance Motor armature inductance in mH. When self-tuning cycle is performed via **R&L search** this parameter is set to the obtained value. Therefore, if necessary, it can be changed.

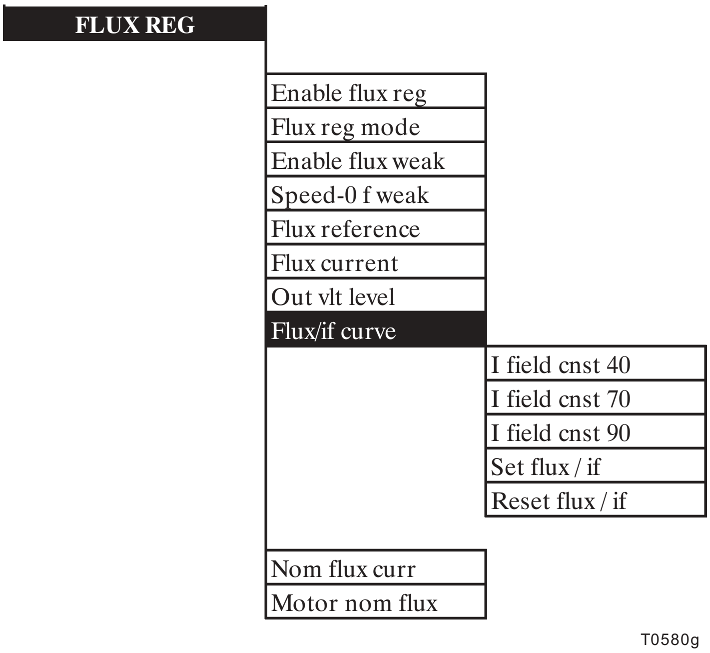
E int Auxiliary signal used to determine wheter the current regulator is correctly tuned. The value should be as low as possible (max ± 80V).

R&L search Execution of self-tuning cycle for the current regulator. These resistance and inductance armature values are set to the **Arm resistance** and **Arm inductance** parameters.

Zero torque The parameter can be used to set the reference value for the armature current **T current ref** to zero so that the drive has no more torque.

Not active (H) **T current ref** not set to zero
Active (L) **T current ref** set to zero. The drive has no torque.

6.9. FLUX REGULATION



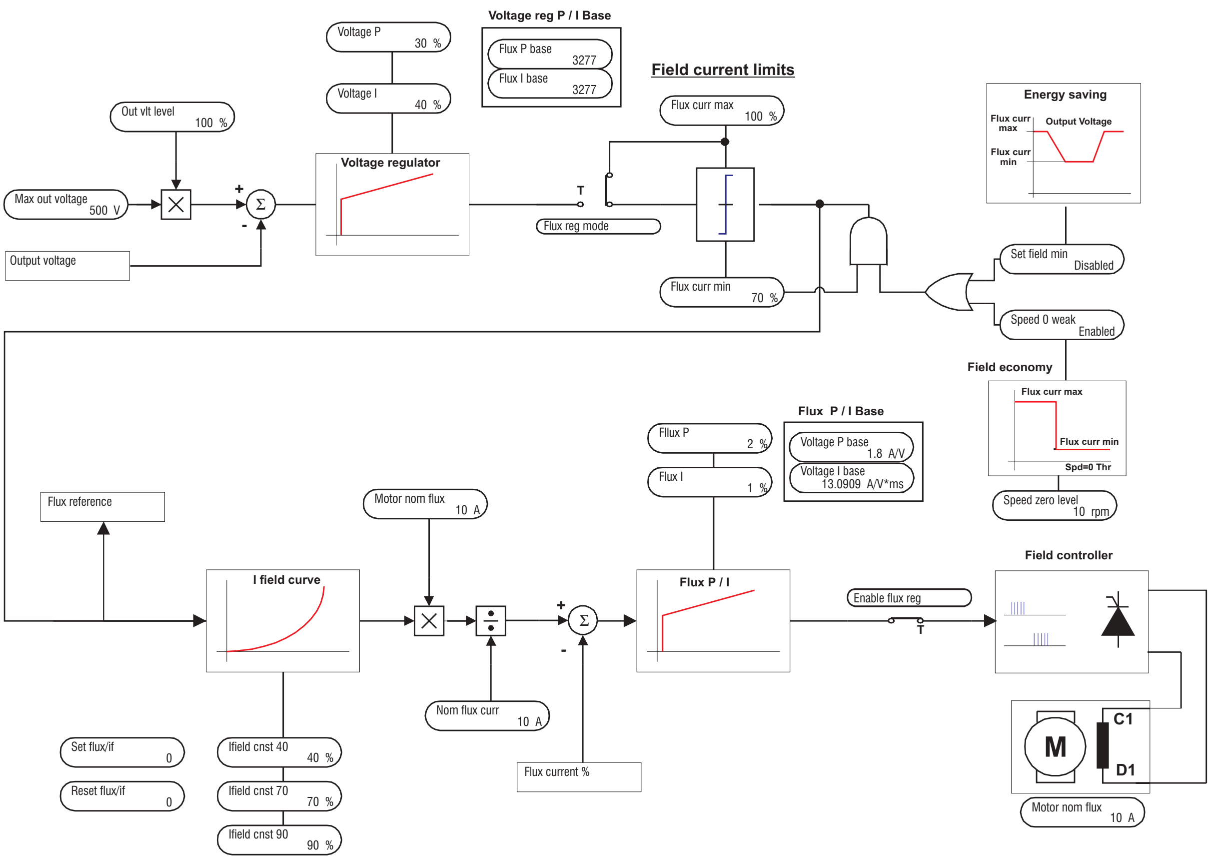


Figure 6.9.1: Motor control

Parameter description	No.	Value			Standard Configuration
		min	max	default	
Enable flux reg (ON / OFF)	497	0	1	ON	*
Flux reg mode (Constant current / voltage control / External control)	469	0	2	Constant current	-
Enable flux weak (ON / OFF)	498	0	1	OFF	*
Speed-0 f weak (ON / OFF)	499	0	1	OFF	
Flux reference [%]	500	0.0	100.0	0.0	**
Flux current [%]	234	0.0	100.0	0.0	**
Out vlt level	921	0.0	100.0	100.0	** / ***
I field cnst 40	916	0.0	100.0	40.0	
I field cnst 70	917	0.0	100.0	70.0	
I filed cnst 90	918	0.0	100.0	90.0	
Set flux / if	919	-	-	-	
Reset flux / if	920	-	-	-	
Nom flux curr [A]	374	0.5	80.0	S	
Motor nom flux [A]	280	0.0	P374	S	

T 6110g

* This function can be set on a programmable digital input
** This parameter can be set on a programmable analog output
** * This parameter can be set on a programmable analog input

Enable flux reg Enable of the field converter
ON Enabled field converter.
OFF Disabled field converter. The field current is zero.

Flux reg mode Operating mode of the field converter.

Constant current: The motor field works with a constant current. The current value corresponds to the setting of the parameter **Motor nom flux**.

If any curve through parameters **I field cnst** will be defined, this value can be changed linearly, through **Flux current max** (percent age of nominal flux **Motor nominal flux**)

(see Flux /if curve paragraph 5.4.5)

Voltage control: The drive works with a regulation combined with torque and constant power (armature and field regulation). Through the **Max out voltage** parameter in the CONFIGURATION menu, is set the max. armature voltage.

External control: The field is supported with an external excitation (rectifier/ converter).

Enable flux weak Command for field weakening

ON: The field current corresponds to the value set via the **Flux current min** parameter.

OFF: The field current is regulated on the basis of the functioning mode and on the drive working situation.

Speed-0 f weak When this function is enabled, and the speed 0 threshold is reached, it will be produced the minimum field current set via **Flux current min**.

Supposing that: **Start** = Low e/o **Fast stop** = Low

Employ as field economy: To avoid the overheating of motors which should not run or to avoid the presence of condensation in motor which work externally (the field will be used as anti condensation heating).

ON Enabled function

OFF Disabled function

Flux reference Flux/current reference : the 100% corresponds to the parameter **Motor nom flux** . With the function Flux / if curve defined , such reference corresponds to the flux reference.

With the function Flux / if curve not defined (default conditions), such reference corresponds to the field current reference.

Flux current Field current feedback, expressed as percentage of the parameter **Motor nom flux**

Out vlt level Percentage of the maximum output voltage according to the parameter **Max out voltage**.

This parameter allows the changing of the output voltage at the ends of the motor in modality "Voltage control" (FLUX REGULATION\Flux reg mode).

I field cnst 40 Current value at 40% of flux (see Flux /if curve paragraph 5.4.5)

I field cnst 70 Current value at 70% of flux (see Flux /if curve paragraph 5.4.5)

I field cnst 90 Current value at 90% of flux (see Flux /if curve paragraph 5.4.5)

Set flux / if Command for the setting of the flux curve according to the setting of **I field cnst 40-70-90** .

With the defined curve, the meaning of **Flux current max/Flux reference** indicates only the flux percentage according to the characteristic of this curve. As a consequence, the value of the field current will be determined by this characteristic (see Flux /if curve paragraph 5.4.5).

Reset flux / if Command for the reset of the flux curve set via command **Set flux / if**.

With this command the parameter Motor nominal flux will be again linearly changed through **Flux current max/Flux reference**. (see Flux /if curve paragraph 5.4.5)

Nom flux curr Rated current I_{dFN} of the field regulator. In order to improve the regulation behavior, the field maximum current can be reduced via the dip switch S14 on the regulation card (see the table in chapter 2.4.3.).

Example	Armarure:	500 VDC 102 ADC	Field:	230 VDC 0.8 ADC
	Drive type:	TPD32-500/...-140...	(Field current 14 A = default)	

Set the dip switches S14 to decrease the field current from the drive supplied, as below:

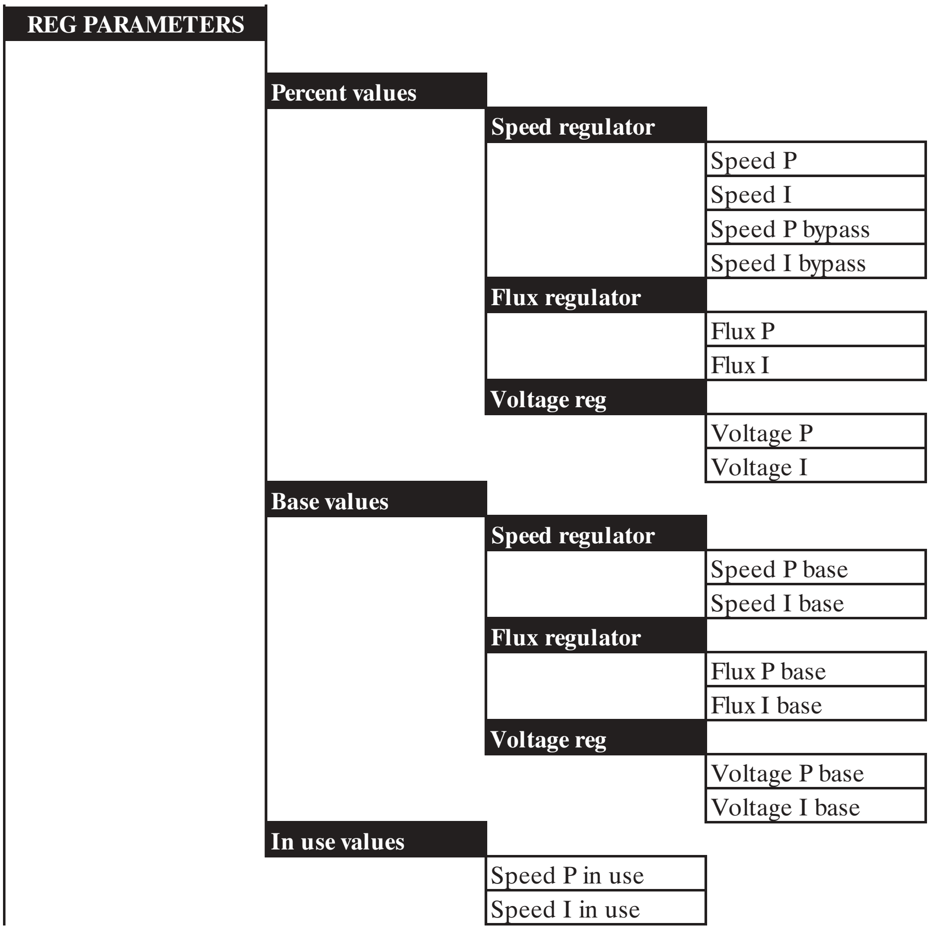
Switch ohms	148 ohm	330 ohm	182 ohm	36.4 ohm	845 ohm	1650 ohm	**Equivalent resistance**
Field curr scale	**S14-1**	**S14-2**	**S14-3**	**S14-4**	**S14-5**	**S14-6**	
1.0 A	OFF	OFF	OFF	OFF	OFF	ON	1650 ohm

GD6111g

Set **Field curr scale** parameter to 0.8.

Motor nom flux Rated field current I_{dFN} of the connected motor.

6.10. REG PARAMETERS



T0590g

Parameter description	N.	Value			Standard Configuration
		min	max	default	
Speed P [%]	87	0.00	100.00	10.00	-
Speed I [%]	88	0.00	100.00	1.00	-
Speed P bypass [%]	459	0.00	100.00	10.00	-
Speed I bypass [%]	460	0.00	100.00	1.0	-
Flux P [%]	91	0.00	100.00	2.0	-
Flux I [%]	92	0.00	100.00	1.0	-
Voltage P [%]	493	0.00	100.00	30.0	-
Voltage I [%]	494	0.00	100.00	40.00	-
Speed P base [A/rpm]	93	0.1	S	0.3•$P93_{max}$	-
Speed I base [A/rpm•ms]	94	0.01	S	0.3•$P94_{max}$	-
Flux P base	97	0.1	32767	3277	-
Flux I base	98	0.01	32767	3277	-
Voltage P base [f%/V]	495	0.1	S	S	-
Voltage I base [f%/V ms]	496	0.01	S	S	-
Speed P in use [%]	99	0.00	100.00	S	-
Speed I in use [%]	100	0.00	100.00	S	-

T6115g

Speed P	Proportional gain K_P* of the speed regulator expressed as a % of **Speed P base**.
Speed I	Integral gain K_I* of the speed regulator expressed as a % of **Speed I** base.
Speed P bypass	Proportional gain K_P* of the speed regulator expressed as a percentage of **Speed P base**, when a feedback via encoder or tachometer is changed into a armature feedback (**Enable fbk bypas** = Enabled).
Speed I bypass	Integral gain K_I* of the speed regulator expressed as a percentage of Speed I base, when a feedback via encoder or tachometer is changed into a armature feedback (Enable fbk bypas = Enabled).
Flux P	Proportional gain K_P* of the flux regulator expressed as % of **FluxP base**.
Flux I	Integral gain K_I* of the flux regulator expressed as a percentage of **Flux I base**.
Voltage P	Proportional gain K_P* of the field voltage regulator expressed as a percentage of **Voltage P base**.
Voltage I	Integral gain K_I* of the field voltage regulator expressed as a percentage of **Voltage I base**.
Speed P base	Proportional gain K_{P0} of the speed regulator in A/rpm (base value)
Speed I base	Integral gain K_{I0} of the speed regulator in A/rpm·ms (base value)
Flux P base	Proportional gain K_{P0} of the field current regulator (base value)
Flux I base	Integral gain K_{I0} of the field current regulator in (base value)
Voltage P base	Proportional gain K_{P0} of the field voltage regulator in A / Vs (base value)
Voltage I base	Integral coefficient K_{I0} of the field voltage regulator in A / V · ms (base value)
Speed P in use	Display of the active proportional coefficient of the speed regulator as a percentage of **Speed P base**
Speed I in use	Display of the active derivative coefficient of the speed regulator as a percentage of **Speed I base**

The maximum value for the regulator parameters is defined by the base values. The settings possible depend on the size of the device.

The user can optimize the function of the regulator by changing the percentage values

(values marked with *).

The resulting gains for the regulator are calculated as follows:

$$K_P = K_{P0} \cdot K_P^* / 100\ \% \qquad K_I = K_{I0} \cdot K_I^* / 100\ \%$$

Example of the speed regulator:

Speed P base = 12 (= K_{P0}) **Speed P** = 70 % (= K_P*)

Proportional gain K_P = 12 · 70 % / 100 % = 8.4

The base values ... base are also the basis for setting the adaptive speed regulator.

When the adaptive speed regulator is enabled (**Enable spd adap** = Enabled), the **Speed P** and **Speed I** parameters have no effect. They still retain their value and are effective again when the speed regulator adaption is disabled.

The **Speed P in use** and **Speed I in use** parameters indicate the current gains for the speed regulator. This also applies when the speed regulator adaption is active.

6.11. CONFIGURATION

6.11.1. Operating mode selection

CONFIGURATION

- Main commands
- Control mode

T0600g

Parameter Description	N.	Value			Standard Configuration
		min	max	factory	
Main commands (Terminals / Digital)	252	0	1	Terminals (0)	-
Control mode (Local / Bus)	253	0	1	Local (0)	-

T6120g

Main commands These commands specify from where the **Enable drive**, **Start** and **Fast stop** commands are to be actuated.

Terminals The above commands are actuated exclusively via the terminal strip.

Digital Commands must be selected both via the terminal strip and via the digital channel (keypad or RS485 or bus, depending on the **Control mode**). If, for example, a stop of the drive is initiated by removing the **Start** command on terminal 13, both the voltage on terminal 13 and the command via the digital channel are necessary to restart the drive. This also applies to a removal of the **Fast stop** command. If the **Stop** is initiated via the digital channel, the digital command is sufficient to restart the drive.

The control method through terminal commands (Terminals) is selectable only keeping the terminals 12 (Enable) and 13 (Start) not supplied.

Carrying out the passage of the commands from Digital to Terminals with those terminals supplied, it will appear the message “**Change input**”, signalling the wrong action.

Control mode Defines whether the digital channel is the keypad/RS485 or a bus system (Option).

Local The digital channel is the keypad or the RS485 serial interface

Bus The digital channel is a bus system (Option)

The following tables show the operating modes possible.

Parameters		Actuation of: Enable drive Start Fast stop	Control mode selection	Failure reset	Save parameters
Main commands	**Control mode**				
Terminals	Local	Terminals	Keypad /RS485	Terminals of Keypad	Keypad /RS485
Digital	Local	Terminals and keypad/RS485	Keypad /RS485	Terminals of Keypad	Keypad /RS485
Terminals	Bus	Terminals	Keypad* / RS485* or Bus	Terminals or keypad* or Bus	Keypad RS485 or Bus
Digital	Bus	Terminals and Field Bus	Keypad* / RS485* or Bus	Terminals or keypad*/ RS485* or Bus	Keypad RS485 or Bus

T6125g

Parameters		Write Access Restrictions		
Main commands	**Control mode**	Terminals	Keypad / RS485	Bus
Terminals	Local	Access to everything assigned to programmable I/Os	Access to all parameters not assigned to programmable I/Os	None
Digital	Local	Access to everything assigned to programmable I/Os	Access to all parameters not assigned to programmable I/Os	None
Terminals	Bus	Access to everything assigned to programmable I/Os	- read all - save parameters -reset failures* - select Control mode*	Access to all parameters not assigned to programmable I/Os
Digital	Bus	Access to everything assigned to programmable I/Os	- read all - save parameters -reset failures* - select Control mode*	Access to all parameters not data channel is not assigned to programmable I/Os

T6130g

* Access via the keypad or the RS485 serial interface is protected in this configuration by **Password level 1**

NOTE! Write access from Bus through data channel is not affected by Control Mode selection.

6.11.2. Speed base value, Full load current

CONFIGURATION	
	Speed base value
	Full load curr
	Max out voltage

T0610g

Parameter Description	N.	Value			Standard Configuration
		min	max	factory	
Speed base value [FF]	45	0,00	16383	1500	-
Full load curr [A]	179	0,1	S	S	-
Max out voltage [V]	175	20	999	400	-

T6135g

Speed base value

The **Speed base value** is defined by the unit specified in the factor function. It is the reference value for all speed values (reference values, adaptive speed regulation.) given as a percentage, and corresponds to 100% of the speed. Changing this parameter is only possible when the drive is disabled (**Enable drive** = Disabled). The **Speed base value** does not define the maximum possible speed, which in some cases can be formed from the addition of several reference values. This is defined with Speed max amount.

Full load curr

The **Full load curr** (FLC) parameter is defined in Amps. It corresponds to 100 % of the current limit. The settings for the current limit and the overload function are based on this active current value.

Max out voltage

Max armature voltage of the drive. When it has been set as **Flux reg mode** "Voltage control", **Max out voltage** is the voltage, which starts the weakening phase of the field. This parameter has an influence on the intervention threshold of the "Overvoltage" message.

6.11.3. Configuration of the OK relay (terminals 35, 36)

CONFIGURATION	
	Ok relay funct

T0620g

Parameter Description	N.	Value			Standard Configuration
		min	max	factory	
OK relay func (Drive healthy / Ready to Start)	412	0	1	Drive healthy 0	—

T6140g

Ok relay func This parameter defines the condition in which the relay contact will close.

Drive healthy — The contact will close when the drive is supplied with voltage and when there are no failure alarms.

Ready to start — The contact closes when the following conditions are fulfilled:

- The drive has a voltage supply
- There are no failure alarms present
- The drive is enabled with **Enable drive**

6.11.4. Configuration of the speed feedback circuit

- **CONFIGURATION**
  - **Speed fbk**
    - Motor max speed
    - Speed fbk sel
    - Enable fbk contr
    - Enable fbk bypas
    - Flux weak speed
    - Speed fbk error
    - Tacho scale
    - Speed offset
    - Encoder 1 pulses
    - Encoder 2 pulses
    - Refresh enc 1
    - Refresh enc 2
    - Enable ind store

T0630i

Parameter description	No.	Value			Standard configuration
		min	max	factory	
Motor nom speed [rpm]	162	0	6553	1500	-
Speed fbk sel	414	0	3	Encoder 2	-
Enable fbk contr	457	0	1	Disabled	-
Enable fbk bypass	458	0	1	Disabled	-
Flux weak speed [%]	456	0	100	100	-
Speed fbk error [%]	455	0	100	22	-
Tacho scale	562	0.90	3.00	1.00	-
Speed offset	563	-20.00	+20.00	0.00	-
Encoder 1 pulses	416	600	9999	1024	-
Encoder 2 pulses	169	150	9999	1000	-
Refresh enc 1	649	0	1	0	-
Refresh enc 2	652	0	1	0	-
Encoder 1 state	648	0	1		
Encoder 2 state	651	0	1		
Enable ind store	911	0	1	Disabled	-
Ind store ctrl	912	0	65535	0	-
Index storing	913	0	$+2^{32}-1$	0	-

T 6145g

NOTE! The encoder or the tachometer are necessary for the regulation mode Flux reg mode "Voltage control" and "External control". The features of the electrical data of the encoder and the tachometer are defined in sections 2.7.2, "Encoder / Tachometer", and 2.4.5, "Accuracy".

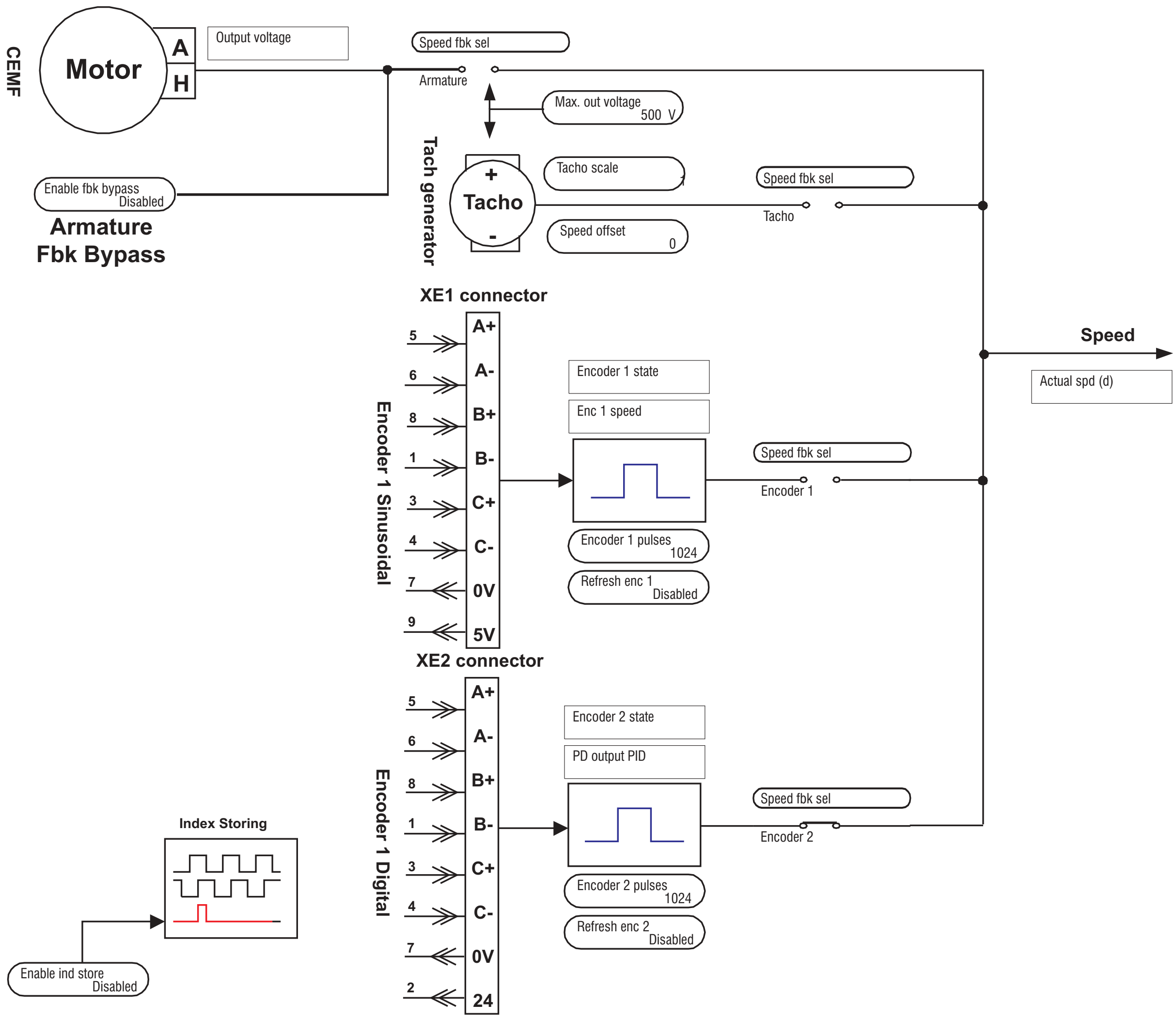


Figure 6.11.4.1: Speed feedback

Motor max speed Max motor speed. It is used to convert tach and armature feedback values in rpm. In case of speed feedback from tachogenerator it is used to convert the tach voltage in an rpm value. In case of armature voltage feedback **Max out voltage** parameter is considered equivalent to Motor max speed. This parameter should be set.

Speed fbk sel Select which feedback has to be used.

Encoder 1	The sinusoidal encoder connected th the XE1 connector is used.
Encoder 2	The digital encoder connected to the XE2 connector is used (standard).
Tach	The analog tachogenerator connected to the terminals + and - is used.
Armature	The internal measurement of the armature voltage is used. No external connection is required.

Enable fbk contr Enable of the control for the speed feedback.

Enabled Enabled control

Disabled Disabled control

This function controls the speed feedback, where a comparison between the armature voltage and the speed value read by the encoder or by the tachometer is made. When an excursion higher of the value set via **Speed fbk error** is signaled, the failure message "Speed fbk loss" appears. This function is automatically disabled when the armature feedback has been selected. (**Speed fbk sel** = Armature).

Enable fbk bypas Enable of the automatic change into an armature feedback when the failure message "Speed fbk loss" is caused by a lack of the encoder or tachometer feedback.

Enabled Enabled automatic change

Disabled Disabled automatic change

After an automatic change into an armature feedback, the speed regulator works with the **Speed P bypass** and **Speed I bypass** parameters of the REG PARAMETERS/Percent values/Speed regulator menu. The failure message "Speed fbk loss" with an enable must be configured so that it is set as "Activity = Warning". When the change has been carried out, the D derivative part of the speed regulator is automatically excluded.

Possible working only with constant field current.

Flux weak speed Speed value as a percentage of **Motor nom speed**, when the field weakening phase starts.

The **Flux weak speed** parameter, when the speed feedback control is enabled (Enable fbk contr = Enabled), is used to underline the fact that during the field weakening phase the armature voltage and the feedback signal are not proportional. If the drive works with a constant torque on the whole regulation range (**Flux reg mode** = Constant Current), it is necessary to insert the factory set 100% value.

Speed fbk error Max. allowed error expressed as a percentage of the max. output voltage (**Max out voltage**).

By means of Max out Voltage, Flux weak speed and Motor nominal speed a relation between motor speed and armature voltage is obtained. If a difference higher than Speed fbk error occurs a Speed fbk loss failure occours.

Tacho scale Fine scaling of the speed feedback using a tachometer analog generator (**Speed fbk sel** = Tacho). It is a multiplier of the read tach voltage.

Speed offset Offset scaling of the feedback circuit.

Encoder 1 pulses Number of pulses per revolution of the sinusoidal encoder connected to the XE1 connector.

Encoder 2 pulses Number of pulses per revolution of the digital encoder connected to the XE2 connector. The Torque **Encoder 2 pulses** and **Motor max speed** shall be inside the allowed area shown in figure 6.11.4.2.

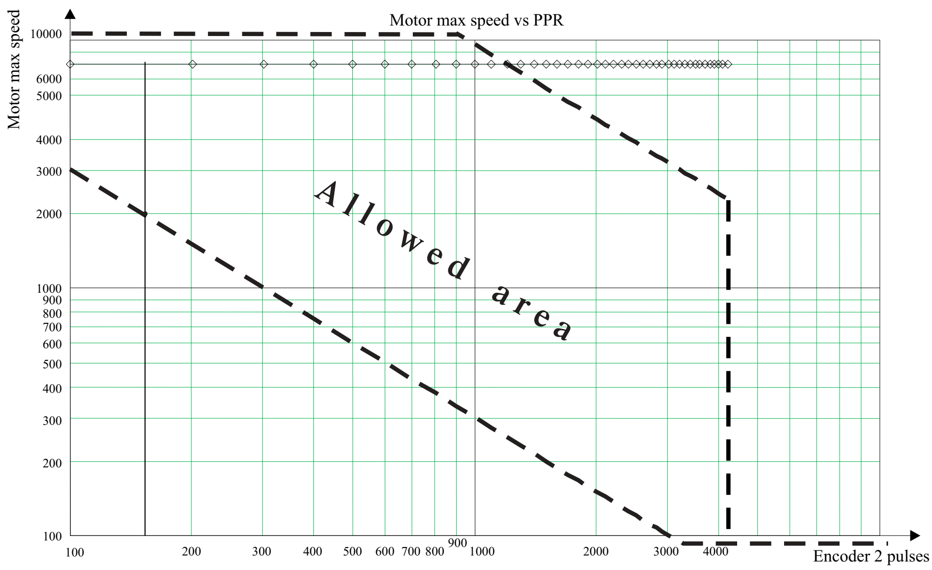


Figure 6.11.4.2

Refresh enc1 Enable the monitoring of the sinus encoder (connector XE1) connection status.

Enabled Sinus encoder controlled

Disabled Sinus encoder not controlled

When an alarm is detct, the keypad will shown "Speed fbk loss". **Encoder 1 state** provides the indication of encoder 1 connection status. The parameter can be programmed on a digital output. This function is activate setting Enable fbk control = Enabled.

Refresh enc 2 Enable the monitoring of the encoder 2 (connector XE2) connection status, in order to detect a speed feedback loss alarm.

Enabled Digital encoder controlled

Disabled Digitalencoder not controlled

When an alarm is detct, the keypad will shown "Speed fbk loss". **Encoder 2 state** provides the indication of encoder 1 connection status. The parameter can be programmed on a digital output. This function is activate setting Enable fbk control = Enabled.

Encoder 1 state Provides the indication of the encoder 1 connection status. The parameter can be programmed on a digital output.

Encoder 2 state Provides the indication of the encoder 2 (connector XE2) connection status. The parameter can be programmed on a digital output.

NOTE! The **Tach scale** and **Speed offset** parameters are used for a fine scaling of the speed feedback circuit. When the factory set parameters are loaded (**Load default)** these two parameters do not undergo any change, so that a new scaling is not necessary!

The following parameters allow to state the machine absolute zero and to carry out a position control by using the DGFC option card.

Enable ind store This parameter enables the reading of the encoder zero pulse (qualification signal (*) or "zero cam"), which is used in systems implementing the position control.

Enabled This setting enables the encoder reading.

Disabled This setting disables the encoder reading.

Ind store ctrl Control register of the zero pulse and of the encoder qualification signal (*).

Index storing Data and function status register.

(*) The encoder qualification signal (or “zero cam”) is not supported by the regulation card R-TPD3G revision “ l ” or lower.

Parameter Ind store ctrl [912]

No. bit	Name	Description	Access (Read/Write)	Default
0-1	-	Not used	-	-
2	POLNLT	It indicates the encoder index edge polarity: 0 = rising edge 1 = falling edge	R/W	0
3	-	Not used	-	-
4-5	ENNQUAL	It indicates the qualifier level that activates the encoder index reading: 0 = OFF 1 = OFF 2 = Through signal = 0 3 = Through signal = 1	W	0
6	Target Enc Num	It points out for which encoder values of this parameter are reporteded: 0 = the required operations have to be carried out on the Encoder 1 1 = the required operations have to be carried out on the Encoder 2	R/W	0
7	-	Not used	-	-
8-9	ENNLT	Control function of the encoder index reading: 0 = OFF, disabled function 1 = Once, enables the reading of the first index signal edge only 2 = Continuous, enables the reading of the index signal	R/W · · ·	0

A6126gA

Parameter Index storing [913]

No. bit	Name	Description	Access (Read/Write)	Default
0	Source Enc Num	It indicates to which encoder the values in this register are referred to: 0 = register data are referred to the Encoder 1 1 = register data are referred to the Encoder 2	R	0
1	MP_IN	Actual Qualifier level value: 0 = qualifier input level is low 1 = qualifier input level is high	R	0
2 3	STATNLT	Status of the acquisition function: 0 = OFF 1 = Once, storing is not executed yet 2 = Once, storing is already executed 3 = Continuous	R	0
16-31	CNTNLT	Position counter value corresponding to the index. Value is only valid when STANLT is equal to 2 or 3	R	0

A6126gB

6.11.5. “Standard / American”, Software Version

CONFIGURATION

Drive type

- Drive size
- 2B + E
- Size selection
- Software version

T0640g

Parameter Description	N.	Value			Standard Configuration
		min	max	factory	
Drive size [A}	465	0	S	S	-
2B + E	201	0	1	0	-
Size selection (Standard / American)	464	0	1	Standard (0)	
Software version	331			-	
Drive type	300	10	11	S	

T6150g

Drive size Display of the converter armature current in ampere (it is codified by the SW8 Switch placed on the R-TPD3. regulation card). The stated value depends on the setting of the **Size selection** parameter.

2B + E Selection of the 2B + external excitation configuration. Only for 2B converters. The function allows the drive to work with an external 4B flux controller. When the parameter is On the Ramp / Speed / T current references and Speed measurement have the same behaviour of the 4B drive.

Size selection With the standard selection “Standard” the converter produces rated current in a continuative way in the preset ambient conditions without overload. In America the rated current will be defined considering an overload of 1.5 times, for the duration of 60 seconds. This causes a reduction of the rated current of the converter (continuative current) for the same type of drive.

Standard — The converter produces rated current in a continuative way I_{dAN}. It is stated as **Drive size**. It is not set any overload function.

American — The rated current (produced continuously) will be reduced and indicated in **Full load current** and **Drive size**.

Automatically it will be inserted the function of overload (FUNCTION\Overload control), which is so programmed:

Enable overload = ON **Overload mode** = Limited

Overload time = 60s **Full load current**=American

Pause time = 540s **T current lim** = 150%

Overload current = 150% **T current lim+** = 150%

Base current = 100% **T current lim -** = 150%

If the size “American”is selected, the parameter **Overcurrent thr** [584] will be set at 160%

NOTE! If the converter will be re-configurated as “Standard”, these parameters and the continuous current limit take again the value correspondent to the previous configuration (overload disabled) and the parameter **Overcurrent thr** [584] returns to 110%.

The size is factory set. This parameter cannot be changed by the user.

Software version Display of the software version number active in the converter.

Drive type Display of the drive type: 2B or 4B.

6.11.6. Dimension factor, Face value factor

- **CONFIGURATION**
  - **Dimension fact**
    - Dim factor num
    - Dim factor den
    - Dim factor text
  - **Face value fact**
    - Face value num
    - Face value den

T0650g

The factor function consists of two factors - the dimension factor and the face value factor. Both factors are defined as fractions.The dimension factor is used to specify the drive speed in a dimension related to the machine concerned, e.g. kg/h or m/min. The face value factor is used to increase the resolution.

See the calculation examples given below.

Parameter Description	N.	Value			Standard Configuration
		min	max	factory	
Dim factor num	50	-2^{31}	$+2^{31}-1$	1	-
Dim factor den	51	-2^{31}	$+2^{31}-1$	1	-
Dim factor text	52			rpm	-
Face value num	54	-32768	+32767	1	-
Face value den	53	-32768	+32767	1	-

T6155g

Dim factor num Numerator of the dimension factor

Dim factor den Denominator of the dimension factor

Dim factor text Unit of the dimension factor (5 characters). This text is shown in the keypad display for reference value entry. Possible characters: /%&+,-.0...9:<=>?A...Z[]a...z

Face value num Numerator of the face value factor

Face value den Denominator of the face value factor

The reference value given multiplied with the dimension factor and the face value factor defines the motor speed in rpm

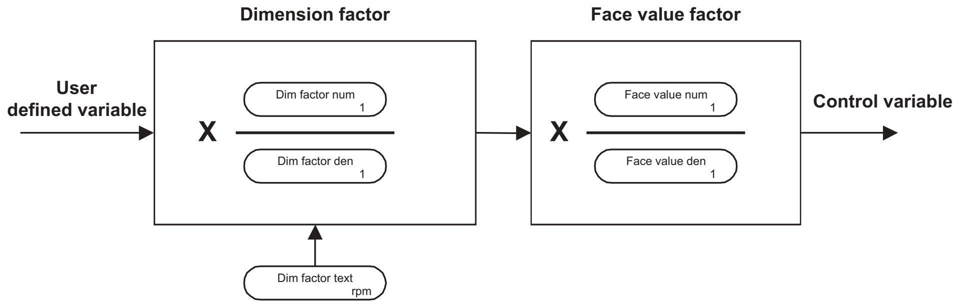


Figure 6.11.6.1: Calculation using dimension and face value factors

Example 1 of the calculation of the dimension factor

The drive speed is given in m/s. The conversion ratio is 0.01 m per revolution of the motor (Note: face value factor = 1). The dimension factor is calculated from

$$\text{Dimension factor} = \frac{\text{output (rpm)}}{\text{input (here: m/s)}}$$

f001

0.01 m corresponds to 1 revolution of hte motor shaft

0.01 m/min corresponds to 1/min

0.01 m/60s corresponds to 1/min

$$\text{Dimension factor} = \frac{1}{\text{min}} \bullet \frac{60\ \text{s}}{0.01\ \text{m}} = \frac{6000}{1} \bullet \frac{1}{\text{min}} \bullet \frac{\text{s}}{\text{m}}$$

f002

When calculating the dimension factor, units should not be shortened (1 min is not shortened as 60 s)

Dim factor num 6000 **Dim factor den** 1 **Dim factor text** m/s

Example 2 of the calculation of the dimension factor

The reference values for a bottling plant are given in bottles per minute. One revolution of the drive corresponds to the filling of 0.75 bottles. This corresponds to a dimension factor of 4/3. The speed limitation and the ramp function are also given in bottles per minute.

$$\text{Dimension factor} = \frac{\text{output (rpm)}}{\text{input (here: bottles / min)}}$$

f003

3/4 of a bottle corresponds to 1 revolution of the motor shaft

$$\text{Dimension factor} = \frac{1}{\text{min}} \bullet \frac{4\ \text{min}}{3\ \text{bottles}} = \frac{4}{3} \bullet \frac{1}{\text{min}} \bullet \frac{\text{min}}{\text{bottles}}$$

f004

Units should not be shortened when calculating the dimension factor.

Dim factor num 4 **Dim factor den** 3 **Dim factor text** F/min (bottles per minute)

Example of the face value factor

Normally the reference value has a resolution of 1 rpm. In order to utilize the resolution, the face value factor is used. The motor speed range required is, for example, 0...1500 rpm. A more accurate resolution (i.e. 1/20 revolution) can be obtained by setting hte face value factor to 1/20.

The value 20 000 is entered, for example, in order to select 1000 rpm This is then multiplied with the face value factor to give the value 1000 rpm.

Face value num 1**Face value den** 20

6.11.7. Programmable alarms

- **CONFIGURATION**
  - **Prog alarms**
    - **Failure supply**
      - Latch
      - Ok relay open
    - **Undervoltage**
      - Undervolt thr
      - Latch
      - Ok relay open
      - Hold off time
      - Restart time
    - **Overvoltage**
      - Activity
      - Latch
      - Ok relay open
      - Hold off time
      - Restart time
    - **Heatsink**
      - Activity
      - Ok relay open
    - **Overtemp motor**
      - Activity
      - Ok relay open
    - **External Fault**
      - Activity
      - Latch
      - Ok relay open
      - Hold off time
      - Restart time
    - **Overcurrent**
      - Overcurrent thr
      - Activity
      - Latch
      - Ok relay open
      - Hold off time
      - Restart time

T 0660-1i

T 0660-2i

The converters of the TPD32 series contain extensive monitoring functions. The effect of possible alarms on the behaviour of the drive are defined in the PROG ALARMS submenu:

- Saving of alarm status
- How the drive is to react to the alarm
- Indication via the relay between terminal 35 and 36 (central alarm). The switch conditions for the relay can be defined with the **Ok relay** func parameter in the CONFIGURATION menu.
- Automatic restart
- Failure reset

For some alarms, the behaviour of the drive can be configured separately. All alarms can also be assigned to a freely programmable digital output (only with TBO option card).

Alarm	N.	Factory					Standard
		Activity	Latch	Open OK relay	Hold off time [ms]	Restart time [ms]	
Failure Supply		Disable drive	ON	ON	-	-	-
Undervoltage		Disable drive	ON	ON	0	1000	Dig. Outp. 7*
Overvoltage		Ignore	ON	ON	0	0	Dig. Outp. 6*
Heatsink		Disable drive	-	ON	-	-	*
Overtemp motor		Disable drive	-	ON	-	-	*
External fault		Disable drive	ON	ON	0	0	*
Overcurrent		Ignore	ON	ON	0	0	Dig. Outp. 8*
Field loss		Disable drive	ON	ON	0	0	*
Speed fbk loss		Disable drive	-	ON	8	-	*
Opt 2 failure		Disable drive	ON	ON	-	-	*
Bus loss		Disable drive	ON	ON	0	0	*
Hw Opt 1 failure		Disable drive	-	ON	-	-	*
Enable seq err		Disable drive	ON	ON	-	-	

* This function can be assigned to one of the programmable digital outputs.

T6160g

If the serial interface or a bus system is used, the alarms can be evaluated via the **Malfunction Code** parameter. The parameters required to configure the alarm are shown in Table in Section 10 of the manual.

Activity	Ignore	No reaction is present. A warning message can be output via a digital output.
	Warning	The alarm does not cause reaction of the drive. A warning message can be output via a digital output. When the drive is disabled, it will not restart until the failure has been canceled.
	Disable drive	The alarm causes the immediate disabling of the converter. The motor runs to an uncontrolled stop.
	Quick stop	When the alarm occurs, the drive stops according to the ramp set in the RAMP / QUICK STOP menu. The converter is then disabled.
	Normal stop	When the alarm occurs, the drive stops according to the ramp set. The converter is then disabled.
	Curr lim stop	When the alarm occurs, the converter brakes with the maximum possible current. The converter is then disabled when stopped.

Not all alarms can initiate a controlled stop of the drive. The possibility of setting the particular "Activity" for individual alarms is described in the table below.

Alarm	Ignore	Warning	Disable drive	Quick stop	Normal stop	Curr lim stop
Failure Supply	-	-	X	-	-	-
Undervoltage	-	-	X	-	-	-
Overvoltage	X	X	X	-	-	-
Heatsink	-	X	X	X	X	X
Overtemp motor	X	X	X	X	X	X
External fault	-	X	X	X	X	X
Overcurrent	X	X	X	-	-	-
Field loss	X	X	X	-	-	-
Speed fbl loss	-	X	X	-	-	-
Opt 2 failure	-	-	X	X	X	X
Bus loss	X	X	X	X	X	X
Hw Opt 1 failure	-	X	X	X	X	X
Enable seq err	X	-	X	-	-	-

T6165g

Latch

ON — The alarm is stored. The programmed actions (e.g. opening the OK relay) are enabled. This status is kept latched even if the fault condition is restored. A Reset command is required before a restart.

OFF — In case of alarm, the drive is disabled and the programmed functions are enabled. The alarm is not latched. When the failure is removed, the alarm is automatically reset and the device tries restarting.

Ok relay open

ON — An alarm causes the opening of the potential isolated contact between terminals 35 and 36.

OFF — The alarm does not cause the opening of the potential free contact of the OK relay.

Hold off time

Delay time between the alarm condition detection and the alarm activation. If an alarm condition occurs the alarm stay OFF for the **Hold off time**. When this time is elapsed and the alarm is still present, the alarm activates.

Restart time

If **Latch**=Off and the alarm condition persists even after the time defined via **Restart time**, the alarm is stored and no restart is possible (**Latch**=OFF).

Note!

In Terminal mode to reset the fault the terminals enable and start must be at zero voltage. The occurrence of a failure is indicated in the display of the keypad. If "Latch"=ON is selected, a Reset command is necessary. This can be carried out, for example, by pressing the CANCEL key on the keypad. If a second error occurs before the first one was reset, the text "Multiple failures" will appear in the display. In this case, a reset is only possible via **Failure reset** parameter in the SPEC FUNCTIONS menu. The reset can be obtained by pressing the ENT key with a disabled inverter.

Failure supply Failure on the supply voltage.

It indicates a failure on the internal voltage of the regulation circuit. The message “Failure supply” occurs if an enabled converter has no voltage on the U2 and V2 terminals. If it is of a short duration and restored, a possible digital output prepared for the message is set to a Low condition. A normal reset can be carried out.

Undervoltage AC Input undervoltage

In case of an AC Input voltage when the regulation is enabled (**Enable drive =** Enabled) the message **Undervoltage** appears. The converter is immediately disabled. To this purpose an intervention threshold is preset via the **Undervolt thr** parameter.

If the alarm is not saved (Latch=OFF), the drive tries to start automatically after the voltage has been restored.

Using the ramp, when the voltage is restored, if the function Auto capture is active, the ramp output is set to the value corresponding to the current motor speed. This avoids speed jumps.

Overvoltage Armature obervoltage. Ther message appears when the armature voltage exceeds the value set via **Max out voltage** by 20%.

If the alarm is not saved (Latch = OFF), the drive will attempt to restart automatically after the voltage has been restored.

Using the ramp, when the voltage is restored, if the function Auto capture is active, the ramp output is set to the valyue corresponding tothe current motor speed. This asvoids speed jumps.

Heatsink Heatsink temperature of the converter is too high

This alarm always initiates the disconnection of the device 10 seconds after the failure has been detected (Latch=ON).

An external controller (PLC,etc.) can read the alarm via programmable output, RS485 or Bus and it can execute a controlled stop within a 10 second delay.

Overtemp motor Motor temperature (connection for thermistor:terminals 78 and 79).

External Fault External fault (no voltage on terminal 15)

Overcurrent Overcurrent (short-circuit / earth fault). The intervention point is determined by the **Overcurrent thr** parameter. This can also be used as indication of threshold overpass for system applications.

Field loss Too low field current. The intervention point corresponds to 50% of the min. field current set with the **Flux current min** parameter. This alarm message is active with the enabled converter (**Enable** drive=Enabled).

Speed fbk loss No speed feedback.

When Activity=Warning in the CONFIGURATION /Speed fbk menu is chosen, the **Enable fbk bypass** parameter has to be set as “Enabled”, otherwise the drive reaches an uncontrolled speed which can not be stopped.

Opt2 failure Failure on the card “Option 2” (optional).

Bus loss Failure in the connection on the field bus (only in connection with an option card of bus interface).

Hw opt1 failure Failure on the card “Option 1” (optional).

Enable seq err Wrong drive enabling sequence. The correct sequence is as follows:

Case a: **Main commands** = Terminal

1 - Regulation board power-up: Enable terminal (term.12) in any state.
2 - Drive initialization. Max duration time: 5 s.
3 - End of drive initialization. The Enable drive terminal (12) is L (0V).
4 - Delay time during which the Enable drive terminal must be L (0V): 1s.
5 - Drive enabling. Terminal 12 is H (+24V).

If at the end of the drive initialization (step 3) or during the 1s delay time the Enable drive terminal (term. 12) is High (+24V) a fault is detected.

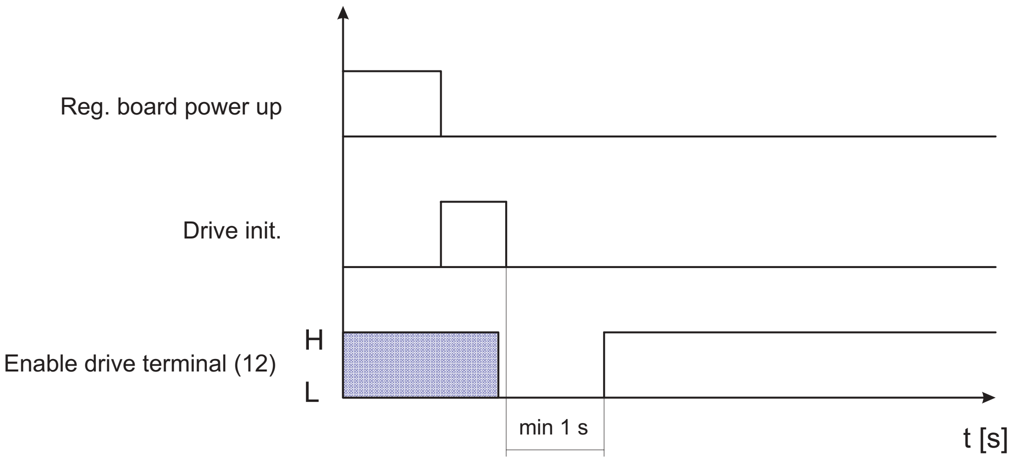


*Figure 6.11.7.1 Drive abilitation sequence: **Main command** = Terminals*

Case b: **Main command** = Digital

1 - Regulation board power-up: Enable terminal (term.12) in any state.
2 - Drive initialization. Max duration time: 5 s.
3 - End of drive initialization.
4 - Delay time during which the Enable drive terminal must be L (0V) and **Enable drive** [314] = Disable (0): 1s. During this time the Process data channels setup initialization occurs.
5 - Drive enabling. Terminal 12 is H (+24V) and **Enable drive** [314] = Enable (1).

If at the end of the drive initialization (step 3) or during the 1s delay time the Enable drive terminal (term. 12) is High (+24V) and **Enable drive** [314] = Disable (0) a fault is detected.

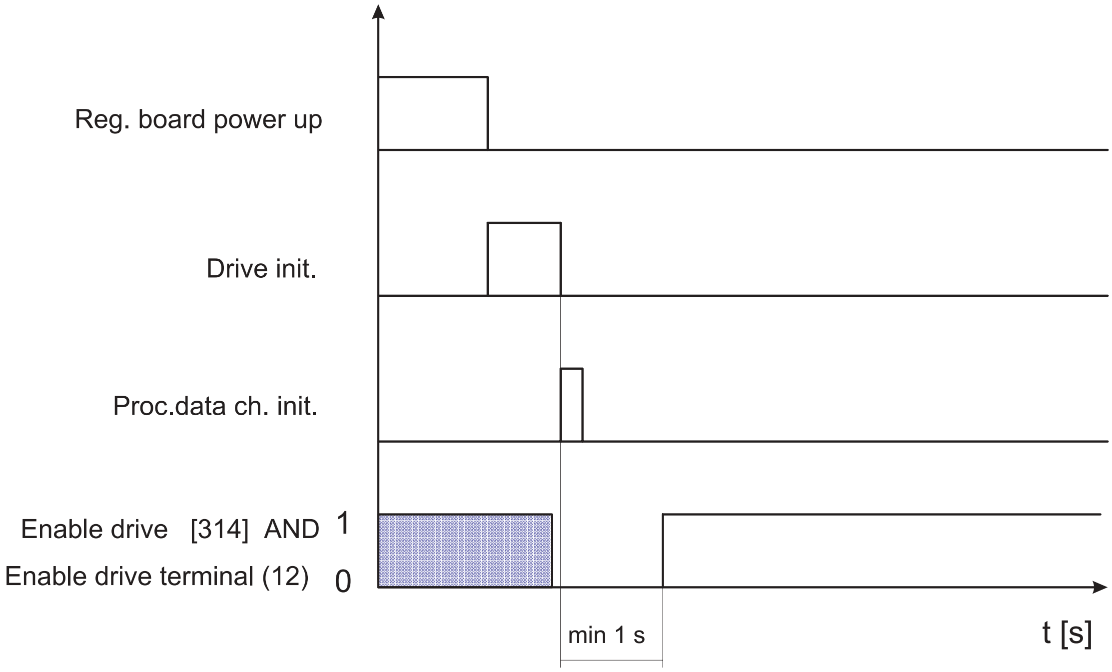


Figure 6.11.7.2: Drive abilitation sequence: ***Main command*** *= Digital*

In case of fault the reset sequence is as follows:

Case a: **Latch** = ON

1 - Set Enable drive terminal (term. 12) = L (0V)
2 - Set **Enable drive** [314] = Disable (0)
3 - If **Main commands** = Terminals set Start/Stop terminal (term. 13) = L (0V)
4 - Failure reset command. The failure is reset and the drive can work normally.

Case b: Latch = OFF

1 - Set Enable drive terminal (term. 12) = L (0V) and **Enable drive** [314] = Disable (0) for at least 30 ms. The failure is automatically reset.

NOTE! In case of Enable seq err alarm, the behaviour of the Ok Relay function can be affected only if **OK relay funct** = Drive Healty. If **OK relay funct** = Ready to start, the contact will be open anyway.

6.11.8. Set serial comm

CONFIGURATION

Set serial comm

Device address
Ser answer delay
Ser protocol sel
Ser baudrate sel

T 0670i

The configuration modes relating to the serial communication are defined in the submenu **Set serial comm.**

Parameter Description	N.	Value			Standard Configuration
		min	max	factory	
Device Address	319	0	255	0	-
Ser answer delay	408	0	900	0	-
Ser protocol sel 0 = SLINK3 * 1 = MODBUS RTU 2 = JBUS	323	0	2	0	-
Ser baudrate sel 0 = 19200 1 = 9600 2 = 4800 3 = 2400 4 = 1200	326	0	4	1	-

T 6170g

* For SLINK3 the baud rate is steady at 9600

NOTE! The settings of Ser protocol sel, and Ser baudrate sel, become active during the Drive start up; they must therefore be stored and the drive has to be switched off. See the specific manual for the numbering system of the registers and of coils Di MODBUS RTV and JBUS.

Device address Address with the drive can be accessed if it is networked via the RS485 interface.

Ser answer delay Setting of the minimum delay between the receiving of the last byte from the converter and the beginning of its answer.

This delay avoids conflicts on the serial line, in case the interface RS485 of the master is not arranged for an automatical commutation Tx/Rx .

The parameter only concerns the working with standard serial line RS485.

Example : if the delay of the commutation Tx/Rx on the master is at its max. 20ms, the setting of the parameter **Ser answer delay** should be at a higher number of 20ms: 22ms

Ser protocol sel Serial protocol signaling procedure.

Ser baudrate sel Baud rate selection (except for SLINK3).

6.11.9. Password

T0680i

Passwords are used by the operator to protect the parameters from unauthorized access.

Parameter Description	N.	Value			Standard Configuration
		min	max	factory	
Pword 1	85	0	99999	0	-

T6173g

Pword 1 Protects the parameters entered by the user from unauthorized changes. It allows the reset of failure messages **(Failure reset)** and to change on the keypad the **Control mode** even when the bus functioning system has been chosen (**Control mode=** Bus). The password can be freely defined by the user in the form of a 5-digit combination.

Proceed as follows to activate **Pword 1**:

- Select **Pword 1** in the CONFIGURATION menu
- This indicates whether the Password is active (Enabled) or not (Disabled)
- If not, press ENTER and enter the password (see Commissioning).
- Press ENTER once more. The keypad indicates that the Password is active (Enabled).
- The password must be saved so that it is valid when the power supply is switched off and then later switched back on. —> Saving parameters

Proceed as follows to unlock the **Pword 1**:

- Select **Pword** in the CONFIGURATION menu
- The display indicates whether the password is active (Enabled) or not (Disabled)
- If yes, press ENTER and enter the password (see start-up)
- Press ENTER again. The display now indicates that the password is not active (Disabled)
- This configuration must be saved in order to keep the password switched off even after the power supply is turned off and switched back on again. -> Saving parameters

The message **Wrong password** appears if an incorrect password is entered.

If the drive shows the message **EEPROM** the password is deactivated. This takes place the first time the drive is switched on and after a possible change of the operating system.

On delivery the Service menu of the drive is protected by **Password 2**. No **Pword 1** has been entered. The user has free access to all parameters.

Password 2 cannot be deactivated.

NOTE! In case personal password has been forgotten, it is possible to deactivate it through the setting of the universal password.

The code of this password is: 51034

The setting mode of this one remains unchanged compared to the personal password.

6.12. I/O CONFIG

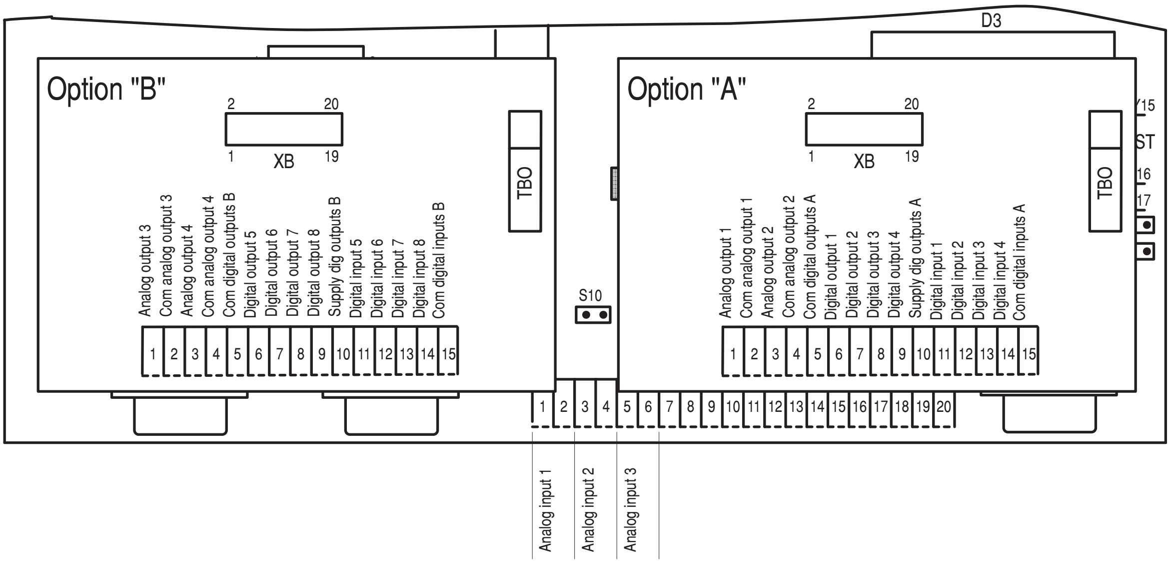


Figure 6.12.1: Arrangement of the programmable I/O

Apart from the terminals which have fixed functions (e.g. for Enables), the converters of the TPD32 series provide the possibility of assigning freely programmable inputs/outputs to particular functions. This can either be carried out via the keypad, the serial interface or any bus connection present.

The freely programmable inputs/outputs are factory set for assignment to the most frequently required functions. However, these can be modified by the user accordingly to meet the requirements of the applicationn at hand.

The basic device is provided with three analog inputs, that are designed as differential inputs. If digital inputs/outputs and/or analog outputs are required, the TBO option card is required. This is fitted on the regulator card of the converter. Up to two cards of this type can be fitted to the device (Option “A” and Option “B”, see Figure above)

The following inputs / outputs are provided when both cards are fitted:

Basic device:	3	Analog inputs (1...3), designed as differential inputs
Option “A”:	2	Analog outputs (1 and 2) with common reference point
`	4	Digital outputs (1...4) with common reference point and common voltage supply
	4	Digital inputs (1...4) with common reference point.
Option “B”:	2	Analog outputs (3 and 4) with common reference point
	4	Digital outputs (5 ...8) with common reference point and common voltage supply
	4	Digital inputs (5...8) with common reference point.

NOTE! If parameters are assigned to particular terminals, the parameter value (e.g. speed reference value) can only be entered via this terminal and not via the keypad or bus.

6.12.1. Analog Outputs

- **I/O CONFIG**
  - **Analog outputs**
    - **Analog output 1**
      - Select output 1
      - Scale output 1
    - **Analog output 2**
      - Select output 2
      - Scale output 2
    - **Analog output 3**
      - Select output 3
      - Scale output 3
    - **Analog output 4**
      - Select output 4
      - Scale output 4

T0690g

Parameter description	No.	Value			Standard Configuration
		min	max	factory	
Select output 1	66	0	93	Motor speed	*
Scale output 1	62	-10.000	+10.000	0.000	
Select output 2	67	0	93	Motor current	*
Scale output 2	63	-10.000	+10.000	0.000	
Select output 3	68	0	93	Flux	**
Scale output 3	64	-10.000	+10.000	0.000	
Select output 4	69	0	93	Output voltage	**
Scale output 4	65	-10.000	+10.000	0.000	

T 6175g

* TBO option card required on socket "A"
** TBO option card required on socket "B"

Select output XX Selection of the parameter assigned as a variable to the corresponding analog output. The following assignments are possible:

OFF [0]
Speed ref 1 1) [1]
Speed ref 2 1) [2]
Ramp ref 1 1) [3]
Ramp ref 2 1) [4]
Ramp ref 1) [5]
Speed ref 1) [6]
Ramp out 1) [7]
Actual speed 1) [8]
T current ref 1 2) [9]
T current ref 2 2) [10]
T current ref 2) [11]
Speed reg out 2) [15]
Motor current 2) [16]
Output voltage 3) [20]
Analog input 1 4) [24]
Analog input 2 4) [25]
Analog input 3 4) [26]
Flux current 5) [27]
Pad 0 6) [31]
Pad 1 6) [32]
Pad 4 6) [33]
Pad 5 6) [34]
Flux reference 7) [35]
Pad 6 6) [38]
PID output 8) [39]
Out vlt level 3) [79]
Flux current max 5) [80]
F act spd 1) [81]
F T curr 2) [82]
Speed draw out 9) [84]
Output power 10) [88]
Roll diameter [89]
Act tension ref [90]
Torque current [91]
W reference [92]
Actual comp[93]

Scale output XX Scaling of the analog output concerned

1) With a scaling factor of 1 the output supplies 10V, when the reference value or speed corresponds to the value defined by **Speed base value**.

2) With a scaling factor of 1 the output supplies 10V, when the reference or the current is 100% or 200% with overload.

3) With a scaling factor of 1 the output supplies 10V, when the voltage corresponds to the Volt value defined via **Max out voltage**.

4) With a scaling factor of 1 the output supplies 10V, when the voltage reaches 10V on the analog input (with scaling factor and **Tune value** of the input= 1). See figure 6.12.2.1.

5) With a scaling factor of 1 the output supplies 10V, when the field current corresponds to **Nom flux curr**.

6) With a scaling factor of 1 the output supplies 10V, when a Pad value corresponds to 2047.

7) With a scaling factor of 1 the output supplies 10V, when the field current reference corresponds to **Nom flux curr**.

8) For the max. full-scale values, refer to paragraph 6.16.3 **PID function**

9) With a scaling factor of 1 the output supplies 10V, when the **Speed ratio** value is equal to 20000.

10) With a scale factor equal to 1, the output supplies 5 volts to the rated power given by: **Full load current * Max out voltage.**

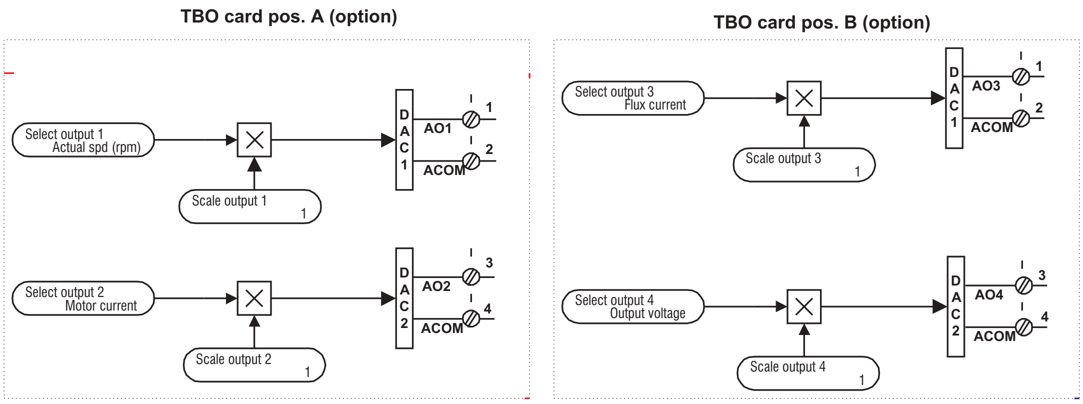


Figure 6.12.1.1: Option card, block diagram of the analog outputs

Example for calculating the scaling factor **Scale output xx**

You have at your disposal an analog display device for indicating the speed of the drive. The instrument has a measuring range of 0 ... 2 V.

This means that at maximum speed 2 V is required at the analog output of the converter. A scaling factor of 1 would supply 10 V. (Scaling factor = 2 V / 10 V = 0.200).

NOTE! Using Regen drive (4 quadrant) the analog output suppllies bipolar 10V.

6.12.2. Analog Inputs

- **I/O CONFIG**
  - **Analog inputs**
    - **Analog input 1**
      - Select input 1
      - An in 1 target
      - Input 1 type
      - Input 1 sign
      - Scale input 1
      - Tune value inp1
      - Auto tune inp 1
      - Input 1 filter
      - Input 1 compare
      - Input 1 cp error
      - Input 1 cp delay
      - Offset input 1
    - **Analog input 2**
      - Select input 2
      - An in 2 target
      - Input 2 type
      - Input 2 sign
      - Scale input 2
      - Tune value inp 2
      - Auto tune inp 2
      - Offset input 2
    - **Analog input 3**
      - Select input 3
      - An in 3 target
      - Input 3 type
      - Input 3 sign
      - Scale input 3
      - Tune value inp 3
      - Auto tune inp 3
      - Offset input 3

T0700i

Parameter description	No.	Value min	Value max	Value di fabbrica	Standard configuration
Select input 1	70	0	31	Ramp ref 1	Terminals 1/2
An in 1 target	295	0	1	0	
Input 1 type (-10V...+10V/0-20mA) 0-10V/4-20 mA	71	0	2	-10V...+10V	
Input 1 sign	389	0	1	Positive	
Input 1 sign +	-			-	*
Input 1 sign -	-			-	*
Scale Input 1	72	-10.000	+10.000	1.000	
Tune value inp 1	73	0.100	10.000	1.000	
Auto tune inp 1	259				
Input 1 filter	792	0	1000	0	
Input 1 compare	1042	-10000	+10000	0	
Input 1 cp error	1043	0	10000	0	
Input 1 cp delay	1044	0	65000	0	
Input 1 cp match	1045	0	1	-	**
Offset input 1	74	-32768	+32767	0	
Select input 2	75	0	31	OFF	Terminals 3/4
An in 2 target	296	0	1	0	
Input 2 type (-10V...+10V/0-20 mA, 0-10V/4-20 mA)	76	0	2	-10V...+10V	
Input 2 sign	390	0	1	Positive	
Input 2 sign +	-			-	*
Input 2 sign -	-			-	*
Scale input 2	77	-10.000	+10.000	1.000	
Tune value inp 2	78	0.100	10.000	1.000	
Auto tune inp 2	260				
Offset input 2	79	-32768	+32767	0	
Select input 3	80	0	31	OFF	Terminals 5/6
An in 3 target	297	0	1	0	
Input 3 type (-10V...+10V/0-20 mA, 0-10V/4-20 mA)	81	0	2	-10V...+10V	
Input 3 sign	391	0	1	Positive	
Input 3 sign +	-			-	*
Input 3 sign -	-			-	*
Scale input 3	82	-10.000	+10.000	1.000	
Tune value inp 3	83	0.100	10.000	1.000	
Auto tune inp 3	261				
Offset input 3	84	-32768	+32767	0	

T6180g

* This parameter can be assigned to one of the programmable digital inputs

** This parameter can be assigned to one of the programmable digital outputs

Select input XX Selection of the parameter to be assigned its value via an analog input. The following assignments are possible:

OFF [0]	T current limit 2) [9	PI central V3 4) [22]
Jog reference 1) [1]	T current lim + 2) [10]	PID feed-back 4) [23]
Speed ref 1 1) [2]	T current lim - 2) [11]	Flux current max [25]
Speed ref 2 1) [3]	Pad 0 3) [12]	Out vlt level [26]
Ramp ref 1 1) [4]	Pad 1 3) [13]	Speed ratio 5) [28]
Ramp ref 2 1) [5]	Pad 2 3) [14]	Tension red [29]
T current ref 1 2) [6]	Pad 3 3) [15]	Tension ref [30]
T current ref 2 2) [7]	Load comp [19]	Preset 3 [31]
Adap reference 1) [8]	PID offset 0 4) [21]	

An in xx target Enables the analog input xx sampling.

Input XX type Selection of input type (voltage or current input)

Jumpers on the regulator card of the TPD32 should be fitted or removed according to the input signal used. The inputs of the device are factory set for voltage signals.

ON Jumper fitted OFF Jumper not fitted

Analog Input	Input Signal: -10 V ... + 10 V / 0 - 10 V	Input Signal: 0 - 20 mA / 4 - 20 mA
Analog input 1	S9 = OFF	S9 = ON
Analog input 2	S10 = OFF	S10 = ON
Analog input 3	S11 = OFF	S11 = ON

T6185g

10 V...+10 V Avoltage of max ±10 V is connected to the analog input concerned. If the signal is used as a reference value, a polarity reversal can be used to reverse the rotation direction of the drive (only with TPD32...4B converters). The TPD32...2B converters accept as speed reference only positive references. Negative references are not accepted and the drive does not start.

0-10V, 0-20mA A voltage of max. 10 V or a current signal of 0...20 mA is connected to the analog input concerned.The signal must be positive. If the signal is used as a reference value for TPD32...4B converters, the rotation direction can be reversed via the **Input XX sign +** and **Input XX sign -** parameters.

4-20 mA A current signal of 4...20 mA is connected to the analog input concerned. The signal must be positive. If the signal is used as a reference value for TPD32...4B converters, the drive rotation direction can be reversed via the **Input XX sign +** and **Input XX sign -** parameters.

Input XX sign Selection of rotation direction when operated via the serial interface or bus for the tetraquadrant TPD32...4B converters.

Input XX sign + Selection of "Clockwise" rotation when operated via the terminal strip for the TPD32...4B converters, when the reference value is only given with one polarity.

High Clockwise selected

Low Clockwise not selected

Input XX sign -	Selection of "Counter-clockwise" rotation when operated via the terminal strip for the TPD32...4B converters, when the reference value is only given with one polarity. High Counterclockwise selected Low Counterclockwise not selected If both **Input XX sign+** and I**nput XX sign-** are 0 or 1 the reference value is zero.
Scale input XX	Scaling of the corresponding analog input 1) With a scaling factor of 1 and a **Tune value inp XX** = 1, 10 V or 20 mA on the input correspond to the **Speed base value**. 2) With a scaling factor of 1 and a **Tune value inp XX** = 1, 10 V or 20 mA on the input correspond to max possible current. 3) With a scaling factor of 1, 10V or 20 mA in the input correspond to the Pad value of 4095. 4) For the max. full scale values, refer to paragraph 6.16.3 **PID function** 5) With a graded value of 1.0 and **Tune value inp** XX=1, 10V or 20mA correspond to **Speed ratio** = 20000.
Tune value inp XX	Fine tuning of the input when the max. signal does not exactly correspond to the rated value. Example see below.
Auto tune inp XX	Automatic fine tuning of the input. If this command is given, **Tune value inp XX** is automatically selected so that the input signal present corresponds to the max. variable value, such as the **Speed base value**. Two conditions are necessary for automatic fine tuning: - Input voltage greater than 1 V or input current greater than 2 mA - Positive polarity. The value found is automatically set for the other direction for the TPD32...4B converters. Note: The automatically calculated value can, if necessary, be modified manually via **Tune value inp XX**.
Input 1 filter	Analog input 1 measure filtering.
Offset inp XX	If the analog signal has an offset or if the variable assigned to the input already has a value although there is no input signal present, this can be compensated via the **Offset inp XX**.

The converter is factory set so that analog values as +10V/-10V. With field bus operation (Option), the **Input XX sign** parameter specifies the sign for the rotation direction. If a parameter is already internally assigned (e.g. if **Speed ref 1** is automatically connected with the ramp output when the ramp is enabled), it will no longer appear in the list of parameters that can be assigned to an analog input.

The **Input XX sign +** and **Input sign -** parameters cannot be addressed via the serial interface

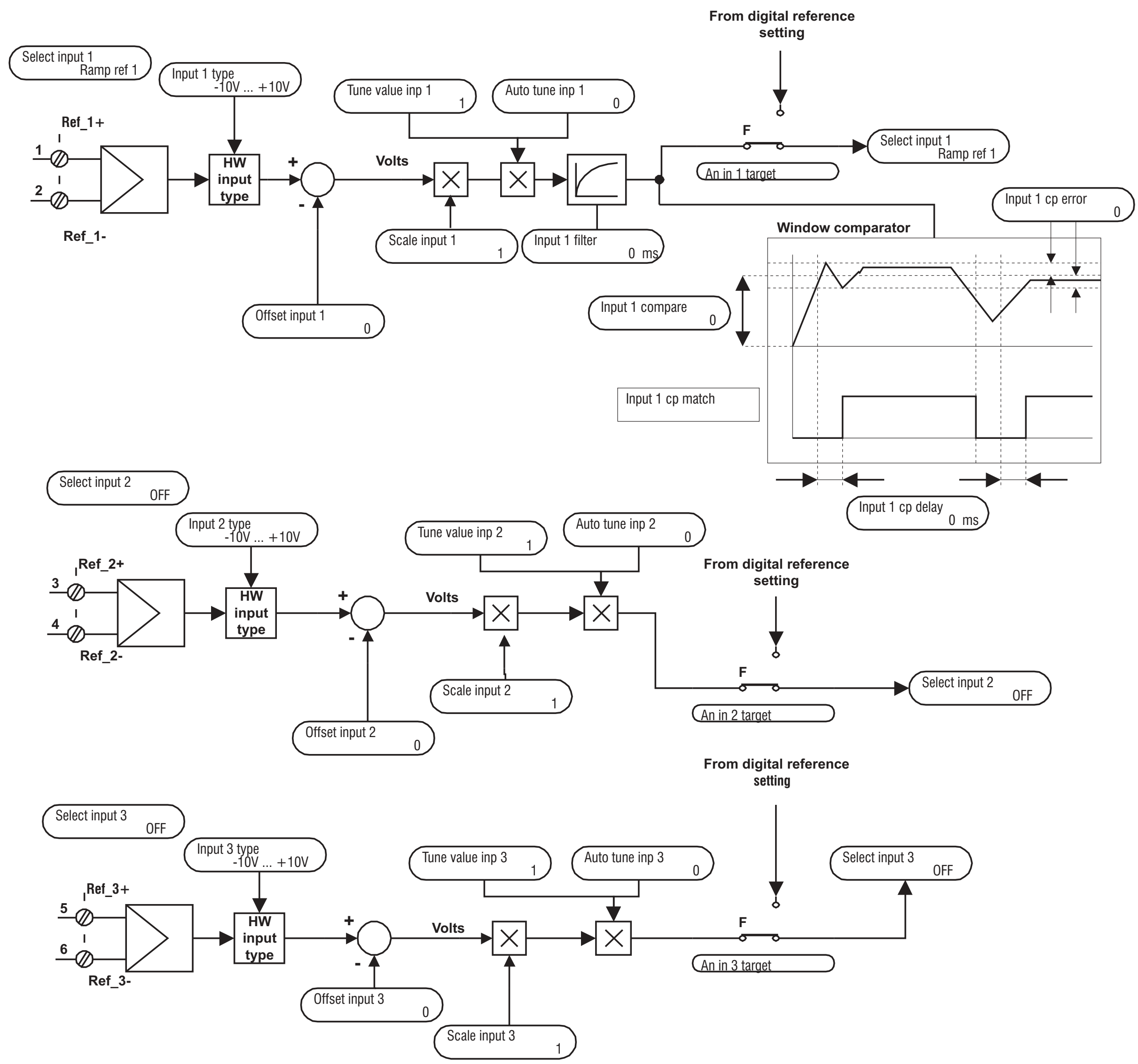


Figure 6.12.2.1: Analog input

Example 1:

The speed reference value of a drive is defined with an external voltage of 5V. With this value the drive should reach the max. allowed speed (set via **Sped base value**).

As parameter **Scale input XX** the scaling factor 2 is entered (10V : 5V)

Example 2:

An external analog reference reaches only max. 9.8V instead of 10V.

As parameter **Tune value inp XX** 1.020 is entered (10V : 9.8V).

The same result would have been obtained via the **Auto tune inp XX** function. The appropriate parameters would have to be entered in the menu of the keypad. The maximum possible analog value (in this case 9.8 V) would have to be present at the terminal with a positive polarity. The keypad will adjust the “Tune value” automatically if the ENTER key is pressed.

Window comparator on the analog input 1 “Analog Input 1”.

This function states the reaching of a programmed reference value on the analog input 1.

Input 1 compare It selects the value to be set as a comparison level.

Input 1 cp error It defines a tolerance area around **Input 1 compare**.

Input 1 cp delay Millisecond delay during the switching from the high to the low level **Input 1 cp match**

Input 1 cp match It states that the tolerance area has been reached. This parameter can be read via the field BUS or a suitable programmed digital output.

High Level The value of **Analog input 1** is inside the tolerance range.

Low Level The value of **Analog input 1** is outside the tolerance range.

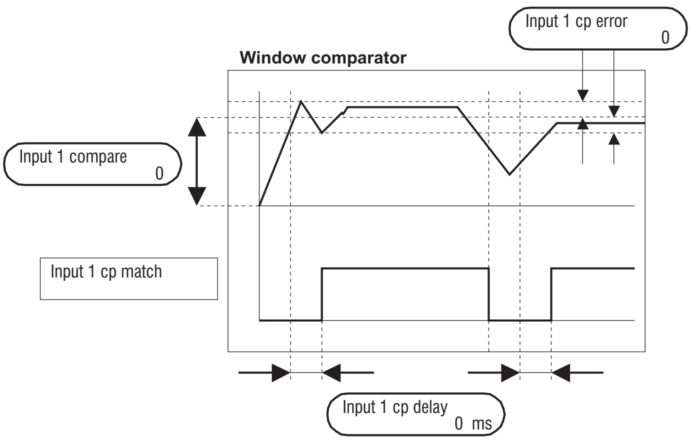


Figure 6.12.2.2: Window comparator

NOTE! How to calculate the value of the parameters **Input 1 compare and Input 1 cp error**:

Input 1 compare = (Comparison value) * 10000 / (Field total value)

Input 1 error = (Tolerance value by midwindow) 10000 / (Field total value)

Example 1:

Select the analog input 1 = **Ramp ref 1**

Speed base value equal to 1500 [rpm]

10 Volt or 20 mA on **Analog Input 1** (**Ramp ref 1= Speed base value**).

The application requires an indication at 700 [rpm] through a digital output, with a tolerance range of 100 [rpm]

Input 1 cp match assigned to a programmable digital output.

Input 1 compare = 700 * 10000 / 1500 = 4667

Input 1 cp error = 100 * 10000 / 1500 = 666

Example 2:

Select the analog input 1 = **Ramp ref 1**

Speed base value equal to 1500 [rpm]

10 Volt or 20 mA on **Analog input 1 (Ramp ref 1= Speed base value).**

The application requires an indication at -700 [rpm] through the field BUS, with tolerance range of ±100 [rpm]

Input 1 compare = -700 * 10000 / 1500 = -4667

Input 1 cp error = 100 * 10000 / 1500 = 666

Example 3:

Select the analog input 1 = **Pad 0**

10 Volt or 20 mA on **Analog input 1** corresponds to **Pad 0= 2047.**

The application requires an indication at 700 [count] through a digital output with a tolerance range of ±50 [count]

Input 1 cp match assigned to a programmable digital output.

Input 1 compare = 700 * 10000 / 2047 = 3420

Input 1 cp error = 50 * 10000 / 2047 = 244

Example 4:

Select the analog input 1 = **PID feedback**

10 Volt or 20 mA on **Analog input 1** corresponds to **PID feedback= 10000.**

The application requires an indication at 4000 [count] through a digital output with a tolerance range of ±1000 [count]

Input 1 set thr assigned to a programmable digital output.

Input 1 thr = 4000 * 10000 / 10000 = 4000

Input 1 cp error = 1000 * 10000 / 10000 = 1000

Example 5:

Select the analog input 1 = **T current lim**

10 Volt or 20 mA on **Analog input 1** corresponds to **T current lim = 100 [%]**

The application requires an indication at a value of 50 [%] through a digital output with a tolerance range of ±2 [%]

Input 1 cp match assigned to a programmable digital output.

Input 1 compare = 50 * 10000 / 100 = 5000

Input 1 cp error = 2 * 10000 / 100 = 200

6.12.3. Digital Outputs

I/O CONFIG	Digital outputs	
		Digital output 1
		Inversion out 1
		Digital output 2
		Inversion out 2
		Digital output 3
		Inversion out 3
		Digital output 4
		Inversion out 4
		Digital output 5
		Inversion out 5
		Digital output 6
		Inversion out 6
		Digital output 7
		Inversion out 7
		Digital output 8
		Inversion out 8
		Relay 2
		Inversion relay2

T 0710i

Parameter description	No.	Value			Standard Configuration
		min	max	factory	
Digital output 1	145	0	49	Ramp +	
Inversion out 1 (Enabled/Disabled)	1267	0	1	Disable	
Digital output 2	146	0	49	Ramp -	
Inversion out 2 (Enabled/Disabled)	1268	0	1	Disable	
Digital output 3	147	0	49	Spd threshold	
Inversion out 3 (Enabled/Disabled)	1269	0	1	Disable	
Digital output 4	148	0	49	Overld available	
Inversion out 4 (Enabled/Disabled)	1270	0	1	Disable	
Digital output 5	149	0	49	Curr limit state	
Inversion out 5 (Enabled/Disabled)	1271	0	1	Disable	
Digital output 6	150	0	49	Overvoltage	
Inversion out 6 (Enabled/Disabled)	1272	0	1	Disable	
Digital output 7	151	0	49	Undervoltage	
Inversion out 7 (Enabled/Disabled)	1273	0	1	Disable	
Digital output 8	152	0	49	Overcurrent	
Inversion out 8 (Enabled/Disabled)	1274	0	1	Disable	
Relay 2	629	0	49	Stop control	
Inversion relay2 (Enabled/Disabled)	1275	0	1	Disable	

T 6190g

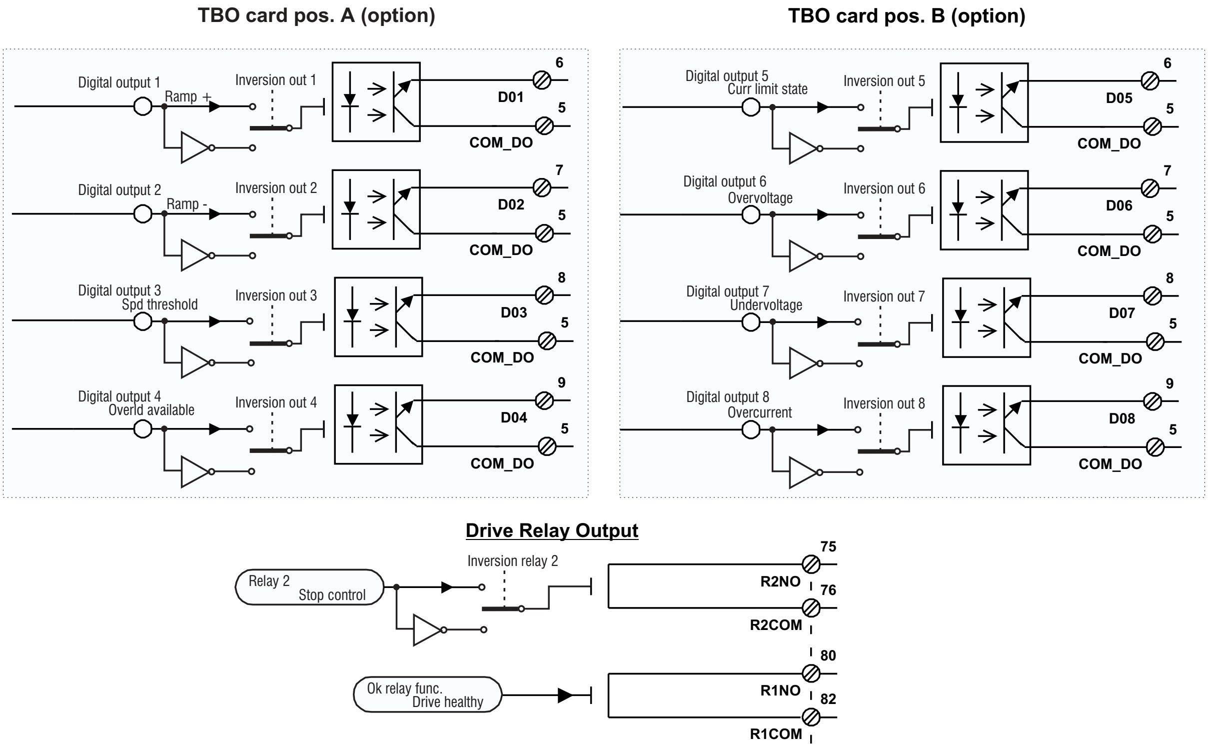


Figure 6.12.3.1: Digital outputs

Digital output XX Selection of the parameter that is assigned to the digital output concerned. The following assignments are possible:

OFF [0]	Undervoltage [11]	Stop control [23]	Diam reached [58]
Speed zero thr [1]	Overvoltage [12]	Field loss [24]	Spd match compl [59]
Spd threshold [2]	Heatsink [13]	Speed fbk loss [25]	Acc state [60]
Set speed [3]	Overcurrent [14]	Bus loss [26]	Dec state [61]
Curr limit state [4]	Overtemp motor [15]	Hw opt1 failure [28]	Brake command [62]
Drive ready [5]	External fault [16]	Opt2 failure [29]	
Overld available [6]	Failure supply [17]	Encoder 1 state [30]	
Overload state [7]	Pad A bit [18]	Encoder 2 state [31]	
Ramp + [8]	Pad B bit [19]	Enable seq err [35]	
Ramp - [9]	Virt dig input [20]	Diameter calc st *) [38]	
Speed limited [10]	Torque sign [21]	Input 1 cp match [49]	

*) Refer to paragraph 6.16.3 **PID function**

Inversion out XX Reverse the digital outputs signal.

Relay 2 Selection of the parameters, for which the relay between the terminals 75 and 76 has to represent.

NOTE! As for an alarm signal the following are valid:
Output = Low and open relay contact:Alarm
Output = High and closed relay contact:No alarm
See the chapters concerning the output behavior with other messages.

6.12.4. Digital Inputs

I/O CONFIG

- **Digital inputs**
  - Digital input 1
  - Inversion in 1
  - Digital input 2
  - Inversion in 2
  - Digital input 3
  - Inversion in 3
  - Digital input 4
  - Inversion in 4
  - Digital input 5
  - Inversion in 5
  - Digital input 6
  - Inversion in 6
  - Digital input 7
  - Inversion in 7
  - Digital input 8
  - Inversion in 8

T 0720i

Parameter description	No.	Value			Standard Configuration
		min	max	factory	
Digital input 1	137	0	58	OFF	
Inversion in 1 Enabled/Disabled	1276	0	1	Disable	
Digital input 2	138	0	58	OFF	
Inversion in 2 Enabled/Disabled	1277	0	1	Disable	
Digital input 3	139	0	58	OFF	
Inversion in 3 Enabled/Disabled	1278	0	1	Disable	
Digital input 4	140	0	58	OFF	
Inversion in 4 Enabled/Disabled	1279	0	1	0	
Digital input 5	141	0	58	OFF	
Inversion in 5 Enabled/Disabled	1280	0	1	Disable	
Digital input 6	142	0	58	OFF	
inversion in 6 Enabled/Disabled	1281	0	1	Disable	
Digital input 7	143	0	58	OFF	
Inversion in 7 Enabled/Disabled	1282	0	1	Disable	
Digital input 8	144	0	58	OFF	
Inversion in 8 Enabled/Disabled	1283	0	1	Disable	

T 6195i

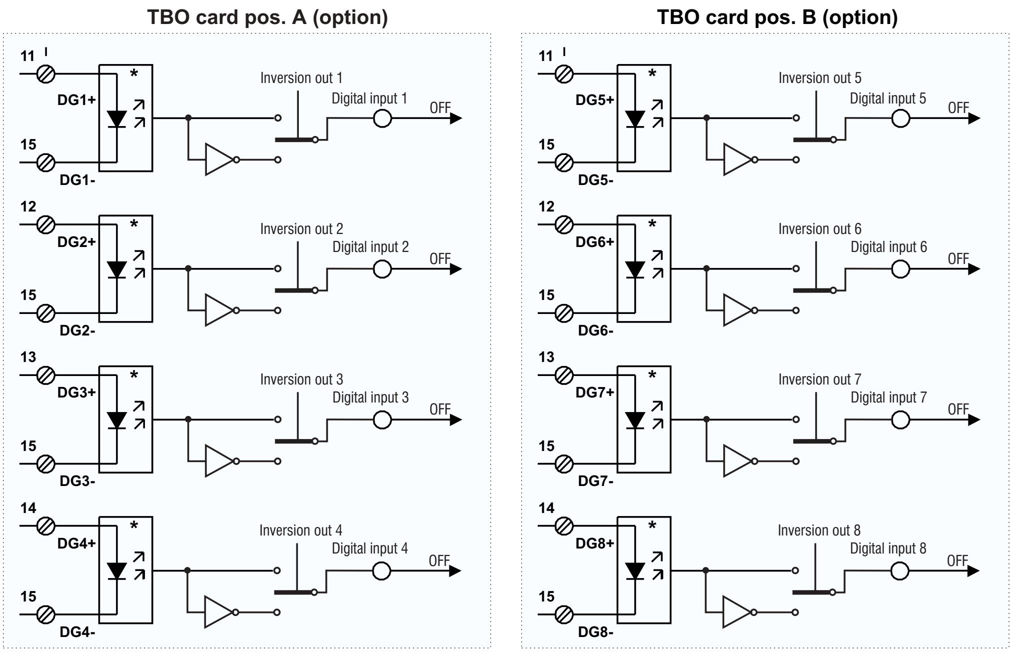


Figure 6.12.4.1: Digital inputs

Digital input XX Selection of the parameter that is addressed by the digital input concerned. The following assignments are possible:

OFF [0]
Motor pot reset [1]
Motor pot up [2]
Motor pot down [3]
Motor pot sign + [4]
Motor pot sign - [5]
Jog + [6]
Jog - [7]
Failure reset [8]
Torque reduct [9]
Ramp out = 0 [10]
Ramp in = 0 [11]
Freeze ramp [12]
Lock speed reg [13]
Lock speed I [14]
Auto capture [15]
Input 1 sign + 1) [16]
Input 1 sign - 1) [17]
Input 2 sign + 1) [18]
Input 2 sign - 1) [19]
Input 3 sign + 1) [20]
Input 3 sign - 1) [21]
Zero torque [22]
Speed sel 0 2) [23]
Speed sel 1 2) [24]
Speed sel 2 2) [25]
Ramp sel 0 3) [26]
Ramp sel 1 3) [27]
Field loss [29]
Enable flux reg [30]
Enable flux weak [31]
Pad A bit 0 [32]
Pad A bit 1 [33]
Pad A bit 2 [34]
Pad A bit 3 [35]
Pad A bit 4 [36]
Pad A bit 5 [37]
Pad A bit 6 [38]
Pad A bit 7 [39]
Forward sign [44]
Reverse sign [45]
An in 1 target [46]
An in 2 target [47]
An in 3 target [48]
Enable droop [49]
Enable PI PID 4) [52]
Enable PD PID 4) [53]
PI integr freeze 4) [54]
PID offs. sel 4) [55]
PI central vs0 4) [56]
PI central vs1 4) [57]
Diameter calc 4) [58]
Diam reset [68]
Diam calc Dis [69]
Torque winder En [70]
Line acc status [71]
Line dec status [72]
Line fstp status [73]
Speed match [74]
Diam inc/dec En [75]
Wind/unwind [76]
Diam preset sel0 [77]
Diam preset se 1 [78]
Taper enable [79]
Speed demand En [80]
Winder side [81]
Enable PI-PD PID [82]
Jog TW enable [83]

1) The **Input xx sign +** and **Input XX sign -** can only be used in conjunction with the other parameter.

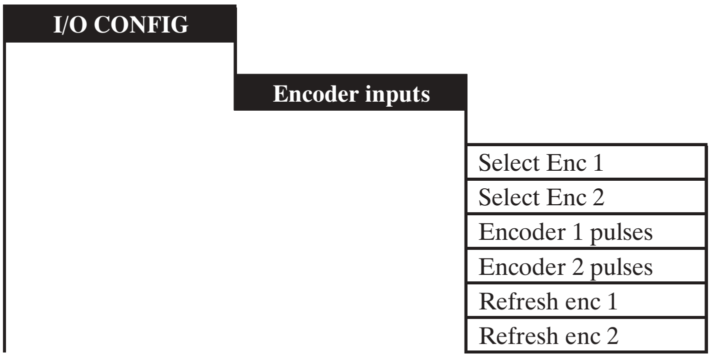
2) The **Speed sel 0**, **Speed sel 1** and **Speed sel 2** parameters can only be used together (see 6.14.3).

3) The **Ramp sel 0** and **Ramp sel 1** parameters can only be used together (see 6.14.4).

4) Refer to paragraph 6.16.3 **PID function**

Inversion in XX Reverse the digital inputs signal.

6.12.5. Speed reference from encoder (Function Tach follower)



T0726i

Parameter description	No.	Value			Standard configuration
		min	max	factory	
Select enc 1 OFF Speed ref 1 Speed ref 2 Ramp ref 1 Ramp ref 2	1020	0	5	OFF	
Select enc 2	1021	0	5	OFF	
Encoder 1 pulses	416	600	9999	1024	
Encoder 2 pulses	169	150	9999	1024	
Refresh enc 1 Enabled Disabled	649	0	1	Disable (0)	
Refresh enc 2 Enabled Disabled	652	0	1	Disable (0)	

T 6126g

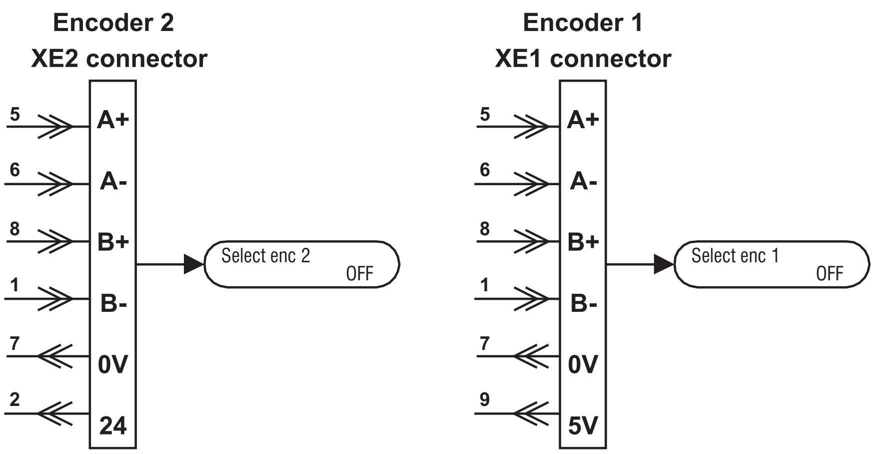


Figure 6.12.5.1: Encoder reference

This configuration allows to use the encoder inputs as a speed reference. Compared to an analog input, these inputs have a high resolution and a high noise immunity.

By using encoder inputs (connectors XE1 or XE2), it is necessary to define the destination of the speed reference, which the input has to be combined with (**Ramp ref 1, Speed ref 1,** etc.)

When the encoder input is used as an input for a speed feedback, it is not possible to use the same input as a speed reference input. The same speed reference selection can not be configured both for the encoder input and for an analog input.

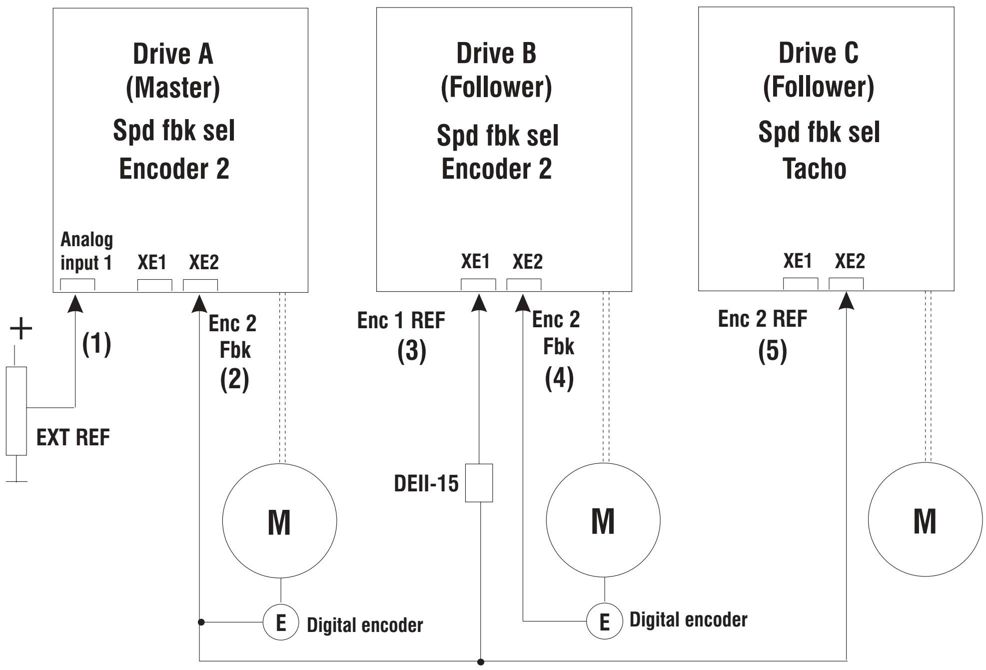
When the encoder input is not configured for the reaction, it can not always be used as a speed reference.

The perfect working configurations are listed in the following table:

Speed fbk sel [414]	Encoder 1 as reference	Encoder 2 as reference
Encoder 1	Not available	Not available
Encoder 2	Available	Not available
Tacho	Not available	Available
Armature	Available	Available

T0727g

WARNING! The converter accepts all kind of configurations. The user must follow the configurations listed in the table.



(1) Analog inputs/ Select input 1 = Ramp ref 1

(2) Speed fbk sel = Encoder 2

(3) Select enc 1 = Ramp ref 1

(4) Speed fbk sel = Encoder 2

(5) Select enc 2 = Ramp ref 1

Figure 6.13.5.1: Example for the application of the speed reference from an encoder input

Select enc 1 (2) These parameters define which speed reference the encoder signal makes reference to. The OFF condition states that the encoder connector is not used as a speed reference and that it can be used as a speed reaction (CONFIGURATION/ Speed fbk sel menu).

The choice of the speed reference destination has to be made in accordance with the configuration of the speed regulator (for example **Speed ref 1** can not be used with an active ramp).

Encoder 1 (2) pulses Number of pulses of the encoder connected to the connector XE1 (XE2)

Refresh enc 1 (2) It enables the control of the connection status of the encoder 1 (2) in order to detect the alarm referring to a speed feedback loss. Figure 6.13.5.1 describes a typical use of this function.

The speed reference of the *Drive A* is given in this case by an external analog signal, but it can be set via an internal digital source (for example the DGFC option card or the field bus).

A configuration using the encoder signal as a reference for the line speed is possible only when the reference source is an additional encoder independent from the motor axis.

6.13. ADDITIONAL SPEED FUNCTIONS

6.13.1. Auto capture

ADD SPEED FUNCT

Auto capture

T0730g

The auto capture function enables the converter to engage a running motor.

Parameter Description	No.	Value			Standard configuration
		min	max	factory	
Auto capture (ON/OFF)	388	-	-	OFF	*

T6200g

* This function can be assigned to one of the programmable digital inputs.

Auto capture

ON When the converter is switched on, the speed of the motor is measured and the ramp output is set accordingly. The drive then runs to the set reference value.

OFF When the converter is switched on, the ramp starts from zero.

Main uses:

- Connection to a motor that is already running due to its load (e.g. in the case of pumps, the flowing medium).
- Reconnection after a fault alarm.

If the speed reference value is defined via the ramp, with **Auto capture** = ON, starting at a reference value corresponding to the motor speed.

NOTE! If the Auto capture function is switched off, ensure that the motor is not turning when the converter is switched on. If this is not the case, this may cause a harsh motor deceleration in current limit.

6.13.2. Adaptive spd reg

- **ADD SPEED FUNCT**
  - **Adaptive speed reg**
    - Enable spd adap
    - Sel adap type
    - Adap reference
    - Adap speed 1
    - Adap speed 2
    - Adap joint 1
    - Adap joint 2
    - Adap P gain 1
    - Adap I gain 1
    - Adap P gain 2
    - Adap I gain 2
    - Adap P gain 3
    - Adap I gain 3

T0740g

The adaptive speed regulator function enables different gains of the speed regulator depending on the speed or another variable (Adaptive Reference). This allows optimum adaptation of the speed regulator to the application at hand.

Parameter Description	N.	Value min	Value max	Value factory	Standard Configuration
Enable spd adap (Enabled/Disabled)	181	-	-	Disabled	-
Select adap type (Speed / Adap reference)	182	-	-	Speed	-
Adap reference [FF]	183	-32768	+32767	1000	*
Adap speed 1 [%]	184	0.0	200.0	20.3	-
Adap speed 2 [%]	185	0.0	200.0	40.7	-
Adap joint 1 [%]	186	0.0	200.0	6.1	-
Adap joint 2 [%]	187	0.0	200.0	6.1	-
Adap P gain 1 [%]	188	0.00	100.00	10.00	-
Adap I gain 1 [%]	189	0.00	100.00	1.00	-
Adap P gain 2 [%]	190	0.00	100.00	10.00	-
Adap I gain 2 [%]	191	0.00	100.00	1.00	-
Adap P gain 3 [%]	192	0.00	100.00	10.00	-
Adap I gain 3 [%]	193	0.00	100.00	1.00	-

T6205g

* This function can be assigned to one of the programmable analog inputs.

Enable spd adap Enabled Adaptive speed regulation enabled.

Disabled Adaptive speed regulation is not enabled. The regulator operates with the parameters set in the REG PARAMETERS menu.

Select adap type Speed The regulator parameters are modified according to the speed.

Adap reference The regulator parameters are modified according to the **Adap reference** parameter.

Adap reference The variable according to which the speed regulator parameters are to be modified (only with **Select adap type** = Adap reference)

Adap speed 1	Parameter set 1 is valid below this point, and parameter set 2 above it. The transition behaviour between the values is defined by the **Adap joint 1** parameter. The definition is a percentage of the **Speed base value** and the maximum value of **Adap reference**
Adap speed 2	Parameter set 2 is valid below this point, and parameter set 3 above it. The transition behaviour between the values is defined by **Adap joint 2**. The definition is a percentage of the **Speed base value** and the maximum value of **Adap reference**
Adap joint 1	Defines a range around **Adap speed 1** in which there is a linear change in gain from parameter set 1 to parameter set 2 in order to prevent jumps in the behavior of the regulator. It is defined as a percentage of **Speed base value**.
Adap joint 2	Defines a range around **Adap Speed 2** in which there is a linear change in gain from parameter set 2 to parameter set 3 in order to prevent jumps in the behavior of the regulator. It is defined as a percentage of **Speed base value**.
Adap P gain 1	Proportional gain for the range from zero to **Adap speed 1**. Defined as a percentage of **Speed P base**.
Adap I gain 1	Integral gain for the range from zero to Adap speed 1. Defined as a percentage of **Speed I base**.
Adap P gain 2	Proportional gain for the range from **Adap speed 1** to **Adap speed 2**. Defined as a percentage of **Speed P base**.
Adap I gain 2	Integral gain for the range from **Adap speed 1** to **Adap speed 2**. Defined as a percentage of **Speed I base**.
Adap P gain 3	Proportional gain for the range above **Adap speed 2**. Defined as a percentage of **Speed P base**.
Adap I gain 3	Integral gain for the range above **Adap speed 2**. Defined as a percentage of **Speed I base**.

In order to activate Adaptive speed regulation, the function must be enabled with the **Enable spd adap** parameter. Normally the gain depends on the speed of the drive. It can, however, also vary according to another variable, defined by the **Adap reference** parameter. This must be selected with the **Select adap type** parameter.

The **Adap speed 1** and **Adap speed 2** parameters are used to define the three ranges that may have different gains. A parameter set can be defined for each of these ranges, with each set containing an individually definable P and I component.

The **Adap joint 1** and **Adap joint 2** parameters ensure a smooth transition between the different parameter sets. The fields must be defined so that **Adap joint 1** and **Adap joint 2** do not overlap.

When the Adaptive speed regulation is enabled (**Enable spd adap** = Enabled) the **Speed P** and **Speed I** parameters have no effect. They still retain their value and are effective after any disabling of the adaptive speed regulation.

When the drive is not enabled, the gain of the speed regulator is determined by the zero speed logic. See section 6.7.2, “Zero speed logic”.

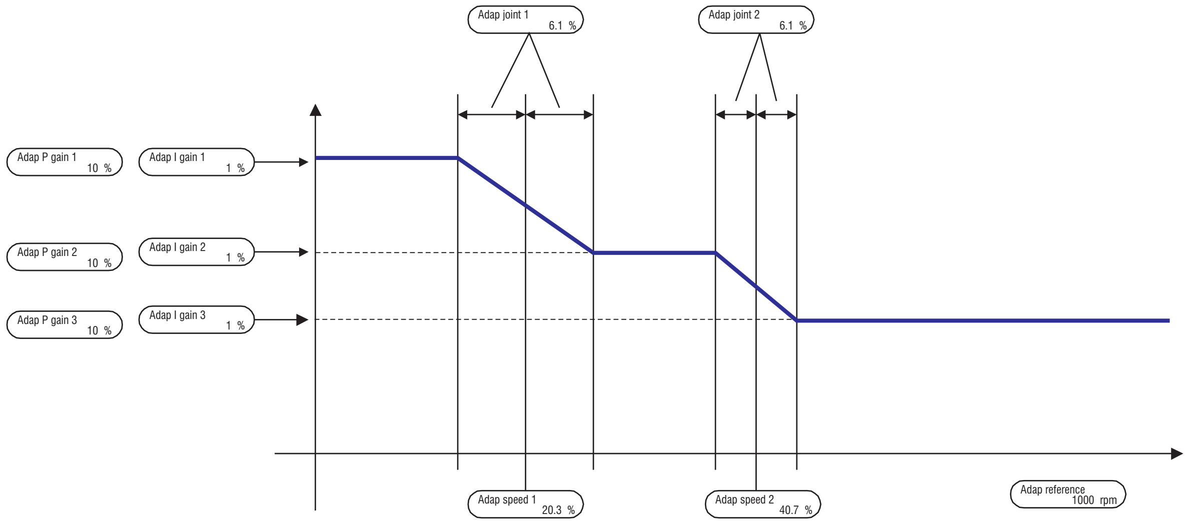


Figure 6.13.2.1: Adaptive of the speed regulator

6.13.3. Speed control

ADD SPEED FUNCT

Speed control

- Spd threshold +
- Spd threshold -
- Threshold delay
- Set error
- Set delay

T0750g

Two speed control messages are provided:

- when a particular, adjustable speed is not exceeded.
- when the speed corresponds to the set reference value

Parameter Description	Nr.	Value			Standard Configuration
		min	max	factory	
Spd threshold + [FF]	101	1	32767	1000	-
Spd threshold - [FF]	102	1	32767	1000	-
Threshold delay [ms]	103	1	65535	100	-
Spd threshold	393	-	-	-	Digital outp. 3*
Set error [FF]	104	1	32767	100	-
Set delay [ms]	105	1	65535	100	-
Set speed	394	0	1	-	*

T6210g

* This function can be assigned to a programmable digital output

Spd threshold +	Switch point for the "Speed not exceeded" for clockwise rotation of the drive in the units defined by the Factor funtion.
Spd threshold -	Switch point for the "Speed not exceeded" for counter-clockwise rotation of the drive in the units defined by the Factor funtion.
Threshold delay	Setting of a delay time in milliseconds which is active when the speed is lowered within the limits of the set threshold.
Spd threshold	Message "Set speed not exceeded" (via a programmable digital input) High — Speed not exceeded Low — Speed exceeded
Set error	Defines a tolerance band around the speed reference in the units specified by the Factor function.
Set delay	Setting of a delay time in milliseconds which is active when the speed is lowered within the limits of the set threshold.
Set speed	Message "The speed corresponds to the reference value" (via a programmable digital output) High — Speed corresponds to the reference value Low — Speed does not corresponds to the reference value

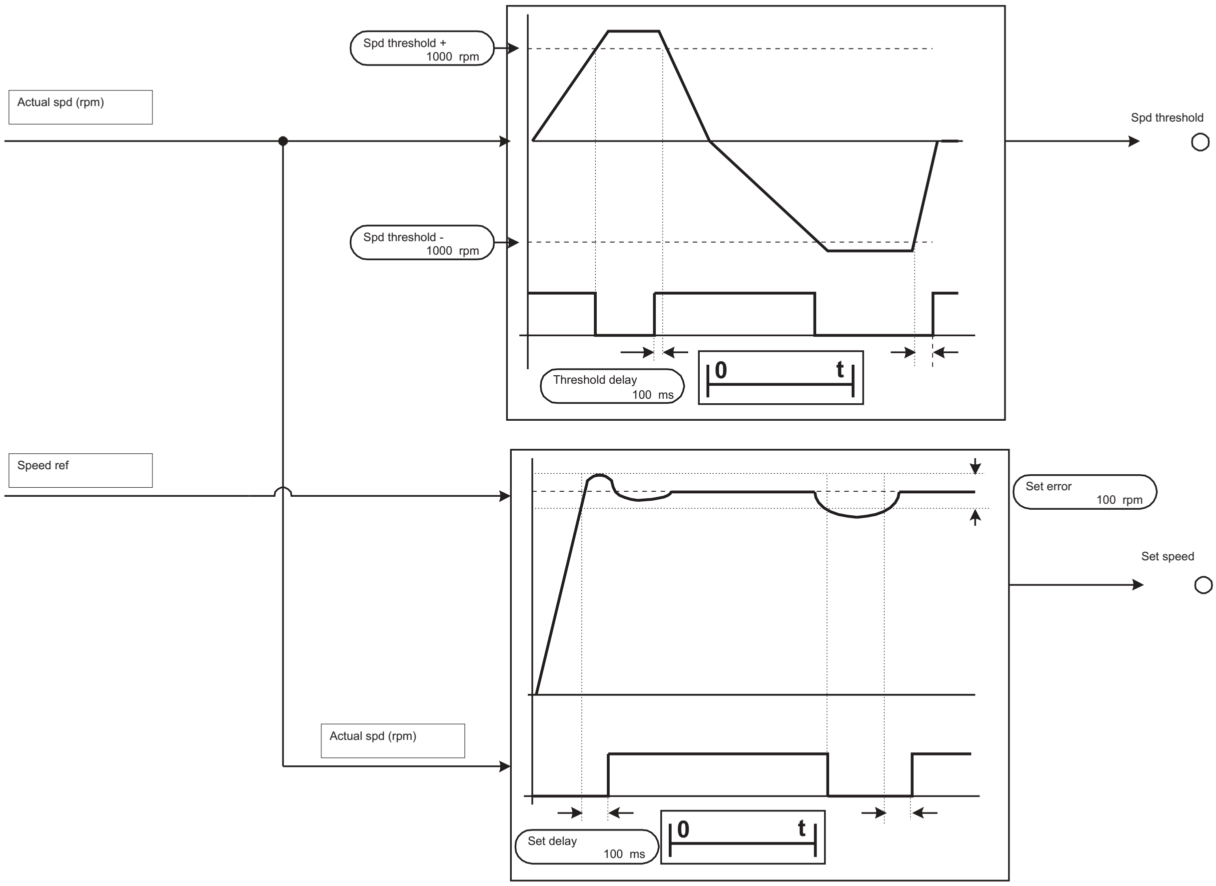


Figure 6.13.3.1: Message "not exceeded speed" (above) and "Speed = Reference" (below).

The message "The speed corresponds to the reference value" refers to the total reference value in front of the **Speed ref** speed regulator and to the **Ramp Ref** ramp reference when the ramp is selected.

When the references are lower than ± 1 % the signal is always Low!

6.13.4. Speed zero

ADD SPEED FUNCT
- **Speed zero**
  - Speed zero level
  - Speed zero delay

T0760g

Parameter Description	N.	Value			Standard Configuration
		min	max	factory	
Speed zero level [FF]	107	1	32767	10	-
Speed zero delay [ms]	108	0	65535	100	-
Speed zero thr	395	0	1	-	*

T6215g

* This function can be assigned to a programmable digital output.

Speed zero level Switch threshold for **Speed zero level**. The value applies to both rotation directions for the TPD32...4B converters. Defined by the units specified in the factor function.

Speed zero delay Definition of a delay time in milliseconds, when the zero speed is reached.

Speed zero thr ”Speed zero thr” message “Drive turning” (via a programmable digital output).

High	Drive turning
Low	Drive not turning

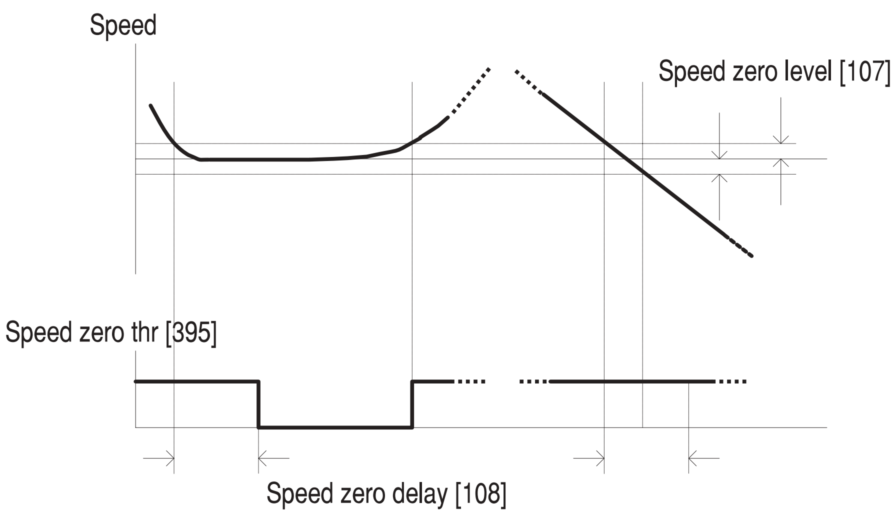


Figure 6.13.4.1: Speed zero

The LED “Zero Speed” is lit when the drive is not turning.

6.14. FUNCTIONS

6.14.1. Motor potentiometer

FUNCTIONS
- **Motor pot**
  - Enab motor pot
  - Motor pot oper
  - Motor pot sign
  - Motor pot reset

T0770g

The motor potentiometer function allows the speed of the drive to be adjusted by pressing a key. The speed is then adjusted according to the defined ramp time.

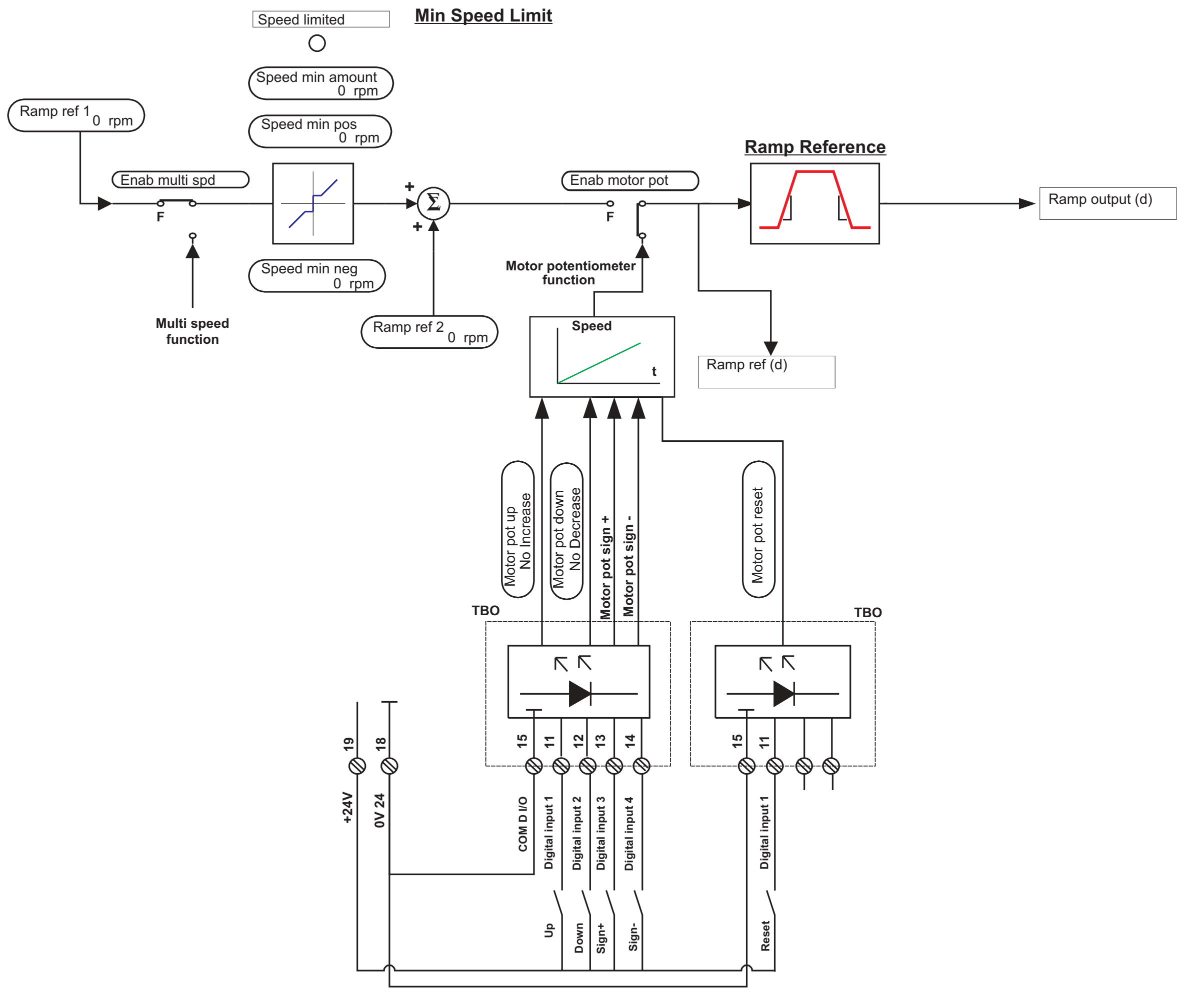


Figure 6.14.1.1: Motor potentiometer

When the rotation sense of the motor has only one direction, the Sign+ and Sign - signals are not required

Parameter Description	No.	Value			Standard
		min	max	factory	configuration
Enable motor pot	246	0	1	Disabled	-
Motor pot oper	247				-
Motor pot sign	248	0	1	Positive	-
Motor pot sign +	-				**
Motor pot sign -	-				**
Motor pot reset	249	-	-	-	*
Motor pot up	396	0	1	-	*
Motor pot down	397	0	1	-	*

T6220g

* This function can be assigned to one of the programmable digital inputs.

** These parameters are only accessible via a programmable digital input.

Enable motor pot

Enabled — The motor potentiometer function is enabled. The ramp receives its reference value from the motor potentiometer function.

Disabled — The reference value potentiometer function is disabled.

Motor pot oper

By pressing the "+" and "-" keys of the keypad the drive can be accelerated or decelerated.

+ Accelerate — **-** Decelerate

Motor pot sign

This parameter is only accessible via the keypad and via the serial interface or Bus. When the drive is operated via the terminal strip, the parameters **Motor pot sign +**and **Motor pot sign -** must be used. As for TPD32...2B... converters the "Positive" function must be selected.

Positive — "Clockwise" rotation selected

Negative — "Counterclockwise" rotation selected

Motor pot sign +

Only for TPD32...4B...! Selection of the "Clockwise" rotation direction when the selection is carried out via the terminal strip. The **Motor pot sign +** parameter is linked with the **Motor pot sign -** parameter via an XOR function. This means that the command (+24V) must be given only to one of the two terminals.

High — "Clockwise" rotation direction selected

Low — "Clockwise" rotation direction not selected

Motor pot sign -

Only for TPD32...4B...! Selection of the "Counterclockwise" rotation when the changeover is carried out via the terminal strip. The **Motor pot sign -** parameter is linked with the **Motor pot sign +** parameter via an XOR function. This means that the command (+24V) must be given only to one of the two terminals.

High — "Counter-clockwise" rotation direction selected.

Low — "Counter-clockwise" rotation direction not selected.

Motor pot reset.

When the Reset command is activated and the drive is switched off, the restart begins at "Zero" speed.

The command is only possible with the drive switched off!

Motor pot up The drive is accelerated with the preselected ramp. The setting is either carried out via the terminal, serial interface or Bus.

Motor pot down The drive is decelerated with the preselected ramp. The setting is either carried out via the terminal, serial interface or Bus.

When the motor potentiometer function is active (**Enable motor pot**), the current speed reference value is shown in the **Motor pot** submenu of the keypad.

When controlled via the keypad, the drive can be accelerated by pressing the “+” key and decelerated by pressing the “-” key. This corresponds to the commands **Motor pot up** and. **Motor pot down**.

Select the menu point **Motor pot oper** for this purpose.

The speed of the drive can be adjusted between 0 to 100 % by setting the command **Motor potdown.**

The drive reduces the speed between 100 and 0 % by setting the command **Motor pot down**.If the command is given when the drive is already at a stop, it will not cause the reverse running of the drive.

If the **Motor pot up** and **Motor pot down** commands are given at the same time, they will not change the speed reference value.

The last speed reference value is saved when the drive is switched off or if there is a fault. When the drive is restarted, it accelerates to this speed according to the ramp set.

If the command **Motor pot reset** is given with the drive switched off, the speed reference value is deleted and the drive starts at zero speed.

If the status of the**Motor pot sign** command is changed while the drive is running, the drive will reverse according to the specified ramp times.

When using the motor potentiometer function, the ramp must be enabled and the **Start** command must be present.

6.14.2. Jog function

FUNCTIONS		
	Jog function	
		Enable jog
		Jog reference
		Jog operation
		Jog selection

T0780g

Parameter Description	No.	Value			Standard configuration
		min	max	factory	
Enable jog (Enabled/Disabled)	244	0	1	Disabled	-
Jog operation	265				
Jog reference [FF]	266	0	32767	0	**
Jog selection Speed input/Ramp input	375	0	1	Speed input 0	-
Jog +	398	0	1	-	*
Jog -	399	0	1	-	*

T6225g

* This function can be assigned to one of the programmable digital inputs.

** This parameter can be assigned to a programmable analog input.

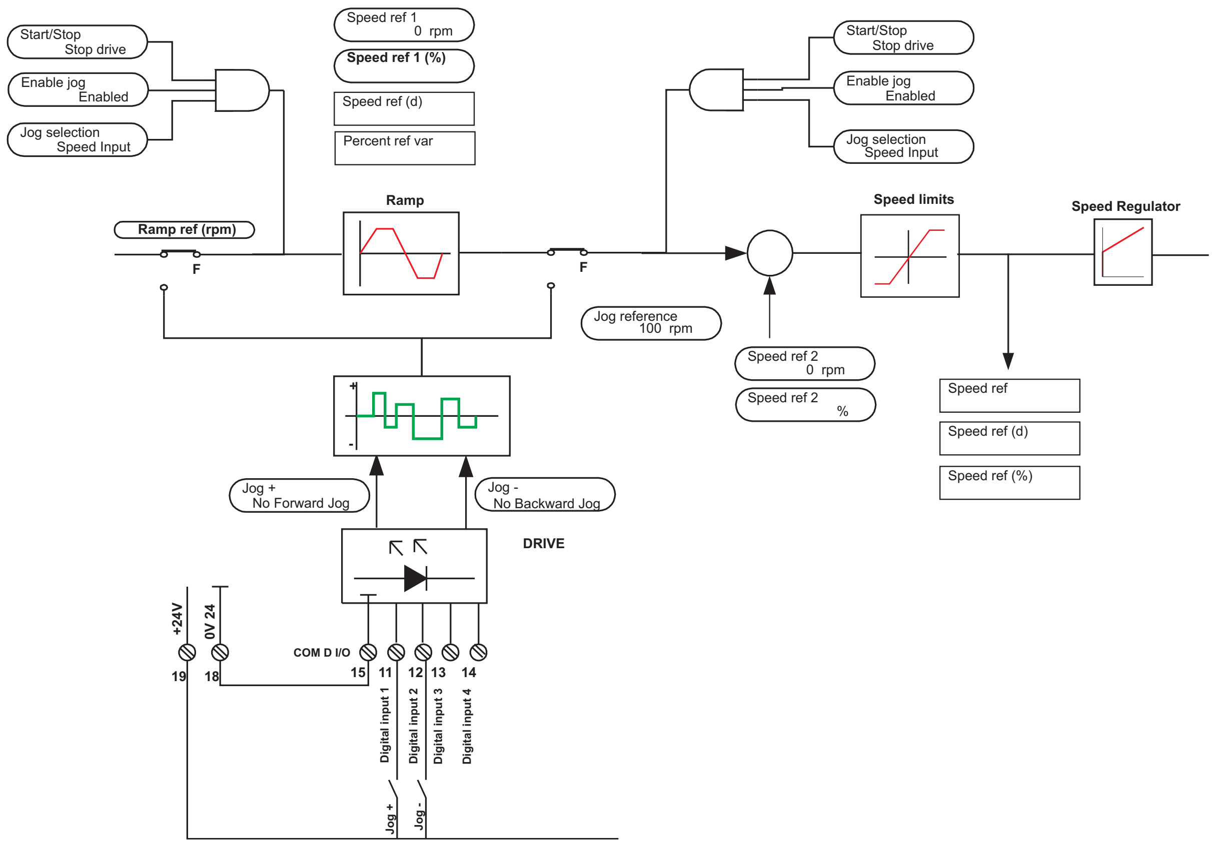


Figure 6.14.2.1: Example of external activation in Jog mode

Enable jog | Enabled | Enabled Jog function (this selection is possible only when the drive is switched off).
| Disabled | Disabled Jog function

Jog operation Pressing the "+" and "-" keys on the keypad enables the drive to be moved forward and backward. In connection with the TPD32...4B converters it is possible to operate the Jog function in an anti-clockwise rotation by pressing the "-" key.

\+ Jog clockwise rotation

\- Jog counter-clockwise rotation

Jog reference Reference value for jog mode. Defined by the units, specified by the factor function.

Jog selection This parameter determines if the Jog function reference must go through the ramp or directly to the speed regulator.

Speed input — The Jog reference is directly defined. The ramp is not active.

Ramp input — The Jog reference is defined with a set ramp.

Jog +

High — Clockwise Jog function when the Jog function is enabled and the **Start** command is not present.

Low — Disabled

Jog -

High — Counter-clockwise Jog function for the TPD32...4B when the Jog function is enabled and the **Start** command is not present.

Low — Disabled

NOTE: The following signals are required for Jog mode in addition to the commands **Jog +** and **Jog -** :

- Enable drive **- Fast Stop** **- External fault**

The jog speed corresponds to the value which is defined by the **Jog reference** parameter. In this case no ramp is used. The jog reference value can only be activated by the **Jog +** or **Jog -** command if there is no **Start** command active and the output frequency of the inverter is zero at the same time.

If the **Start** command is given in addition to the **Jog +** and **Jog -** command, Jog mode will be aborted and the drive will react according to the Start command.

When controlled via the keypad the “+” and “-” keys can be used in the Jog function menu. (only for TPD32...4B...). For this select the **Jog operation** menu point.

The correction value **Speed ref 2** for the speed regulator is also active in jog operation.

NOTE! If the **Stop control** function is activated, to enable the Jog function the **Jog Stop control** (FUNCTION/Stop control) must also be set to ON (1).

6.14.3. Multi speed function

FUNCTIONS
- **Multi speed fct**
  - Enab multi spd
  - Multi spd 1
  - Multi spd 2
  - Multi spd 3
  - Multi spd 4
  - Multi spd 5
  - Multi spd 6
  - Multi spd 7
  - Multi speed sel

T0790g

The Multi speed function allows up to seven internally saved reference values to be called up via a digital signal.

Parameter Description	No.	Value			Standard
		min	max	factory	Configuration
Enab multi spd	153	-	-	Disabled	—
Multi speed 1	154	-32767	+32767	0	—
Multi speed 2	155	-32767	+32767	0	—
Multi speed 3	156	-32767	+32767	0	—
Multi speed 4	157	-32767	+32767	0	—
Multi speed 5	158	-32767	+32767	0	—
Multi speed 6	159	-32767	+32767	0	—
Multi speed 7	160	-32767	+32767	0	—
Speed sel 0	400	0	1	0	Digital inp. 5*
Speed sel 1	401	0	1	0	Digital imp. 6*
Speed sel 2	402	0	1	0	Digital inp. 7*
Multi speed sel	208	0	7	0	

T6230g

* This function can be assigned to one of the programmable digital inputs.

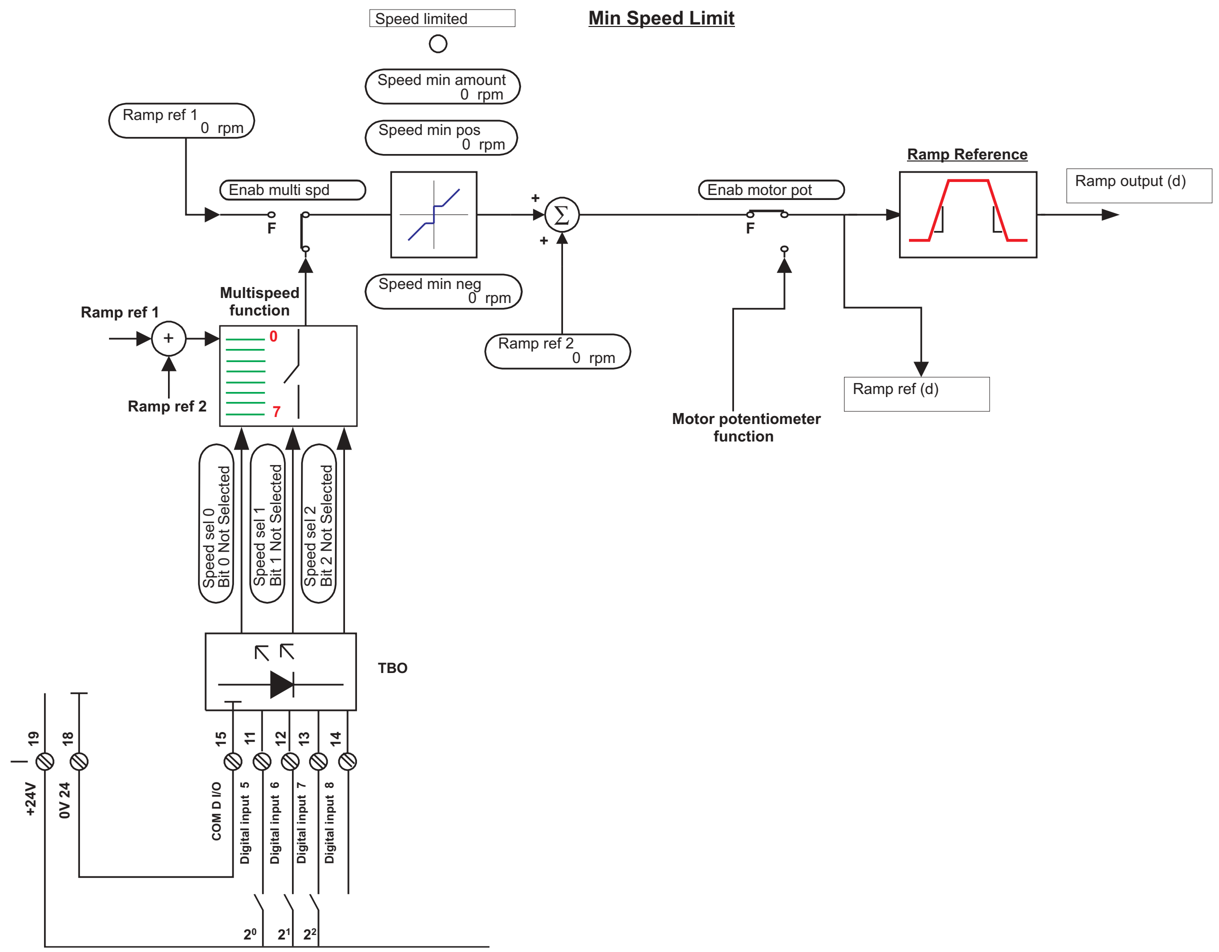


Figure 6.14.3.1: Selection of different references via terminals

Enab multi spd — Enabled: Enabled multi speed function
Disabled: Disabled multi speed function

Multi speed 1 — Reference value 1 for enabled multi speed function. Defined by the units specified in the factor function

Multi speed 2 — Reference value 2 for enabled multi speed function. Defined by the units specified in the factor function

Multi speed 3 — Reference value 3 for enabled multi speed function. Defined by the units specified in the factor function

Multi speed 4 — Reference value 4 for enabled multi speed function. Defined by the units specified in the factor function

Multi speed 5 — Reference value 5 for enabled multi speed function. Defined by the units specified in the factor function

Multi speed 6 — Reference value 6 for enabled multi speed function. Defined by the units specified in the factor function

Multi speed 7 — Reference value 7 for enabled multi speed function. Defined by the units specified in the factor function

Speed sel 0 — Reference value selection with the significance 2^0 (=1). Parameter can only be used in conjunction with **Speed sel 1** and **Speed sel 2**.
High: Significance 2^0 selected
Low: Significance 2^0 not selected

Speed sel 1 Reference value selection with the significance 2^1 (=2). Parameter can only be used in conjunction with **Speed sel 0** and **Speed sel 2**.

High	Significance 2^1 selected
Low	Significance 2^1 not selected

Speed sel 2 Reference value selection with the significance 2^2 (=4). Parameter can only be used in conjunction with **Speed sel 0** and **Speed sel 1**.

High	Significance 2^2 selected
Low	Significance 2^2 not selected

Multi speed sel It is the word representation of the three parameters **Speed sel 1** (bit0), **Speed sel 2** (bit1) and **Speed sel 3** (bit2). Used to change the speed selection by changing only one parameter instead of three. This allows selecting different speeds via serial line or Bus instantaneously.

The table and graph below show the interaction between the selection and the corresponding reference value.

Speed sel 0 Bit 0 Not Selected	Speed sel 1 Bit 1 Not Selected	Speed sel 2 Bit 2 Not Selected	REFERENCE
0	0	0	Ramp ref 1 0 rpm + Ramp ref 2 0 rpm
1	0	0	Multi speed 1 0 rpm
0	1	0	Multi speed 2 0 rpm
1	1	0	Multi speed 3 0 rpm
0	0	1	Multi speed 4 0 rpm
1	0	1	Multi speed 5 0 rpm
0	1	1	Multi speed 6 0 rpm
1	1	1	Multi speed 7 0 rpm

Enable multi spd Disabled

Multi speed sel. 0

Ramp ref (d)

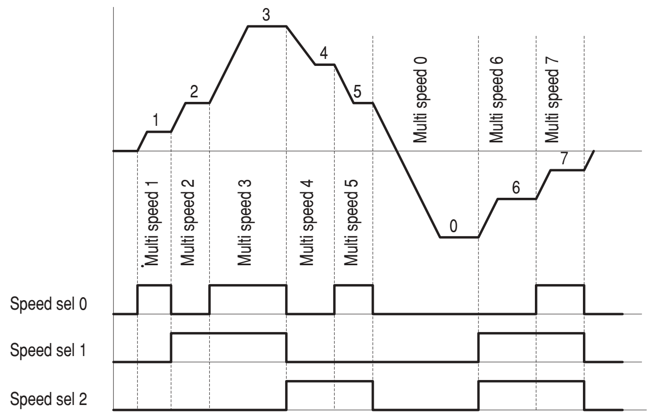


Figure 6.14.3.2: Multi speed function

In order to operate the Multi speed function, it must be enabled with **Enab multi spd** parameter.

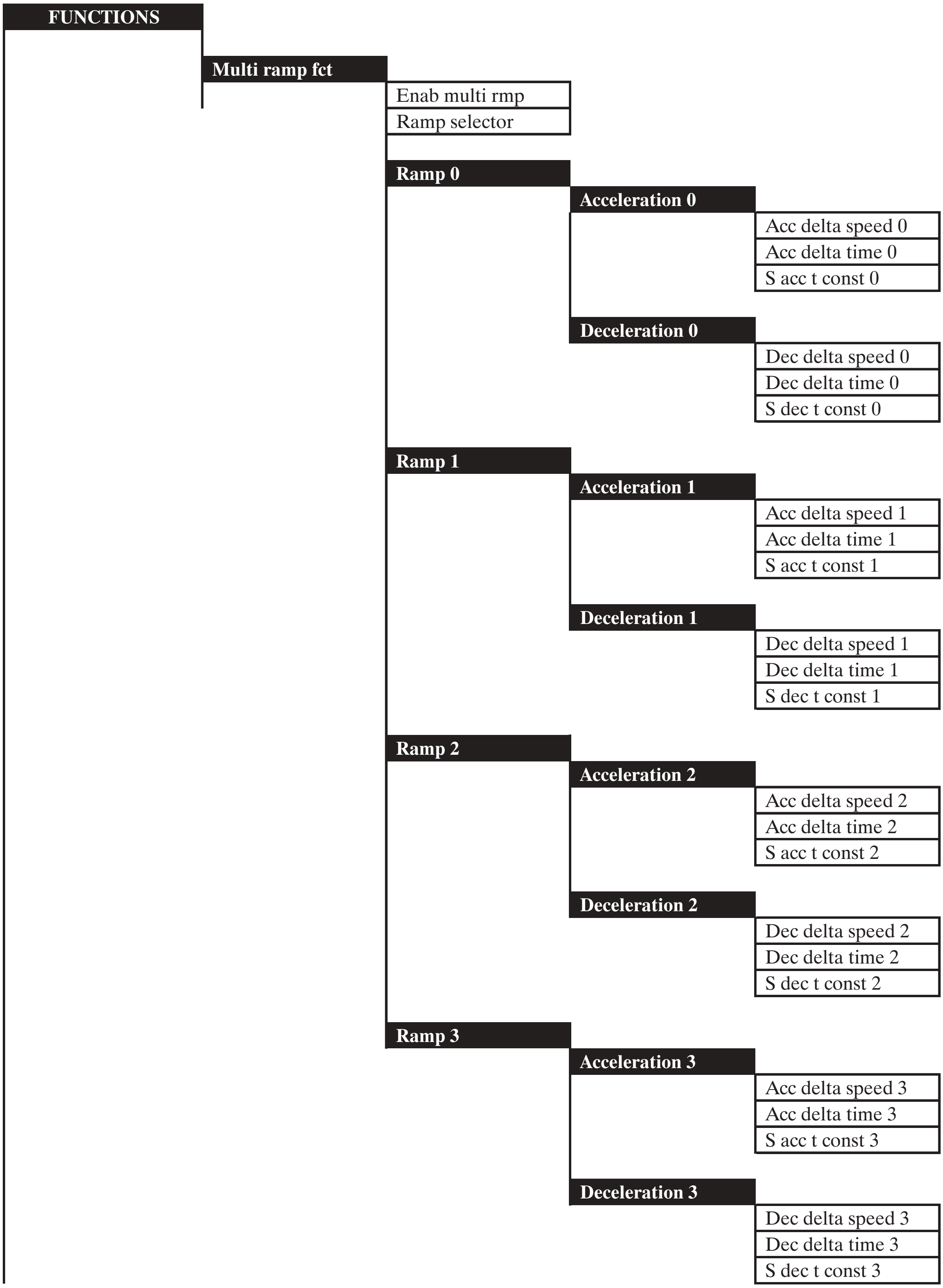
The required reference value is selected with the **Speed sel 0**, **Speed sel 1** and **Speed sel 2** signals.

The selection of the reference values is carried out via the keypad or the serial interface.

The reference values are signed so that they can be defined for a particular rotation direction of the drive. As for the TPD32...2B... the reference must have a positive polarity.

When the Multi speed function is enabled, Multi speed 0 is defined by the addition of the reference values **Ramp ref 1** and **Ramp ref 2**.

6.14.4. Multi ramp function



T0800i

The Multi ramp function enables up to four different ramps to be called up. The acceleration and deceleration times can also be defined here separately. The ramps are called up via digital signals.

Parameter description	No.	Value			Standard
		min	max	factory	configuration
Enab multi rmp	243	0	1	Disabled	-
Ramp selector	202	0	3	0	-
Acc delta speed0 [FF]	659	0	2^{32}-1	100	-
Acc delta time 0 [s]	660	0	65535	1	-
S acc t const 0 [ms]	665	100	3000	300	
Dec delta speed0 [FF]	661	0	2^{32}-1	100	-
Dec delta time 0 [s]	662	0	65535	1	-
S dec t const 0 [ms]	666	100	3000	300	
Acc delta speed 1 [FF]	23	0	2^{32}-1	100	-
Acc delta time 1 [s]	24	0	65535	1	-
S acc t const 1 [ms]	667	100	3000	300	
Dec delta speed 1 [FF]	31	0	2^{32}-1	100	-
Dec delta time 1 [s]	32	0	65535	1	-
S dec t const 1 [ms]	668	100	3000	300	
Acc delta speed 2 [FF]	25	0	2^{32}-1	100	-
Acc delta time 2 [s]	26	0	65535	1	-
S acc t const 2 [ms]	669	100	3000	300	
Dec delta speed 2 [FF]	33	0	2^{32}-1	100	-
Dec delta time 2 [s]	34	0	65535	1	-
S dec t const 2 [ms]	670	100	3000	300	
Acc delta speed 3 [FF]	27	0	2^{32}-1	100	-
Acc delta time 3 [s]	28	0	65535	1	-
S acc t const 3 [ms]	671	100	3000	300	
Dec delta speed 3 [FF]	35	0	2^{32}-1	100	-
Dec delta time 3 [s]	36	0	65535	1	-
S dec t const 3 [ms]	672	100	3000	300	
Ramp sel 0	403	0	1	Low	*
Ramp sel 1	404	0	1	Low	*

T6240g

* This function can be assigned to one of the programmable digital inputs.

Enab multi rmp Enabled The Multi ramp function is enabled

Disabled The Multi ramp function is disabled

Ramp selector It is the word representaton of the two parameters **Ramp sel 0** (bit0) and **Ramp sel 1** (bit1). Used to change the ramp selection by changing only one parameter instead of two. This allows to select different ramps via serial line or Bus instantaneously.

Ramp sel 0 Ramp selection with the significance 2^0. Parameter can only be used in conjunction with **Ramp sel 1**.

High Significance 2^0 selected

Low Significance 2^0 not selected

Ramp sel 1 Ramp selection with the significance 2^1. Parameter can only be used in conjunction with **Ramp sel 0**.

High Significance 2^1 selected

Low Significance 2^1 not selected

Acc delta speed 0 It defines together with **Acc delta time 0** the acceleration ramp 0. Defined by the units specified in the factor function.

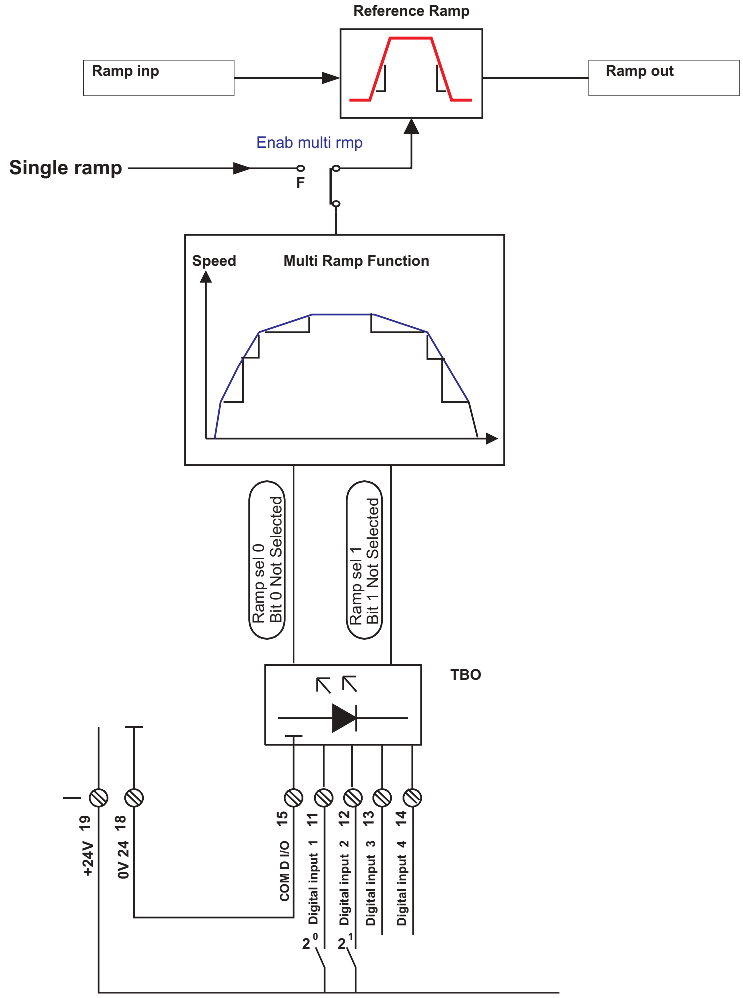


Figure 6.14.4.1: Multi ramp selection via terminals

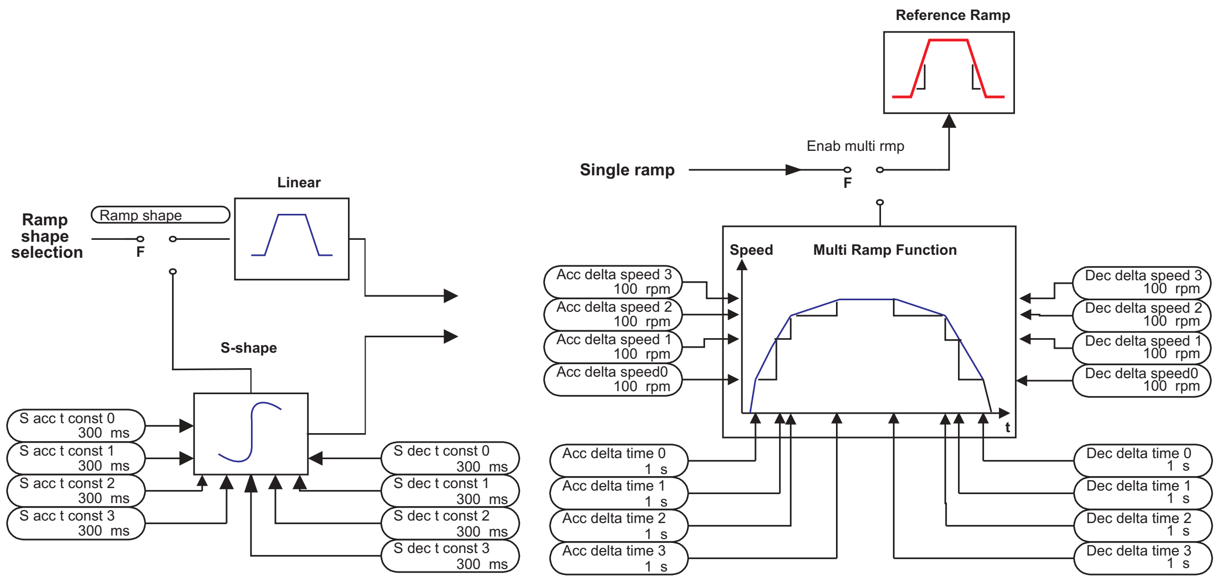


Figure 6.14.4.2: Multi ramp selection via signals

Acc delta time 0	It defines together with **Acc delta speed 0** the acceleration ramp 0. Defined in seconds.
S acc t const 0	Defines the acceleration curve for S-shape ramp 0. Defined in ms.
Dec delta speed 0	It defines together with **Dec delta time 0** the deceleration ramp 0. Defined by the units specified in the factor function.
Dec delta time 0	It defines together with **Acc delta speed 0** the acceleration ramp 0. Defined in seconds.
S dec t const 0	Defines the deceleration curve for **S-shape ramp 0.** Defined in ms.
Acc delta speed 1	It defines together with **Acc delta time 1** the acceleration ramp 1. Defined by the units specified in the factor function.
Acc delta time 1	It defines together with **Acc delta speed 1** the acceleration ramp 1. Defined in seconds.
S acc t const 1	Defines the acceleration curve for **S-shape ramp 1**. Defined in ms.
Dec delta speed 1	It defines together with **Dec delta time 1** the deceleration ramp 1. Defined by the units specified in the factor function.
Dec delta time 1	It defines together with **Dec delta speed** 1 the deceleration ramp 1. Defined in seconds.
S dec t const 1	Defines the deceleration curve for **S-shape ramp 1**. Defined in ms.
Acc delta speed 2	It defines together with **Acc delta time 2** the acceleration ramp 2. Defined by the units specified in the factor function.
Acc delta time 2	It defines together with **Acc delta speed 2** the acceleration ramp 2. Defined in seconds.
S acc t const 2	Defines the acceleration curve for **S-shape ramp 2**. Defined in ms.
Dec delta speed 2	It defines together with **Dec delta time 2** the deceleration ramp 2. Defined by the units specified in the factor function.
Dec delta time 2	It defines together with **Dec delta speed 2** the deceleration ramp 2. Defined in seconds.
S dec t const 2	Defines the deceleration curve for **S-shape ramp 2**. Defined in ms.
Acc delta speed 3	It defines together with **Acc delta time 3** the acceleration ramp 3. Defined by the units specified in the factor function.
Acc delta time 3	It defines together with **Acc delta speed 3** the acceleration ramp 3. Defined in seconds.
S acc t const 3	Defines the acceleration curve for **S-shape ramp 3**. Defined in ms.
Dec delta speed3	It defines together with **Dec delta time 3** the deceleration ramp 3. Defined by the units specified in the factor function.
Dec delta time 3	It defines together with **Dec delta speed 3** the deceleration ramp 3. Defined in seconds.
S dec t const 3	Defines the deceleration curve for **S-shape ramp 3**. Defined in ms.

See in the following table the interaction between the selection and the ramp

	Ramp sel 0	**Ramp sel 1**
Ramp 0	Low	Low
Ramp 1	High	Low
Ramp 2	Low	High
Ramp 3	High	High

T6242g

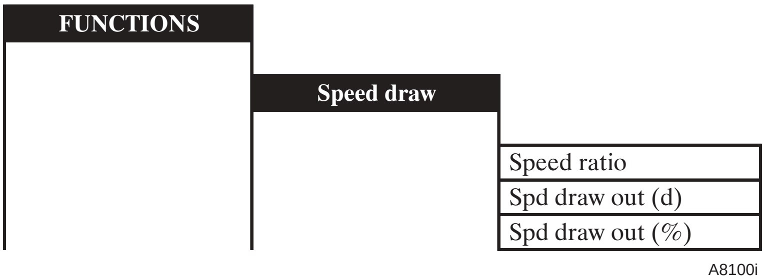
In order to activiate the “Multi ramp” function, it must be enabled with the **Enab multi rmp**.

The selection of the wished ramps occurs through the signals **Ramp sel 0** and **Ramp sel 1**.

The selection by terminal can be set even selecting only one digital input, configuration that obviously enables exclusively the ramp for which the input has been programmed.

The selection of every different ramp makes that in acc./dec. condition the reference follows the new ramp. The ramp parameter setting can be carried out through keypad or serial line.

6.14.5. Speed Draw function



Parameter	N.	Value			Standard configuration
		min	max	default	
Speed ratio	1017	0	32767	10000	*
Speed draw out (d)	1018	-32768	32767	-	**
Spd draw out (%)	1019	-200	200	-	

T 6323g

* This parameter can be assigned to a programmable analog input

** This parameter can be assigned to a programmable analog output

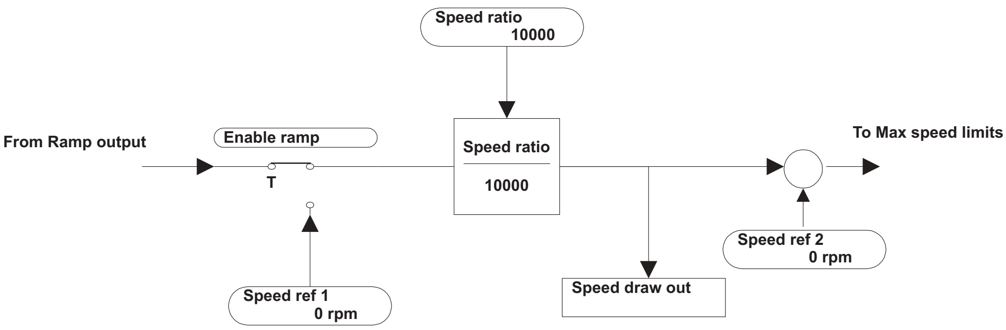


Figure 6.14.5.1 Speed draw block diagram

This function allows a configurable **Speed ratio** to be applied to the main reference **Speed ref 1**.

The Speed ratio range can be set between 0 and 32767 if written in digital form. It can be set from 0 to 20000 (0 to +10V) if assigned via an analog input.

This function is useful in a multidrive system where between the motors is required (see example in figure 6.14.5.2). The speed resulting value can be read through the **Spd draw out** parameter via an analog output.

Speed ratio This parameter determines the speed ratio value.This setting can be done in digital form, via LAN or through an analog input.

Spd draw out (d) Speed value in the unit specified by the factor function.

Spd draw out (%) Speed value as a percentage of **Speed base value**.

EXAMPLE (RUBBER CALENDER)

Example Setting:

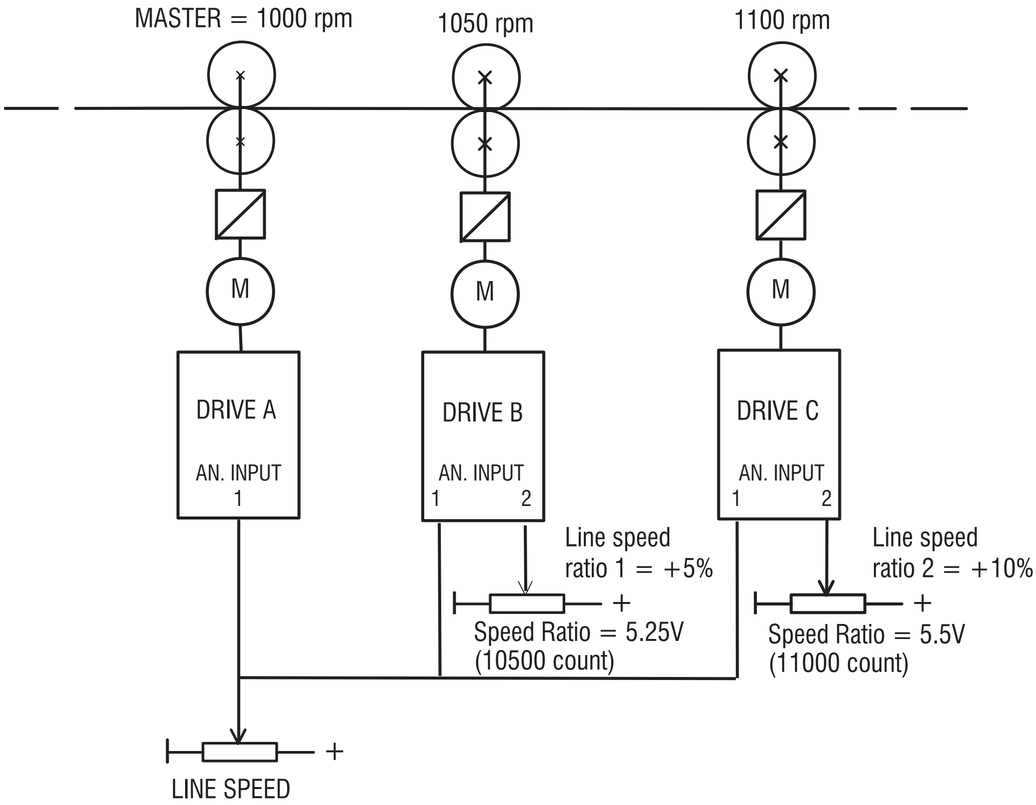


Figure 6.14.5.2 Rubber calender example

DRIVE A (master)

Set **Analog input 1** = **Ramp ref 1**

DRIVE B

Line speed ratio 1 = Line speed + 5%

Set **Analog input 1** = **Ramp ref 1**

Set **Analog input 2** = **Speed ratio**

Set **Speed ratio** parameter = **10500**

DRIVE C

Line speed ratio 2 = **Line speed + 10%**

Set **Analog input 1** = **Ramp ref 1**

Set **Analog input 2** = **Speed ratio**

Set **Speed ratio** parameter = **11000**

6.14.6. Overload control

FUNCTIONS

Overload contr

- Enable overload
- Overload mode
- Overload current
- Base current
- Overload time
- Pause time

T0810g

The Overload control function allows an overcurrent for a limited time that can also exceed the rated current of the inverter. It is used in order to provide the drive with an increased acceleration torque or for example to allow peak loads, such as with cyclical loads characteristics.

Parameter description	No.	Value				Standard configuration
		min	max	factory		
				American	European	
Enable overload (Enabled/Disabled)	309	0	1	Disabled	Disabled	-
Overload mode (Curr limited/Curr not limited)	405	0	1	Curr limited	Curr limited	-
Overload Current [%]	312	P313	200	150	100	
Base current [%]	313	0	P312<100	100	80	-
Overload time [s]	310	0	65535	60	30	-
Pause time [s]	311	0	65535	540	300	-
Overld available	406	0	1	-	-	Digital outp. 4*
Overload state	407	0	1	-	-	*

T6245g

* This parameter can be assigned to a programmable digital output.

Enable overload Enabled — Overload control is enabled

Disabled — Overload control is disabled

Overload mode Curr limited — The armature current is restricted to the limits set by the Overload control (size and duration of overcurrent).

Curr not limited — The armature current is not limited by the Overload control. However, an alarm is possible via the **Overload state** parameter. This alarm indicates whether the current is within the set limits or not.

Overload current	Armature current that is permissible during the overload time (set with **Overload time**). It is always 200% as a maximum of the active current at **Full load curr** and therefore proportional to the torque.
Base current	Armature current that is permissible during the pause time (set with Pause time). The percentage refers to the active current at **Full load curr**.
Overload time	Maximum time in which the **Overload current** is permissible.
Pause time	Minimum time between two Overload cycles. During this time the **Base current** is permissible.
Overld available	Indicates whether an overload is possible this very instant or whether this is not yet the case, due to the set cycle (**Pause time** not yet expired). High Overload possible Low Overload currently not possible
Overload state	If the **Overload mode** parameter is defined so that the current is not limited by the Overload control, the **Overload state** can be used to determine whether the current is within the set limits or not. High Current exceeds the set limits Low Current does not exceed the set limits.

The Overload control is enabled with the **Enable overload** parameter.

It can be used to protect the drive or motor from thermal overloads with cyclical loads.

The max. posible values (as for the converter) are obtainable through the following curves.

The operating point must always be below the corresponding curve. At the verification it is to state, that the torque and the current are proportional.

The **Overld available** parameter allows to understand if the drive is ready to supply an overload current.

If the current exceeds the value defined by the **Base current** parameter, the time set by the **Overload time** parameter starts to run. Once this time has expired, the current is limited again to the Base current.

This takes place irrespective of how high the overload was and how long it lasted.

A subsequent overload is permissable immediatly after the time set by the **Pause time** parameter. If **Overload mode** is set to “Curr not limited”, The current is not limited but the **Overload state** parameter indicates whether it is out of the defined range.

CAUTION! A wrong input of the values may cause the destruction of the device!

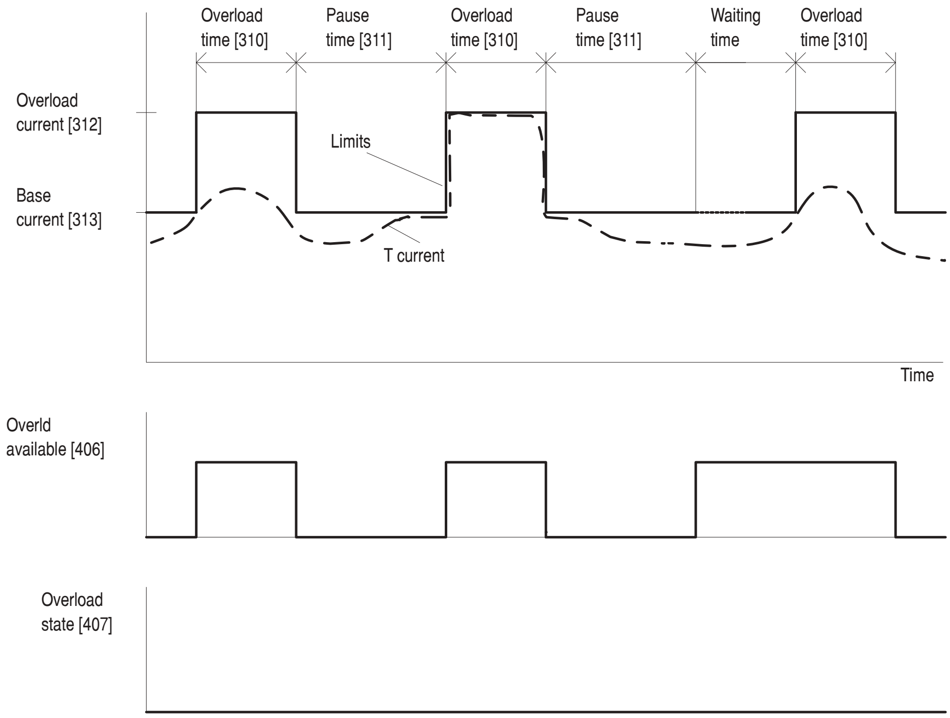


Figure 6.14.6.1: Overload control (Overload mode = curr limited)

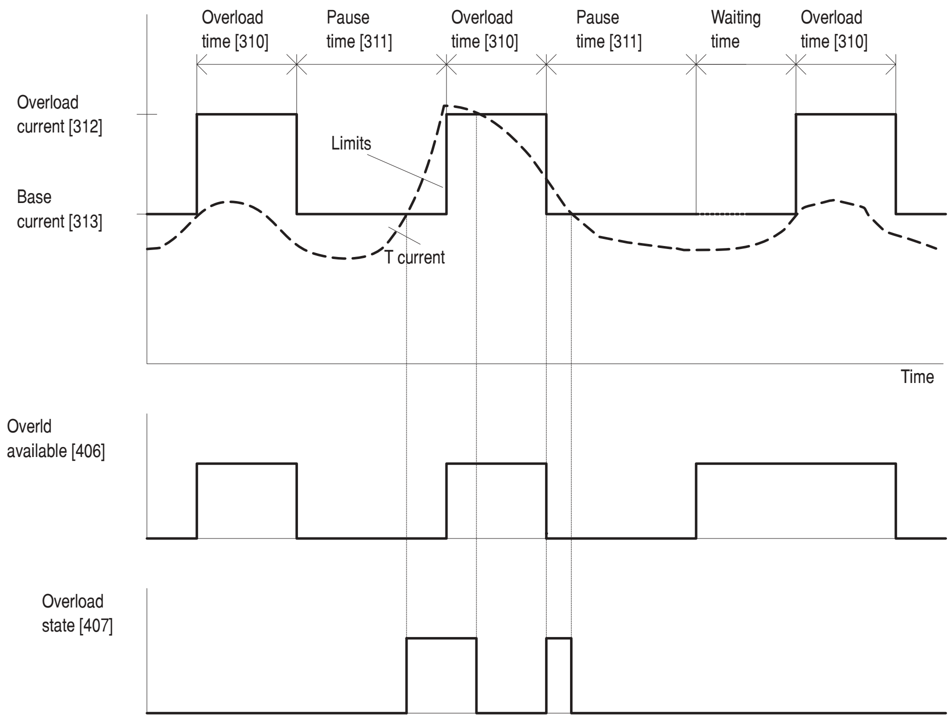


Figure 6.14.6.2: Overload control (Overload mode: Curr not limited)

I_{dAN} = 20 ... 70 A

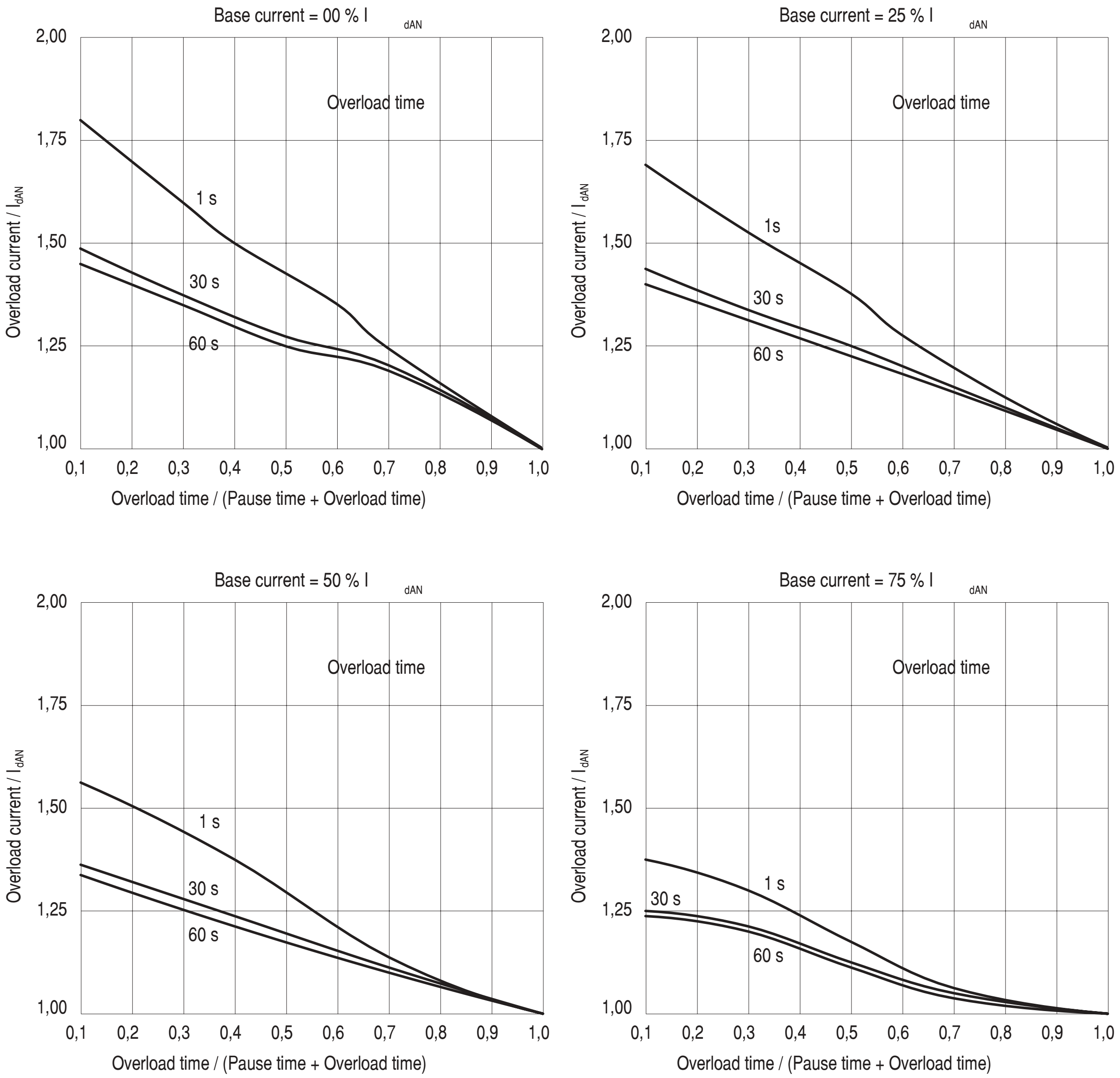


Figure 6.14.6.3 Allowed overload for size from 20 up to 70 A

I_{dAN} = 110 ... 185 A

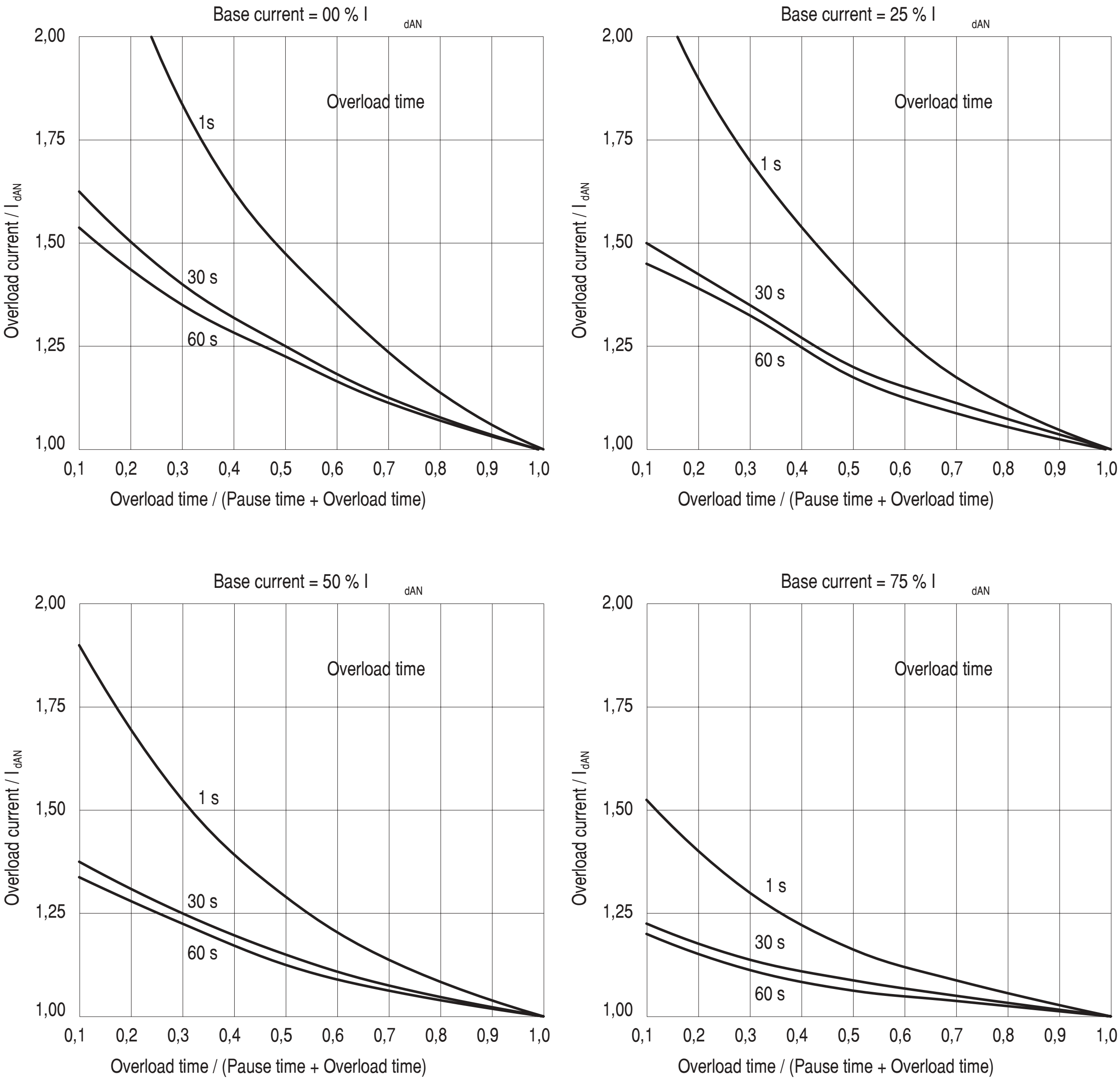


Figure 6.14.6.4 Allowed overload for size from 110 up to 185 A

I_{dAN} = 280 ... 650 A

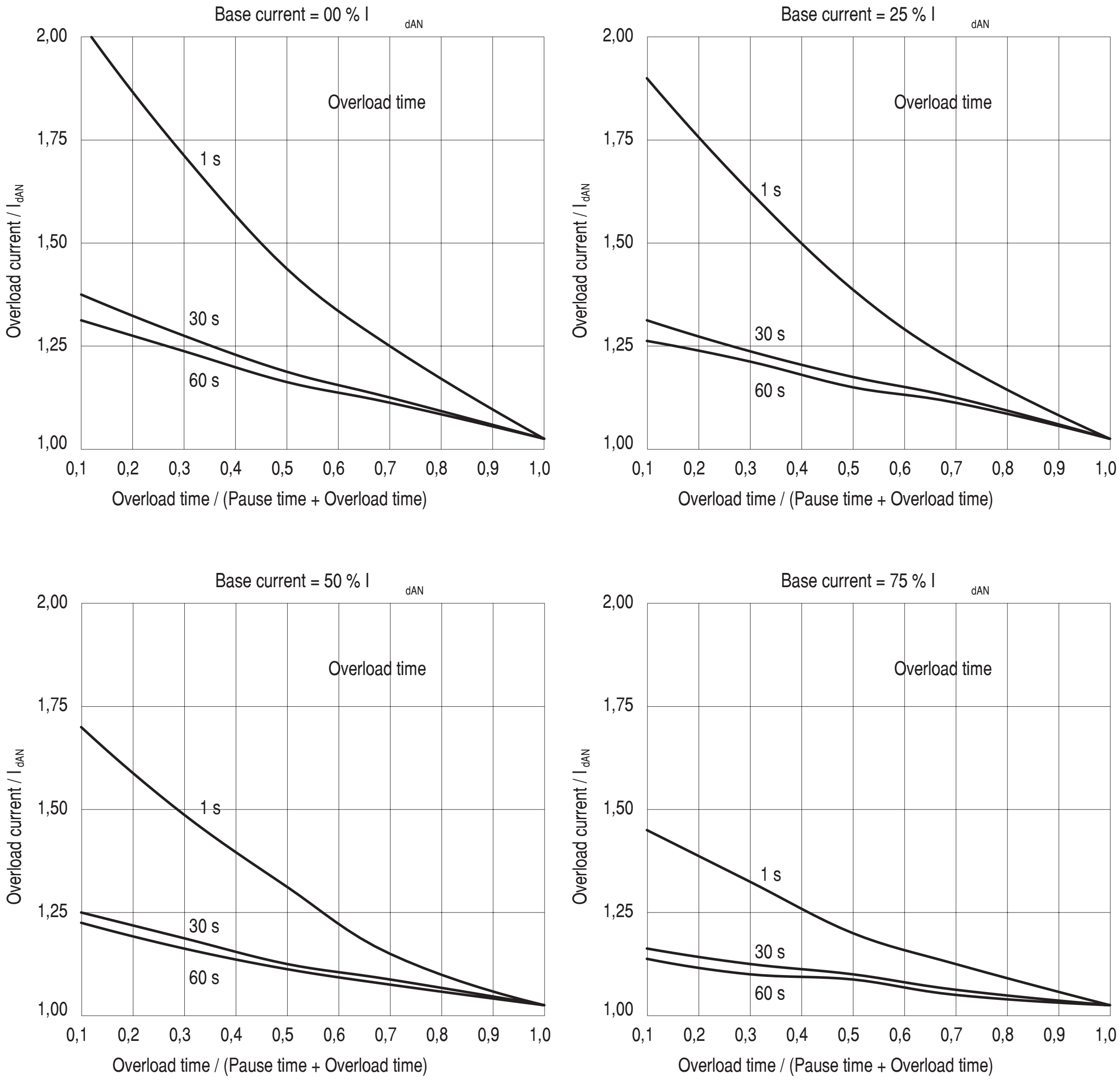


Figure 6.14.6.5 Allowed overload for size from 280 up to 650 A

I_{dAN} = 770 ... 1050 A

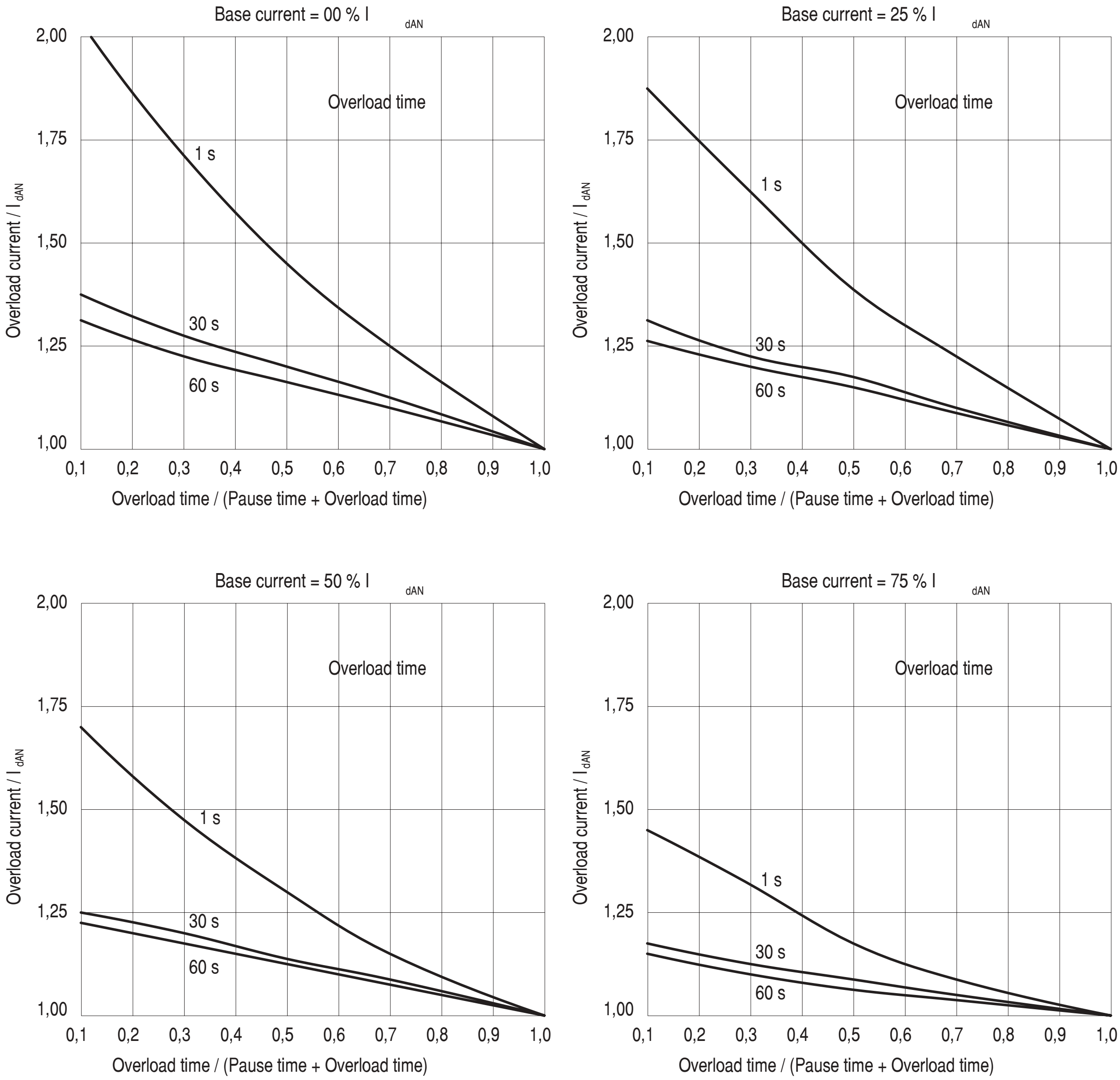


Figure 6.14.6.6 Allowed overload for size from 770 up to 1050 A

Example

Motor	I_{dAN} (Armature current) = 82 A
Loadcycle	The motor is overloaded for 1 s at 180 % of the rated current, then it works at the rated load for at least 5 s. Four quadrant converter.
Procedure	At first select the dc current according to the motor rated current.
Converter	TPD32-400/420-110-4B

Diagram

$$\frac{\text{Base current}}{I_{dAN}} = \frac{82\ \text{A}}{110\ \text{A}} = 0{,}7454 = 74{,}5\%$$ f005

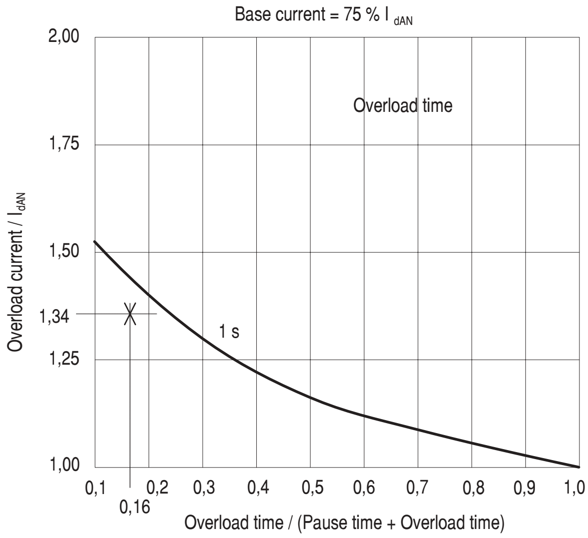
This means that the diagram for the converters 110 A ... 185 A with a Base current = 75 % has to be considered for the calculation.

Operating point — Basis: rated data of the converter

$$\text{Overload current} = 82\text{A} \bullet 1{,}8 = 147{,}6\text{A}$$ f008

$$\frac{\text{Overload current}}{I_{dAN}\ \text{(of converter)}} = \frac{147{,}6\ \text{A}}{110\text{A}} = 1{,}34$$ f006

$$\frac{\text{Overload time}}{\text{Pause time + Overload time}} = \frac{1\text{s}}{5\text{s} + 1\text{s}} = 0{,}16$$ f007



The calculated operating point is below the corresponding curve for an overload time of 1 s. Therefore the converter is suitable for the application.

If the determined motor operating point is not below the Overload curve of the converter, the calculation should be repeated with the next larger converter size.

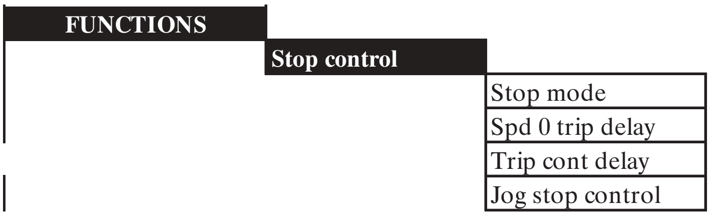
The following two settings are possible:

Full load curr	82 A	or	110 A
Enable overload	Enabled		
Overload current	180 %	or	134 %

Base current	100 %	or	75 %
Overload time	1 s		
Pause time	5 s		

NOTE! The percentages for **Overload current** and **Base current** are referred to **Full load curr** and not to the converter rated current!

6.14.7. Stop control



T0820g

This function is intended to help the system engineer to coordinate the AC input contactor with the drive enabling. According to the selected mode the terminals 75 and 76 drive the ON/OFF of the AC input contactor. Basically, when the drive receives the Start command the Relay 2 closes the AC input contactor, the drive waits for a certain time the AC input voltage, syncronizes itself and starts the motor. When the drive stops , the motor goes to zero speed.

When the zero speed is reached, the drive is disabled only when a “Spd 0 trip” delay is elapsed. Then after the “Trip cont delay” the Relay 2 opens to remove the supply from the drive.

Parameter Description	N.	Value			Standard Configuration
		min	max	factory	
Stop mode (OFF/Stop & Speed 0/ Fast stp & spd 0/ Fst/stp & spd 0)	626	0	3	Stop & Speed 0	* Relay 75/76
Spd 0 trip delay [ms]	627	0	40000	0	-
Trip cont delay [ms]	628	0	40000	0	-
Jog stop control (OFF/ON)	630	0	1	OFF	-

T6250g

* This parameter can be assigned to a programmable analog input

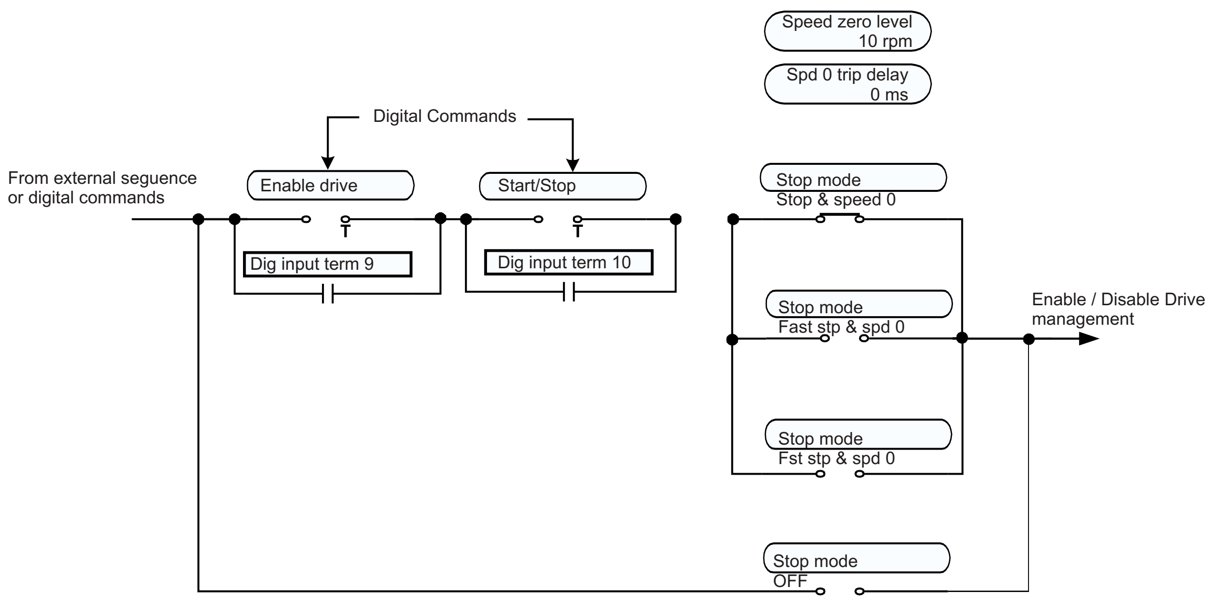


Figure 6.14.7.1: Start and stop management

Stop mode	***OFF***	The function is disabled.
	Stop & Speed 0	The Start command determines the behavior. If the Start command is not present (digital or via terminal strip) and the drive is stopped, the converter is blocked and the contact is open. When the Start command is given, the converter is enabled and the contact is closed. Disabling the Start command and after reaching zero speed, the converter is blocked after a timespan set by **Spd 0 trip delay**. The relay contact between the terminals 75/76 opens after a timespan set by **Trip cont delay**.
	Fast stp & spd 0	The Fast Stop command determines the behavior. If the Fast Stop command is present (digital or via terminal strip; f.e. with 0 V on the terminal 14) and the drive is stopped, the converter is blocked and the contact is open.When the Fast Stop command is disabled (i.e. with 24 V on the terminal 14), The converter is enabled and the contact is closed. Entering the Fast Stop command, when the zero speed has been reached, the converter is blocked after a timespan set with **Spd 0 trip delay**
	Fst / stp & spd 0	The Fast Stop and Start commands determine the behavior. When the Stop or Fast Stop commands are present and the drive is stopped, the converter is blocked and the contact is open. When the Start command is given or when the Fast Stop command is disabled, the converter is blocked and the contact is closed. When the Start command is disabled or when a Fast Stop command is entered and after reaching zero speed, the converter is stopped after a timespan set by **Spd 0 trip delay**. The relay contact between the terminals 75/76 opens after a timespan set by **Trip cont delay**.

Spd 0 trip delay Delay time in ms between reaching zero speed and disenabling of the converter.

Trip cont delay Delay time in ms between disenabling and opening of the contact between the terminals 75 and 76.

Jog stop control	OFF	The behavior selected by **Stop mode** has no influence on the Jog function.
	ON	The behavior selected by **Stop mode** is active also on the Jog function.

The mentioned “contact” can be either the one between the terminals 75/76 or a digital output (option TBO). In both cases during the display of the message the “**Stop control**” parameter must be selected. The function is factory set on the relay contact. The open contact, mentioned in the description, corresponds to 0 V on the digital output, while the closed contact corresponds to +24 V on the digital output.

NOTE! At all the described possiblilities for **Stop mode**, the stop signal on the terminal 13 must be present. With **Main commands** = Digital, it is necessary to select **Enable drive** parameter = Enabled via keypad or Bus.

6.14.8. Brake control

FUNCTIONS
- **Brake control**
  - Enable ramp in=0
  - Closing speed
  - Opening delay
  - Actuator delay

T 1820i

Parameter Description	N.	Value			Standard Configuration
		min	max	factory	
Enable ramp in=0 Enabled/Disabled	1265	0	1	Disabled	-
Closing speed	1262	0	200	30	-
Opening delay [s]	1263	0	30000	0	-
Actuator delay [s]	1266	0	30000	0	-

T 6350g

This function is aimed at handling an external mechanical brake according to the sequences indicated in the "State machine" as per following figure.

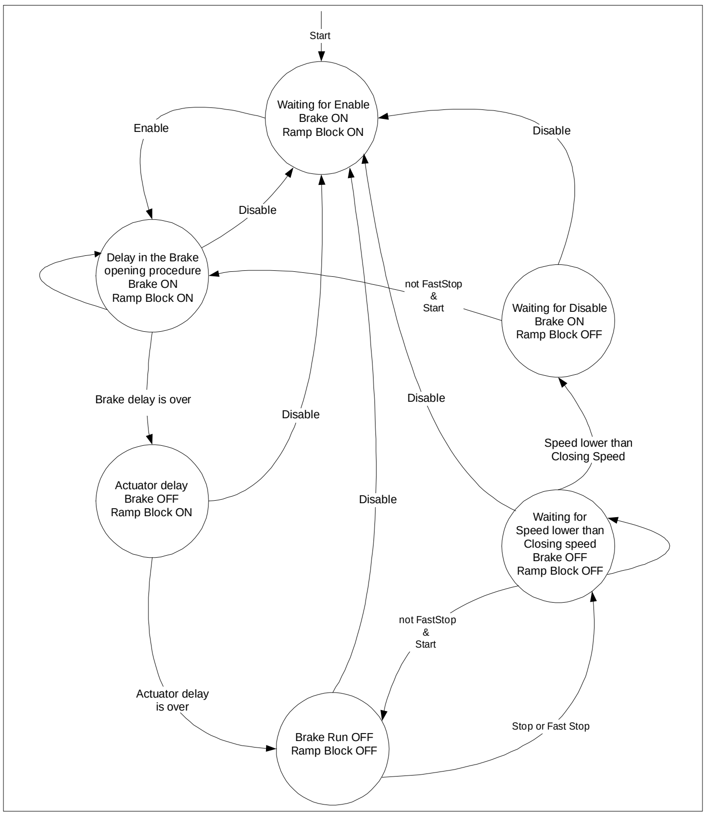


Figure 6.14.8.1: State machine, brake output management

Enable ramp in=0 It enables the zero setting of the ramp input performed by the state machine.

Closing speed Motor speed at which the brake is closed.

Opening delay Opening delay of the brake with respect to the Drive enabling, expressed in [s].

Actuator delay Actuator delay in releasing the load, expressed in [s].

6.14.9. Current limitation according to the speed (I/n curve)

FUNCTIONS
- **I/n curve**
  - I/n curve
  - I/n lim 0
  - I/n lim 1
  - I/n lim 2
  - I/n lim 3
  - I/n lim 4
  - I/n speed

T0821g

This function allows the changing of the current limits “**In use Tcur lim + / -**“ according to the motor speed, through a curve composed by six setpoints; the parameters that allow to define the curve are “**I/n speed**” and “**I/n lim 0-1-2-3-4**”.

The parameter “**I/n speed**” defines the speed range, in which the current limits are kept at the value of “**I/n lim 0**”; while the speed range included between “**I/n speed**” and the 100% of the max. speed will be divided internally in four equal segments, at whose ends there are associated the restant current limits “**I/n lim 1-2-3-4**”.

The set values must be decreasing , starting from “**I/n lim 0**” up to “**I/n lim 4**”.

Parameter description	N.	Value			Standard Configuration
		min	max	factory	
I/n curve (Disabled/Enabled)	750	0	1	0	-
I/n lim 0 [%]	751	0	200	0	-
I/n lim1 [%]	752	0	200	0	-
I/n lim 2 [%]	753	0	200	0	-
I/n lim 3 [%]	754	0	200	0	-
I/n lim 4 [%]	755	0	200	0	-
I/n speed [rpm]	756	0	P 162	0	-

T6251g

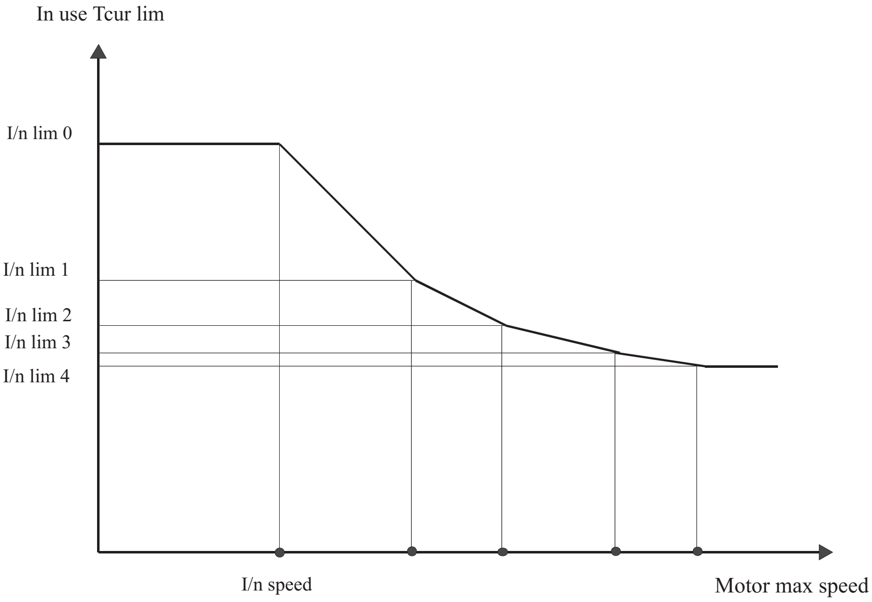


Figure 6.14.9.1: Current limitation according to the speed

"I/n curve"	Enabled	Limits current /speed curve enabled
	Disabled	Limits current /speed curve disabled

"I/n lim 0" Current limit of the I/n curve that operates constantly up to the speed set through the parameter "**I/n speed**".

"I/n lim 1" First current limit which states the construction of the curve I/n.

"I/n lim 2" Second current limit which states the I/n curve construction.

"I/n lim 3" Third current limit which states the I/n curve construction.

"I/n lim 4" Fourth current limit which states the I/n curve construction.

"I/n speed" Threshold speed further than it starts the torque reduction.

6.15. SPEC FUNCTIONS

6.15.1. Test generator

SPEC FUNCTIONS
- **Test generator**
  - Gen access
  - Gen frequency
  - Gen amplitute
  - Gen offset

T0830g

The test generator of the TPD32 converter is used to manual tune the regulators. It consists of a square wave generator whose frequency, offset and amplitude can be set.

Parameter Description	N.	Value			Standard Configuration
		min	max	factory	
Gen access Not connected Tcurrent ref Flux ref Ramp ref Speed ref	58	0	5	Not connected (0)	
Gen frequency [Hz]	59	0.1	62,5	0.1	
Gen amplitude [%]	60	0,00	200,00	0,00	
Gen offset [%]	61	-200.00	+200.00	0,00	

T6255g

The output signal of the "Test Generator" can be set on a programmable analog output.

Gen access Different parameters can be simulated by the test generator. The parameter concerned then has the value of the generator output.

Gen frequency Output frequency of the generator in Hz.

Gen amplitude Amplitude of the square-wave signal produced by the generator in percent.

Generator offset Offset of the generator in percent.

The generator output consists of the addition of **Gen amplitude** and **Generator offset**.

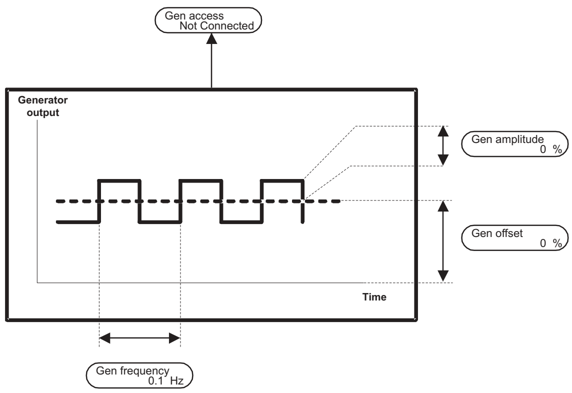


Figure 6.15.1.1: Test generator output

6.15.2. Saving parameters, loading default factory settings, life time

SPEC FUNCTIONS	
	Save parameters
	Load default
	Life time

T0840g

Parameter Description	N.	Value			Standard Configuration
		min	max	factory	
Save parameters	256	-	-	-	-
Load default	258	-	-	-	-
Life time [h.min]	235	0.00	65535.00	-	-

T6260g

Save parameters Saving of parameters that are currently set. This command can also be given from keypad, wehn “Bus” through the **Control mode** parameter, has been selected.

Load default Loading of the default settings (“Factory” column in the parameter table).

Life time Shows the operating time of the converter. This parameter counts the time in which the converter is powered on (even if disabled).

Default values for individual parameters are factory set in the device. These values are shown in the “Factory” column of the individual parameter tables.

In order to obtain the values specific to your application when the device is switched on, they must be saved via the Save parameters command after being set.

The factory default values can be re-loaded by selecting **Load default**. If these are not saved, the application specific drive settings will still be available the next time the drive is switched on.

When the device is switched on the saved parameter set is loaded.

NOTE! The **Tacho scale** and **Speed offset** parameters are used for the fine scaling of the speed feedback circuit. When the factory set parameters are loaded (**Load Default**) these two parameters do not change, so that a new scaling is not required!

6.15.3. Failure Register

SPEC FUNCTIONS	
	Failure register
	Failure reset
	Failure reg del

T0850g

Parameter Description	N.	Value			Standard Configuration
		min	max	factory	
Failure register	320	-	-	-	-
Failure reset	262	-	-	-	-
Failure reg del	263	-	-	-	-

T6265g

Failure register The Failure register contains the last 10 failures that have occurred. It also contains information about the time the failure occurred, based on the operating hours (**Life time**), as well as information on the type of failure. This information can be accessed by pressing the ENTER key on the keypad when a failure is indicated. If several failures occur in sequence, all the failures are stored in the failure register until a failure occurs that causes the disconnection of the drive (Latch = ON, see Programmable alarms).The content of the failure register can also be read out via the bus or the serial interface.

Failure reset Acknowledgement of a failure. The failure reset can be initiated by pressing the CANCEL key when the failure is shown in the display of the keypad. If, however, several failures occur in sequence, these can only be reset by selecting **Failure reset** command through the ENT key.

Failure reg del Clearing the failure register.

6.15.4. Signal adaptation (Link1 ...(Link6)

The Link1 and Link 2 functions are two control section operating independently of each other for the signal adaptation.

With the Links, parameters can be:
- rectified
- limited
- multiplied by a factor
- divided by a factor
- provided with an offset.

- **SPEC FUNCTIONS**
  - **Links**
    - **Link 1**
      - Source
      - Destination
      - Mul gain
      - Div gain
      - Input max
      - Input min
      - Input offset
      - Output offset
      - Inp absolute
    - **Link 2 ... 6**
      - Source
      - Destination
      - Mul gain
      - Div gain
      - Input max
      - Input min
      - Input offset
      - Output offset
      - Inp absolute

T0860i

Parameter description	*link 1* No.	*link 2* No.	*link 3* No.	*link 4* No.	*link 5* No.	*link 6* No.	Value min	Value max	Value factory	Standard configuration
Source	484	553	1218	1227	1236	1245	0	65535	0	—
Destination	485	554	1219	1228	1237	1246	0	65535	0	—
Mul gain	486	555	1220	1229	1238	1247	-10000	+10000	1	—
Div gain	487	556	1221	1230	1239	1248	-10000	+10000	1	—
Input max	488	557	1222	1231	1240	1249	-2^{31}	$+2^{31}-1$	0	—
Input min	489	558	1223	1232	1241	1250	-2^{31}	$+2^{31}-1$	0	—
Input offset	490	559	1224	1233	1242	1251	-2^{31}	$+2^{31}-1$	0	—
Output offset	491	560	1225	1234	1243	1252	-2^{31}	$+2^{31}-1$	0	—
Inp absolute (ON/OFF)	492	561	1226	1235	1244	1253	0	1	OFF	—

T6270g

Source Parameter number used as an input quantity. The value 2000H (= decimal 8192) must be added to the parameter number in order to obtain the index. For example write 8234 (8192 + 42) for the **Speed ref 1** parameter. Select the parameter number in the individual descriptions or in the list of all parameters in section 10, “Parameter list”.

Destination Parameter number, which determines the output quantity. The value 2000H (=decimal 8192) must be added to the parameter number in order to obtain the index. For example write 8231 (8192 + 39) for the **T current ref 1** parameter. Select the parameter number in the individual description column or in the list of all parameters in the in section 10, “Parameter list”.

Mul gain Multiplicative factor of the input quantity (after a possible limitation). Resolution: 5 digits.

Div gain Divisor, through which it is possible to divide the input quantity already multiplied and limited. Resolution: 5 digits.

Input max Max. limit of the input quantity. Resolution: 5 digits.

Input min Min. limit of the input quantity. Resolution: 5 digits.

Input offset Offset to be added to the input quantity. Resolution: 5 digits.

Output offset Offset to be added to the output quantity. Resolution: 5 digits.

Inp absolute The input behavior can be determined with this parameter.

OFF The input quantity is processed with its sign.

ON The input quantity is processed with a positive sign (absolute value). It is possible to have a polarity change with the signs of **Mul gain** or **Div gain**.

The Links are executed with an approximate cycle time of 20 ms. They are not mainly intended to be used for regulation but to access or connect parameters otherwise not accessible. The use of Links according to the parameter chosen as a destination involves a CPU overhead that can slow down the keypad/display operation. Check that the functionality corresponds to the needs before plant-wide implementation.

NOTE! The following parameters cannot be used as a destination of a Link:
- All parameters with only “R” access code
- All parameters with only “Z” access code
- All parameters with only “C” access code
- All the following

Parameters not allowed as link Destination

19	S shape t const	474	Field loss - Restart time	665	S acc t const 0
55	Control word	475	Field loss - Hold off time	666	S dec t const 0
72	Scale input 1	480	Speed fbk loss - Hold off time	667	S acc t const 1
73	Tune value inp 1	482	Overvoltage - Hold off time	668	S dec t const 1
77	Scale input 2	483	Overvoltage - Restart time	669	S acc t const 2
78	Tune value inp 2	484	Link1 - Source	670	S dec t const 2
82	Scale input 3	485	Link1 - Destination	671	S acc t const 3
85	Pword1	501	External fault - Restart time	672	S dec t const 3
83	Tune value inp 3	502	External fault - Hold off time	776	PI central V1
86	Password2	553	Link2 - Source	785	PI bottom lim
318	Overload mode	554	Link2 - Destination	786	PID source
408	Ser answer delay	562	Tacho scale	792	Input 1 filter
425	Enable OPT2	585	Overcurrent - Restart time	1012	Inertia c filter
444	Prop. Filter	586	Overcurrent - Hold off time	1013	Torque const
453	Arm resistance	636	Bus loss - Hold off time	1014	Inertia
454	Arm inductance	637	Bus loss - Restart time	1015	Friction
456	Flux weak speed	649	Refresh enc 1	1042	Input 1 compare
467	Flux current max	652	Refresh enc 2	1043	Input 1 cp error
468	Flux current min	663	S acc t const	1044	Input 1 cp delay
470	Undervoltage - Hold off time	664	S dec t con		

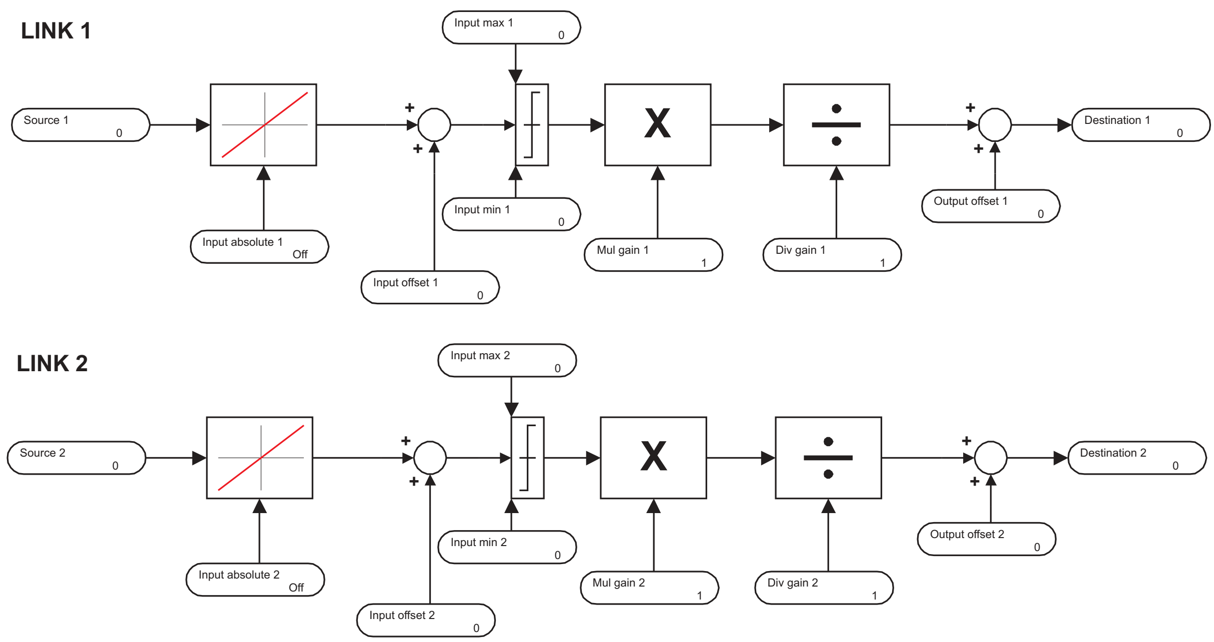


Figure 6.15.4.1: Structure of the signal adaptation

6.15.5. Pads

The pads are used for the data exchange among the several components of a Bus system. They can be compared to the variables of a PLC. The figure 6.15.5.1 shows the overall structure of the system. With the help of pads it is possible for example to send information from a field Bus to an option card. All the pads can be written and read. See the several access possibilities in section 10, “Parameter lists”.

- **SPEC FUNCTIONS**
  - **Pad parameters**
    - Pad 0
    - Pad 1
    - Pad 2
    - Pad 3
    - Pad 4
    - Pad 5
    - Pad 6
    - Pad 7
    - Pad 8
    - Pad 9
    - Pad 10
    - Pad 11
    - Pad 12
    - Pad 13
    - Pad 14
    - Pad 15
    - Bitword pad A
    - Bitword pad B

T0870g

Parameter Description	N.	Value			Standard Configuration
		min	max	factory	
Pad 0	503	-32768	+32767	0	*, **
Pad 1	504	-32768	+32767	0	*, **
Pad 2	505	-32768	+32767	0	*
Pad 3	506	-32768	+32767	0	*
Pad 4	507	-32768	+32767	0	**
Pad 5	508	-32768	+32767	0	**
Pad 6	509	-32768	+32767	0	**
Pad 7	510	-32768	+32767	0	-
Pad 8	511	-32768	+32767	0	-
Pad 9	512	-32768	+32767	0	-
Pad 10	513	-32768	+32767	0	-
Pad 11	514	-32768	+32767	0	-
Pad 12	515	-32768	+32767	0	-
Pad 13	516	-32768	+32767	0	-
Pad 14	517	-32768	+32767	0	-
Pad 15	518	-32768	+32767	0	-
Bitword Pad A	519	0	65535	0	***, ****
Pad A bit 0	520	0	1	0	***, ****
Pad A bit 1	521	0	1	0	***, ****
Pad A bit 2	522	0	1	0	***, ****
Pad A bit 3	523	0	1	0	***, ****
Pad A bit 4	524	0	1	0	***, ****
Pad A bit 5	525	0	1	0	***, ****
Pad A bit 6	526	0	1	0	***, ****
Pad A bit 7	527	0	1	0	***, ****
Pad A bit 8	528	0	1	0	
Pad A bit 9	529	0	1	0	
Pad A bit 10	530	0	1	0	
Pad A bit 11	531	0	1	0	
Pad A bit 12	532	0	1	0	
Pad A bit 13	533	0	1	0	
Pad A bit 14	534	0	1	0	*****
Pad A bit 15	535	0	1	0	
Bitword pad B	536	0	65535	0	****
Pad B bit 0	537	0	1	0	****
Pad B bit 1	538	0	1	0	****
Pad B bit 2	539	0	1	0	****
Pad B bit 3	540	0	1	0	****
Pad B bit 4	541	0	1	0	****
Pad B bit 5	542	0	1	0	****
Pad B bit 6	543	0	1	0	****
Pad B bit 7	544	0	1	0	****
Pad B bit 8	545	0	1	0	
Pad B bit 9	546	0	1	0	
Pad B bit 10	547	0	1	0	
Pad B bit 11	548	0	1	0	
Pad B bit 12	549	0	1	0	
Pad B bit 13	550	0	1	0	
Pad B bit 14	551	0	1	0	*****
Pad B bit 15	552	0	1	0	

T6275g

* These parameters can be set on a programmable analog input

** These parameters can be set on a programmable analog ouput

*** These parameters can be set on a programmable digital input

**** These parameters can be set on a programmable digital output

***** These parameters can be set on Relay 2

Pad 0...15 General variables, 16 Bit. The Pads 0...3 can be set via analog inputs. The values of the Pads 0, 1, 4 , 5 and 6 can be set on analog outputs.

Bitword pad A (B) Bitmap of the parameters **Pad A (B)** bit 0 up to Pad **A (B) bit 15**. With a parameter it is possible to read or write all the Bits inside a Word.

Example:

Pad A bit 0	0		
Pad A bit 1	1	$= 2^1$	=2
Pad A bit 2	0		
Pad A bit 3	0		
Pad A bit 4	0		
Pad A bit 5	1	$= 2^5$	= 32
Pad A bit 6	1	$= 2^6$	= 64
Pad A bit 7	0		
Pad A bit 8	0		
Pad A bit 9	0		
Pad A bit 10	1	$= 2^{10}$	= 1024
Pad A bit 11	0		
Pad A bit 12	1	$= 2^{12}$	= 4096
Pad A bit 13	0		
Pad A bit 14	0		
Pad A bit 15	0		

Bitword pad A = 2 + 32 + 64 + 1024 + 4096 = 5218

Pad A (B) bit 0...15 Bit variables. The single Bits can be read or written. With the **Bitword pad A (B)** it is possible to process a Word. See the example. From the Pad A it is possible to read the Bits 0.....7 of a digital input. On a digital output it is possible to write all the Bits.

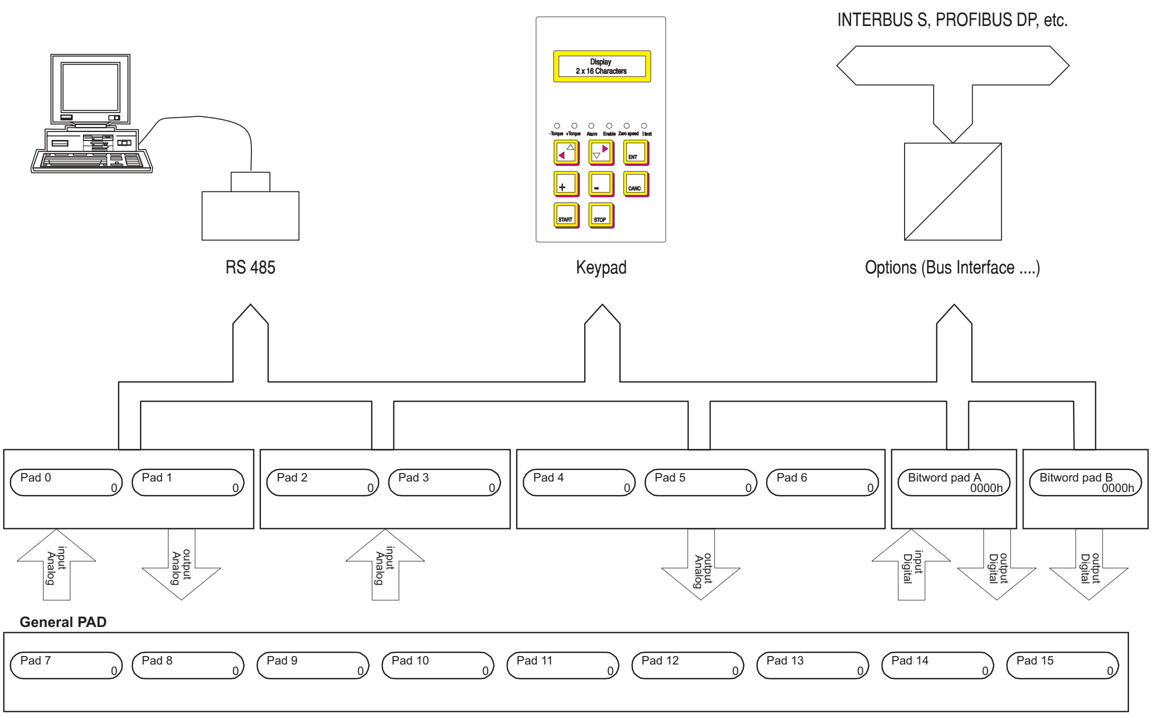


Figure 6.15.5.1: Bus pads

6.16. OPTIONS

6.16.1. Option 1

T0871g

Interface menu between the field bus card and drive.

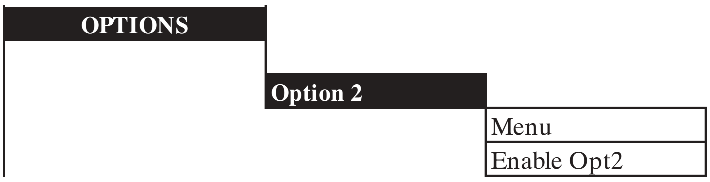
Through this menu it can be carried out the assignement of the drive parameters to the virtual digital I/O (menu MONITOR\Virtual digital Inp-Out) and to the process data channels (PDC) of the field bus .

If the bus card is not present you will be prompted by the message **OPT1 not present**.

If the bus card used is not up-to-dated for this management, you will be prompted by the message **OPT1 old version**.

For more detailed information, refer to the instruction manual of the bus interface board.

6.16.2. Option 2



T0880g

Parameter Description	N.	Value			Standard Configuration
		min	max	factory	
Menu					
Enable OPT2	425	0	1	Disabled	

T6277g

This menu allows the user access to the parameter set of the OPT2 option card.

Menu The menu is active only if the OPT2 card is present (e.g. a DGFC card).

If the user tries to enter in the Option 2 menu and the card is not mounted on the device the message “Not present” is displayed.

For further and detailed information see the instruction book of the optional board.

Enable OPT2

Enabled — When the converter is switched on, the presence of the DGFC card is checked. If the card is present, the “Menu” parameters are started and the DGFC parameters can be reached.

Disabled — When the converter is switched on, the presence of the DGFC card is not checked. Therefore, the option parameters are not taken into consideration even though the card is present.

Default configuration = Disabled.

To change the configuration:

1 - Set the new value of **Enable OPT2** parameter

2 - Store via the **Save parameters** (BASIC MENU)

3 - Switch-off and switch-on the drive

The change in the value of **Enable OPT2** takes effect only after the drive has been switched off and on again.

If this parameter is configurated as Enabled and the card DGFC is not present, the following failure will automatically occur:

OPT2 failure code 100-98 o 100-96.

NOTE! When using the Option 2 card, all parameters listed in the “Opt2-A/PDC” column of Parameter List (section 10.1 and 10.2) can be accessed through the automatic asynchronous communication. Parameters listed in the High Priority Parameter List (section 10.4) can be accessed by means of the automatic synchronous communication. (See options card manual for more details.)

6.16.3. PID Function

- **OPTIONS**
  - **PID**
    - Enable PI PID
    - Enable PD PID
    - **PID source**
      - PID source
      - PID source gain
    - Feed-fwd PID
    - **PID references**
      - PID error
      - Act tension ref
      - PID feed-back
      - PID offs. sel
      - PID offset 0
      - PID offset 1
      - PID acc time
      - PID dec time
      - PID error gain
      - PID clamp
    - **PI controls**
      - PI P gain PID
      - PI I gain PID
      - PI steady thr
      - PI steady delay
      - P init gain PID
      - I init gain PID
      - PI central v sel
      - PI central v 1
      - PI central v 2
      - PI central v 3
      - PI top lim
      - PI bottom lim
      - PI integr freeze
    - PI output PID
    - Real FF PID
    - **PD controls**
      - PD P gain 1 PID
      - PD D gain 1 PID
      - PD P gain 2 PID
      - PD D gain 2 PID
      - PD P gain 3 PID
      - PD D gain 3 PID
      - PD D filter PID
    - PD output PID
    - PID out.sign PID
    - PID output
    - **PID target**
      - PID target
      - PID out scale
    - **Diameter calc**
      - Diameter calc
      - Positioning spd
      - Max deviation
      - Gear box ratio
      - Dancer constant
      - Minimum diameter

T0881i

6.16.3.1 Generality

The PID function has been developed for general uses which can include on purpose of nip-roll, winders, unwinders, pressure control of pumps and extruders.

A dancer and a load cell can be used as position/tension transducer it is possible to use both.

The inputs (with the exception of those concerning the transducers) and the outputs can be configurated, they can be associated to various converter parameters, i.g. the PID output can be sent either to the speed and to current regulator.

The analog inputs/outputs will be sampled/updated to 2ms.

The digital inputs/outputs will be sampled/updated to 8ms.

NOTE! PID function in the firmware and DGF card are mutually exclusive.

6.16.3.2. Inputs / Outputs

Regulation Inputs/outputs

PID source Sample parameter of Feed-forward normally programmed on analog input.

PID feed-back Analog input of position / tension transducer (dancer/load cell).

Normally PID feed-back must be programmed on the analog input 1 (terminals 1-2), because provided with filter.

PID offset 0 Offset analog input added to **PID feed-back**. It can be used for the adjustement of the dancer position.

PID target Parameter associated to the regulator output, normally it will be programmed on the speed reference of the drive.

PID output Analog output of the regulator. It can be used to carry on a references cascade in the multidrives systems.

PI central v3 PID Initial value setting of the integral component of the regulator (correspondent to initial diameter). It can be programmed on an analog input connected, i.g. to an ultrasonic transducer used for the diameter measure of a winder/unwinder.

Input Command (programmable on digital inputs)

Enable PI PID Enable of the PI part (proportional - integral) of the regulator. Input L –H transition need the automatic acquirement of integral component of power value (correpondent to initial diameter).

Enable PD PID Enable of the PD part (proportional - derivative) of the regulator.

PI integral freeze Freezing of the actual situation of the integral component of the regulator..

PID offset sel Offset selection in addition to **PID feed-back**: L = **PID offset 0**, H = **PID offset 1**.

PI central v S0 Output selector of initial block PI. With **PI central v S1** determined, through binary selection, what between the 4 possible settings of the integral initial level (correspondent to initial diameter) can be used.

PI central v S1 Output selector of initial block PI. With **PI central v S0** determined, through binary selection, what between the 4 possible settings of the integral initial level (correspondent to initial diameter) can be used.

Diameter calc Enable of the calculation.

Diameter calc st Calculation of the ended initial diameter (digital output).

6.16.3.3. Feed - Forward

When used , the feed-forward signal represents the main reference of the regulator. Inside the regulator it will be attenuated or amplified by the PID function and inserted in the output as reference signal for the drive.

PID source	
	PID source
	PID source gain
Feed-fwd PID	

T0882g

Parameter	N.	Value			Standard configuration
		min	max	default	
PID source	786	0	65535	0	
PID source gain	787	-100,000	100,000	0	
Feed-fw PID	758	-Max PID inp	+Max PID inp	0	*

T6390g

* This parameter can be set on an analog programmable input.

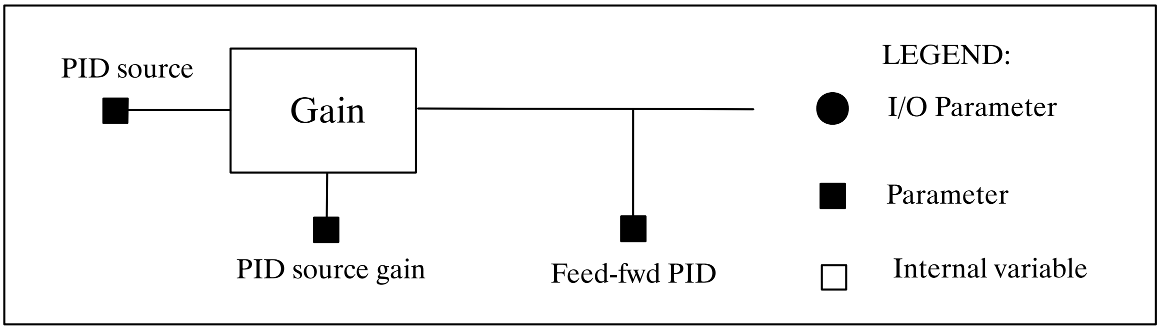


Figure 6.16.3.1: Feed-forward block description

PID source Address of the parameter (Feed-forward value) which contains the value which will be used as PID source.

Number +2000H (8192 decimal) must be added to the parameter.

PID source gain Multiplier factor of the input value to PID source.

Feed-fwd PID Value of feed-forward

Through the parameter **PID source** it is possible to select in which point of the drive one wishes to read the feed-forward signal; the selctable parameters are those indicated in the paragraph 10.4. "*List of the high-priority parameters*", the measure units are those indicated in the notes at the end of this paragraph.

1. Programming example of the ramp output block (Parameter Ramp out) on PID source:

Menu' OPTION
————> PID
————> PID source
————> PID source = 8305

On **PID source** it must be set the parameter number which has to be associated, choosing it from paragraph 10.4. "List of high-priority parameters' (**Ramp out** has the decimal number 113).

To obtain the value must be added the decimal value 8192 (fixed offset):

8192 + 113 = 8305.

If you need to set the feed-forward on analog input, given that they are not directly inserted in the 'high-priority parameters', it is necessary to pass through a **PAD 0.....PAD 15** support parameters.

2. Programming example of the analog input 2 on PID source:

a) Input programming on a PAD parameter
Menu I/O CONFIG
————> Analog input
————> Analog input 2
————> Select input 2 = PAD 0

b) Setting of the **PAD 0** as feed-forward input:
Menu OPTION
————> PID
————> PID source
————> PID source = 8695

On **PID source** it must be set the parameter number which has to be associated, choosing it from paragraph 10.4 “List of high-priority parameters’ (**PAD 0** has the decimal number 503).

To obtain the value must be added the decimal value 8192 (fixed offset):

8192 + 503 = 8695.

The full-scale of the feed-forward is limited to the value +/- 10000, which depends on the parameter set on **PID source**. It will be necessary the calibration through **PID gain source**.

The measure units are those indicated in the notes at the end of the paragraph 10.4. “*List of the high-priority parameters*”.

The feed-forward value can be read through parameter **Feed-fwd PID** via keypad or serial line.

Referring to the above mentioned examples

1. Programming example of the ramp output block (**Parameter Ramp out**) on **PID source**:

Speeds will be converted inside the drive into RPM x 4.

The ramp input references take as maximum set value what set in **Speed base value**.

Feed - fwd PID = Speed base value x 4 x PID source gain

If, with max. ramp reference and **Speed base value** = 3000rpm, to have

Feed - fwd PID = 10000, it is necessary to set:

PID source gain = 10000 / (3000 x 4) = 0,833

2. Programming for example analog input 2 on **PID source**:

When an analog input will be set on a **PAD** parameter, this will have a max. value of + / - 2047.

With max. analog reference, for having **Feed - fwd PID** = 10000, it is necessary to set:

PID source gain = 10000 / 2047 = 4,885.

NOTE! Using the regulator as “generic PID” without the feed -forward function, **Feed - fwd PID** must be at its max. value.

To do this it is necessary to set **PID source** on a **PAD** parameter and programming this one = 10000

6.16.3.4. PID function

The PID function is divided in three blocks:
- Feed-back input "**PID reference**"
- Proportional-integral control block "**PI controls**"
- Proportional-derivative control block "**PD controls**"

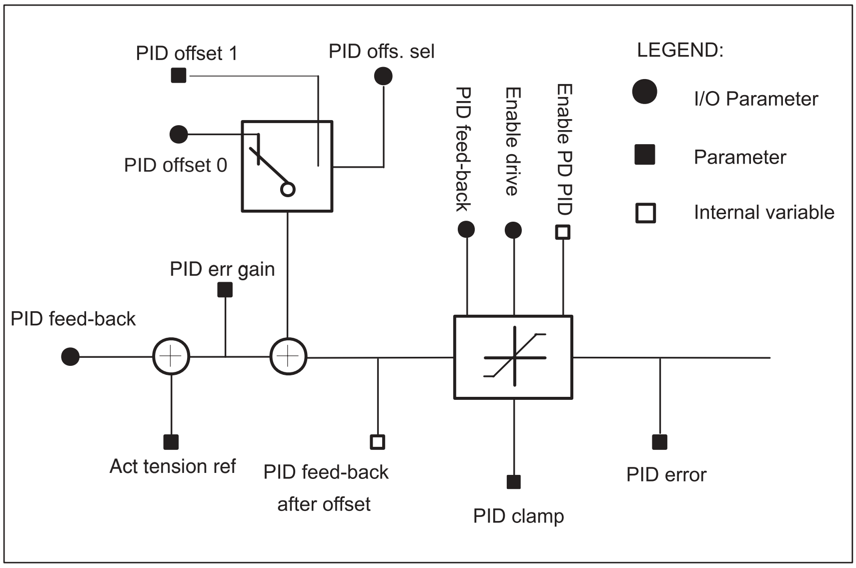


Figure 6.16.3.2: PID blocks description

PID references	
	PID error
	Act tension ref
	PID feed-back
	PID offs. Sel
	PID offset 0
	PID offset 1
	Pid err gain
	PID clamp

T0883i

Parameter description	No.	Value			Standard configuration
		min	max	factory	
PID error	759	-10000	+10000	0	
Act tension ref	1194	0.00	200.00	0	
PID feed back	763	-10000	+10000	0	**
PID offs. Sel	762	0	1	0	*
PID offset 0	760	-10000	+10000	0	**
PID offset 1	761	-10000	+10000	0	
PID acc time	1046	0.0	900.0	0.0	
PID dec time	1047	0.0	900.0	0.0	
PID err gain	1254	0.00	8.00	1	
PID clamp	757	-10000	+10000	10000	

T6279i

* This function can be set on a digital programmable input

** This parameter can be set on an analog programmable input

PID error	Error reading in the input of the function PID (**PID clamp** block output).
Act tension ref	Monitor of the % tension reference less the Taper percentage set via **Tension red**; if the Taper function is not enabled, it corresponds to **Tension ref**.
PID feed-back	Reading of feed-back value from the transducer position (dancer) or tension (load cell).
PID offs. sel	Offset selector added to **PID feed-back**. This parameter can be set on a digital programmable input. 0 = **PID offset 0** 1 = **PID offset 1**
PID offset 0	Offset 0 added to **PID feed-back**. This parameter can be set on analog input , i.g. for the tension setting when a load cell has to be used as feed-back.
PID offset 1	Offset 1 added to **PID feed-back**.
PID acc time	Ramp acceleration time in sec. after the block **PID offset**.
PID dec time	Ramp deceleration time in sec. after the block **PID offset**.
PID err gain	Gain percentage of **PID error**
PID clamp	The clamper allows a smooth tension setting of a controlled system winder/ unwinder, when cannot be used the "Function for the calculation of the initial diameter". When enabling the drive, the dancer is at its lower full scale, being **PID error** at its maximum value, the motor could have a too fast acceleration for setting the dancer in its central position of work. Setting **PID clamp** at a value sufficiently low E.g = 1000, enabling the drive and enabling the **Enable PD PID**, the value of **PID error** is limited at 1000 till when the signal coming from the dancer (**PID feed-back**) does not go down this value. Now **PID clamp** is automatically take back at its maximum value corresponding to 10000. The clamper is kept at 10000 till the next disabling of the drive or of **Enable PD PID**.

The feed - back input is provided for the analog transducers connection like dancer, with relative potentiometer or load cell. Neverthless it is possible to use this input block as comparison point between two whatever analog signals + / - 10V.

Connection to a dancer with potentiometer connected between - 10 e + 10V.

The cursor of the potentiometer can be connected to one of the analog inputs of the drive. Normally it should be used the analog input 1 (terminals 1 and 2) because it is provided with filter.

The input choosen for that connection must be programmed in the menu I/O CONFIG as **PID feed - back**, its value can be read in the **PID feed - back** parameter in the **PID REFERENCE** submenu.

Through **PID offset 1** (or PID offset 0) it is possible to carry on the adjustement of the dancer position.

Connection to a load cell with full range + 10V.

The output of the load cell can be connected to one of the drive analog input. Normally the analog input 1 (terminals 1 and 2) should be used because provided with filter.

The input choosen for that connection must be programmed in the menu I/O CONFIG as **PID feed - back**, its value can be read in the **PID feed - back** parameter of the **PID REFERENCE** submenu.

The tension setting can be sent, with value 0...-10V, to one of the restant programmable analog inputs in the **I/O CONFIG** menu as **PID offset 0**.

6.16.3.5. Proportional - integral block

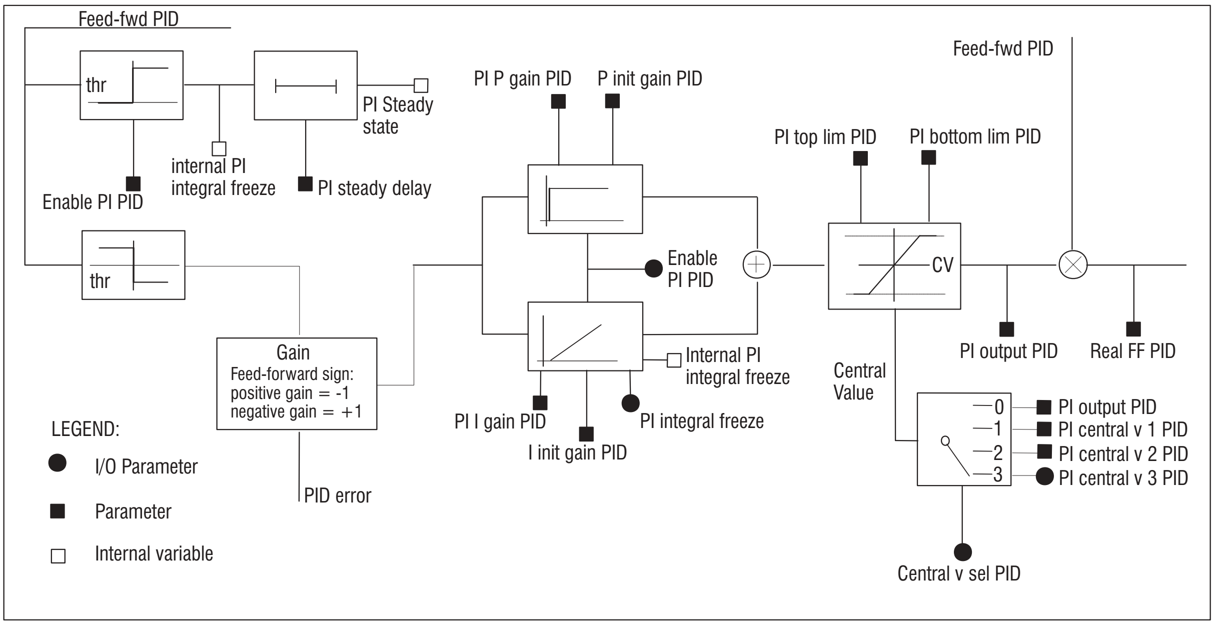


Figure 6.16.3.3: PI block description

The PI block receives in its input the **PID error** parameter, which represents the error that must be elaborated by the regulator. The PI block carries on a proportional-integral regulation, its output **PI output PID** after having been appropriately adapted, according to the system which has to control, it will be used as multiplier factor of the feed-forward (**Feed-fwd PID**) obtaining the correct value of the speed reference for the drive (**Real FF PID**).

The PI block will be enabled setting **Enable PI PID** = Enable. If **Enable PI PID** has been programmed on a digital input, this must be brought at a high logical level (+24V).

PID
Enable PI PID
T0931g

Parameter	N.	Value			Standard configuration
		min	max	default	
Menu					
Enable PI PID	769	0	1	Disabled	*

T6392g

* This function can be set on a digital programmable input

Enable PI PID Enabled Enable of the proportional-integral block
Disabled Disabling of the proportional-integral block.

PI controls	
	PI P gain PID
	PI I gain PID
	PI steady thr
	PI steady delay
	P init gain PID
	I init gain PID
	PI central v sel
	PI central v 1
	PI central v 2
	PI central v 3
	PI top lim
	PI bottom lim
	PI integral freeze
PI output PID	
Real FF PID	

T0884g

Parameter description	No.	Value			Standard configuration
		min	max	default	
PI P gain PID	765	0.00	100.00	10.00	
PI I gain PID	764	0.00	100.00	10.00	
PI steady thr	695	0	10000	0	
PI steady delay	731	0	60000	0	
P init gain PID	793	0.00	100.00	10.00	
I init gain PID	734	0.00	100.00	10.00	
PI central v sel	779	0	3	1	*
PI central v 1	776	PI bottom lim	PI top lim	1.00	
PI central v 2	777	PI bottom lim	PI top lim	1.00	
PI central v 3	778	PI bottom lim	PI top lim	1.00	**
PI top limit	784	PI bottom lim	10.00	10.00	
PI bottom limit	785	-10.00	PI top lim	0.00	
PI integral freeze	783	0	1	0	*
PI output PID	771	0	1000 x PI top lim	0.00	
Real FF PID	418	-10000	+10000	0	

T6393g

* This function can be set on a digital programmable input

** This parameter can be set on an analog programmable input

PI P gain PID Proportional gain of PI block

PI I gain PID Integral gain of PI block

PI steady thr Threshold feed-forward survey. If **Feed-fwd PID** is less than **PI steady thr** the integral regulation will be frozen, the proportional gain assumes the value set in **P init gain PID**.

When **Feed-fwd PID** overcomes the threshold, the integral regulation with the gain set in **I init gain PID** will be enabled. The PI block will mantain the gains **P init gain PID** and **I init gain PID** for the time preset through **PI steady delay**; once elapsed this delay, they will be brought automatically to **PI P gain PID** and **PI I gain PID**.

PI steady delay Time for which the gains **P init gain PID** and **I init gain PID** have been kept operative after the overcoming of feed-forward **PI steady thr** threshold.

The delay time **PI steady delay** and the consequentely function of initial gains changing, is operative also on the transition L - H of the **Enable PI PID** parameter.

P init gain PID Initial proportional gain. **P init gain PID** is operative when feed-forward is less than **PI steady thr** and at its overcoming, for the time set in **PI steady delay** or on the transition L - H of **Enable PI PID** for the same time.

I init gain PID Initial integral gain. **I init gain PID** is operative after that the threshold **PI steady thr** had been overcome or on the transition L - H of **Enable PI PID** for the time set in **PI steady delay**.

PI central v sel Output selector of the starting PI block. **PI central v sel** (0...3) fixes which between the 4 possible settings of the initial value of the regulator integral component (correspondent to initial diameter) has to be used .

PI central v sel can be set directly from keypad, serial line or through two digital inputs set respectively as **PI central v S0 e PI central v S1**.

Selecting **PI central v sel = 0**, when PI block is disabled (**Enable PI PID** = Disable), is stored the last value of the integral component calculated (correspondent to swift diameter). This value is what displayed in **PI output PID**. When enabled again the regulation restarts again from that value. The same functionality has been forseen also in case of switching off of the drive . This kind of operation can be used when controlling a winder , it is necessary , for any pourpose, let the machine stopped and disabled the drives or even remove AC incoming power from the electrical cabinet.

Selecting **PI central v sel** = 1-2-3, when PI block has been disabled, the value of **PI output PID** will be set at what programmed in the correspondent parameter (x1000). When the drive is restarted after a switching off, the precalculated value will be automatically set only if when powering up the drive, the digital input programmed as **Enable PI PID** is already set at a high level.

PI central v 1 Setting of the first initial value of the regulator's integral component (correspondent to initial diameter 1). The **PI central v 1** value must be included in the limits set in **PI top lim PID** e **PI bottom lim PID**.

PI central v 1 will be selected programming as 1 the parameter **PI central v sel**.

PI central v 2 Setting of the second initial value of the regulator's integral component (correspondent to initial diameter 2). The **PI central v 2** value must be included in the limits set in

PI top lim PID e **PI bottom lim PID**.

PI central v 2 will be selected programming as 2 the parameter **PI central v sel**.

PI central v 3 Setting of the third initial value of the regulator's integral component (correspondent to initial diameter 3). The **PI central v 1** value must be included in the limits given by **PI top lim PID** e **PI bottom lim PID**.

PI central v 3 will be selected programming as 3 the parameter **PI central v sel**.

PI top lim It defines the higher limit of the adapting block of the PI correction.

PI bottom lim It defines the lower limit of the adapting block of the PI correction.

The output of the PI block represents the multiplier factor of feed-forward, whose value must be adapted from the regulator in the max. limits included between +10000 and -10000 and defined by **PI top lim** and **PI bottom lim**. The value of these parameters will be defined according to the system that has to be controlled; for a better comprehension please refer to the paragraph “Examples of application”.

PI integral freeze Freezing of the present condition of the regulator integral component.

PI output PID Output of PI block, adapted to the values included between **PI top limit** and **PI bottom limit**. At the switching on of the drive, **PI output PID** acquires automatically the selected value with **PI central v sel** multiplied with 1000.

Example: if **PI central v 2** = 0.5 is selected, at the start **PI output PID** acquires value = 500.

When **Enable PI PID** has been enabled, the output **PI output PID** is able, dipendentely from the input error, to integrate its value up to the limits set with **PI top limit** or **PI bottom limit** multiplied with 1000.

Example: **PI top limit** = 2, **PI output PID** max = 2000.

The PI block output will be further limited from the parameter saturation **Real FF PID** (see correspondent parameter).

As previously described, **PI output PID** is used as multiplier factor of the feed-forward, in order to obtain the angular speed reference of the motor. So in case the PID function is used to control a winder/unwinder system, its value is inversely proportional to the swift diameter.

Windering with a constant peripheral speed it can be valid the following:

$\omega 0\Phi 1 = \omega 1\Phi 1$

where

ω_0 = angular speed at minimum diameter

Φ_0 = minimum diameter

ω_1 = angular speed at actual diameter

Φ_0 = actual diameter

$\omega_1 = \omega_0 \times (\Phi_0/\Phi_1)$

Setting appropriately the drive, $\omega 0$ is equivalent to the maximum value of the feed-forward, then **PI output PID** depends on (Φ_0/Φ_1).

Taking into consideration the internal coefficients of the firmware, it can be written:

PI output PID = (Φ_0/Φ_1) x 1000

This formula can be used to verify the accuracy of the setting when the system is on working or during the procedure for the calculation of the initial diameter.

Real FF PID Represents the feed-forward value which has been recalculated according to the PI correction. It will be calculated with the following formula:

Real FF PID = (**Feed-fwd PID** / 1000) x **PI output PID**

The max. value of **Real FF PID** is +/- 10.000. In case during the working this limit had been reached, in order to avoid dangerous phenomenons of regulator’s saturation, each further increase of **PI output PID** will be blocked.

Example: Feed-fwd = + 8000, the positive limit of PI output PID will be automatically set at

10000 / (8000 / 1000) = 1250.

6.16.3.6. Proportional - Derivative control block

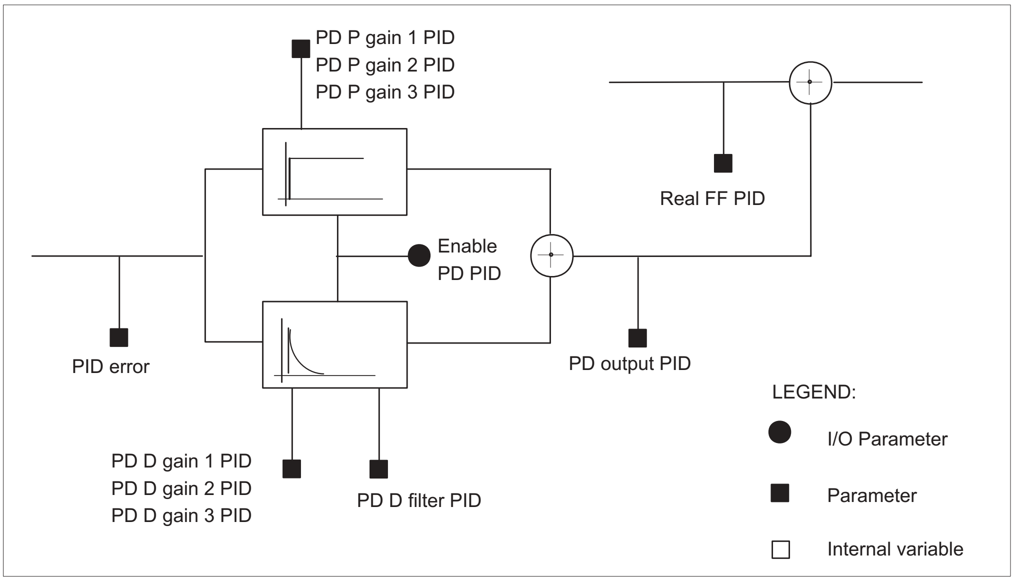


Figure 6.16.3.4: PD block description

The PD block receives the parameter **PID error** at its input, which represents the error that must be elaborated by the regulator. The PD block carries out a proportional-derivative regulation, its output **PD output PID** will be directly added to **Real FF PID**.

The PD block will be enabled setting **Enable PD PID** = Enable. If **Enable PD PID** has been programmed on a digital input, this one must be brought to high logical level.

PID	
	Enable PD PID

T0932g

Parameter	N.	Value			Standard
		min	max	default	configuration
Menu					
Enable PD PID	770	0	1	Disabled	*

T6394g

* This function can be set on a digital programmable input

Enable PD PID — Enabled: Enabling of the block proportional-derivative

Disabled: Disabling of the block proportional-derivative

PD controls	
	PD P gain 1 PID
	PD D gain 1 PID
	PD P gain 2 PID
	PD D gain 2 PID
	PD P gain 3 PID
	PD D gain 3 PID
	PD D filter PID
PD output PID	

T0885g

Parameter	N.	Value			Standard configuration
		min	max	default	
PD P gain 1 PID	768	0.00	100.00	10.00	
PD D gain 1 PID	766	0.00	100.00	10.00	
PD P gain 2 PID	788	0.00	100.00	10.00	
PD D gain 2 PID	789	0.00	100.00	10.00	
PD P gain 3 PID	790	0.00	100.00	10.00	
PD D gain 3 PID	791	0.00	100.00	10.00	
PD D filter PID	767	0	1000	0	
PD output PID	421	-10000	+10000	0	

T6395g

The gains of the block can be kept fixed and programmed in this case through the parameters **PD P gain 1 PID** e **PD I gain 1 PID**, or changed dependentely from the machine parameters through the function Adap spd reg, in this case the gains depend from **PD P gain 1-2-3 PID** e **PD I gain 1-2-3 PID**.

For example, it is possible to modify dynamically the gains of PD block according to the speed, to a regulation parameter internal to the drive or to an analog input proportional to whatever unit related to the machine. The behaviour of the regulator can be so configurated in the best way for the suitable needings.

NOTE: When **Adap Spd reg** has been enabled (paragraph 6.13.2. of the manual), it operates both on the PID function than on the gains of the speed regulator. So it is necessary to program appropriately all relative parameters. If one wishes to modify dynamically only the gains of the speed regulator and keep fixed the gains of the PID function, it is necessary set the three proportional gains and integral gains of the PD block at the same value. The same is valid in case the PID gains have to be dynamically modified and the speed regulator gain must remain fixed.

PD P gain 1 Proportional gain 1 of the block PD (its selection depends on the eventual enabling of the function **Adap Spd reg** and its configuration).

PD D gain 1 Derivative gain 1 of block PD (its selection depends on the eventual enabling of the function **Adap Spd reg** and its configuration).

PD P gain 2 Proportional gain 2 of the block PD (its selection depends on the eventual enabling of the function **Adap Spd reg** and its configuration).

PD D gain 2 Derivative gain 2 of block PD (its selection depends on the eventual enabling of the function **Adap Spd reg** and its configuration).

PD P gain 3 Proportional gain 3 of the block PD (its selection depends on the eventual enabling of the function **Adap Spd reg** and its configuration).

PD D gain 3 Derivative gain 3 of block PD (its selection depends on the eventual enabling of the function **Adap Spd reg** and its configuration).

PD D filter PID Time constant of the filter from the derivative side.

PD output PID PD block output.

6.16.3.7. Output reference

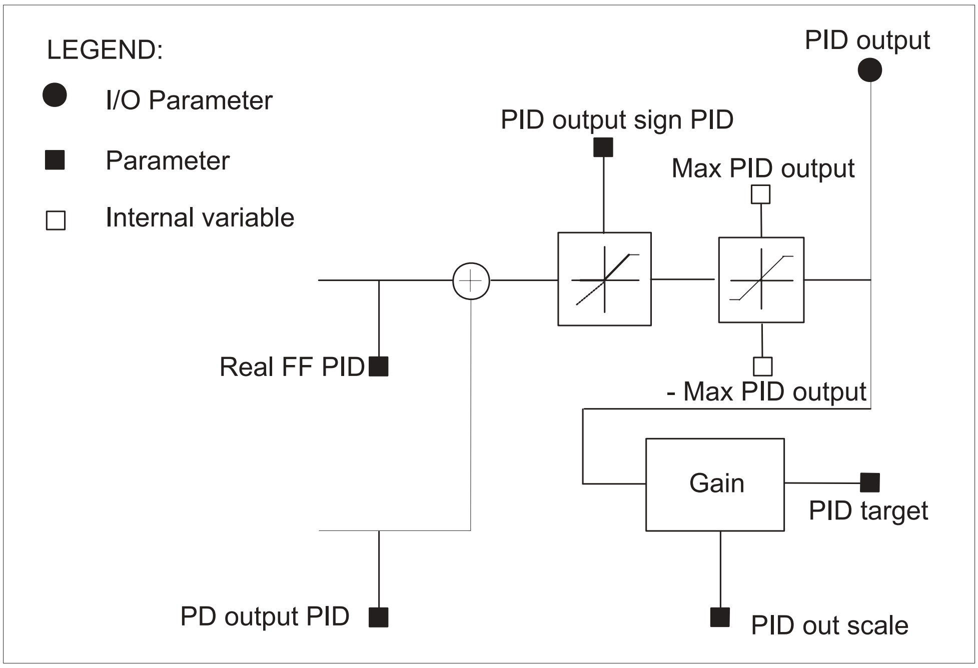


Figure 6.16.3.5: Output reference block description

PD controls
- PID out. Sign PID
- PID output

T0886g

Parameter description	No.	Value			Standard configuration
		min	max	default	
PID output sign PID	772	0	1	1	
PID output	774	-10000	+10000	0	*

T6396g

* This parameter can be set on an analogue programmable output.

PID out. sign PID Through this parameter it is possible to fix whether the output of the regulator had to be bipolar or simply positive (clamp of negative side).

PID output Display of regulator output. It is possible to program this parameter on an analog output, in order to preform a references cascade in multidrive systems.

PD output PID
- PID target
- PID out scale

T0887g

Parameter	N.	Value			Standard configuration
		min	max	default	
PID target	782	0	65535	1	
PID out scale	773	-100.00	+100.00	1.000	

T6397g

PID target Address of the parameter which contains the value which will be used as PID target. To obtain the real settable value it is necessary to add +2000H (8192 decimal) to the parameter number.

PID out scale Matching factor of **PID output**. Its value depends on the parameter on which one wishes to address the regulator output.

Through the parameter **PID target** it is possible to select in which point of the drive has to be addressed the output signal of the regulation; the selectable parameters are those signed as writing parameters (W o R/W) indicated in the paraghraph 10.4. "*List of high-priority parameters*'", the units are those indicated in the notes at the end of the paraghraph.

Programming example of the speed reference 1 (parameter **Speed ref 1**) on **PID target**:

Menu OPTION

————> PID

————> PID target

————> PID target = 8234

On **PID target** it must be set the number of the parameter which has to be associated, choosing it from the paragraph 10.4. "List of high-priority parameters'" (**Speed ref 1** has the decimal number 42). To obtain the value it must be added the decimal number 8192 (fixed offset):

8192 + 42 = 8234.

NOTE: When the ramp function has been enabled, Speed ref 1 will be automatically programmed on its output; to have it available it is necessary to set parameter Enable ramp = disable.

Speed ref 1 will be set in RPM x 4, considering that **PID output** assumes values included between 0....10000, it is necessary to set appropriately the calibration through **PID out scale**.

Calculatione of **PID out scale**:

If one wishes that **PID output**, at its max. value = 10000, corresponds at speed reference = 2000rpm it is necessary to set:

PID out scale = (2000 x 4) / 10000 = 0.8

It is possible to read the set value of **Speed ref 1** in the appropriate parameter of the menu **INPUT VARIABLES / Speed ref**.

NOTE: The value of PID out scale will be defined according to the system which has to be controlled, for a better comprehension , please refer to the paragraph "Application examples".

6.16.3.8. Function of calculation for initial diameter

This function allows to perform a preliminary calculation of the diameter of an unwinder/winder before to start the line. This allows a better control of the system avoiding unwilling balancing of the dancer.

The calculation is based on the measure of the movement of the dancer from the position of fullrange lower than its central position of work, and on the measure of angular movement of the swift during the initial phase.

NOTA: The function of initial diameter calculation can be carried out only when the winder/ unwinder are controlled through dancer (no load cell) and the speed feed-back is carried out through encoder.

The result of the calculation is assigned to the parameter **PI output PID**, and so it represents the multiplier factor of the feed-forward, in order to obtain the angular speed reference of the motor.

Its value is universely proportional to the swift diameter.

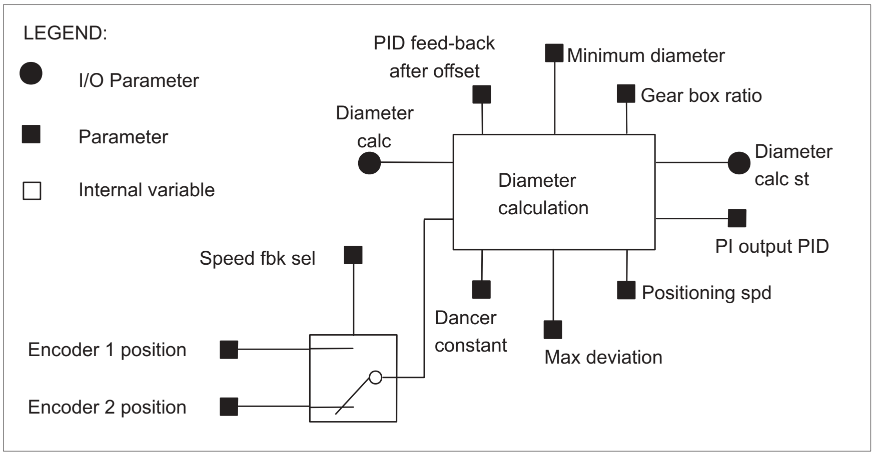


Figure 6.16.3.6: Diameter calculation block description

Diameter calc	
	Diameter calc
	Positioning spd
	Max deviation
	Gear box ratio
	Dancer constant
	Minimum diameter

T0888g

Parameter	N.	Value			Standard configuration
		min	max	default	
Diameter calc	794	0	1	0	*
Positioning spd	795	-100	+100	0	
Max deviation	796	-10000	+10000	8000	
Gear box ratio	797	0.001	1.000	1.000	
Dancer constant	798	1	10000	1	
Minimum diameter	799	1	2000	1	

T6398g

* This function can be set on a digital programmable input.

Diameter calc Enabling of the initial function of diameter calculation.
The calculation will be enabled setting **Diameter calc** = Enable.
If **Diameter calc** has been programmed on a digital input, this must be brought to logical high level.

Positioning spd Motor speed at which is wished to positioning the dancer on its central working position, during the calculation phase of the initial diameter.

Max deviation Value expressed in count of D/A which corresponds to the position of maximum shift admitted by the dancer. At this value it will be associated the starting measurement of the dancer movement during the phase of calculation of the initial diameter.

During the preliminary phase of the commissioning, it is necessary to carry out the self-calibration of the analog inputs, so at the fullrange position of the dancer they will correspond, whatever was the value of the analog input, at 10000 counts. The parameter **Max deviation**, in order to guarantee a precise calculation of the movement , must be set at a value slightly lower. (standard **Max deviation** = 8000).

Gear box ratio Ratio reduction between the motor and the swift (< = 1).

Dancer constant It expresses the measure in mm corresponding to the total bunching of the material in the dancer.

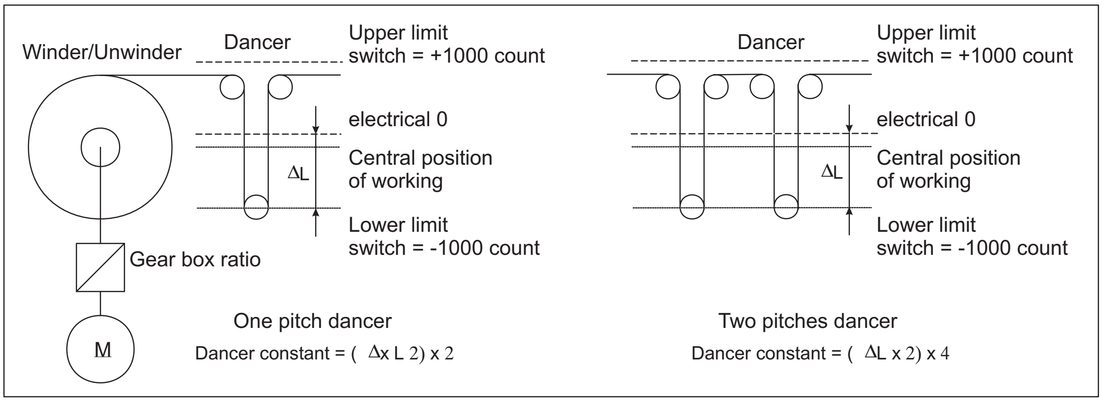


Figure 6.16.3.7: Diameter calculation

Measurement of **Dancer constant**:

With dancer in lower fullrange position, perform the self-calibration of the analog input programmed as **PID feed-back**.

Set the keypad of the drive on the parameter **PID feed-back**.

Measure and multiply by 2, the distance in mm between the lower mechanical fullrange and the position of the dancer, so that on the parameter **PID feed-back** will be displayed 0 (position of electrical 0).

Multiply the above calculated value by 2 if the dancer is composed by an only pitch, by 4 if the dancer is composed by two pitches and so on, as per the figure above.

Minimum diameter Min. value of swift diameter (swift soul) expressed in cm.

6.16.3.9. Procedure of calculation for initial diameter

The calculation is based on the measurement of the dancer movement from the lower fullrange position to its central working position, and on the measurent of the angular movement of the swift during the drawing phase, for that reason, during this period one must be sure that the nip-roll downstream the unwinder, or upstream the winder, mantaining the material blocked. For this reason it is necessary to enable the regulation of the nip-roll drive with speed reference = 0.

If also line gear are controlled by dancers or load cells, it is necessary to carry out firstly the calculation of the diameter with consequentely drawing of the winders/unwinders, then the gear drawing.

The parameter **PI central v sel** must be set at 0 to avoid that **PI output PID** will be automatically set at a predefined value.

Bringing to a high logical level (+24V) the digital input programmed as **Diameter calc**, if the drive is enabled, the procedure will be activated, during this phase the parameters **Enable PI PID** e **Enable PD PID** are automatically disabled.

The regulation verifies the signal coming from the dancer potentiometer, if this is higher than what already set in **Max deviation**, the motor starts running with speed reference set in **Positioning speed** in order to wind the material on the swift and bring the dancer in its central position of working.

The polarity of the reference assigned to **Positioning speed** will be anyway (winder or unwinder) equal to the one of the working as swift winder.

If initially the regulation verifies that the signal coming from the potentiometer of the dancer is lower than what already set in **Max deviation**, the motor starts running with speed reference set in **Positioning speed** in order to unwind the material and bring the dancer on the point identified by **Max deviation**, at this point the reference will be inverted up to bringing the dancer in its central position of work.

When the dancer has reached the central position, the parameter **PI output PID** will be set at a value inversely proportional to the diameter and the digital output **Diameter calc st**, that indicates the end of the fase of diameter calculation, will be brought to high logical level .

At this point, if **Enable PI PID** and/or **Enable PD PID** are enabled, the system passes automatically in regulation, for this reason generally the digital inputs programmed as **Diameter calc** and **Enable PI PID** and/or **Enable PD PID** will be brought to high logical level at the same time.

The output signal Diameter calc st can be used to reset the command **Diameter calc** (this command will be activated on the sliding edge of the digital input, for that reason must be brought to high logical level after the supply of the regulation part of the drive and reset once the initial calculation phase has finished).

The value of **PI output PID** will be calculated with the following formula:

PI output PID = (**Min diameter x PI top lim**) / Value of the calculated diameter

The parameters **PI top limit** and **PI bottom limit** of the menu **PI controls** have to be set according to the max. and min. diameter of the swift, for a better comprehension please refer to paragraph 6.16.3.10 “Application examples”.

6.16.3.10. Examples of application

Control with dancer

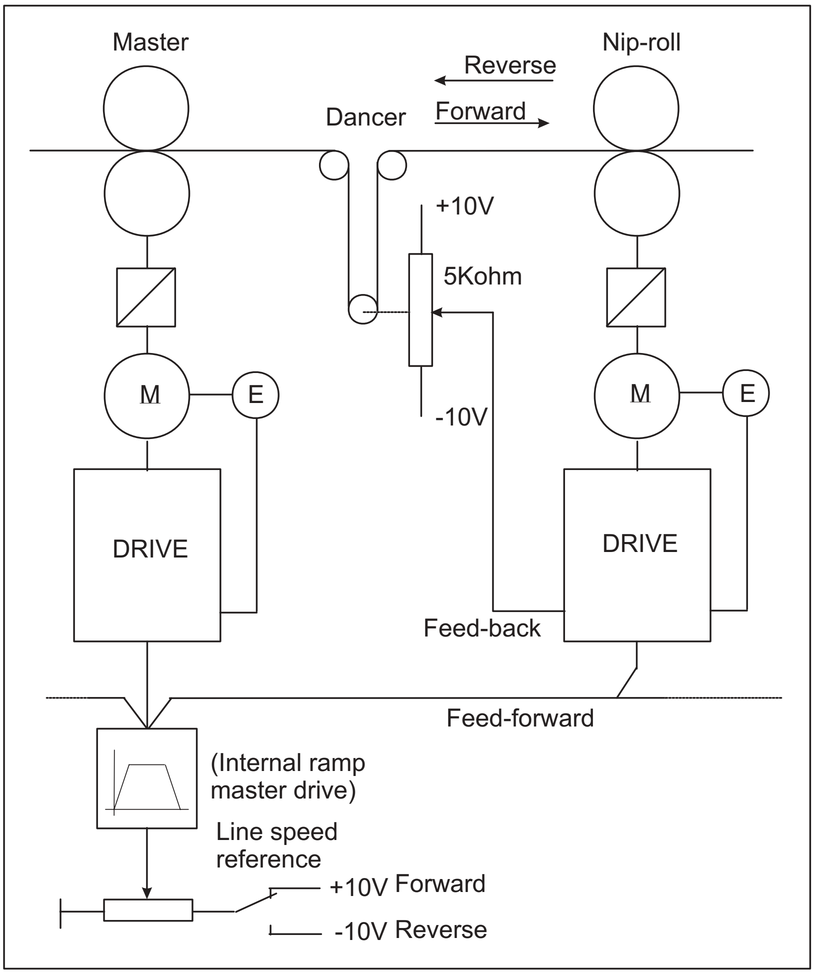


Figure 6.16.3.8: Control with dancer

Machine data:

Rated speed of slave motor Vn = 3000rpm
Slave motors speed correspondent to the max. line speed = 85% Vn = 2550rpm
Max. correction of the dancer = +/- 15% of the line speed = +/- 382.5rpm

To the drive of the nip-roll slave, have to be send the analog signals regarding the line speed and the position of the dancer (whose potentiometer will be supplied between terminals -10V... +10V) and the digital commands regarding the enabling of the PID control.
The regulator output will be sent to the speed reference 1.

Drive setting: (here below are reported only the ones regarding the PID function)

Input/output

Set **Analog input 1** as input for the cursor of the dancer.

Analog input 1 / Select input 1= PID Feed-back

Set **Analog input 2** as line speed input (feed- forward).

Setting the feed-forward on analog input, seeing that this one is not directly inserted in the list of high-priority parameters, it is necessary to pass through a supporting parameter **PAD 0.....PAD 15**.

Analog input 2 / Select input 2 = PAD 0

Set **Digital input 1** as enabling input of PI block of the PID

Digital input 1 = Enable PI PID

Set **Digital input 2** as enabling input of PD block of the PID

Digital input 2 = Enable PD PID

Parameters

Set **Speed base value** equal to the rated speed of the motor.

Speed base value = 3000rpm

Set **PID source** as **PAD 0**.

(**PAD 0** has been used as supporting parameter for the feed-forward reading on **Analog input 2**)

On PID source it must be set the parameter number which has to be associated, choosing it from the list of paragraph 10.4. "*List of high-priority parameters*' (**PAD 0** has the decimal number 503).

To obtain the value it must be added the decimal number 8192 (fixed offset):

PID source = (8192 + 503) = 8695

Set **PID source Gain** so that **Feed-fwd PID** reaches, in correspondance with the max. analog value on Analog input 2, the 85% of its max. value = 10000 x 85%.

When an analog input is set on a PAD parameter, this will have a max. value +/- 2047.

So: **PID source Gain** = (max **Feed-fwd PID** x 85%) / max **PAD 0** = (10000 x 0.85) / 2047 = 4.153

Set **PID target** as speed ref.eference 1 **Speed ref 1**.

NOTE: When the ramp function is enabled, **Speed ref 1** will be automatically programmed on its output, in order to keep it available, it is necessary to set the parameter **Enable ramp** = Disable.

For **PID target** set the parameter number which has to be associated, choosing it from the list of paragraph 104. "*List of high-priority parameters*" (**Speed ref 1** has the decimal number 42).

To obtain the value it must be added the decimal number 8192 (fixed offset)

PID target = 8192 + 42 = 8234

Set **PID out scale** so that , in correspondance with the max. analog value on **Analog input 2** (**Feed-fwd PID** = 8500) and with **Enable PI PID** and **Enable PD PID** = Disable, **Speed ref 1** is the same at 2550rpm.

The parameter **Speed ref 1** will set in RPM x 4, so:

PID out scale = (2550 x 4) / 8500 = 1.2

Set **PI central v sel** = 1.

Set **PI central v 1** = 1

In absence of a correction performed by the PI block of the regulator, the line speed reference (Feed-forward) must be multiplied by 1 and sent directly to the speed regulator of the drive.

In this application, generally, the regulator carries out a mono type proportional control. The correction will be indicated in percentage, according to the line speed, from 0 to the maximum.

Set **PI top limit** e **PI bottom limit** so that, with max. banking of the dancer (max.value of the analog input 1 = **PID Feed-back**) and setting the proportional gain of the PI block at 15%, it will correspond an equal proportional correction of feed-forward. For this reason set:

PI top limit = 10

PI bottom limit = 0.1

Set **PI P gain PID** = 15%

Set **PI I gain PID** = 0%

With this configuration, having a correction proportional to the line speed, the PI block is not able to position the dancer at speed=0. In order to do the drawing in stop conditions, it is necessary to use on the PD block.

Set **PD P gain PID** at a such value to allow the positioning of the dancer without large dynamics variation. For example:

PD P gain PID = 1%

If necessary use the derivative component as damping component of the system, programming for example:

PD D gain PID = 5%

PD D filter PID = 20ms

If not necessary, mantain these parameters = 0.

In case it is necessary to carry out a references cascade for a further drive, set **PID output** on an analog output, for example:

Analog output 1 / Select output 1= PID output

(with **Real FF PID** = 10000 count, **Analog output 1** = 10V).

Control with load cell

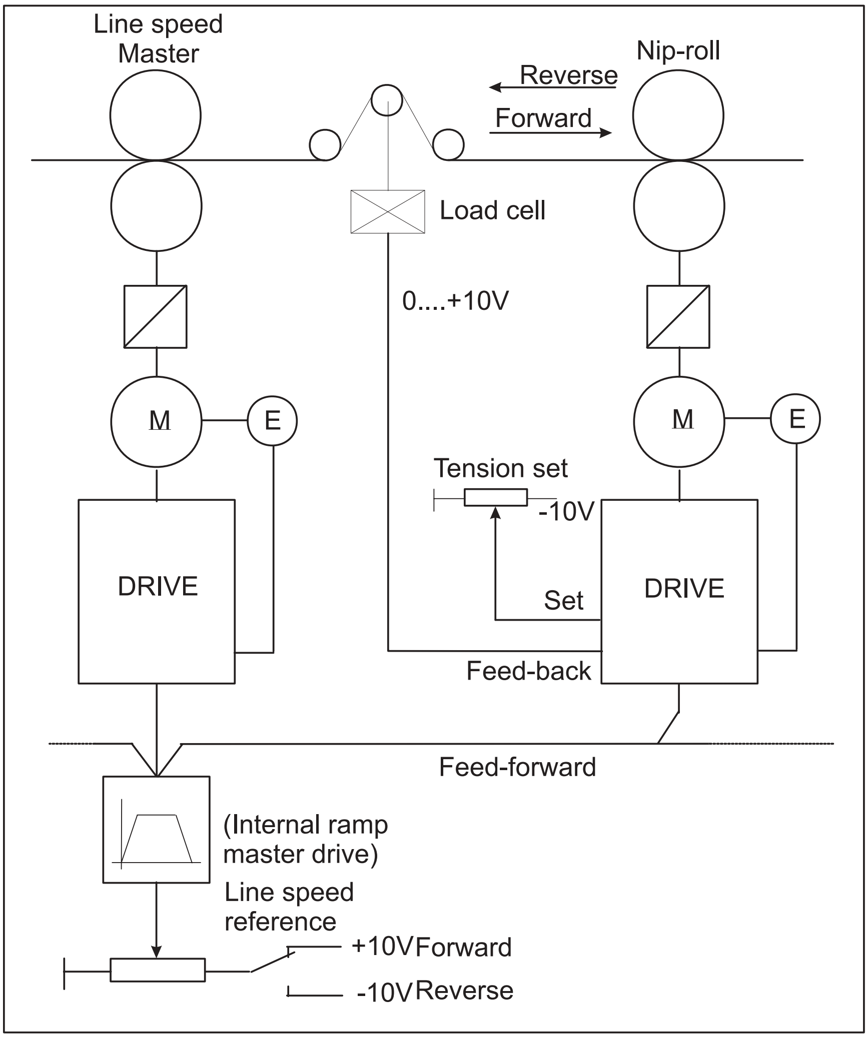


Figure 6.16.3.9: Control with load cell

Machine data:

Rated speed of slave motor Vn = 3000rpm
Slave motors speed correspondant to the max. line speed = 85% Vn = 2550rpm
Max. correction of the dancer = +/- 20% of the line speed = +/-510rpm

To the slave drive must be sent the analog signals regarding the line speed and the position of the load cell (whose potentiometer will be supplied between terminals 0….+10V) and the digital commands regarding the enabling of the PID control.
The regulator output will be sent to the speed reference 1.

Drive setting: (here below are described only the ones regarding the PID function)

Input/output.

Programm **Analog input 1** as input for the cursor of the dancer.

Analog input 1 / Select input 1= PID Feed-back

Set **Analog input 2** as line speed input (feed- forward).

To set the feed-forward on analog input, seeing that this one is not directly inserted in the list of high-priority parameters, it is necessary to pass through a supporting parameter **PAD 0.....PAD 15**.

Analog input 2 / Select input 2 = PAD 0

Set **Analog input 3** as input for the tension set (**PID offset 0**).

Analog input 3 / Select input 3 / PID offset 0

Set **Digital input 1** as enabling input of the PI block of the PID

Digital input 1 = Enable PI PID

Set **Digital input 2** as enabling input of the PI block of the PID

Digital input 2 = Enable PD PID

Parameters

Set **Speed base value** equal to the rated speed of the motor.

Speed base value = 3000rpm

Set **PID source** as **PAD 0**.

(**PAD 0** has been used as supporting parameter of the feed-forward reading on **Analog input 2**)

For **PID source** set parameter number which has to be associated, choosing it from the list of paragraph 10.4. “*List of high-priority parameters*’ (**PAD 0** has the decimal number 503).

To obtain the value it must be added the decimal number 8192 (fixed offset):

PID source = (8192 + 503) = 8695

Set **PID source Gain** so that **Feed-fwd PID** reaches, in correspondance with the max. analog value on **Analog input 2**, the’85% of its max. value = 10000 x 85%.

When an analog input is set on a PAD parameter , this will have a max. value +/- 2047.

So: **PID source Gain** = (max **Feed-fwd PID** x 85%) / max **PAD 0** = (10000 x 0.85) / 2047 = 4.153

Set **PID target** as speed reference 1 **Speed ref 1**.

NOTE: When the ramp function is enabled, Speed ref 1 will be automatically programmed on its output, in order to keep it available, it is necessary to set the parameter **Enable ramp** = Disable.

For **PID target** set the parameter number to which it will be associated, choosing it from the list of paragraph 10.4 "*List of high-priority parameters*' (**Speed ref 1** has the decimal number 42).

To obtain the value it must be added the decimal number 8192 (fixed offset)

PID target = 8192 + 42 = <u>8234</u>

Set **PID out scale** so that , in correspondence with the max. analog value on **Analog input 2** (**Feed-fwd PID** = 8500) and with **Enable PI PID** e **Enable PD PID** = disable, **Speed ref 1** is the same at 2550rpm.

Speed ref 1 parameter will be set in *RPM x 4*, so:

PID out scale = (2550 x 4) / 8500 = <u>1.2</u>

Programm **PI central v sel** = 1.

Programm **PI central v 1** = 1

In absence of a correction carried out from the PI block of the regulator, the line speed reference (Feed-forward) must be multiplied by 1 and sent directly to the speed regulator of the drive.

In this application, generally, the regulator carries out a mono type proportional control. The correction will be indicated in percentage according to the line speed, from 0 to the maximum.

Program **PI top limit** and **PI bottom limit** so that, the max. correction of PI block corresponds at 20% of speed line.

PI top limit and **PI bottom limit** parameters are the maximum and minimum. multiplier factor of Feed-forward value.

At the max. line speed it will correspond 2550rpm of the motor (max. feed-forward).

Max. correction = 2550 x 20% = 510rpm

2550 + 510 = 3060rpm ——> **PI top limit** = 3060 / 2550 = 1.2

2550 - 510 = 2040rpm ——> **PI bottom limit** = 2040 / 2550 = 0.80

<u>which corresponds to multiply the setting of **PI central v 1** (= 1) by + 20% (1.2) and - 20% (0.80)</u>.

With this configuration, having a correction proportional to the line speed, the PI block is not able to apply tension at speed = 0. In order to apply tension in stop conditions, it is necessary to use the PD block.

The gains of the single components must with loaded machine; it is possible to start tests with values below indicated (default values):

Set **PI P gain PID** = 10%

Set **PI I gain PID** = 10%

Set **PD P gain PID** = 10%

In case use the derivative component for forcing the regulator output during velocity changes of the system, programming for example:

PD D gain PID = 5%

PD D filter PID = 20ms

If not necessary, mantain these parameters = 0.

In case it is necessary to carry out a references cascade for a another drive, set **PID output** on an analog output, for example:

Analog output 1 / Select output 1= PID output

(with **Real FF PID** = 10000 count, **Analog output 1** = 10V).

NOTE: In case it is necessary a system with the integral regulation enabled, also with feed-forward = 0, able to apply tension with null error also when the machine is stopped, please refer to the paragraph “Generic PID”.

Winder/Unwinder control with dancer

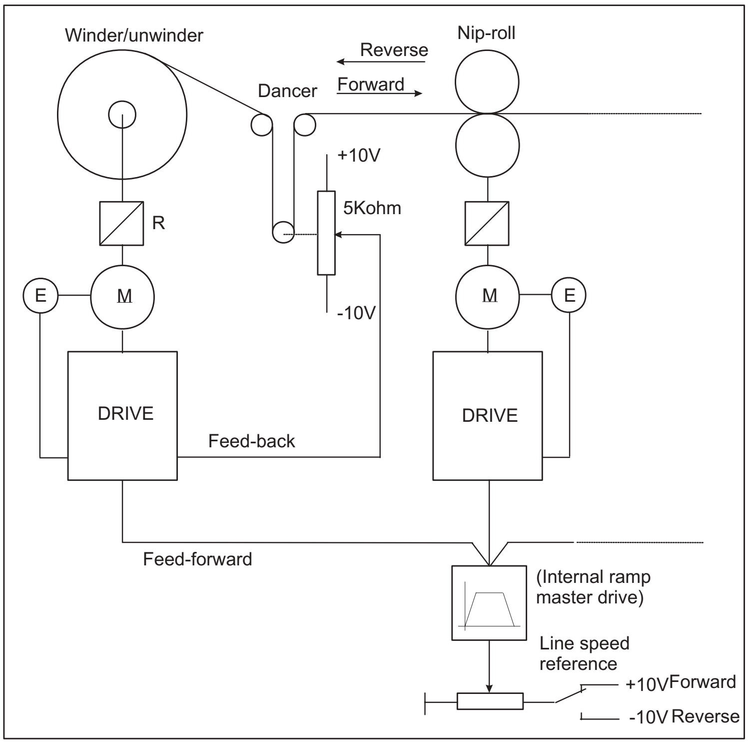


Figure 6.16.3.10 Winder/Unwinder control with dancer

Machine data:
Max. line speed =400m/min
Rated speed of the motor swift Vn = 3000rpm
Max. diameter of the swift = 700mm
Min. diameter of the swift = 100mm
Reduction ratio motor-swift = 0.5
One pitch dancer
Dancer stroke from the lower limit switch to the position of electric 0 = 160mm

To the drive of the winder/unwinder, have to be send the analog signals regarding the line speed and the position of the dancer (whose potentiometer will be supplied between the terminals -10V... +10V) and the digital commands regarding the enabling of the PID control.
The regulator output will be sent to the speed reference 1.
Drive setting: (here below are described only the ones regarding the PID function)

<u>Input/output</u>

Set **Analog input 1** as input for the cursor of the dancer.
Analog input 1 / Select input 1= PID Feed-back

Set **Analog input 2** as line speed input (feed- forward).

Setting the feed-forward on an analog input, seeing that this one is not directly inserted in the list of high-priority parameters, it is necessary to pass through a supporting parameter **PAD 0.....PAD 15**.

Analog input 2 / Select input 2 = PAD 0

Set **Digital input 1** as enabling input of the PI block of the PID
Digital input 1 = Enable PI PID

Set **Digital input 2** as enabling input of the PI block of the PID
Digital input 2 = Enable PD PID

Set **Digital input 3** as enabling input of the calculation function of initial diameter.
Digital input 3 = Diameter calc

Set **Digital output 1** as signalling " phase of calculation of starting diameter ".
Digital output 1 = Diameter calc st

Parameters

Set **Speed base value** equal to the rated speed of the motor.
Speed base value = 3000rpm

Set **PID source** as **PAD 0**.
(**PAD 0** has been used as supporting parameter of the feed-forward reading on **Analog input 2**)
For **PID source** set the parameter number to which it will be associated, choosing it from the list of the paragraph 10.4. "*List of high-priority parameters*' (**PAD 0** had the decimal number 503). To obtain the correct value it must be added the decimal number 8192 (fixed offset):
PID source = (8192 + 503) = 8695

Set **Gain source** and **PID out scale** so that, in correspondance with the max. analog value on **Analog input 2** and without the PID correction (**Enable PI PID** e **Enable PD PID** = Disable), the peripheral speed of the swift in conditions of minimum diameter (soul) is the same of the max. line speed.

Calculation of the motor speed in the condition above mentionned:

$Vp = \pi \times \Phi min \times \omega \times R$
where:
Vp = peripheral speed of the swift = line speed
Φmin = min. diameter of the swift [m]
ω = angular speed of the motor [rpm]
R = reduction ratio motor-swift

$\omega = Vp / \pi \times \Phi min \times R = 400 / (\pi \times 0.1 \times 0.5) = 2546rpm$ = about 2550rpm

Mantaining a 15% margin as to the saturation limit of the regulator (10000 count), it is necessary to set **PID source Gain** so that **Feed-fwd PID** reaches, along with the max. analog value on **Analog input 2**, the 85% of its max. value.

When an analog input is set on a PAD parameter , this will have a max. value +/- 2047.

So: **PID source Gain** = (max **Feed-fwd PID** x 85%) / max **PAD 0** = (10000 x 0.85) / 2047 = 4.153

The speed reference of the motor is set in *RPM* x 4, so program as follows:

PID out scale = (2550 x 4) / (10000 x 0.85) = 1.2

Set **PID target** as speed reference 1 **Speed ref 1**.

NOTE: When the ramp function has been enabled, **Speed ref 1** will be automatically programmed on its output, to keep it available it is necessary to set the parameter **Enable ramp** = Disable.

For **PID target** set the parameter number to which it will be associated, choosing it from the list of paragraph 10.4. "*List of high-priority parameters*' (**Speed ref 1** has the decimal number 42).

To obtain the correct value it must be added the decimal number 8192 (fixed offset):

PID source = (8192 + 42) = 8234

Set **PI central v sel** = 0.

With this configuration, having a correction proportional to the line speed, the PI block is not able to position the dancer at speed = 0. In order to do the drawing in stop conditions, it is necessary to use the PD block.

As already previously the procedure determines the theoretical multiplier factor (**PI output PID**) of feed-forward as relation of the diameter calculated, in order to send to the drive the correct speed angular value.

NOTE: When **PI central v sel** = 0 has been selected and the the PI block has been disabled, the system keeps in memory, or reset automatically in case of switching off, the last value calculated of **PI output PID**. If it would be necessary to set the value in order to have at the output an incorrect reference and so equal to the feed-forward, it is possible to configure a digital input as correction reset.

So configure:

Digital input 4 = PI central v S0

PI central v 1 = 1.00

Bringing the digital input to logical high level, the **PI output PID** will be reset.

Set **PI top lim** e **PI bottom lim** according to the ratio diameters swift.

Parameters **PI top lim** and **PI bottom lim** can be considerated as multiplier factors, respectively max. and min. of the feed-forward.

Considering that the angular speed of the motor and consequentely the corresponding reference, they change inversely to the unwinder/winder diameter; set:

PI top lim = 1

PI bottom lim = Φmin / Φmax = 100 / 700 = 0.14

Below the explication of above setting.

Calculation of the angular speed of the motor:

ω max. = Vl / (π x Φmin x R) and ω min = Vl / (π x Φmax. x R) where:

ω max. = angular speed of the motor in conditions of min. diameter [rpm]

ω min = angular speed of the motor in conditions of max. diameter [rpm]

Vl = line speed

Φmin = min. diameter of the core [m]

Φmax. = max. diameter of the core [m]

R = reduction ratio motor-winder/unwinder gear

So:

ω max. / ω min = Φmax. / Φmin from which ω min = (Φmin / Φmax) x ω max.

Considering that the parameters **PI top lim** and **PI bottom lim** can be seen as multiplier factors of respectively, min. and max. of the feed-forward.

Multiplying the feed-forward by **PI top lim** = 1, gives the max. speed reference concerning the minimum diameter.

Multiplying the feed-forward by **PI bottom lim** = 0.14, gives the min. speed reference concerning the max. diameter.

This application operates by using the proportional-integral regulation.

The gains of a single component will be experimentally set with loaded machine. It is possible to begin the tests with the values below:

Set **PI P gain PID** = 15%

Set **PI I gain PID** = 8%

Set **PD P gain PID** = 5%

In case use the derivative component for forcing the regulated output during velocity changes of the system. Programming for example:

PD D gain PID = 20%

PD D filter PID = 20ms

In case it is necessary to carry out a reference cascade for a another drive, program **PID output** on an analog output, for example:

Analog output 1 / Select output 1= PID output

(with **Real FF PID** = 10000 count, **Analog output 1** = 10V).

Parameters regarding the calculation function of the initial diameter

This function is always necessary when one has to control an unwinder or anyway when the starting diameter is unknown.

Set **Positioning spd** at the value in rpm with which the initial positionning of the dancer has to be done. For example:

Positioning spd = 15rpm

The polarity of the reference assigned to **Positioning speed** will be anyway (winder/unwinder) equal to the one of the functioning as swift winder.

If for example one has to control an unwinder and the speed reference in standard functioning is positive, assign to **Positioning spd** a negative value.

Set **Max deviation** at a value slightly lower than the one correspondent to the position of max. mechanical sealing allowed by the dancer.

While the commissioning it is always necessary to carry out the self calibration of the analog inputs of the drive, the one regarding analog input 1, with dancer in its position of lower fullrange, It is automatically assigned to this position the value 10000. So in order to guarantee a precise calculation it might be assigned:

Max deviation = 8000 (Value di default)

Set **Gear box ratio** equal to the reduction ratio between the motor and the winder/unwinder:

Gear box ratio = 0.5

Set **Dancer constant** to the value in mm correspondent to the total accumulation of material in the dancer:

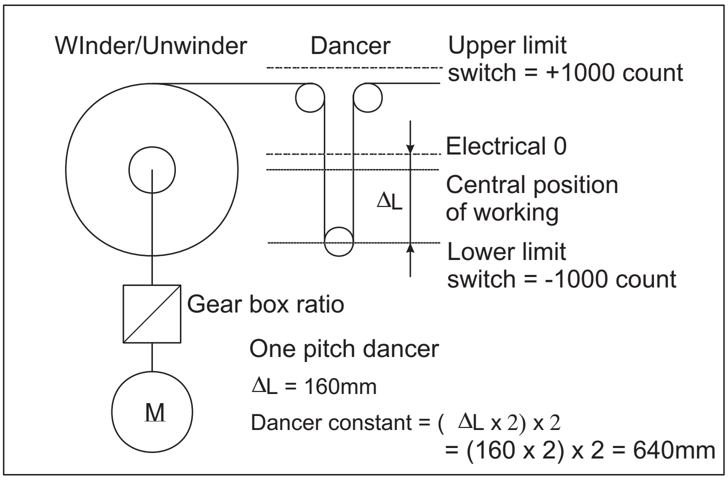


Figure 6.16.3.11: Diameter calculation

Measure of **Dancer constant**:

Set the keypad of the drive on the parameter **PID feed-back**.

Measure and multiply by 2, the distance between the lower mechanical fullrange and the position of the dancer so that in the parameter **PID feed-back** will be displayed 0 (position of 0 electric).

As the dancer is composed by one pitch, multiply the above calculated value by 2.

In this case set:

Dancer constant = 640mm

Programm **Minimum diameter** equal to the minimum value of the core diameter [cm]:

Minimum diameter = 10cm

Use of the diameter sensor

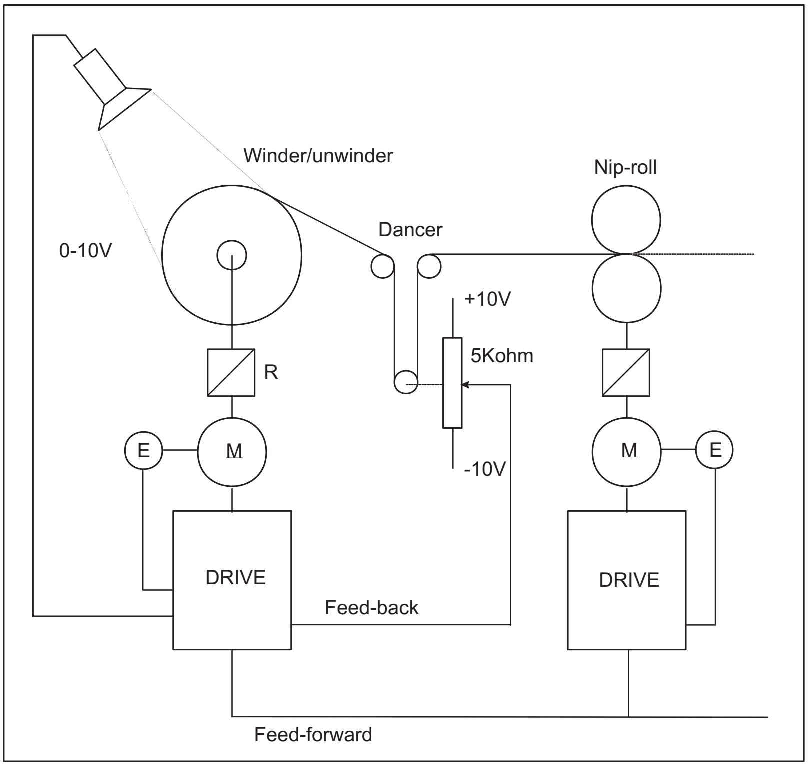


Figure 6.16.3.12 Winder/unwinder control with sensor diameter

The diameter sensor can be favourably used in case of unwinder system with automatic gear.

In these cases, it is necessary to know the value of the starting diameter, in order to calculate the reference of the angular speed of the motor, before the insertion of the new core.

The transducer must set in order to supply a voltage signal proportional to the swift diameter.

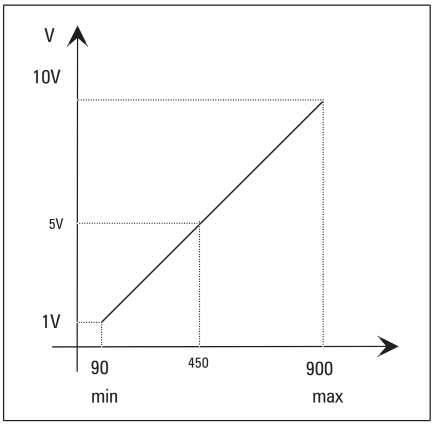


Figure 6.16.3.13 Relation between transducer signal and swift signal

Example:

Φmin = 90 mm transducer output = 1V

Φmax= 900 mm transducer output = 10V

Φ = 450 mm transducer output = 5V

The analog input to which the sensor is connected, must be programmed as **PI central V3**.

The parameter **PI central v sel**, must be set = 3.

When **Enable PI PID** = disable, the value of **PI central V3** is written in **PI output PID** and used as multiplier factor of the feed-forward.

As previously described in the instruction book, the setting of **PI output PID** depends on the diameters ratio, so the voltage signal proportional to the diameter will be automatically recalculated with the formula:

PI central V3 = (F_0 / F_1)

Where: Φ_0 = minimum winder diameter
Φ_1 = actual diameter

Setting resolution = 3 digits after the comma (also if in **PI central V3** are displayed only 2 digits after the comma).

NOTE ! During the commissioning, it is necessary to verify that the signal coming from the sensor is really proportional to the diameter and that its maximum value is corresponding to 10V (in case carry out the autotune of the analog input).

Besides, it is necessary to verify that **PI top** lim **and PI bottom lim** had been programmed

Pressure control for pumps and extruders

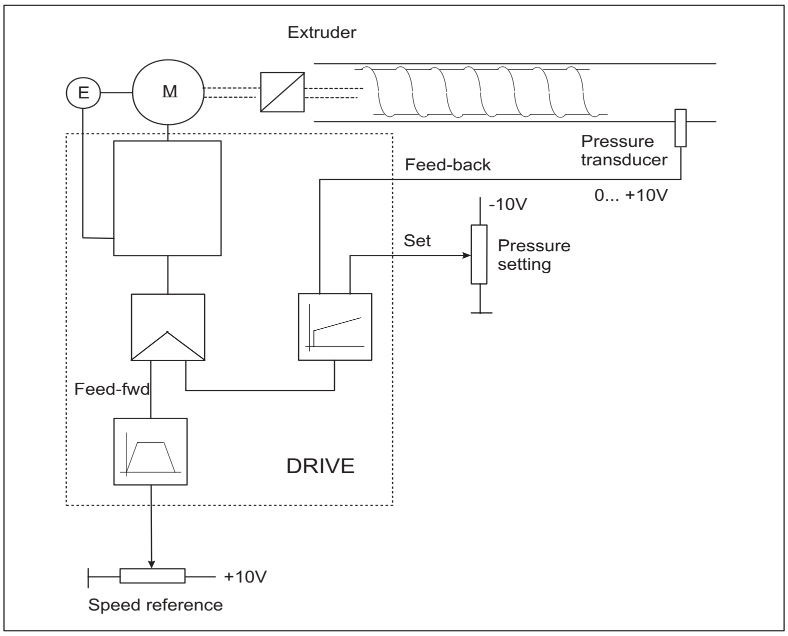


Figure 6.16.3.14: Pressure control for pumps and extruder

Machine Data:

Nominal speed of the extruder motor Vn = 3000rpm

Pressure transducer 0... +10V

To the drive of the extruder slave must be sent: the analog signals concerning the speed reference, the pressure transducer, the setting potentiometer of pressure (supplied between 0V... -10V) and the digital commands concerning the enabling of the PID control.

The regulator output must be sent to the speed reference 1.

Setting of the drive: (here are described only the ones about the PID function)

Input/output.

Set **Analog input 1** as input for the pressure transducer.

Analog input 1 / Select input 1= PID Feed-back

Set **Analog input 2** as input for the ramp block. The output of the ramp block must be used as speed reference. (feed- forward).

Analog input 2 / Select input 2 = Ramp ref 1

Set **Analog input 3** as input for the tension setting (**PID offset 0**).

Analog input 3 / Select input 3 / PID offset 0

Set **Digital input 1** as enabling input for the PI block of the PID

Digital input 1 = Enable PI PID

Set **Digital input 2** as enabling input for the PD block of the PID

Digital input 2 = Enable PD PID

Parameters

Set **Speed base value** equal to the motor nominal speed .

Speed base value = 3000rpm

Set **PID source** as **Ramp output**.

On **PID source** set the parameter number to which it will be associated, choosing it from the list of section 10.4. "*List of high priority parameters*' (**Ramp output** has the decimal number113).

To obtain the correct value it must be added the decimal value 8192 (fixed offset):

PID source = (8192 + 113) = 8305

Set **PID source Gain** so that **Feed-fwd PID** reached in correspondance of the maximum value of **Ramp output** (corresponding to the maximum value of the analog input 2), the 100% of its value = 10000.

The ramp reference and its output automatically acquire as maximum value the setting of **Speed base value**. Therefore it must be taken into consideration that each writing or reading of any parameter concerning the speed is defined as *RPM* x 4.

So: **PID source Gain** = max **Feed-fwd PID** / (**Speed base value** x 4) = 10000 / (3000 x 4) = 0.833

Set **PID target** as speed reference1 (**Speed ref 1**).

NOTE: When the ramp function is enabled, **Speed ref 1** is automatically set on its output. In order to make it available it is necessary to set the parameter **Enable ramp** = Disable. (This setting allows the working of the ramp block, but disconnects its output from the speed reference 1).

On **PID target** set the parameter number to which it will be associated, choosing it from the list of the section 10.4. "*List of high priority parameters*'" (**Speed ref 1** has the decimal number 42).

To obtain the correct value it must be added the decimal value 8192 (fixed offset):

PID target = 8192 + 42 = 8234

Set **PID out scale** so that the maximum analog value on **Analog input 2** (**Feed-fwd PID** = 10000) and with **Enable PI PID** e **Enable PD PID** = Disable, **Speed ref 1** were equal to 3000rpm.

The **Speed ref 1** must be set as *RPM x 4*, then:

PID out scale = (3000 x 4) / 10000 = 1.2

Set **PI central v sel** = 1.

Set **PI central v 1** = 1

In absence of correction performed by the PI block of the regulator, the line reference speed (Feed-forward) must be multiplied x 1 and sent directly to the speed regulator of the drive.

In this application, generally , the regulator makes a proportional-integral control.

Set **PI top limit** e **PI bottom limit** in order to obtain a maximum correction of the PI block equal to the 100% of the speed reference.

The parameters **PI top limit** and **PI bottom limit** could be considered as the multiplier factor respectively maximum and minimum of the feed-forward.

PI top limit = 1

PI bottom limit = 0

In this application the regulator uses a proportional-integral type of control.

The gains of the various components must be set experimentally with the load on the machine. A reference it is possible to start the test with the value below (default values):

Set **PI P gain PID** = 10%

Set **PI I gain PID** = 20%

Set **PD P gain PID** = 10%

If necessary use the derivative component for forcing the regulator output during velocity changes of the system, setting for example:

PD D gain PID = 5%

PD D filter PID = 20ms

If not necessary what above specified, keep these parameters = 0.

6.16.3.11. Generic PID

Drive settings: (here below are reported only the ones concering the PID function)

Input/output

Set **Analog input 1** as input of the variable which has to be regulated (Feed-back).

Analog input 1 / Select input 1= PID Feed-back

Set **Analog input 2** as input of the probably setting signal (**PID offset 0**).

Analog input 2 / Select input 2 / PID offset 0

Set **Digital input 1** as input for the enabling of the PI block of the PID

Digital input 1 = Enable PI PID

Set **Digital input 2** as input for the enabling of the PD block of the PID

Digital input 2 = Enable PD PID

Parameters

In case it necessary to use the regulator as "Generic PID", then independent from the feed-forward function, the parameter **Feed-fwd PID** must be set at its maximum value. In order to do this it is necessary to go through a PAD parameter.

Set **PID source** come **PAD 0**.

On **PID source** set the parameter number to which it will be associated, choosing it from the list of the section 10.4. "*List of high priority parameters*" (**PAD 0** has the decimal number 503).

To obtain the correct value, it must be added the decimal value 8192 (fixed offset):

PID source = (8192 + 503) = 8695

Set **PAD 0** = 10000

(The parameter **PAD 0** is situated in the menu' "Special Function").

NOTE: Setting PAD 0 = -10000, the output regulator polarity will be overturned.

Set **PID source Gain** = 1

Set **PID target** with the parameter number that has to be addressed to the output regulator.

To obtain the value it must be added the decimal value 8192.

The parameters that can be addressed are the ones described in the list of the section 10.4. "*List of high priority parameters*".

Set **PID out scale** according to the parameter on which has been addressed the regulator output.

From the section 10.4. "List of high priority parameters " comes out that:

The parameters concerning the speed are expressed as [*SPD*].

For all the drive sizes, the rated current will be 2000 [CURR], so:

PID out scale = 2000/ max. output PID = 2000/ 10000 = 0,2

NOTE: In case it would be necessary to use the drive with a provisory current higher than the rated cuurent of the drive, it is possible to increase the above described value of **PID out scale**. For example, if one wants to obtain 1.5 times the size, one has to set:

PID out scale = 0,2 x 1,5 = 0,3

In this case it is necessary to enable the function of overload control "**Overload contr**" setting correctly the values **Overload current**, **Overload time**, **Base current** and **Pause Time**.

NOTE: The firmware of the drive does not prerform a control on the polarity of the value sent, for this reason, in case it is not wished address the regulator output on parameters "Unsigned", it is better set the PID output so that it can be only positive.

PID out. sign PID = Only positive

The parameters "Unsigned", for example the current limits **T current lim +** and **T current lim -**, are indicated in the "*List of high priority parameters* " with the symbol "U16".

Set **PI central v sel** = 1.

Set **PI central v 1** = 0

In this configuration, when is executed the transition Off / On of the parameters for the enabling of the PID function, the regulator output starts from 0.

In case it is wished to mantain stored the last value calculated also when the machine is disabled, it necassary to use a digital input programmed as:

Digital input xx = PI central v S0

PI central v 1 = 0

When the digital input is at a low logic level (L), it is stored the last value calculated, applying a high logic level (H) the value is reset.

Set **PI top lim** and **PI bottom lim** in order to obtain a correction of the PID block equal to 100% of its maximum value.

PI top lim = 1

PI bottom lim = -1

In this configuration the PID block output will be either positive and negative.

Setting **PI top lim** = 0, the positive part is blocked.

Setting **PI bottom lim** = 0, the negative part is blocked.

The gains of the various components must be set sperimentally with the machine loaded.

It is so possible to start tests with the values below indicated:

Set **PI P gain PID** = 10%

Set **PI I gain PID** = 4%

Set **PD P gain PID** = 10%

In case, use the derivative component as damping component of the system, setting for example:

PD D gain PID = 5%

PD D filter PID = 20ms

If not necessary what above specified, keep these parameters = 0.

6.16.3.12 Application note

Dynamic modification of the integral gain of the PI block

Normally the integral gain of the PID is set to a value that is much lower as much higher is the diameter ratio of the controlled swifts. A too big value could allow a good regulation at the smallest diameters but it could cause strong jumps of the system when the swift reaches larger diameters.

On the contrary too low values of the integral gain could cause, on minimum diameter conditions, a shift of the dancer position from its electric zero condition, that would be much larger as much higher is the line speed. This happens because the charge and discharge of the integral component occurs within a shorter time in the variation time of the diameter.

In case of higher ratio diameters could be necessary to modify dinamically the value of the parameter **PI I gain PID** according to the actual diameter.

At the moment this functionality has not been yet implemented as specific function.

Anyway it is possible to obtain it through the use of the LINK functions.

Supposing for example to control a winder having a diameters ratio of 1/10.

The function LINK 1 is used to get a connection between the diameter and the value of the integral component of the PI block.

The integral component of the regulator must have a behaviour inversely proportional to the diameter.

The value of the parameter **PI output PID** already follows this behaviour, infact it changes according to the relation Φ_0 / Φ_{act}.

Where: Φ_0 = minimum swift diamenter
Φ_{act} = actual swift diameter

The operation to carry out through the LINK parameter is:

PI output PID x KI = **PI I gain PID**

Where KI corresponds to the value of the integral component on minimum diameter condition.

Supposing that by functioning tests comes out that the system, on condition of minimum diameter is able to work till the maximum speed with steady dancer in electric zero position with **PI I gain PID** = 40%.

The LINK source must be associated to **PI output PID** [n^0 771]:

Source *link 1* = 8192 + 771 = 8963

The LINK destination must be associated to the value of the integral component= parameter **PI I gain PID** [n^0 764]:

Destination *link 1* = 8192 + 764 = 8956

The multiplier factor must be set to the value defined by the functioning tests above mentioned.

Mul gain *link 1* = 40

Besides, it will be necessary to set:

Div gain *link 1* = 1000 *
Input max *link 1* = 1000 *
Input min *link 1* = 100 **
Input offset *link 1* = 0
Output offset *link 1* = 0
Input absolute *link 1* = OFF

* The value 1000 is defined by **PI top lim** which will be in this case = 1 (correspondent to a maximum value of **PI output PID** = 1000).

** The value 100 is defined by **PI bottom lim** which will be in this case = 0.1 (correspondent to a minimum value of **PI output PID** = 100).

With this configuration at minimum diameter it will correspond an integral gain = 40% and at maximum diameter it will correspond an integral gain = 4%, between the two setpoints the gain will change with an hyperbolic characteristic.

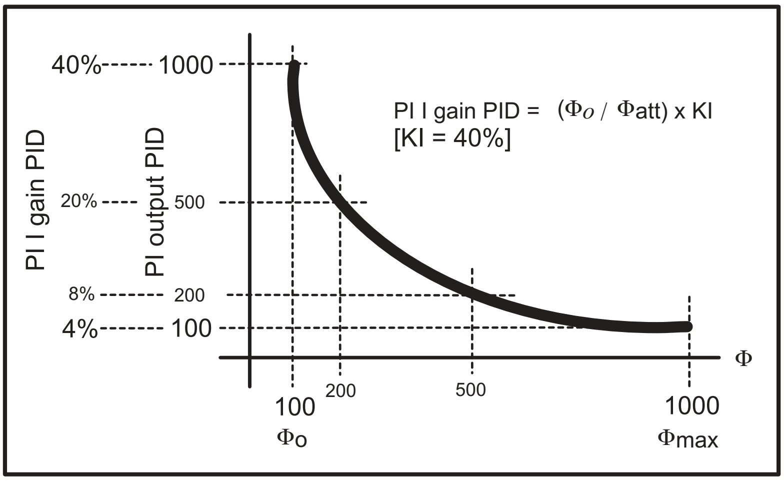


Figure 6.16.3.15: PI I gain PID and PI output PID

The value of **PI I gain PID** will be displayed in the relative parameter of the submenu **PI controls**.

If necessary, using the LINK 2, it is possible to modify dinamically also the proportional gain **P gain PID**.

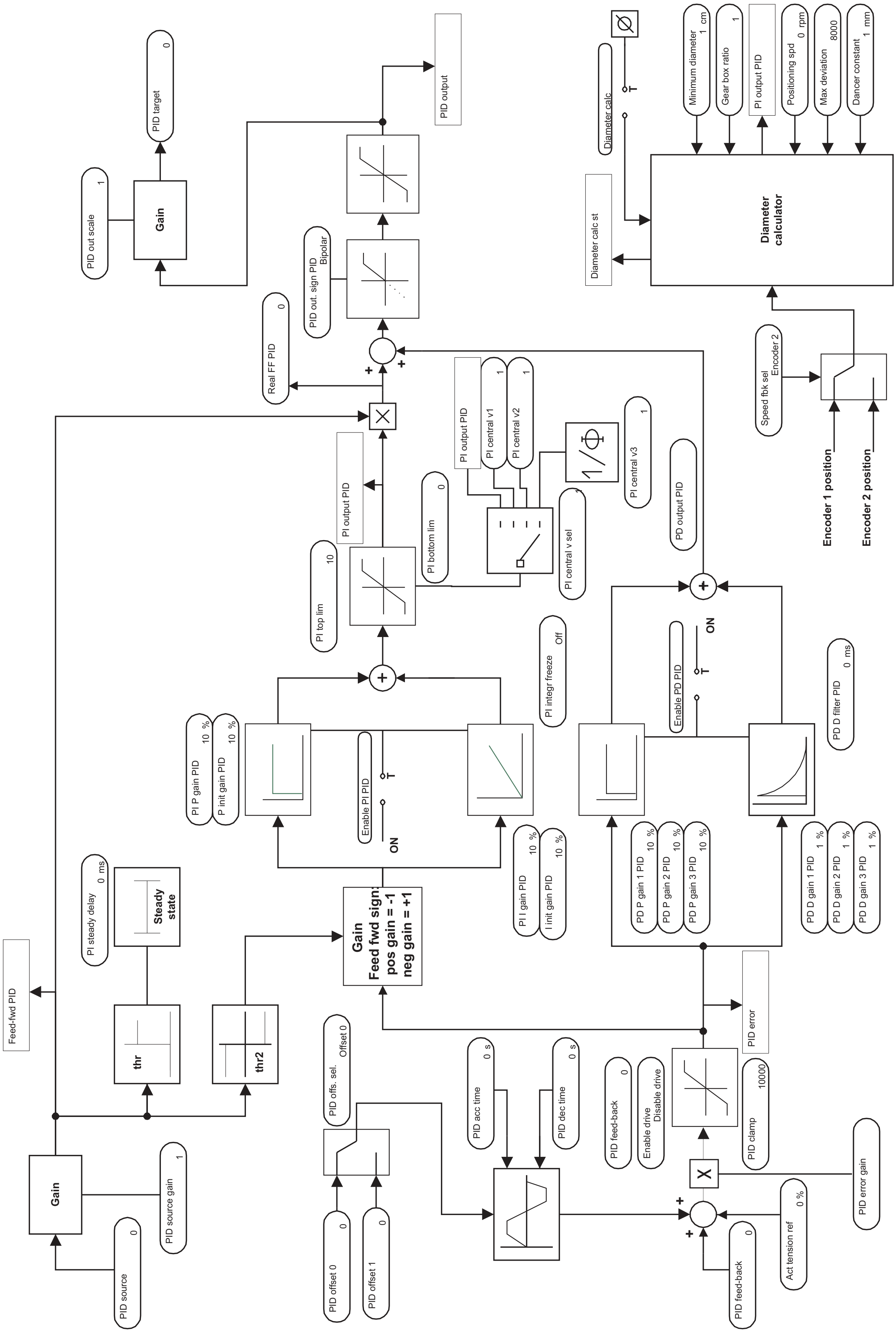


Figure 6.16.3.16: General description of the PID blocks

6.17. TORQUE WINDER FUNCTION

The center wind function inside the TPD32 converters is used to control winders and unwinders whose tension regulation is carried out via an open or closed loop control.

Apart from calculation functions for torque, diameter, compensation and Taper tension, the system foresees the calculation of the motor speed reference. Such function allows to use the drive on the four regulation quadrants controlling both winders and unwinders, and to control the motor with a peripheral speed proportional to the diameter in case of a break of the wound material.

The torque is adjusted according to the motor flux, thus meaning that the system is suitable to control motors with a constant torque-power ratio.

The closed loop regulation foresees an analog input for the loading cell 0…10V, 0…20mA, 4…20mA.

The output of the center wind function is sent directly to the current limits; the specific parameters T current lim +/- and the limits set by the programmable overload function are anyway active in order to protect both the inverter and the motor; among the three possible settings the one with the lowest value is always the most important.

Input / Output

Line spd source	Line speed sampling parameter. It is used exclusively for the diameter calculation. The speed threshold, **Ref speed thr**, under which the calculation procedure is blocked, refers to **Ref line speed**. It can be programmed as analog input or encoder input.
Ref spd source	Line reference sampling parameter. It is used exclusively for the calculation of: - the inertia compensations - the line speed reference. It can be programmed as analog input or encoder input.
<u>Analog inputs</u>	
Tension ref	Per cent tension reference; 10V (20mA) = 100%.
Tension red	Per cent decrease in the Taper tension; 10V (20mA) = 100%.
Diam preset 3	Setting of the starting diameter; 10V (20mA) = max. diameter.
<u>Analog outputs</u>	
Roll diameter	Present diameter; 10V = max. diameter.
Act tension ref	Tension reference decreased by the Taper percentage; 10V = 100% Tension ref.
Torque current	Request for torque current; 5V = drive size.
W reference	Reference for angular speed, 10V = 100% Base omega.
Actual comp	Active compensation monitor (it sums up static, dynamic and inertial frictions); 5V = drive size.
<u>Digital inputs</u>	
Torque winder En	Enabling of the center wind function.
Diam calc Dis	Enabling of the diameter calculation.
Diam inc/dec En	If enabled and if winder, the calculated diameter can never decrease; if unwinder the calculated diameter can never increase. It is used to improve the system stability.
Wind/unwind	Winder/unwinder selection: 0 = winder, 1 = unwinder.
Winder side	Selection of the winding/unwinding side: 0 = up, 1 = down

Diam preset sel 0 LSD digital input; preselection of the starting diameter.

Diam preset sel 1 MSD digital input; preselection of the starting diameter.

Diam reset Reset of the calculated diameter.

Taper Enable Enabling of the Taper function.

Speed match Coil “launching” phase command for automatic switching.

Line acc status Active acceleration.

Line dec status Active deceleration.

Line fstp status Fast deceleration.

The last three parameters are inputs sending to the drive the status of the line speed: they are used when the internal calculation procedure for the line acceleration is disabled.

Speed demand En Enabling of the speed reference calculation.

Closed loop En Enabling of the closed loop control.

<u>Digital outputs</u>

Diameter reached Indication: the diameter threshold has been overcome.

Spd match compl Indication: the “launching” speed has been reached.

6.17.1. Diameter calculation

- **OPTIONS**
  - **TORQUE WINDER**
    - **Diam Calculatio**
      - Roll diameter
      - Line speed
      - Ref line spd
      - Diam calc Dis
      - Diam inc/dec En
      - Wind/unwind
      - Minimum diameter
      - Maximum diameter
      - Line spd source
      - Ref spd source
      - Line speed gain
      - Ref speed gain
      - Base omega
      - Ref speed thr
      - Diam filter
      - Diam init filter
      - Diam stdy delay
      - Diam reset
      - Diam thr
      - Diam reached
      - Diam preset sel
      - Diam preset 0
      - Diam preset 1
      - Diam preset 2
      - Diam preset 3

Parameter description	No.	Value			Standard configuration
		min	max	factory	
Roll diameter [m]	1154				****
Line speed [%]	1160	0.00	200.00		
Ref line spd [%]	1286	0.00	200.00		
Diam calc Dis OFF/ON	1161	0	1	ON	*
Diam inc/dec En Disabled/Enabled	1205	0	1	Disabled 0	*
Wind/unwind Unwinder/Winder	1187	0	1	Winder 0	*
Minimum diameter [mm]	799	1	2000	100	
Maximum diameter [m]	1153	0.000	32.000	1.000	
Line spd source	1204	0	65535	0	
Ref spd source	1284	0	65535	0	
Line speed gain	1156	0	32767	0	
Ref speed gain	1285	0	32767	0	
Base omega [rpm]	1163	0	8191	1500	
Ref speed thr [%]	1155	0.00	150.00	5.00	
Diam filter [ms]	1162	0	5000	100	
Diam init filter [ms]	1206	0	5000	100	
Diam stdy delay [ms]	1207	0	60000	0	
Diam reset	1157	0	1	0	*
Diam thr [%]	1158	0.00	150.00	10.00	
Diam reached	1159	0	1		**
Diam preset sel	1168	0	3	0	*
Diam preset 0 [m]	1164	0.000	32.000	0	
Diam preset 1 [m]	1165	0.000	32.000	0	
Diam preset 2 [m]	1166	0.000	32.000	0	
Diam preset 3 [m]	1167	0.000	32.000	0	***

T 1135g

*	This parameter can be set on a programmable digital input.
**	This parameter can be set on a programmable digital output.
***	This parameter can be set on a programmable analog input.
****	This parameter can be set on a programmable analog output.

The inputs received by the diameter calculator are the angular speed of the controlled motor and the line speed. The latter can be measured through an analog input or an encoder.

The value of the calculated diameter can be sent to an analog output; via a digital output it is also possible to state the overcoming of a programmable threshold.

It is possible to select four values of the starting diameters; one value can derive from an analog input.

Roll diameter Monitor of the calculated diameter in [m].

Line speed Monitor of the line speed in [%].

Ref line speed Reference monitor for the line speed in [%].

Diam calc Dis Disabling of the diameter calculation (see also par. **Ref speed thr**). In case such function is temporarily disabled during the functioning period, the system stores the last calculated value.

Diam inc/dec En If enabled and if winder, the calculated diameter can never decrease; if unwinder the calculated diameter can never increase. It is used to improve the system stability.

Wind/unwind Winder/unwinder selection. If the selection is carried out via a digital input: 0V = winder , +24V = unwinder.

Minimum diameter Value of the minimum diameter in [mm].

Maximum diameter Value of the maximum diameter in [m].

Line spd source Number of the sampling parameter for the line speed. In order to obtain the real number to be set, it is necessary to add +2000H (8192 decimal) to the parameter number.

Programming example for the encoder 1 (connector XE1) on **Line speed source**:

OPTION Menu
————> Torque winder
————> Diam calculation
————> Line speed source = 8619

Paragraph 10.4. *“List of the high priority parameters’* shows that **Enc 1 speed** has the decimal number 427. In order to obtain the value to be entered it is necessary to add 8192 decimal (fixed offset): 8192 + 427 = 8619

Programming example for the analog input 2 on **Line speed source**:

a) input programming on a PAD parameter
I/O CONFIG Menu
————> Analog input
————> Analog input 2
————> Select input 2 = PAD 0

b) setting of **PAD 0** as a line speed input:
OPTION Menu
————> Torque winder
————> Diam calculation
————> Line speed source = 8695

Paragraph 10.4. *“List of the high priority parameters’* shows that **PAD 0** has the decimal number 503. In order to obtain the value to be entered it is necessary to add 8192 decimal (fixed offset): 8192 + 503 = 8695

Line speed gain Calibration value for the line speed.

Its setting depends on the sampling parameter of the line speed; it is used to obtain “Line speed” = 100% at its maximum value

The calculation of **Line speed gain** must be carried out with the formula:

[32768 x 16384 / (maximum value of the sampling parameter x 8)] -1

Programming example for the encoder 1 (connector XE1) on **Line speed source**:

If the encoder has an unknown rotation speed, the input value of the encoder 1 can be read in the

MONITOR Menu
————> Measurements
————> Speed
————> Speed in rpm
————> **Enc 1 speed**

Remember that the drive internally converts the speed in *RPM x 4*, therefore assuming to have maximum **Enc 1 speed** = 1500rpm:

Line speed gain = [32768 x 16384 / (1500 x 4 x 8) – 1] = 11184

Programming example for the analog input 2 on **Line speed source**:

When an analog input is set on a PAD parameter, its maximum value is + / - 2048, therefore in order to have **Line speed** = 100%:

Line speed gain = [32768 x 16384 / (2048 x 8) – 1] = 32767

(In order to obtain a fine tuning it is necessary to carry out the self tuning procedure of the analog input).

Ref spd source

Ref speed gain Their functions are similar to **Line speed source** and **Line speed gain**. They can set the signal used for the calculation of the inertia compensations and of the speed reference. With the exception of particular conditions, for example a difference between the line speed and the speed reference due to the presence of a loop on the material, such values are set on the same source with the same gains.

Base omega Value in [rpm] corresponding to the maximum angular speed of the winder/ unwinder (motor shaft side).

Line speed thr Line speed detecting threshold in %.

When “Ref line speed” is lower than “Ref speed thr” the diameter calculation is stopped. The diameter is kept at a constant value. When “Ref line speed” overcomes the threshold, the diameter calculation is enabled with an initial filter corresponding to **Diam init filter** for the time set in **Diam stdy delay.** At the end of this time the filter will be set to **Diam filter**.

Diam filter Filter on the diameter calculation in [ms].

Diam init filter Initial filter on the diameter calculation in [ms].

Diam stdy delay Time in [ms] during which the value of **Diam init filter** is kept active after **Line speed thr** has been overcome.

Diam reset Diameter reset. When this parameter is enabled, the diameter gets a starting value selected with **Diam preset sel**.

Diam thr Programmable diameter threshold as a percentage of **Maximum diameter**. The threshold overcoming is detected by **Diam reached** and it can be sent to a digital output.

Diam reached Indication for the overcoming of the diameter threshold.

Diam preset sel Selector of the starting diameter [0…3]. **Diam preset sel** can be set directly via the keypad or serial line or via two digital inputs programmed as **Diam preset sel 0** and **Diam preset sel 1**, the selection in this case is carried out with a binary logic.

Diam preset 0 0 starting diameter in [m]. The setting of this value must be included between **Minimum diameter** and **Maximum diameter**.

Diam preset 1 1 starting diameter in [m]. The setting of this value must be included between **Minimum diameter** and **Maximum diameter**.

Diam preset 2 2 starting diameter in [m]. The setting of this value must be included between **Minimum diameter** and **Maximum diameter**.

Diam preset 3 3 starting diameter in [m]. The setting of this value must be included between **Minimum diameter** and **Maximum diameter**.

It can be assigned to an analog input, in this case 10V correspond to **Maximum diameter** and the voltage referring to the minimum diameter is = 10 x (**Minimum diameter / Maximum diameter**).

6.17.2. Torque calculation

The torque calculator is made of three blocks:

1. Torque calculation according to the winder/unwinder ray and to the set tension: C = T x r
2. Calculation of the static, dynamic and inertial compensations
3. If the Taper function is enabled, the calculation of the tension curve is made according to the ray.

The tension and Taper reduction references can be sent via an analog input, serial line or field bus. The calculation of the angular acceleration, necessary to the inertial compensations, can be carried out through asuitable internal function or by stating via three digital inputs the acceleration, deceleration and fast deceleration conditions.

The connection to the PID function belongs to the compensation block. Such connection is necessary when a closed loop tension control with loading cell is carried out.

The calculation result is sent directly to the drive current limits and can be monitored in the parameters **In use Tcur lim +** and **In use Tcur lim –** of the LIMITS menu.

The standard parameters **T current lim +/-** and the limits set by the programmable overload function are anyway active in order to protect both the inverter and the motor; the setting with the lowest value is always the most important. It is also possible to set a specific current limit for the coil “launching” function during an automatic switching. The outcoming tension value and that of the calculated torque current can be monitored on the analog outputs.

OPTIONS
TORQUE WINDER
Torque calculat
- Tension ref
- Tension scale
- Act tension ref
- Torque current

T1115i

Parameter description	No.	Value			Standard configuration
		min	max	factory	
Tension ref [%]	1180	0.00	199.99	0.00	*
Tension scale [%]	1181	0	200	100	
Act tension ref [%]	1194	0.00	199.99		
Torque current [%]	1193	0.00	200.00		**

T1140g

* This parameter can be set on a programmable analog input.

** This parameter can be set on a programmable analog output.

Tension ref Per cent tension reference.

Tension scale Scale factor of the torque current in %.

This parameter is used when the value of the maximum winding torque has to be limited or when a closed loop control is used in order to adjust the torque current value to the real tension on the material measured by the loading cell.

As for tuning refer to paragraph *Application example*.

Act tension ref Monitor of the % tension reference less the Taper percentage set via **Tension red**; if the Taper function is not enabled, it corresponds to **Tension ref**.

Torque current Monitor for the requirement of the torque current in %.

6.17.2.1. Compensations and closing of the tension loop

OPTIONS
- **TORQUE WINDER**
  - **Torque calculat**
    - **Comp calculat**
      - Int acc calc En
      - Time acc/dec min
      - Acc/dec filter
      - Line acc %
      - Line dec %
      - Line fast stop %
      - Line acc status
      - Line dec status
      - Line fstp status
      - Variable J comp
      - Constant J comp
      - Act var J comp
      - Act const J comp
      - Mat width
      - Static f
      - Dinamic f
      - Static f Zero
      - Actual comp
      - Closed loop En
      - Close loop comp

T 1120i

Parameter description	No.	Value			Standard configuration
		min	max	factory	
Int acc calc En Disabled/Enabled	1183	0	1	Enabled 1	*
Time acc/dec min [s]	1182	0.15	300.00	9.01	
Acc/dec filter [ms]	1212	0	5000	30	
Line acc [%]	1184	0.00	100.00	100.00	
Line dec [%]	1185	0.00	100.00	100.00	
Line fast stop [%]	1186	0.00	100.00	100.00	
Line acc status	1188	0	1	OFF	*
Line dec status	1189	0	1	OFF	*
Line fstp status	1190	0	1	OFF	*
Variable J comp [%]	1171	0.00	199.99	0	
Constant J comp [%]	1172	-100.00	+100.00	0	
Act var J comp [%]	1192	-	200.00	0	
Act const J comp [%]	1191	-	200.00	0	
Mat width [%]	1173	0.00	100.00	100.00	
Static f [%]	1174	0.00	199.99	0	
Dinamic f [%]	1175	0.00	199.99	0	
Static f Zero Disabled/Enabled	1287	0	1	Disabled 0	
Actual comp [%]	1213	-200	+200		**
Closed loop En Disabled/Enabled	1214	0	1	Disabled 0	
Closed loop comp	1208	-32767	+32767		

T 1145g

* This parameter can be set on a programmable digital input.

** This parameter can be set on a programmable digital output.

Int acc calc En Enabling of the calculation of the coil acceleration.

If enabled this function carries out the calculation of the angular acceleration inside the drive. In this case it is necessary to set just the value of **Time acc/dec min**. If disabled, it is necessary to set the parameters **Line acc %, Line dec % , Fast stop %** and **Time acc/dec min** and to supply the corresponding status indication to the digital inputs.

Time acc/dec min Time in [s] corresponding to the lower acceleration, deceleration and fast deceleration time.

Acc/dec filter Filter in [ms] on the calculation of the acceleration inside the drive.

Line acc % Acceleration time as a percentage of **Time acc/dec min**.

Ex: Acceleration = line deceleration = 10s
Fast deceleration (fast stop) = 5s
Time acc/dec min = 5s
Line acc % = (5 / 10) x 100 = 50%

Line dec % Deceleration time as a percentage of **Time Acc/dec min**.

Ex: Acceleration = line deceleration = 10s
Fast deceleration (fast stop) = 5s
Time acc/dec min = 5s
Line dec % = (5 / 10) x 100 = 50%

Line fast stop % Fast deceleration time as a percentage of **Time Acc/dec min**.

Ex: Acceleration = line deceleration = 10s
Fast deceleration (fast stop) = 5s
Time acc/dec min = 5s
Line fast stop % = (5 / 5) x 100 = 100%

Line acc status Acceleration stating input .

Line dec status Deceleration stating input.

These two indications are combined with the drive digital outputs **Acc state** and **Dec state** (see fig. 6.17.1).

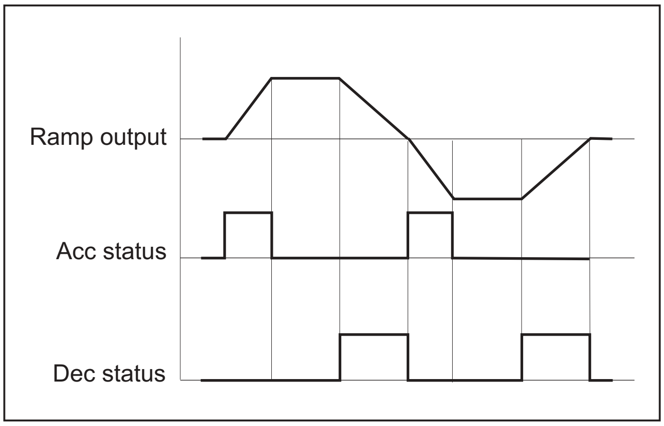


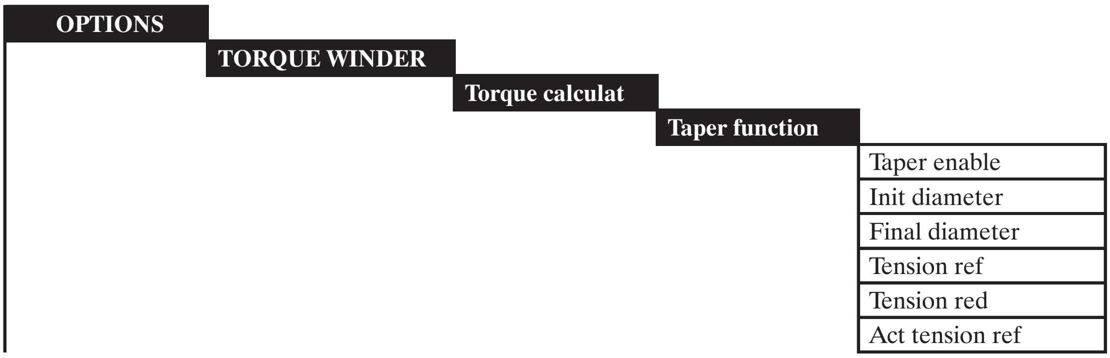
Figure 6.17.1: Acceleration and deceleration indication

Line fstp status Indication of a fast deceleration.

Variable J comp Torque compensation due to the wound material as a percentage of the drive rated current. As for tuning see the paragraph *Application example*.

Constant J comp	Compensation of the fixed section (motor, reducer,pin) as a percentage of the drive rated current. As for tuning see the paragraph *Application example.*
Act var J comp	Monitor for the active compensation of the variable section as a percentage of the drive rated current.
Act const J comp	Monitor for the active compensation of the fixed section as a percentage of the drive rated current.
Mat width	Width of the wound material as a percentage of the maximum width.
Static f	Compensation of the static frictions as a percentage of the drive rated current. As for tuning see the paragraph *Application example.*
Dinamic f	Compensation of the dynamic frictions as a percentage of the drive rated current. As for tuning see the paragraph *Application examples.*
Static f Zero	By setting the parameter on "Enabled", the friction compensation is completely inserted for all speed values. When it set as "Disabled", the static friction compensation is completely inserted with Ref line speed = 1.5%.
Act comp	Monitor for the active compensations (it sums up the static, dynamic and inertial frictions) as a percentage of the drive rated current.
Closed loop En	Enabling of the tension loop closing (to be used with a loading cell).
Closed loop comp	Monitor for the active compensation, output of the PID regulator used for the loop closing.

6.17.2.2. Taper function



T1125i

Parameter description	No.	Value			Standard configuration
		min	max	factory	
Taper enable Disabled/Enabled	1176	0	1	Disabled 0	*
Init diameter [m]	1177	0.000	32.000	0.1	
Final diameter [m]	1178	0.000	32.000	1.000	
Tension ref [%]	1180	0.00	199.99	0	**
Tension red [%]	1179	0.00	199.99	0	**
Act tension ref [%]	1194	0.00	200.00	0	***

T1150g

* This parameter can be set on a programmable digital input.
** This parameter can be set on a programmable analog input.
*** This parameter can be set on a programmable analog output.

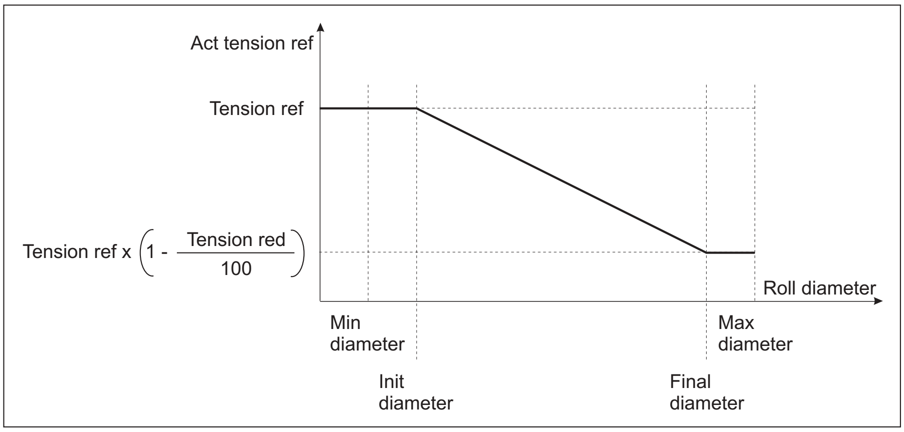


Figure 6.17.2: Relation among the Taper function parameters

Taper enable Enabling of Taper function.
Init diameter Diameter for the starting of the taper tension reduction in meters.
Final diameter Diameter for the ending of the taper tension reduction in meters.
Tension ref Tension reference in %.
Tension red Taper tension reduction as a percentage of **Tension ref**.
Act tension ref Monitor for the active tension reference as a percentage of **Tension ref.**

6.17.3. Calculation of the speed reference

- **OPTIONS**
  - **TORQUE WINDER**
    - **Speed demand**
      - Speed demand en
      - Winder side
      - W gain
      - Speed match
      - Spd match gain
      - Spd match acc
      - Spd match dec
      - Spd match compl
      - Spd match torque
      - W offset
      - Offset acc time
      - W target
      - W reference
      - Jog TW enable
      - Jog TW speed

T1130i

The calculation and control of the reference for the motor angular speed allow to use the drive on the four regulation quadrants both with a winder and unwinder control and to control the motor with a peripheral speed proportional to the diameter in case the wound material breaks down.

Such program block contains also the control of the coil "launching" reference during the initial and automatic switching phases with a stopped line.

The calculator output can be addressed to one of the four possible speed references of the drive or on an analog output.

Parameter description	No.	Value			Standard configuration
		min	max	factory	
Speed demand En Disabled/Enabled	1215	0	1	Disabled	
Winder side Up/Down	1201	0	1	Up 0	*
W gain [%]	1202	0	100	0	
Speed match OFF/ON	1195	0	1	OFF	*
Spd match gain [%]	1200	0	150	100	
Spd match acc [s]	1196	0.30	300.00	83.88	
Spd match dec [s]	1197	0.30	300.00	83.88	
Spd match compl	1203	0	1		**
Spd match torque [%]	1216	0	200	100	
W offset [rpm]	1199	0	1000	0	
Offset acc time [s]	1198	0.30	950.00	83.88	
W target	1210	0	65535	0	
W reference [rpm]	1217	-8192	+8192		***
Jog TW enable Disabled/Enabled	1256	0	1	Disabled	*
Jog TW speed [%]	1255	0	100	0	

T1155g

* This parameter can be set on a programmable digital input.

** This parameter can be set on a programmable digital output.

*** This parameter can be set on a programmable analog output.

Speed demand En	Speed reference calculation enabled.
Winder side	Selection of the winding/unwinding side: 0 = up, 1 = down
W gain	Setting of the speed reference gain used to saturate the loop. Parameter as a percentage of the increasing/decreasing value of the angular speed reference.
Speed match	Command of the coil “launching” phase for an automatic switching.
Spd match gain	Setting of the speed reference gain during the launching phase, 100% corresponds to a peripheral speed equal to the line speed.
Spd match acc	Motor acceleration time during the launching phase, in [s].
Spd match dec	Motor deceleration time in [s] if during the launching phase a stop command is given.
Spd match compl	Indication of a completed launching ramp, if it is programmed on a digital output it can be used to state that the coil can be changed.
Spd match torque	Setting of the torque current during the launching and change phase. The parameter is given as a percentage of the drive rated current.
W offset	Offset setting on the speed reference for the initial phase of the winder/unwinder when the line is stopped. The parameter is given in [rpm].
Offset acc time	Setting of the ramp for the initial phase when the machine is stopped. The parameter is given in [s]. It refers to **Speed base value**.
W target	Parameter number where the speed reference has to be addressed to. In order to obtain the real number to be set, it is necessary to add +2000H (8192 decimal) to the parameter number.

1. Addressing example on the speed reference 2:

OPTION Menu

————> Torque winder

————> Speed demand

————> W target = 8235

Paragraph 10.4. *“List of the high priority parameters’* shows that **Speed ref 2** has the decimal number 43. In order to obtain the value to be entered, it is necessary to add 8192 decimal (fixed offset): 8192 + 427 = 8235

W reference	Monitor for the speed reference.
Jog TW enable	Jog function enabled.
Jog TW speed	Reference setting for Jog function. The parameter is given as a % of **Line spe**

Control of the speed reference

In order to calculate the speed reference during the different functioning phases of the machine, a status logic has been developed. The status sequence and the operativeness is described in the figure 6.17.3.

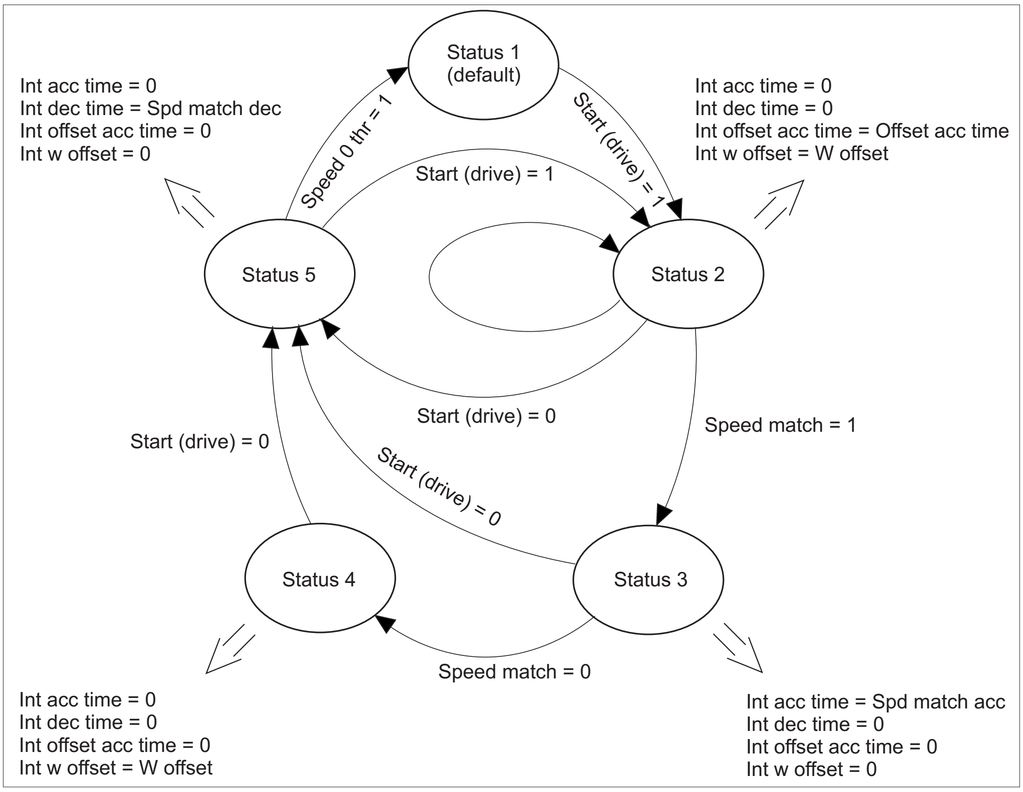


Figure 6.17.3: Operative sequence of the functioning status

<u>Status 1:</u>

Default status, this system condition is given when the drive is in a Stop condition. The speed reference is zero.

Status 2:

The system reaches this status when the Start command is given.

When the line is stopped, the initial phase reference **W offset** is assigned with the ramp time **Offset acc time**.

When the line is started, the motor speed reference follows its profile with a value corresponding to:

W reference = ± Line speed x (Minimum diameter ÷ Roll diameter) ± (W gain % + W offset)

the sign of:

± Line speed x (Minumum diameter ÷ Roll diameter)

is positive if **Wind/unwind** = winder

is negative if **Wind/unwind** = unwinder

the sign of:

± (W gain % + W offset)

is usually positive, it could be changed only if during the acceleration or deceleration phases a torque inversion is required.

The polarity of **W reference** will be further inverted if **Winder side** = 1

(winding/unwinding down).

If during a Status 1functioning period the system receives a Stop command (Start drive = 0), the Status 5 is forced.

Status 3:

The system reaches this status if the command **Speed match** = 1 and the Start command are given.

Starting from a Stop condition, if these commands are given, the motor speed reference is set with:***W reference = [± Line speed x (Min dia ÷ Roll dia) ± (W gain % * W offset)] x Spd match gain***

where **W offset** is forced to 0 with a ramp time set to **Spd match acc**.

If during a Status 3 functioning period the command **Speed match** is set at zero, the Status 4 is forced.

If during a Status 3 functioning period the system receives a Stop command (Start drive = 0), the Status 5 is forced.

Status 4:

The system reaches this status if starting from the Status 3 the command **Speed match** is set at zero.

It usually happens simultaneously with the cutting and coil change command.

In this status the motor speed reference is set to:

W reference = ± Line speed x (Minimum diameter ÷ Roll diameter) ± (W gain % + W offset)

all the internal ramp times for the reference calculation are set at zero.

If during a Status 4 functioning period the system receives a Stop command (Start drive = 0), the Status 5 is set at zero.

Status 5:

The system reaches this status through the Status 2, 3, and 4 if it receives a Stop command (Start drive = 0).

It usually happens:

a) after an automatic switching in order to stop the rotating coil.

The speed reference is set at zero with a ramp time set to **Spd match dec**.

The parameter **W offset** is immediately set at zero in order to slow down the coil starting from the present speed

b) After the line stop if the tension has to be removed (in this case the drive has to be disabled).

Anyway, when the speed = 0 has been reached, the system switches automatically to the Status 1.

Status 6:

The system reaches this status when the parameter **Jog TW enable** is enabled and the Start command has been given. The Jog command is used on unwinders in order to bring the coil material till the first nip roll. See figure 6.17.4.

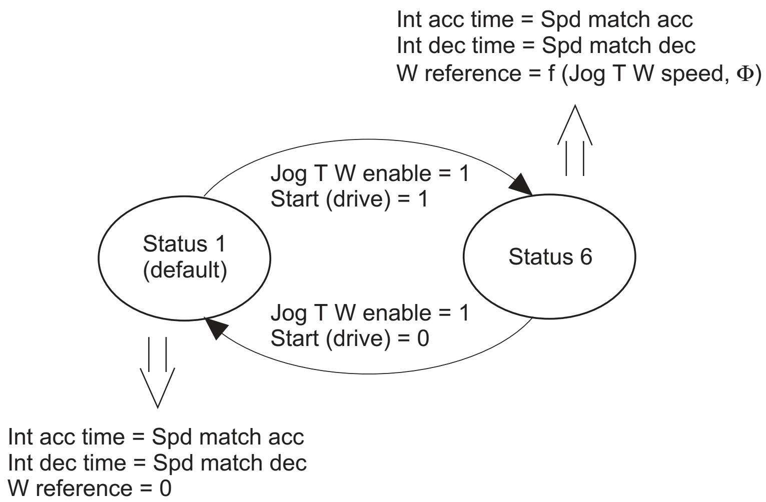


Figure 6.17.4: Functioning with Jog TW enable

Jog TW enable prepares the system for a particular functioning condition; in order to enable the coil rotation it is necessary to give the Start command, a following Stop will force the speed reference to 0 (see paragraph *Control logic*).

In the Status 6 the motor speed reference is set to:

W reference = Jog TW speed x Minimum diameter ÷ Roll diameter

It is possible to change the Jog speed sign by using the command **Winder side**.

If starting from the Status 6, **Jog TW enable** is disabled by keeping the Start command, the system switches to the Status 2.

6.17.4. Typical connection diagrams

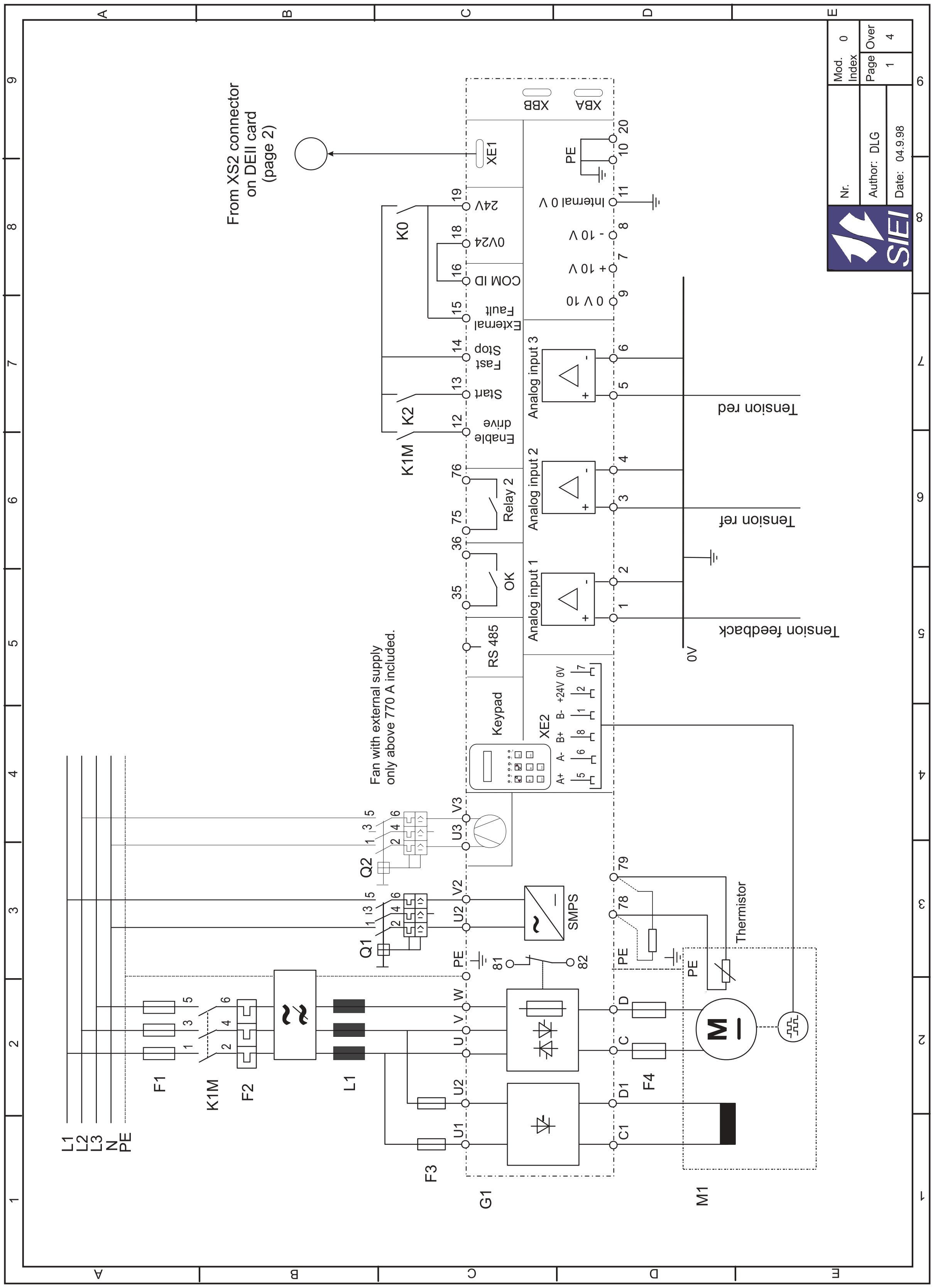


Figure 6.17.5: Winder with an automatic switch and a closed loop tension regulation

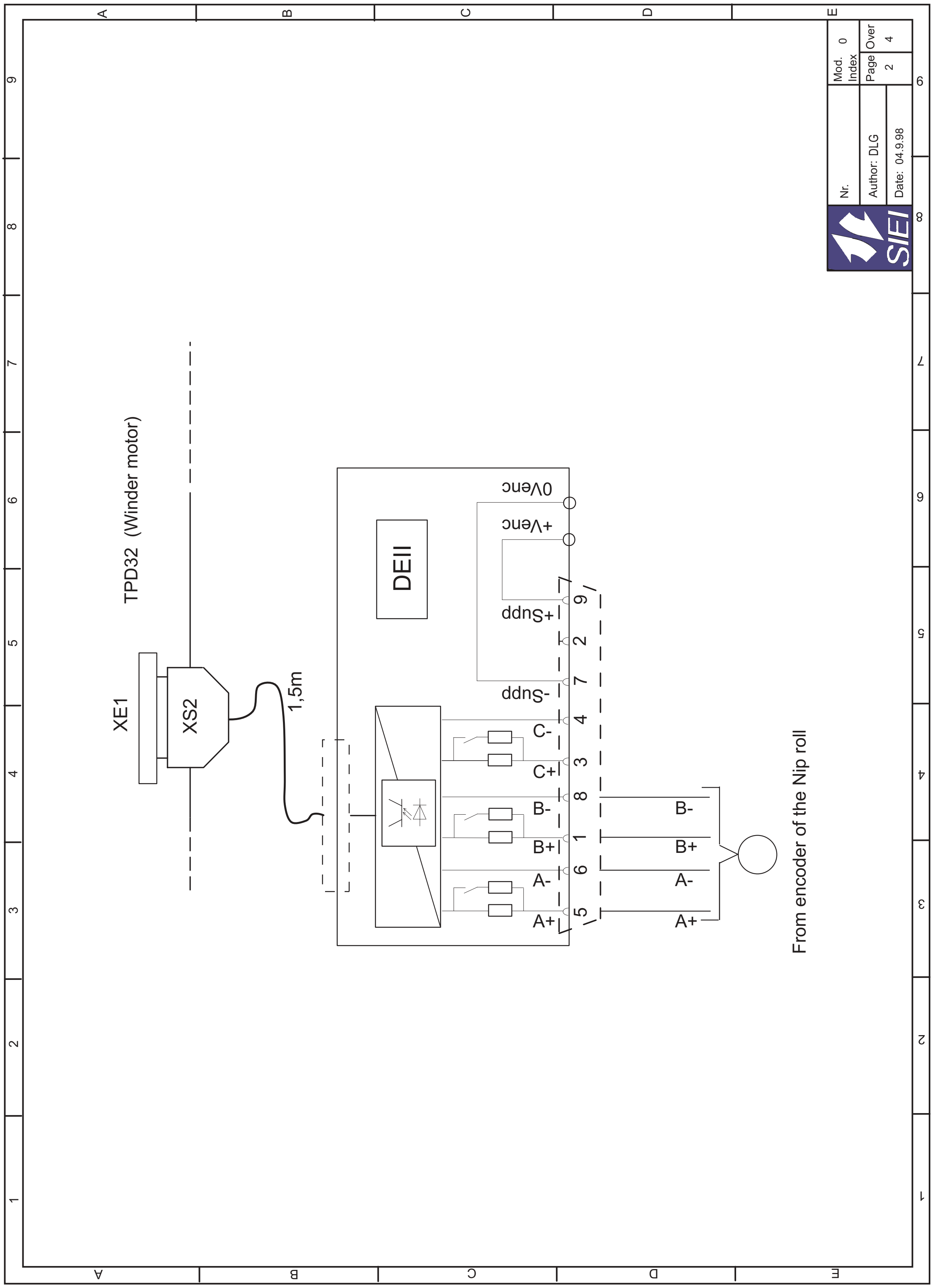


Figure 6.17.6: Winder with an automatic switch and a closed loop tension regulation (Interface card of the second encoder)

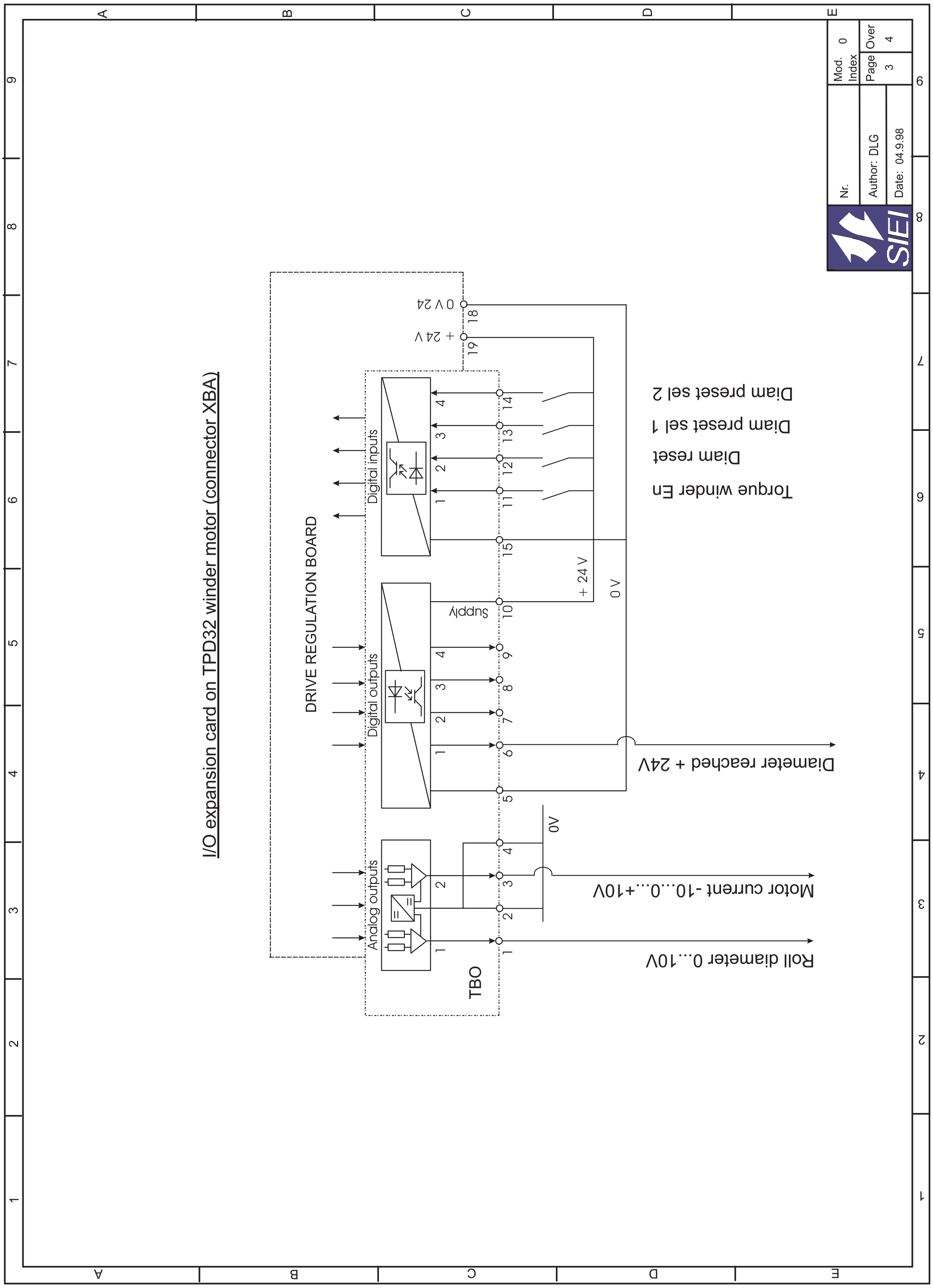


Figure 6.17.7: Winder with an automatic switch and a closed loop tension regulation
(I/O expansion card)

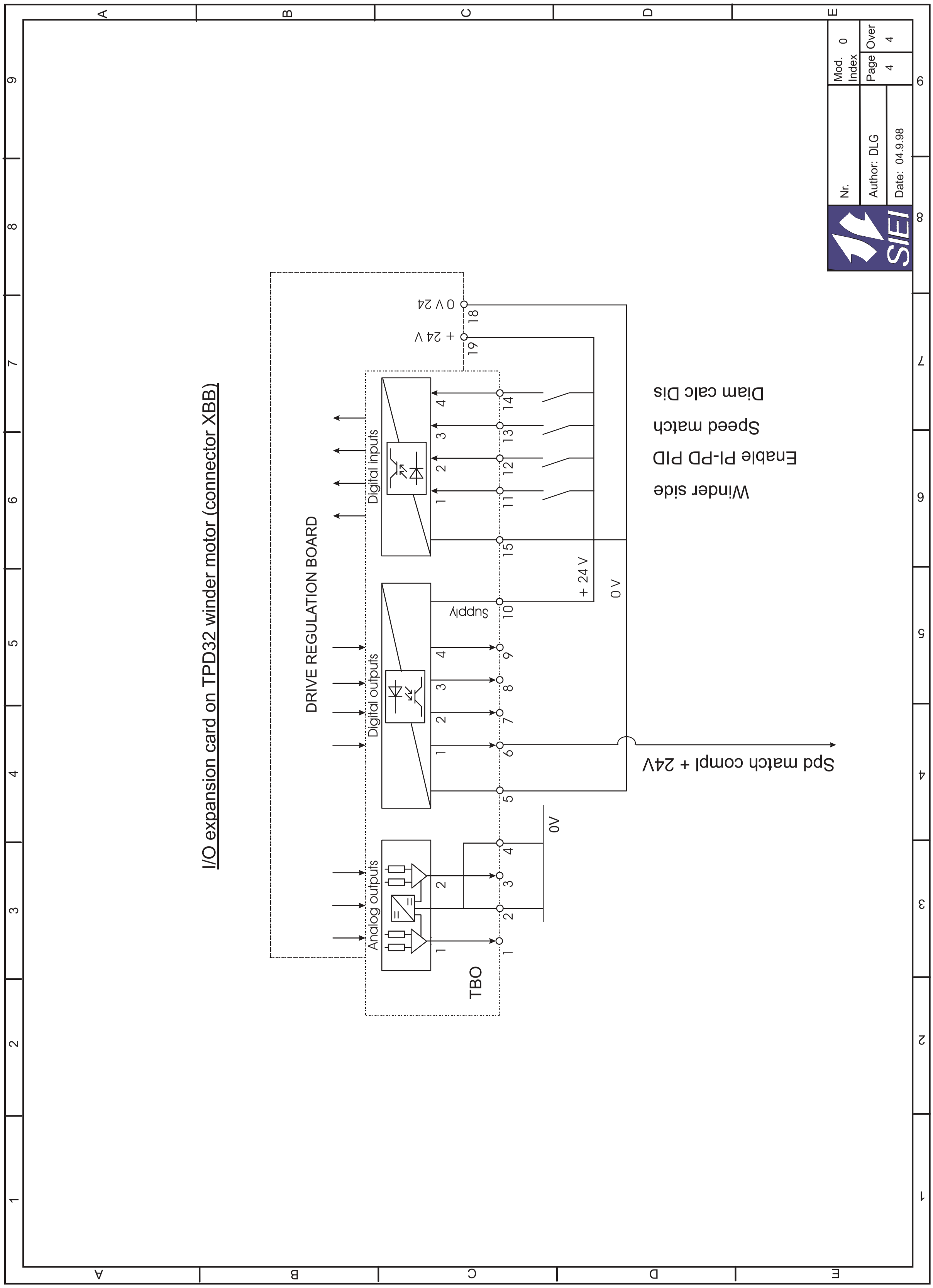


Figure 6.17.8: Winder with an automatic switch and a closed loop tension regulation (I/O expansion card)

6.17.5. Control logic

This chapter describes the most common logic sequences:

1. Diameter initialization
2. Initial phase
3. Automatic switch
4. Coil stop
5. Jog function

Diameter initialization

This sequence is carried out before the starting of a winder/unwinder both with a coil initial phase when the line is stopped and during an automatic switching.

The diameter value set in **Roll diameter** depends on the parameters **Diam preset 0**, **1**, **2**, **3** and on **Diam preset sel**.

If 2-4 different values of the starting diameter have been set, the selection has to be carried out via some programmed digital inputs such as **Diam preset sel 0** and **Diam preset sel 1**, or via the parameter **Diam preset sel**.

If the value of the starting diameter is set via an analog input, set **Diam preset sel** = 3.

Enable the parameter **Diam reset** for a time longer than 20ms.

Reset the digital input status before the start.

Initial phase

This sequence is carried out in order to start the initial phase with a stopped line.

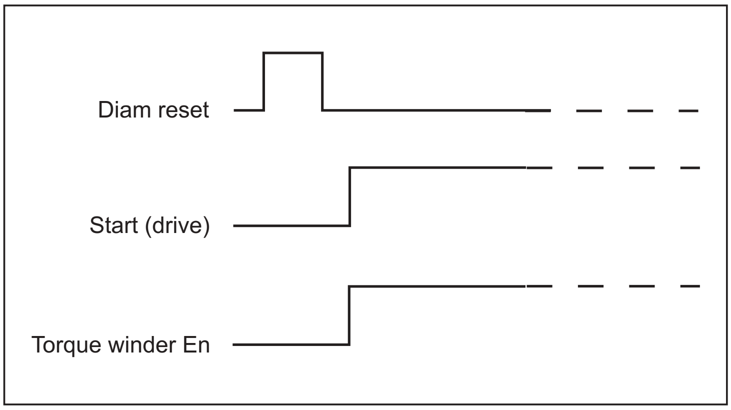


Figure 6.17.9: Initial phase with a stopped line

Initialize the diameter value as stated above.

Enable the tension control and give the start command to the drive.

If the speed reference calculation is carried out inside the drive (**Speed demand en** = Enable) the initial phase is started with the reference set to **W offset** and with a ramp time **Offset acc time**.

Now the line can be started.

Automatic switching

This sequence carries out an automatic switching between two coils during a winding/unwinding period.

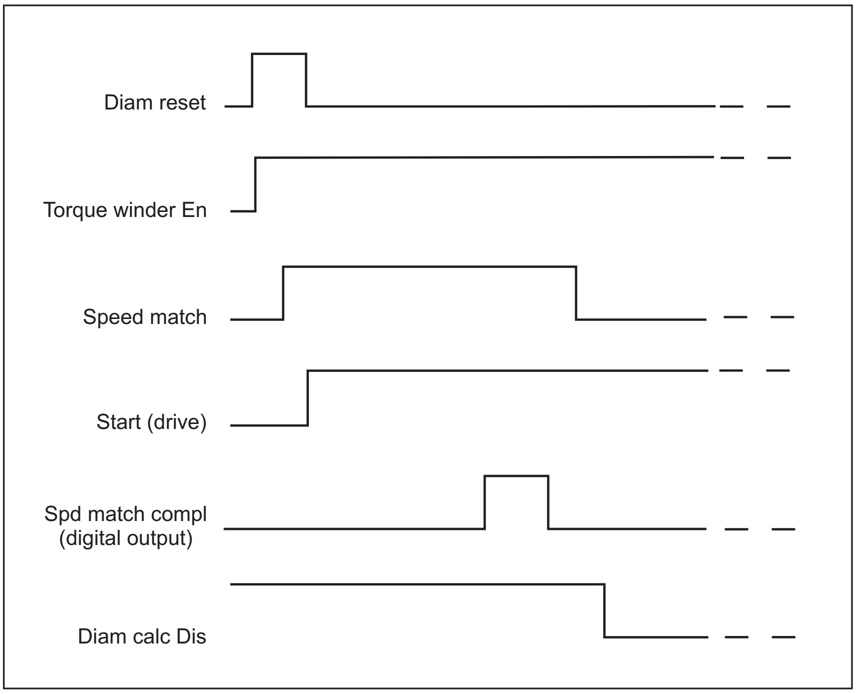


Figure 6.17.10: Automatic switching between two coils during a winding/unwinding period

a) Commands referring to the old coil:

During the star rotation phase it is advisable to disable the diameter calculation of the coil functioning as **Diam calc dis** = 1 in order to avoid errors in the diameter calculation.

b) Commands referring to the new coil:

Initialize the diameter value as stated above.

Enable the command **Speed match**, **Torque winder en** and give the start command to the drive. The motor will increase the coil speed till a peripheral speed has been reached which corresponds to the line speed for **Spd match gain** with the ramp set to **Spd match acc**. After reaching such speed, the drive indicates the end of the launching phase with the parameter **Spd match compl**.

Disable the command **Spd match** simultaneously to the switching between the two coils.

Enable the diameter calculation: **Diam calc dis** = 0.

Coil stop

This sequence is used to stop the ended coil after carrying out the automatic switching.

Disabled the diameter calculation **Diam calc Dis** = 1 and Start command. The reel will decrease up to zero speed with the time set on **Spd match dec** .

At speed = 0 disabled **Torque winder en**.

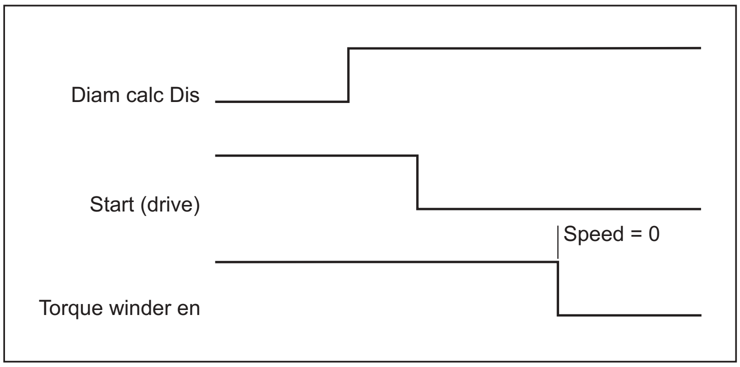


Figure 6.17.11: Coil stop after the automatic switching

Jog function

This sequence is used in particular on unwinders in order to bring the coil material till the first nip roll.

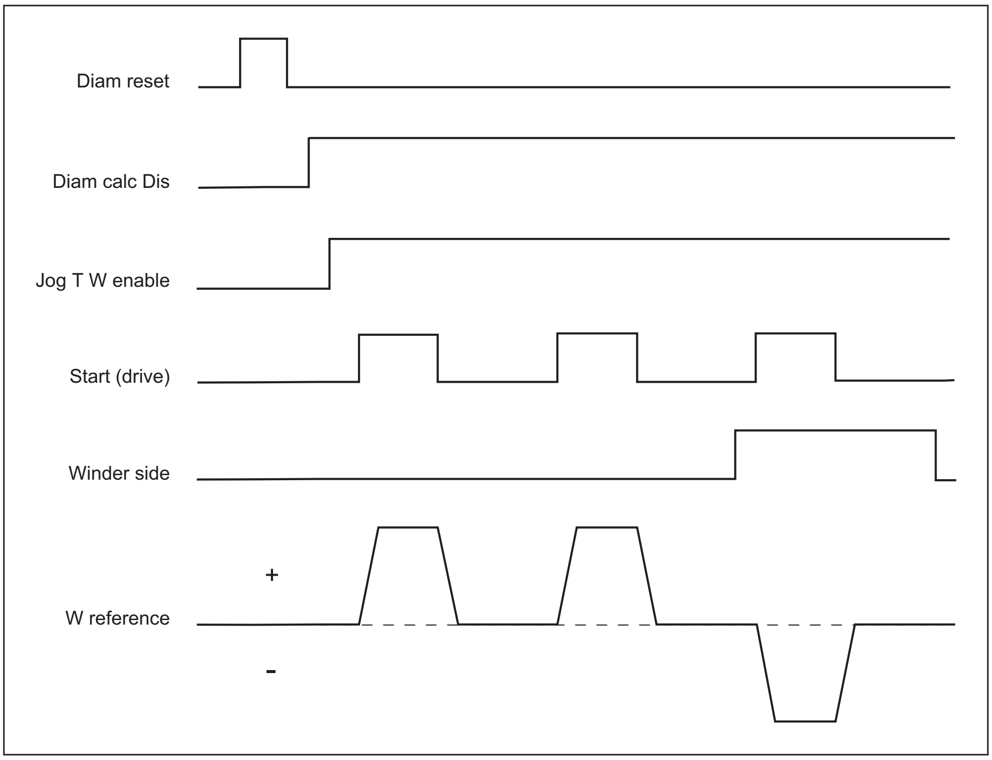


Figure 6.17.12: Jog function to prepare the machine

Initialize the diameter value as stated above.

Disable the diameter calculation. Enable **Jog TW enable.**

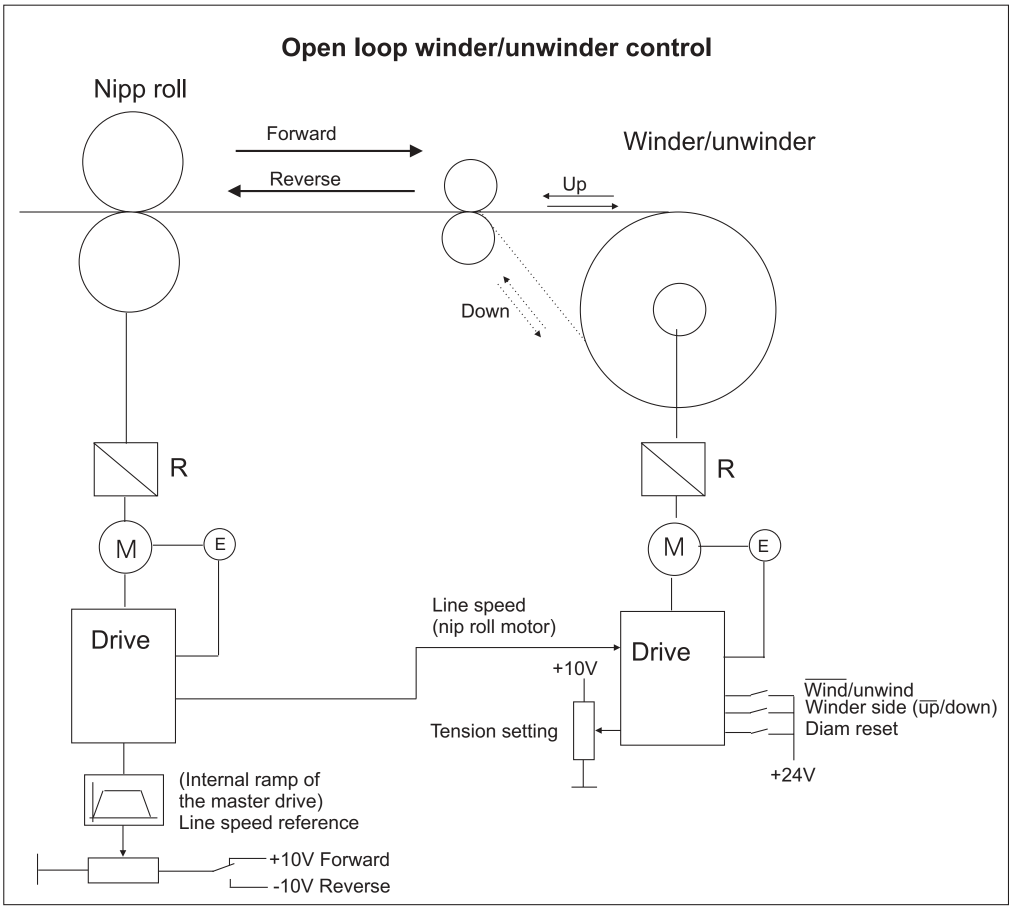
Use the Start/stop command to carry out the Jog function.

With the Start the motor increases the coil speed till reaching the peripheral speed set in **Jog TW speed** with the ramp time **Spd match acc**.

With the Stop the motor decreases its speed till reaching the 0 speed with the ramp time **Spd match dec**.

In order to change the rotation direction use the command **Winder side**.

6.17.6. Application example



Machine data:

Maximum line speed=400m/min
Rated speed of the winder motor Vn=3000rpm
Winder maximum diameter=0.7m
Winder minimum diameter=100mm
Motor - winder reduction ratio=0.5
Line speed reference 0-10V from nip roll motor.
Line acceleration/deceleration time =30sec.
Fast deceleration time fast/stop=15 sec.
Winder/unwinder selection via a digital input.
Winding side selection (up/down) via a digital input.
Tension setting via the analog input.

The winder/unwinder drive receives the analog signals referring to the line speed, to the tension setting, to the digital commands for the winder/unwinder selection, winding side (up/down), and to the diameter reset.
Drive settings:(only the settings referring to the function Torque Winder are described)

PROGRAMMING OF ANALOG INPUTS

ANALOG INPUT 1

Tension ref Tension reference in %;10V (20mA)=100%

I/O CONFIG Menu

————> Analog input

————> Analog input 1

————> Select input 1 **Tension ref**:

ANALOG INPUT 2 If the parameter **Line spd source** has to be set on an analog input, as this parameter is not listed among the high priority parameters, it is necessary to pass through a support parameter PAD0…PAD15.

Line spd source: 10V (20mA)=100%

Programming of the analog input 2 on **PAD 0:**

I/O CONFIG Menu

————> Analog input

————> Analog input 2

————> Select input 2 = PAD 0

ANALOG INPUT 3 If the parameter **Ref spd source** has to be set on an analog input, as this parameter is not listed among the high priority parameters, it is necessary to pass through a support parameter PAD0…PAD15.

Ref spd source: 10V (20mA)=100%

Programming of the analog input 2 on **PAD 1:**

I/O CONFIG Menu

————> Analog input

————> Analog input 3

————> Select input 3 = PAD 1

PROGRAMMING OF DIGITAL INPUTS

DIGITAL INPUT 1

Diam calc Dis: Disabling of the diameter calculation (see also par. **Line speed thr**). In case during the functioning period it is temporarily disabled, the system stores the last calculated value. This function has to be enabled only if the application requires it.

I/O CONFIG Menu

————> digital input

————> digital input 1: **Diam calc Dis**:

DIGITAL INPUT 2

Wind/unwind Winder/unwinder selection. In case the selection is carried out via the digital input: 0V =Winder, +24V = Unwinder.

DIGITAL INPUT 3

Winder side Selection of the winding/unwinding side: in case the selection is carried out via a digital input: 0 =UP, 1 = Down

DIGITAL INPUT 4

Diam reset Diameter reset. When this parameter is enabled, the diameter gets the starting value selected with **Diam preset sel**.

If 2-4 different values of the starting diameter have been set, the selection has to be carried out via some programmed digital inputs such as: **Diam preset sel 0-Diam preset sel 0**

If the value of the starting diameter is set via an analog input, set **Diam preset sel** = 3. In case of a winder control, it is necessary to give a reset command every time a coil change is performed by setting the minimum diameter value (winder empty diam.)

In case of an unwinder control, it is necessary to give a reset command every time a coil change is performed by setting the maximum diameter value(winder maximum diam.).

Enable the parameter **Diam reset** for a time longer than 20ms.

Reset the digital input status before the start

DIGITAL INPUT 5

Diam preset sel 0

DIGITAL INPUT 6

Diam preset sel 1 In case of a system with a winder or unwinder control, it is possible to set in **Diam preset 0** the value of the starting diameter; for the winder control a minimum diameter, for the unwinder control a maximum diameter. Set **Diam preset sel =0** (do not set any digital input as diam preset sel 0-diam preset 1). By starting the command of **Diam reset** the value of diam preset 0 is entered in **Roll diameter.**

OPTION Menu

————> Torque winder

Torque winder En ; set **Enable** to enable the center wind function.

If the system requires it, it is possible to set this function (enable/disable)also via a digital input.

Setting of the parameters in the DIAMETER CALCULATION menu

PARAMETERS

OPTION Menu

————> Torque winder

————> Diam calculation

Wind/unwind Winder/unwinder selection. Selection to be carried out only if the digital inputs are not set.

Minimum diameter Minimum diameter value in [mm]. Set 100mm

Maximum diameter Maximum diameter value in [m]. Set 0.7m

Line spd source Number of the sampling parameter of the line speed. In order to get the real number to be set it is necessary to add +2000H (8192 decimal) to the parameter number.

Setting of **PAD 0** as a line speed input:

OPTION Menu

————> Torque winder

————> Diam calculation

————> Line speed source = 8695

Line speed gain Calibration value of the line speed.

Its programming depends on the sampling parameter of the line speed; it is used to get “Line speed” = 100% of its maximum value.

The calculation of **Line speed gain** must be carried out with the formula:

[32768 x 16384 / (maximum value of the sampling parameter x 8)] -1

When this analog input is set on a PAD parameter, its maximum value is + / - 2048, therefore to have **Line speed** = 100%:

Line speed gain = [32768 x 16384 / (2048 x 8) – 1] = 32767

(A fine tuning can be obtained by carrying out the self tuning procedure of the analog input).

Ref spd source Sampling parameter number relating to the line speed reference. In order to get the real number to be set it is necessary to add +2000H (8192 decimal) to the parameter number.

Setting of **PAD 0** as a line speed input:

OPTION Menu

————> Torque winder

————> Diam calculation

————> Ref speed source = 8695

Ref speed gain Gauging value of the line speed reference.

The relative setting depends on the sampling parameter of the line speed reference and is used to obtain "Line speed" = 100% at its peak.

The calculation of **Ref speed gain** must be carried out with the formula:

[32768 x 16384 / (maximum value of the sampling parameter x 8)] -1

When this analog input is set on a PAD parameter, its maximum value is + / - 2048, therefore to have **Ref line spd** = 100%:

Ref speed gain = [32768 x 16384 / (2048 x 8) – 1] = 32767

(A fine tuning can be obtained by carrying out the self tuning procedure of the analog input).

Line speed Monitor of the line speed in [%]. After programming line speed source and line speed gain it is possible to control the tuning by checking that with a line speed at its maximum value the parameter line speed =100%.

Ref line speed Line reference Monitor.

Base omega Value in [rpm] corresponding to the maximum angular speed of the winder/ unwinder (motor shaft side).

Vp=p x Fmin x w x R

where :

Vp= peripheral speed

Fmin=winder minimum diameter (mm)

w = motor angular speed

R =reduction ratio

w=Vp/ p x Fmin x R=400/(3.14 x 0.1 x 0.5)=2547rpm

Base omega =set 2547rpm.

Ref speed thr Line speed detecting threshold in %.

When “Line speed” is lower than “Line speed thr” the diameter calculation is disabled. When “Line speed” is higher than the threshold, the diameter calculation is enabled with an initial filter corresponding to **Diam init filter** for the time set in **Diam stdy delay**. At the end of this time the filter is set to **Diam filter**.

Maximum line speed =400m/min . Line speed thr=5% (the diameter calculation is automatically enabled at 20m/min).

Setting of the parameters in the SPEED DEMAND menu

PARAMETERS

OPTION Menu

————> Torque winder

————> Speed demand

Speed demand En Enabling of the speed reference calculation; set **Enable**

Winder side Selection of the winding/unwinding side. Selection to be carried out only if the digital inputs are not set. 0 =up, 1 =down

W gain Setting of the speed reference gain used for the loop saturation. Parameter given as a percentage of the increase/decrease of the angular speed reference.

W gain=30% (set this starting value)

W offset Offset setting on the speed reference for the winder/unwinder initial phase with a stopped line. Parameter in [rpm].

W offset=50rpm (check with the material)

Offset acc time Setting of the initial phase ramp with a stopped machine. Parameter in [s]. The acc time refers to the parameter **speed base value**

W target Parameter number which the speed reference has to be addressed to. In order to obtain the real number to be set it is necessary to add +2000H (8192 decimal) to the parameter number.

W target : set 2 as a speed reference:

OPTION Menu

————> Torque winder

————> Speed demand

————> W target = 8235

Paragraph 10.4. *“List of the high priority parameters’* shows that **Speed ref 2** has the decimal number 43. In order to obtain the value to be entered add 8192 decimal (fixed offset): 8192 + 427 = 8235

W reference: It is possible to use it as a monitor for the speed reference .

Setting of the parameters in the COMP CALCULATION menu

OPTION Menu

————> Torque winder

————> torque calculation

————> comp calculation

Static f: Compensation of the static frictions as a percentage of the drive rated current

· Check that the parameters **Static f and Dinamic f**=0

· Set the tension (tension ref)=0

· The diameter calculation function is blocked (enable the programmed digital input as Dis diam calc)

· Operations to be carried out without line reference, jog function and materials on the machine (the compensation of the static frictions is completely entered only when the line speed is higher than 1.5%).

· Stopped winder/unwinder motor within the current limit (In use t curr lim+/-=0)

· Gradually increase the value of **Static f**. The motor will start rotating. Set a suitable value so that the winder/unwinder can rotate with a speed near to the zero (it must always be within the current limit. The led Ilim on the keypad is lighted)

Dinamic f: Compensation of the dynamic frictions as a percentage of the drive rated current

· Set the maximum line speed reference, check that the minimum diameter has been set in **roll diameter** (if not carry out a **Diam reset** on the minimum diameter)

· Set temporarily the parameter **Static f**: with a value of 10-20%. The motor speed will increase reaching the speed **Base omega** (the converter in this phase has to overcome the current limit) .

· When the motor reaches its rated speed, set the parameter **Static f** with its previously tuned value. The speed will start decreasing.

· Increase gradually the parameter **Dinamic f** till the speed ends its decreasing phase and the motor rotates at a constant speed.

· Increase the speed by increasing temporarily the parameter **Static f**. Reset the parameter **Static f** with its right value. The motor must keep the reached speed.

· In a negative case, reset the parameter **Dinamic f** and repeat the tests till the required conditions have been reached.

Static f Zero By setting the parameter on "Enabled", the friction compensation is completely inserted for all speed values. When it set as "Disabled", the static friction compensation is completely inserted with Ref line speed = 1.5%.

Int acc calc En Enabling of the calculation for the coil acceleration.

If enabled, this function calculates the angular acceleration inside the drive. In this case it is necessary to set just the value of **Time acc/dec min**. If disabled, the parameters **Line acc % - dec % - fast stop %** and **Time acc/dec min** have to be set and the digital inputs have to be supplied with the suitable indications.

Time acc/dec min Set the time in [s] corresponding to the lowest acceleration, deceleration and fast deceleration time.

Set time acc/dec min =15sec (time required for a fast deceleration)

Acc/dec filter Filter in [ms] on the acceleration calculation inside the drive

Set =30 msec

Mat width Width of the wound material as a percentage of the maximum width. Set =100%

Constant J comp Compensation of the fixed section (motor, reducer,core) as a percentage of the drive rated current. Increase the value till the motor can increase the speed following the line reference. During this phase the converter has always to be within the current limit.

· Diameter calculation function disabled (enable the programmed digital input as **Dis diam calc)**

· Operations to be carried out without material on the machine,

· Install the empty winder (check that the parameter **Roll diameter**= min. diam). Check that the parameters **Constant J comp- Variable J comp**=0

· Set the tension (**tension ref**)=0

· Minimum jog function and line reference

· Carry out some changes on the line reference.

· Increase gradually the value of the parameter **Constant J comp** till the winder/ unwinder is able to follow the line speed reference.

Variable J comp Torque compensation due to the wound material as a percentage of the drive rated current.

· Operation to be carried out without material on the machine

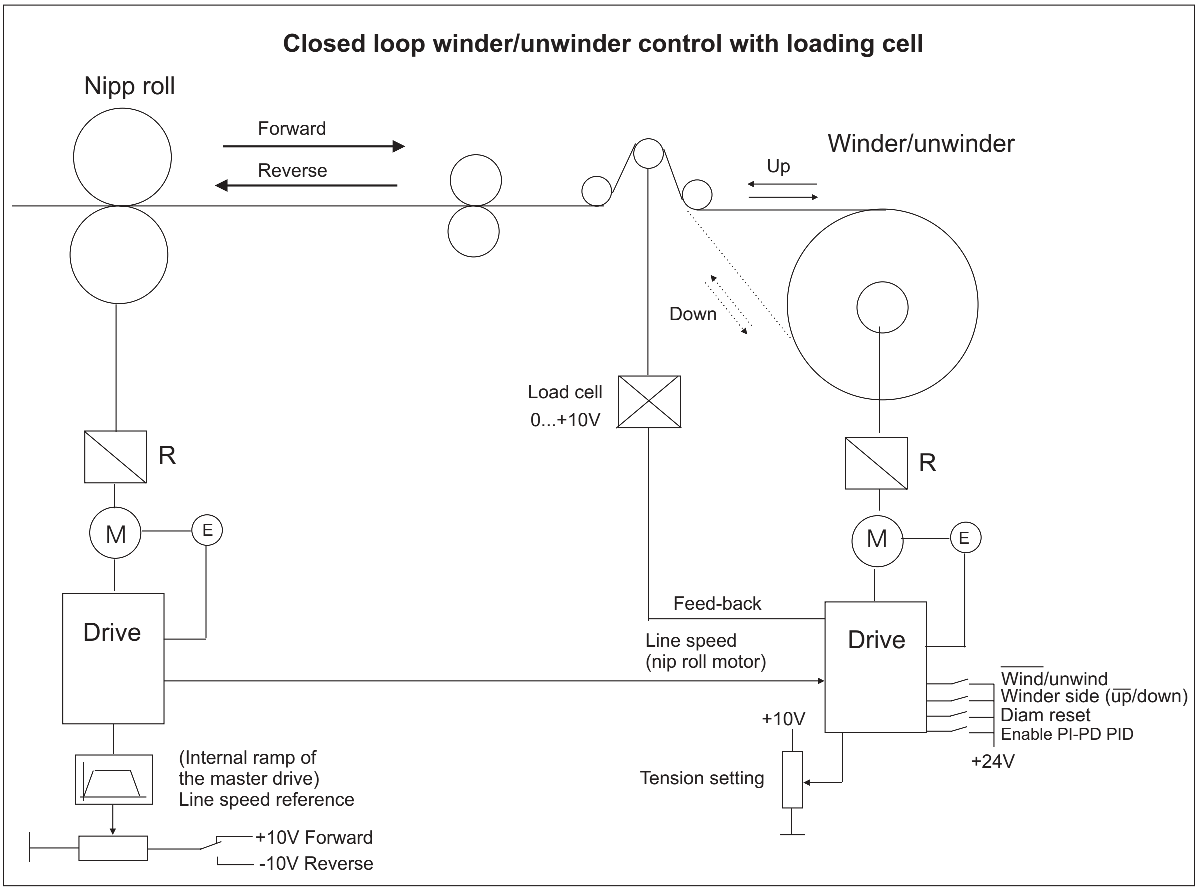
· Install a full coil on the winder (check that the parameter **Roll diameter**= max. diam).

· Follow the same procedure as the one carried out for the tuning of **Constant J comp**

Act var J comp Monitor for the compensation of the variable section as a percentage of the drive rated current.

Act const J comp Monitor for the compensation of the fixed section as a percentage of the drive rated current.

Act comp Monitor for the compensations (it sums up static, dynamic and inertial frictions) as a percentage of the drive rated current.



Machine data

Maximum line speed=400m/min
Rated speed of the winder motorVn=3000rpm
Winder maximum diameter=0.7m
Winder minimum diameter=100mm
Motor-winder reduction ratio=0.5
Line speed reference 0-10V from nip roll motor.
Line acceleration/deceleration time =30sec.
Fast deceleration time fast/stop=15 sec.
Winder/unwinder selection via a digital input.
Winding side selection (up/down) via a digital input.
Tension setting via the analog input.

Set all the parameters as stated in the previous example. After testing the machine with an open loop material, carry out such settings for the tuning with a loading cell.

ANALOG INPUT 3

Pid feed back Input of the loading cell;10V (20mA)=100%
I/O CONFIG Menu
————> Analog input
————> Analog input 3 **Pid feed back**

Closed loop En Closing of the tension loop enabled (to be used with a loading cell).
Set the parameter **Closed loop En=**enable

Closed loop comp Monitor for the present compensation on the output of the PID regulator used for the loop closing.

DIGITAL INPUT
Programming of a digital input to enable the PID function
I/O CONFIG Menu
————> digital input
————> digital input 7:**enable PI-PD PID**

<u>Setting of Pid parameters</u>

Set **Pid Source** as **PAD 1.**
Pid source=(8192+504)=8696
PARAMETERS
OPTION Menu
————> PID
————> Pid source
————> Pid source=8695

Set **PAD 1** =10000
(Pad 1 is in the "Special function" menu)

Set **Pid source gain** =1

Set **PID target** as the parameter **Closed loop comp**
The parameter Closed loop comp has the decimal number 1208
In order to obtain the value to be entered add 8192 decimal (fixed offset)
PID target=8192+1208=9400

Set **Pid out scale**
Pid out scale=(max .value of closed loop comp)/max oPID output
Pid out scale=10000/10000=1

Set **PI top lim** and **Pi bottom lim** in order to have a 100% correction of its maximum value.

PI top lim=1

Pi bottom lim=-1

With this configuration the regulator output is positive and negative.

The gains of the several components have to be set experimentally with a loaded machine.

It is possible to start the tests with the values below :

set **PI P gain PID**=10%

set **PI I gain PID**=4%

set **PD P gain PID**=5%

set **PD D gain PID**=0%

PD D filter PID=20msec

Set **PI central vsel**=1

Set **PI central v 1**=0

With this configuration, when the switching ON/OFF of the parameters enabling the PID function is carried out, the regulator output starts from 0.

Before enabling the PID regulator and the loop closing it is necessary to check the matching between the set tension and the tension measured by the loading cell.

The loading cell has to be tuned in order to have an analog output =10V connected to the maximum tension on the required material.

With a loaded machine start the winder/unwinder by setting a tension of 50%.

Check the values of the parameters **Act tension ref** (0 ¸ 100%, tension set in the Torque winder menu) and **Pid feedback** ((0 ¸ 10000, loading cell feedback in the PID menu). The two values must be the same.

If not, act on the parameter **Tension scale** till the two parameters reach the same values.

After this parameterization has been carried out, it is possible to start the tests with the material.

Improve the system stability via the different components of the blocks PI and PD PID .

Provisions

In order to make the commissioning procedure easier and uniform, the system contains a clause referring to the speed and torque directions to be respected:

As a general rule the winder speed and the torque direction are considered positive with a upper winding side.

All the possible system configurations stated in the examples below refer to this clause.

NOTE! The polarity of the line speed reference is not important, because the system states the output reference polarity only according to the parameters **Wind/unwind** and **Winder side**.

1. Drive used as a winder – winding side = up

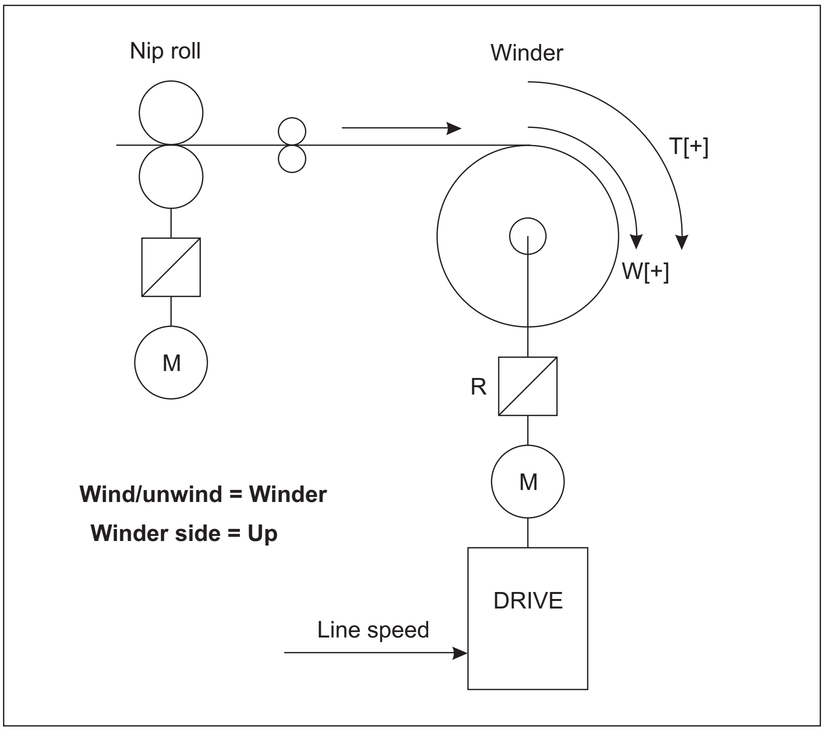


Figure 6.17.13: Drive used as a winder – winding side = up

If the speed demand function is used, the system creates a positive speed reference; it is therefore necessary to connect the motor so that, with this polarity, the coil winds the material starting from the upper side. The winding torque is positive.

2. Drive used as a winder – winding side = down

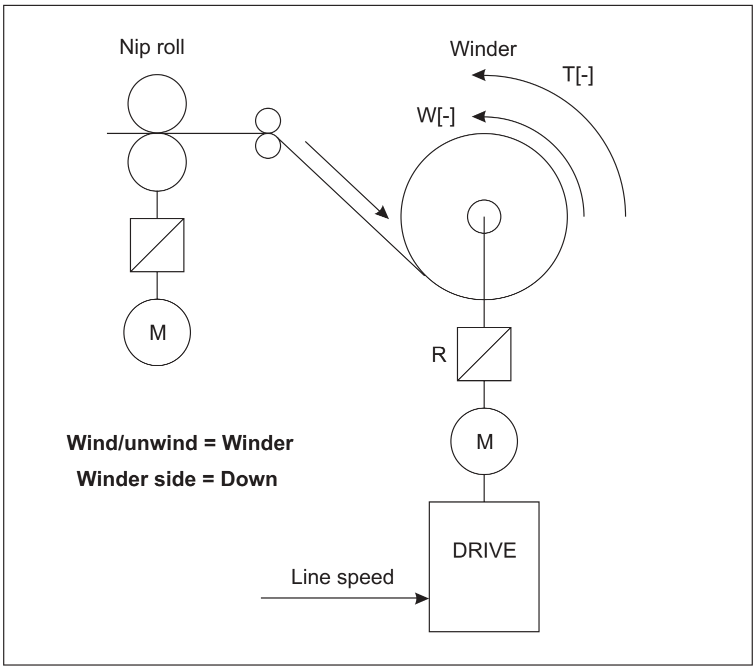


Figure 6.17.14: Drive used as a winder – winding side = down

If the speed demand function is used, the system creates a negative speed reference; it is therefore necessary to connect the motor so that, with this polarity, the coil winds the material starting from the lower side. The winding torque is negative.

3. Drive used as an unwinder – unwinding side = up

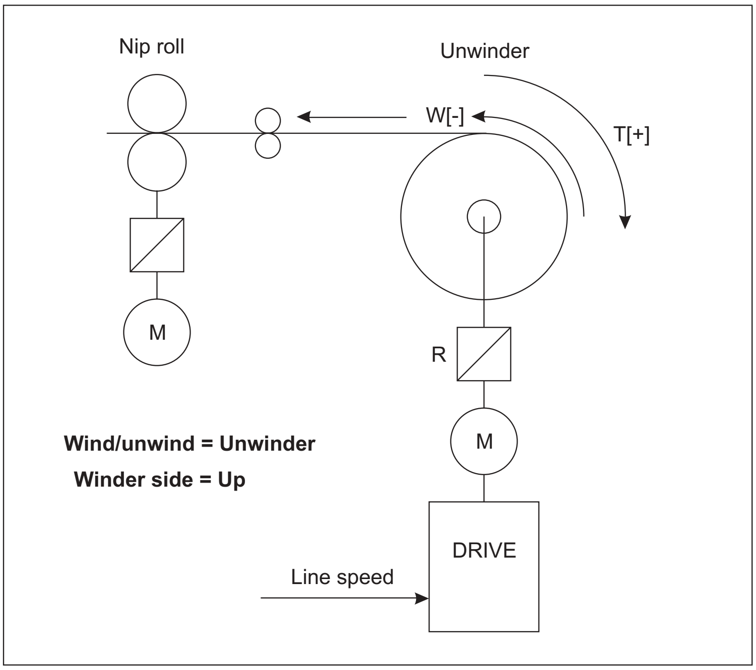


Figure 6.17.15: Drive used as an unwinder – unwinding side = up

If the speed demand function is used, the system creates a negative speed reference; it is therefore necessary to connect the motor so that, with this polarity, the coil unwinds the material starting from the upper side. The unwinding torque is positive.

4. Drive used as an unwinder – unwinding side = down

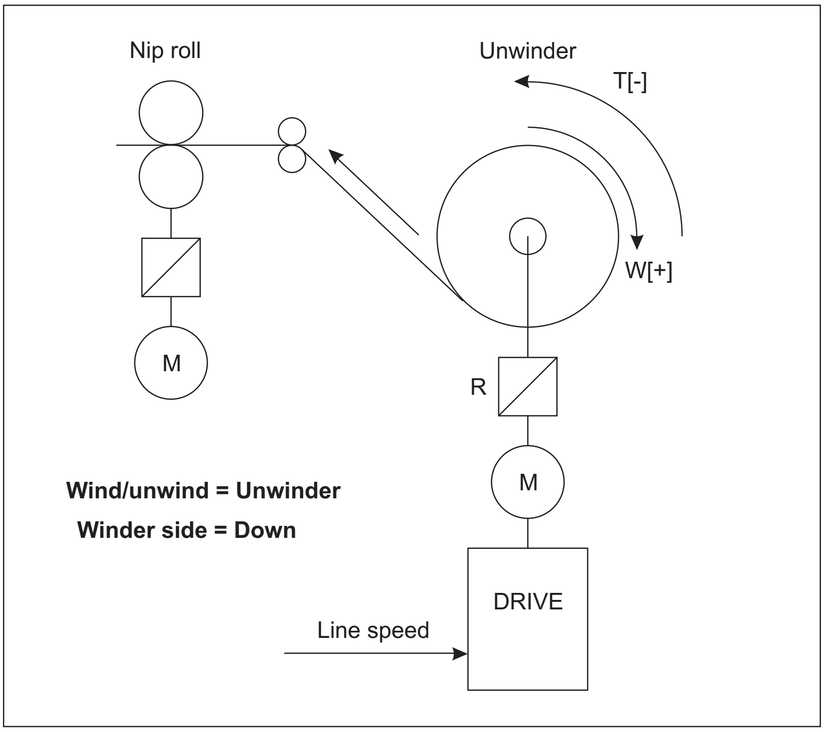
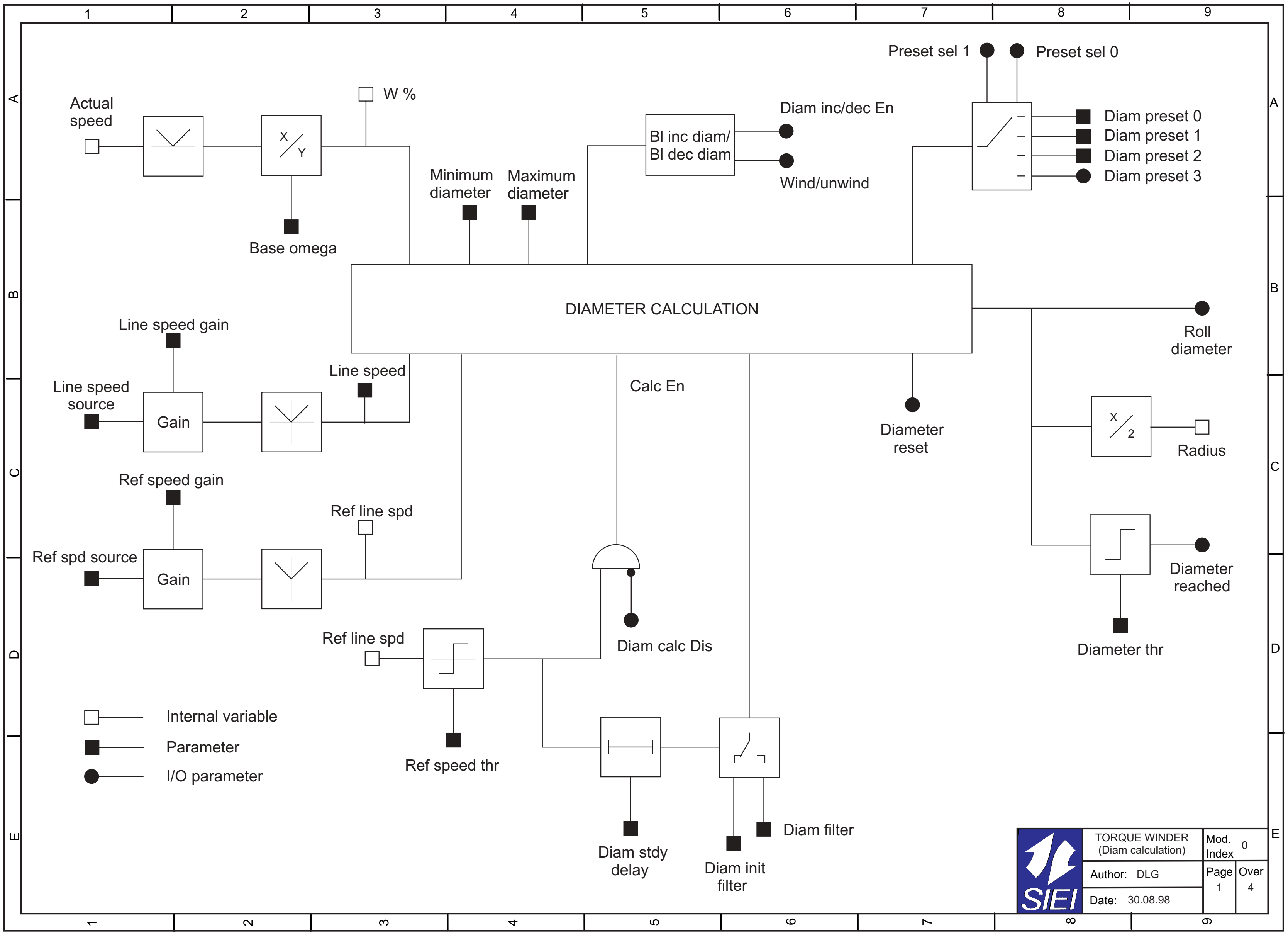
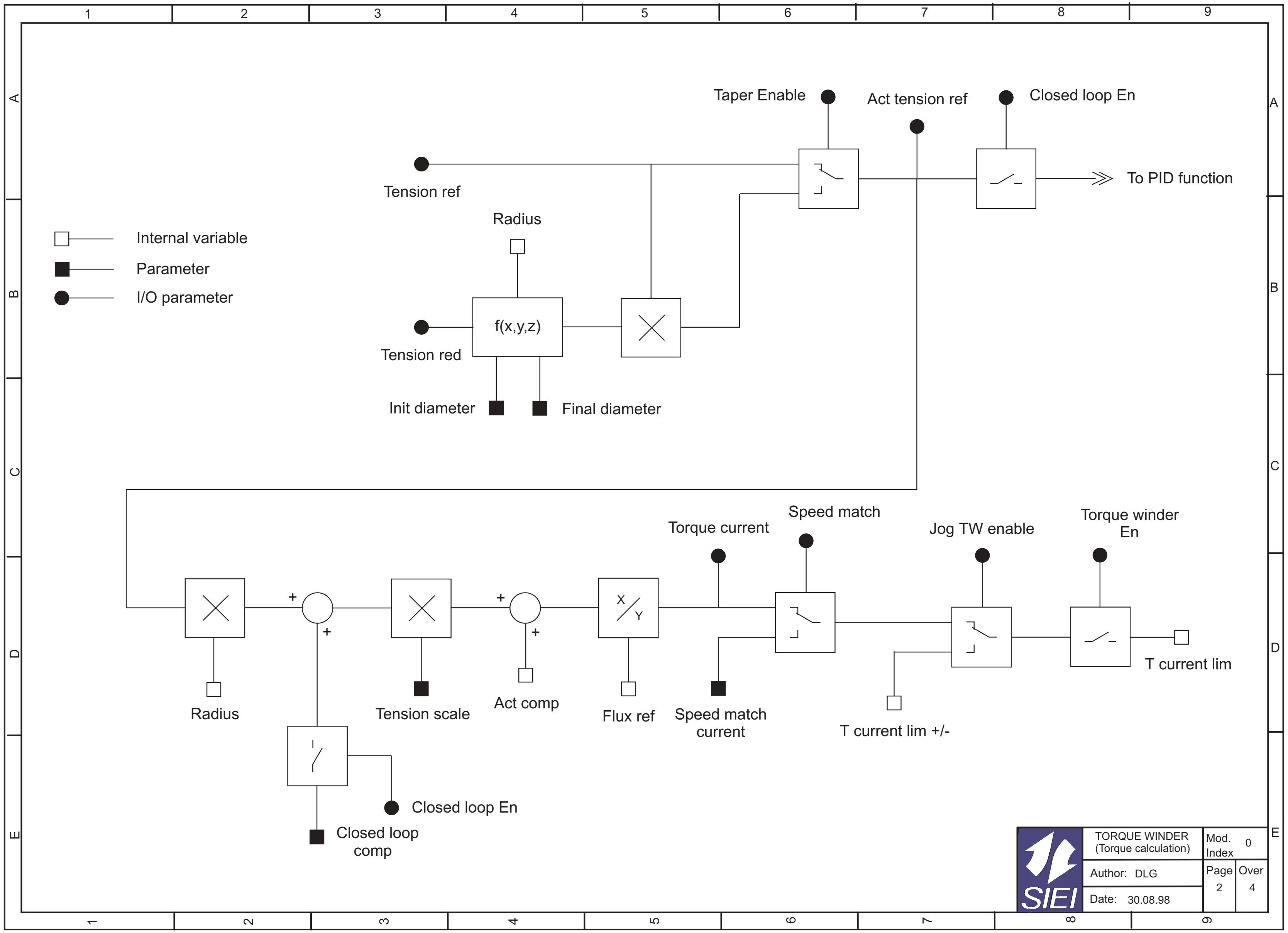


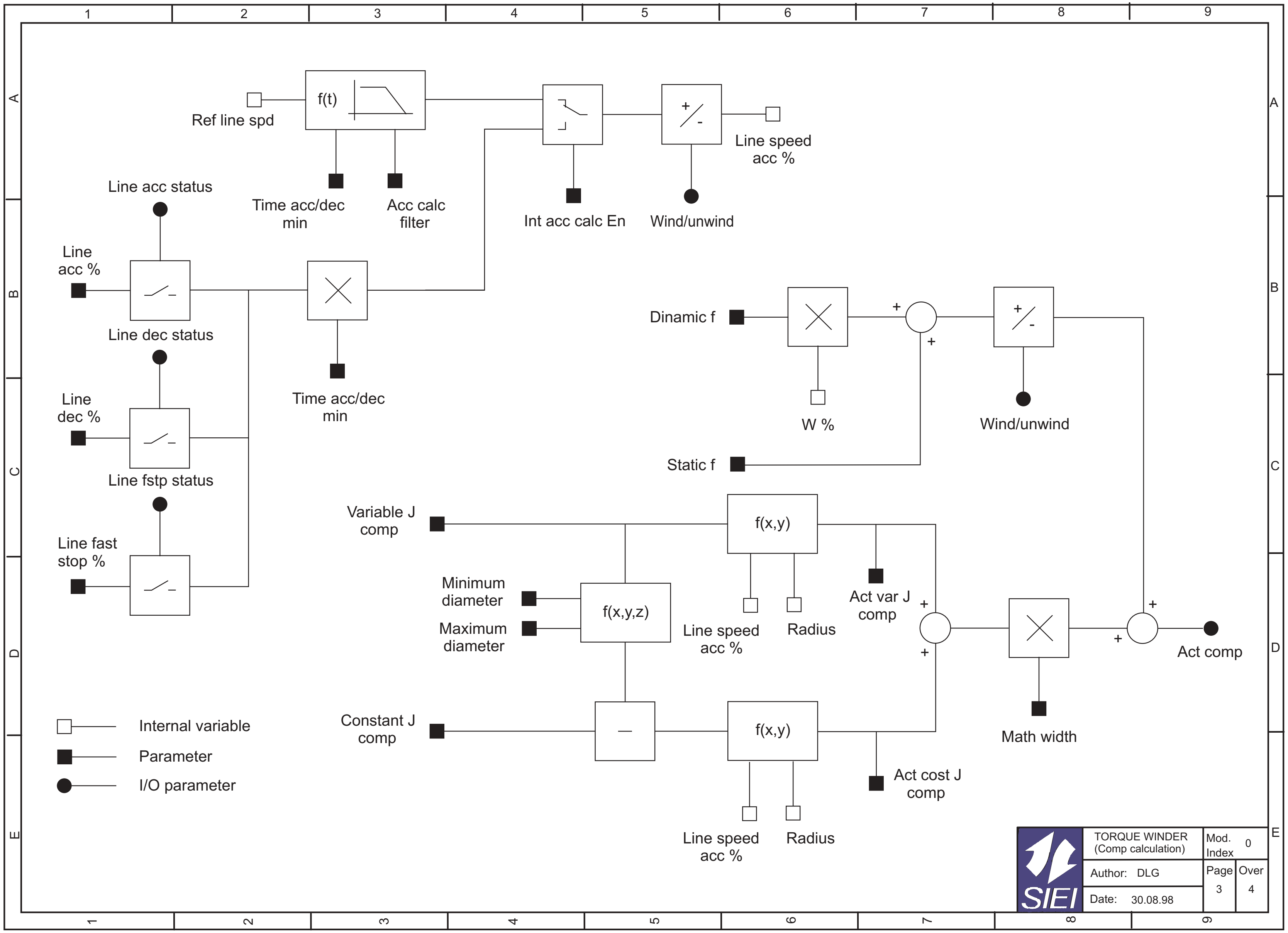
Figure 6.17.16: Drive used as an unwinder – unwinding side = down

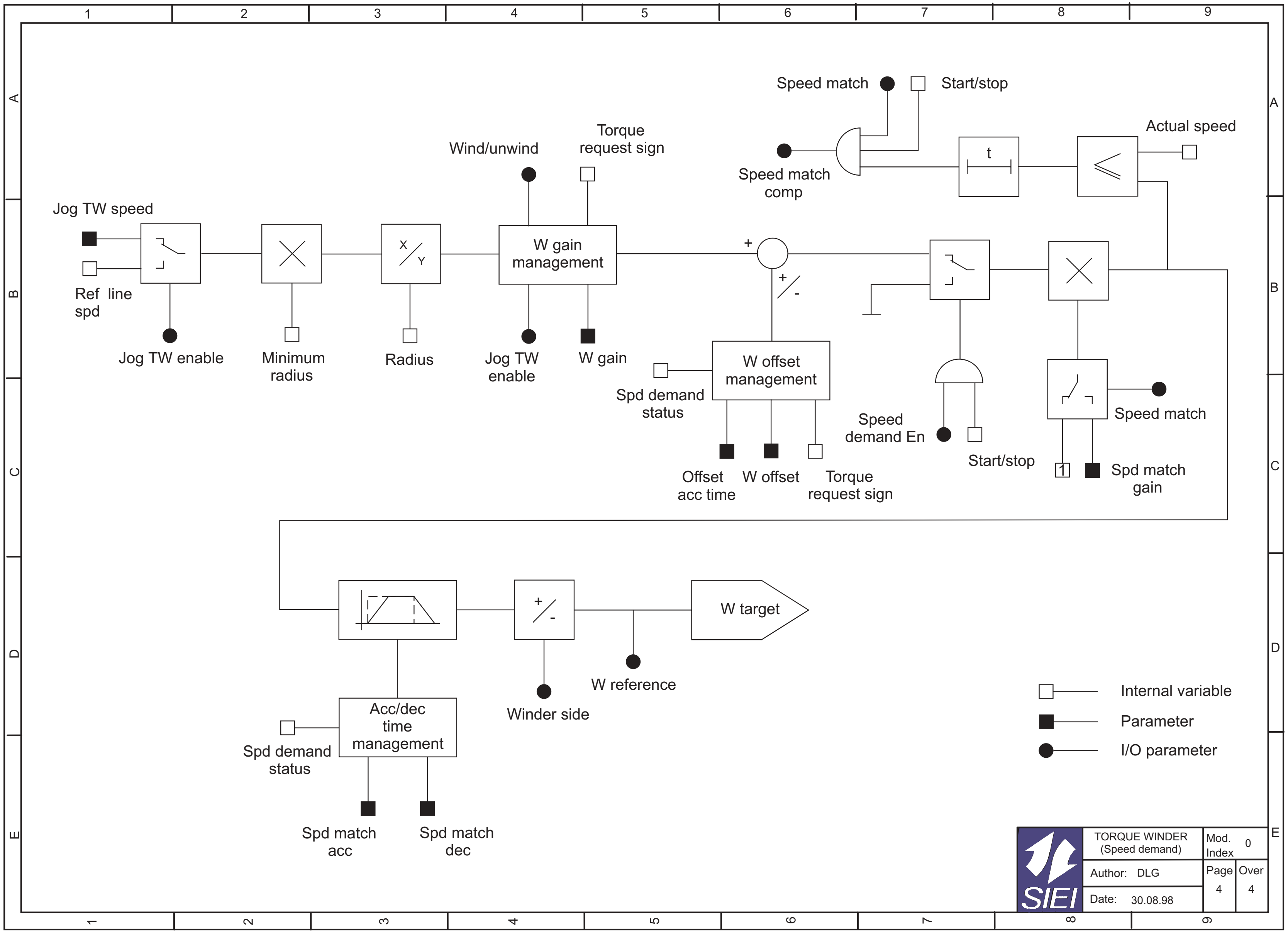
If the speed demand function is used, the system creates a positive speed reference; it is therefore necessary to connect the motor so that, with this polarity, the coil unwinds the material starting from the lower side. The unwinding torque is negative.

6.17.7. Block diagram




Taper Enable
Act tension ref
Closed loop En
Tension ref
To PID function
Radius
Internal variable
Parameter
I/O parameter
f(x,y,z)
Tension red
Init diameter
Final diameter
Torque current
Speed match
Jog TW enable
Torque winder En
Radius
Tension scale
Act comp
Flux ref
Speed match current
T current lim +/-
T current lim
Closed loop En
Closed loop comp
TORQUE WINDER
(Torque calculation)
Mod. Index 0
Author: DLG
Date: 30.08.98
Page 2
Over 4
SIEI


Ref line spd
f(t)
Time acc/dec min
Acc calc filter
Int acc calc En
Wind/unwind
Line speed acc %
Line acc status
Line acc %
Line dec status
Line dec %
Line fstp status
Line fast stop %
Time acc/dec min
Dinamic f
W %
Wind/unwind
Static f
Variable J comp
f(x,y)
Minimum diameter
Maximum diameter
f(x,y,z)
Line speed acc %
Radius
Act var J comp
Math width
Act comp
Constant J comp
f(x,y)
Act cost J comp
Line speed acc %
Radius
Internal variable
Parameter
I/O parameter
SIEI
TORQUE WINDER (Comp calculation)
Author: DLG
Date: 30.08.98
Mod. Index 0
Page 3
Over 4



Speed match
Start/stop
Actual speed
Wind/unwind
Torque request sign
Speed match comp
t
Jog TW speed
Ref line spd
W gain management
X
Y
W offset management
Jog TW enable
Minimum radius
Radius
Jog TW enable
W gain
Spd demand status
Speed demand En
Start/stop
Speed match
Offset acc time
W offset
Torque request sign
Spd match gain
1
W target
W reference
Winder side
Acc/dec time management
Spd demand status
Spd match acc
Spd match dec
Internal variable
Parameter
I/O parameter
TORQUE WINDER (Speed demand)
Mod. Index 0
Author: DLG
Page 4
Over 4
Date: 30.08.98
SIEI

6.18. DRIVECOM

The DRIVECOM profile #21 “Power transmission,” defines the behavior of the drive if this is operated via the INTERBUS-S field bus. The DRIVECOM menu of the TPD32 converter provides functions that were defined in the above standards and which are required to operate a motor with the converter.

The TPD32 converters, however, have a considerably greater range of functions than is defined here. Apart from a few exceptions the parameters provided in this menu are described somewhere else in detail. We will therefore restrict this description to the Parameters function. See section 10, “Parameter list” and the above standard for further information on the parameters. When operating from a Bus, the parameters in the Drivecom group can also be accessed using the format and index specified in the above standard.

6.18.1. Control word, status word, malfunction code

DRIVECOM

- Malfunction code
- Control-Word
- Status word

T0890g

The three parameters are defined by the DRIVECOM specification.

Parameter Description	N.	Value			Standard
		min	max	factory	Configuration
Malfunction code	57	0	65535	0	
Control word	55	0	65535	0	0
Status word	56	0	65535	0	

T6280g

Malfunction code Malfunction code according to DRIVECOM specification (Mandatory functions)

The code displayed indicates a particular failure. The meaning of the individual failures concerned is described in the section Programmable Alarms.

0000h **No failure**

1001h **Unknown**

2300h **Overcurrent**

3120h **Undervoltage**

3310h **Overvoltage**

3330h **Field loss**

4210h **Heatsink**

4310h **Overtemp motor**

5000h **Hardware**

5100h **Failure supply**

6110h **Dsp error**

6120h **Interrupt error**

7301h **Speed fbk loss**

7400h **Opt2**

7510h **Hw Opt 1 failure**

8110h **Bus loss**

9000h **External fault**

9009h **Enable seq err**

The code and the alarm are displayed in plain text in the event of a failure. The code is given in hexadecimal format.

Control word Control word according to DRIVECOM specification (Mandatory functions)

Status word Status word according to DRIVECOM specification (Mandatory functions).

6.18.2. Speed

DRIVECOM

Speed input var
Speed ref var
Act speed value

Speed base value
Speed input perc
Percent ref var
Act percentage

T0900g

Parameter Description	No.	Value			Standard Configuration
		min	max	factory	
Speed input var [FF]	44	-2 x P45	+2 x P45		*
Speed ref var [FF]	115	-32768	+32767		**
Act speed value [FF]	119	-32768	+32767		***
Speed base value [FF]	45	0	16383	1500	
Speed input per [%]	46	-23768	32767	0	*
Percent ref var [%]	116	-32768	32767		**
Act percentage [%]	120	-32768	+32767		***

T6285g

* Factory set as **Ramp ref 1** and connected to analog input 1 (terminal 1 and 2). See reference values.

** Factory set as **Speed ref 1** and connected to the ramp output. See reference values

*** Factory set as **Motor speed** and connected to analog output 1. See DRIVE STATUS menu

Speed input var 1st ramp reference value. The value to be entered is based on the factor function

Speed ref var 1st speed reference value. The value to be entered is based on the factor function

Act speed value Speed actual value in the unit specified in the factor function.

Speed base value The **Speed base value** is given in the unit specified in the factor function. It is the base value for all speed values given as a percentage (reference values, adaptive speed regulation ...). A change in this parameter is only possible when the drive is disabled. (**Enable drive** = Disabled).

Speed input perc 1st ramp reference value. Defined as a percentage of the **Speed base value**

Percent ref var 1st speed reference value. Defined as a percentage of the **Speed base value**

Act percentage Speed actual value as a percentage of the **Speed base value**

6.18.3. Speed limitation

- **DRIVECOM**
  - **Speed amount**
    - Speed min amount
    - Speed max amount
  - **Speed min/max**
    - Speed min pos
    - Speed max pos
    - Speed min neg
    - Speed max neg

T0910g

Parameter Description	N.	Value			Standard
		min	max	factory	Configuration
Speed min amount [FF]	1	0	232	0	—
Speed max amount [FF]	2	0	232	5000	—
Speed min pos [FF]	5	0	232	0	—
Speed max pos [FF]	3	0	232	5000	—
Speed min neg [%]	6	0	232	0	—
Percent max neg [%]	4	0	232	5000	—

T6290g

* Factory set as **Ramp ref 1** and connected to analog input 1 (terminal 1 and 2). See reference values.

** Factory set as **Speed ref 1** and connected to the ramp output. See reference values

*** Factory set as **Motor speed** and connected to analog output 1. See BASIC MENU

Speed min amount Defines the minimum speed for both rotation directions (with TPD32...4B...). A lower value than the defined value is not possible, regardless of the reference value set. It has an effect on the input of the ramp. If the **Speed min amount** parameter is changed, the **Speed min pos** and **Speed min neg** parameters are set to the same value. If one of these two parameters is changed later, the last change is valid. The current value for positive rotation (clockwise) is shown in the display of the keypad. The value to be entered is based on the factor function.

Speed max amount Defines the maximum speed for both rotation directions (with TPD32...4B...). The function has an effect on the input of the speed regulator and therefore takes into account the reference value that comes from the ramp as well as the directly defined values (see Figure 6.4.2.1). If the Speed max amount is changed, the **Speed max pos** and **Speed max neg** parameters are set to the same value. If one of these two parameters is changed later, the last change is valid. The current value for positive rotation (clockwise) is shown in the display of the keypad. The value to be entered is based on the factor function.

Speed min pos Defines the minimum speed for the clockwise rotation of the motor. A lower value than the defined value is not possible, regardless of the reference value. The function has an effect on the input of the ramp (see Figure 6.4.1.1). The value to be entered is based on the factor function.

Speed max pos Defines the maximum speed for the clockwise rotation of the motor. The function has an effect on the input of the speed regulator, and therefore takes into consideration the reference value that comes from the ramp as well as those that are entered directly (see Figure 6.4.2.1). The value to be entered is based on the factor function.

Speed min neg Defines the minimum speed for the anti-clockwise rotation of the motor (with TPD32...4B...). A lower value than the defined value is not possible, regardless of the reference value. The function has an effect on the input of the ramp (see Figure 6.4.1.1). The value to be entered is based on the factor function.

Speed max neg Defines the maximum speed for the anti-clockwise rotation of the motor (with TPD32...4B...). The function has an effect on the input of the speed regulator, and therefore takes into consideration the reference value that comes from the ramp as well as the those that are entered directly (see Figure 6.4.2.1). The value to be entered is based on the factor function.

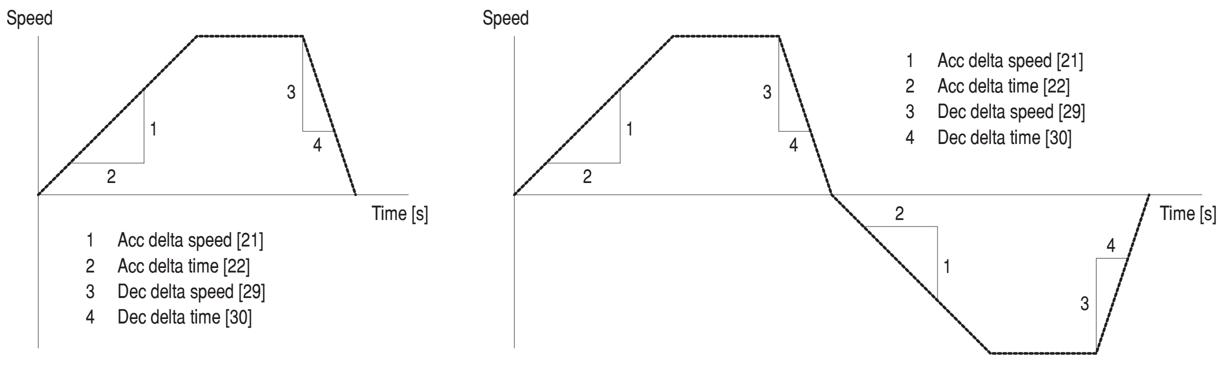
6.18.4. Acceleration / Deceleration

- **DRIVECOM**
  - **Acceleration**
    - Acc delta speed
    - Acc delta time
  - **Deceleration**
    - Dec delta speed
    - Dec delta time
  - **Quick stop**
    - QStp delta speed
    - QStp delta time

T0920g

Parameter Description	No.	Value			Standard configuration
		min	max	factory	
Acc delta speed [FF]	21	0	2^{32}-1	100	
Acc delta time [s]	22	0	65535	1	
Dec delta speed [FF]	29	0	2^{32}-1	100	
Dec delta time [s]	30	0	65535	1	
Qstp delta speed [FF]	37	0	2^{32}-1	1000	
Qstp delta time [s]	38	0	65535	1	
Quick stop Quick stop No quick stop	343	0	1	No Quick stop (1)	

T6295g



TPD32...2B TPD32...4B

Figure 6.18.4.1: Acceleration / Deceleration

Acc delta speed Has the same unit as the ramp reference value and is based on the factor function.

Acc delta time Is defined in seconds. The ramp output follows the reference value directly if “0 s” is entered.

Dec delta speed Has the same unit as the ramp reference value and is based on the factor function.

Dec delta time Is defined in seconds. If “0 s” is entered, the ramp output follows the reference value directly.

Qstp delta speed Has the same unit as the ramp reference value and is based on the factor function.

Qstp delta time Is defined in seconds. If “0 s” is entered, the ramp output follows the reference value directly.

Quick stop Activates the Quick stop ramp to stop the Drive.

The acceleration of the drive is defined as a quotient of the **Acc delta speed** and **Acc delta time** parameters. It is the same for both rotation directions of the motor.

The deceleration of the drive is defined as a quotient of the **Dec delta speed** and **Dec delta time** parameters. It is the same for both rotation directions of the motor.

The Quick stop function provides a second deceleration ramp for braking the drive to halt in the event of an emergency. The deceleration of the drive using the Quick stop function is defined as a quotient of the Qstp delta speed and Qstp delta time. It is the same for both rotation directions of the motor. This function is only available via the serial interface or BUS.

6.17.5. Factor function

- **DRIVECOM**
  - **Face value fact**
    - Face value num
    - Face value den
  - **Dimension fact**
    - Dim factor num
    - Dim factor den
    - Dim factor text

T0930g

The factor function contains two factors, the Dimension factor and Face value factor. They are both expressed as fraction numbers.

The dimension factor enables the drive speed to be defined in a machine-related dimension, e.g. kg/h or m/min.

Further information and examples are given in the section on the Configuration menu.

Parameter Description	No.	Value			Standard Configuration
		min	max	factory	
Face value num	53	1	+32767	1	
Face value den	54	1	+32767	1	
Dim factor num	50	1	65535	1	
Dim factor den	51	1	$+2^{31}$-1	1	
Dim factor text	52			rpm	

T6300g

Face value num Numerator of the reference value factor.

Face value den Denominator of the reference value factor.

Dim factor num Numerator of the dimension factor

Dim factor den Denomiator of the dimension factor

Dim factor text Unit of the dimension factor. This text is shown in the display of the keypad when the reference value is shown.

Possible characters: / % & + , - . 0..9 : < = > ? A...Z [ ] a...z

See example in section 6.11.6, “Dimension factor, Face value factor”, on how to make the calculation.

6.18. SERVICE

The SERVICE menu is only accessible for the service personnel of the manufacturer.

7. MAINTENANCE

7.1. CARE

The TPD32 converters must be installed according to the relevant installation regulations. They do not require any particular care. They should not be cleaned with a wet or moist cloth. The power supply must be switched off before cleaning.

7.2. SERVICE

The screws of all terminals on the device should be tightened two weeks after initial commissioning. This should be repeated once a year.

7.3. REPAIRS

Repairs on the device should be made by your supplier's trained personnel.

If you carry out a repair of your own, observe the following points:

- When ordering spare parts, do not only state the device type but also the device number (nameplate). It is also useful to state the type of regulator card and the software version of the operating system (printed on EEPROMs)

- When exchanging cards, ensure that the positions of switches and jumpers are observed. This particularly applies to switch SW8 on the regulator card. This sets the rated current of the converter.

NOTE The manufacturer does not accept any liability for any device parts that are destroyed due to the incorrect position of switch SW8.

For customer service, please contact your SIEI Spa office.

8. TROUBLESHOOTING

The following describes possible faults and their causes.

Failure alarms in the keypad display

FAILURE ALARM	POSSIBLE CAUSES
Failure supply	Fault in voltage supply = the voltages are below the permitted value **CAUTION:** switch off voltage before removing terminal strips. In most cases the cause is in the external wiring. Pull out the plug-in terminal strips of the regulator card and enter the Reset command. If no other failures are reported, check your wiring for a short-circuit, in some cases with the cable shielding. If this has not rectified the fault: remove the terminal strips of the I/O option card (if present) and try RESET once more. If you are still unsuccessful: probably an internal fault. Contact your sales office.
Undervoltage	Undervoltage on the power circuit **Undervolt thr** parameter set incorrectly (possibly 400 V set, although the device is run on 230 V). Remedy: set parameter correctly and then acknowledge the failure via RESET. The incoming voltage to the terminals U/V/W of the device is too low due to: too low an AC input voltage poor cable connections (e.g. terminals on contactor, choke, filter ... not properly fixed). Remedy: check connections. Intervention of the line fuses AC input voltage dips, or high distortion of the supply voltage The converter has been enabled when the supply voltage is not present
Overvoltage	Overvoltage of the armature circuit **Max out voltage** parameter set too low. The drive does not operate with a field weakening, even though the set speed can be reached only with a field weakening. Check the **Flux reg mode** parameter.

FAILURE ALARM **POSSIBLE CAUSES**

Heatsink

Heatsink temperature too high

Ambient temperature too high

Failure of device fan [with devices > 110 A]

Dirty heatsink

Overtemp Motor

Motor overtemperature (signaled by the thermistor to the terminals 78/79)

The motor is not provided with a thermistor: no jumper between the terminals 78 and 79

Cable between thermistor connection on motor and terminals 78 and 79 interrupted.

Overheating of motor:

Load cycle too extreme

Ambient temperature at site of motor too high

Motor has an external fan: fan failed

Motor does not have an external fan: too large a load at low speeds. The cooling effect of the fan on the motor shaft is too low for this load cycle. Change cycle or fit external fan.

External fault

External failure, reported on terminal 15

If the “External fault” message is not used: connection missing between terminals 16 and 18 (reference point) and/or 15 and 19.

If the “External fault” message is used:

The signal on terminal 15 is missing (15 ... 30 V to terminal 16). With external voltage supply: reference points must be connected with each other!

Overcurrent

Overcurrent in the motor circuit

Short-circuit or ground fault at the output of the converter

Current regulator optimized incorrectly

Overcurrent thr parameter too low

Field loss

Too low field current

The field regulation is blocked

The conductors in the field circuit are interrupted

Field fuses are active

FAILURE ALARM	**POSSIBLE CAUSES**
Speed fbk loss	No speed feedback signal The conductors of the reaction signal are interrupted One or several encoder channels are missing (conductor interruption, no encoder power supply)
Opt2 failure	Failure on the option card 2 Try a RESET. If you are still unsuccessful: probable internal fault. Contact your sales office.
Bus loss	Failure in the Bus connection (only with interface Bus option card) Check the Bus connection EMC compatibility problems Try a RESET. If you are still unsuccessful: probable internal fault. Contact your sales office.
Enable seq err	Drive is powered up or Reset with Enable input connected to 24 V (picked up) and the Drive is configured to run from the terminals. Refer to CONFIGURATION/MAINS COMMAND.
Hw opt1 failure	Failure on the option card 1 Try a RESET. If you are still unsuccessful: probable internal fault. Contact your sales office.

Other faults

FAILURE	**POSSIBLE CAUSES**
The motor is not turning	Failure alarm is displayed: see table above Once the error has been rectified give the RESET command Keypad display is dark: voltage supply to terminals U2/V2 missing or internal fuse blown or missing Enable and/or start command missing Converter not accepting commands: incorrect or wrongly selected operating mode Protective device of the power supply has tripped: protective device incorrectly sized or fault on the thyristor bridge The analog input used for the reference value was not assigned or assigned differently. Negative reference with TPD32...2B. The reference for the biquadrant converters must always be positive!

FAILURE **POSSIBLE CAUSES**

The motor is turning in a wrong way

Wrong polarity of the reference sign (with TPD32...4B)

The motor is connected in a wrong way.

ATTENTION: when the motor turns in a wrong way but the rotation direction can be changed, remember to change both the armature or field conductors and the two encoder connections (A+ with A- or B+ with B-). Using a tachometer change the conductor polarity.

The motor does not reach the rated speed

Drive is within speed limitation. Remedy: check Speed max amount, Speed max pos and Speed max neg parameters

Drive working at current limit (LED I_{LIM}lit) Possible causes:

Motor overloaded

Converter sized too small

Flux reduction selected via Torque reduct

The entered value for the number of encoder pulses is too high. Remedy: check the parameters concerned (encoder 1 pulses when using plug connector XE1 or encoder 2 pulses with plug connector XE2) and set correct value.

Wrong adaptation of the tachometer voltage. Check the voltage field choice (jumpers to the terminals A/B/C). Check the Tacho scale parameter.

A correction value reduces the main reference value. Remedy: check the configuration

The factor function is set incorrectly.

The motor reaches the maximum speed immediately

Reference value set via terminals: Check whether the value varies from min. to max. value. Potentiometer used for reference value setting: is there a 0V connection present?

Encoder/tachometer not connected, or incorrectly connected or not supplied:

Preset the Actual spd parameter in the DRIVE STATUS menu.

With the regulator disabled turn the motor clockwise (viewed from the front of the shaft). The value indicated must be positive.

If the indicated value does not change or if inexplicable values are shown, check the power supply and the cabling of the encoder/tachometer.

If the indicated value is negative, reverse the encoder connections. Exchange channel A+ and A- or B+ and B-. Using a tachometer change the conductor polarity.

FAILURE	POSSIBLE CAUSES

The motor accelerates too slowly

Ramp set incorrectly

Motor running at max. current

Motor overloaded

Converter too small

The motor decelerates too slowly

Ramp values and times incorrectly set

Braking current too low

With twoquadrant drives: moment of inertia too high.

The motor turns slowly even though the reference value = zero

Minimum speed selected

Interference due to unused analog input. Remedy: set unused analog inputs to OFF

Disconnect reference value on used analog input

If drive now stands still, the effect is due to the cable resistance of the 0V cable.

If the drive is still turning: check if the speed reference is zero. If it is not zero set Offset input xx parameter so that the drive stands still. If it is zero set Spd offset parameter.

The motor thermic is active

Overloaded motor

Motor thermic protection relay incorrectly scaled

The motor is not supplying the max torque and the max power

Drive working at current limit

Check whether the value for Full load curr in the CONFIGURATION menu is set correctly

Check the value for the current limitation

The speed during acceleration with max. current is not linear

Reduce the Speed I and Speed P proportionally. If this does not lead to an improvement, optimize the regulator (see chapter “Optimizing the regulator”).

Speed oscillating

Check Speed P and Speed I parameter

If the operating point is in the field weak range, check the Flux P and Flux I parameters and eventually Voltage P and Voltage I parameters.

Remedy: Optimize the regulator as previously described

FAILURE **POSSIBLE CAUSES**

Drive not reacting to adaptive speed regulation

Adaptive speed regulation not enabled. Enable spd adap = Enabled

Motor potentiometer function not executed

Function not enabled. Enable motor pot = Enabled

With operation via the terminal strip: Motor pot up and/or Motor pot down were not assigned to a digital input

Jog operation not possible

A start command is still present

Function not enabled. Enable jog = Enabled

With operation via terminal strip: Jog + and/or Jog - were not assigned to a digital input.

Internal speed reference values not carried out

Function not enabled. Enab multi spd = Enabled

With operation via terminal strip: Speed sel 0, Speed sel 1 and Speed sel 2 were not assigned to a digital input.

Multi-Ramp function not reacting

Function not enabled. Enab multi rmp = Enabled

With operation via terminal strip: Ramp sel 0 and Ramp sel 1 were not assigned to a digital input

Overload not possible

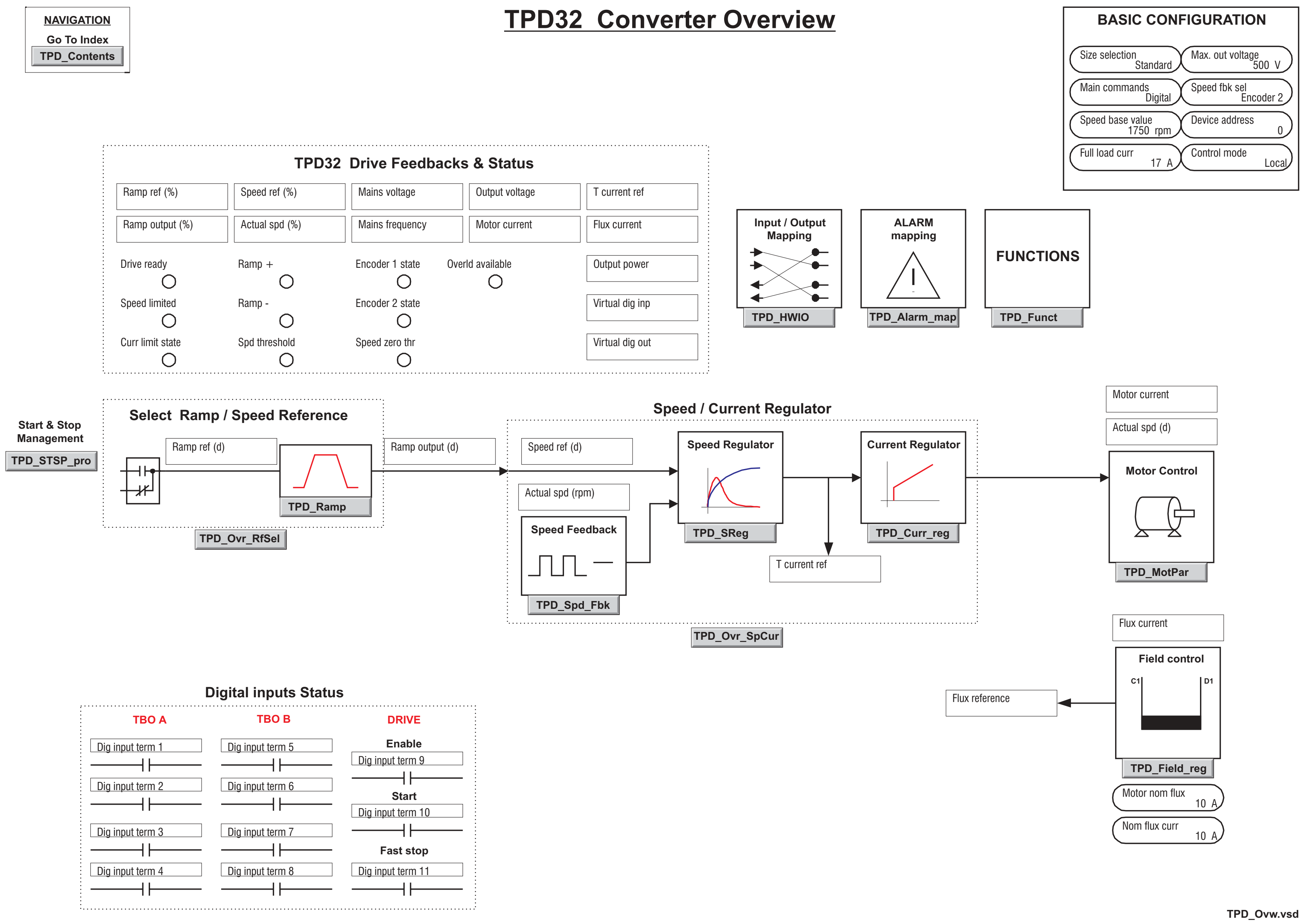
Function not enabled. Enable overload = Enabled

The R&L Search procedure never finishes and continues over and over again.

Because of the motor inductance value, the routine is executing an endless loop. The inductance value is cycling between two values without an evolution of the algorithm.
Solution procedure:
1) verify the two displayed inductance values
2) insert the average value as motor inductance during the autotuning.
If the procedure does not end, repeat step 1) and 2).

9. BLOCK DIAGRAMS

9.1. CONTROL BLOCK DIAGRAMS

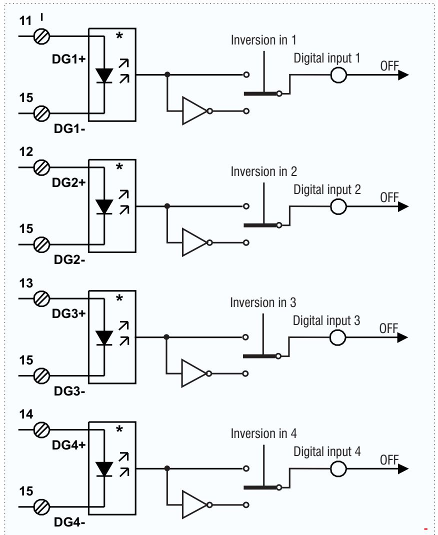


NAVIGATION
Overview TPD_Ovw
Analog I/O TPD_HWIOAN

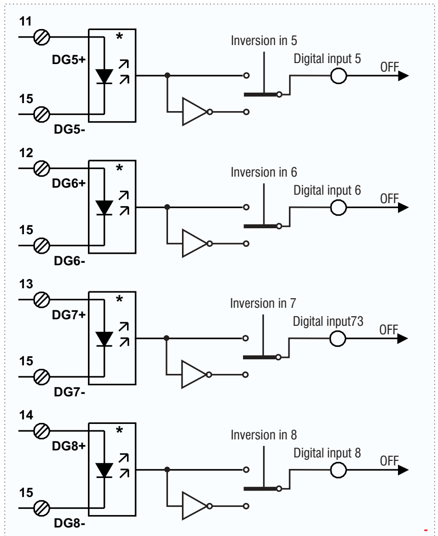
Digital Inputs/Outputs & Mapping Standard and TBO cards

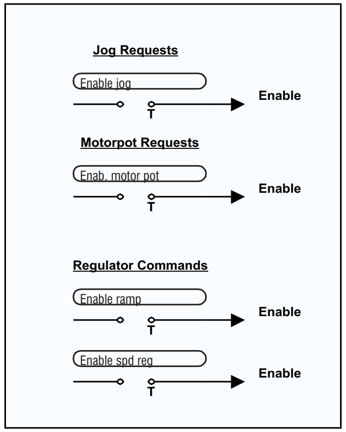
Digital Inputs

TBO card pos. A (option)

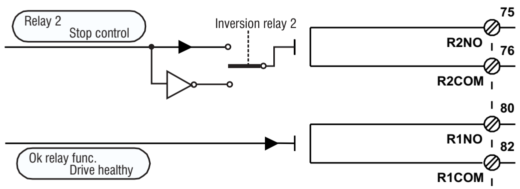


TBO card pos. B (option)



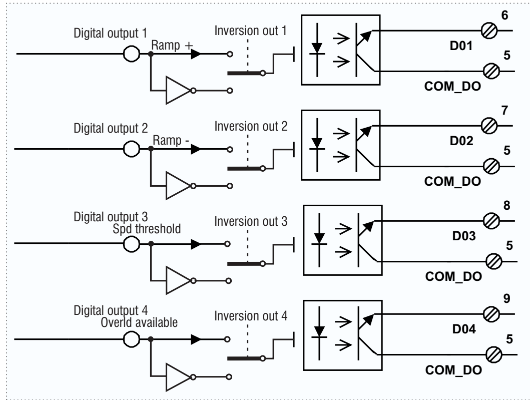


Drive Relay Output

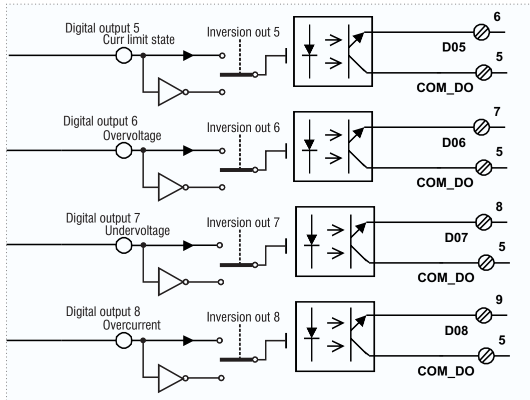


Digital Outputs

TBO card pos. A (option)

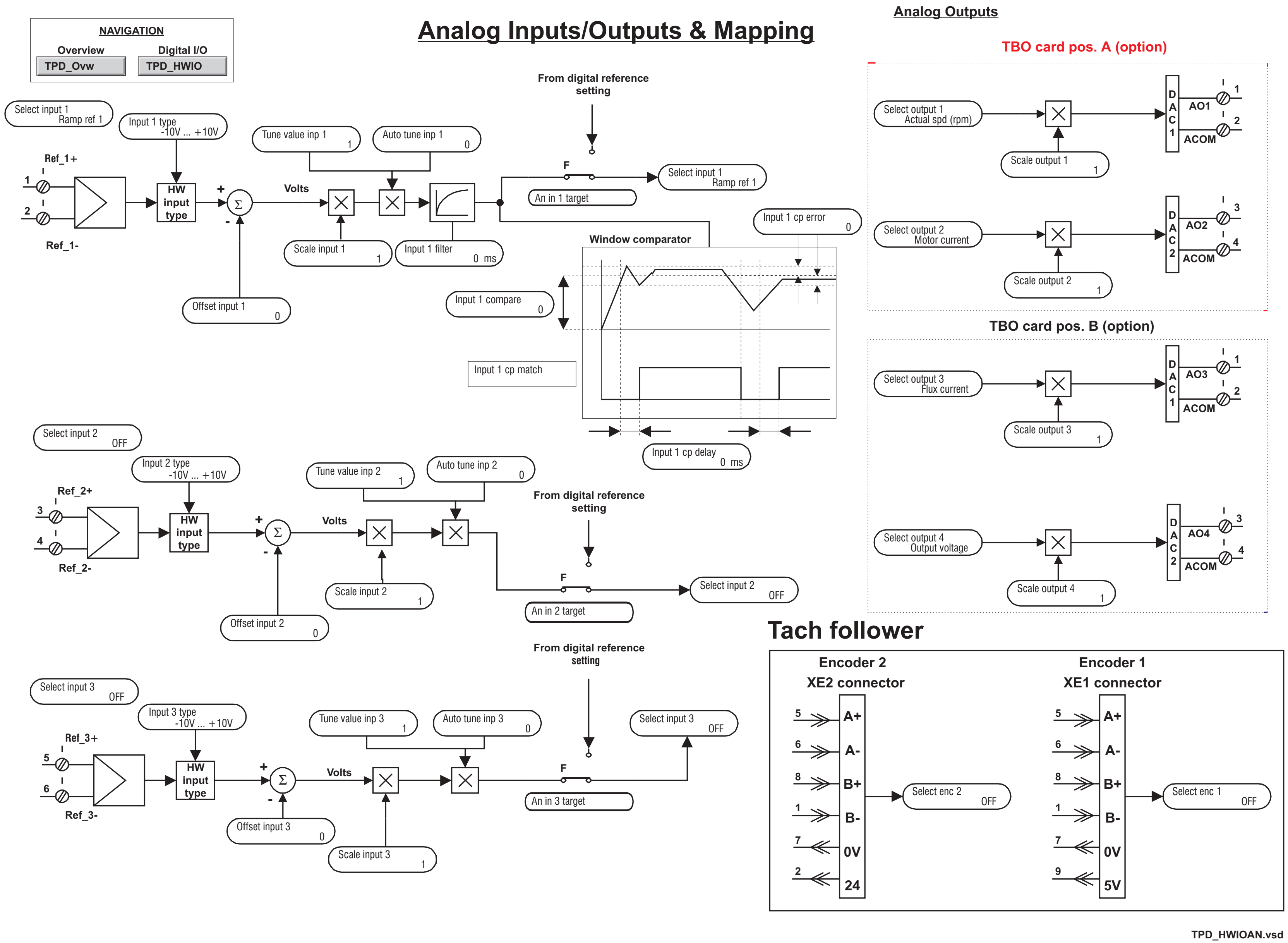


TBO card pos. B (option)



TPD_HWIO.vsd

Analog Inputs/Outputs & Mapping



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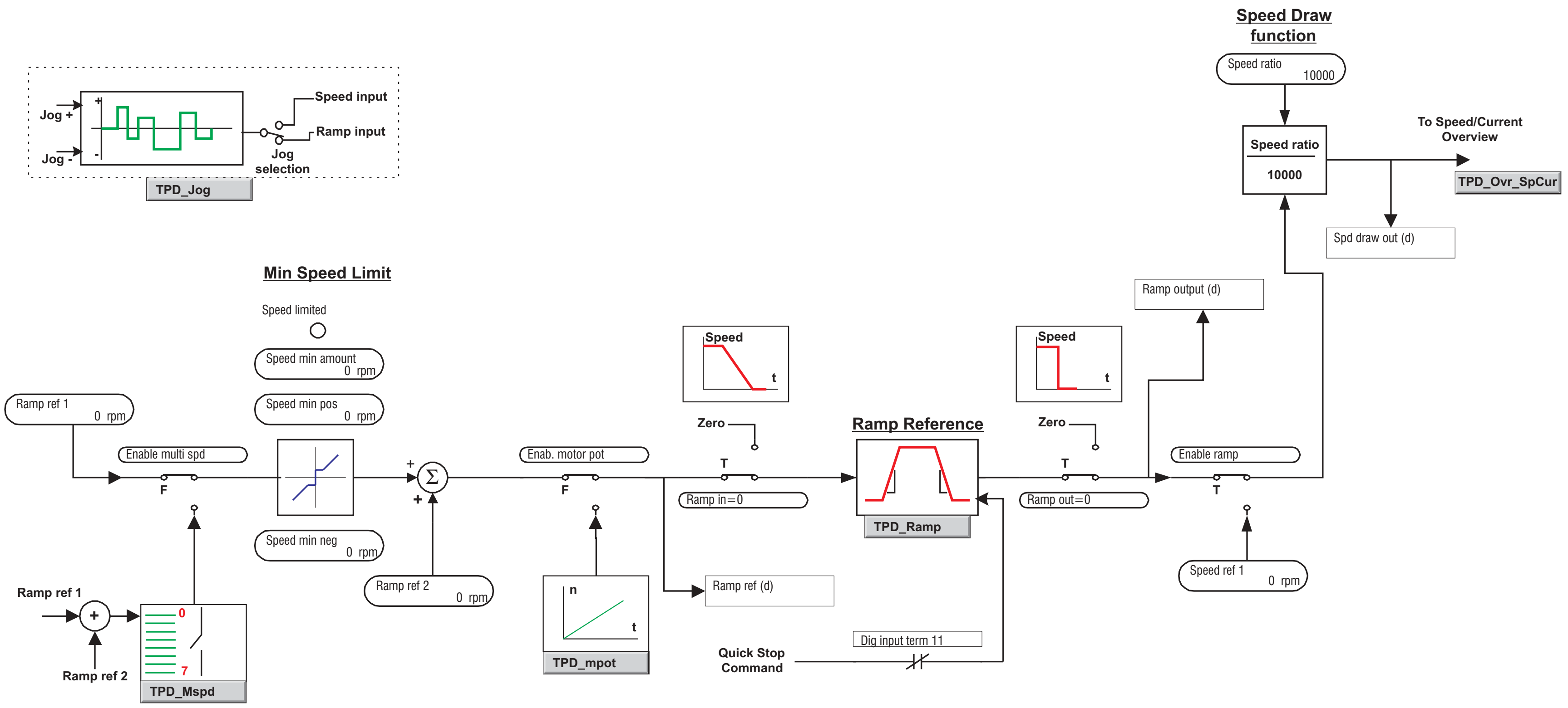
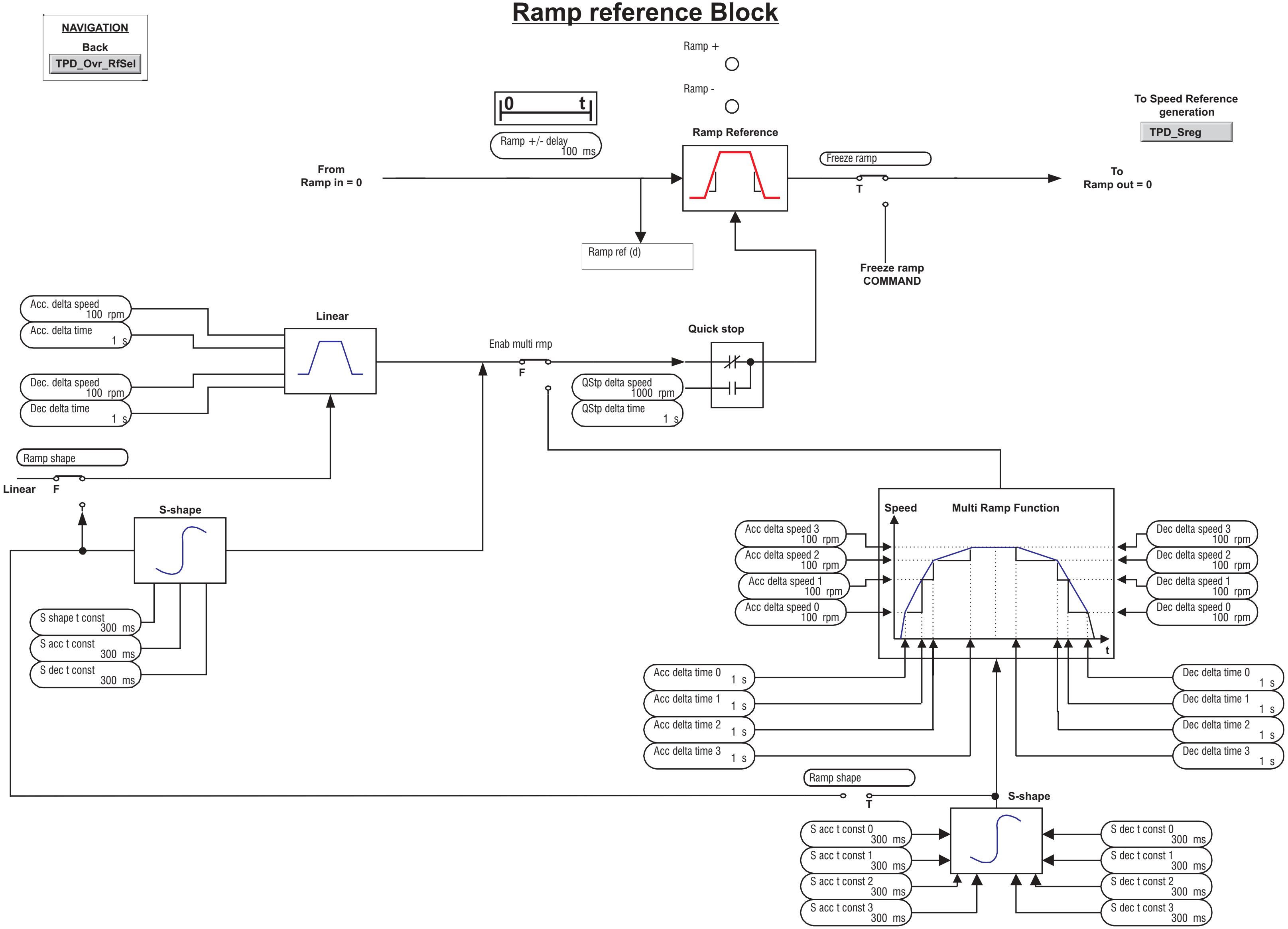
Speed Reference Generation



TPD_Ovr_RfSel.vsd

Ramp reference Block



TPD_Ramp.vsd

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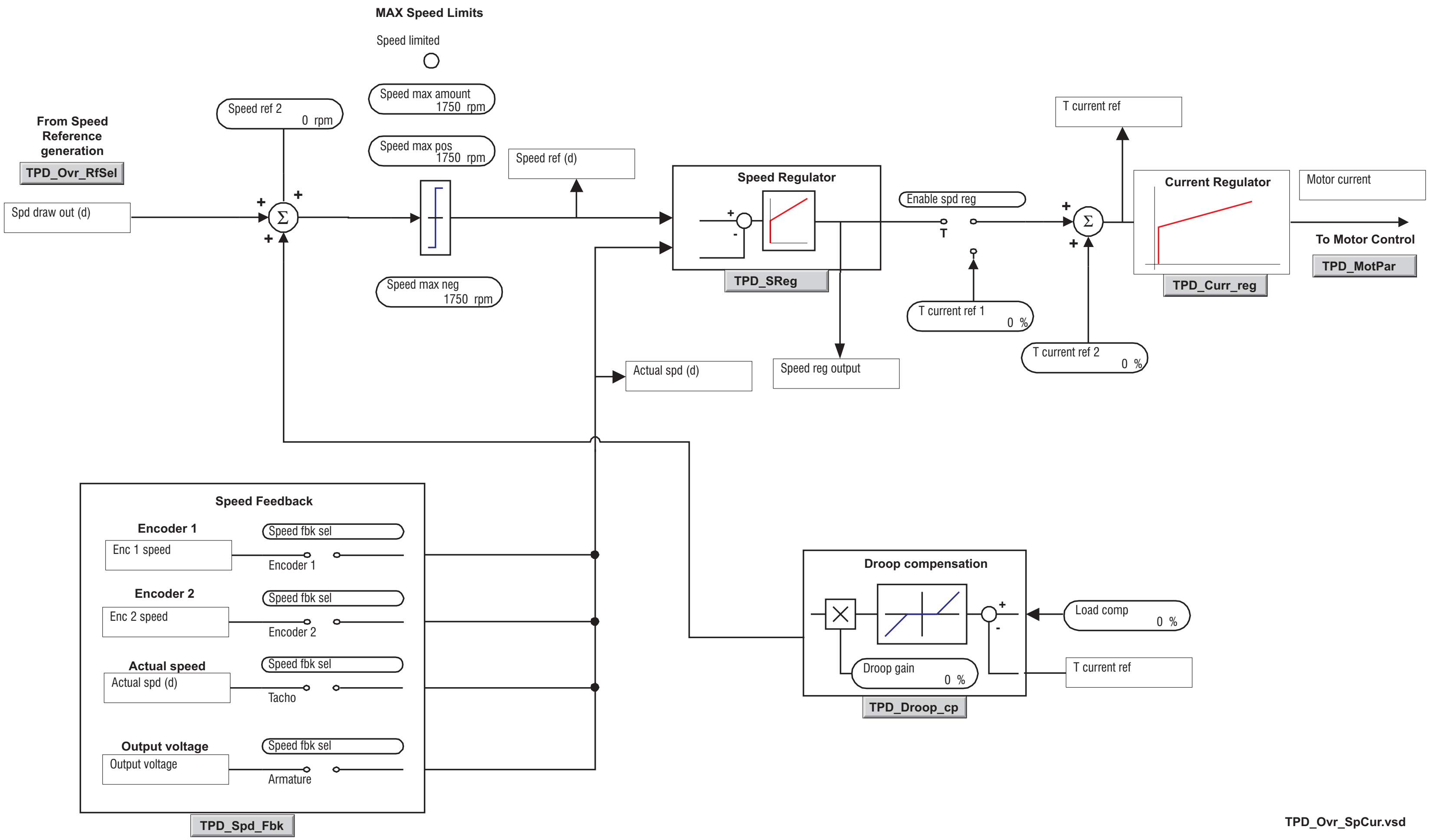
Speed / Current Regulator Overview



TPD_Ovr_SpCur.vsd

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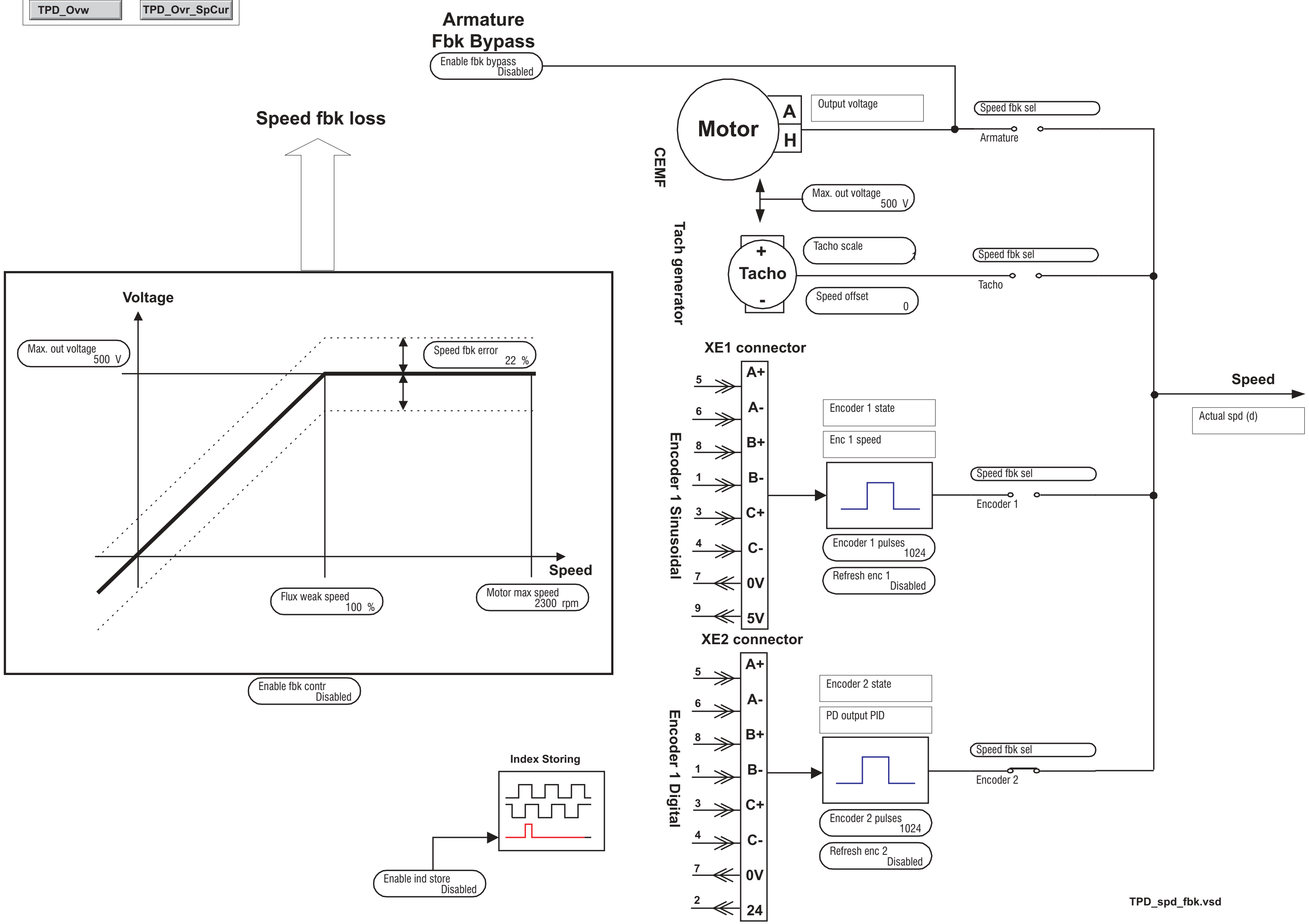
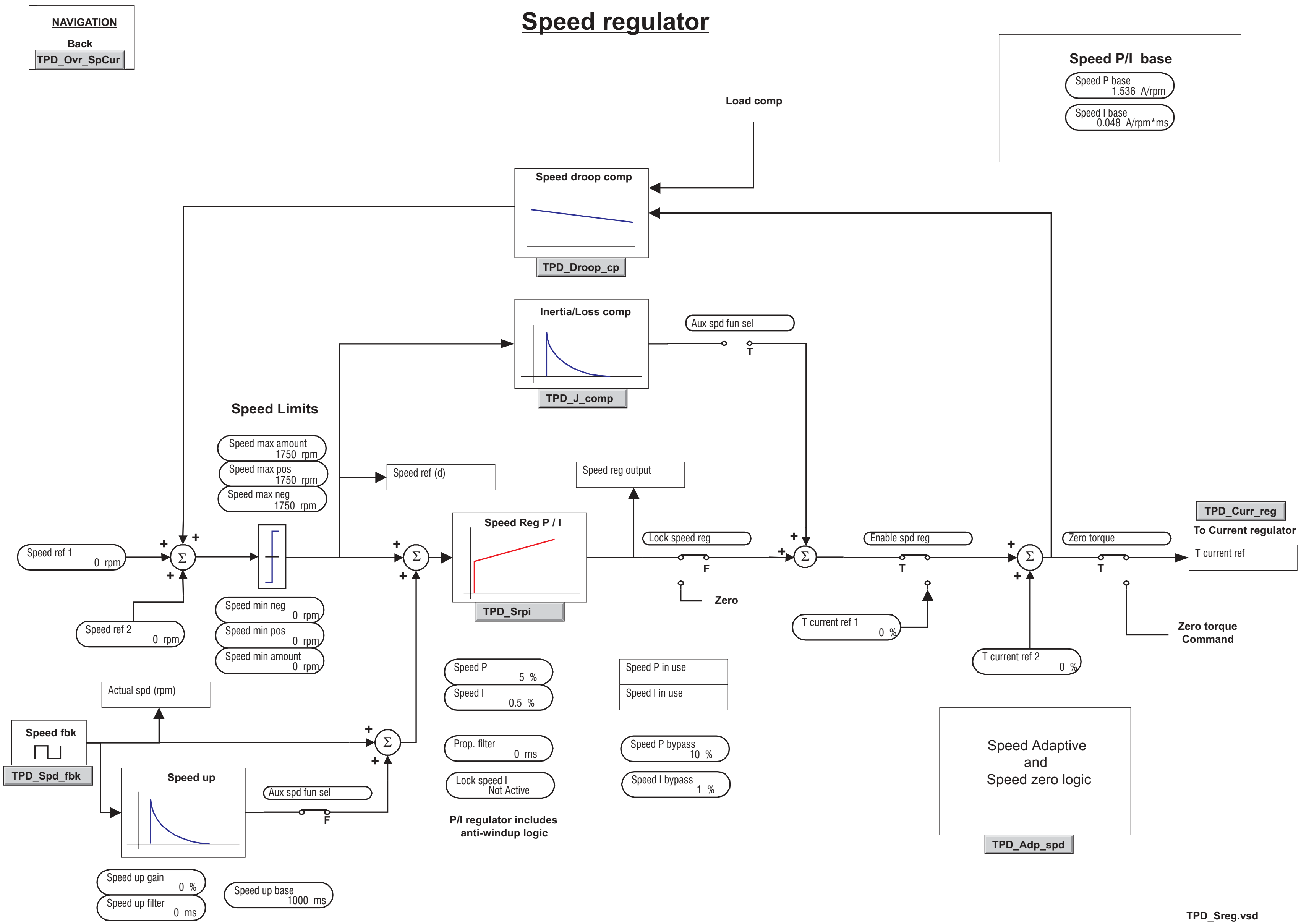
Speed Feedback setting



TPD_spd_fbk.vsd

Speed regulator



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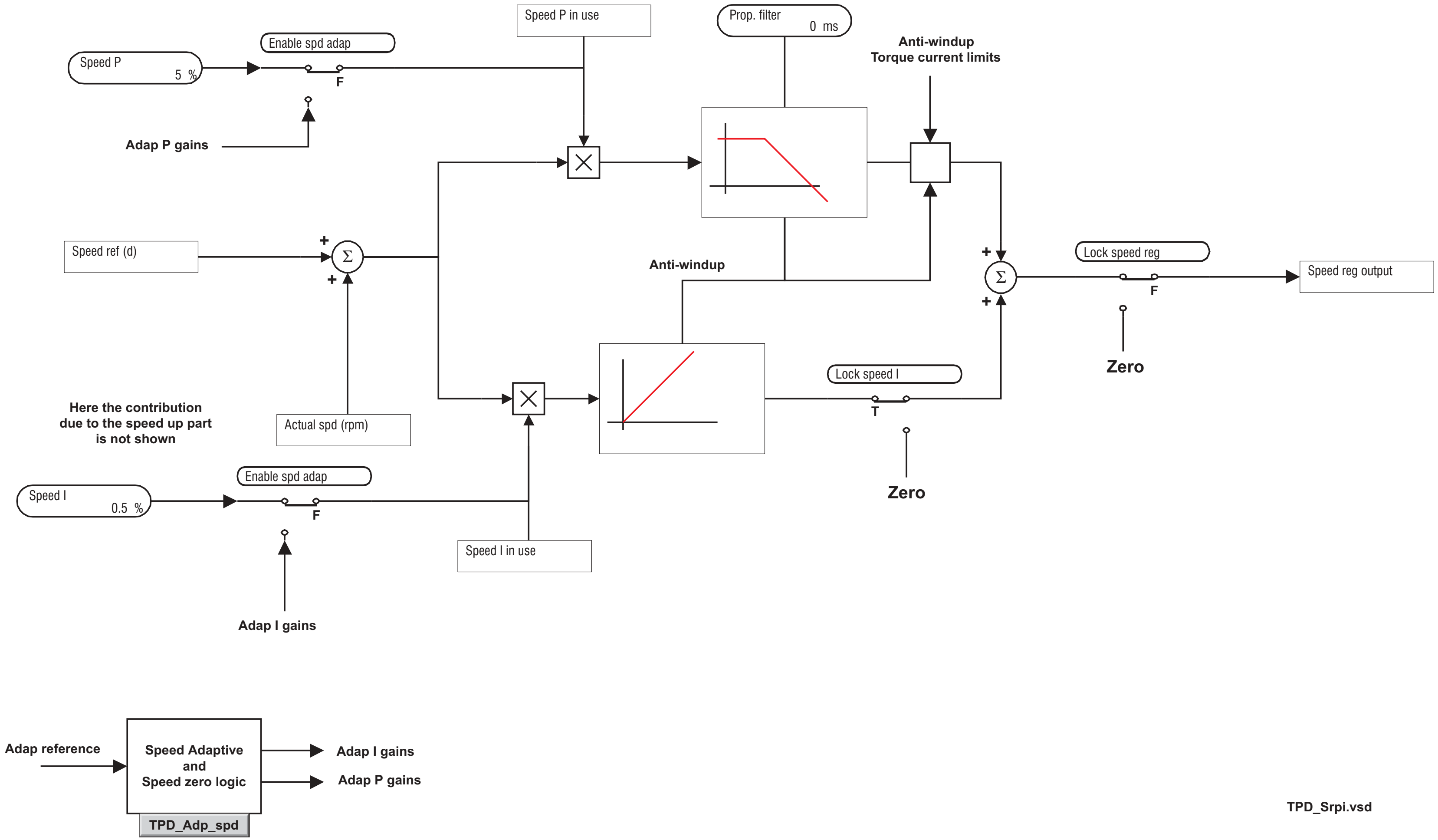
TPD_Sreg

Speed regulator PI part



TPD_Srpi.vsd

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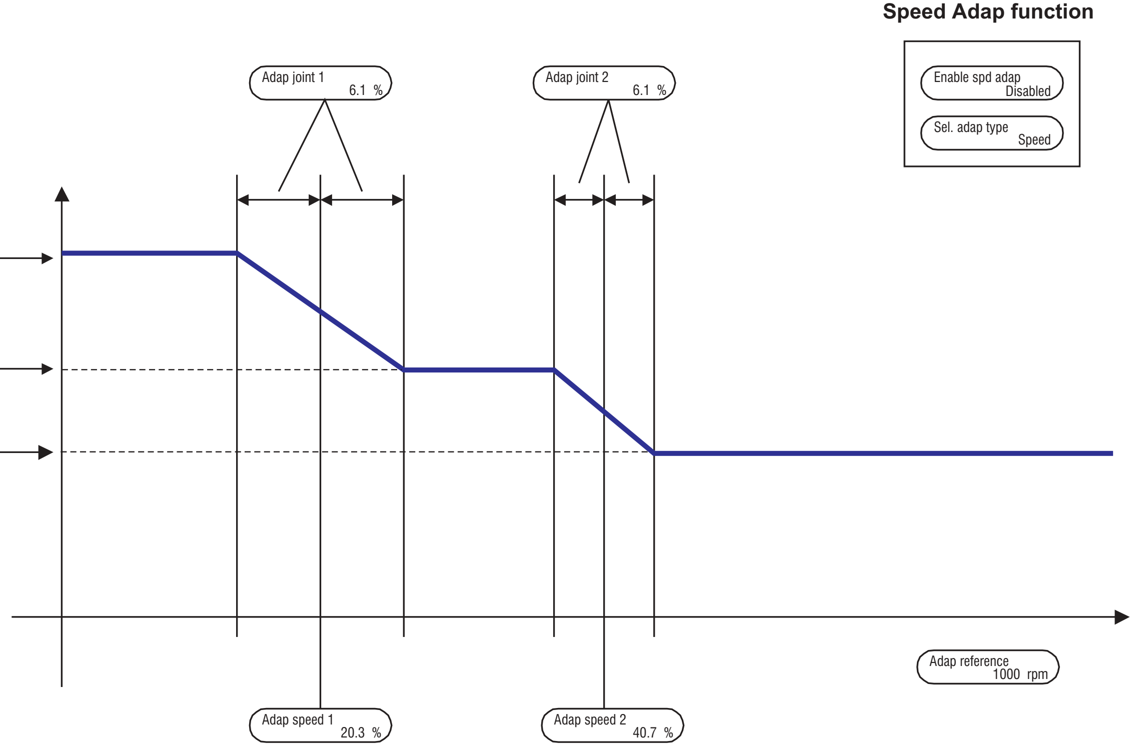
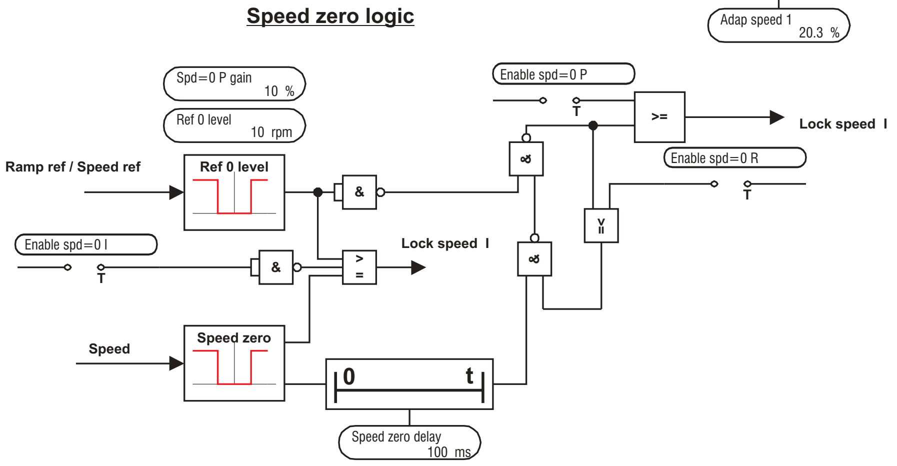
TPD_Sreg

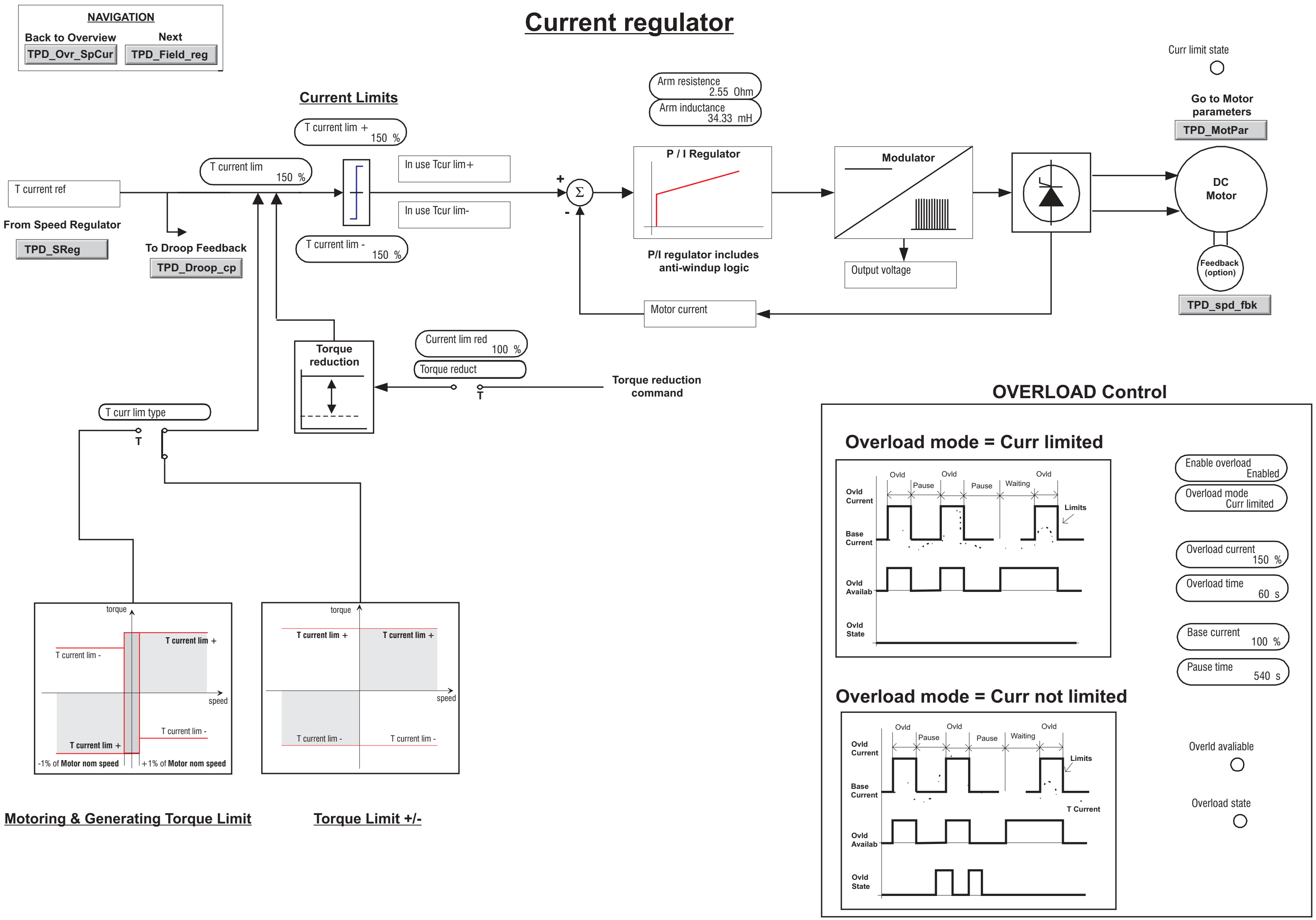
Speed adaptive and Speed zero logic





TPD_Adp_spd.vsd

Current regulator



TPD_Curr_reg.vsd

NAVIGATION

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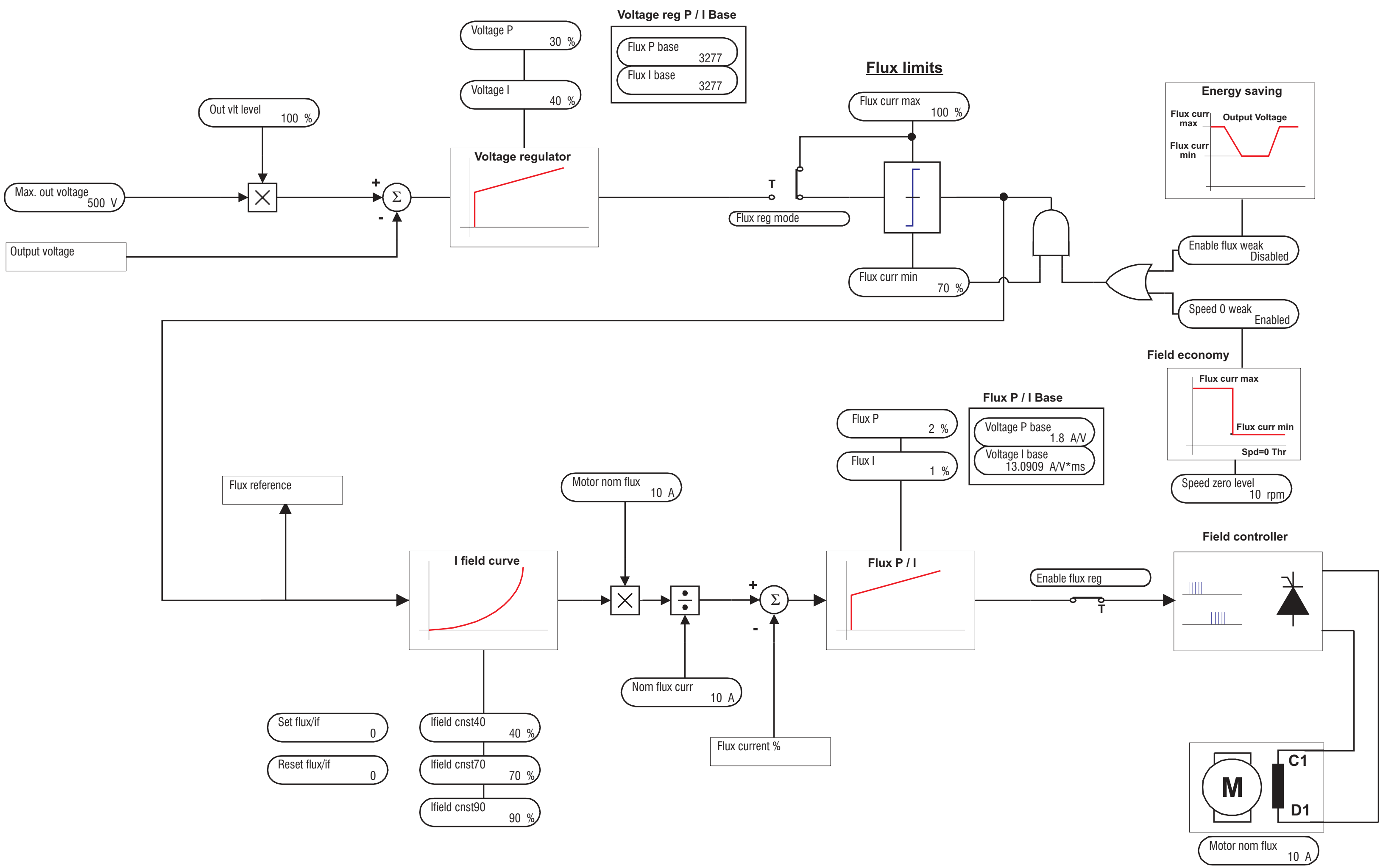
Back TPD_Curr_reg

Field current regulator



TPD_Field_reg.vsd

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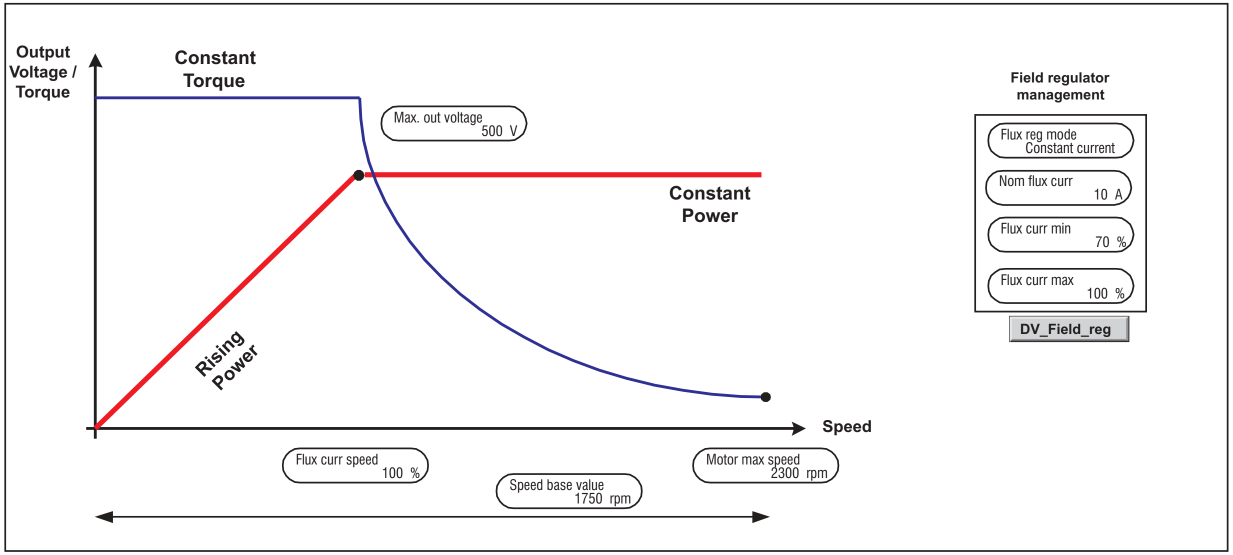
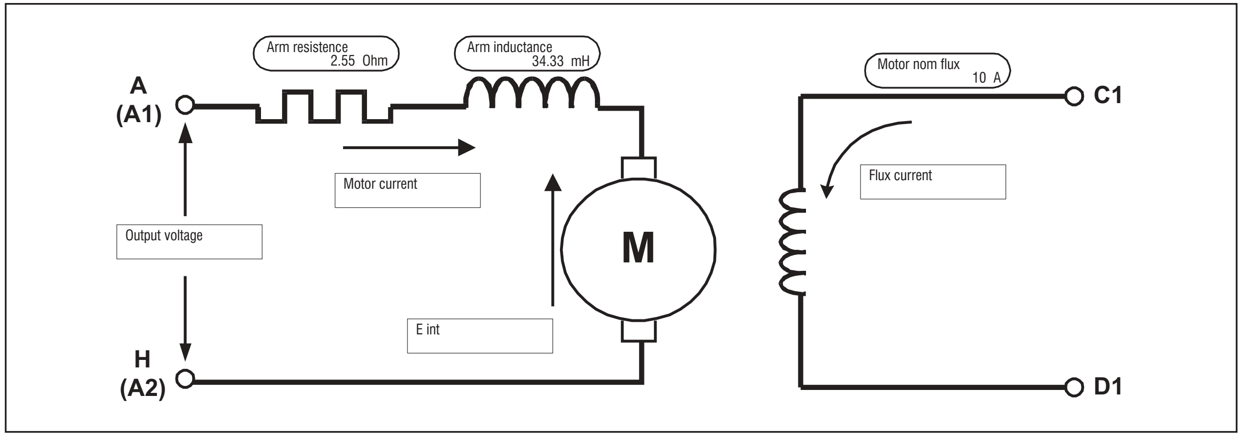
Back to Curr_reg TPD_Curr_reg

Motor parameters



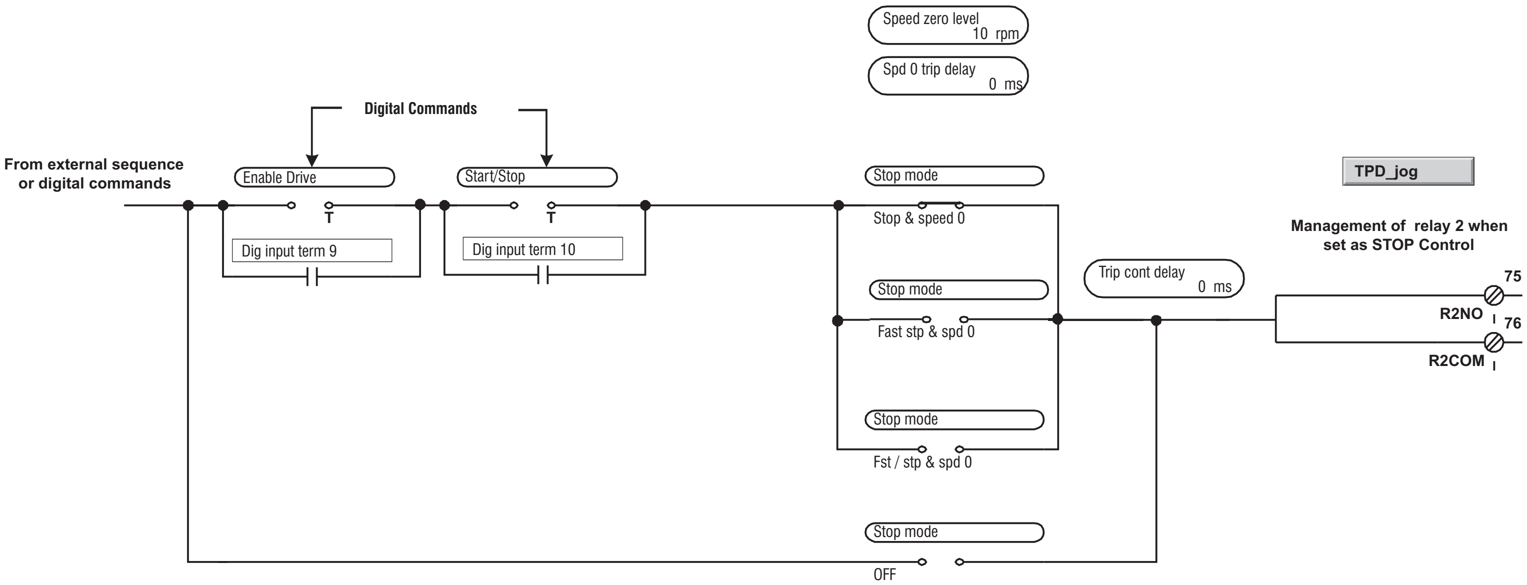


TPD_MotPar.vsd

Start and Stop management

NAVIGATION

Overview	Go to functions
TPD_Ovw	TPD_Funct



TPD_STSP_pro.vsd

NAVIGATION

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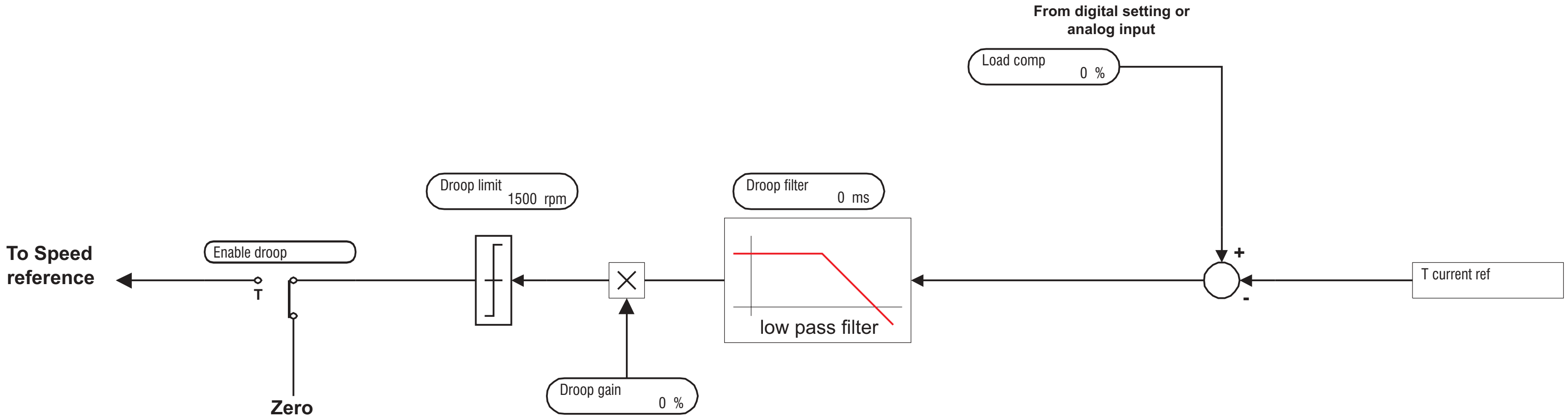
TPD_Sreg

Droop compensation



DV_Droop_cp.vsd

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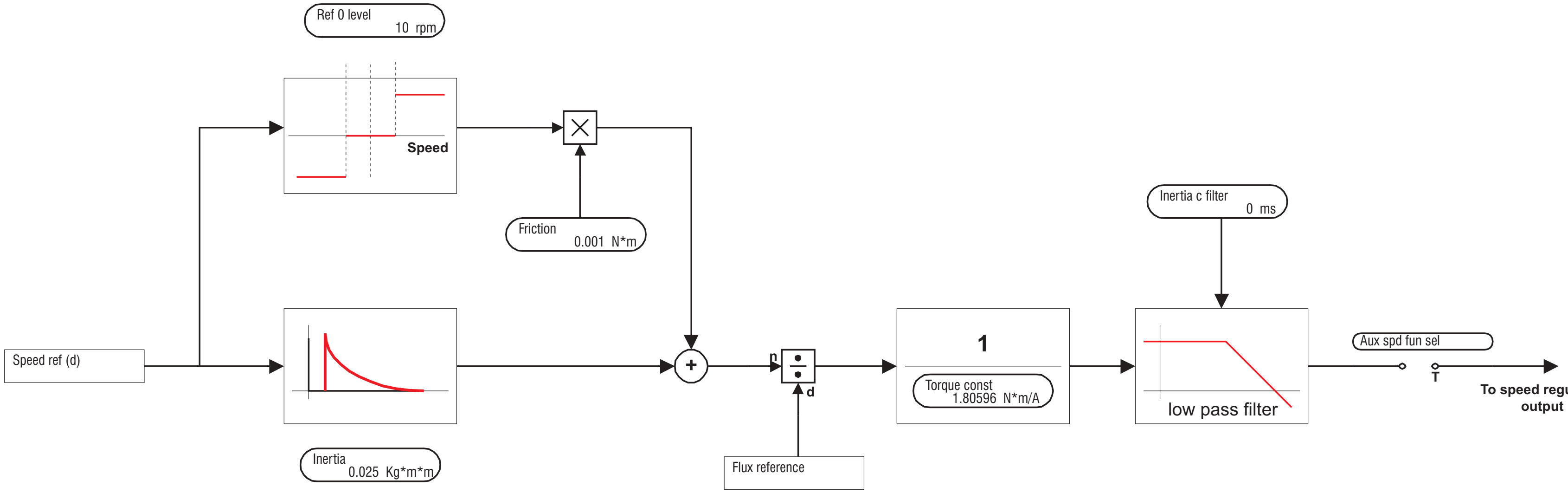
Inertia/Loss compensation



TPD_J_comp.vsd

NAVIGATION
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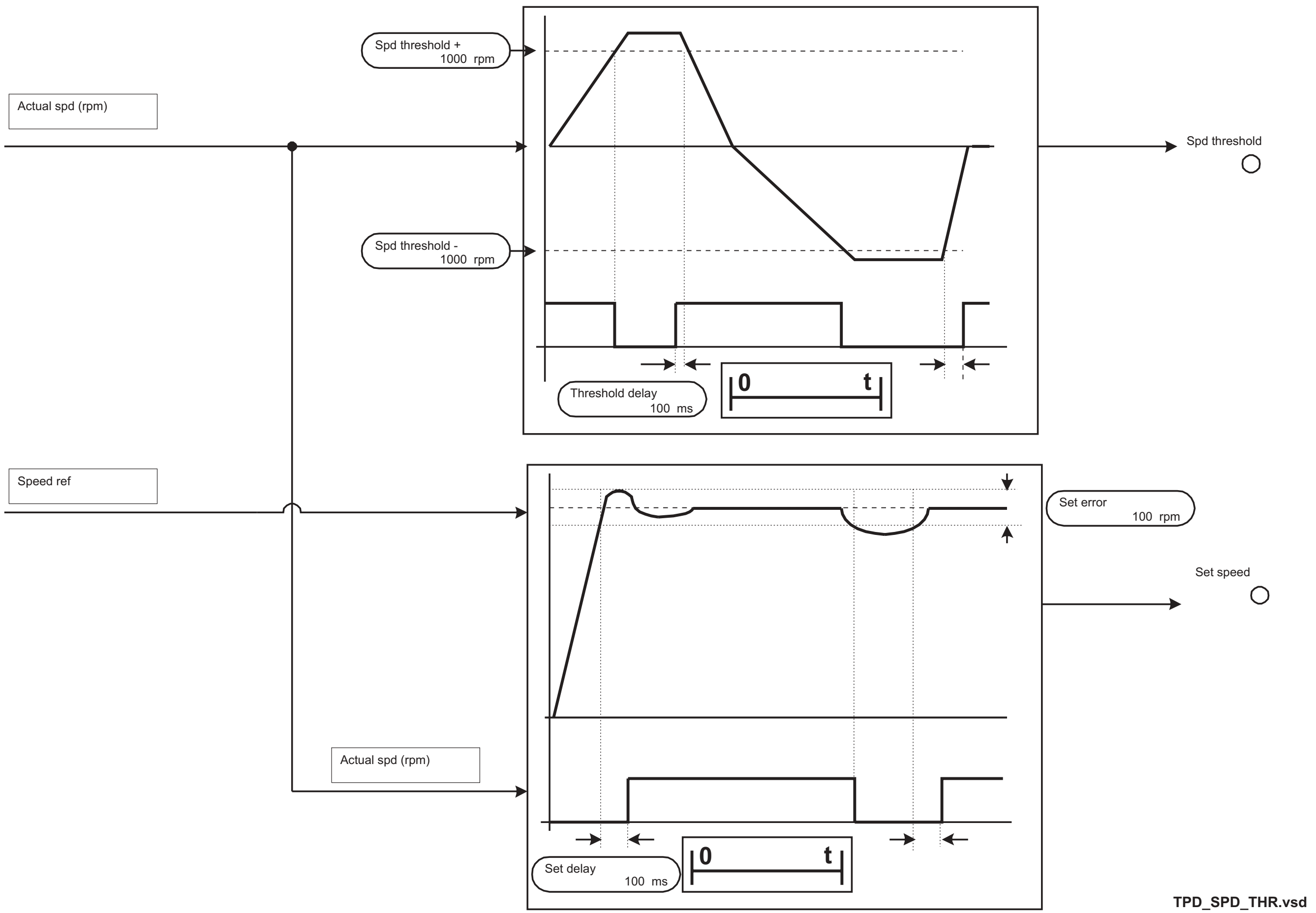
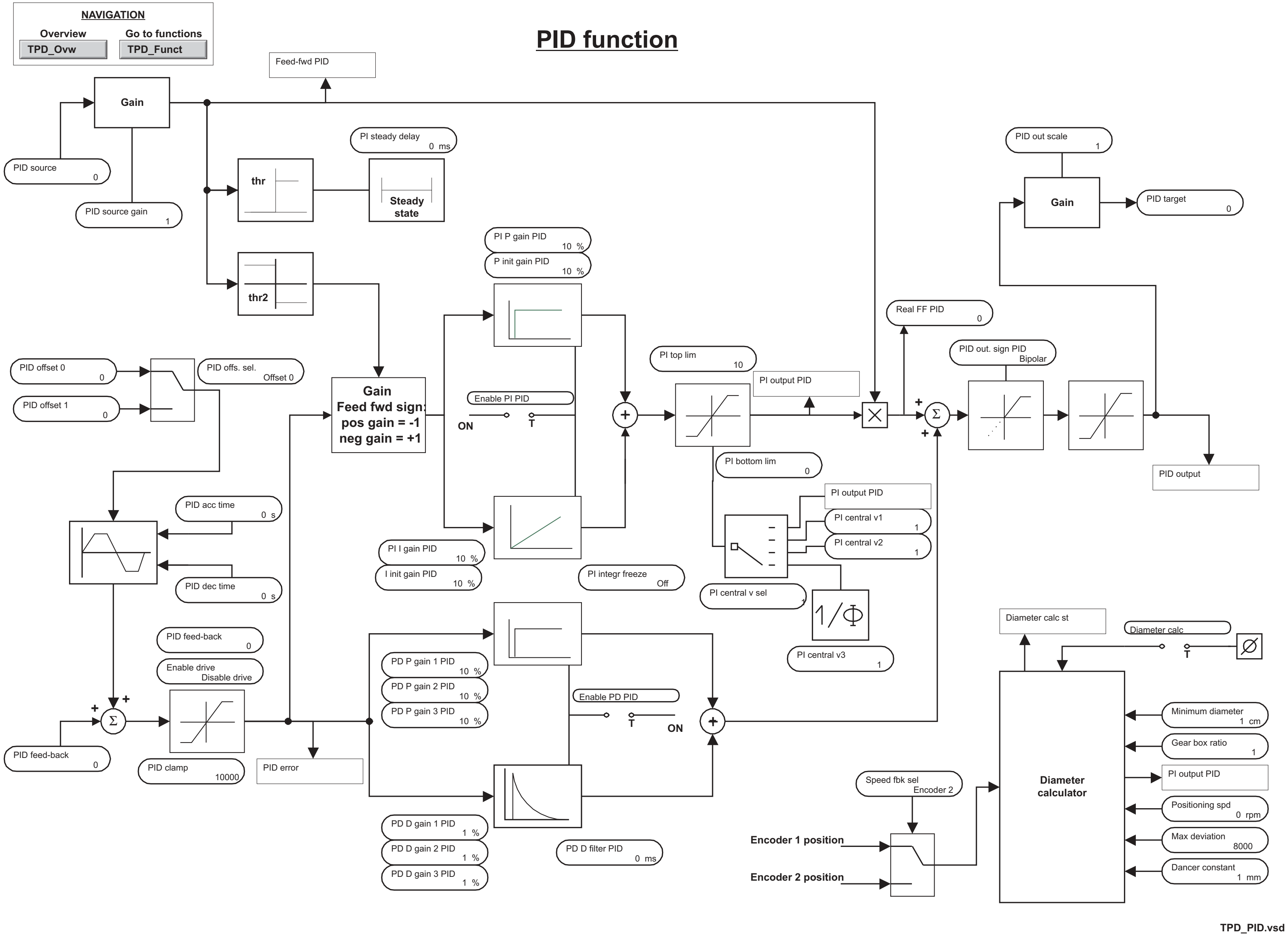
TPD_Ovw | TPD_Funct

Speed Threshold / Speed control



PID function



NAVIGATION
Back to Overview
TPD_Ovw

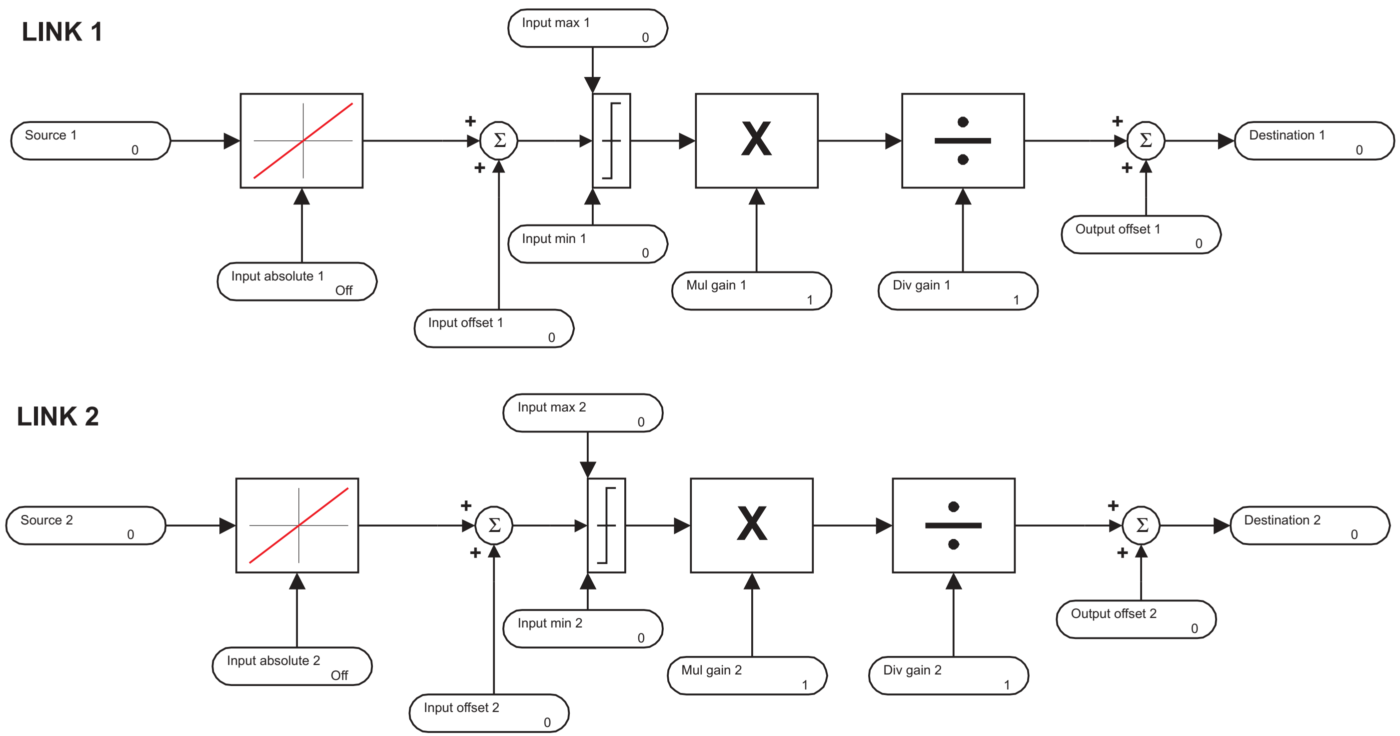
Functions

LINKS (TPD_Links)	PAD Parameters (TPD_PAD)	I/n curve (TPD_Taper_lim)	Dimension factor Face value factor (TPD_fctfct)
Test Generator (TPD_Test_gen)	JOG function (TPD_jog)	Multispeed (TPD_mspd)	Motor potentiometer (TPD_mpot)
	PID function (TPD_PID)	Start - Stop Programming (TPD_STSP_pro)	

TPD_Funct.vsd

NAVIGATION
Overview Go to functions
TPD_Ovw TPD_Funct

LINKS Function



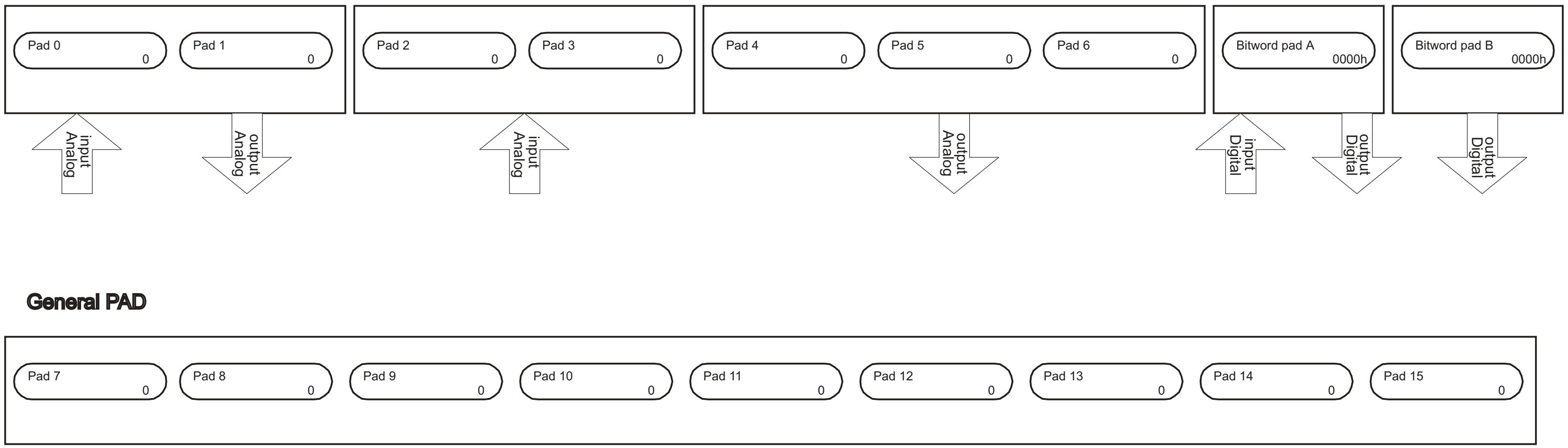
TPD_Links.vsd

NAVIGATION

Overview: TPD_Ovw

Go to functions: TPD_Funct

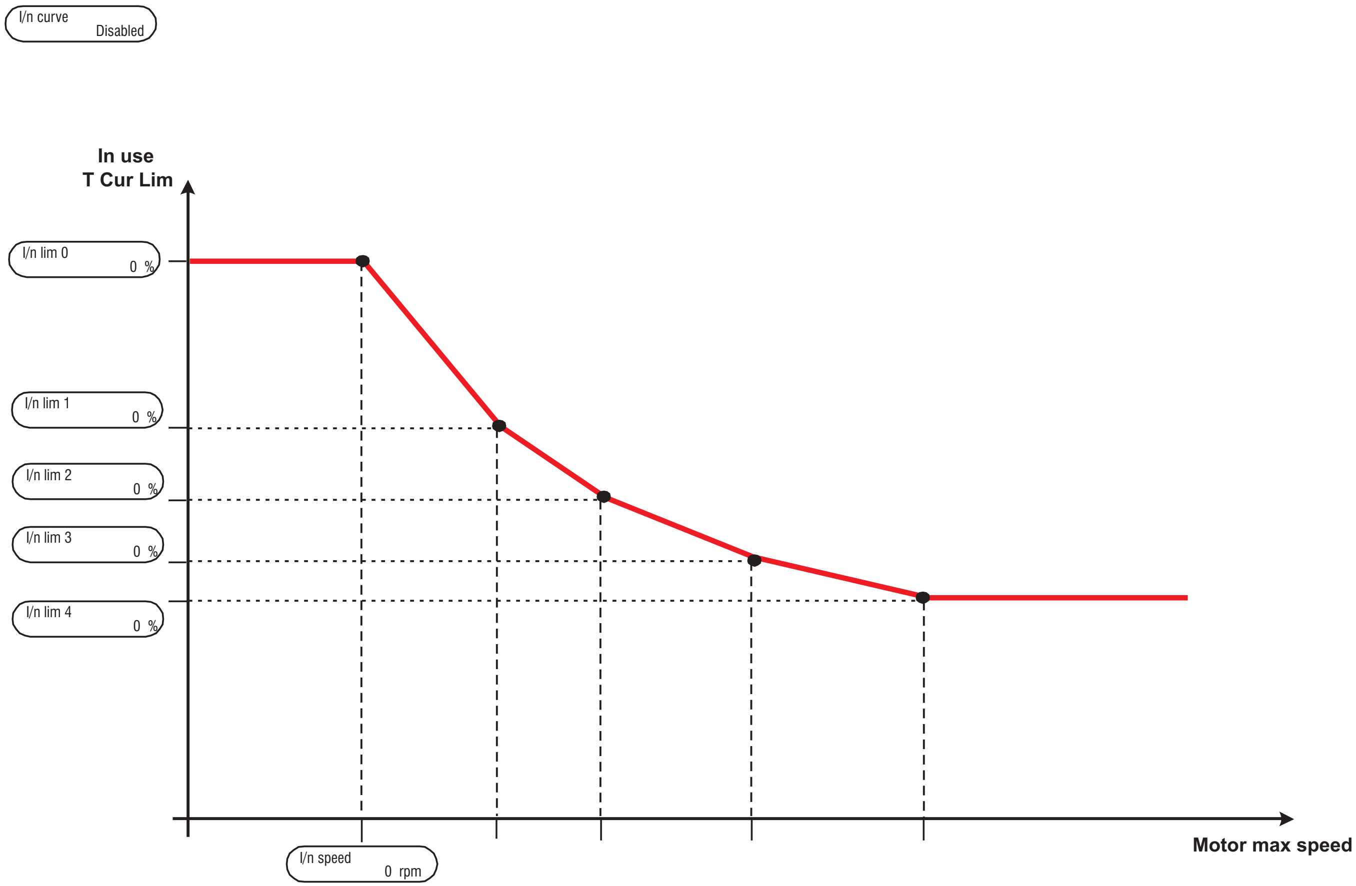
PAD parameters



TPD_pad.vsd

Taper Current Limits

NAVIGATION
Back to Overview TPD_Ovw
Back to Function TPD_Funct



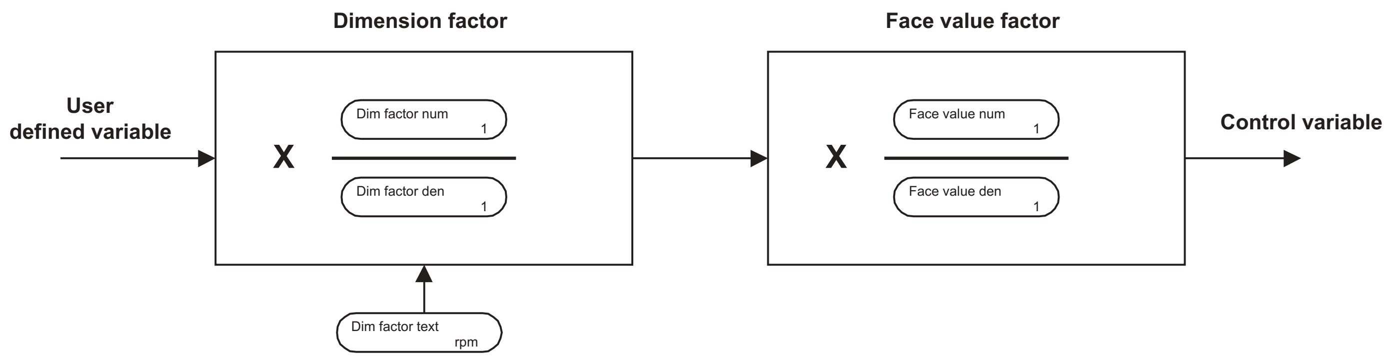
TPD_Taper_lim.vsd

NAVIGATION

Overview: TPD_Ovw

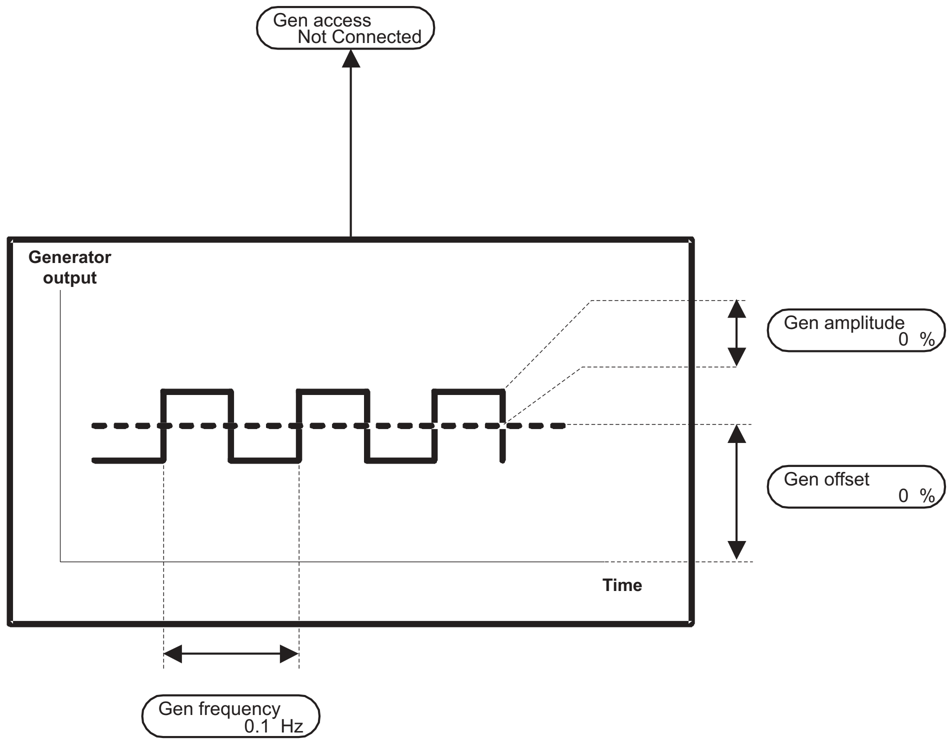
Go to functions: TPD_Funct

Dimension factor
Face value factor



NAVIGATION
Overview | Go to functions
TPD_Ovw | TPD_Funct

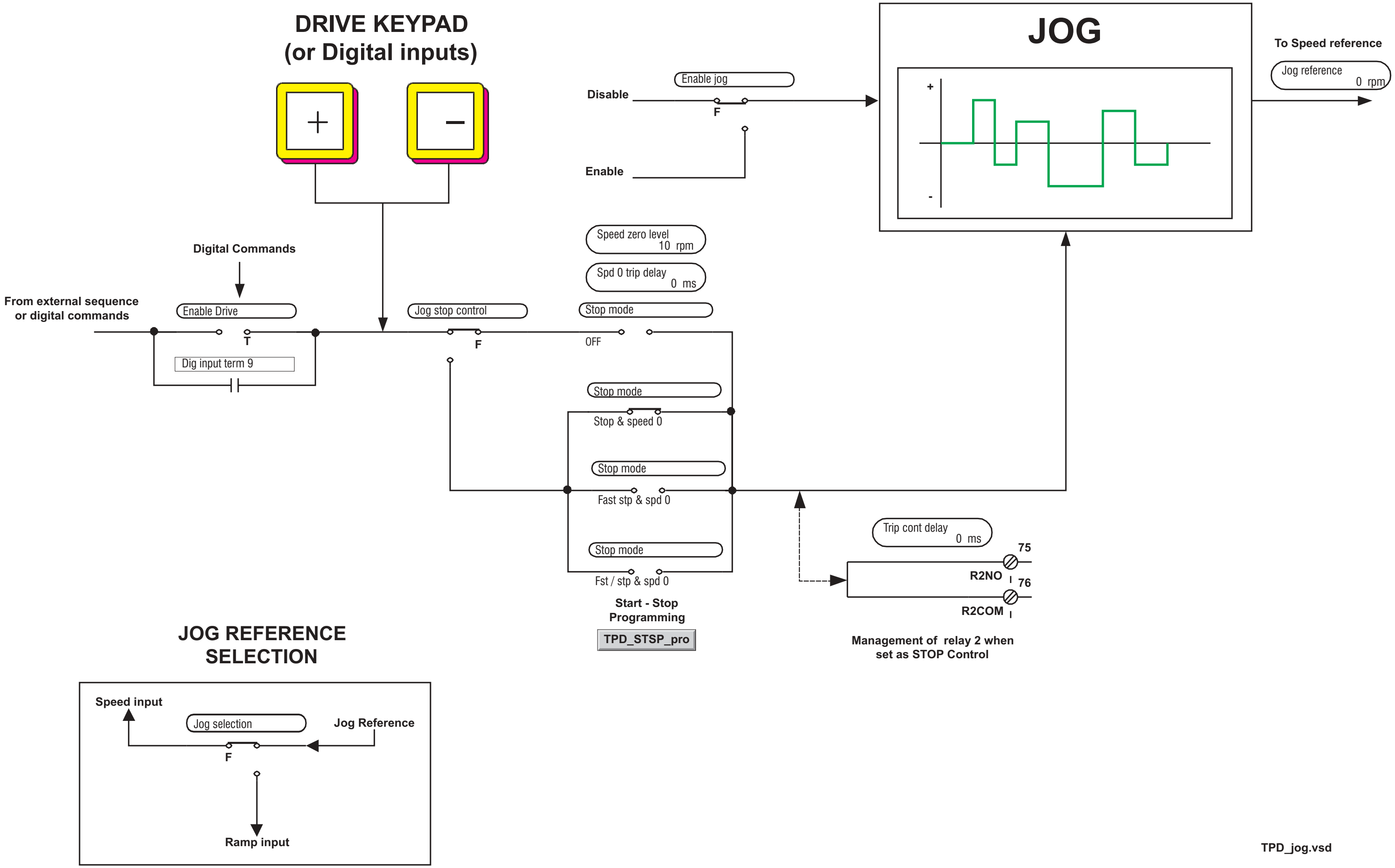
Test Generator



TPD_Test_gen.vsd

JOG function

NAVIGATION
Overview TPD_Ovw
Go to functions TPD_Funct



TPD_jog.vsd

NAVIGATION

Overview: TPD_Ovw
Go to functions: TPD_Funct

Multi speed

Enable multi spd Disabled

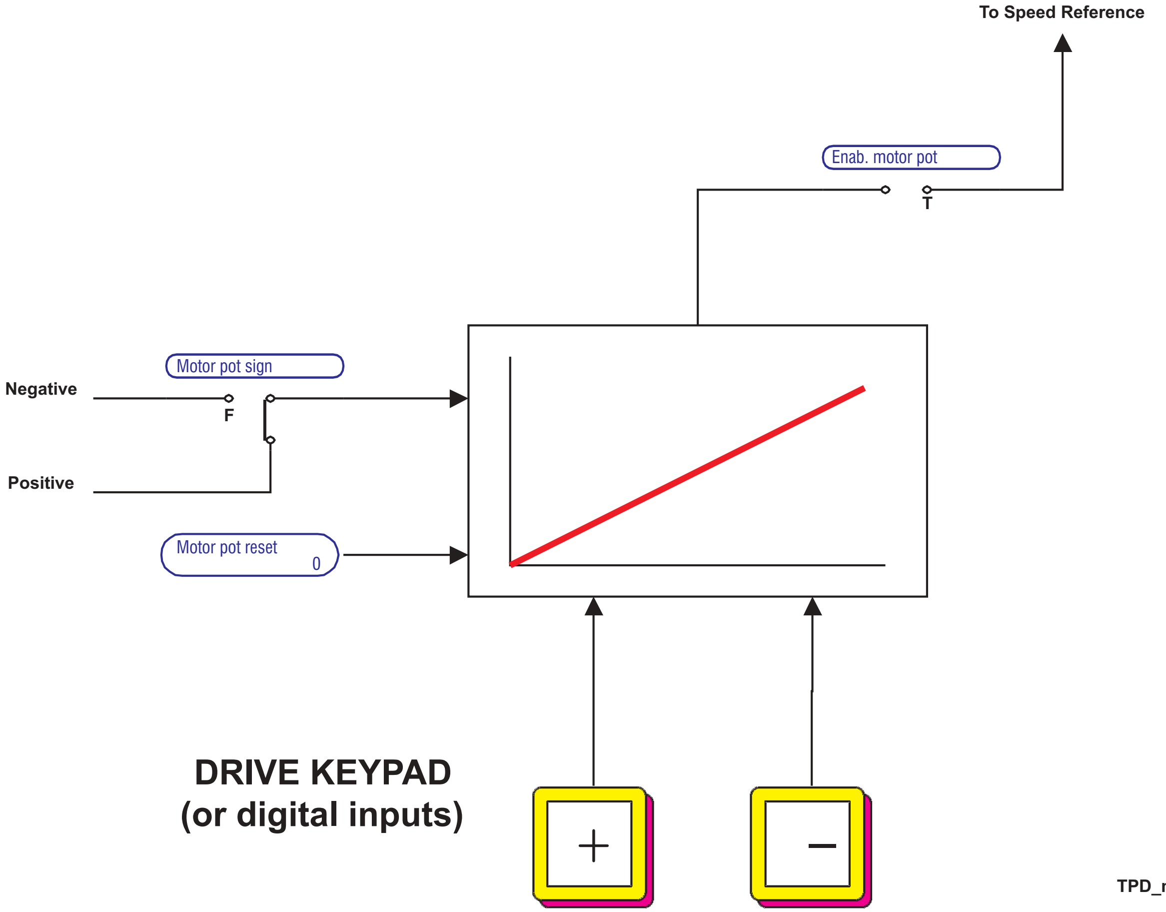
Multi speed sel. 0

Ramp ref (d)

Speed sel 0 Bit 0 Not Selected	Speed sel 1 Bit 1 Not Selected	Speed sel 2 Bit 2 Not Selected	REFERENCE
0	0	0	Ramp ref 1 0 rpm + Ramp ref 2 0 rpm
1	0	0	Multi speed 1 0 rpm
0	1	0	Multi speed 2 0 rpm
1	1	0	Multi speed 3 0 rpm
0	0	1	Multi speed 4 0 rpm
1	0	1	Multi speed 5 0 rpm
0	1	1	Multi speed 6 0 rpm
1	1	1	Multi speed 7 0 rpm

TPD_mspd.vsd

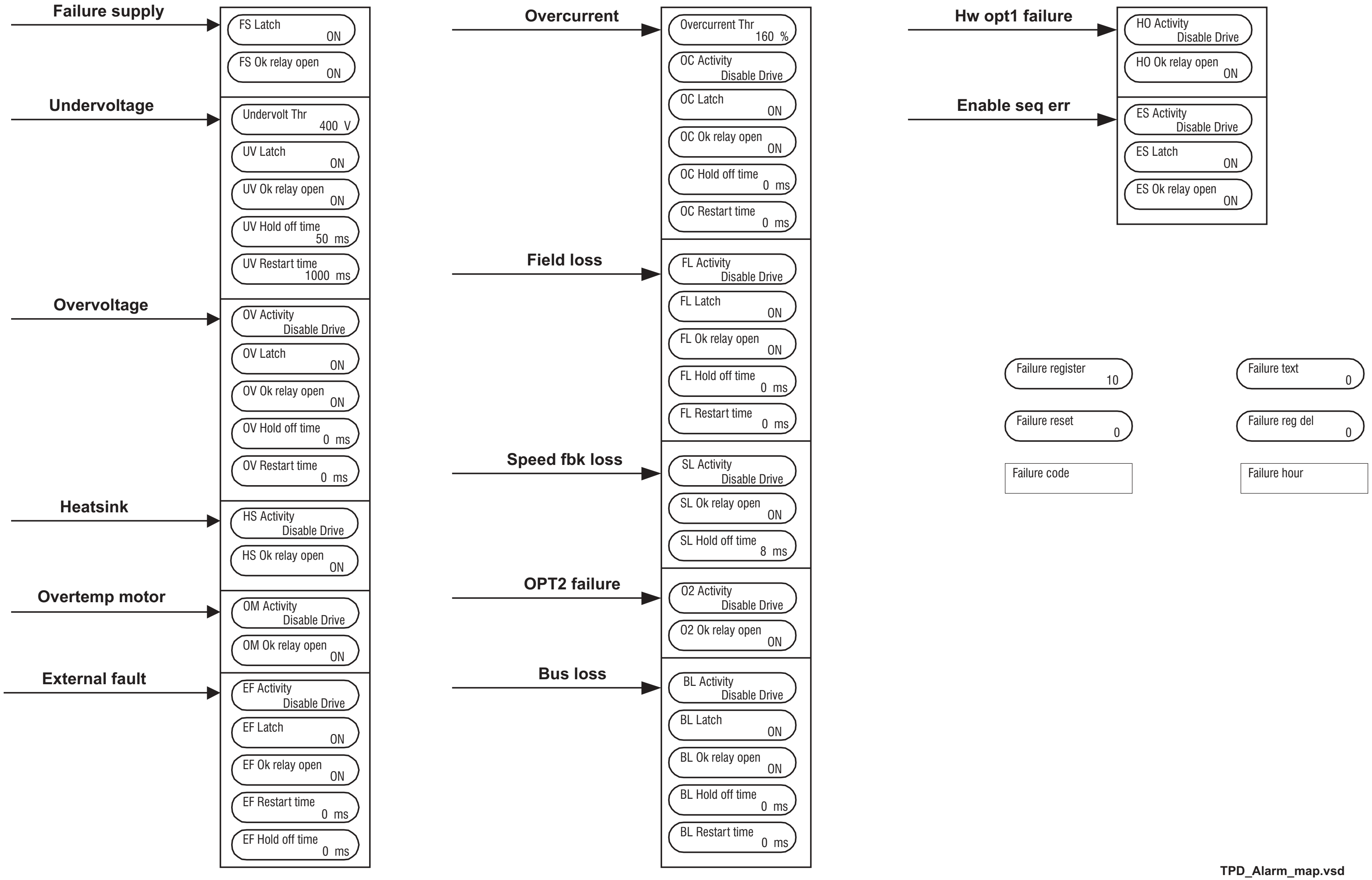
Motor potentiometer



TPD_mpot.vsd

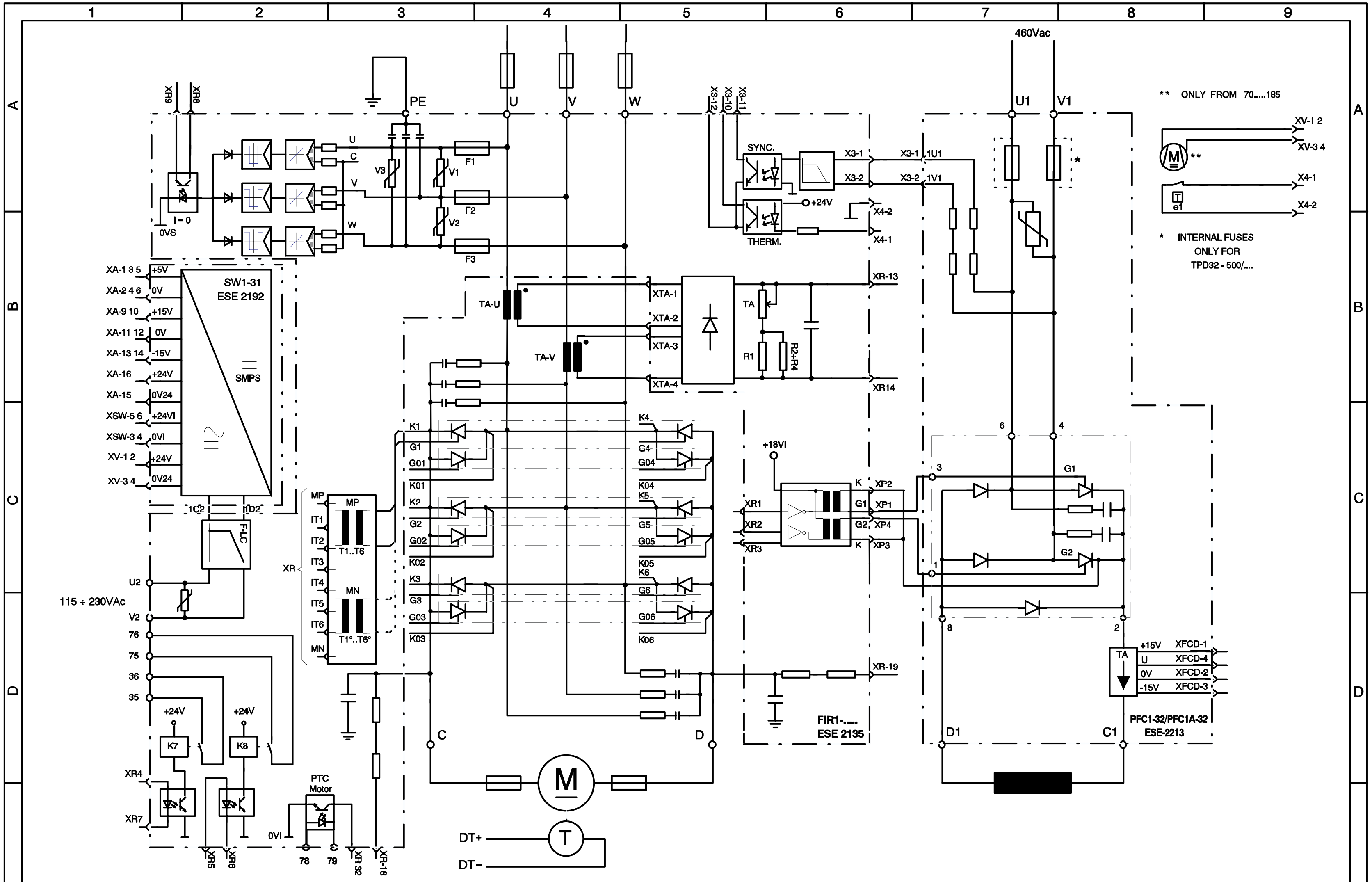
NAVIGATION
Overview
TPD_Ovw

Alarm mapping



TPD_Alarm_map.vsd

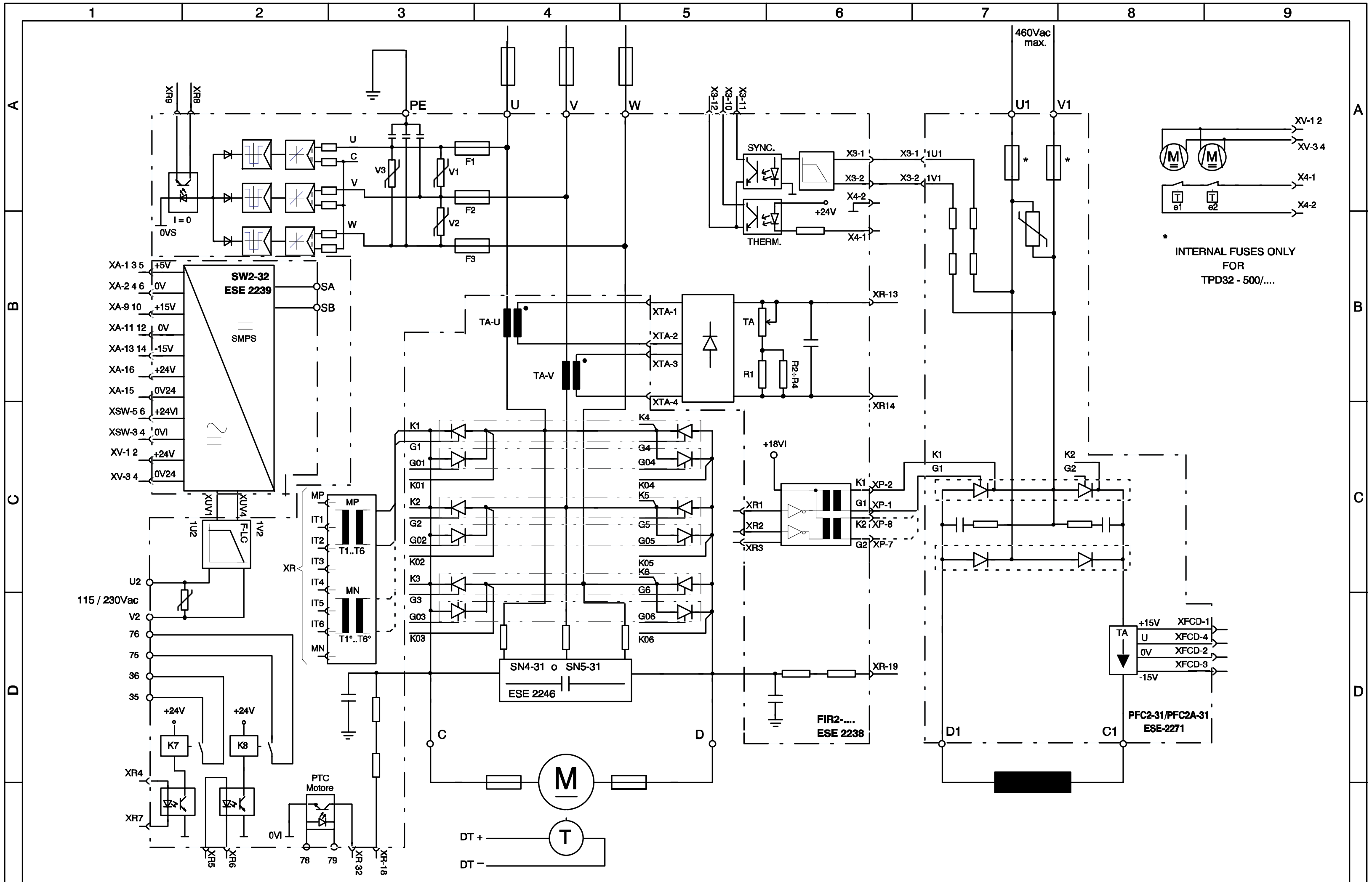
9.2. POWER CIRCUIT BLOCK DIAGRAMS



MOD.	DATE	MODIFICATION DESCRIPTION	ECS Nr.	Des. / Sch.	Approved
A	24-04-96	Aggiornamenti schede e connessioni EF			
B	26-02-97	Aggiornamenti EAM 1472/1 e 1472/2 EF			
C	10-12-97	Aggiornamenti schede EF			
D	22-05-98	Agg. EAM 1535/3, 1542/4, 1534/2 PA			

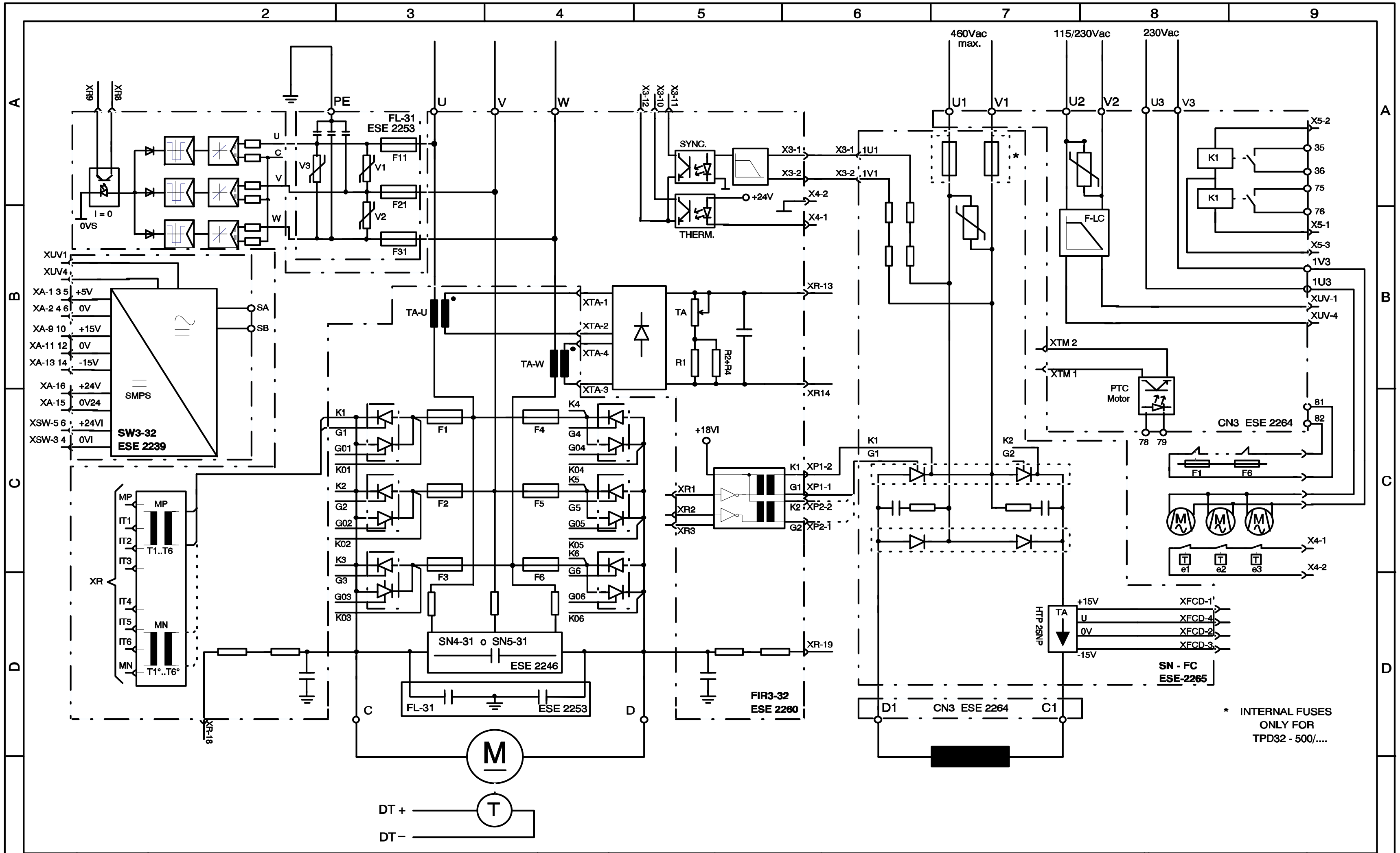
Name: TPD32 - 400/420 - 20 ÷ 185 - 4B TPD32 - 500/520 - 20 ÷ 185 - 4B			Nr: ESE 2257	Mod. Index D
Des. RNC	Sch. BAR	Rout	SIEI S.p.A.	Page 1 / Over 4
Layout ECS Nr.		Apprv.	Date: 19/06/96	

SIEI



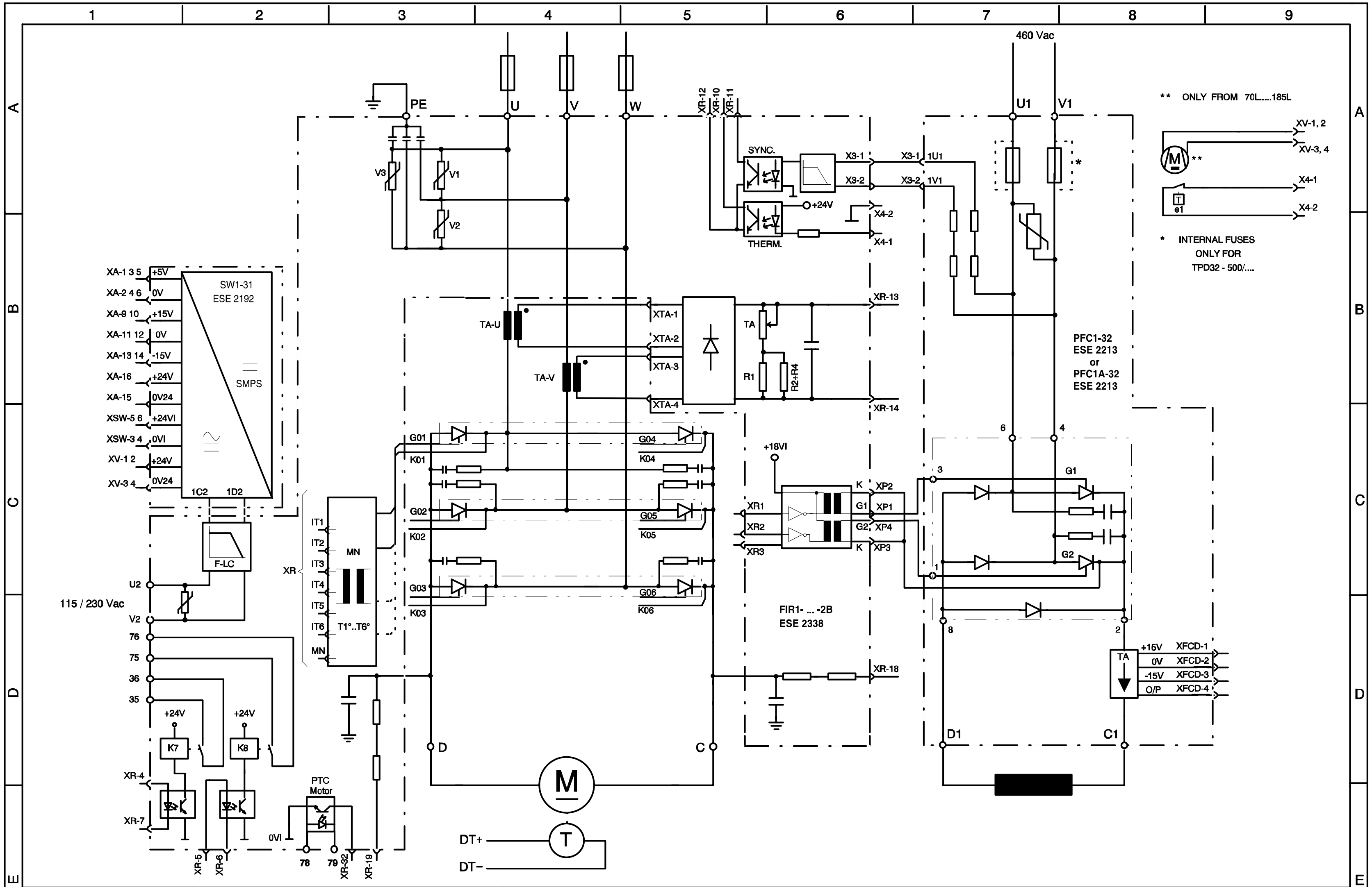
MOD.	DATE	MODIFICATION DESCRIPTION	ECS Nr.	Des. / Sch.	Approved
a	19-07-96	mod. 2U1-2V1-2C1-2D1 aggiunto X2 EF			
b	26-02-97	aggiornamento EAM EF			
c	11-12-97	aggiornamento schede EF			

Name: TPD 32 - 400 / 420 - 280 ÷ 650 - 4B TPD 32 - 500 / 520 - 280 ÷ 650 - 4B			Nr: ESE 2268	Mod. Index c	
Des. RNC	Sch. BAR	Rout	SIEI S.p.A.	Page	Over
Layout ECS Nr.		Apprv.	Date: 19 / 06 / 96	1	3



MOD.	DATE	MODIFICATION DESCRIPTION	ECS Nr.	Des. / Sch.	Approved
A	12-12-97	Aggiornamento schede EF			
B	22-04-98	Aggiornamento schede EF			

Name: TPD 32 - 400 / 420 - 770 ÷ 1050 - 4B TPD 32 - 500 / 520 - 770 ÷ 1050 - 4B		Nr: ESE 2330	Mod. Index B
Des. RNC	Sch. BAR	Rout	SIEI S.p.A.	Page 1 / Over 3
Layout ECS Nr.		Apprv.	Date: 19/06/96	



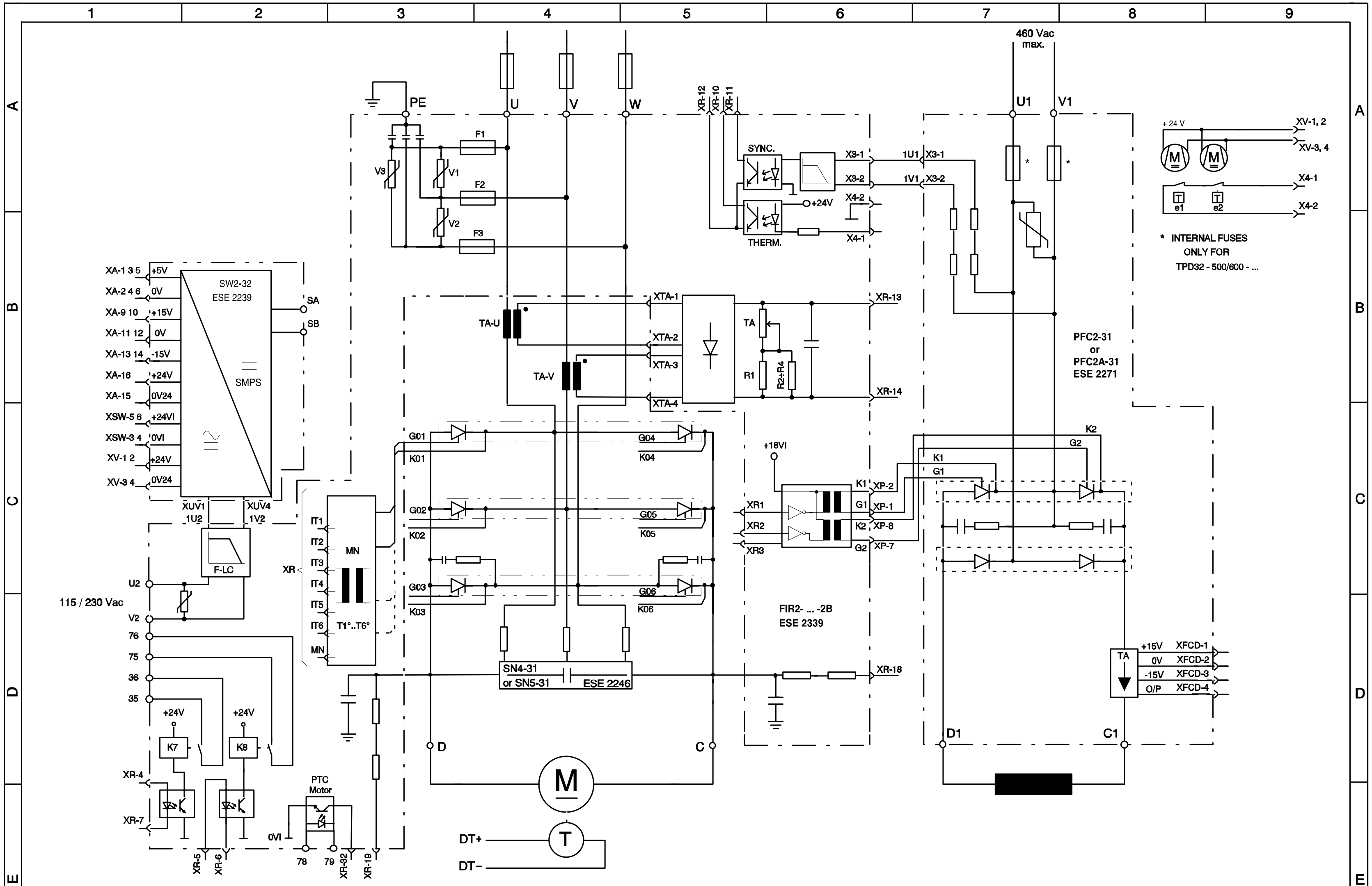
MOD.	DATE	MODIFICATION DESCRIPTION	MOD.	DATE	MODIFICATION DESCRIPTION
A	26/02/97	Aggiornamento EAM 1472/1 e 1472/2			
B	13/11/97	Revisione schede			
C	23/04/98	Spostato TA da W a V			
D	22/05/98	Agg. EAM 1417/4, 1535/3, 1542/4, 1534/2			

NAME : SCHEMA DELLE CONNESSIONI ELETTRICHE DEL
TPD32-400/470 -20+185-2B
TPD32-500/600 -20+185-2B

DES. BAR SCH. RNC APPR.

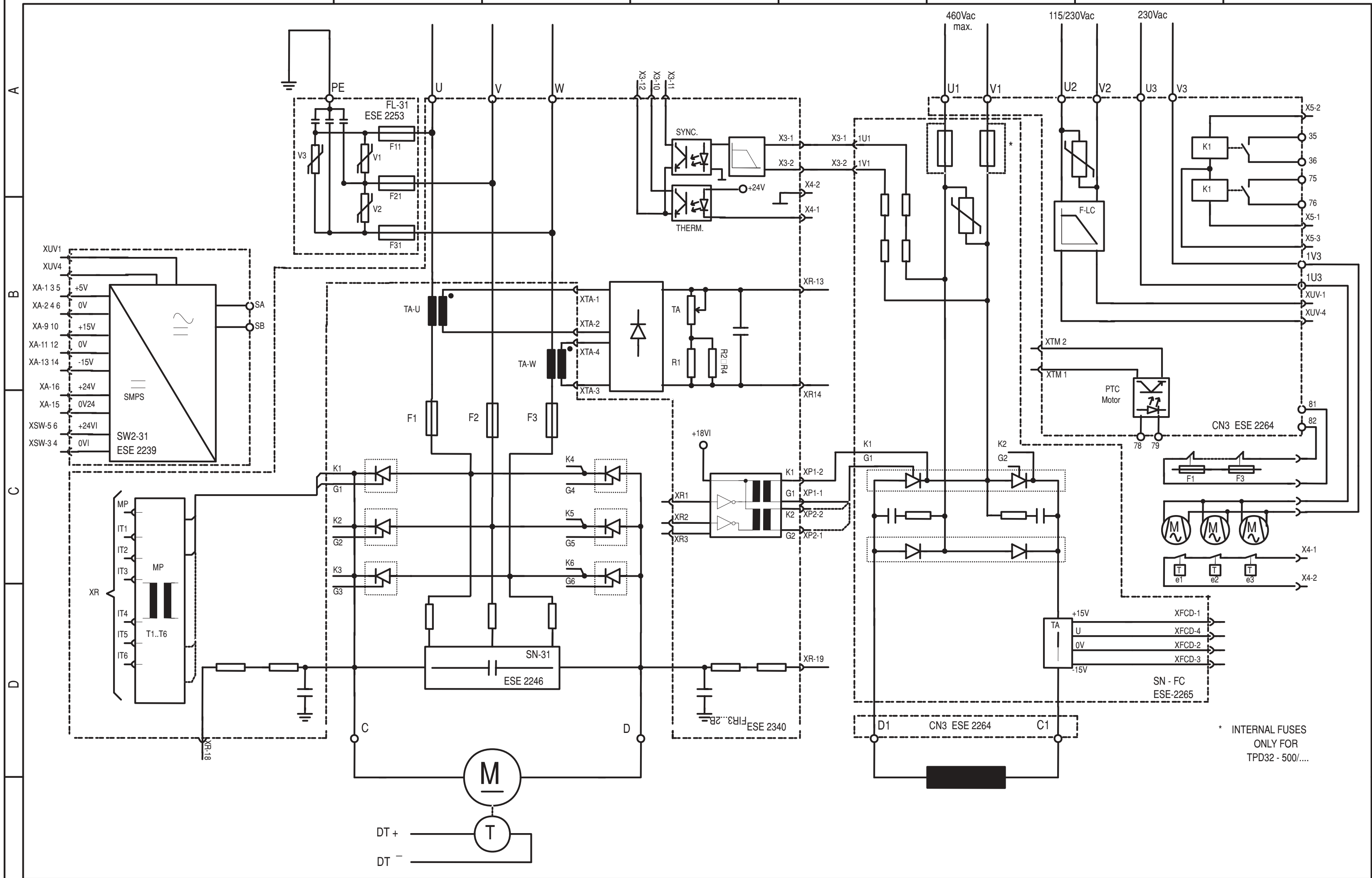
SIEI

Nr : ESE 2358
MOD. INDEX D
SIEI S.p.A.
DATE : 31-07-96
PAGE 1 OVER 4



MOD.	DATE	MODIFICATION DESCRIPTION	MOD.	DATE	MODIFICATION DESCRIPTION
A	26/02/97	Aggiornamento EAM 1471/1 e 1471/2			
B	13/11/97	Revisione schede			
C	23/04/98	Spostato TA da W a V			

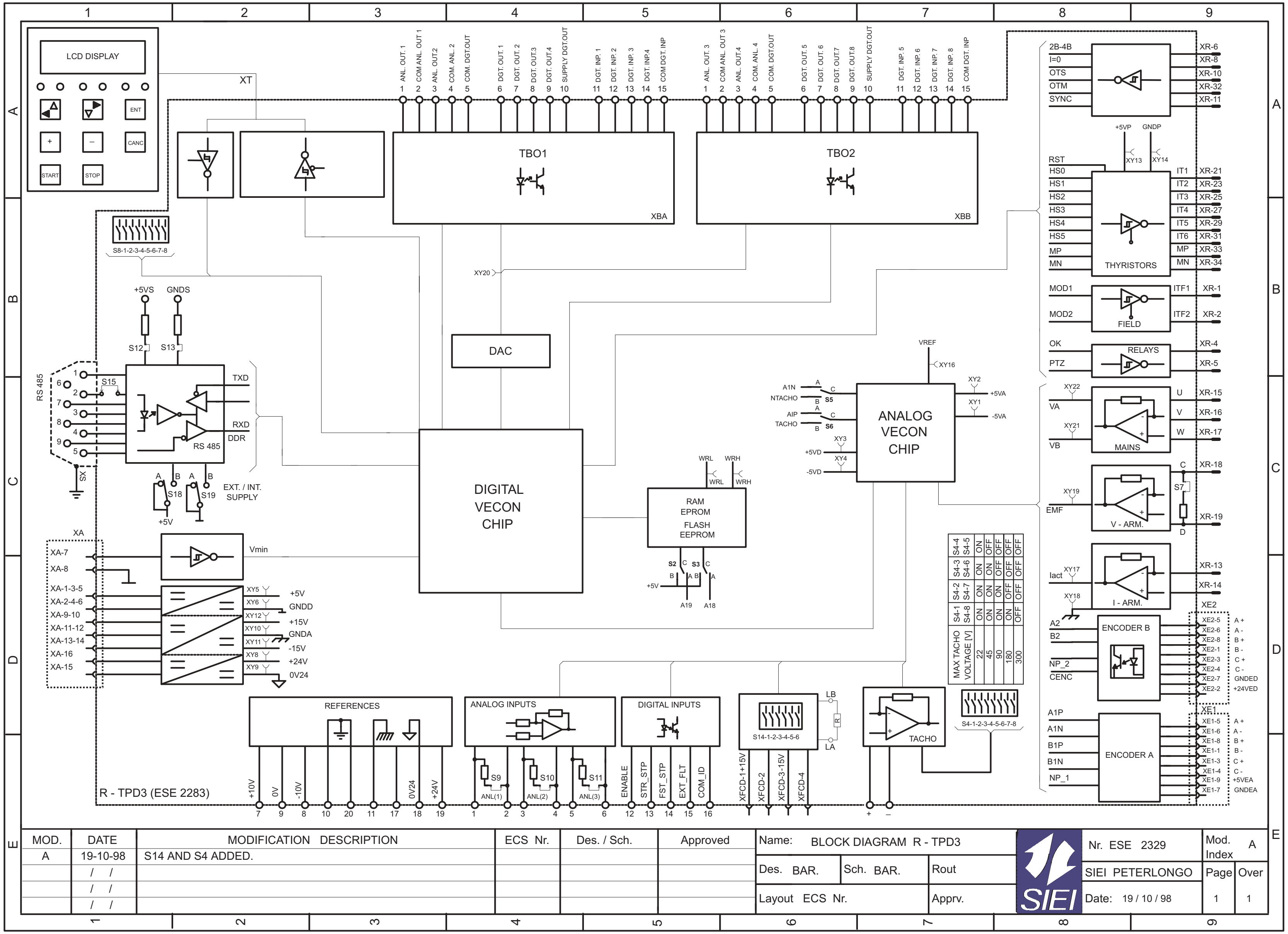
NAME: SCHEMA DELLE CONNESSIONI ELETTRICHE DEL TPD32-400/470 -280÷650-2B TPD32-500/600 -280÷650-2B	SIEI	Nr: ESE 2359	MOD. INDEX C
		SIEI S.p.A.	PAGE 1 OVER 3
DES. BAR SCH. RNC APPR.		DATE: 31-07-96	



MOD.	DATE	MODIFICATION DESCRIPTION	ECS Nr.	Des. / Sch.	Approved
	/ /				
	/ /				
	/ /				
	/ /				

Name: TPD 32 - 400 / 470 - 770L □ 1000L - 2B TPD 32 - 500 / 600 - 770L □ 1000L - 2B			SIEI	Nr: ESE 2360	Mod. Index
Des. RNC	Sch. BAR	Rout		SIEI PETERLONGO	Page 1 / Over 3
Layout ECS Nr.		Apprv.		Date: 01/08/96	

9.3. REGULATION CARD BLOCK DIAGRAM



10. PARAMETER LISTS

10.1. COMPLETE MAIN MENU LIST

Explanation of tables:

White text on black background	Menu/submenu
White text on black background in brackets	Menu does not exist in the keypad
Fields with gray background	Function not accessible via keypad. The status of the corresponding parameter is only displayed.
[FF] in the Parameter column	Dimension based on the factor function
"No." column	**Parameter number (decimal). The value 2000H (= decimal 8192) must be added to the number given in the "No." column in order to obtain the index to access the parameter via Bus , RS485 or Opt2. The parameters in the Drivecom group can be accessed using the format and index specified in the DRIVECOM power transmission profile (#21).**
"Format" column	Internal parameter format: I = Integer (Example: I16 = Integer 16 bit) U = Unsigned (Example: U32 = unsigned 32 bit) Float = Floating point
"Value" column	Minimum, maximum and factory parameter values. S = The value is depending on the size of the device.
"Keypad" column	✓ = Parameter available via keypad
"RS485/BUS/Opt2-M" column	Parameter available via RS485, field Bus or via the DGFC manual communication (see the DGFC user manual) Low priority. The numbers indicate what has to be sent via interface line in order to set the single parameters.

"Term." column	Parameter addressable to one of the analog or digital input/ output terminals.
"Opt2-A/PDC"	Parameter available via DGF386 asynchronous communication (see the DGFC user manual) and/or the Process Data Channel (PDC). "Opt2-A" = Low priority "PDC" = High priority When using a field bus interface, parameters whose range is [min=0; max=1] can be assigned to either Virtual digital inputs (if W access code exists) and/or Virtual digital outputs (if R access code exists). The numbers indicate what has to be sent via interface line in order to set the single parameters.
IA, QA, ID, QD in the "Term." column	The function can be accessed via a freely programmable analog or digital input or output. IA = analog input QA = analog output ID = digital input QD = digital output. The eventually present number is the one by which the terminal is called.
H, L in the "Term." column	Level of the terminal signals (H=high, L=low) which enables the single function.
R/W/Z/C	Access possibilities via the serial interface, Bus or Opt2 manual or asynchronous communication : R = Read, W = Write, Z = Write only when drive disabled, C = Command parameter (the writing of any value causes the execution of a command).
X · Pyy	The value of this parameter can correspond to min/max X times the value of the yy parameter.

Parameter	No.	Format	Value min	Value max	Value Factory	Access via Keyp.	Access via RS485/ BUS/ Opt2-M	Access via Term.	Access via Opt2-A/ PDC
Drive ready	380	U16	0	1	-	-	R	QD	R
Drive ready							1	H	1
Drive not ready							0	L	0
Quick stop	343	U16	-	-	-	-	R/W	-	-
No Quick stop							1		
Quick stop							0		
Start/Stop	315	U16	0	1			R/W	13	R/W
Start							1	H	1
Stop							0	L	0
Fast stop	316	U16	-	-	-	-	R/W	14	R/W
No Fast Stop							1	H	1
Fast Stop							0	L	0
DRIVE STATUS									
Ramp ref 1 [FF]	44	I16	-2 P45	+2 P45	0	✓	R/W	IA, QA	R/W
Enable drive	314	U16	0	1	Disabled	✓	R/W	12	R/W
Enabled							1	H	1
Disabled					(0)		0	L	0
Start/Stop	315	U16	0	1	Stop	✓	R/W	13	R/W
Start							1	H	1
Stop					(0)		0	L	0
Output voltage [V]	233	Float **	0	999	-	✓	R	QA	R
Motor current [%]	199	I16	-250	250	-	✓	R	QA	R
Actual spd (rpm)	122	I16				✓	R	QA	R
Speed ref (rpm)	118	I16	-32768	+32767	-	✓	R	QA	R
Output power [Kw]	1052	Float	0.01	9999.99	-	✓	R	-	-
Flux current (A)	351	Float	0.1	99.9	S	✓	R	-	-
Mains voltage [V]	466	U16	0	999	-	✓	R	-	-
Digital I/Q					-	✓	-	-	-
START UP									
Speed base value [FF]	45	U32***	1	16383	1500	✓	R/Z	-	R
Nom flux curr [A]	374	Float	0.5	80.0	S	✓	R/Z	-	-
Speed-0 f weak	499	U16	0	1	Disabled	✓	R/W	-	-
Enabled							1		
Disabled					(0)		0		
Acc delta speed [FF]	21	U32	0	2^{32}-1	100	✓	R/W	-	-
Acc delta time [s]	22	U16	0	65535	1	✓	R/W	-	-
Dec delta speed [FF]	29	U32	0	2^{32}-1	100	✓	R/W	-	-
Dec delta time [s]	30	U16	0	65535	1	✓	R/W	-	-
START UP \ Motor data									
Motor nom flux [A]	280	Float	0.0	P374	P374x0.3	✓	R/Z	-	-
Flux reg mode	469	U16	0	2	Const. current (0)	✓	R/Z	-	-
Constant current							0		
Voltage control							1		
External control							2		
Full load curr [A]	179	Float	0.1	I_{dAN}	I_{dAN}	✓	R/Z	-	-
Motor max speed [rpm]	162	Float *	0	6553	1500	✓	R/Z	-	R
Max out voltage [V]	175	Float	20	999	400	✓	R/Z	-	-
Flux weak speed [%]	456	U16	0	100	100	✓	R/Z	-	R
START UP \ Limits									
T current lim [%]	7	U16	0	200	100	✓	R/W	IA	R/W
Flux current max [%]	467	U16	P468	100	100	✓	R/W	-	R/W
Flux current min [%]	468	U16	0	P467	5	✓	R/W		-
Speed min amount [FF]	1	U32	0	2^{32}-1	0	✓	R/Z	-	-
Speed max amount [FF]	2	U32	0	2^{32}-1	5000	✓	R/Z		

Parameter	No.	Format	Value			Access via			
			min	max	Factory	Keyp.	RS485/ BUS/ Opt2-M	Term.	Opt2-A/ PDC
START UP \ Speed feedback									
Speed fbk sel	414	U16	0	3	1	✓	R/Z	-	R
Encoder 1							0		
Encoder 2							1		
Tacho							2		
Armature							3		
Tacho scale	562	Float	0.90	3.00	1.00	✓	R/W	-	-
Speed offset	563	Float	-20.00	+20.00	0.00	✓	R/W	-	-
Encoder 2 pulses	169	Float *	150	9999	1000	✓	R/Z	-	R
Enable fbk contr	457	U16	0	1	Disabled	✓	R/Z	-	-
Enabled							1		
Disabled					(0)		0		
Refresh enc 2	652	U16	0	1	Disabled	✓	R/W	-	-
Enabled							1		
Disabled					(0)		0		
START UP \ Alarms									
Undervolt thr [V]	481	U16	0	1000	230	✓	R/W	-	-
Overcurrent thr [%]	584	U16	0	200	110	✓	R/W	-	-
START UP \ Overload contr									
Enable overload	309	I16	0	1	Disabled	✓	R/Z	-	-
Enabled							1		
Disabled					(0)		0		
Overload mode	318	I16	0	1	Curr limited	✓	R/W	-	-
Curr not limited							1		
Curr limited					(0)		0		
Overload current [%]	312	U16	P313	200	100	✓	R/W	-	-
Base current [%]	313	U16	0	P312 ≤ 100	80	✓	R/W	-	-
Overload time [s]	310	U16	0	65535	30	✓	R/W	-	-
Pause time [s]	311	U16	0	65535	300	✓	R/W	-	-
START UP \ Analog inputs \ Analog input 1									
Select input 1	70	U16	0	31	Ramp ref1	✓	R/Z	-	-
OFF							0		
Jog reference							1		
Speed ref 1							2		
Speed ref 2							3		
Ramp ref 1					(4)		4		
Ramp ref 2							5		
T current ref 1							6		
T current ref 2							7		
Adap reference							8		
T current limit							9		
T current lim +							10		
T current lim -							11		
Pad 0							12		
Pad 1							13		
Pad 2							14		
Pad 3							15		
Load comp							19		
PID offset 0							21		
PI central v3							22		
PID feed-back							23		
Flux current max							25		
Out vlt level							26		
Speed ratio							28		
Tension red							29		
Tension ref							30		
Preset 3							31		
Scale input 1	72	Float	-10.000	10.000	1.000	✓	R/W	-	-
Auto tune inp 1	259	U16				✓	C/W	-	-
Auto tune							1		
Offset input 1	74	I16	-32768	+32767	0	✓	R/W	-	-

Parameter	No.	Format	Value min	Value max	Value Factory	Access via Keyp.	Access via RS485/ BUS/ Opt2-M	Access via Term.	Access via Opt2-A/ PDC
START UP \ Analog inputs \ Analog input 2									
Select input 2 (Select like Input 1)	75	U16	0	31	OFF (0)	✓	R/Z	-	-
Scale input 2	77	Float	-10.000	10.000	1.000	✓	R/W	-	-
Auto tune inp 2 Auto tune	260	U16				✓	C/W 1	-	-
Offset input 2	79	I16	-32768	+32767	0	✓	R/W	-	-
START UP \ Analog inputs \ Analog input 3									
Select input 3 (Select like Input 1)	80	U16	0	31	OFF (0)	✓	R/Z	-	-
Scale input 3	82	Float	-10.000	10.000	1.000	✓	R/W	-	-
Auto tune inp 3 Auto tune	261	U16				✓	C/W 1	-	-
Offset input 3	84	I16	-32768	+32767	0	✓	R/W	-	-
START UP									
R&L Search OFF ON	452	U16	0	1	OFF	✓	R/Z 0 1	-	-
Enable drive Enabled Disabled	314	U16	0	1	Disabled (0)	✓	R/W 1 0	12 H L	R/W 1 0
Start/Stop Start Stop	315	U16	0	1	Stop (0)	✓	R/W 1 0	13 H L	R/W 1 0
START UP \ Speed self tune									
Fwd-Rev spd tune Fwd direction Rev direction	1029	U16	1	2	Fwd Direction (1)	✓	R/Z 1 2	-	-
Test T curr lim [%]	1048	U16	0	S	20	✓	R/Z	-	-
Start	1027	U16	0	65535	-	✓	C	-	-
Inertia [kg*m*m*]	1014	Float	0.001	999.999	S	✓	R/W	-	-
Inertia Nw [kg*m*m*]	1030	Float	0.001	999.999	-	✓	R	-	-
Friction [N*m]	1015	Float	0.000	99.999	S	✓	R/W	-	-
Friction Nw [N*m]	1031	Float	0.00	99.99	-	✓	R	-	-
Speed P [%]	87	Float	0.00	100.00	S	✓	R/W	-	-
Speed P Nw [%]	1032	Float	0.00	100.00	-	✓	R	-	-
Speed I [%]	88	Float	0.00	100.00	S	✓	R/W	-	-
Speed I Nw [%]	1033	Float	0.00	100.00	-	✓	R	-	-
Take val	1028	U16	0	65535	-	✓	Z/C	-	-
START UP									
Main commands Digitals Terminals	252	U16	0	1	Term (0)	✓	R/Z 1 0	-	-
Control mode Bus Local	253	U16	0	1	Local (0)	✓	R/Z 1 0	-	-
Save parameters	256	U16				✓	C/W (1)	-	-
TUNING									
R&L Search ON OFF	452	U16	0	1	OFF (0)	✓	R/Z 1 0	-	-
Enable drive Enabled Disabled	314	U16	0	1	Disabled (0)	✓	R/W 1 0	12 H L	R/W 1 0
Start/Stop Start Stop	315	U16	0	1	Stop (0)	✓	R/W 1 0	13 H L	R/W 1 0

Parameter	No.	Format	Value min	Value max	Value Factory	Keyp.	Access via RS485/ BUS/ Opt2-M	Access via Term.	Access via Opt2-A/ PDC
TUNING \ Speed self tune									
Fwd-Rev spd tune Fwd direction Rev direction	1029	U16	1	2	Fwd Direction (1)	✓	R/Z 1 2	-	-
Test T curr lim [%]	1048	U16	0	S	20	✓	R/Z	-	-
Start	1027	U16	0	65535	-	✓	C	-	-
Inertia [kg*m*m*]	1014	Float	0.001	999.999	S	✓	R/W	-	-
Inertia Nw [kg*m*m*]	1030	Float	0.001	999.999	-	✓	R	-	-
Friction [N*m]	1015	Float	0.000	99.999	S	✓	R/W	-	-
Friction Nw [N*m]	1031	Float	0.00	99.99	-	✓	R	-	-
Speed P [%]	87	Float	0.00	100.00	S	✓	R/W	-	-
Speed P Nw [%]	1032	Float	0.00	100.00	-	✓	R	-	-
Speed I [%]	88	Float	0.00	100.00	S	✓	R/W	-	-
Speed I Nw [%]	1033	Float	0.00	100.00	-	✓	R	-	-
Take val	1028	U16	0	65535	-	✓	Z/C	-	-
TUNING									
Speed P [%]	87	Float	0.00	100.00	10.00	✓	R/W	-	-
Speed I [%]	88	Float	0.00	100.00	1.00	✓	R/W	-	-
Prop filter [ms]	444	U16	0	1000	0	✓	R/W	-	-
Flux P [%]	91	Float	0.00	100.00	2.00	✓	R/W	-	-
Flux I [%]	92	Float	0.00	100.00	1.00	✓	R/W		
Voltage P [%]	493	Float	0.00	100.00	30.00	✓	R/W	-	-
Voltage I [%]	494	Float	0.00	100.00	40.00	✓	R/W		
Save parameters	256	U16				✓	C/W (1)	-	-
MONITOR									
Enable drive Enabled Disabled	314		0	1	Disabled (0)	✓	R/W 1 0	12 H L	R/W 1 0
Start/Stop Start Stop	315	U16	0	1	Stop (0)	✓	R/W 1 0	13 H L	R/W 1 0
MONITOR \ Measurements \ Speed \ Speed in DRC [ ]									
Ramp ref (d) [FF]	109	I16	-32768	+32767	-	✓	R	-	R
Ramp output (d) [FF]	112	I16	-32768	+32767	-	✓	R	-	R
Speed ref (d) [FF]	115	I16	-32768	+32767	-	✓	R	-	R
Actual spd (d) [FF]	119	I16	-32768	+32767	-	✓	R	-	R
F act spd (d) [FF]	925	I16	-32768	+32767	-	✓	R	-	R
Act spd filter [s]	923	Float	0.001	1.000	0.100	✓	R/W	-	-
MONITOR \ Measurements \ Speed \ Speed in rpm									
Ramp ref (rpm)	110	I16	-32768	+32767	-	✓	R	QA	R
Ramp outp (rpm)	113	I16	-32768	+32767	-	✓	R	QA	R
Speed ref (rpm)	118	I16	-32768	+32767	-	✓	R	QA	R
Actual spd (rpm)	122	I16	-8192	+8192	-	✓	R	QA	R
Enc 1 speed (rpm)	427	I16	-8192	+8192	-	✓	R		R
Enc 2 speed (rpm)	420	I16	-8192	+8192	-	✓	R		R
F act spd (rpm)	924	I16	-32768	+32767	-	✓	R	QA	R
Act spd filter [s]	923	Float	0.001	1.000	0.100	✓	R/W	-	-
MONITOR \ Measurements \ Speed \ Speed in %									
Ramp ref (%)	111	Float	-200.0	+ 200.0	-	✓	R	-	-
Ramp output (%)	114	Float	-200.0	+ 200.0	-	✓	R	-	-
Speed ref (%)	117	Float	-200.0	+ 200.0	-	✓	R	-	-
Actual spd (%)	121	Float	-200.0	+ 200.0	-	✓	R	-	-
MONITOR \ Measurements									
Mains voltage [V]	466	U16	0	999	-	✓	R	-	-
Mains frequency [Hz]	588	Float	0.0	70.0	-	✓	R	-	-
Output power [Kw]	1052	Float	0.01	9999.99	-	✓	R	-	-
Output voltage [V]	233	Float **	0	999	-	✓	R	QA	R
Motor current [%]	199	I16	-250	250	-	✓	R	QA	R

Parameter	No.	Format	Value			Access via			
			min	max	Factory	Keyp.	RS485/ BUS/ Opt2-M	Term.	Opt2-A/ PDC
F T curr (%)	928	I16	-500	+500	-	✓	R	QA	R
T curr filter [s]	926	Float	0.001	0.250	0.100	✓	R/W	-	-
T current ref [%]	41	I16	-200	+200	-	✓	R	QA	R
Flux reference [%]	500	Float	0.0	100.0	-	✓	R	QA	-
Flux current [%]	234	Float *	0.0	100.0	-	✓	R	QA	R
Flux current (A)	351	Float	0.1	99.9	S	✓	R	-	-
MONITOR \ I/O									
Digital I/Q					-	✓	-	-	-
Dig input term	564	U16	0	65535	-	-	R	-	R
Dig input term 1	565	U16	0	1	-	-	R	-	R
Dig input term 2	566	U16	0	1	-	-	R	-	R
Dig input term 3	567	U16	0	1	-	-	R	-	R
Dig input term 4	568	U16	0	1	-	-	R	-	R
Dig input term 5	569	U16	0	1	-	-	R	-	R
Dig input term 6	570	U16	0	1	-	-	R	-	R
Dig input term 7	571	U16	0	1	-	-	R	-	R
Dig input term 8	572	U16	0	1	-	-	R	-	R
Dig input term 9	573	U16	0	1	-	-	R	-	R
Dig input term 10	574	U16	0	1	-	-	R	-	R
Dig input term 11	575	U16	0	1	-	-	R	-	R
Dig input term 12	576	U16	0	1	-	-	R	-	R
Dig input term 15	579	U16	0	1	-	-	R	-	R
Dig input term 16	580	U16	0	1	-	-	R	-	R
Dig output term	581	U16	0	65535	-		R	-	R
Virtual dig inp	582	U16	0	65535	-	✓	R	-	-
Virtual dig out	583	U16	0	65535	-	✓	R	-	-
INPUT VARIABLES \ Ramp ref \ Ramp ref 1									
Ramp ref 1 [FF]	44	I16	-2 P45	+2 P45	0	✓	R/W	IA, QA	R/W
Ramp ref 1 (%)	47	Float	-200.0	+200.0	0	✓	R/W		
INPUT VARIABLES \ Ramp ref \ Ramp ref 2									
Ramp ref 2 [FF]	48	I16	-2 P45	+2 P45	0	✓	R/W	IA, QA	R/W
Ramp ref 2 (%)	49	Float	-200.0	+200.0	0	✓	R/W	-	-
INPUT VARIABLES \ Speed ref \ Speed ref 1									
Speed ref 1 [FF]	42	I16	-2 P45	+2 P45	0	✓	R/W	IA, QA	R/W
Speed ref 1 (%)	378	Float	-200.0	+200.0	0	✓	R/W	-	-
INPUT VARIABLES \ Speed ref \ Speed ref 2									
Speed ref 2 [FF]	43	I16	-2 P45	+2 P45	0	✓	R/W	IA, QA	R/W
Speed Ref 2 (%)	379	Float	-200.0	+200.0	0	✓	R/W	-	-
INPUT VARIABLES \ T current ref									
T current ref 1 [%]	39	I16	-200	+200 see 6.4.3	0	✓	R/W	IA, QA	R/W
T current ref 2 [%]	40	I16	-200	+200	0	✓	R/W	IA, QA	-
LIMITS \ Speed limits \ Speed amount									
Speed min amount [FF]	1	U32	0	2^{32}-1	0	✓	R/Z	-	-
Speed max amount [FF]	2	U32	0	2^{32}-1	5000	✓	R/Z		
LIMITS \ Speed limits \ Speed min/max									
Speed min pos [FF]	5	U32	0	2^{32}-1	0	✓	R/Z	-	-
Speed max pos [FF]	3	U32	0	2^{32}-1	5000	✓	R/Z	-	-
Speed min neg [FF]	6	U32	0	2^{32}-1	0	✓	R/Z	-	-
Speed max neg [FF]	4	U32	0	2^{32}-1	5000	✓	R/Z	-	-
Speed limited Speed limited Speed not limited	372	U16	0	1		-	R 1 0	QD H L	R 1 0

Parameter	No.	Format	Value min	Value max	Value Factory	Keyp.	Access via RS485/ BUS/ Opt2-M	Access via Term.	Access via Opt2-A/ PDC
LIMITS \ Current limits									
T current lim type T lim mot gen T lim +/-	715	U16	0	1	0	✓	R/Z 1 0	-	-
T current lim [%]	7	U16	0	200	100	✓	R/W	IA	R/W
T current lim + [%]	8	U16	0	200	100	✓	R/W	IA	R/W
T current lim - [%]	9	U16	0	200	100	✓	R/W	IA	R/W
Curr limit state Curr. limit reached Curr. limit not reached	349	U16	0	1		-	R 1 0	QD H L	R 1 0
In use Tcur lim+ [%]	10	U16	0	200		✓	R	-	R
In use Tcur lim- [%]	11	U16	0	200		✓	R	-	R
Current lim red [%]	13	U16	0	200	100	✓	R/W	-	R/W
Torque reduct Active Not active	342	U16	0	1	Not active (0)	✓	R/W 1 0	ID H L	R/W 1 0
LIMITS \ Flux limits									
Flux current max [%]	467	U16	P468	100	100	✓	R/W	-	R/W
Flux current min [%]	468	U16	0	P467	5	✓	R/W		-
RAMP \ Acceleration									
Acc delta speed [FF]	21	U32	0	2^{32}-1	100	✓	R/W	-	-
Acc delta time [s]	22	U16	0	65535	1	✓	R/W		
RAMP \ Deceleration									
Dec delta speed [FF]	29	U32	0	2^{32}-1	100	✓	R/W	-	-
Dec delta time [s]	30	U16	0	65535	1	✓	R/W		
RAMP \ Quick stop									
QStp delta speed [FF]	37	U32	0	2^{32}-1	1000	✓	R/W	-	-
QStp delta time [s]	38	U16	0	65535	1	✓	R/W		
RAMP									
Ramp shape S-Shaped Linear	18	U16	0	1	Linear (0)	✓	R/Z 1 0	-	-
S shape t const [ms]	19	Float	100	3000	300	✓	R/W	-	-
S acc t const [ms]	663	Float	100	3000	300	✓	R/W	-	-
S dec t const [ms]	664	Float	100	3000	300	✓	R/W	-	-
Ramp +/- delay [ms]	20	U16	0	65535	100	✓	R/W	-	-
Fwd-Rev No direction Fwd direction Rev direction No direction	673	U16	0	3	1	✓	R/W 0 1 2 3	ID	R/W 0 1 2 3
Forward sign	293	U16	0	1	0	-	R/W	ID	R/W
Reverse sign	294	U16	0	1	0	-	R/W	ID	R/W
Enable ramp Enabled Disabled	245	I16	0	1	Enabled (1)	✓	R/Z 1 0	-	-
Ramp out = 0 Not active Active	344	U16	0	1	Not active (1)	✓	R/W 1 0	ID H L	R/W 1 0
Ramp in = 0 Not active Active	345	U16	0	1	Not active (1)	✓	R/W 1 0	ID H L	R/W 1 0
Freeze ramp Not active Active	373	U16	0	1	Not active (1)	✓	R/W 1 0	ID H L	R/W 1 0
Ramp + Acc.CW + Dec. anti-CW Other states	346	U16	0	1	-	-	R 1 0	QD H L	R 1 0
Ramp - Acc.anti-CW + Dec. CW Other states	347	U16	0	1	-	-	R 1 0	QD H L	R 1 0

Parameter	No.	Format	Value min	Value max	Value Factory	Access via Keyp.	Access via RS485/ BUS/ Opt2-M	Access via Term.	Access via Opt2-A/ PDC
Acc state Acc CW + Acc anti-CW Other states	1259	U16	0	1	-	-	R 1 0	QD H L	R 1 0
Dec sate Dec CW + Dec anti-CW Other states	1260	U16	0	1	-	-	R 1 0	QD H L	R 1 0
SPEED REGULAT									
Speed ref [rpm]	118	I16	-32768	+32767	-	✓	R	QA	R
Speed reg output [%]	236	I16	-200	+200 see 6.7.1	-	✓	R	QA	R
Lock speed reg ON OFF	322	U16	0	1	OFF (0)	✓	R/W 1 0	ID H L	R/W 1 0
Enable spd reg Enabled Disabled	242	I16	0	1	Enabled (1)	✓	R/Z 1 0	-	-
Lock speed I Not active Active	348	U16	t0	1	Not active (1)	✓	R/W 1 0	ID H L	R/W 1 0
Aux spd fun sel Inertia-loss cp Speed up	1016	U16	0	1	Speed up (0)	✓	R/Z 1 0	-	-
Prop filter [ms]	444	U16	0	1000	0	✓	R/W	-	-
SPEED REGULAT. \ Self tuning									
Fwd-Rev spd tune Fwd direction Rev direction	1029	U16	1	2	Fwd Direction (1)	✓	R/Z 1 2	-	-
Test T curr lim [%]	1048	U16	0	S	20	✓	R/Z	-	-
Start	1027	U16	0	65535	-	✓	C	-	-
Inertia [kg*m*m*]	1014	Float	0.001	999.999	S	✓	R/W	-	-
Inertia Nw [kg*m*m*]	1030	Float	0.001	999.999	-	✓	R	-	-
Friction [N*m]	1015	Float	0.000	99.999	S	✓	R/W	-	-
Friction Nw [N*m]	1031	Float	0.00	99.99	-	✓	R	-	-
Speed P [%]	87	Float	0.00	100.00	S	✓	R/W	-	-
Speed P Nw [%]	1032	Float	0.00	100.00	-	✓	R	-	-
Speed I [%]	88	Float	0.00	100.00	S	✓	R/W	-	-
Speed I Nw [%]	1033	Float	0.00	100.00	-	✓	R	-	-
Take val	1028	U16	0	65535	-	✓	Z/C	-	-
SPEED REGULAT \ Spd zero logic									
Enable spd=0 I Enabled Disabled	123	U16	0	1	Disabled (0)	✓	R/Z 1 0	-	-
Enable spd=0 R Enabled Disabled	124	U16	0	1	Disabled (0)	✓	R/Z 1 0	-	-
Enable spd=0 P Enabled Disabled	125	U16	0	1	Disabled (0)	✓	R/Z 1 0	-	-
Spd=0 P gain [%]	126	Float	0.00	100.00	10.00	✓	R/W	-	-
Ref 0 level [FF]	106	U16	1	32767	10	✓	R/W		
SPEED REGULAT \ Speed up									
Speed up gain [%]	445	Float	0.00	100.00	0.00	✓	R/W	-	-
Speed up base [ms]	446	Float	0	16000	1000	✓	R/W	-	-
Speed up filter [ms]	447	U16	0	1000	0	✓	R/W	-	-
SPEED REGULAT \ Droop function									
Droop gain [%]	696	Float	0.00	100.00	0.00	✓	R/W	-	-
Droop filter [ms]	697	U16	0	1000	0	✓	R/W	-	-
Load comp [%]	698	I16	-200	+200	0	✓	R/W	IA	R/W
Droop limit [FF]	700	U16	0	2*P45	1500	✓	R/W	-	-
Enable droop Enabled Disabled	699	U16	0	1	Disabled (0)	✓	R/W 1 0	ID	R/W 1 0

Parameter	No.	Format	Value min	Value max	Value Factory	Access via Keyp.	Access via RS485/ BUS/ Opt2-M	Access via Term.	Access via Opt2-A/ PDC
SPEED REGULAT \ Inertia/loss cp									
Inertia [kg*m*m]	1014	Float	0.001	999.999	S	✓	R/W	-	-
Friction [N*m]	1015	Float	0.000	99.999	S	✓	R/W	-	-
Torque const [N*m/A]	1013	Float	0.01	99.99	S	✓	R	-	-
Inertia c filter [ms]	1012	U16	0	1000	0	✓	R/W	-	-
CURRENT REGULAT									
T current ref [%]	41	I16	-200	+200	-	✓	R	QA	R
Motor current [%]	199	I16	-250	250	-	✓	R	QA	R
Arm resistance [ ]	453	Float	S	S	0.500	✓	R/W	-	-
Arm inductance [mH]	454	Float	S	S	4.00	✓	R/W	-	-
E int [V]	587	I16	-80	+80	-	✓	R	QA	-
R&L search ON OFF	452	U16	0	1	OFF (0)	✓	R/Z 1 0	-	-
Zero torque Not active Active	353	U16	0	1	Not active (1)	✓	R/W 1 0	ID H L	R/W
FLUX REGULATION									
Enable flux reg ON OFF	497	U16	0	1	ON (1)	✓	R/W 1 0	ID H L	-
Flux reg mode Constant current Voltage control External control	469	U16	0	2	Const. current (0)	✓	R/Z 0 1 2	-	-
Enable flux weak ON OFF	498	U16	0	1	OFF (0)	✓	R/W 1 0	ID H L	-
Speed-0 f weak ON OFF	499	U16	0	1	OFF (0)	✓	R/W 1 0	-	-
Flux reference [%]	500	Float*	0.0	100.0	0.0	✓	R	QA	-
Flux current [%]	234	Float*	0.0	100.0	-	✓	R	QA	R
Out vlt level	921	Float*	0	100.0	100.0	✓	R/W	IA, QA	R/W
FLUX REGULATION \ Flux \ if curve									
I field cnst 40	916	Float	0	100.0	40.0	✓	R/Z		-
I field cnst 70	917	Float	0	100.0	70.0	✓	R/Z		-
I field cnst 90	918	Float	0	100.0	90.0	✓	R/Z		-
Set flux / if	919	U16				✓	Z/C		-
Reset flux / if	920	U16				✓	Z/C		-
Nom flux curr [A]	374	Float	0.5	80.0	S	✓	R/Z	-	-
Motor nom flux [A]	280	Float	0.0	P374	P374x0.3	✓	R/Z		
REG PARAMETERS \ Percent values \ Speed regulator									
Speed P [%]	87	Float	0.00	100.00	10.00	✓	R/W	-	-
Speed I [%]	88	Float	0.00	100.00	1.00	✓	R/W	-	-
Speed P bypass [%]	459	Float	0.00	100.00	10.00	✓	R/W	-	-
Speed I bypass [%]	460	Float	0.00	100.00	1.00	✓	R/W		
REG PARAMETERS \ Percent values \ Flux regulator									
Flux P [%]	91	Float	0.00	100.00	2.00	✓	R/W	-	-
Flux I [%]	92	Float	0.00	100.00	1.00	✓	R/W		
REG PARAMETERS \ Percent values \ Voltage reg									
Voltage P [%]	493	Float	0.00	100.00	30.00	✓	R/W	-	-
Voltage I [%]	494	Float	0.00	100.00	40.00	✓	R/W		
REG PARAMETERS \ Base values \ Speed regulator									
Speed P base [A/rpm]	93	Float	0.001	S	0,300 $P93_{max}$	✓	R/Z	-	-
Speed I base [A/rpm·ms]	94	Float	0.001	S	0,3 $P94_{max}$	✓	R/Z		

Parameter	No.	Format	Value min	Value max	Value Factory	Access via Keyp.	Access via RS485/ BUS/ Opt2-M	Access via Term.	Access via Opt2-A/ PDC
REG PARAMETERS \ Base values \ Flux regulator									
Flux P base	97	Float	1	32767	3277	✓	R/Z	-	-
Flux I Base	98	Float	1	32767	3277	✓	R/Z		
REG PARAMETERS \ Base values \ Voltage reg									
Voltage P base [f%/V]	495	Float	0.0100	S	S	✓	R/Z	-	-
Voltage I base [f%/V·ms]	496	Float	0.01	S	S	✓	R/Z		
REG PARAMETERS \ In use values									
Speed P in use [%]	99	Float	0.00	100.00	S	✓	R	-	-
Speed I in use [%]	100	Float	0.00	100.00	S	✓	R	-	-
CONFIGURATION									
Main commands Digital Terminals	252	U16	0	1	Term. (0)	✓	R/Z 1 0	-	-
Control mode Bus Local	253	U16	0	1	Local (0)	✓	R/Z 1 0	-	-
Speed base value [FF]	45	U32***	1	16383	1500	✓	R/Z	-	R
Full load curr [A]	179	Float	0.1	I_{dAN}	I_{dAN}	✓	R/Z	-	-
Max out voltage [V]	175	Float	20	999	400	✓	R/Z	-	-
Ok relay funct Ready to Start Drive healthy	412	I16	0	1	0	✓	R/Z 1 0	-	-
CONFIGURATION \ Speed fbk									
Motor max speed [rpm]	162	Float *	0	6553	1500	✓	R/Z	-	R
Speed fbk sel Encoder 1 Encoder 2 Tacho Armature	414	U16	0	3	1	✓	R/Z 0 1 2 3	-	R
Encoder 1 state Encoder ok Encoder Fault	648	U16	0	1		-	R 1 0	QD	R 1 0
Enable fbk contr Enabled Disabled	457	U16	0	1	Disabled (0)	✓	R/Z 1 0	-	-
Enable fbk bypas Enabled Disabled	458	U16	0	1	Disabled (0)	✓	R/Z 1 0	-	-
Flux weak speed [%]	456	U16	0	100	100	✓	R/Z	-	R
Speed fbk error [%]	455	U16	0	100	22	✓	R/Z	-	-
Tacho scale	562	Float	0.90	3.00	1.00	✓	R/W	-	-
Speed offset	563	Float	-20.00	+20.00	0.00	✓	R/W	-	-
Encoder 1 pulses	416	Float *	600	9999	1024	✓	R/Z	-	R
Encoder 2 pulses	169	Float *	150	9999	1000	✓	R/Z	-	R
Refresh enc 1 Enabled Disabled	649	U16	0	1	Disabled (0)	✓	R/W 1 0	-	-
Encoder 2 state Encoder ok Encoder Fault	651	U16	0	1		-	R 1 0	QD	R 1 0
Refresh enc 2 Enabled Disabled	652	U16	0	1	Disabled (0)	✓	R/W 1 0	-	-
Enable ind store Enabled Disabled	911	U16	0	1	Disabled (0)	✓	R/W 1 0	-	R/W
Ind store ctrl	912	U16	0	65535	0	-	R/W	-	R/W
Index storing	913	U32	0	$+2^{32}-1$	0	-	R	-	R

Parameter	No.	Format	Value min	Value max	Value Factory	Access via Keyp.	Access via RS485/ BUS/ Opt2-M	Access via Term.	Access via Opt2-A/ PDC
CONFIGURATION \ Drive type									
Drive size [A]	465	U16	0	S	S	✓	R	-	R
2B + E ON OFF	201	U16	0	1	OFF (0)	✓	R/Z 1 0		-
Size selection American Standard	464	U16	0	1	S	✓	R/Z 1 0	-	-
Software version	331	Text				✓	R	-	-
Drive type TPD32...2B TPD32...4B	300	U16	10	11	S	-	R 10 11	-	R 10 11
CONFIGURATION \ Dimension fact									
Dim factor num	50	I32***	1	65535	1	✓	R/Z	-	R
Dim factor den	51	I32***	1	$+2^{31}-1$	1	✓	R/Z	-	R
Dim factor text	52	Text			rpm	✓	R/Z		
CONFIGURATION \ Face value fact									
Face value num	54	I16	1	+32767	1	✓	R/Z	-	R
Face value den	53	I16	1	+32767	1	✓	R/Z	-	R
CONFIGURATION \ Prog alarms \ Failure supply									
Latch ON OFF	194	U16	0	1	ON (1)	✓	R/Z 1 0	-	-
Ok relay open ON OFF	195	I16	0	1	ON (1)	✓	R/W 1 0	-	-
CONFIGURATION \ Prog alarms \ Undervoltage									
Undervolt thr [V]	481	U16	0	1000	230	✓	R/W	-	-
Latch ON OFF	357	U16	0	1	ON (1)	✓	R/Z 1 0	-	-
Ok relay open ON OFF	358	I16	0	1	ON (1)	✓	R/W 1 0	-	-
Hold off time [ms]	470	U16	0	100	0	✓	R/W	-	-
Restart time [ms]	359	U16	0	65535	1000	✓	R/W		
CONFIGURATION \ Prog alarms \ Overvoltage									
Activity Ignore Warning Disable drive	203	U16	0	2	Ignore (0)	✓	R/Z 0 1 2	-	-
Latch ON OFF	361	U16	0	1	ON (1)	✓	R/Z 1 0	-	-
Ok relay open ON OFF	362	I16	0	1	ON (1)	✓	R/W 1 0	-	-
Hold off time [ms]	482	U16	0	10000	0	✓	R/W	-	-
Restart time [ms]	483	U16	0	10000	0	✓	R/W		

Parameter	No.	Format	Value			Access via			
			min	max	Factory	Keyp.	RS485/ BUS/ Opt2-M	Term.	Opt2-A/ PDC
CONFIGURATION \ Prog alarms \ Heatsink									
Activity Warning Disable drive Quick stop Normal stop Curr lim stop	368	U16	1	5	Disable drive	✓	R/Z 1 2 3 4 5	-	-
Ok relay open ON OFF	370	I16	0	1	ON (1)	✓	R/W 1 0	-	-
CONFIGURATION \ Prog alarms \ Overtemp motor									
Activity Ignore Warning Disable drive Quick stop Normal stop Curr lim stop	365	U16			Disable dive	✓	R/Z 0 1 2 3 4 5	-	-
Ok relay open ON OFF	367	I16			ON (1)	✓	R/W 1 0	-	-
CONFIGURATION \ Prog alarms \ External fault									
Activity Warning Disable drive Quick stop Normal stop Curr lim stop	354	U16	1	5	Disable drive	✓	R/Z 1 2 3 4 5	-	-
Latch ON OFF	355	U16	0	1	ON (1)	✓	R/Z 1 0	-	-
Ok relay open ON OFF	356	I16	0	1	ON (1)	✓	R/W 1 0	-	-
Hold off time [ms]	502	U16	0	10000	0	✓	R/W	-	-
Restart time [ms]	501	U16	0	10000	0	✓	R/W		
CONFIGURATION \ Prog alarms \ Overcurrent									
Overcurrent thr [%]	584	U16	0	200	110	✓	R/W	-	-
Activity Ignore Warning Disable drive	212	U16	0	2	Ignore (0)	✓	R/Z 0 1 2	-	-
Latch ON OFF	363	U16	0	1	ON (1)	✓	R/Z 1 0	-	-
Ok relay open ON OFF	364	I16	0	1	ON (1)	✓	R/W 1 0	-	-
Hold off time [ms]	586	U16	0	10000	0	✓	R/W	-	-
Restart time [ms]	585	U16	0	10000	0	✓	R/W		
CONFIGURATION \ Prog alarms \ Field loss									
Activity Ignore Warning Disable drive	473	U16	0	2	Disable drive	✓	R/Z 0 1 2	-	-
Latch ON OFF	471	U16	0	1	ON (1)	✓	R/Z 1 0	-	-
Ok relay open ON OFF	472	I16	0	1	ON (1)	✓	R/W 1 0	-	-
Hold off time [ms]	475	U16	0	10000	0	✓	R/W	-	-
Restart time [ms]	474	U16	0	10000	0	✓	R/W		

Parameter	No.	Format	Value			Access via			
			min	max	Factory	Keyp.	RS485/ BUS/ Opt2-M	Term.	Opt2-A/ PDC
CONFIGURATION \ Prog alarms \ Speed fbk loss									
Activity	478	U16	1	2	Disable drive	✓	R/Z	-	-
Warning							1		
Disable drive							2		
Ok relay open	477	I16	0	1	ON (1)	✓	R/W	-	-
ON							1		
OFF							0		
Hold off time [ms]	480	U16	0	10000	8	✓	R/W		
CONFIGURATION \ Prog alarms \ Opt2 failure									
Activity	639	U16	0	5	Disable drive	✓	R/Z	-	-
Disable drive							2		
Quick stop							3		
Normal stop							4		
Curr lim stop							5		
Ok relay open	640	I16	0	1	ON (1)	✓	R/W	-	-
ON							1		
OFF							0		
CONFIGURATION \ Prog alarms \ Bus loss									
Activity	634	U16	0	5	Disable drive	✓	R/Z	-	-
Ignore							0		
Warning							1		
Disable drive							2		
Quick stop							3		
Normal stop							4		
Curr lim stop							5		
Latch	633	U16	0	1	ON (1)	✓	R/Z	-	-
ON							1		
OFF							0		
Ok relay open	635	I16	0	1	ON (1)	✓	R/W	-	-
ON							1		
OFF							0		
Hold off time [ms]	636	U16	0	10000	0	✓	R/W	-	-
Restart time [ms]	637	U16	0	10000	0	✓	R/W		
CONFIGURATION \ Prog alarms \ Hw opt1 failure									
Activity	386	U16	1	5	Disable drive	✓	R/Z	-	-
Warning							1		
Disable drive							2		
Quick stop							3		
Normal stop							4		
Curr lim stop							5		
Ok relay open	387	I16	0	1	ON (1)	✓	R/W	-	-
ON							1		
OFF							0		
CONFIGURATION \ Prog alarms \ Enable seq err									
Activity	728	U16	0	2	Disable drive	✓	R/Z	-	-
Ignore							0		
Disable drive							2		
Latch	729	U16	0	1	ON (1)	✓	R/Z	-	-
ON							1		
OFF							0		
Ok relay open	730	U16	0	1	ON (1)	✓	R/W	-	-
ON							1		
OFF							0		

Parameter	No.	Format	Value min	Value max	Value Factory	Access via Keyp.	Access via RS485/ BUS/ Opt2-M	Access via Term.	Access via Opt2-A/ PDC
CONFIGURATION \ Set serial comm									
Device address	319	U16	0	255	0	✓	R/Z	-	-
Ser answer delay	408	U16	0	900	0	✓	R/W	-	-
Ser protocol sel	323	U16	0	2	SLINK3	✓	R/W	-	-
SLINK3					(0)		0		
MODBUS RTU							1		
JBUS							2		
Ser baudrate sel	326	U16	0	4	9600	✓	R/W	-	-
19200							0		
9600					(1)		1		
4800							2		
2400							3		
1200							4		
CONFIGURATION									
Pword 1	85	I32	0	99999	-	✓	W		
I/O CONFIG \ Analog outputs \ Analog output 1									
Select output 1	66	U16	0	93	Actual speed	✓	R/Z	-	-
OFF							0		
Speed ref 1							1		
Speed ref 2							2		
Ramp ref 1							3		
Ramp ref 2							4		
Ramp ref							5		
Speed ref							6		
Ramp out							7		
Actual speed					(8)		8		
T current ref 1							9		
T current ref 2							10		
T current ref							11		
Speed reg out							15		
Motor current							16		
Output voltage							20		
Analog input 1							24		
Analog input 2							25		
Analog input 3							26		
Flux current							27		
Pad 0							31		
Pad 1							32		
Pad 4							33		
Pad 5							34		
Flux reference							35		
Pad 6							38		
PID output							39		
Out vlt level							79		
Flux current max							80		
F act spd							81		
F T curr							82		
Speed draw out							84		
Output power							88		
Roll diameter							89		
Act tension ref							90		
Torque current							91		
W reference							92		
Actual comp							93		
Scale output 1	62	Float	-10.000	+10.000	0	✓	R/W		
I/O CONFIG \ Analog outputs \ Analog output 2									
Select output 2 (Select like output 1)	67	U16	0	93	Motor current (16)	✓	R/Z	-	-
Scale output 2	63	Float	-10.000	+10.000	0	✓	R/W		

Parameter	No.	Format	Value min	Value max	Value Factory	Access via Keyp.	RS485/ BUS/ Opt2-M	Term.	Opt2-A/ PDC
I/O CONFIG \ Analog outputs \ Analog output 3									
Select output 3 (Select like output 1)	68	U16	0	93	Flux (27)	✓	R/Z	-	-
Scale output 3	64	Float	-10.000	+10.000	0	✓	R/W		
I/O CONFIG \ Analog outputs \ Analog output 4									
Select output 4 (Select like output 1)	69	U16	0	93	Output voltage (20)	✓	R/Z	-	-
Scale output 4	65	Float	-10.000	+10.000	0	✓	R/W		
I/O CONFIG \ Analog inputs \ Analog input 1									
Select input 1 OFF Jog reference Speed ref 1 Speed ref 2 Ramp ref 1 Ramp ref 2 T current ref 1 T current ref 2 Adap reference T current limit T current lim + T current lim - Pad 0 Pad 1 Pad 2 Pad 3 Load comp PID offset 0 PI central v3 PID feed-back Flux current max Out vlt level Speed ratio Tension red Tension ref Preset 3	70	U16	0	31	Ramp ref 1 (4)	✓	R/Z 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 19 21 22 23 25 26 28 29 30 31	-	-
An in 1 target Not assigned Assigned	295	U16	0	1	0	✓	R/W 1 0	ID H L	R/W 1 0
Input 1 type -10V ... + 10 V 0...20 mA, 0...10 V 4...20 mA	71	U16	0	2	± 10 V	✓	R/Z 0 1 2	-	-
Input 1 sign Positive Negative	389	U16	0	1	1	✓	R/W 1 0	-	R/W 1 0
Scale input 1	72	Float	-10.000	10.000	1.000	✓	R/W	-	-
Tune value inp 1	73	Float	0.100	10.000	1.000	✓	R/W	-	-
Auto tune inp 1 Auto tune	259	U16				✓	C/W 1	-	-
Input 1 filter [ms]	792	U16	0	1000	0	✓	R/W	-	R/W
Input 1 compare	1042	I16	-10000	+10000	0	✓	R/W	-	-
Input 1 cp error	1043	U16	0	10000	0	✓	R/W	-	-
Input 1 cp delay	1044	U16	0	65000	0	✓	R/W	-	-
Input 1 cp match Input 1=thr.val. Input 1 not thr.val.	1045	U16	0	1	-	-	R 1 0	QD H L	R
Offset input 1	74	I16	-32768	+32767	0	✓	R/W	-	-

Parameter	No.	Format	Value min	Value max	Value Factory	Access via Keyp.	RS485/ BUS/ Opt2-M	Term.	Opt2-A/ PDC
I/O CONFIG \ Analog inputs \ Analog input 2									
Select input 2 (Select like Input 1)	75	U16	0	31	OFF (0)	✓	R/Z	-	-
An in 2 target Assigned Not assigned	296	U16	0	1	0	✓	R/W 0 1	ID L H	R/W 0 1
Input 2 type -10V ... + 10 V 0...20 mA, 0...10 V 4...20 mA	76	U16	0	2	± 10 V	✓	R/Z 0 1 2	-	-
Input 2 sign Positive Negative	390	U16	0	1	1	✓	R/W 1 0	-	R/W 1 0
Scale input 2	77	Float	-10.000	10.000	1.000	✓	R/W	-	-
Tune value inp 2	78	Float	0.100	10.000	1.000	✓	R/W	-	-
Auto tune inp 2 Auto tune	260	U16				✓	C/W 1	-	-
Offset input 2	79	I16	-32768	+32767	0	✓	R/W	-	-
I/O CONFIG \ Analog inputs \ Analog input 3									
Select input 3 (Select like Input 1)	80	U16	0	31	OFF (0)	✓	R/Z	-	-
An in 3 target Not assigned Assigned	297	U16	0	1	0	✓	R/W 1 0	ID H L	R/W 1 0
Input 3 type -10V ... + 10 V 0...20 mA, 0...10 V 4...20 mA	81	U16	0	2	± 10 V	✓	R/Z 0 1 2	-	-
Input 3 sign Positive Negative	391	U16	0	1	1	✓	R/W 1 0	-	R/W 1 0
Scale input 3	82	Float	-10.000	10.000	1.000	✓	R/W	-	-
Tune value inp 3	83	Float	0.100	10.000	1.000	✓	R/W	-	-
Auto tune inp 3 Auto tune	261	U16				✓	C/W 1	-	-
Offset input 3	84	I16	-32768	+32767	0	✓	R/W	-	-

Parameter	No.	Format	Value			Access via			
			min	max	Factory	Keyp.	RS485/ BUS/ Opt2-M	Term.	Opt2-A/ PDC
I/O CONFIG \ Digital outputs									
Digital output 1	145	U16	0	61	Ramp +	✓	R/Z	-	-
OFF							0		
Speed zero thr							1		
Spd threshold							2		
Set speed							3		
Curr limit state							4		
Drive ready							5		
Overld available							6		
Overload state							7		
Ramp +					(8)		8		
Ramp -							9		
Speed limited							10		
Undervoltage							11		
Overvoltage							12		
Heatsink							13		
Overcurrent							14		
Overtemp motor							15		
External fault							16		
Failure supply							17		
Pad A bit							18		
Pad B bit							19		
Virt dig input							20		
Torque sign							21		
Stop control							23		
Field loss							24		
Speed fbk loss							25		
Bus loss							26		
Hw opt1 failure							28		
Opt2 failure							29		
Encoder 1 state							30		
Encoder 2 state							31		
Enable seq err							35		
Diameter calc st							38		
Input 1 cp match							49		
Diam reached							58		
Spd match compl							59		
Acc state							60		
Dec state							61		
Brake comand							62		
Inversion out 1	1267	U16	0	1	Disabled	✓	R/W	-	-
Enabled							1		
Disabled					(0)		0		
Digital output 2 (Select like output 1)	146	U16	0	61	Ramp - (9)	✓	R/Z	-	-
Inversion out 2	1268	U16	0	1	Disabled	✓	R/W	-	-
Enabled							1		
Disabled					(0)		0		
Digital output 3 (Select like output 1)	147	U16	0	61	Spd thr. (2)	✓	R/Z	-	-
Inversion out 3	1269	U16	0	1	Disabled	✓	R/W	-	-
Enabled							1		
Disabled					(0)		0		
Digital output 4 (Select like output 1)	148	U16	0	61	Overld avail. (6)	✓	R/Z	-	-
Inversion out 4	1270	U16	0	1	Disabled	✓	R/W	-	-
Enabled							1		
Disabled					(0)		0		
Digital output 5 (Select like output 1)	149	U16	0	61	Curr lim. State (4)	✓	R/Z	-	-
Inversion out 5	1271	U16	0	1	Disabled	✓	R/W	-	-
Enabled							1		
Disabled					(0)		0		

Parameter	No.	Format	Value			Keyp.	Access via		
			min	max	Factory		RS485/ BUS/ Opt2-M	Term.	Opt2-A/ PDC
Digital output 6 (Select like output 1)	150	U16	0	61	Overvolt (12)	✓	R/Z	-	-
Inversion out 6 Enabled Disabled	1272	U16	0	1	Disabled (0)	✓	R/W 1 0	-	-
Digital output 7 (Select like output 1)	151	U16	0	61	Undervolt (11)	✓	R/Z	-	-
Inversion out 7 Enabled Disabled	1273	U16	0	1	Disabled (0)	✓	R/W 1 0	-	-
Digital output 8 (Select like output 1)	152	U16	0	61	Overcurr (14)	✓	R/Z	-	-
Inversion out 8 Enabled Disabled	1274	U16	0	1	Disabled (0)	✓	R/W 1 0	-	-
Relay 2 (Select like output 1)	629	U16	0	61	Stop ctrl (23)	✓	R/Z		
Inversion relay 2 Enabled Disabled	1275	U16	0	1	Disabled (0)	✓	R/W 1 0	-	-

Parameter	No.	Format	Value			Access via			
			min	max	Factory	Keyp.	RS485/ BUS/ Opt2-M	Term.	Opt2-A/ PDC
I/O CONFIG \ Digital inputs									
Digital input 1	137	U16	0	83	OFF	✓	R/Z	-	-
OFF					(0)		0		
Motor pot reset							1		
Motor pot up							2		
Motor pot down							3		
Motor pot sign +							4		
Motor pot sign -							5		
Jog +							6		
Jog -							7		
Failure reset							8		
Torque reduct							9		
Ramp out = 0							10		
Ramp in = 0							11		
Freeze ramp							12		
Lock speed reg							13		
Lock speed I							14		
Auto capture							15		
Input 1 sign +							16		
Input 1 sign -							17		
Input 2 sign +							18		
Input 2 sign -							19		
Input 3 sign +							20		
Input 3 sign -							21		
Zero torque							22		
Speed sel 0							23		
Speed sel 1							24		
Speed sel 2							25		
Ramp sel 0							26		
Ramp sel 1							27		
Field loss							29		
Enable flux reg							30		
Enable flux weak							31		
Pad A bit 0							32		
Pad A bit 1							33		
Pad A bit 2							34		
Pad A bit 3							35		
Pad A bit 4							36		
Pad A bit 5							37		
Pad A bit 6							38		
Pad A bit 7							39		
Forward sign							44		
Reverse sign							45		
An in 1 target							46		
An in 2 target							47		
An in 3 target							48		
Enable droop							49		
Enable PI PID							52		
Enable PD PID							53		
PI integral freeze							54		
PID offs. Sel							55		
PI central vs0							56		
PI central vs1							57		
Diameter calc							58		
Diam reset							68		
Diam calc Dis							69		
Torque winder EN							70		
Line acc status							71		
Line dec status							72		
Line fstp status							73		
Speed match							74		
Diam inc/dec En							75		
Wind/unwind							76		
Diam preset sel0							77		
Diam preset sel1							78		
Taper enable							79		
Speed demand En							80		
Winder side							81		
Enable PI-PD PID							82		
Jog TW enable							83		

Parameter	No.	Format	Value			Access via			
			min	max	Factory	Keyp.	RS485/ BUS/ Opt2-M	Term.	Opt2-A/ PDC
Inversion in 1 Enabled Disabled	1276	U16	0	1	Disabled (0)	✓	R/W 1 0	-	-
Digital input 2 (Select like input 1)	138	U16	0	83	OFF (0)	✓	R/Z	-	-
Inversion in 2 Enabled Disabled	1277	U16	0	1	Disabled (0)	✓	R/W 1 0	-	-
Digital input 3 (Select like input 1)	139	U16	0	83	OFF (0)	✓	R/Z	-	-
Inversion in 3 Enabled Disabled	1278	U16	0	1	Disabled (0)	✓	R/W 1 0	-	-
Digital input 4 (Select like input 1)	140	U16	0	83	OFF (0)	✓	R/Z	-	-
Inversion in 4 Enabled Disabled	1279	U16	0	1	Disabled (0)	✓	R/W 1 0	-	-
Digital input 5 (Select like input 1)	141	U16	0	83	OFF (0)	✓	R/Z	-	-
Inversion in 5 Enabled Disabled	1280	U16	0	1	Disabled (0)	✓	R/W 1 0	-	-
Digital input 6 (Select like input 1)	142	U16	0	83	OFF (0)	✓	R/Z	-	-
Inversion in 6 Enabled Disabled	1281	U16	0	1	Disabled (0)	✓	R/W 1 0	-	-
Digital input 7 (Select like input 1)	143	U16	0	83	OFF (0)	✓	R/Z	-	-
Inversion in 7 Enabled Disabled	1282	U16	0	1	Disabled (0)	✓	R/W 1 0	-	-
Digital input 8 (Select like input 1)	144	U16	0	83	OFF (0)	✓	R/Z	-	-
Inversion in 8 Enabled Disabled	1283	U16	0	1	Disabled (0)	✓	R/W 1 0	-	-

Parameter	No.	Format	Value min	Value max	Value Factory	Access via Keyp.	Access via RS485/ BUS/ Opt2-M	Access via Term.	Access via Opt2-A/ PDC
I/O CONFIG \ Encoder inputs									
Select enc 1	1020	U16	0	5	OFF	✓	R/Z	-	-
OFF					(0)		0		
Speed ref 1							2		
Speed ref 2					see		3		
Ramp ref 1					6.12.5		4		
Ramp ref 2							5		
Select enc 2	1021	U16	0	5	OFF	✓	R/Z	-	-
OFF					(0)		0		
Speed ref 1							2		
Speed ref 2					see		3		
Ramp ref 1					6.12.5		4		
Ramp ref 2							5		
Encoder 1 pulses	416	Float*	600	9999	1024	✓	R/Z	-	R
Encoder 2 pulses	169	Float*	150	9999	1024	✓	R/Z	-	R
Refresh enc 1	649	U16	0	1	Disabled	✓	R/W	-	-
Enabled							1		
Disabled					(0)		0		
Refresh enc 2	652	U16	0	1	Disabled	✓	R/W	-	-
Enabled							1		
Disabled					(0)		0		

ADD SPEED FUNCT									
Auto capture	388	U16			OFF	✓	R/W	ID	-
ON							1	H	
OFF					(0)		0	L	
ADD SPEED FUNCT \ Adaptive spd reg									
Enable spd adap	181	U16	0	1	Disabled	✓	R/Z	-	-
Enabled							1		
Disabled					(0)		0		
Select adap type	182	U16	0	1	Speed	✓	R/Z	-	-
Adap reference							1		
Speed							0		
Adap reference [FF]	183	I16	-32768	+32767	1000	✓	R/W	IA	R/W
Adap speed 1 [%]	184	Float	0.0	200.0	20.3	✓	R/W	-	-
Adap speed 2 [%]	185	Float	0.0	200.0	40.7	✓	R/W	-	-
Adap joint 1 [%]	186	Float	0.0	200.0	6.1	✓	R/W	-	-
Adap joint 2 [%]	187	Float	0.0	200.0	6.1	✓	R/W	-	-
Adap P gain 1 [%]	188	Float	0.00	100.00	10.00	✓	R/W	-	-
Adap I gain 1 [%]	189	Float	0.00	100.00	1.00	✓	R/W	-	-
Adap P gain 2 [%]	190	Float	0.00	100.00	10.00	✓	R/W	-	-
Adap I gain 2 [%]	191	Float	0.00	100.00	1.00	✓	R/W	-	-
Adap P gain 3 [%]	192	Float	0.00	100.00	10.00	✓	R/W	-	-
Adap I gain 3 [%]	193	Float	0.00	100.00	1.00	✓	R/W	-	-

Parameter	No.	Format	Value min	Value max	Value Factory	Keyp.	Access via RS485/ BUS/ Opt2-M	Access via Term.	Access via Opt2-A/ PDC
ADD SPEED FUNCT \ Speed control									
Spd threshold + [FF]	101	U16	1	32767	1000	✓	R/W	-	-
Spd threshold - [FF]	102	U16	1	32767	1000	✓	R/W	-	-
Threshold delay [ms]	103	U16	0	65535	100	✓	R/W	-	-
Spd threshold Speed not exceeded Speed exceeded	393	U16	0	1		-	R 1 0	QD H L	R 1 0
Set error [FF]	104	U16	1	32767	100	✓	R/W	-	-
Set delay [ms]	105	U16	1	65535	100	✓	R/W	-	-
Set speed Speed = ref. val. Speed not ref. val.	394	U16	0	1		-	R 1 0	QD H L	R 1 0
ADD SPEED FUNCT \ Speed zero									
Speed zero level [FF]	107	U16	1	32767	10	✓	R/W	-	-
Speed zero delay [ms]	108	U16	0	65535	100	✓	R/W	-	-
Speed zero thr Drive rotating Drive not rotating	395	U16	0	1		-	R 1 0	QD H L	R 1 0
FUNCTIONS \ Motor pot									
Enable motor pot Enabled Disabled	246	I16	0	1	Disabled (0)	✓	R/Z 1 0	-	-
Motor pot oper	247					✓	-	-	-
Motor pot sign Positive Negative	248	I16	0	1	Positive (1)	✓	R/W 1 0	ID	-
Motor pot reset	249	U16				✓	Z/C(1)	ID (H)	-
Motor pot up Acceleration No acceleration	396	U16	0	1			R/W 1 0	ID H L	R/W 1 0
Motor pot down Deceleration No deceleration	397	U16	0	1			R/W 1 0	ID H L	R/W 1 0
FUNCTIONS \ Jog function									
Enable jog Enabled Disabled	244	I16	0	1	Disabled (0)	✓	R/Z 1 0	-	-
Jog operation	265	-	-	-	-	✓	-	-	-
Jog selection Ramp input Speed input	375	U16	0	1	0	✓	R/Z 1 0	-	-
Jog reference [FF]	266	I16	0	32767	0	✓	R/W	IA	-
Jog + Forwards jog No jog forwards	398	U16	0	1			R/W 1 0	ID H L	R/W 1 0
Jog - Backwards jog No backwards jog	399	U16	0	1			R/W 1 0	ID H L	R/W 1 0

Parameter	No.	Format	Value			Access via			
			min	max	Factory	Keyp.	RS485/ BUS/ Opt2-M	Term.	Opt2-A/ PDC
FUNCTIONS \ Multi speed fct									
Enab multi spd Enabled Disabled	153	I16	0	1	Disabled (0)	✓	R/Z 1 0	-	-
Multi speed 1 [FF]	154	I16	-32768	+32767	0	✓	R/W	-	-
Multi speed 2 [FF]	155	I16	-32768	+32767	0	✓	R/W	-	-
Multi speed 3 [FF]	156	I16	-32768	+32767	0	✓	R/W	-	-
Multi speed 4 [FF]	157	I16	-32768	+32767	0	✓	R/W	-	-
Multi speed 5 [FF]	158	I16	-32768	+32767	0	✓	R/W	-	-
Multi speed 6 [FF]	159	I16	-32768	+32767	0	✓	R/W	-	-
Multi speed 7 [FF]	160	I16	-32768	+32767	0	✓	R/W	-	-
Speed sel 0 Value 2^0 selected Value 2^0 not selected	400	U16	0	1		-	R/W 1 0	ID H L	R/W 1 0
Speed sel 1 Value 2^1 selected Value 2^1 not selected	401	U16	0	1		-	R/W 1 0	ID H L	R/W 1 0
Speed sel 2 Value 2^2 selected Value 2^2 not selected	402	U16	0	1		-	R/W 1 0	ID H L	R/W 1 0
Multispeed sel	208	U16	0	7	0	✓	R/W	ID	R/W
FUNCTIONS \ Multi ramp fct									
Enab multi rmp Enabled Disabled	243	I16	0	1	Disabled (0)	✓	R/Z 1 0	-	-
Ramp selector	202	U16	0	3	0	✓	R/W	ID	R/W
FUNCTIONS \ Multi ramp fct \ Ramp 0 \ Acceleration 0									
Acc delta speed0 [FF]	659	U32	0	2^{32}-1	100	✓	R/W	-	-
Acc delta time 0 [s]	660	U16	0	65535	1	✓	R/W	-	-
S acc t const 0 [ms]	665	Float	100	3000	300	✓	R/W		
FUNCTIONS \ Multi ramp fct \ Ramp 0 \ Deceleration 0									
Dec delta speed0 [FF]	661	U32	0	2^{32}-1	100	✓	R/W	-	-
Dec delta time 0 [s]	662	U16	0	65535	1	✓	R/W	-	-
S dec t const 0 [ms]	666	Float	100	3000	300	✓	R/W		
FUNCTIONS \ Multi ramp fct \ Ramp 0 \ Acceleration 1									
Acc delta speed1 [FF]	23	U32	0	2^{32}-1	100	✓	R/W	-	-
Acc delta time 1 [s]	24	U16	0	65535	1	✓	R/W	-	-
S acc t const 1 [ms]	667	Float	100	3000	300	✓	R/W	-	-
FUNCTIONS \ Multi ramp fct \ Ramp 0 \ Deceleration 1									
Dec delta speed1 [FF]	31	U32	0	2^{32}-1	100	✓	R/W	-	-
Dec delta time 1 [s]	32	U16	0	65535	1	✓	R/W	-	-
S dec t const 1 [ms]	668	Float	100	3000	300	✓	R/W	-	-
FUNCTIONS \ Multi ramp fct \ Ramp 0 \ Acceleration 2									
Acc delta speed2 [FF]	25	U32	0	2^{32}-1	100	✓	R/W	-	-
Acc delta time 2 [s]	26	U16	0	65535	1	✓	R/W	-	-
S acc t const 2 [ms]	669	Float	100	3000	300	✓	R/W	-	-
FUNCTIONS \ Multi ramp fct \ Ramp 0 \ Deceleration 2									
Dec delta speed2 [FF]	33	U32	0	2^{32}-1	100	✓	R/W	-	-
Dec delta time 2 [s]	34	U16	0	65535	1	✓	R/W	-	-
S dec t const 2 [ms]	670	Float	100	3000	300	✓	R/W	-	-
FUNCTIONS \ Multi ramp fct \ Ramp 0 \ Acceleration 3									
Acc delta speed3 [FF]	27	U32	0	2^{32}-1	100	✓	R/W	-	-
Acc delta time 3 [s]	28	U16	0	65535	1	✓	R/W	-	-
S acc t const 3 [ms]	671	Float	100	3000	300	✓	R/W	-	-

Parameter	No.	Format	Value min	Value max	Value Factory	Access via Keyp.	RS485/ BUS/ Opt2-M	Term.	Opt2-A/ PDC
FUNCTIONS \ Multi ramp fct \ Ramp 0 \ Deceleration 3									
Dec delta speed3 [FF]	35	U32	0	2^{32}-1	100	✓	R/W	-	-
Dec delta time 3 [s]	36	U16	0	65535	1	✓	R/W	-	-
S dec t const 3 [ms]	672	Float	100	3000	300	✓	R/W	-	-
Ramp sel 0 Value 2^0 selected Value 2^0 not selected	403	U16	0	1		-	R/W 1 0	ID H L	R/W 1 0
Ramp sel 1 Value 2^1 selected Value 2^1 not selected	404	U16	0	1		-	R/W 1 0	ID H L	R/W 1 0
FUNCTIONS \ Speed draw									
Speed ratio	1017	I16	0	+32767	+10000	✓	R/W	IA	R/W
Speed draw out (d)	1018	I16	-32768	+32767	-	✓	R	QA	R/W
Speed draw out (%)	1019	Float	-200.0	+200.0	-	✓	R	-	-
FUNCTIONS \ Overload contr									
Enable overload Enabled Disabled	309	I16	0	1	Disabled (0)	✓	R/Z 1 0	-	-
Overload mode Curr not limited Curr limited	318	I16	0	1	Curr limited	✓	R/W 1 0	-	-
Overload current [%]	312	U16	P313	200	100	✓	R/W	-	-
Base current [%]	313	U16	0	P312 ≤ 100	80	✓	R/W	-	-
Overload time [s]	310	U16	0	65535	30	✓	R/W	-	-
Pause time [s]	311	U16	0	65535	300	✓	R/W	-	-
Overld available Overload possible Overload not possible	406	U16	0	1		-	R 1 0	QD H L	R 1 0
Overload state Current > limit value Current limit value	407	U16	0	1		-	R 1 0	QD H L	R 1 0
FUNCTIONS \ Stop control									
Stop mode OFF Stop & speed 0 Fast stp & spd 0 Fst / stp & spd 0	626	U16	0	3	Stop & Speed 0	✓	R/Z 0 1 2 3	-	-
Spd 0 trip delay [ms]	627	U16	0	40000	0	✓	R/W	-	-
Trip cont delay [ms]	628	U16	0	40000	0	✓	R/W	-	-
Jog stop control ON OFF	630	U16	0	1	OFF (0)	✓	R/Z 1 0	-	-
FUNCTIONS \Brake control									
Enable ramp in=0 Enabled Disabled	1265	U16	0	1	Disabled (0)	✓	R/W 1 0	-	-
Closing speed	1262	U16	0	200	30	✓	R/W	-	-
Opening delay	1263	U16	0	30000	0	✓	R/W	-	-
Actuator delay	1266	U16	0	30000	0	✓	R/W	-	-
FUNCTIONS \ I/n curve									
I/n curve Enabled Disabled	750	U16	0	1	Disabled (0)	✓	R/Z 1 0	-	-
I/n lim 0 [%]	751	U16	0	200	0	✓	R/Z	-	-
I/n lim 1 [%]	752	U16	0	200	0	✓	R/Z	-	-
I/n lim 1 [%]	752	U16	0	200	0	✓	R/Z	-	-
I/n lim 2 [%]	753	U16	0	200	0	✓	R/Z	-	-
I/n lim 3 [%]	754	U16	0	200	0	✓	R/Z	-	-
I/n lim 4 [%]	755	U16	0	200	0	✓	R/Z	-	-
I/n speed [rpm]	756	U16	0	P162	0	✓	R/Z	-	-

Parameter	No.	Format	Value min	Value max	Value Factory	Access via Keyp.	RS485/ BUS/ Opt2-M	Term.	Opt2-A/ PDC
SPEC FUNCTIONS \ Test generator									
Generator access	58	U16	0	5	Not conn.	✓	R/Z	-	-
Not connected							0		
T current ref							2		
Flux ref							3		
Ramp ref							4		
Speed ref							5		
Gen frequency [Hz]	59	Float	0.1	62.5	0.1	✓	R/W	-	-
Gen amplitude [%]	60	Float	0	200.00	0	✓	R/W	-	-
Generator offset [%]	61	Float	-200.00	+200.00	0	✓	R/W		
SPEC FUNCTIONS									
Save parameters	256	U16				✓	C/W(1)	-	-
Load default	258	U16				✓	Z/C(1)	-	-
Life time [h.min]	235	Float	0,00	65535,00		✓	R	-	-
Failure register	330	U16	1	10	10	✓	R/W	-	-
Failure text	327	Text				-	R	-	-
Failure hour	328	U16	0	65535			R	-	-
Failure minute	329	U16	0	59			R	-	-
Failure code	417	U16	0	65535			R	-	-
Failure supply							5100h		
Undervoltage							3120h		
Overvoltage							3310h		
Overcurrent							2300h		
Heatsink							4210h		
Hardware							5000h		
DSP error							6110h		
Interrupt error							6120h		
Speed fbk							7301h		
External fault							9000h		
Overtemp motor							4310h		
Field loss							3330h		
Bus loss							8110h		
Hw opt 1 failure							7510h		
Opt2							7400h		
Unknown							1001h		
Enable seq err							9009h		
Failure reset	262	U16				✓	Z/C (1)	ID (H)	W
Failure reg del	263	U16				✓	C	-	-
SPEC FUNCTIONS \ Links \ Link 1									
Source	484	U16	0	65535	0	✓	R/W	-	-
Destination	485	U16	0	65535	0	✓	R/W	-	-
Mul gain	486	Float	-10000	+10000	1	✓	R/W	-	-
Div gain	487	Float	-10000	+10000	1	✓	R/W	-	-
Input max	488	Float	-2^{31}	$2^{31}-1$	0	✓	R/W	-	-
Input min	489	Float	-2^{31}	$2^{31}-1$	0	✓	R/W	-	-
Input offset	490	Float	-2^{31}	$2^{31}-1$	0	✓	R/W	-	-
Output offset	491	Float	-2^{31}	$2^{31}-1$	0	✓	R/W	-	-
Inp absolute	492	U16	0	1	OFF	✓	R/W	-	-
ON							1		
OFF					(0)		0		
SPEC FUNCTIONS \ Links \ Link 2									
Source	553	U16	0	65535	0	✓	R/W	-	-
Destination	554	U16	0	65535	0	✓	R/W	-	-
Mul gain	555	Float	-10000	+10000	1	✓	R/W	-	-
Div gain	556	Float	-10000	+10000	1	✓	R/W	-	-
Input max	557	Float	-2^{31}	$2^{31}-1$	0	✓	R/W	-	-
Input min	558	Float	-2^{31}	$2^{31}-1$	0	✓	R/W	-	-
Input offset	559	Float	-2^{31}	$2^{31}-1$	0	✓	R/W	-	-
Output offset	560	Float	-2^{31}	$2^{31}-1$	0	✓	R/W	-	-
Inp absolute	561	U16	0	1	OFF	✓	R/W	-	-
ON							1		
OFF					(0)		0		

Parameter	No.	Format	Value min	Value max	Value Factory	Access via Keyp.	RS485/ BUS/ Opt2-M	Term.	Opt2-A/ PDC
SPEC FUNCTIONS \ Links \ Link 3									
Source	1218	U16	0	65535	0	✓	R/W	-	-
Destination	1219	U16	0	65535	0	✓	R/W	-	-
Mul gain	1220	Float	-10000	+10000	1	✓	R/W	-	-
Div gain	1221	Float	-10000	+10000	1	✓	R/W	-	-
Input max	1222	Float	-2^{31}	$2^{31}-1$	0	✓	R/W	-	-
Input min	1223	Float	-2^{31}	$2^{31}-1$	0	✓	R/W	-	-
Input offset	1224	Float	-2^{31}	$2^{31}-1$	0	✓	R/W	-	-
Output offset	1225	Float	-2^{31}	$2^{31}-1$	0	✓	R/W	-	-
Inp absolute	1226	U16	0	1	OFF	✓	R/W	-	-
ON							1		
OFF					(0)		0		
SPEC FUNCTIONS \ Links \ Link 4									
Source	1227	U16	0	65535	0	✓	R/W	-	-
Destination	1228	U16	0	65535	0	✓	R/W	-	-
Mul gain	1229	Float	-10000	+10000	1	✓	R/W	-	-
Div gain	1230	Float	-10000	+10000	1	✓	R/W	-	-
Input max	1231	Float	-2^{31}	$2^{31}-1$	0	✓	R/W	-	-
Input min	1232	Float	-2^{31}	$2^{31}-1$	0	✓	R/W	-	-
Input offset	1233	Float	-2^{31}	$2^{31}-1$	0	✓	R/W	-	-
Output offset	1234	Float	-2^{31}	$2^{31}-1$	0	✓	R/W	-	-
Inp absolute	1235	U16	0	1	OFF	✓	R/W	-	-
ON							1		
OFF					(0)		0		
SPEC FUNCTIONS \ Links \ Link 5									
Source	1236	U16	0	65535	0	✓	R/W	-	-
Destination	1237	U16	0	65535	0	✓	R/W	-	-
Mul gain	1238	Float	-10000	+10000	1	✓	R/W	-	-
Div gain	1239	Float	-10000	+10000	1	✓	R/W	-	-
Input max	1240	Float	-2^{31}	$2^{31}-1$	0	✓	R/W	-	-
Input min	1241	Float	-2^{31}	$2^{31}-1$	0	✓	R/W	-	-
Input offset	1242	Float	-2^{31}	$2^{31}-1$	0	✓	R/W	-	-
Output offset	1243	Float	-2^{31}	$2^{31}-1$	0	✓	R/W	-	-
Inp absolute	1244	U16	0	1	OFF	✓	R/W	-	-
ON							1		
OFF					(0)		0		
SPEC FUNCTIONS \ Links \ Link 6									
Source	1245	U16	0	65535	0	✓	R/W	-	-
Destination	1246	U16	0	65535	0	✓	R/W	-	-
Mul gain	1247	Float	-10000	+10000	1	✓	R/W	-	-
Div gain	1248	Float	-10000	+10000	1	✓	R/W	-	-
Input max	1249	Float	-2^{31}	$2^{31}-1$	0	✓	R/W	-	-
Input min	1250	Float	-2^{31}	$2^{31}-1$	0	✓	R/W	-	-
Input offset	1251	Float	-2^{31}	$2^{31}-1$	0	✓	R/W	-	-
Output offset	1252	Float	-2^{31}	$2^{31}-1$	0	✓	R/W	-	-
Inp absolute	1253	U16	0	1	OFF	✓	R/W	-	-
ON							1		
OFF					(0)		0		

Parameter	No.	Format	Value			Access via			
			min	max	Factory	Keyp.	RS485/ BUS/ Opt2-M	Term.	Opt2-A/ PDC
SPEC FUNCTIONS \ Pad Parameters									
Pad 0	503	I16	-32768	+32767	0	✓	R/W	IA, QA	R/W
Pad 1	504	I16	-32768	+32767	0	✓	R/W	IA, QA	R/W
Pad 2	505	I16	-32768	+32767	0	✓	R/W	IA	R/W
Pad 3	506	I16	-32768	+32767	0	✓	R/W	IA	R/W
Pad 4	507	I16	-32768	+32767	0	✓	R/W	QA	R/W
Pad 5	508	I16	-32768	+32767	0	✓	R/W	QA	R/W
Pad 6	509	I16	-32768	+32767	0	✓	R/W	QA	R/W
Pad 7	510	I16	-32768	+32767	0	✓	R/W	-	R/W
Pad 8	511	I16	-32768	+32767	0	✓	R/W	-	R/W
Pad 9	512	I16	-32768	+32767	0	✓	R/W	-	R/W
Pad 10	513	I16	-32768	+32767	0	✓	R/W	-	R/W
Pad 11	514	I16	-32768	+32767	0	✓	R/W	-	R/W
Pad 12	515	I16	-32768	+32767	0	✓	R/W	-	R/W
Pad 13	516	I16	-32768	+32767	0	✓	R/W	-	R/W
Pad 14	517	I16	-32768	+32767	0	✓	R/W	-	R/W
Pad 15	518	I16	-32768	+32767	0	✓	R/W	-	R/W
Bitword pad A	519	U16	0	65535	0	✓	R/W	ID*, QD*	R/W
Pad A Bit 0	520	U16	0	1	0	-	R/W	ID, QD	R/W
Pad A Bit 1	521	U16	0	1	0	-	R/W	ID, QD	R/W
Pad A Bit 2	522	U16	0	1	0	-	R/W	ID, QD	R/W
Pad A Bit 3	523	U16	0	1	0	-	R/W	ID, QD	R/W
Pad A Bit 4	524	U16	0	1	0	-	R/W	ID, QD	R/W
Pad A Bit 5	525	U16	0	1	0	-	R/W	ID, QD	R/W
Pad A Bit 6	526	U16	0	1	0	-	R/W	ID, QD	R/W
Pad A Bit 7	527	U16	0	1	0	-	R/W	ID, QD	R/W
Pad A Bit 8	528	U16	0	1	0	-	R/W	QD*	-
Pad A Bit 9	529	U16	0	1	0	-	R/W	QD*	-
Pad A Bit 10	530	U16	0	1	0	-	R/W	QD*	-
Pad A Bit 11	531	U16	0	1	0	-	R/W	QD*	-
Pad A Bit 12	532	U16	0	1	0	-	R/W	QD*	-
Pad A Bit 13	533	U16	0	1	0	-	R/W	QD*	-
Pad A Bit 14	534	U16	0	1	0	-	R/W	QD*	-
Pad A Bit 15	535	U16	0	1	0	-	R/W	QD*	-
Bitword pad B	536	U16	0	65535	0	✓	R/W	QD*	R/W
Pad B Bit 0	537	U16	0	1	0	-	R/W	QD	R
Pad B Bit 1	538	U16	0	1	0	-	R/W	QD	R
Pad B Bit 2	539	U16	0	1	0	-	R/W	QD	R
Pad B Bit 3	540	U16	0	1	0	-	R/W	QD	R
Pad B Bit 4	541	U16	0	1	0	-	R/W	QD	R
Pad B Bit 5	542	U16	0	1	0	-	R/W	QD	R
Pad B Bit 6	543	U16	0	1	0	-	R/W	QD	R
Pad B Bit 7	544	U16	0	1	0	-	R/W	QD	R
Pad B Bit 8	545	U16	0	1	0	-	R/W	QD*	-
Pad B Bit 9	546	U16	0	1	0	-	R/W	QD*	-
Pad B Bit 10	547	U16	0	1	0	-	R/W	QD*	-
Pad B Bit 11	548	U16	0	1	0	-	R/W	QD*	-
Pad B Bit 12	549	U16	0	1	0	-	R/W	QD*	-
Pad B Bit 13	550	U16	0	1	0	-	R/W	QD*	-
Pad B Bit 14	551	U16	0	1	0	-	R/W	QD*	-
Pad B Bit 15	552	U16	0	1	0	-	R/W	QD*	-
OPTIONS \ Option 1									
Accessible only with optional Field Bus card (see Bus card user manual)									
OPTIONS \ Option 2									
Menu	Accessible only with optional DGFC card (see DGFC card user manual)								
Enable OPT2 Enabled Disabled	425	U16	0	1	Disabled (0)	✓	R/Z 1 0	-	-

Parameter	No.	Format	Value min	Value max	Value Factory	Access via Keyp.	Access via RS485/ BUS/ Opt2-M	Access via Term.	Access via Opt2-A/ PDC
OPTIONS \ PID									
Enable PI PID Enabled Disabled	769	U16	0	1	Disabled (0)	✓	R/W 1 0	ID	R/W
Enable PD PID Enabled Disabled	770	U16	0	1	Disabled (0)	✓	R/W 1 0	ID	R/W
Enable PI-PD PID Enabled Disabled	1258	U16	0	1	Disabled (0)	-	R/W 1 0	ID	R/W
OPTIONS \ PID \ PID source									
PID source	786	U16	0	65535	0	✓	R/W	-	-
PID source gain	787	Float	-100.000	+100.00	1.000	✓	R/W	-	-
Feed-fwd PID	758	I16	-10000	+10000	0	✓	R	IA	R
OPTIONS \ PID \ PID references									
PID error	759	I16	-10000	+10000	0	✓	R	-	R
Act tension ref	1194	Float	0.00	200.00	0	✓	R	-	R
PID feed-back	763	I16	-10000	+10000	0	✓	R/W	IA	R/W
PID offs. Sel Offset 1 Offset 0	762	U16	0	1	0	✓	R/W 1 0	ID	R/W
PID offset 0	760	I16	-10000	+10000	0	✓	R/W	IA	R/W
PID offset 1	761	I16	-10000	+10000	0	✓	R/W	-	-
PID acc time	1046	Float	0.0	900.0	0.0	✓	R/W	-	-
PID dec time	1047	Float	0.0	900.0	0.0	✓	R/W	-	-
PID err gain [%]	1254	Float	0.00	32.00	1	✓	R/W	-	-
PID clamp	757	I16	-10000	+10000	10000	✓	R/W	-	-
OPTIONS \ PID \ PI controls									
PI P gain PID	765	Float	0.00	100.00	10.00	✓	R/W	-	-
PI I gain PID	764	Float	0.00	100.00	10.00	✓	R/W	-	-
PI steady thr	695	I16	0	10000	0	✓	R/W	-	-
PID steady delay	731	U16	0	60000	0	✓	R/W	-	-
P init gain PID	793	Float	0.00	100.00	10.00	✓	R/W	-	-
I init gain PID	734	Float	0.00	100.00	10.00	✓	R/W	-	-
PI central v sel	779	U16	0	3	1	✓	R/W	ID	R/W
PI central v1	776	Float	PI bot lim	PI toplim	1.00	✓	R/W	-	-
PI central v2	777	Float	PI bot lim	PI toplim	1.00	✓	R/W	-	-
PI central v3	778	Float	PI bot lim	PI toplim	1.00	✓	R/W	IA	-
PI top lim	784	Float	PI bot lim	10.00	10.00	✓	R/W	-	-
PI bottom lim	785	Float	-10.00	PI toplim	0.00	✓	R/W	-	-
PI integr freeze ON OFF	783	U16	0	1	OFF (0)	✓	R/W 1 0	ID	R/W
PI output PID	771	I16	0	1000 x PI toplim	1000	✓	R	-	R
Real FF PID	418	I16	-10000	+10000	0	✓	R/W	-	R
OPTIONS \ PID \ PD control									
PD P gain 1 PID [%]	768	Float	0.00	100.00	10.00	✓	R/W	-	-
PD D gain 1 PID [%]	766	Float	0.00	100.00	1.00	✓	R/W	-	-
PD P gain 2 PID [%]	788	Float	0.00	100.00	10.00	✓	R/W	-	-
PD D gain 2 PID [%]	789	Float	0.00	100.00	1.00	✓	R/W	-	-
PD P gain 3 PID [%]	790	Float	0.00	100.00	10.00	✓	R/W	-	-
PD D gain 3 PID[%]	791	Float	0.00	100.00	1.00	✓	R/W	-	-
PD D filter PID [ms]	767	U16	0	1000	0	✓	R/W	-	-
PD output PID	421	I16	-10000	+10000	0	✓	R	-	-
PID out sign PID Bipolar Positive	772	U16	0	1	Bipolar (1)	✓	R/W 1 0	-	-
PID output	774	I16	-10000	+10000	0	✓	R	QA	R

Parameter	No.	Format	Value min	Value max	Value Factory	Access via Keyp.	Access via RS485/ BUS/ Opt2-M	Access via Term.	Access via Opt2-A/ PDC
OPTIONS \ PID \ PID target									
PID target	782	U16	0	65535	0	✓	R/W	-	-
PID out scale	773	Float	-100.000	+100.000	1.000	✓	R/W	-	-
OPTIONS \ PID \ Diameter calc									
Diameter calc Enabled Disabled	794	U16	0	1	Disabled (0)	✓	Z/R 1 0	ID	R/W
Positioning spd [rpm]	795	I16	-100	100	0	✓	R/W	-	-
Max deviation	796	I16	-10000	+10000	8000	✓	R/W	-	-
Gear box ratio	797	Float	0.001	1.000	1.000	✓	R/W	-	-
Dancer constant [mm]	798	U16	1	10000	1	✓	R/W	-	-
Minimum diameter [cm]	799	U16	1	2000	1	✓	R/W	-	-
OPTIONS \ PID									
PI central vs0	780	U16	0	1	1	-	R/W	ID	R/W
PI central vs1	781	U16	0	1	0	-	R/W	ID	R/W
Diameter calc st	800	U16	0	1	0	-	R	QD	R
OPTIONS \ TORQUE WINDER									
Torque winder En Enabled Disabled	1209	U16	0	1	Disabled (0)	✓	R/W 1 0	ID	R/W
OPTIONS \ TORQUE WINDER \ Diam Calculatio									
Roll diameter [m]	1154	Float	0.000	32.000		✓	R	QA	-
Line speed [%]	1160	Float	0.00	200.00		✓	R	-	-
Ref line speed [%]	1286	Float	0.00	200.00		✓	R	-	-
Diam calc Dis ON OFF	1161	U16	0	1	ON (1)	✓	R/W 1 0	ID	R/W
Diam inc/dec En Enabled Disabled	1205	U16	0	1	Enabled (0)	✓	R/W 1 0	ID	R/W
Wind/unwind Unwinder Winder	1187	U16	0	1	Winder (0)	✓	R/W 1 0	ID	R/W
Minimum diameter [mm]	799	U16	1	2000	100	✓	R/Z	-	-
Maximum diameter [m]	1153	Float	0.000	32.000	1.000	✓	R/Z	-	-
Line spd source	1204	U16	0	65535	0	✓	R/Z	-	-
Ref spd source	1284	U16	0	65535	0	✓	R/Z	-	-
Line speed gain	1156	I16	0	32767	0	✓	R/W	-	-
Ref speed gain	1285	I16	0	32767	0	✓	R/W	-	-
Base omega [rpm]	1163	U16	0	8191	1500	✓	R/W	-	-
Ref speed thr [%]	1155	Float	0	150.00	5	✓	R/W	-	-
Diam filter [ms]	1162	U16	0	5000	100	✓	R/W	-	-
Diam init filter [ms]	1206	U16	0	5000	100	✓	R/W	-	-
Diam stdy delay [ms]	1207	U16	0	60000	0	✓	R/W	-	-
Diam reset	1157	U16	0	1	0	✓	R/W	ID	R/W
Diam thr [%]	1158	Float	0	150.00	10	✓	R/W	-	-
Diam reached	1159	U16	0	1		✓	R	QD	R
Diam preset sel	1168	U16	0	3	0	✓	R/W	ID	-
Diam preset 0 [m]	1164	Float	0.000	32.000	0	✓	R/W	-	-
Diam preset 1 [m]	1165	Float	0.000	32.000	0	✓	R/W	-	-
Diam preset 2 [m]	1166	Float	0.000	32.000	0	✓	R/W	-	-
Diam preset 3 [m]	1167	Float	0.000	32.000	0	✓	R/W	IA	-
OPTIONS \ TORQUE WINDER \ Torque calculat									
Tension ref [%]	1180	Float	0.00	199.99	0	✓	R/W	IA	-
Tension scale [%]	1181	I16	0	200	100	✓	R/W	-	-
Act tension ref [%]	1194	Float	0.00	199.99		✓	R	-	-
Torque current [%]	1193	Float	0.00	200.00		✓	R	QA	-

Parameter	No.	Format	Value min	 max	 Factory	Keyp.	Access via RS485/ BUS/ Opt2-M	 Term.	 Opt2-A/ PDC
OPTIONS \ TORQUE WINDER \ Torque calculat \ Comp calculat									
Int acc calc En Enabled Disabled	1183	U16	0	1	Enabled (1)	✓	R/Z 1 0	-	-
Time acc/dec min [s]	1182	Float	0.15	300.00	9.01	✓	R/W	-	-
Acc/dec filter [ms]	1212	U16	0	5000	30	✓	R/W	-	-
Line acc [%]	1184	Float	0.00	100.00	100	✓	R/W	-	-
Line dec [%]	1185	Float	0.00	100.00	100	✓	R/W	-	-
Line fast stop [%]	1186	Float	0.00	100.00	100	✓	R/W	-	-
Line acc status	1188	U16	0	1	OFF	✓	R/W	ID	R/W
Line dec status	1189	U16	0	1	OFF	✓	R/W	ID	R/W
Line fstp status	1190	U16	0	1	OFF	✓	R/W	ID	R/W
Variable J comp [%]	1171	Float	0.00	199.99	0	✓	R/W	-	-
Constant J comp [%]	1172	Float	-100.00	+100.00	0	✓	R/W	-	-
Act var J comp [%]	1192	Float	-	200.00	0	✓	R	-	-
Act const J comp [%]	1191	Float	-	200.00	0	✓	R	-	-
Mat width [%]	1173	Float	0.00	100.00	100	✓	R/W	-	-
Static f [%]	1174	Float	0.00	199.99	0	✓	R/W	-	-
Dinamic f [%]	1175	Float	0.00	199.99	0	✓	R/W	-	-
Static f Zero Enabled Disabled	1287	U16	0	1	Disabled (0)	✓	R/W 1 0	-	-
Actual comp [%]	1213	I16	-200	+200		✓	R	QD	-
Closed loop En Enabled Disabled	1214	U16	0	1	Disabled (0)	✓	R/Z 1 0	-	R/Z
Close loop comp	1208	I16	-32767	+32767		✓	R	-	-
OPTIONS \ TORQUE WINDER \ Torque calculat \ Taper function									
Taper enable Enabled Disabled	1176	U16	0	1	Disabled (0)	✓	R/W 1 0	ID	R/W
Init diameter [m]	1177	Float	0.000	32.000	0.1	✓	R/W	-	-
Final diameter [m]	1178	Float	0.000	32.000	1	✓	R/W	-	-
Tension ref [%]	1180	Float	0.00	199.99	0	✓	R/W	IA	-
Tension red [%]	1179	Float	0.00	199.99	0	✓	R/W	IA	-
Act tension ref [%]	1194	Float	0.00	200.00	0	✓	R	QA	-
OPTIONS \ TORQUE WINDER \ Speed demand									
Speed demand En Enabled Disabled	1215	U16	0	1	Disabled (0)	✓	R/W 1 0	-	R/W
Winder side Down Up	1201	U16	0	1	Up (0)	✓	R/W 1 0	ID	R/W
W gain [%]	1202	U16	0	100	0	✓	R/W	-	-
Speed match ON OFF	1195	U16	0	1	OFF (0)	✓	R/W 1 0	ID	R/W
Spd match gain [%]	1200	U16	0	150	100	✓	R/W	-	-
Spd match acc [s]	1196	Float	0.30	300.00	83.88	✓	R/W	-	-
Spd match dec [s]	1197	Float	0.30	300.00	83.88	✓	R/W	-	-
Spd match compl	1203	U16	0	1		✓	R	QD	R
Spd match torque [%]	1216	U16	0	200	100	✓	R/W	-	-
W offset [rpm]	1199	I16	0	1000	0	✓	R/W	-	-
Offset acc time [s]	1198	Float	0.30	950.00	83.88	✓	R/W	-	-
W target	1210	U16	0	65535	0	✓	R/Z	-	-
W reference [rpm]	1217	I16	-8192	+8192		✓	R	QA	-
Jog TW enable Enabled Disabled	1256	U16	0	1	Disabled (0)	✓	R/W 1 0	ID	R/W
Jog TW speed [%]	1255	I16	0	100	0	✓	R/W	-	-

Parameter	No.	Format	Value min	Value max	Value Factory	Access via Keyp.	Access via RS485/ BUS/ Opt2-M	Access via Term.	Access via Opt2-A/ PDC
DRIVECOM									
Malfunction code	57	I16				✓	R	-	R
Failure supply						5100h	5100h		
Undervoltage						3120h	3120h		
Overvoltage						3310h	3310h		
Overcurrent						2300h	2300h		
Heatsink						4210h	4210h		
Hardware						5000h	5000h		
DSP error						6110h	6110h		
Interrupt error						6120h	6120h		
Speed fbk loss						7301h	7301h		
External fault						9000h	9000h		
Overtemp motor						4310h	4310h		
Field loss						3330h	3330h		
Bus loss						8110h	8110h		
Hw opt 1 failure						7510h	7510h		
Opt2						7400h	7400h		
Unknown						1001h	1001h		
Enable seq err						9009h	9009h		
Control word	55	U16	0	65535		✓	R/W	-	R/W
Status word	56	U16	0	65535	4440	✓	R	-	R
Speed input var [FF]	44	I16	-2 P45	+2 P45		✓	R/W	IA, QA	R/W
Speed ref var [FF]	115	I16	-32768	32767		✓	R	-	R
Act speed value [FF]	119	I16	-32768	32767		✓	R	-	R
DRIVECOM \ Speed amount									
Speed min amount [FF]	1	U32	0	2^{32}-1	0	✓	R/Z	-	-
Speed max amount [FF]	2	U32	0	2^{32}-1	5000	✓	R/Z		
DRIVECOM \ Speed min/max									
Speed min pos [FF]	5	U32	0	2^{32}-1	0	✓	R/Z	-	-
Speed max pos [FF]	3	U32	0	2^{32}-1	5000	✓	R/Z	-	-
Speed min neg [FF]	6	U32	0	2^{32}-1	0	✓	R/Z	-	-
Speed max neg [FF]	4	U32	0	2^{32}-1	5000	✓	R/Z	-	-
DRIVECOM \ Acceleration									
Acc delta speed [FF]	21	U32	0	2^{32}-1	100	✓	R/W	-	-
Acc delta time [s]	22	U16	0	65535	1	✓	R/W		
DRIVECOM \ Deceleration									
Dec delta speed [FF]	29	U32	0	2^{32}-1	100	✓	R/W	-	-
Dec delta time [s]	30	U16	0	65535	1	✓	R/W		
DRIVECOM \ Quick stop									
QStp delta speed [FF]	37	U32	0	2^{32}-1	1000	✓	R/W	-	-
QStp delta time [s]	38	U16	0	65535	1	✓	R/W	-	-
Quick stop	343	U16	-	-	-	-	R/W	-	-
No Quick stop							1		
Quick stop							0		
DRIVECOM \ Face value fact									
Face value num	54	I16	1	+32767	1	✓	R/Z	-	R
Face value den	53	I16	1	+32767	1	✓	R/Z	-	R
DRIVECOM \ Dimension fact									
Dim factor num	50	I32***	1	65535	1	✓	R/Z	-	R
Dim factor den	51	I32***	1	+2^{31}-1	1	✓	R/Z	-	R
Dim factor text	52	Text			rpm	✓	R/Z	-	-
DRIVECOM									
Speed base value [FF]	45	U32***	1	16383	1500	✓	R/Z	-	R
Speed input perc [%]	46	I16	-32768	+32767	0	✓	R/W	-	R/W
Percent ref var [%]	116	I16	-32768	+32767		✓	R	-	R
Act percentage [%]	120	I16	-32768	+32767		✓	R	-	R
SERVICE									
Password 2									

* Quando si accede al parametro tramite Opt2-A/PDC il formato è U16
** Quando si accede al parametro tramite Opt2-A/PDC il formato è I16
*** Quando si accede al parametro tramite Opt2-A/PDC viene considerata solo la word bassa del testo

10.2. NUMERICAL LIST

Parameter	No.	Format	Value min	Value max	Value Factory	Access via Keyp.	Access via RS485/ BUS/ Opt2-M	Access via Term.	Access via Opt2-A/ PDC
Speed min amount [FF]	1	U32	0	2^{32}-1	0	✓	R/Z	-	-
Speed max amount [FF]	2	U32	0	2^{32}-1	5000	✓	R/Z		
Speed max pos [FF]	3	U32	0	2^{32}-1	5000	✓	R/Z	-	-
Speed max neg [FF]	4	U32	0	2^{32}-1	5000	✓	R/Z	-	-
Speed min pos [FF]	5	U32	0	2^{32}-1	0	✓	R/Z	-	-
Speed min neg [FF]	6	U32	0	2^{32}-1	0	✓	R/Z	-	-
T current lim [%]	7	U16	0	200	100	✓	R/W	IA	R/W
T current lim + [%]	8	U16	0	200	100	✓	R/W	IA	R/W
T current lim - [%]	9	U16	0	200	100	✓	R/W	IA	R/W
In use Tcur lim+ [%]	10	U16	0	200		✓	R	-	R
In use Tcur lim- [%]	11	U16	0	200		✓	R	-	R
Current lim red [%]	13	U16	0	200	100	✓	R/W	-	R/W
Ramp shape S-Shaped Linear	18	U16	0	1	Linear (0)	✓	R/Z 1 0	-	-
S shape t const [ms]	19	Float	100	3000	300	✓	R/W	-	-
Ramp +/- delay [ms]	20	U16	0	65535	100	✓	R/W	-	-
Acc delta speed [FF]	21	U32	0	2^{32}-1	100	✓	R/W	-	-
Acc delta time [s]	22	U16	0	65535	1	✓	R/W		
Acc delta speed1 [FF]	23	U32	0	2^{32}-1	100	✓	R/W	-	-
Acc delta time 1 [s]	24	U16	0	65535	1	✓	R/W	-	-
Acc delta speed2 [FF]	25	U32	0	2^{32}-1	100	✓	R/W	-	-
Acc delta time 2 [s]	26	U16	0	65535	1	✓	R/W	-	-
Acc delta speed3 [FF]	27	U32	0	2^{32}-1	100	✓	R/W	-	-
Acc delta time 3 [s]	28	U16	0	65535	1	✓	R/W	-	-
Dec delta speed [FF]	29	U32	0	2^{32}-1	100	✓	R/W	-	-
Dec delta time [s]	30	U16	0	65535	1	✓	R/W		
Dec delta speed1 [FF]	31	U32	0	2^{32}-1	100	✓	R/W	-	-
Dec delta time 1 [s]	32	U16	0	65535	1	✓	R/W	-	-
Dec delta speed2 [FF]	33	U32	0	2^{32}-1	100	✓	R/W	-	-
Dec delta time 2 [s]	34	U16	0	65535	1	✓	R/W	-	-
Dec delta speed3 [FF]	35	U32	0	2^{32}-1	100	✓	R/W	-	-
Dec delta time 3 [s]	36	U16	0	65535	1	✓	R/W	-	-
QStp delta speed [FF]	37	U32	0	2^{32}-1	1000	✓	R/W	-	-
QStp delta time [s]	38	U16	0	65535	1	✓	R/W		
T current ref 1 [%]	39	I16	-200	+200 see 6.4.3	0	✓	R/W	IA, QA	R/W
T current ref 2 [%]	40	I16	-200	+200	0	✓	R/W	IA, QA	-
T current ref [%]	41	I16	-200	+200	-	✓	R	QA	R
Speed ref 1 [FF]	42	I16	-2 P45	+2 P45	0	✓	R/W	IA, QA	R/W
Speed ref 2 [FF]	43	I16	-2 P45	+2 P45	0	✓	R/W	IA, QA	R/W
Ramp ref 1 [FF]	44	I16	-2 P45	+2 P45	0	✓	R/W	IA, QA	R/W
Speed input var [FF]	44	I16	-2 P45	+2 P45		✓	R/W	IA, QA	R/W
Speed base value [FF]	45	U32***	1	16383	1500	✓	R/Z	-	R
Speed input perc [%]	46	I16	-32768	+32767	0	✓	R/W	-	R/W
Ramp ref 1 (%)	47	Float	-200.0	+200.0	0	✓	R/W		
Ramp ref 2 [FF]	48	I16	-2 P45	+2 P45	0	✓	R/W	IA, QA	R/W
Ramp ref 2 (%)	49	Float	-200.0	+200.0	0	✓	R/W	-	-
Dim factor num	50	I32***	1	65535	1	✓	R/Z	-	R
Dim factor den	51	I32***	1	+2^{31}-1	1	✓	R/Z	-	R

Parameter	No.	Format	Value min	Value max	Factory	Access via Keyp.	RS485/ BUS/ Opt2-M	Term.	Opt2-A/ PDC
Dim factor text	52	Text			rpm	✓	R/Z		
Face value den	53	I16	1	+32767	1	✓	R/Z	-	R
Face value num	54	I16	1	+32767	1	✓	R/Z	-	R
Control word	55	U16	0	65535		✓	R/W	-	R/W
Status word	56	U16	0	65535	4440	✓	R	-	R
Malfunction code	57	I16				✓	R	-	R
Failure supply						5100h	5100h		
Undervoltage						3120h	3120h		
Overvoltage						3310h	3310h		
Overcurrent						2300h	2300h		
Heatsink						4210h	4210h		
Hardware						5000h	5000h		
DSP error						6110h	6110h		
Interrupt error						6120h	6120h		
Speed fbk loss						7301h	7301h		
External fault						9000h	9000h		
Overtemp motor						4310h	4310h		
Field loss						3330h	3330h		
Bus loss						8110h	8110h		
Hw opt 1 failure						7510h	7510h		
Opt2						7400h	7400h		
Unknown						1001h	1001h		
Enable seq err						9009h	9009h		
Generator access	58	U16	0	5	Not conn.	✓	R/Z	-	-
Not connected							0		
T current ref							2		
Flux ref							3		
Ramp ref							4		
Speed ref							5		
Gen frequency [Hz]	59	Float	0.1	62.5	0.1	✓	R/W	-	-
Gen amplitude [%]	60	Float	0	200.00	0	✓	R/W	-	-
Generator offset [%]	61	Float	-200.00	+200.00	0	✓	R/W		
Scale output 1	62	Float	-10.000	+10.000	0	✓	R/W		
Scale output 2	63	Float	-10.000	+10.000	0	✓	R/W		
Scale output 3	64	Float	-10.000	+10.000	0	✓	R/W		
Scale output 4	65	Float	-10.000	+10.000	0	✓	R/W		

Parameter	No.	Format	Value			Access via			
			min	max	Factory	Keyp.	RS485/ BUS/ Opt2-M	Term.	Opt2-A/ PDC
Select output 1	66	U16	0	93	Actual speed	✓	R/Z	-	-
OFF							0		
Speed ref 1							1		
Speed ref 2							2		
Ramp ref 1							3		
Ramp ref 2							4		
Ramp ref							5		
Speed ref							6		
Ramp out							7		
Actual speed					(8)		8		
T current ref 1							9		
T current ref 2							10		
T current ref							11		
Speed reg out							15		
Motor current							16		
Output voltage							20		
Analog input 1							24		
Analog input 2							25		
Analog input 3							26		
Flux current							27		
Pad 0							31		
Pad 1							32		
Pad 4							33		
Pad 5							34		
Flux reference							35		
Pad 6							38		
PID output							39		
Out vlt level							79		
Flux current max							80		
F act spd							81		
F T curr							82		
Speed draw out							84		
Output power							88		
Roll diameter							89		
Act tension ref							90		
Torque current							91		
W reference							92		
Actual comp							93		
Select output 2 (Select like output 1)	67	U16	0	93	Motor current (16)	✓	R/Z	-	-
Select output 3 (Select like output 1)	68	U16	0	93	Flux (27)	✓	R/Z	-	-
Select output 4 (Select like output 1)	69	U16	0	93	Output voltage (20)	✓	R/Z	-	-

Parameter	No.	Format	Value min	Value max	Value Factory	Access via Keyp.	RS485/ BUS/ Opt2-M	Term.	Opt2-A/ PDC
Select input 1	70	U16	0	31	Ramp ref1	✓	R/Z	-	-
OFF							0		
Jog reference							1		
Speed ref 1							2		
Speed ref 2							3		
Ramp ref 1					(4)		4		
Ramp ref 2							5		
T current ref 1							6		
T current ref 2							7		
Adap reference							8		
T current limit							9		
T current lim +							10		
T current lim -							11		
Pad 0							12		
Pad 1							13		
Pad 2							14		
Pad 3							15		
Load comp							19		
PID offset 0							21		
PI central v3							22		
PID feed-back							23		
Flux current max							25		
Out vlt level							26		
Speed ratio							28		
Tension red							29		
Tension ref							30		
Preset 3							31		
Input 1 type	71	U16	0	2	± 10 V	✓	R/Z	-	-
-10V ... + 10 V							0		
0...20 mA, 0...10 V							1		
4...20 mA							2		
Scale input 1	72	Float	-10.000	10.000	1.000	✓	R/W	-	-
Tune value inp 1	73	Float	0.100	10.000	1.000	✓	R/W	-	-
Offset input 1	74	I16	-32768	+32767	0	✓	R/W	-	-
Select input 2 (Select like Input 1)	75	U16	0	31	OFF (0)	✓	R/Z	-	-
Input 2 type	76	U16	0	2	± 10 V	✓	R/Z	-	-
-10V ... + 10 V							0		
0...20 mA, 0...10 V							1		
4...20 mA							2		
Scale input 2	77	Float	-10.000	10.000	1.000	✓	R/W	-	-
Tune value inp 2	78	Float	0.100	10.000	1.000	✓	R/W	-	-
Offset input 2	79	I16	-32768	+32767	0	✓	R/W	-	-
Select input 3 (Select like Input 1)	80	U16	0	31	OFF (0)	✓	R/Z	-	-
Input 3 type	81	U16	0	2	± 10 V	✓	R/Z	-	-
-10V ... + 10 V							0		
0...20 mA, 0...10 V							1		
4...20 mA							2		
Scale input 3	82	Float	-10.000	10.000	1.000	✓	R/W	-	-
Tune value inp 3	83	Float	0.100	10.000	1.000	✓	R/W	-	-
Offset input 3	84	I16	-32768	+32767	0	✓	R/W	-	-
Pword 1	85	I32	0	99999	-	✓	W		
Speed P [%]	87	Float	0.00	100.00	10.00	✓	R/W	-	-
Speed I [%]	88	Float	0.00	100.00	1.00	✓	R/W	-	-
Flux P [%]	91	Float	0.00	100.00	2.00	✓	R/W	-	-
Flux I [%]	92	Float	0.00	100.00	1.00	✓	R/W		

Parameter	No.	Format	Value			Access via			
			min	max	Factory	Keyp.	RS485/ BUS/ Opt2-M	Term.	Opt2-A/ PDC
Speed P base [A/rpm]	93	Float	0.001	S	0,300 P93$_{max}$	✓	R/Z	-	-
Speed I base [A/rpm·ms]	94	Float	0.001	S	0,3 P94$_{max}$	✓	R/Z		
Flux P base	97	Float	1	32767	3277	✓	R/Z	-	-
Flux I Base	98	Float	1	32767	3277	✓	R/Z		
Speed P in use [%]	99	Float	0.00	100.00	S	✓	R	-	-
Speed I in use [%]	100	Float	0.00	100.00	S	✓	R	-	-
Spd threshold + [FF]	101	U16	1	32767	1000	✓	R/W	-	-
Spd threshold - [FF]	102	U16	1	32767	1000	✓	R/W	-	-
Threshold delay [ms]	103	U16	0	65535	100	✓	R/W	-	-
Set error [FF]	104	U16	1	32767	100	✓	R/W	-	-
Set delay [ms]	105	U16	1	65535	100	✓	R/W	-	-
Ref 0 level [FF]	106	U16	1	32767	10	✓	R/W		
Speed zero level [FF]	107	U16	1	32767	10	✓	R/W	-	-
Speed zero delay [ms]	108	U16	0	65535	100	✓	R/W	-	-
Ramp ref (d) [FF]	109	I16	-32768	+32767	-	✓	R	-	R
Ramp ref (rpm)	110	I16	-32768	+32767	-	✓	R	QA	R
Ramp ref (%)	111	Float	-200.0	+ 200.0	-	✓	R	-	-
Ramp output (d) [FF]	112	I16	-32768	+32767	-	✓	R	-	R
Ramp outp (rpm)	113	I16	-32768	+32767	-	✓	R	QA	R
Ramp output (%)	114	Float	-200.0	+ 200.0	-	✓	R	-	-
Speed ref (d) [FF]	115	I16	-32768	+32767	-	✓	R	-	R
Speed ref var [FF]	115	I16	-32768	32767		✓	R	-	R
Percent ref var [%]	116	I16	-32768	+32767		✓	R	-	R
Speed ref (%)	117	Float	-200.0	+ 200.0	-	✓	R	-	-
Speed ref [rpm]	118	I16	-32768	+32767	-	✓	R	QA	R
Actual spd (d) [FF]	119	I16	-32768	+32767	-	✓	R	-	R
Act speed value [FF]	119	I16	-32768	32767		✓	R	-	R
Act percentage [%]	120	I16	-32768	+32767		✓	R	-	R
Actual spd (%)	121	Float	-200.0	+ 200.0	-	✓	R	-	-
Actual spd (rpm)	122	I16	-8192	+8192	-	✓	R	QA	R
Enable spd=0 I Enabled Disabled	123	U16	0	1	Disabled (0)	✓	R/Z 1 0	-	-
Enable spd=0 R Enabled Disabled	124	U16	0	1	Disabled (0)	✓	R/Z 1 0	-	-
Enable spd=0 P Enabled Disabled	125	U16	0	1	Disabled (0)	✓	R/Z 1 0	-	-
Spd=0 P gain [%]	126	Float	0.00	100.00	10.00	✓	R/W	-	-

Parameter	No.	Format	Value min	Value max	Factory	Keyp.	Access via RS485/ BUS/ Opt2-M	Term.	Opt2-A/ PDC
Digital input 1	137	U16	0	83	OFF	✓	R/Z	-	-
OFF					(0)		0		
Motor pot reset							1		
Motor pot up							2		
Motor pot down							3		
Motor pot sign +							4		
Motor pot sign -							5		
Jog +							6		
Jog -							7		
Failure reset							8		
Torque reduct							9		
Ramp out = 0							10		
Ramp in = 0							11		
Freeze ramp							12		
Lock speed reg							13		
Lock speed I							14		
Auto capture							15		
Input 1 sign +							16		
Input 1 sign -							17		
Input 2 sign +							18		
Input 2 sign -							19		
Input 3 sign +							20		
Input 3 sign -							21		
Zero torque							22		
Speed sel 0							23		
Speed sel 1							24		
Speed sel 2							25		
Ramp sel 0							26		
Ramp sel 1							27		
Field loss							29		
Enable flux reg							30		
Enable flux weak							31		
Pad A bit 0							32		
Pad A bit 1							33		
Pad A bit 2							34		
Pad A bit 3							35		
Pad A bit 4							36		
Pad A bit 5							37		
Pad A bit 6							38		
Pad A bit 7							39		
Forward sign							44		
Reverse sign							45		
An in 1 target							46		
An in 2 target							47		
An in 3 target							48		
Enable droop							49		
Enable PI PID							52		
Enable PD PID							53		
PI integral freeze							54		
PID offs. Sel							55		
PI central vs0							56		
PI central vs1							57		
Diameter calc							58		
Diam reset							68		
Diam calc Dis							69		
Torque winder EN							70		
Line acc status							71		
Line dec status							72		
Line fstp status							73		
Speed match							74		
Diam inc/dec En							75		
Wind/unwind							76		
Diam preset sel0							77		
Diam preset sel1							78		
Taper enable							79		
Speed demand En							80		
Winder side							81		
Enable PI-PD PID							82		
Jog TW enable							83		

Parameter	No.	Format	Value			Access via			
			min	max	Factory	Keyp.	RS485/ BUS/ Opt2-M	Term.	Opt2-A/ PDC
Digital input 2 (Select like input 1)	138	U16	0	83	OFF (0)	✓	R/Z	-	-
Digital input 3 (Select like input 1)	139	U16	0	83	OFF (0)	✓	R/Z	-	-
Digital input 4 (Select like input 1)	140	U16	0	83	OFF (0)	✓	R/Z	-	-
Digital input 5 (Select like input 1)	141	U16	0	83	OFF (0)	✓	R/Z	-	-
Digital input 6 (Select like input 1)	142	U16	0	83	OFF (0)	✓	R/Z	-	-
Digital input 7 (Select like input 1)	143	U16	0	83	OFF (0)	✓	R/Z	-	-
Digital input 8 (Select like input 1)	144	U16	0	83	OFF (0)	✓	R/Z	-	-
Digital output 1	145	U16	0	61	Ramp +	✓	R/Z	-	-
OFF							0		
Speed zero thr							1		
Spd threshold							2		
Set speed							3		
Curr limit state							4		
Drive ready							5		
Overld available							6		
Overload state							7		
Ramp +					(8)		8		
Ramp -							9		
Speed limited							10		
Undervoltage							11		
Overvoltage							12		
Heatsink							13		
Overcurrent							14		
Overtemp motor							15		
External fault							16		
Failure supply							17		
Pad A bit							18		
Pad B bit							19		
Virt dig input							20		
Torque sign							21		
Stop control							23		
Field loss							24		
Speed fbk loss							25		
Bus loss							26		
Hw opt1 failure							28		
Opt2 failure							29		
Encoder 1 state							30		
Encoder 2 state							31		
Enable seq err							35		
Diameter calc st							38		
Input 1 cp match							49		
Diam reached							58		
Spd match compl							59		
Acc state							60		
Dec state							61		
Brake comand							62		
Digital output 2 (Select like output 1)	146	U16	0	61	Ramp - (9)	✓	R/Z	-	-
Digital output 3 (Select like output 1)	147	U16	0	61	Spd thr. (2)	✓	R/Z	-	-
Digital output 4 (Select like output 1)	148	U16	0	61	Overld avail. (6)	✓	R/Z	-	-

Parameter	No.	Format	Value			Access via			
			min	max	Factory	Keyp.	RS485/ BUS/ Opt2-M	Term.	Opt2-A/ PDC
Digital output 5 (Select like output 1)	149	U16	0	61	Curr lim. state (4)	✓	R/Z	-	-
Digital output 6 (Select like output 1)	150	U16	0	61	Overvolt (12)	✓	R/Z	-	-
Digital output 7 (Select like output 1)	151	U16	0	61	Undervolt (11)	✓	R/Z	-	-
Digital output 8 (Select like output 1)	152	U16	0	61	Overcurr (14)	✓	R/Z	-	-
Enab multi spd Enabled Disabled	153	I16	0	1	Disabled (0)	✓	R/Z 1 0	-	-
Multi speed 1 [FF]	154	I16	-32768	+32767	0	✓	R/W	-	-
Multi speed 2 [FF]	155	I16	-32768	+32767	0	✓	R/W	-	-
Multi speed 3 [FF]	156	I16	-32768	+32767	0	✓	R/W	-	-
Multi speed 4 [FF]	157	I16	-32768	+32767	0	✓	R/W	-	-
Multi speed 5 [FF]	158	I16	-32768	+32767	0	✓	R/W	-	-
Multi speed 6 [FF]	159	I16	-32768	+32767	0	✓	R/W	-	-
Multi speed 7 [FF]	160	I16	-32768	+32767	0	✓	R/W	-	-
Motor max speed [rpm]	162	Float *	0	6553	1500	✓	R/Z	-	R
Encoder 2 pulses	169	Float *	150	9999	1000	✓	R/Z	-	R
Max out voltage [V]	175	Float	20	999	400	✓	R/Z	-	-
Full load curr [A]	179	Float	0.1	I_{dAN}	I_{dAN}	✓	R/Z	-	-
Enable spd adap Enabled Disabled	181	U16	0	1	Disabled (0)	✓	R/Z 1 0	-	-
Select adap type Adap reference Speed	182	U16	0	1	Speed	✓	R/Z 1 0	-	-
Adap reference [FF]	183	I16	-32768	+32767	1000	✓	R/W	IA	R/W
Adap speed 1 [%]	184	Float	0.0	200.0	20.3	✓	R/W	-	-
Adap speed 2 [%]	185	Float	0.0	200.0	40.7	✓	R/W	-	-
Adap joint 1 [%]	186	Float	0.0	200.0	6.1	✓	R/W	-	-
Adap joint 2 [%]	187	Float	0.0	200.0	6.1	✓	R/W	-	-
Adap P gain 1 [%]	188	Float	0.00	100.00	10.00	✓	R/W	-	-
Adap I gain 1 [%]	189	Float	0.00	100.00	1.00	✓	R/W	-	-
Adap P gain 2 [%]	190	Float	0.00	100.00	10.00	✓	R/W	-	-
Adap I gain 2 [%]	191	Float	0.00	100.00	1.00	✓	R/W	-	-
Adap P gain 3 [%]	192	Float	0.00	100.00	10.00	✓	R/W	-	-
Adap I gain 3 [%]	193	Float	0.00	100.00	1.00	✓	R/W	-	-
Latch ON OFF	194	U16	0	1	ON (1)	✓	R/Z 1 0	-	-
Ok relay open ON OFF	195	I16	0	1	ON (1)	✓	R/W 1 0	-	-
Motor current [%]	199	I16	-250	250	-	✓	R	QA	R
2B + E ON OFF	201	U16	0	1	OFF (0)	✓	R/Z 1 0		-
Ramp selector	202	U16	0	3	0	✓	R/W	ID	R/W
Activity Ignore Warning Disable drive	203	U16	0	2	Ignore (0)	✓	R/Z 0 1 2	-	-
Multispeed sel	208	U16	0	7	0	✓	R/W	ID	R/W

Parameter	No.	Format	Value			Access via			
			min	max	Factory	Keyp.	RS485/ BUS/ Opt2-M	Term.	Opt2-A/ PDC
Activity Ignore Warning Disable drive	212	U16	0	2	Ignore (0)	✓	R/Z 0 1 2	-	-
Output voltage [V]	233	Float **	0	999	-	✓	R	QA	R
Flux current [%]	234	Float*	0.0	100.0	-	✓	R	QA	R
Life time [h.min]	235	Float	0,00	65535,00		✓	R	-	-
Speed reg output [%]	236	I16	-200	+200 see 6.7.1	-	✓	R	QA	R
Enable spd reg Enabled Disabled	242	I16	0	1	Enabled (1)	✓	R/Z 1 0	-	-
Enab multi rmp Enabled Disabled	243	I16	0	1	Disabled (0)	✓	R/Z 1 0	-	-
Enable jog Enabled Disabled	244	I16	0	1	Disabled (0)	✓	R/Z 1 0	-	-
Enable ramp Enabled Disabled	245	I16	0	1	Enabled (1)	✓	R/Z 1 0	-	-
Enable motor pot Enabled Disabled	246	I16	0	1	Disabled (0)	✓	R/Z 1 0	-	-
Motor pot oper	247					✓	-	-	-
Motor pot sign Positive Negative	248	I16	0	1	Positive (1)	✓	R/W 1 0	ID	-
Motor pot reset	249	U16				✓	Z/C(1)	ID (H)	-
Main commands Digitals Terminals	252	U16	0	1	Term (0)	✓	R/Z 1 0	-	-
Control mode Bus Local	253	U16	0	1	Local (0)	✓	R/Z 1 0	-	-
Save parameters	256	U16				✓	C/W(1)	-	-
Load default	258	U16				✓	Z/C(1)	-	-
Auto tune inp 1 Auto tune	259	U16				✓	C/W 1	-	-
Auto tune inp 2 Auto tune	260	U16				✓	C/W 1	-	-
Auto tune inp 3 Auto tune	261	U16				✓	C/W 1	-	-
Failure reset	262	U16				✓	Z/C (1)	ID (H)	W
Failure reg del	263	U16				✓	C	-	-
Jog operation	265	-	-	-	-	✓	-	-	-
Jog reference [FF]	266	I16	0	32767	0	✓	R/W	IA	-
Motor nom flux [A]	280	Float	0.0	P374	P374x0.3	✓	R/Z		
Forward sign	293	U16	0	1	0	-	R/W	ID	R/W
Reverse sign	294	U16	0	1	0	-	R/W	ID	R/W
An in 1 target Not assigned Assigned	295	U16	0	1	0	✓	R/W 1 0	ID H L	R/W 1 0
An in 2 target Assigned Not assigned	296	U16	0	1	0	✓	R/W 0 1	ID L H	R/W 0 1
An in 3 target Not assigned Assigned	297	U16	0	1	0	✓	R/W 1 0	ID H L	R/W 1 0

Parameter	No.	Format	Value			Access via			
			min	max	Factory	Keyp.	RS485/ BUS/ Opt2-M	Term.	Opt2-A/ PDC
Drive type TPD32...2B TPD32...4B	300	U16	10	11	S	-	R 10 11	-	R 10 11
Enable overload Enabled Disabled	309	I16	0	1	Disabled (0)	✓	R/Z 1 0	-	-
Overload time [s]	310	U16	0	65535	30	✓	R/W	-	-
Pause time [s]	311	U16	0	65535	300	✓	R/W	-	-
Overload current [%]	312	U16	P313	200	100	✓	R/W	-	-
Base current [%]	313	U16	0	P312 ≤ 100	80	✓	R/W	-	-
Enable drive Enabled Disabled	314		0	1	Disabled (0)	✓	R/W 1 0	12 H L	R/W 1 0
Start/Stop Start Stop	315	U16	0	1	Stop (0)	✓	R/W 1 0	13 H L	R/W 1 0
Fast stop No Fast Stop Fast Stop	316	U16	-	-	-	-	R/W 1 0	14 H L	R/W 1 0
Overload mode Curr not limited Curr limited	318	I16	0	1	Curr limited (0)	✓	R/W 1 0	-	-
Device address	319	U16	0	255	0	✓	R/Z	-	-
Lock speed reg ON OFF	322	U16	0	1	OFF (0)	✓	R/W 1 0	ID H L	R/W 1 0
Ser protocol sel SLINK3 MODBUS RTU JBUS	323	U16	0	2	SLINK3 (0)	✓	R/W 0 1 2	-	-
Ser baudrate sel 19200 9600 4800 2400 1200	326	U16	0	4	9600 (1)	✓	R/W 0 1 2 3 4	-	-
Failure text	327	Text				-	R	-	-
Failure hour	328	U16	0	65535			R	-	-
Failure minute	329	U16	0	59			R	-	-
Failure register	330	U16	1	10	10	✓	R/W	-	-
Software version	331	Text				✓	R	-	-
Torque reduct Active Not active	342	U16	0	1	Not active (0)	✓	R/W 1 0	ID H L	R/W 1 0
Quick stop No Quick stop Quick stop	343	U16	-	-	-	-	R/W 1 0	-	-
Ramp out = 0 Not active Active	344	U16	0	1	Not active (1)	✓	R/W 1 0	ID H L	R/W 1 0
Ramp in = 0 Not active Active	345	U16	0	1	Not active (1)	✓	R/W 1 0	ID H L	R/W 1 0
Ramp + Acc.CW + Dec. anti-CW Other states	346	U16	0	1	-	-	R 1 0	QD H L	R 1 0
Ramp - Acc.anti-CW + Dec. CW Other states	347	U16	0	1	-	-	R 1 0	QD H L	R 1 0

Parameter	No.	Format	Value		Factory	Keyp.	Access via		
			min	max			RS485/ BUS/ Opt2-M	Term.	Opt2-A/ PDC
Lock speed I Not active Active	348	U16	0	1	Not active (1)	✓	R/W 1 0	ID H L	R/W 1 0
Curr limit state Curr. limit reached Curr. limit not reached	349	U16	0	1		-	R 1 0	QD H L	R 1 0
Flux current (A)	351	Float	0.1	99.9	S	✓	R	-	-
Zero torque Not active Active	353	U16	0	1	Not active (1)	✓	R/W 1 0	ID H L	R/W
Activity Warning Disable drive Quick stop Normal stop Curr lim stop	354	U16	1	5	Disable drive	✓	R/Z 1 2 3 4 5	-	-
Latch ON OFF	355	U16	0	1	ON (1)	✓	R/Z 1 0	-	-
Ok relay open ON OFF	356	I16	0	1	ON (1)	✓	R/W 1 0	-	-
Latch ON OFF	357	U16	0	1	ON (1)	✓	R/Z 1 0	-	-
Ok relay open ON OFF	358	I16	0	1	ON (1)	✓	R/W 1 0	-	-
Restart time [ms]	359	U16	0	65535	1000	✓	R/W		
Latch ON OFF	361	U16	0	1	ON (1)	✓	R/Z 1 0	-	-
Ok relay open ON OFF	362	I16	0	1	ON (1)	✓	R/W 1 0	-	-
Latch ON OFF	363	U16	0	1	ON (1)	✓	R/Z 1 0	-	-
Ok relay open ON OFF	364	I16	0	1	ON (1)	✓	R/W 1 0	-	-
Activity Ignore Warning Disable drive Quick stop Normal stop Curr lim stop	365	U16			Disable dive	✓	R/Z 0 1 2 3 4 5	-	-
Ok relay open ON OFF	367	I16			ON (1)	✓	R/W 1 0	-	-
Activity Warning Disable drive Quick stop Normal stop Curr lim stop	368	U16	1	5	Disable drive	✓	R/Z 1 2 3 4 5	-	-
Ok relay open ON OFF	370	I16	0	1	ON (1)	✓	R/W 1 0	-	-

Speed limited Speed limited Speed not limited	372	U16	0	1		-	R 1 0	QD H L	R 1 0
Freeze ramp Not active Active	373	U16	0	1	Not active (1)	✓	R/W 1 0	ID H L	R/W 1 0
Nom flux curr [A]	374	Float	0.5	80.0	S	✓	R/Z	-	-
Jog selection Ramp input Speed input	375	U16	0	1	0	✓	R/Z 1 0	-	-
Speed ref 1 (%)	378	Float	-200.0	+200.0	0	✓	R/W	-	-
Speed Ref 2 (%)	379	Float	-200.0	+200.0	0	✓	R/W	-	-
Drive ready Drive ready Drive not ready	380	U16	0	1	-	-	R 1 0	QD H L	R 1 0
Activity Warning Disable drive Quick stop Normal stop Curr lim stop	386	U16	1	5	Disable drive	✓	R/Z 1 2 3 4 5	-	-
Ok relay open ON OFF	387	I16	0	1	ON (1)	✓	R/W 1 0	-	-
Auto capture ON OFF	388	U16			OFF (0)	✓	R/W 1 0	ID H L	-
Input 1 sign Positive Negative	389	U16	0	1	1	✓	R/W 1 0	-	R/W 1 0
Input 2 sign Positive Negative	390	U16	0	1	1	✓	R/W 1 0	-	R/W 1 0
Input 3 sign Positive Negative	391	U16	0	1	1	✓	R/W 1 0	-	R/W 1 0
Spd threshold Speed not exceeded Speed exceeded	393	U16	0	1		-	R 1 0	QD H L	R 1 0
Set speed Speed = ref. val. Speed not ref. val.	394	U16	0	1		-	R 1 0	QD H L	R 1 0
Speed zero thr Drive rotating Drive not rotating	395	U16	0	1		-	R 1 0	QD H L	R 1 0
Motor pot up Acceleration No acceleration	396	U16	0	1			R/W 1 0	ID H L	R/W 1 0
Motor pot down Deceleration No deceleration	397	U16	0	1			R/W 1 0	ID H L	R/W 1 0
Jog + Forwards jog No jog forwards	398	U16	0	1			R/W 1 0	ID H L	R/W 1 0
Jog - Backwards jog No backwards jog	399	U16	0	1			R/W 1 0	ID H L	R/W 1 0
Speed sel 0 Value 2^0 selected Value 2^0 not selected	400	U16	0	1		-	R/W 1 0	ID H L	R/W 1 0

Parameter	No.	Format	Value min	Value max	Factory	Keyp.	Access via RS485/ BUS/ Opt2-M	Access via Term.	Opt2-A/ PDC
Speed sel 1	401	U16	0	1		-	R/W	ID	R/W
Value 2^1 selected							1	H	1
Value 2^1 not selected							0	L	0
Speed sel 2	402	U16	0	1		-	R/W	ID	R/W
Value 2^2 selected							1	H	1
Value 2^2 not selected							0	L	0
Ramp sel 0	403	U16	0	1		-	R/W	ID	R/W
Value 2^0 selected							1	H	1
Value 2^0 not selected							0	L	0
Ramp sel 1	404	U16	0	1		-	R/W	ID	R/W
Value 2^1 selected							1	H	1
Value 2^1 not selected							0	L	0
Overld available	406	U16	0	1		-	R	QD	R
Overload possible							1	H	1
Overload not possible							0	L	0
Overload state	407	U16	0	1		-	R	QD	R
Current > limit value							1	H	1
Current limit value							0	L	0
Ser answer delay	408	U16	0	900	0	✓	R/W	-	-
Ok relay funct	412	I16	0	1	0	✓	R/Z	-	-
Ready to Start							1		
Drive healthy							0		
Speed fbk sel	414	U16	0	3	1	✓	R/Z	-	R
Encoder 1							0		
Encoder 2							1		
Tacho							2		
Armature							3		
Encoder 1 pulses	416	Float*	600	9999	1024	✓	R/Z	-	R
Failure code	417	U16	0	65535			R	-	-
Failure supply							5100h		
Undervoltage							3120h		
Overvoltage							3310h		
Overcurrent							2300h		
Heatsink							4210h		
Hardware							5000h		
DSP error							6110h		
Interrupt error							6120h		
Speed fbk							7301h		
External fault							9000h		
Overtemp motor							4310h		
Field loss							3330h		
Bus loss							8110h		
Hw opt 1 failure							7510h		
Opt2							7400h		
Unknown							1001h		
Enable seq err							9009h		
Real FF PID	418	I16	-10000	+10000	0	✓	R/W	-	R
Enc 2 speed (rpm)	420	I16	-8192	+8192	-	✓	R		R
PD output PID	421	I16	-10000	+10000	0	✓	R	-	-
Enable OPT2	425	U16	0	1	Disabled	✓	R/Z	-	-
Enabled							1		
Disabled					(0)		0		
Enc 1 speed (rpm)	427	I16	-8192	+8192	-	✓	R		R
Prop filter [ms]	444	U16	0	1000	0	✓	R/W	-	-
Speed up gain [%]	445	Float	0.00	100.00	0.00	✓	R/W	-	-
Speed up base [ms]	446	Float	0	16000	1000	✓	R/W	-	-
Speed up filter [ms]	447	U16	0	1000	0	✓	R/W	-	-
R&L search	452	U16	0	1	OFF	✓	R/Z	-	-
ON							1		
OFF					(0)		0		
Arm resistance [ ]	453	Float	S	S	0.500	✓	R/W	-	-
Arm inductance [mH]	454	Float	S	S	4.00	✓	R/W	-	-
Speed fbk error [%]	455	U16	0	100	22	✓	R/Z	-	-

Parameter	No.	Format	Value min	 max	Factory	Keyp.	Access via RS485/ BUS/ Opt2-M	 Term.	Opt2-A/ PDC
Flux weak speed [%]	456	U16	0	100	100	✓	R/Z	-	R
Enable fbk contr Enabled Disabled	457	U16	0	1	Disabled (0)	✓	R/Z 1 0	-	-
Enable fbk bypas Enabled Disabled	458	U16	0	1	Disabled (0)	✓	R/Z 1 0	-	-
Speed P bypass [%]	459	Float	0.00	100.00	10.00	✓	R/W	-	-
Speed I bypass [%]	460	Float	0.00	100.00	1.00	✓	R/W		
Size selection American Standard	464	U16	0	1	S		R/Z	-	-
Drive size [A]	465	U16	0	S	S	✓	R	-	R
Mains voltage [V]	466	U16	0	999	-	✓	R	-	-
Flux current max [%]	467	U16	P468	100	100	✓	R/W	-	R/W
Flux current min [%]	468	U16	0	P467	5	✓	R/W		-
Flux reg mode Constant current Voltage control External control	469	U16	0	2	Const. current (0)	✓	R/Z 0 1 2	-	-
Hold off time [ms]	470	U16	0	100	0	✓	R/W	-	-
Latch ON OFF	471	U16	0	1	ON (1)	✓	R/Z 1 0	-	-
Ok relay open ON OFF	472	I16	0	1	ON (1)	✓	R/W 1 0	-	-
Activity Ignore Warning Disable drive	473	U16	0	2	Disable drive	✓	R/Z 0 1 2	-	-
Restart time [ms]	474	U16	0	10000	0	✓	R/W		
Hold off time [ms]	475	U16	0	10000	0	✓	R/W	-	-
Ok relay open ON OFF	477	I16	0	1	ON (1)	✓	R/W 1 0	-	-
Activity Warning Disable drive	478	U16	1	2	Disable drive	✓	R/Z 1 2	-	-
Hold off time [ms]	480	U16	0	10000	8	✓	R/W		
Undervolt thr [V]	481	U16	0	1000	230	✓	R/W	-	-
Hold off time [ms]	482	U16	0	10000	0	✓	R/W	-	-
Restart time [ms]	483	U16	0	10000	0	✓	R/W		
Source *Link 1*	484	U16	0	65535	0	✓	R/W	-	-
Destination *Link 1*	485	U16	0	65535	0	✓	R/W	-	-
Mul gain *Link 1*	486	Float	-10000	+10000	1	✓	R/W	-	-
Div gain *Link 1*	487	Float	-10000	+10000	1	✓	R/W	-	-
Input max *Link 1*	488	Float	-2^{31}	$2^{31}-1$	0	✓	R/W	-	-
Input min *Link 1*	489	Float	-2^{31}	$2^{31}-1$	0	✓	R/W	-	-
Input offset *Link 1*	490	Float	-2^{31}	$2^{31}-1$	0	✓	R/W	-	-
Output offset *Link 1*	491	Float	-2^{31}	$2^{31}-1$	0	✓	R/W	-	-
Inp absolute *Link 1* ON OFF	492	U16	0	1	OFF (0)	✓	R/W 1 0	-	-
Voltage P [%]	493	Float	0.00	100.00	30.00	✓	R/W	-	-
Voltage I [%]	494	Float	0.00	100.00	40.00	✓	R/W		
Voltage P base [f%/V]	495	Float	0.0100	S	S	✓	R/Z	-	-
Voltage I base [f%/V·ms]	496	Float	0.01	S	S	✓	R/Z		

Parameter	No.	Format	Value			Access via			
			min	max	Factory	Keyp.	RS485/ BUS/ Opt2-M	Term.	Opt2-A/ PDC
Enable flux reg ON OFF	497	U16	0	1	ON (1)	✓	R/W 1 0	ID H L	-
Enable flux weak ON OFF	498	U16	0	1	OFF (0)	✓	R/W 1 0	ID H L	-
Speed-0 f weak ON OFF	499	U16	0	1	OFF (0)	✓	R/W 1 0	-	-
Flux reference [%]	500	Float*	0.0	100.0	0.0	✓	R	QA	-
Restart time [ms]	501	U16	0	10000	0	✓	R/W		
Hold off time [ms]	502	U16	0	10000	0	✓	R/W	-	-
Pad 0	503	I16	-32768	+32767	0	✓	R/W	IA, QA	R/W
Pad 1	504	I16	-32768	+32767	0	✓	R/W	IA, QA	R/W
Pad 2	505	I16	-32768	+32767	0	✓	R/W	IA	R/W
Pad 3	506	I16	-32768	+32767	0	✓	R/W	IA	R/W
Pad 4	507	I16	-32768	+32767	0	✓	R/W	QA	R/W
Pad 5	508	I16	-32768	+32767	0	✓	R/W	QA	R/W
Pad 6	509	I16	-32768	+32767	0	✓	R/W	QA	R/W
Pad 7	510	I16	-32768	+32767	0	✓	R/W	-	R/W
Pad 8	511	I16	-32768	+32767	0	✓	R/W	-	R/W
Pad 9	512	I16	-32768	+32767	0	✓	R/W	-	R/W
Pad 10	513	I16	-32768	+32767	0	✓	R/W	-	R/W
Pad 11	514	I16	-32768	+32767	0	✓	R/W	-	R/W
Pad 12	515	I16	-32768	+32767	0	✓	R/W	-	R/W
Pad 13	516	I16	-32768	+32767	0	✓	R/W	-	R/W
Pad 14	517	I16	-32768	+32767	0	✓	R/W	-	R/W
Pad 15	518	I16	-32768	+32767	0	✓	R/W	-	R/W
Bitword pad A	519	U16	0	65535	0	✓	R/W	ID*, QD*	R/W
Pad A Bit 0	520	U16	0	1	0	-	R/W	ID, QD	R/W
Pad A Bit 1	521	U16	0	1	0	-	R/W	ID, QD	R/W
Pad A Bit 2	522	U16	0	1	0	-	R/W	ID, QD	R/W
Pad A Bit 3	523	U16	0	1	0	-	R/W	ID, QD	R/W
Pad A Bit 4	524	U16	0	1	0	-	R/W	ID, QD	R/W
Pad A Bit 5	525	U16	0	1	0	-	R/W	ID, QD	R/W
Pad A Bit 6	526	U16	0	1	0	-	R/W	ID, QD	R/W
Pad A Bit 7	527	U16	0	1	0	-	R/W	ID, QD	R/W
Pad A Bit 8	528	U16	0	1	0	-	R/W	QD*	-
Pad A Bit 9	529	U16	0	1	0	-	R/W	QD*	-
Pad A Bit 10	530	U16	0	1	0	-	R/W	QD*	-
Pad A Bit 11	531	U16	0	1	0	-	R/W	QD*	-
Pad A Bit 12	532	U16	0	1	0	-	R/W	QD*	-
Pad A Bit 13	533	U16	0	1	0	-	R/W	QD*	-
Pad A Bit 14	534	U16	0	1	0	-	R/W	QD*	-
Pad A Bit 15	535	U16	0	1	0	-	R/W	QD*	-
Bitword pad B	536	U16	0	65535	0	✓	R/W	QD*	R/W
Pad B Bit 0	537	U16	0	1	0	-	R/W	QD	R
Pad B Bit 1	538	U16	0	1	0	-	R/W	QD	R
Pad B Bit 2	539	U16	0	1	0	-	R/W	QD	R
Pad B Bit 3	540	U16	0	1	0	-	R/W	QD	R
Pad B Bit 4	541	U16	0	1	0	-	R/W	QD	R
Pad B Bit 5	542	U16	0	1	0	-	R/W	QD	R
Pad B Bit 6	543	U16	0	1	0	-	R/W	QD	R
Pad B Bit 7	544	U16	0	1	0	-	R/W	QD	R
Pad B Bit 8	545	U16	0	1	0	-	R/W	QD*	-
Pad B Bit 9	546	U16	0	1	0	-	R/W	QD*	-
Pad B Bit 10	547	U16	0	1	0	-	R/W	QD*	-
Pad B Bit 11	548	U16	0	1	0	-	R/W	QD*	-

Parameter	No.	Format	Value min	 max	Factory	Keyp.	Access via RS485/ BUS/ Opt2-M	 Term.	Opt2-A/ PDC
Pad B Bit 12	549	U16	0	1	0	-	R/W	QD*	-
Pad B Bit 13	550	U16	0	1	0	-	R/W	QD*	-
Pad B Bit 14	551	U16	0	1	0	-	R/W	QD*	-
Pad B Bit 15	552	U16	0	1	0	-	R/W	QD*	-
Source *Link 2*	553	U16	0	65535	0	✓	R/W	-	-
Destination *Link 2*	554	U16	0	65535	0	✓	R/W	-	-
Mul gain *Link 2*	555	Float	-10000	+10000	1	✓	R/W	-	-
Div gain *Link 2*	556	Float	-10000	+10000	1	✓	R/W	-	-
Input max *Link 2*	557	Float	-2^{31}	$2^{31}-1$	0	✓	R/W	-	-
Input min *Link 2*	558	Float	-2^{31}	$2^{31}-1$	0	✓	R/W	-	-
Input offset *Link 2*	559	Float	-2^{31}	$2^{31}-1$	0	✓	R/W	-	-
Output offset *Link 2*	560	Float	-2^{31}	$2^{31}-1$	0	✓	R/W	-	-
Inp absolute *Link 2* ON OFF	561	U16	0	1	OFF (0)	✓	R/W 1 0	-	-
Tacho scale	562	Float	0.90	3.00	1.00	✓	R/W	-	-
Speed offset	563	Float	-20.00	+20.00	0.00	✓	R/W	-	-
Dig input term	564	U16	0	65535	-	-	R	-	R
Dig input term 1	565	U16	0	1	-	-	R	-	R
Dig input term 2	566	U16	0	1	-	-	R	-	R
Dig input term 3	567	U16	0	1	-	-	R	-	R
Dig input term 4	568	U16	0	1	-	-	R	-	R
Dig input term 5	569	U16	0	1	-	-	R	-	R
Dig input term 6	570	U16	0	1	-	-	R	-	R
Dig input term 7	571	U16	0	1	-	-	R	-	R
Dig input term 8	572	U16	0	1	-	-	R	-	R
Dig input term 9	573	U16	0	1	-	-	R	-	R
Dig input term 10	574	U16	0	1	-	-	R	-	R
Dig input term 11	575	U16	0	1	-	-	R	-	R
Dig input term 12	576	U16	0	1	-	-	R	-	R
Dig input term 15	579	U16	0	1	-	-	R	-	R
Dig input term 16	580	U16	0	1	-	-	R	-	R
Dig output term	581	U16	0	65535	-		R	-	R
Virtual dig inp	582	U16	0	65535	-	✓	R	-	-
Virtual dig out	583	U16	0	65535	-	✓	R	-	-
Overcurrent thr [%]	584	U16	0	200	110	✓	R/W	-	-
Restart time [ms]	585	U16	0	10000	0	✓	R/W		
Hold off time [ms]	586	U16	0	10000	0	✓	R/W	-	-
E int [V]	587	I16	-80	+80	-	✓	R	QA	-
Mains frequency [Hz]	588	Float	0.0	70.0	-	✓	R	-	-
Stop mode OFF Stop & speed 0 Fast stp & spd 0 Fst / stp & spd 0	626	U16	0	3	Stop & Speed 0	✓	R/Z 0 1 2 3	-	-
Spd 0 trip delay [ms]	627	U16	0	40000	0	✓	R/W	-	-
Trip cont delay [ms]	628	U16	0	40000	0	✓	R/W	-	-
Relay 2 (Select like output 1)	629	U16	0	61	Stop ctrl (23)	✓	R/Z		
Jog stop control ON OFF	630	U16	0	1	OFF (0)	✓	R/Z 1 0	-	-
Latch ON OFF	633	U16	0	1	ON (1)	✓	R/Z 1 0	-	-

Parameter	No.	Format	Value min	 max	Factory	Keyp.	Access via RS485/ BUS/ Opt2-M	 Term.	Opt2-A/ PDC
Activity Ignore Warning Disable drive Quick stop Normal stop Curr lim stop	634	U16	0	5	Disable drive	✓	R/Z 0 1 2 3 4 5	-	-
Ok relay open ON OFF	635	I16	0	1	ON (1)	✓	R/W 1 0	-	-
Hold off time [ms]	636	U16	0	10000	0	✓	R/W	-	-
Restart time [ms]	637	U16	0	10000	0	✓	R/W		
Activity Disable drive Quick stop Normal stop Curr lim stop	639	U16	0	5	Disable drive	✓	R/Z 2 3 4 5	-	-
Ok relay open ON OFF	640	I16	0	1	ON (1)	✓	R/W 1 0	-	-
Encoder 1 state Encoder ok Encoder Fault	648	U16	0	1		-	R 1 0	QD	R 1 0
Refresh enc 1 Enabled Disabled	649	U16	0	1	Disabled (0)	✓	R/W 1 0	-	-
Encoder 2 state Encoder ok Encoder Fault	651	U16	0	1		-	R 1 0	QD	R 1 0
Refresh enc 2 Enabled Disabled	652	U16	0	1	Disabled (0)	✓	R/W 1 0	-	-
Acc delta speed0 [FF]	659	U32	0	2^{32}-1	100	✓	R/W	-	-
Acc delta time 0 [s]	660	U16	0	65535	1	✓	R/W	-	-
Dec delta speed0 [FF]	661	U32	0	2^{32}-1	100	✓	R/W	-	-
Dec delta time 0 [s]	662	U16	0	65535	1	✓	R/W	-	-
S acc t const [ms]	663	Float	100	3000	300	✓	R/W	-	-
S dec t const [ms]	664	Float	100	3000	300	✓	R/W	-	-
S acc t const 0 [ms]	665	Float	100	3000	300	✓	R/W		
S dec t const 0 [ms]	666	Float	100	3000	300	✓	R/W		
S acc t const 1 [ms]	667	Float	100	3000	300	✓	R/W	-	-
S dec t const 1 [ms]	668	Float	100	3000	300	✓	R/W	-	-
S acc t const 2 [ms]	669	Float	100	3000	300	✓	R/W	-	-
S dec t const 2 [ms]	670	Float	100	3000	300	✓	R/W	-	-
S acc t const 3 [ms]	671	Float	100	3000	300	✓	R/W	-	-
S dec t const 3 [ms]	672	Float	100	3000	300	✓	R/W	-	-
Fwd-Rev No direction Fwd direction Rev direction No direction	673	U16	0	3	1	✓	R/W 0 1 2 3	ID	R/W 0 1 2 3
PI steady thr	695	I16	0	10000	0	✓	R/W	-	-
Droop gain [%]	696	Float	0.00	100.00	0.00	✓	R/W	-	-
Droop filter [ms]	697	U16	0	1000	0	✓	R/W	-	-
Load comp [%]	698	I16	-200	+200	0	✓	R/W	IA	R/W
Enable droop Enabled Disabled	699	U16	0	1	Disabled (0)	✓	R/W 1 0	ID	R/W 1 0
Droop limit [FF]	700	U16	0	2*P45	1500	✓	R/W	-	-

Parameter	No.	Format	Value min	Value max	Factory	Keyp.	Access via RS485/ BUS/ Opt2-M	Access via Term.	Access via Opt2-A/ PDC
T current lim type	715	U16	0	1	0	✓	R/Z	-	-
T lim mot gen							1		
T lim +/-							0		
Activity	728	U16	0	2	Disable drive	✓	R/Z	-	-
Ignore							0		
Disable drive							2		
Latch	729	U16	0	1	ON (1)	✓	R/Z	-	-
ON							1		
OFF							0		
Ok relay open	730	U16	0	1	ON (1)	✓	R/W	-	-
ON							1		
OFF							0		
PID steady delay	731	U16	0	60000	0	✓	R/W	-	-
I init gain PID	734	Float	0.00	100.00	10.00	✓	R/W	-	-
I/n curve	750	U16	0	1	Disabled	✓	R/Z	-	-
Enabled							1		
Disabled					(0)		0		
I/n lim 0 [%]	751	U16	0	200	0	✓	R/Z	-	-
I/n lim 1 [%]	752	U16	0	200	0	✓	R/Z	-	-
I/n lim 2 [%]	753	U16	0	200	0	✓	R/Z	-	-
I/n lim 3 [%]	754	U16	0	200	0	✓	R/Z	-	-
I/n lim 4 [%]	755	U16	0	200	0	✓	R/Z	-	-
I/n speed [rpm]	756	U16	0	P162	0	✓	R/Z	-	-
PID clamp	757	I16	-10000	+10000	10000	✓	R/W	-	-
Feed-fwd PID	758	I16	-10000	+10000	0	✓	R	IA	R
PID error	759	I16	-10000	+10000	0	✓	R	-	R
PID offset 0	760	I16	-10000	+10000	0	✓	R/W	IA	R/W
PID offset 1	761	I16	-10000	+10000	0	✓	R/W	-	-
PID offs. Sel	762	U16	0	1	0	✓	R/W	ID	R/W
Offset 1							1		
Offset 0							0		
PID feed-back	763	I16	-10000	+10000	0	✓	R/W	IA	R/W
PI I gain PID	764	Float	0.00	100.00	10.00	✓	R/W	-	-
PI P gain PID	765	Float	0.00	100.00	10.00	✓	R/W	-	-
PD D gain 1 PID [%]	766	Float	0.00	100.00	1.00	✓	R/W	-	-
PD D filter PID [ms]	767	U16	0	1000	0	✓	R/W	-	-
PD P gain 1 PID [%]	768	Float	0.00	100.00	10.00	✓	R/W	-	-
Enable PI PID	769	U16	0	1	Disabled	✓	R/W	ID	R/W
Enabled							1		
Disabled					(0)		0		
Enable PD PID	770	U16	0	1	Disabled	✓	R/W	ID	R/W
Enabled							1		
Disabled					(0)		0		
PI output PID	771	I16	0	1000 x PI toplim	1000	✓	R	-	R
PID out sign PID	772	U16	0	1	Bipolar (1)	✓	R/W	-	-
Bipolar							1		
Positive							0		
PID out scale	773	Float	-100.000	+100.000	1.000	✓	R/W	-	-
PID output	774	I16	-10000	+10000	0	✓	R	QA	R
PI central v1	776	Float	PI bot lim	PI toplim	1.00	✓	R/W	-	-
PI central v2	777	Float	PI bot lim	PI toplim	1.00	✓	R/W	-	-
PI central v3	778	Float	PI bot lim	PI toplim	1.00	✓	R/W	IA	-
PI central v sel	779	U16	0	3	1	✓	R/W	ID	R/W
PI central vs0	780	U16	0	1	1	-	R/W	ID	R/W
PI central vs1	781	U16	0	1	0	-	R/W	ID	R/W
PID target	782	U16	0	65535	0	✓	R/W	-	-
PI integr freeze	783	U16	0	1	OFF	✓	R/W	ID	R/W
ON							1		
OFF					(0)		0		

Parameter	No.	Format	Value		Factory	Keyp.	Access via		
			min	max			RS485/ BUS/ Opt2-M	Term.	Opt2-A/ PDC
PI top lim	784	Float	PI bot lim	10.00	10.00	✓	R/W	-	-
PI bottom lim	785	Float	-10.00	PI toplim	0.00	✓	R/W	-	-
PID source	786	U16	0	65535	0	✓	R/W	-	-
PID source gain	787	Float	-100.000	+100.00	1.000	✓	R/W	-	-
PD P gain 2 PID [%]	788	Float	0.00	100.00	10.00	✓	R/W	-	-
PD D gain 2 PID [%]	789	Float	0.00	100.00	1.00	✓	R/W	-	-
PD P gain 3 PID [%]	790	Float	0.00	100.00	10.00	✓	R/W	-	-
PD D gain 3 PID[%]	791	Float	0.00	100.00	1.00	✓	R/W	-	-
Input 1 filter [ms]	792	U16	0	1000	0	✓	R/W	-	R/W
P init gain PID	793	Float	0.00	100.00	10.00	✓	R/W	-	-
Diameter calc Enabled Disabled	794	U16	0	1	Disabled (0)	✓	Z/R 1 0	ID	R/W
Positioning spd [rpm]	795	I16	-100	100	0	✓	R/W	-	-
Max deviation	796	I16	-10000	+10000	8000	✓	R/W	-	-
Gear box ratio	797	Float	0.001	1.000	1.000	✓	R/W	-	-
Dancer constant [mm]	798	U16	1	10000	1	✓	R/W	-	-
Minimum diameter [mm]	799	U16	1	2000	100	✓	R/Z	-	-
Diameter calc st	800	U16	0	1	0	-	R	QD	R
Enable ind store Enabled Disabled	911	U16	0	1	Disabled (0)	✓	R/W 1 0	-	R/W
Ind store ctrl	912	U16	0	65535	0	-	R/W	-	R/W
Index storing	913	U32	0	$+2^{32}-1$	0		R	-	R
I field cnst 40	916	Float	0	100.0	40.0	✓	R/Z		-
I field cnst 70	917	Float	0	100.0	70.0	✓	R/Z		-
I field cnst 90	918	Float	0	100.0	90.0	✓	R/Z		-
Set flux / if	919	U16				✓	Z/C		-
Reset flux / if	920	U16				✓	Z/C		-
Out vlt level	921	Float*	0	100.0	100.0	✓	R/W	IA, QA	R/W
Act spd filter [s]	923	Float	0.001	1.000	0.100	✓	R/W	-	-
F act spd (rpm)	924	I16	-32768	+32767	-	✓	R	QA	R
F act spd (d) [FF]	925	I16	-32768	+32767	-	✓	R	-	R
T curr filter [s]	926	Float	0.001	0.250	0.100	✓	R/W	-	-
F T curr (%)	928	I16	-500	+500	-	✓	R	QA	R
Inertia c filter [ms]	1012	U16	0	1000	0	✓	R/W	-	-
Torque const [N*m/A]	1013	Float	0.01	99.99	S	✓	R	-	-
Inertia [kg*m*m*]	1014	Float	0.001	999.999	S	✓	R/W	-	-
Friction [N*m]	1015	Float	0.000	99.999	S	✓	R/W	-	-
Aux spd fun sel Inertia-loss cp Speed up	1016	U16	0	1	Speed up (0)	✓	R/Z 1 0	-	-
Speed ratio	1017	I16	0	+32767	+10000	✓	R/W	IA	R/W
Speed draw out (d)	1018	I16	-32768	+32767	-	✓	R	QA	R/W
Speed draw out (%)	1019	Float	-200.0	+200.0	-	✓	R	-	-
Select enc 1 OFF Speed ref 1 Speed ref 2 Ramp ref 1 Ramp ref 2	1020	U16	0	5	OFF (0) see 6.12.5	✓	R/Z 0 2 3 4 5	-	-
Select enc 2 OFF Speed ref 1 Speed ref 2 Ramp ref 1 Ramp ref 2	1021	U16	0	5	OFF (0) see 6.12.5	✓	R/Z 0 2 3 4 5	-	-
Start	1027	U16	0	65535	-	✓	C	-	-

Parameter	No.	Format	Value min	Value max	Value Factory	Access via Keyp.	RS485/ BUS/ Opt2-M	Term.	Opt2-A/ PDC
Take val	1028	U16	0	65535	-	✓	Z/C	-	-
Fwd-Rev spd tune Fwd direction Rev direction	1029	U16	1	2	Fwd Direction (1)	✓	R/Z 1 2	-	-
Inertia Nw [kg*m*m*]	1030	Float	0.001	999.999	-	✓	R	-	-
Friction Nw [N*m]	1031	Float	0.00	99.99	-	✓	R	-	-
Speed I Nw [%]	1033	Float	0.00	100.00	-	✓	R	-	-
Input 1 compare	1042	I16	-10000	+10000	0	✓	R/W	-	-
Input 1 cp error	1043	U16	0	10000	0	✓	R/W	-	-
Input 1 cp delay	1044	U16	0	65000	0	✓	R/W	-	-
Input 1 cp match Input 1=thr.val. Input 1 not thr.val.	1045	U16	0	1	-	-	R 1 0	QD H L	R
PID acc time	1046	Float	0.0	900.0	0.0	✓	R/W	-	-
PID dec time	1047	Float	0.0	900.0	0.0	✓	R/W	-	-
Test T curr lim [%]	1048	U16	0	S	20	✓	R/Z	-	-
Output power [Kw]	1052	Float	0.01	9999.99	-	✓	R	-	-
Maximum diameter [m]	1153	Float	0.000	32.000	1.000	✓	R/Z	-	-
Roll diameter [m]	1154	Float	0.000	32.000		✓	R	QA	-
Ref speed thr [%]	1155	Float	0	150.00	5	✓	R/W	-	-
Line speed gain	1156	I16	0	32767	0	✓	R/W	-	-
Diam reset	1157	U16	0	1	0	✓	R/W	ID	R/W
Diam thr [%]	1158	Float	0	150.00	10	✓	R/W	-	-
Diam reached	1159	U16	0	1		✓	R	QD	R
Line speed [%]	1160	Float	0.00	200.00		✓	R	-	-
Diam calc Dis ON OFF	1161	U16	0	1	ON (1)	✓	R/W 1 0	ID	R/W
Diam filter [ms]	1162	U16	0	5000	100	✓	R/W	-	-
Base omega [rpm]	1163	U16	0	8191	1500	✓	R/W	-	-
Diam preset 0 [m]	1164	Float	0.000	32.000	0	✓	R/W	-	-
Diam preset 1 [m]	1165	Float	0.000	32.000	0	✓	R/W	-	-
Diam preset 2 [m]	1166	Float	0.000	32.000	0	✓	R/W	-	-
Diam preset 3 [m]	1167	Float	0.000	32.000	0	✓	R/W	IA	-
Diam preset sel	1168	U16	0	3	0	✓	R/W	ID	-
Variable J comp [%]	1171	Float	0.00	199.99	0	✓	R/W	-	-
Constant J comp [%]	1172	Float	-100.00	+100.00	0	✓	R/W	-	-
Mat width [%]	1173	Float	0.00	100.00	100	✓	R/W	-	-
Static f [%]	1174	Float	0.00	199.99	0	✓	R/W	-	-
Dinamic f [%]	1175	Float	0.00	199.99	0	✓	R/W	-	-
Taper enable Enabled Disabled	1176	U16	0	1	Disabled (0)	✓	R/W 1 0	ID	R/W
Init diameter [m]	1177	Float	0.000	32.000	0.1	✓	R/W	-	-
Final diameter [m]	1178	Float	0.000	32.000	1	✓	R/W	-	-
Tension red [%]	1179	Float	0.00	199.99	0	✓	R/W	IA	-
Tension ref [%]	1180	Float	0.00	199.99	0	✓	R/W	IA	-
Tension scale [%]	1181	I16	0	200	100	✓	R/W	-	-
Time acc/dec min [s]	1182	Float	0.15	300.00	9.01	✓	R/W	-	-
Int acc calc En Enabled Disabled	1183	U16	0	1	Enabled (1)	✓	R/Z 1 0	-	-
Line acc [%]	1184	Float	0.00	100.00	100	✓	R/W	-	-
Line dec [%]	1185	Float	0.00	100.00	100	✓	R/W	-	-
Line fast stop [%]	1186	Float	0.00	100.00	100	✓	R/W	-	-
Wind/unwind Unwinder Winder	1187	U16	0	1	Winder (0)	✓	R/W 1 0	ID	R/W
Line acc status	1188	U16	0	1	OFF	✓	R/W	ID	R/W

Parameter	No.	Format	Value min	Value max	Value Factory	Access via Keyp.	Access via RS485/ BUS/ Opt2-M	Access via Term.	Access via Opt2-A/ PDC
Line dec status	1189	U16	0	1	OFF	✓	R/W	ID	R/W
Line fstp status	1190	U16	0	1	OFF	✓	R/W	ID	R/W
Act const J comp [%]	1191	Float	-	200.00	0	✓	R	-	-
Act var J comp [%]	1192	Float	-	200.00	0	✓	R	-	-
Speed match ON OFF	1195	U16	0	1	OFF (0)	✓	R/W 1 0	ID	R/W
Spd match acc [s]	1196	Float	0.30	300.00	83.88	✓	R/W	-	-
Spd match dec [s]	1197	Float	0.30	300.00	83.88	✓	R/W	-	-
Offset acc time [s]	1198	Float	0.30	950.00	83.88	✓	R/W	-	-
W offset [rpm]	1199	I16	0	1000	0	✓	R/W	-	-
Spd match gain [%]	1200	U16	0	150	100	✓	R/W	-	-
Winder side Down Up	1201	U16	0	1	Up (0)	✓	R/W 1 0	ID	R/W
W gain [%]	1202	U16	0	100	0	✓	R/W	-	-
Spd match compl	1203	U16	0	1		✓	R	QD	R
Line spd source	1204	U16	0	65535	0	✓	R/Z	-	-
Diam inc/dec En Enabled Disabled	1205	U16	0	1	Enabled (0)	✓	R/W 1 0	ID	R/W
Diam init filter [ms]	1206	U16	0	5000	100	✓	R/W	-	-
Diam stdy delay [ms]	1207	U16	0	60000	0	✓	R/W	-	-
Close loop comp	1208	I16	-32767	+32767		✓	R	-	-
Torque winder En Enabled Disabled	1209	U16	0	1	Disabled (0)	✓	R/W 1 0	ID	R/W
W target	1210	U16	0	65535	0	✓	R/Z	-	-
Acc/dec filter [ms]	1212	U16	0	5000	30	✓	R/W	-	-
Actual comp [%]	1213	I16	-200	+200		✓	R	QD	-
Closed loop En Enabled Disabled	1214	U16	0	1	Disabled (0)	✓	R/Z 1 0	-	R/Z
Speed demand En Enabled Disabled	1215	U16	0	1	Disabled (0)	✓	R/W 1 0	-	R/W
Spd match torque [%]	1216	U16	0	200	100	✓	R/W	-	-
W reference [rpm]	1217	I16	-8192	+8192		✓	R	QA	-
Source *Link 3*	1218	U16	0	65535	0	✓	R/W	-	-
Destination *Link 3*	1219	U16	0	65535	0	✓	R/W	-	-
Mul gain *Link 3*	1220	Float	-10000	+10000	1	✓	R/W	-	-
Div gain *Link 3*	1221	Float	-10000	+10000	1	✓	R/W	-	-
Input max *Link 3*	1222	Float	-2^{31}	$2^{31}-1$	0	✓	R/W	-	-
Input min *Link 3*	1223	Float	-2^{31}	$2^{31}-1$	0	✓	R/W	-	-
Input offset *Link 3*	1224	Float	-2^{31}	$2^{31}-1$	0	✓	R/W	-	-
Output offset *Link 3*	1225	Float	-2^{31}	$2^{31}-1$	0	✓	R/W	-	-
Inp absolute *Link 3* ON OFF	1226	U16	0	1	OFF (0)	✓	R/W 1 0	-	-
Source *Link 4*	1227	U16	0	65535	0	✓	R/W	-	-
Destination *Link 4*	1228	U16	0	65535	0	✓	R/W	-	-
Mul gain *Link 4*	1229	Float	-10000	+10000	1	✓	R/W	-	-
Div gain *Link 4*	1230	Float	-10000	+10000	1	✓	R/W	-	-
Input max *Link 4*	1231	Float	-2^{31}	$2^{31}-1$	0	✓	R/W	-	-
Input min *Link 4*	1232	Float	-2^{31}	$2^{31}-1$	0	✓	R/W	-	-
Input offset *Link 4*	1233	Float	-2^{31}	$2^{31}-1$	0	✓	R/W	-	-
Output offset *Link 4*	1234	Float	-2^{31}	$2^{31}-1$	0	✓	R/W	-	-

Parameter	No.	Format	Value min	Value max	Value Factory	Access via Keyp.	RS485/ BUS/ Opt2-M	Term.	Opt2-A/ PDC
Inp absolute *Link 4* ON OFF	1235	U16	0	1	OFF (0)	✓	R/W 1 0	-	-
Source *Link 5*	1236	U16	0	65535	0	✓	R/W	-	-
Destination *Link 5*	1237	U16	0	65535	0	✓	R/W	-	-
Mul gain *Link 5*	1238	Float	-10000	+10000	1	✓	R/W	-	-
Div gain *Link 5*	1239	Float	-10000	+10000	1	✓	R/W	-	-
Input max *Link 5*	1240	Float	-2^{31}	$2^{31}-1$	0	✓	R/W	-	-
Input min *Link 5*	1241	Float	-2^{31}	$2^{31}-1$	0	✓	R/W	-	-
Input offset *Link 5*	1242	Float	-2^{31}	$2^{31}-1$	0	✓	R/W	-	-
Output offset *Link 5*	1243	Float	-2^{31}	$2^{31}-1$	0	✓	R/W	-	-
Inp absolute *Link 5* ON OFF	1244	U16	0	1	OFF (0)	✓	R/W 1 0	-	-
Source *Link 6*	1245	U16	0	65535	0	✓	R/W	-	-
Destination *Link 6*	1246	U16	0	65535	0	✓	R/W	-	-
Mul gain *Link 6*	1247	Float	-10000	+10000	1	✓	R/W	-	-
Div gain *Link 6*	1248	Float	-10000	+10000	1	✓	R/W	-	-
Input max *Link 6*	1249	Float	-2^{31}	$2^{31}-1$	0	✓	R/W	-	-
Input min *Link 6*	1250	Float	-2^{31}	$2^{31}-1$	0	✓	R/W	-	-
Input offset *Link 6*	1251	Float	-2^{31}	$2^{31}-1$	0	✓	R/W	-	-
Output offset *Link 6*	1252	Float	-2^{31}	$2^{31}-1$	0	✓	R/W	-	-
Inp absolute *Link 6* ON OFF	1253	U16	0	1	OFF (0)	✓	R/W 1 0	-	-
PID err gain [%]	1254	Float	0.00	32.00	1	✓	R/W	-	-
Jog TW speed [%]	1255	I16	0	100	0	✓	R/W	-	-
Jog TW enable Enabled Disabled	1256	U16	0	1	Disabled (0)	✓	R/W 1 0	ID	R/W
Enable PI-PD PID Enabled Disabled	1258	U16	0	1	Disabled (0)	-	R/W 1 0	ID	R/W
Acc state Acc CW + Acc anti-CW Other states	1259	U16	0	1	-	-	R 1 0	QD H L	R 1 0
Dec state Dec CW + Dec anti-CW Other states	1260	U16	0	1	-	-	R 1 0	QD H L	R 1 0
Closing speed	1262	U16	0	200	30	✓	R/W	-	-
Opening delay	1263	U16	0	30000	0	✓	R/W	-	-
Brake command	1264	U16	0	1	0		R/W		
Enable ramp in=0 Enabled Disabled	1265	U16	0	1	Disabled (0)	✓	R/W 1 0	-	-
Actuator delay	1266	U16	0	30000	0	✓	R/W	-	-
Inversion out 1 Enabled Disabled	1267	U16	0	1	Disabled (0)	✓	R/W 1 0	-	-
Inversion out 2 Enabled Disabled	1268	U16	0	1	Disabled (0)	✓	R/W 1 0	-	-
Inversion out 3 Enabled Disabled	1269	U16	0	1	Disabled (0)	✓	R/W 1 0	-	-
Inversion out 4 Enabled Disabled	1270	U16	0	1	Disabled (0)	✓	R/W 1 0	-	-

Parameter	No.	Format	Value			Access via			
			min	max	Factory	Keyp.	RS485/ BUS/ Opt2-M	Term.	Opt2-A/ PDC
Inversion out 5 Enabled Disabled	1271	U16	0	1	Disabled (0)	✓	R/W 1 0	-	-
Inversion out 6 Enabled Disabled	1272	U16	0	1	Disabled (0)	✓	R/W 1 0	-	-
Inversion out 7 Enabled Disabled	1273	U16	0	1	Disabled (0)	✓	R/W 1 0	-	-
Inversion out 8 Enabled Disabled	1274	U16	0	1	Disabled (0)	✓	R/W 1 0	-	-
Inversion relay2 Enabled Disabled	1275	U16	0	1	Disabled (0)	✓	R/W 1 0	-	-
Inversion in 1 Enabled Disabled	1276	U16	0	1	Disabled (0)	✓	R/W 1 0	-	-
Inversion in 2 Enabled Disabled	1277	U16	0	1	Disabled (0)	✓	R/W 1 0	-	-
Inversion in 3 Enabled Disabled	1278	U16	0	1	Disabled (0)	✓	R/W 1 0	-	-
Inversion in 4 Enabled Disabled	1279	U16	0	1	Disabled (0)	✓	R/W 1 0	-	-
Inversion in 5 Enabled Disabled	1280	U16	0	1	Disabled (0)	✓	R/W 1 0	-	-
Inversion in 6 Enabled Disabled	1281	U16	0	1	Disabled (0)	✓	R/W 1 0	-	-
Inversion in 7 Enabled Disabled	1282	U16	0	1	Disabled (0)	✓	R/W 1 0	-	-
Inversion in 8 Enabled Disabled	1283	U16	0	1	Disabled (0)	✓	R/W 1 0	-	-
Ref spd source	1284	U16	0	65535	0	✓	R/Z	-	-
Ref speed gain	1285	I16	0	32767	0	✓	R/W	-	-
Ref line spd [%]	1286	Float	0.00	200.00		✓	R	-	-
Static f Zero Enabled Disabled	1287	U16	0	1	Disabled (0)	✓	R/W	-	-

* When the parameter is accessed by Opt2-A/PDC the format is U16
** When the parameter is accessed by Opt2-A/PDC the format is I16
*** When the parameter is accessed by Opt2-A/PDC the lower word of the parameter is considered

10.3. PARAMETERS IN ALPHABETICAL ORDER

Parameter	No.	Position
2B + E	201	CONFIGURATION \ Drive type
Acc delta speed [FF]	21	DRIVECOM \ Acceleration
Acc delta speed [FF]	21	RAMP \ Acceleration
Acc delta speed [FF]	21	START UP
Acc delta speed0 [FF]	659	FUNCTIONS \ Multi ramp fct \ Ramp 0 \ Acceleration 0
Acc delta speed1 [FF]	23	FUNCTIONS \ Multi ramp fct \ Ramp 0 \ Acceleration 1
Acc delta speed2 [FF]	25	FUNCTIONS \ Multi ramp fct \ Ramp 0 \ Acceleration 2
Acc delta speed3 [FF]	27	FUNCTIONS \ Multi ramp fct \ Ramp 0 \ Acceleration 3
Acc delta time [s]	22	DRIVECOM \ Acceleration
Acc delta time [s]	22	RAMP \ Acceleration
Acc delta time [s]	22	START UP
Acc delta time 0 [s]	660	FUNCTIONS \ Multi ramp fct \ Ramp 0 \ Acceleration 0
Acc delta time 1 [s]	24	FUNCTIONS \ Multi ramp fct \ Ramp 0 \ Acceleration 1
Acc delta time 2 [s]	26	FUNCTIONS \ Multi ramp fct \ Ramp 0 \ Acceleration 2
Acc delta time 3 [s]	28	FUNCTIONS \ Multi ramp fct \ Ramp 0 \ Acceleration 3
Acc/dec filter [ms]	1212	OPTIONS \ TORQUE WINDER \ Torque calculat \ Comp calculat
Act const J comp [%]	1191	OPTIONS \ TORQUE WINDER \ Torque calculat \ Comp calculat
Act percentage [%]	120	DRIVECOM
Act spd filter [s]	923	MONITOR \ Measurements \ Speed \ Speed in DRC [ ]
Act spd filter [s]	923	MONITOR \ Measurements \ Speed \ Speed in rpm
Act speed value [FF]	119	DRIVECOM
Act tension ref [%]	1194	OPTIONS \ TORQUE WINDER \ Torque calculat
Act tension ref [%]	1194	OPTIONS \ TORQUE WINDER \ Torque calculat \ Taper function
Act tension ref	1194	OPTIONS \ PID \ PID references
Act var J comp [%]	1192	OPTIONS \ TORQUE WINDER \ Torque calculat \ Comp calculat
Activity	203	CONFIGURATION \ Prog alarms \ Overvoltage
Activity	212	CONFIGURATION \ Prog alarms \ Overcurrent
Activity	354	CONFIGURATION \ Prog alarms \ External fault
Activity	365	CONFIGURATION \ Prog alarms \ Overtemp motor
Activity	368	CONFIGURATION \ Prog alarms \ Heatsink
Activity	386	CONFIGURATION \ Prog alarms \ Hw opt1 failure
Activity	473	CONFIGURATION \ Prog alarms \ Field loss
Activity	478	CONFIGURATION \ Prog alarms \ Speed fbk loss
Activity	634	CONFIGURATION \ Prog alarms \ Bus loss
Activity	639	CONFIGURATION \ Prog alarms \ Opt2 failure
Activity	728	CONFIGURATION \ Prog alarms \ Enable seq err
Actual comp [%]	1213	OPTIONS \ TORQUE WINDER \ Torque calculat \ Comp calculat
Actual spd (%)	121	MONITOR \ Measurements \ Speed \ Speed in %
Actual spd (d) [FF]	119	MONITOR \ Measurements \ Speed \ Speed in DRC [ ]
Actual spd (rpm)	122	DRIVE STATUS
Actual spd (rpm)	122	MONITOR \ Measurements \ Speed \ Speed in rpm
Actuator delay	1266	FUNCTIONS \ Brake control
Adap I gain 1 [%]	189	ADD SPEED FUNCT \ Adaptive spd reg
Adap I gain 2 [%]	191	ADD SPEED FUNCT \ Adaptive spd reg
Adap I gain 3 [%]	193	ADD SPEED FUNCT \ Adaptive spd reg
Adap joint 1 [%]	186	ADD SPEED FUNCT \ Adaptive spd reg

Parameter	No.	Position
Adap joint 2 [%]	187	ADD SPEED FUNCT \ Adaptive spd reg
Adap P gain 1 [%]	188	ADD SPEED FUNCT \ Adaptive spd reg
Adap P gain 2 [%]	190	ADD SPEED FUNCT \ Adaptive spd reg
Adap P gain 3 [%]	192	ADD SPEED FUNCT \ Adaptive spd reg
Adap reference [FF]	183	ADD SPEED FUNCT \ Adaptive spd reg
Adap speed 1 [%]	184	ADD SPEED FUNCT \ Adaptive spd reg
Adap speed 2 [%]	185	ADD SPEED FUNCT \ Adaptive spd reg
An in 1 target	295	I/O CONFIG \ Analog inputs \ Analog input 1
An in 2 target	296	I/O CONFIG \ Analog inputs \ Analog input 2
An in 3 target	297	I/O CONFIG \ Analog inputs \ Analog input 3
Arm inductance [mH]	454	CURRENT REGULAT
Arm resistance [ ]	453	CURRENT REGULAT
Auto capture	388	ADD SPEED FUNCT
Auto tune inp 1	259	I/O CONFIG \ Analog inputs \ Analog input 1
Auto tune inp 1	259	START UP \ Analog inputs \ Analog input 1
Auto tune inp 2	260	I/O CONFIG \ Analog inputs \ Analog input 2
Auto tune inp 2	260	START UP \ Analog inputs \ Analog input 2
Auto tune inp 3	261	I/O CONFIG \ Analog inputs \ Analog input 3
Auto tune inp 3	261	START UP \ Analog inputs \ Analog input 3
Aux spd fun sel	1016	SPEED REGULAT
Base current [%]	313	FUNCTIONS \ Overload contr
Base current [%]	313	START UP \ Overload contr
Base omega [rpm]	1163	OPTIONS \ TORQUE WINDER \ Diam Calculatio
Bitword pad A	519	SPEC FUNCTIONS \ Pad Parameters
Bitword pad B	536	SPEC FUNCTIONS \ Pad Parameters
Close loop comp	1208	OPTIONS \ TORQUE WINDER \ Torque calculat \ Comp calculat
Closed loop En	1214	OPTIONS \ TORQUE WINDER \ Torque calculat \ Comp calculat
Closing speed	1262	FUNCTIONS \ Brake control
Constant J comp [%]	1172	OPTIONS \ TORQUE WINDER \ Torque calculat \ Comp calculat
Control mode	253	CONFIGURATION
Control mode	253	START UP
Control word	55	DRIVECOM
Curr limit state	349	LIMITS \ Current limits
Current lim red [%]	13	LIMITS \ Current limits
Dancer constant [mm]	798	OPTIONS \ PID \ Diameter calc
Dec delta speed [FF]	29	DRIVECOM \ Deceleration
Dec delta speed [FF]	29	RAMP \ Deceleration
Dec delta speed [FF]	29	START UP
Dec delta speed0 [FF]	661	FUNCTIONS \ Multi ramp fct \ Ramp 0 \ Deceleration 0
Dec delta speed1 [FF]	31	FUNCTIONS \ Multi ramp fct \ Ramp 0 \ Deceleration 1
Dec delta speed2 [FF]	33	FUNCTIONS \ Multi ramp fct \ Ramp 0 \ Deceleration 2
Dec delta speed3 [FF]	35	FUNCTIONS \ Multi ramp fct \ Ramp 0 \ Deceleration 3
Dec delta time [s]	30	DRIVECOM \ Deceleration
Dec delta time [s]	30	RAMP \ Deceleration
Dec delta time [s]	30	START UP
Dec delta time 0 [s]	662	FUNCTIONS \ Multi ramp fct \ Ramp 0 \ Deceleration 0
Dec delta time 1 [s]	32	FUNCTIONS \ Multi ramp fct \ Ramp 0 \ Deceleration 1
Dec delta time 2 [s]	34	FUNCTIONS \ Multi ramp fct \ Ramp 0 \ Deceleration 2
Dec delta time 3 [s]	36	FUNCTIONS \ Multi ramp fct \ Ramp 0 \ Deceleration 3

Parameter	No.	Position
Dec state	1260	RAMP
Destination	485	SPEC FUNCTIONS \ Links \ Link 1
Destination	554	SPEC FUNCTIONS \ Links \ Link 2
Destination	1219	SPEC FUNCTIONS \ Links \ Link 3
Destination	1228	SPEC FUNCTIONS \ Links \ Link 4
Destination	1237	SPEC FUNCTIONS \ Links \ Link 5
Destination	1246	SPEC FUNCTIONS \ Links \ Link 6
Device address	319	CONFIGURATION \ Set serial comm
Diam calc Dis	1161	OPTIONS \ TORQUE WINDER \ Diam Calculatio
Diam filter [ms]	1162	OPTIONS \ TORQUE WINDER \ Diam Calculatio
Diam inc/dec En	1205	OPTIONS \ TORQUE WINDER \ Diam Calculatio
Diam init filter [ms]	1206	OPTIONS \ TORQUE WINDER \ Diam Calculatio
Diam preset 0 [m]	1164	OPTIONS \ TORQUE WINDER \ Diam Calculatio
Diam preset 1 [m]	1165	OPTIONS \ TORQUE WINDER \ Diam Calculatio
Diam preset 2 [m]	1166	OPTIONS \ TORQUE WINDER \ Diam Calculatio
Diam preset 3 [m]	1167	OPTIONS \ TORQUE WINDER \ Diam Calculatio
Diam preset sel	1168	OPTIONS \ TORQUE WINDER \ Diam Calculatio
Diam reached	1159	OPTIONS \ TORQUE WINDER \ Diam Calculatio
Diam reset	1157	OPTIONS \ TORQUE WINDER \ Diam Calculatio
Diam stdy delay [ms]	1207	OPTIONS \ TORQUE WINDER \ Diam Calculatio
Diam thr [%]	1158	OPTIONS \ TORQUE WINDER \ Diam Calculatio
Diameter calc st	800	OPTIONS \ PID
Diameter calc	794	OPTIONS \ PID \ Diameter calc
Dig input term 1	565	MONITOR \ I/O
Dig input term 10	574	MONITOR \ I/O
Dig input term 11	575	MONITOR \ I/O
Dig input term 12	576	MONITOR \ I/O
Dig input term 15	579	MONITOR \ I/O
Dig input term 16	580	MONITOR \ I/O
Dig input term 2	566	MONITOR \ I/O
Dig input term 3	567	MONITOR \ I/O
Dig input term 4	568	MONITOR \ I/O
Dig input term 5	569	MONITOR \ I/O
Dig input term 6	570	MONITOR \ I/O
Dig input term 7	571	MONITOR \ I/O
Dig input term 8	572	MONITOR \ I/O
Dig input term 9	573	MONITOR / I/O
Dig input term	564	MONITOR \ I/O
Dig output term	581	MONITOR / I/O
Digital I/Q		DRIVE STATUS
Digital input 1	137	I/O CONFIG \ Digital inputs
Digital input 2	138	I/O CONFIG \ Digital inputs
Digital input 3	139	I/O CONFIG \ Digital inputs
Digital input 4	140	I/O CONFIG \ Digital inputs
Digital input 5	141	I/O CONFIG \ Digital inputs
Digital input 6	142	I/O CONFIG \ Digital inputs
Digital input 7	143	I/O CONFIG \ Digital inputs
Digital input 8	144	I/O CONFIG \ Digital inputs
Digital output 1	145	I/O CONFIG \ Digital outputs

Parameter	No.	Position
Digital output 2	146	I/O CONFIG \ Digital outputs
Digital output 3	147	I/O CONFIG \ Digital outputs
Digital output 4	148	I/O CONFIG \ Digital outputs
Digital output 5	149	I/O CONFIG \ Digital outputs
Digital output 6	150	I/O CONFIG \ Digital outputs
Digital output 7	151	I/O CONFIG \ Digital outputs
Digital output 8	152	I/O CONFIG \ Digital outputs
Dim factor den	51	CONFIGURATION \ Dimension fact
Dim factor den	51	DRIVECOM \ Dimension fact
Dim factor num	50	CONFIGURATION \ Dimension fact
Dim factor num	50	DRIVECOM \ Dimension fact
Dim factor text	52	CONFIGURATION \ Dimension fact
Dim factor text	52	DRIVECOM \ Dimension fact
Dinamic f [%]	1175	OPTIONS \ TORQUE WINDER \ Torque calculat \ Comp calculat
Div gain	487	SPEC FUNCTIONS \ Links \ Link 1
Div gain	556	SPEC FUNCTIONS \ Links \ Link 2
Div gain	1221	SPEC FUNCTIONS \ Links \ Link 3
Div gain	1230	SPEC FUNCTIONS \ Links \ Link 4
Div gain	1239	SPEC FUNCTIONS \ Links \ Link 5
Div gain	1248	SPEC FUNCTIONS \ Links \ Link 6
Drive size [A]	465	CONFIGURATION \ Drive type
Drive type	300	CONFIGURATION \ Drive type
Droop gain [%]	696	SPEED REGULAT \ Droop function
Droop filter [ms]	697	SPEED REGULAT \ Droop function
Droop limit [FF]	700	SPEED REGULAT \ Droop function
E int [V]	587	CURRENT REGULAT
Enab multi rmp	243	FUNCTIONS \ Multi ramp fct
Enab multi spd	153	FUNCTIONS \ Multi speed fct
Enable drive	314	DRIVE STATUS
Enable drive	314	MONITOR
Enable drive	314	START UP
Enable drive	314	TUNING
Enable droop	699	SPEED REGULAT \ Droop function
Enable fbk bypas	458	CONFIGURATION \ Speed fbk
Enable fbk contr	457	CONFIGURATION \ Speed fbk
Enable fbk contr	457	START UP \ Speed feedback
Enable flux reg	497	FLUX REGULATION
Enable flux weak	498	FLUX REGULATION
Enable ind store	911	CONFIGURATION \ Speed fbk
Enable jog	244	FUNCTIONS \ Jog function
Enable motor pot	246	FUNCTIONS \ Motor pot
Enable OPT2	425	OPTIONS \ Option 2
Enable overload	309	FUNCTIONS \ Overload contr
Enable overload	309	START UP \ Overload contr
Enable PD PID	770	OPTIONS \ PID
Enable PI PID	769	OPTIONS \ PID
Enable ramp	245	RAMP
Enable ramp in=0	1265	FUNCTIONS \ Brake control
Enable spd adap	181	ADD SPEED FUNCT \ Adaptive spd reg

Parameter	No.	Position
Enable spd reg	242	SPEED REGULAT
Enable spd=0 I	123	SPEED REGULAT \ Spd zero logic
Enable spd=0 P	125	SPEED REGULAT \ Spd zero logic
Enable spd=0 R	124	SPEED REGULAT \ Spd zero logic
Enc 1 speed (rpm)	427	MONITOR \ Measurements \ Speed \ Speed in rpm
Enc 2 speed (rpm)	420	MONITOR \ Measurements \ Speed \ Speed in rpm
Encoder 1 pulses	416	CONFIGURATION \ Speed fbk
Encoder 1 pulses	416	I/O CONFIG \ Encoder inputs
Encoder 1 state	648	CONFIGURATION \ Speed fbk
Encoder 2 pulses	169	CONFIGURATION \ Speed fbk
Encoder 2 pulses	169	I/O CONFIG \ Encoder inputs
Encoder 2 pulses	169	START UP \ Speed feedback
Encoder 2 state	651	CONFIGURATION \ Speed fbk
F act spd (d)	925	MONITOR \ Measurements \ Speed \ Speed in DRC [ ]
F act spd (rpm)	924	MONITOR \ Measurements \ Speed \ Speed in rpm
F T curr	928	MONITOR \ Measurements
Face value den	53	CONFIGURATION \ Face value fact
Face value den	53	DRIVECOM \ Face value fact
Face value num	54	CONFIGURATION \ Face value fact
Face value num	54	DRIVECOM \ Face value fact
Failure code	417	SPEC FUNCTIONS
Failure hour	328	SPEC FUNCTIONS
Failure minute	329	SPEC FUNCTIONS
Failure reg del	263	SPEC FUNCTIONS
Failure register	330	SPEC FUNCTIONS
Failure reset	262	SPEC FUNCTIONS
Failure text	327	SPEC FUNCTIONS
Feed-fwd PID	758	OPTIONS \ PID \ PID source
Final diameter [m]	1178	OPTIONS \ TORQUE WINDER \ Torque calculat \ Taper function
Flux current (%)	234	FLUX REGULATION
Flux current (%)	234	MONITOR \ Measurements
Flux current (A)	351	DRIVE STATUS
Flux current (A)	351	MONITOR \ Measurements
Flux current max [%]	467	LIMITS \ Flux limits
Flux current max [%]	467	START UP \ Limits
Flux current min [%]	468	LIMITS \ Flux limits
Flux current min [%]	468	START UP \ Limits
Flux I [%]	92	REG PARAMETERS \ Percent values \ Flux regulator
Flux I [%]	92	TUNING
Flux I Base	98	REG PARAMETERS \ Base values \ Flux regulator
Flux P [%]	91	REG PARAMETERS \ Percent values \ Flux regulator
Flux P [%]	91	TUNING
Flux P base	97	REG PARAMETERS \ Base values \ Flux regulator
Flux reference [%]	500	FLUX REGULATION
Flux reference [%]	500	MONITOR \ Measurements
Flux reg mode	469	FLUX REGULATION
Flux reg mode	469	START UP \ Motor data
Flux weak speed [%]	456	CONFIGURATION \ Speed fbk
Flux weak speed [%]	456	START UP \ Motor data

Parameter	No.	Position
Forward sign	293	RAMP
Freeze ramp	373	RAMP
Friction Nw	1031	SPEED REGULAT \ Self tuning
Friction Nw	1031	START UP \ Speed self tune
Friction Nw	1031	TUNING \ Speed self tune
Friction	1015	SPEED REGULAT \ Inertia \ loss cp
Friction	1015	SPEED REGULAT \ Self tuning
Friction	1015	START UP \ Speed self tune
Friction	1015	TUNING \ Speed self tune
Full load curr [A]	179	CONFIGURATION
Full load curr [A]	179	START UP \ Motor data
Fwd-Rev spd tune	1029	SPEED REGULAT \ Self tuning
Fwd-Rev spd tune	1029	START UP \ Speed self tune
Fwd-Rev spd tune	1029	TUNING \ Speed self tune
Fwd-Rev	673	RAMP
Gear box ratio	797	OPTIONS \ PID \ Diameter calc
Gen amplitude [%]	60	SPEC FUNCTIONS \ Test generator
Gen frequency [Hz]	59	SPEC FUNCTIONS \ Test generator
Generator access	58	SPEC FUNCTIONS \ Test generator
Generator offset [%]	61	SPEC FUNCTIONS \ Test generator
Hold off time [ms]	470	CONFIGURATION \ Prog alarms \ Undervoltage
Hold off time [ms]	475	CONFIGURATION \ Prog alarms \ Field loss
Hold off time [ms]	480	CONFIGURATION \ Prog alarms \ Speed fbk loss
Hold off time [ms]	482	CONFIGURATION \ Prog alarms \ Overvoltage
Hold off time [ms]	502	CONFIGURATION \ Prog alarms \ External fault
Hold off time [ms]	586	CONFIGURATION \ Prog alarms \ Overcurrent
Hold off time [ms]	636	CONFIGURATION \ Prog alarms \ Bus loss
I field cnst 40	916	FLUX REGULATION \ Flux \ if curve
I field cnst 70	917	FLUX REGULATION \ Flux \ if curve
I field cnst 90	918	FLUX REGULATION \ Flux \ if curve
I init gain PID	734	OPTIONS \ PID \ PI control
I/n curve	750	FUNCTIONS \ I/n curve
I/n lim 0 [%]	751	FUNCTIONS \ I/n curve
I/n lim 1 [%]	752	FUNCTIONS \ I/n curve
I/n lim 2 [%]	753	FUNCTIONS \ I/n curve
I/n lim 3 [%]	754	FUNCTIONS \ I/n curve
I/n lim 4 [%]	755	FUNCTIONS \ I/n curve
I/n speed [rpm]	756	FUNCTIONS \ I/n curve
In use Tcur lim- [%]	11	LIMITS \ Current limits
In use Tcur lim+ [%]	10	LIMITS \ Current limits
Ind store ctrl	912	CONFIGURATION \ Speed fbk
Index storing	913	CONFIGURATION \ Speed fbk
Inertia Nw	1030	SPEED REGULAT \ Self tuning
Inertia Nw	1030	START UP \ Speed self tune
Inertia Nw	1030	TUNING \ Speed self tune
Inertia c filter	1012	SPEED REGULAT \ Inertia \ loss cp
Inertia	1014	SPEED REGULAT \ Inertia \ loss cp
Inertia	1014	SPEED REGULAT \ Self tuning
Inertia	1014	START UP \ Speed self tune

Parameter	No.	Position
Inertia	1014	TUNING \ Speed self tune
Init diameter [m]	1177	OPTIONS \ TORQUE WINDER \ Torque calculat \ Taper function
Inp absolute	492	SPEC FUNCTIONS \ Links \ Link 1
Inp absolute	561	SPEC FUNCTIONS \ Links \ Link 2
Inp absolute	1226	SPEC FUNCTIONS \ Links \ Link 3
Inp absolute	1235	SPEC FUNCTIONS \ Links \ Link 4
Inp absolute	1244	SPEC FUNCTIONS \ Links \ Link 5
Inp absolute	1253	SPEC FUNCTIONS \ Links \ Link 6
Input 1 compare	1042	I/O CONFIG \ Analog inputs \ Analog input 1
Input 1 cp delay	1044	I/O CONFIG \ Analog inputs \ Analog input 1
Input 1 cp error	1043	I/O CONFIG \ Analog inputs \ Analog input 1
Input 1 cp match	1045	I/O CONFIG \ Analog inputs \ Analog input 1
Input 1 filter [ms]	792	I/O CONFIG \ Analog inputs \ Analog input 1
Input 1 sign	389	I/O CONFIG \ Analog inputs \ Analog input 1
Input 1 type	71	I/O CONFIG \ Analog inputs \ Analog input 1
Input 2 sign	390	I/O CONFIG \ Analog inputs \ Analog input 2
Input 2 type	76	I/O CONFIG \ Analog inputs \ Analog input 2
Input 3 sign	391	I/O CONFIG \ Analog inputs \ Analog input 3
Input 3 type	81	I/O CONFIG \ Analog inputs \ Analog input 3
Input max	488	SPEC FUNCTIONS \ Links \ Link 1
Input max	557	SPEC FUNCTIONS \ Links \ Link 2
Input max	1222	SPEC FUNCTIONS \ Links \ Link 3
Input max	1231	SPEC FUNCTIONS \ Links \ Link 4
Input max	1240	SPEC FUNCTIONS \ Links \ Link 5
Input max	1249	SPEC FUNCTIONS \ Links \ Link 6
Input min	489	SPEC FUNCTIONS \ Links \ Link 1
Input min	558	SPEC FUNCTIONS \ Links \ Link 2
Input min	1223	SPEC FUNCTIONS \ Links \ Link 3
Input min	1232	SPEC FUNCTIONS \ Links \ Link 4
Input min	1241	SPEC FUNCTIONS \ Links \ Link 5
Input min	1250	SPEC FUNCTIONS \ Links \ Link 6
Input offset	490	SPEC FUNCTIONS \ Links \ Link 1
Input offset	559	SPEC FUNCTIONS \ Links \ Link 2
Input offset	1224	SPEC FUNCTIONS \ Links \ Link 3
Input offset	1233	SPEC FUNCTIONS \ Links \ Link 4
Input offset	1242	SPEC FUNCTIONS \ Links \ Link 5
Input offset	1251	SPEC FUNCTIONS \ Links \ Link 6
Int acc calc En	1183	OPTIONS \ TORQUE WINDER \ Torque calculat \ Comp calculat
Inversion in 1	1276	I/O CONFIG \ Digital inputs
Inversion in 2	1277	I/O CONFIG \ Digital inputs
Inversion in 3	1278	I/O CONFIG \ Digital inputs
Inversion in 4	1279	I/O CONFIG \ Digital inputs
Inversion in 5	1280	I/O CONFIG \ Digital inputs
Inversion in 6	1281	I/O CONFIG \ Digital inputs
Inversion in 7	1282	I/O CONFIG \ Digital inputs
Inversion in 8	1283	I/O CONFIG \ Digital inputs
Inversion out 1	1267	I/O CONFIG \ Digital output
Inversion out 2	1268	I/O CONFIG \ Digital output
Inversion out 3	1269	I/O CONFIG \ Digital output

Parameter	No.	Position
Inversion out 4	1270	I/O CONFIG \ Digital output
Inversion out 5	1271	I/O CONFIG \ Digital output
Inversion out 6	1272	I/O CONFIG \ Digital output
Inversion out 7	1273	I/O CONFIG \ Digital output
Inversion out 8	1274	I/O CONFIG \ Digital output
Inversion relay 2	1275	I/O CONFIG \ Digital output
Jog -	399	FUNCTIONS \ Jog function
Jog +	398	FUNCTIONS \ Jog function
Jog operation	265	FUNCTIONS \ Jog function
Jog reference [FF]	266	FUNCTIONS \ Jog function
Jog selection	375	FUNCTIONS \ Jog function
Jog stop control	630	FUNCTIONS \ Stop control
Jog TW enable	1256	OPTIONS \ TORQUE WINDER \ Speed demand
Jog TW speed [%]	1255	OPTIONS \ TORQUE WINDER \ Speed demand
Latch	194	CONFIGURATION \ Prog alarms \ Failure supply
Latch	355	CONFIGURATION \ Prog alarms \ External fault
Latch	357	CONFIGURATION \ Prog alarms \ Undervoltage
Latch	361	CONFIGURATION \ Prog alarms \ Overvoltage
Latch	363	CONFIGURATION \ Prog alarms \ Overcurrent
Latch	471	CONFIGURATION \ Prog alarms \ Field loss
Latch	633	CONFIGURATION \ Prog alarms \ Bus loss
Latch	729	CONFIGURATION \ Prog alarms \ Enable seq err
Life time [h.min]	235	SPEC FUNCTIONS
Line acc [%]	1184	OPTIONS \ TORQUE WINDER \ Torque calculat \ Comp calculat
Line acc status	1188	OPTIONS \ TORQUE WINDER \ Torque calculat \ Comp calculat
Line dec [%]	1185	OPTIONS \ TORQUE WINDER \ Torque calculat \ Comp calculat
Line dec status	1189	OPTIONS \ TORQUE WINDER \ Torque calculat \ Comp calculat
Line fast stop [%]	1186	OPTIONS \ TORQUE WINDER \ Torque calculat \ Comp calculat
Line fstp status	1190	OPTIONS \ TORQUE WINDER \ Torque calculat \ Comp calculat
Line spd source	1204	OPTIONS \ TORQUE WINDER \ Diam Calculatio
Line speed [%]	1160	OPTIONS \ TORQUE WINDER \ Diam Calculatio
Line speed gain	1156	OPTIONS \ TORQUE WINDER \ Diam Calculatio
Load comp [%]	698	SPEED REGULAT \ Droop function
Load default	258	SPEC FUNCTIONS
Lock speed I	348	SPEED REGULAT
Lock speed reg	322	SPEED REGULAT
Main commands	252	CONFIGURATION
Main commands	252	START UP
Mains frequency [Hz]	588	MONITOR \ Measurements
Mains voltage [V]	466	DRIVE STATUS
Mains voltage [V]	466	MONITOR \ Measurements
Malfunction code	57	DRIVECOM
Mat width [%]	1173	OPTIONS \ TORQUE WINDER \ Torque calculat \ Comp calculat
Max deviation	796	OPTIONS \ PID \ Diameter calc
Max out voltage [V]	175	CONFIGURATION
Max out voltage [V]	175	START UP \ Motor data
Maximum diameter [m]	1153	OPTIONS \ TORQUE WINDER \ Diam Calculatio
Minimum diameter [mm]	799	OPTIONS \ TORQUE WINDER \ Diam Calculatio
Minimum diameter [cm]	799	OPTIONS \ PID \ Diameter calc

Parameter	No.	Position
Motor current [%]	199	CURRENT REGULAT
Motor current [%]	199	DRIVE STATUS
Motor current [%]	199	MONITOR \ Measurements
Motor max speed [rpm]	162	CONFIGURATION \ Speed fbk
Motor max speed [rpm]	162	START UP \ Motor data
Motor nom flux [A]	280	FLUX REGULATION \ Flux \ if curve
Motor nom flux [A]	280	START UP \ Motor data
Motor pot down	397	FUNCTIONS \ Motor pot
Motor pot oper	247	FUNCTIONS \ Motor pot
Motor pot reset	249	FUNCTIONS \ Motor pot
Motor pot sign	248	FUNCTIONS \ Motor pot
Motor pot up	396	FUNCTIONS \ Motor pot
Mul gain	486	SPEC FUNCTIONS \ Links \ Link 1
Mul gain	555	SPEC FUNCTIONS \ Links \ Link 2
Mul gain	1220	SPEC FUNCTIONS \ Links \ Link 3
Mul gain	1229	SPEC FUNCTIONS \ Links \ Link 4
Mul gain	1238	SPEC FUNCTIONS \ Links \ Link 5
Mul gain	1247	SPEC FUNCTIONS \ Links \ Link 6
Multi speed 1 [FF]	154	FUNCTIONS \ Multi speed fct
Multi speed 2 [FF]	155	FUNCTIONS \ Multi speed fct
Multi speed 3 [FF]	156	FUNCTIONS \ Multi speed fct
Multi speed 4 [FF]	157	FUNCTIONS \ Multi speed fct
Multi speed 5 [FF]	158	FUNCTIONS \ Multi speed fct
Multi speed 6 [FF]	159	FUNCTIONS \ Multi speed fct
Multi speed 7 [FF]	160	FUNCTIONS \ Multi speed fct
Multispeed sel	208	FUNCTIONS \ Multi speed fct
Nom flux curr [A]	374	FLUX REGULATION \ Flux \ if curve
Nom flux curr [A]	374	START UP
Offset acc time [s]	1198	OPTIONS \ TORQUE WINDER \ Speed demand
Offset input 1	74	I/O CONFIG \ Analog inputs \ Analog input 1
Offset input 1	74	START UP \ Analog inputs \ Analog input 1
Offset input 2	79	I/O CONFIG \ Analog inputs \ Analog input 2
Offset input 2	79	START UP \ Analog inputs \ Analog input 2
Offset input 3	84	I/O CONFIG \ Analog inputs \ Analog input 3
Offset input 3	84	START UP \ Analog inputs \ Analog input 3
Ok relay funct	412	CONFIGURATION
Ok relay open	195	CONFIGURATION \ Prog alarms \ Failure supply
Ok relay open	356	CONFIGURATION \ Prog alarms \ External fault
Ok relay open	358	CONFIGURATION \ Prog alarms \ Undervoltage
Ok relay open	362	CONFIGURATION \ Prog alarms \ Overvoltage
Ok relay open	364	CONFIGURATION \ Prog alarms \ Overcurrent
Ok relay open	367	CONFIGURATION \ Prog alarms \ Overtemp motor
Ok relay open	370	CONFIGURATION \ Prog alarms \ Heatsink
Ok relay open	387	CONFIGURATION \ Prog alarms \ Hw opt1 failure
Ok relay open	472	CONFIGURATION \ Prog alarms \ Field loss
Ok relay open	477	CONFIGURATION \ Prog alarms \ Speed fbk loss
Ok relay open	635	CONFIGURATION \ Prog alarms \ Bus loss
Ok relay open	640	CONFIGURATION \ Prog alarms \ Opt2 failure
Ok relay open	730	CONFIGURATION \ Prog alarms \ Enable seq err

Parameter	No.	Position
Opening delay	1263	FUNCTIONS \ Brake control
Out vlt level	921	FLUX REGULATION
Output offset	491	SPEC FUNCTIONS \ Links \ Link 1
Output offset	560	SPEC FUNCTIONS \ Links \ Link 2
Output offset	1225	SPEC FUNCTIONS \ Links \ Link 3
Output offset	1234	SPEC FUNCTIONS \ Links \ Link 4
Output offset	1243	SPEC FUNCTIONS \ Links \ Link 5
Output offset	1252	SPEC FUNCTIONS \ Links \ Link 6
Output power	1052	DRIVE STATUS
Output power	1052	MONITOR \ Measurements
Output voltage [V]	233	DRIVE STATUS
Output voltage [V]	233	MONITOR \ Measurements
Overcurrent thr [%]	584	CONFIGURATION \ Prog alarms \ Overcurrent
Overcurrent thr [%]	584	START UP \ Alarms
Overld available	406	FUNCTIONS \ Overload contr
Overload current [%]	312	FUNCTIONS \ Overload contr
Overload current [%]	312	START UP \ Overload contr
Overload mode	318	FUNCTIONS \ Overload contr
Overload mode	318	START UP \ Overload contr
Overload state	407	FUNCTIONS \ Overload contr
Overload time [s]	310	FUNCTIONS \ Overload contr
Overload time [s]	310	START UP \ Overload contr
P init gain PID	793	OPTIONS \ PID \ PI control
Pad 0	503	SPEC FUNCTIONS \ Pad Parameters
Pad 1	504	SPEC FUNCTIONS \ Pad Parameters
Pad 2	505	SPEC FUNCTIONS \ Pad Parameters
Pad 3	506	SPEC FUNCTIONS \ Pad Parameters
Pad 4	507	SPEC FUNCTIONS \ Pad Parameters
Pad 5	508	SPEC FUNCTIONS \ Pad Parameters
Pad 6	509	SPEC FUNCTIONS \ Pad Parameters
Pad 7	510	SPEC FUNCTIONS \ Pad Parameters
Pad 8	511	SPEC FUNCTIONS \ Pad Parameters
Pad 9	512	SPEC FUNCTIONS \ Pad Parameters
Pad 10	513	SPEC FUNCTIONS \ Pad Parameters
Pad 11	514	SPEC FUNCTIONS \ Pad Parameters
Pad 12	515	SPEC FUNCTIONS \ Pad Parameters
Pad 13	516	SPEC FUNCTIONS \ Pad Parameters
Pad 14	517	SPEC FUNCTIONS \ Pad Parameters
Pad 15	518	SPEC FUNCTIONS \ Pad Parameters
Pad A Bit 0	520	SPEC FUNCTIONS \ Pad Parameters
Pad A Bit 1	521	SPEC FUNCTIONS \ Pad Parameters
Pad A Bit 2	522	SPEC FUNCTIONS \ Pad Parameters
Pad A Bit 3	523	SPEC FUNCTIONS \ Pad Parameters
Pad A Bit 4	524	SPEC FUNCTIONS \ Pad Parameters
Pad A Bit 5	525	SPEC FUNCTIONS \ Pad Parameters
Pad A Bit 6	526	SPEC FUNCTIONS \ Pad Parameters
Pad A Bit 7	527	SPEC FUNCTIONS \ Pad Parameters
Pad A Bit 8	528	SPEC FUNCTIONS \ Pad Parameters
Pad A Bit 9	529	SPEC FUNCTIONS \ Pad Parameters

Parameter	No.	Position
Pad A Bit 10	530	SPEC FUNCTIONS \ Pad Parameters
Pad A Bit 11	531	SPEC FUNCTIONS \ Pad Parameters
Pad A Bit 12	532	SPEC FUNCTIONS \ Pad Parameters
Pad A Bit 13	533	SPEC FUNCTIONS \ Pad Parameters
Pad A Bit 14	534	SPEC FUNCTIONS \ Pad Parameters
Pad A Bit 15	535	SPEC FUNCTIONS \ Pad Parameters
Pad B Bit 0	537	SPEC FUNCTIONS \ Pad Parameters
Pad B Bit 1	538	SPEC FUNCTIONS \ Pad Parameters
Pad B Bit 2	539	SPEC FUNCTIONS \ Pad Parameters
Pad B Bit 3	540	SPEC FUNCTIONS \ Pad Parameters
Pad B Bit 4	541	SPEC FUNCTIONS \ Pad Parameters
Pad B Bit 5	542	SPEC FUNCTIONS \ Pad Parameters
Pad B Bit 6	543	SPEC FUNCTIONS \ Pad Parameters
Pad B Bit 7	544	SPEC FUNCTIONS \ Pad Parameters
Pad B Bit 8	545	SPEC FUNCTIONS \ Pad Parameters
Pad B Bit 9	546	SPEC FUNCTIONS \ Pad Parameters
Pad B Bit 10	547	SPEC FUNCTIONS \ Pad Parameters
Pad B Bit 11	548	SPEC FUNCTIONS \ Pad Parameters
Pad B Bit 12	549	SPEC FUNCTIONS \ Pad Parameters
Pad B Bit 13	550	SPEC FUNCTIONS \ Pad Parameters
Pad B Bit 14	551	SPEC FUNCTIONS \ Pad Parameters
Pad B Bit 15	552	SPEC FUNCTIONS \ Pad Parameters
Password 2		SERVICE
Pause time [s]	311	FUNCTIONS \ Overload contr
Pause time [s]	311	START UP \ Overload contr
PD D filter PID [ms]	767	OPTIONS \ PID \ PD control
PD D gain 1 PID [%]	766	OPTIONS \ PID \ PD control
PD D gain 2 PID [%]	789	OPTIONS \ PID \ PD control
PD D gain 3 PID[%]	791	OPTIONS \ PID \ PD control
PD output PID	421	OPTIONS \ PID \ PD control
PD P gain 1 PID [%]	768	OPTIONS \ PID \ PD control
PD P gain 2 PID [%]	788	OPTIONS \ PID \ PD control
PD P gain 3 PID [%]	790	OPTIONS \ PID \ PD control
Percent ref var [%]	116	DRIVECOM
PI bottom lim	785	OPTIONS \ PID \ PI control
PI central v sel	779	OPTIONS \ PID \ PI control
PI central v1	776	OPTIONS \ PID \ PI control
PI central v2	777	OPTIONS \ PID \ PI control
PI central v3	778	OPTIONS \ PID \ PI control
PI central vs0	780	OPTIONS \ PID
PI central vs1	781	OPTIONS \ PID
PI I gain PID	764	OPTIONS \ PID \ PI control
PI integr freeze	783	OPTIONS \ PID \ PI control
PI output PID	771	OPTIONS \ PID \ PI control
PI P gain PID	765	OPTIONS \ PID \ PI control
PI steady thr	695	OPTIONS \ PID \ PI control
PI top lim	784	OPTIONS \ PID \ PI control
PID acc time	1046	OPTIONS \ PID \ PID references
PID clamp	757	OPTIONS \ PID \ PID references

Parameter	No.	Position
PID dec time	1047	OPTIONS \ PID \ PID references
PID err gain	1254	OPTIONS \ PID \ PID references
PID error	759	OPTIONS \ PID \ PID references
PID feed-back	763	OPTIONS \ PID \ PID references
PID offs. Sel	762	OPTIONS \ PID \ PID references
PID offset 0	760	OPTIONS \ PID \ PID references
PID offset 1	761	OPTIONS \ PID \ PID references
PID out scale	773	OPTIONS \ PID \ PID target
PID out sign PID	772	OPTIONS \ PID \ PD control
PID output	774	OPTIONS \ PID \ PD control
PID source gain	787	OPTIONS \ PID \ PID source
PID source	786	OPTIONS \ PID \ PID source
PID steady delay	731	OPTIONS \ PID \ PI control
PID target	782	OPTIONS \ PID \ PID target
Positioning spd [rpm]	795	OPTIONS \ PID \ Diameter calc
Prop filter [ms]	444	SPEED REGULAT
Prop filter [ms]	444	TUNING
Pword 1	85	CONFIGURATION
QStp delta speed [FF]	37	DRIVECOM \ Quick stop
QStp delta speed [FF]	37	RAMP \ Quick stop
QStp delta time [s]	38	DRIVECOM \ Quick stop
QStp delta time [s]	38	RAMP \ Quick stop
Quick stop	343	DRIVECOM \ Quick stop
R&L Search	452	CURRENT REGULAT
R&L Search	452	START UP
R&L Search	452	TUNING
Ramp -	347	RAMP
Ramp +	346	RAMP
Ramp +/- delay [ms]	20	RAMP
Ramp in = 0	345	RAMP
Ramp out = 0	344	RAMP
Ramp outp (rpm)	113	MONITOR \ Measurements \ Speed \ Speed in rpm
Ramp output (%)	114	MONITOR \ Measurements \ Speed \ Speed in %
Ramp output (d) [FF]	112	MONITOR \ Measurements \ Speed \ Speed in DRC [ ]
Ramp ref (%)	111	MONITOR \ Measurements \ Speed \ Speed in %
Ramp ref (d) [FF]	109	MONITOR \ Measurements \ Speed \ Speed in DRC [ ]
Ramp ref (rpm)	110	MONITOR \ Measurements \ Speed \ Speed in rpm
Ramp ref 1 (%)	47	INPUT VARIABLES \ Ramp ref \ Ramp ref 1
Ramp ref 1 [FF]	44	DRIVE STATUS
Ramp ref 1 [FF]	44	INPUT VARIABLES \ Ramp ref \ Ramp ref 1
Ramp ref 2 (%)	49	INPUT VARIABLES \ Ramp ref \ Ramp ref 2
Ramp ref 2 [FF]	48	INPUT VARIABLES \ Ramp ref \ Ramp ref 2
Ramp sel 0	403	FUNCTIONS \ Multi ramp fct \ Ramp 0 \ Deceleration 3
Ramp sel 1	404	FUNCTIONS \ Multi ramp fct \ Ramp 0 \ Deceleration 3
Ramp selector	202	FUNCTIONS \ Multi ramp fct
Ramp shape	18	RAMP
Real FF PID	418	OPTIONS \ PID \ PI control
Ref 0 level [FF]	106	SPEED REGULAT \ Spd zero logic
Ref line spd	1286	OPTIONS \ TORQUE WINDER \ diam Calculation

Parameter	No.	Position
Ref spd source	1284	OPTIONS \ TORQUE WINDER \ diam Calculation
Ref speed gain	1285	OPTIONS \ TORQUE WINDER \ diam Calculation
Ref speed thr [%]	1155	OPTIONS \ TORQUE WINDER \ diam Calculation
Refresh enc 1	649	CONFIGURATION \ Encoder inputs
Refresh enc 1	649	CONFIGURATION \ Speed fbk
Refresh enc 2	652	CONFIGURATION \ Encoder inputs
Refresh enc 2	652	CONFIGURATION \ Speed fbk
Refresh enc 2	652	START UP \ Speed feedback
Relay 2	629	I/O CONFIG \ Digital outputs
Reset flux / if	920	FLUX REGULATION \ Flux \ if curve
Restart time [ms]	359	CONFIGURATION \ Prog alarms \ Undervoltage
Restart time [ms]	474	CONFIGURATION \ Prog alarms \ Field loss
Restart time [ms]	483	CONFIGURATION \ Prog alarms \ Overvoltage
Restart time [ms]	501	CONFIGURATION \ Prog alarms \ External fault
Restart time [ms]	585	CONFIGURATION \ Prog alarms \ Overcurrent
Restart time [ms]	637	CONFIGURATION \ Prog alarms \ Bus loss
Reverse sign	294	RAMP
Roll diameter [m]	1154	OPTIONS \ TORQUE WINDER \ Diam Calculatio
S acc t const [ms]	663	RAMP
S acc t const 0 [ms]	665	FUNCTIONS \ Multi ramp fct \ Ramp 0 \ Acceleration 0
S acc t const 1 [ms]	667	FUNCTIONS \ Multi ramp fct \ Ramp 0 \ Acceleration 1
S acc t const 2 [ms]	669	FUNCTIONS \ Multi ramp fct \ Ramp 0 \ Acceleration 2
S acc t const 3 [ms]	671	FUNCTIONS \ Multi ramp fct \ Ramp 0 \ Acceleration 3
S dec t const [ms]	664	RAMP
S dec t const 0 [ms]	666	FUNCTIONS \ Multi ramp fct \ Ramp 0 \ Deceleration 0
S dec t const 1 [ms]	668	FUNCTIONS \ Multi ramp fct \ Ramp 0 \ Deceleration 1
S dec t const 2 [ms]	670	FUNCTIONS \ Multi ramp fct \ Ramp 0 \ Deceleration 2
S dec t const 3 [ms]	672	FUNCTIONS \ Multi ramp fct \ Ramp 0 \ Deceleration 3
S shape t const [ms]	19	RAMP
Save parameters	256	SPEC FUNCTIONS
Save parameters	256	START UP
Save parameters	256	TUNING
Scale input 1	72	I/O CONFIG \ Analog inputs \ Analog input 1
Scale input 1	72	START UP \ Analog inputs \ Analog input 1
Scale input 2	77	I/O CONFIG \ Analog inputs \ Analog input 2
Scale input 2	77	START UP \ Analog inputs \ Analog input 2
Scale input 3	82	I/O CONFIG \ Analog inputs \ Analog input 3
Scale input 3	82	START UP \ Analog inputs \ Analog input 3
Scale output 1	62	I/O CONFIG \ Analog outputs \ Analog output 1
Scale output 2	63	I/O CONFIG \ Analog outputs \ Analog output 2
Scale output 3	64	I/O CONFIG \ Analog outputs \ Analog output 3
Scale output 4	65	I/O CONFIG \ Analog outputs \ Analog output 4
Select adap type	182	ADD SPEED FUNCT \ Adaptive spd reg
Select enc 1	1020	I/O CONFIG \ Encoder inputs
Select enc 2	1021	I/O CONFIG \ Encoder inputs
Select input 1	70	I/O CONFIG \ Analog inputs \ Analog input 1
Select input 1	70	START UP \ Analog inputs \ Analog input 1
Select input 2	75	I/O CONFIG \ Analog inputs \ Analog input 2
Select input 2	75	START UP \ Analog inputs \ Analog input 2

Parameter	No.	Position
Select input 3	80	I/O CONFIG \ Analog inputs \ Analog input 3
Select input 3	80	START UP \ Analog inputs \ Analog input 3
Select output 1	66	I/O CONFIG \ Analog outputs \ Analog output 1
Select output 2	67	I/O CONFIG \ Analog outputs \ Analog output 2
Select output 3	68	I/O CONFIG \ Analog outputs \ Analog output 3
Select output 4	69	I/O CONFIG \ Analog outputs \ Analog output 4
Ser baudrate sel	326	CONFIGURATION \ Set serial comm
Ser answer delay	408	CONFIGURATION \ Set serial comm
Ser protocol sel	323	CONFIGURATION \ Set serial comm
Set delay [ms]	105	ADD SPEED FUNCT \ Speed control
Set error [FF]	104	ADD SPEED FUNCT \ Speed control
Set flux / if	919	FLUX REGULATION \ Flux / if curve
Set speed.	394	ADD SPEED FUNCT \ Speed control
Size selection	464	CONFIGURATION \ Drive type
Software version	331	CONFIGURATION \ Drive type
Source	484	SPEC FUNCTIONS \ Links \ Link 1
Source	553	SPEC FUNCTIONS \ Links \ Link 2
Source	1218	SPEC FUNCTIONS \ Links \ Link 3
Source	1227	SPEC FUNCTIONS \ Links \ Link 4
Source	1236	SPEC FUNCTIONS \ Links \ Link 5
Source	1245	SPEC FUNCTIONS \ Links \ Link 6
Spd 0 trip delay [ms]	627	FUNCTIONS \ Stop control
Spd match acc [s]	1196	OPTIONS \ TORQUE WINDER \ Speed demand
Spd match compl	1203	OPTIONS \ TORQUE WINDER \ Speed demand
Spd match dec [s]	1197	OPTIONS \ TORQUE WINDER \ Speed demand
Spd match gain [%]	1200	OPTIONS \ TORQUE WINDER \ Speed demand
Spd match torque [%]	1216	OPTIONS \ TORQUE WINDER \ Speed demand
Spd threshold - [FF]	102	ADD SPEED FUNCT \ Speed control
Spd threshold + [FF]	101	ADD SPEED FUNCT \ Speed control
Spd threshold	393	ADD SPEED FUNCT \ Speed control
Spd=0 P gain [%]	126	SPEED REGULAT \ Spd zero logic
Speed base value [FF]	45	CONFIGURATION
Speed base value [FF]	45	DRIVECOM
Speed base value [FF]	45	START UP
Speed demand En	1215	OPTIONS \ TORQUE WINDER \ Speed demand
Speed draw out (%)	1019	FUNCTIONS \ Speed draw
Speed draw out (d)	1018	FUNCTIONS \ Speed draw
Speed fbk error [%]	455	CONFIGURATION \ Speed fbk
Speed fbk sel	414	CONFIGURATION \ Speed fbk
Speed fbk sel	414	START UP \ Speed feedback
Speed I [%]	88	REG PARAMETERS \ Percent values \ Speed regulator
Speed I [%]	88	REG PARAMETERS \ Self tuning
Speed I [%]	88	START UP \ Speed self tune
Speed I [%]	88	TUNING
Speed I [%]	88	TUNING \ Speed self tune
Speed I base [A/rpm·ms]	94	REG PARAMETERS \ Base values \ Speed regulator
Speed I bypass [%]	460	REG PARAMETERS \ Percent values \ Speed regulator
Speed I in use [%]	100	REG PARAMETERS \ In use values
Speed I Nw [%]	1033	REG PARAMETERS \ Self tuning

Parameter	No.	Position
Speed I Nw [%]	1033	START UP \ Speed self tune
Speed I Nw [%]	1033	TUNING \ Speed self tune
Speed input perc [%]	46	DRIVECOM
Speed input var [FF]	44	DRIVECOM
Speed limited	372	LIMITS \ Speed limits \ Speed min/max
Speed match	1195	OPTIONS \ TORQUE WINDER \ Speed demand
Speed max amount [FF]	2	DRIVECOM \ Speed amount
Speed max amount [FF]	2	LIMITS \ Speed limits \ Speed amount
Speed max amount [FF]	2	START UP \ Limits
Speed max neg [FF]	4	DRIVECOM \ Speed min/max
Speed max neg [FF]	4	LIMITS \ Speed limits \ Speed min/max
Speed max pos [FF]	3	DRIVECOM \ Speed min/max
Speed max pos [FF]	3	LIMITS \ Speed limits \ Speed min/max
Speed min amount [FF]	1	DRIVECOM \ Speed amount
Speed min amount [FF]	1	LIMITS \ Speed limits \ Speed amount
Speed min amount [FF]	1	START UP \ Limits
Speed min neg [FF]	6	DRIVECOM \ Speed min/max
Speed min neg [FF]	6	LIMITS \ Speed limits \ Speed min/max
Speed min pos [FF]	5	DRIVECOM \ Speed min/max
Speed min pos [FF]	5	LIMITS \ Speed limits \ Speed min/max
Speed offset	563	CONFIGURATION \ Speed fbk
Speed offset	563	START UP \ Speed feedback
Speed P [%]	87	REG PARAMETERS \ Percent values \ Speed regulator
Speed P [%]	87	REG PARAMETERS \ Self tuning
Speed P [%]	87	START UP \ Speed self tune
Speed P [%]	87	TUNING
Speed P [%]	87	TUNING \ Speed self tune
Speed P base [A/rpm]	93	REG PARAMETERS \ Base values \ Speed regulator
Speed P bypass [%]	459	REG PARAMETERS \ Percent values \ Speed regulator
Speed P in use [%]	99	REG PARAMETERS \ In use values
Speed P Nw [%]	1032	REG PARAMETERS \ Self tuning
Speed P Nw [%]	1032	START UP \ Speed self tune
Speed P Nw [%]	1032	TUNING \ Speed self tune
Speed ratio	1017	FUNCTIONS \ Speed draw
Speed ref (%)	117	MONITOR \ Measurements \ Speed \ Speed in %
Speed ref (d) [FF]	115	MONITOR \ Measurements \ Speed \ Speed in DRC [ ]
Speed ref (rpm)	118	DRIVE STATUS
Speed ref (rpm)	118	MONITOR \ Measurements \ Speed \ Speed in rpm
Speed ref [rpm]	118	SPEED REGULAT
Speed ref 1 (%)	378	INPUT VARIABLES \ Speed ref \ Speed ref 1
Speed ref 1 [FF]	42	INPUT VARIABLES \ Speed ref \ Speed ref 1
Speed Ref 2 (%)	379	INPUT VARIABLES \ Speed ref \ Speed ref 2
Speed ref 2 [FF]	43	INPUT VARIABLES \ Speed ref \ Speed ref 2
Speed ref var [FF]	115	DRIVECOM
Speed reg output [%]	236	SPEED REGULAT
Speed sel 0	400	FUNCTIONS \ Multi speed fct
Speed sel 1	401	FUNCTIONS \ Multi speed fct
Speed sel 2	402	FUNCTIONS \ Multi speed fct
Speed up base [ms]	446	SPEED REGULAT \ Speed up

Parameter	No.	Position
Speed up filter [ms]	447	SPEED REGULAT \ Speed up
Speed up gain [%]	445	SPEED REGULAT \ Speed up
Speed zero delay [ms]	108	ADD SPEED FUNCT \ Speed zero
Speed zero level [FF]	107	ADD SPEED FUNCT \ Speed zero
Speed zero thr	395	ADD SPEED FUNCT \ Speed zero
Speed-0 f weak	499	FLUX REGULATION
Speed-0 f weak	499	START UP
Start	1027	SPEED REGULAT \ Self tuning
Start	1027	START UP \ Speed self tune
Start	1027	TUNING \ Speed self tune
Start/Stop	315	DRIVE STATUS
Start/Stop	315	MONITOR
Start/Stop	315	START UP
Start/Stop	315	TUNING
Static f [%]	1174	OPTIONS \ TORQUE WINDER \ Torque calculat \ Comp calculat
Static f Zero	1287	OPTIONS \ TORQUE WINDER \ Torque calculat \ Comp calculat
Status word	56	DRIVECOM
Stop mode	626	FUNCTIONS \ Stop control
T curr filter	926	MONITOR \ Measurements
T current lim - [%]	9	LIMITS \ Current limits
T current lim [%]	7	LIMITS \ Current limits
T current lim [%]	7	START UP \ Limits
T current lim + [%]	8	LIMITS \ Current limits
T current lim type	715	LIMITS \ Current limits
T current ref [%]	41	CURRENT REGULAT
T current ref [%]	41	MONITOR \ Measurements
T current ref 1 [%]	39	INPUT VARIABLES \ T current ref
T current ref 2 [%]	40	INPUT VARIABLES \ T current ref
Tacho scale	562	CONFIGURATION \ Speed fbk
Tacho scale	562	START UP \ Speed feedback
Take val	1028	SPEED REGULAT \ Self tuning
Take val	1028	START UP \ Speed self tune
Take val	1028	TUNING \ Speed self tune
Taper enable	1176	OPTIONS \ TORQUE WINDER \ Torque calculat \ Taper function
Tension red [%]	1179	OPTIONS \ TORQUE WINDER \ Torque calculat \ Taper function
Tension ref [%]	1180	OPTIONS \ TORQUE WINDER \ Torque calculat
Tension ref [%]	1180	OPTIONS \ TORQUE WINDER \ Torque calculat \ Taper function
Tension scale [%]	1181	OPTIONS \ TORQUE WINDER \ Torque calculat
Test T curr lim	1048	SPEED REGULAT \ Self tuning
Test T curr lim	1048	START UP \ Speed self tune
Test T curr lim	1048	TUNING \ Speed self tune
Threshold delay [ms]	103	ADD SPEED FUNCT \ Speed control
Time acc/dec min [s]	1182	OPTIONS \ TORQUE WINDER \ Torque calculat \ Comp calculat
Torque const	1013	SPEED REGULAT \ Inertia \ loss cp
Torque current [%]	1193	OPTIONS \ TORQUE WINDER \ Torque calculat
Torque reduct	342	LIMITS \ Current limits
Torque winder En	1209	OPTIONS \ TORQUE WINDER
Trip cont delay [ms]	628	FUNCTIONS \ Stop control
Tune value inp 1	73	I/O CONFIG \ Analog inputs \ Analog input 1

Parameter	No.	Position
Tune value inp 2	78	I/O CONFIG \ Analog inputs \ Analog input 2
Tune value inp 3	83	I/O CONFIG \ Analog inputs \ Analog input 3
Undervolt thr [V]	481	CONFIGURATION \ Prog alarms \ Undervoltage
Undervolt thr [V]	481	START UP \ Alarms
Variable J comp [%]	1171	OPTIONS \ TORQUE WINDER \ Torque calculat \ Comp calculat
Virtual dig inp	582	MONITOR \ I/O
Virtual dig out	583	MONITOR \ I/O
Voltage I [%]	494	REG PARAMETERS \ Percent values \ Voltage reg
Voltage I [%]	494	TUNING
Voltage I base [f%/V·ms]	496	REG PARAMETERS \ Base values \ Voltage reg
Voltage P [%]	493	REG PARAMETERS / Percent values / Voltage reg
Voltage P [%]	493	TUNING
Voltage P base [f%/V]	495	REG PARAMETERS / Base values / Voltage reg
W gain [%]	1202	OPTIONS \ TORQUE WINDER \ Speed demand
W offset [rpm]	1199	OPTIONS \ TORQUE WINDER \ Speed demand
W reference [rpm]	1217	OPTIONS \ TORQUE WINDER \ Speed demand
W target	1210	OPTIONS \ TORQUE WINDER \ Speed demand
Wind/unwind	1187	OPTIONS \ TORQUE WINDER \ Diam Calculatio
Winder side	1201	OPTIONS \ TORQUE WINDER \ Speed demand
Zero torque	353	CURRENT REGULAT

10.4. LIST OF HIGH PRIORITY PARAMETERS

Access mode OPT2-S. When a OPT2 card (e.g. DGFC Digital General Function Card) is used a subset of the TPD32 parameters can be exchanged with the optional card through the **Automatic synchronous communication**. For more details see the DGFC technical documentation.

Parameter	No.	Format	Value			Read/ Write
			min	max	factory	
T current lim + [CURR]	8	U16	0	2 * TOP_CURR	TOP_CURR	R/W
T current lim - [CURR]	9	U16	0	2 * TOP_CURR	TOP_CURR	R/W
In use Tcur lim+ [CURR]	10	U16	0	2 * TOP_CURR	-	R
In use Tcur lim- [CURR]	11	U16	0	2 * TOP_CURR	-	R
Current lim red [CURR]	13	U16	0	2 * TOP_CURR	TOP_CURR	R
T current ref 1 [CURR]	39	I16	-2 * TOP_CURR	+2 * TOP_CURR	0	R/W
T current ref 2 [CURR]	40	I16	-2 * TOP_CURR	+2 * TOP_CURR	0	R/W
T current ref [CURR]	41	I16	-2 * TOP_CURR	+2 * TOP_CURR	-	R
Speed ref 1 [SPD]	42	I16	-32767	32767	0	R/W
Speed ref 2 [SPD]	43	I16	-32767	32767	0	R/W
Ramp ref 1 [SPD]	44	I16	-32767	32767	0	R/W
Ramp ref 2 [SPD]	48	I16	-32767	32767	0	R/W
Control word	55	U16				R/W
Status word	56	U16				R
Ramp ref [SPD]	110	I16	-32767	32767	-	R
Ramp outp [SPD]	113	I16	-32767	32767	-	R
Speed ref [SPD]	118	I16	-32767	32767	-	R
Actual spd [SPD]	122	I16	-32767	32767	-	R
Adap reference [SPD]	183	I16	-32767	32767	4000	R/W
Enc 1 position [ENC_PLS] *	197	I16	-32767	32767	-	R
Enc 2 position [ENC_PLS] *	198	I16	-32767	32767	-	R
Enc 1 last time [ENC_TIM] *	204	U32	0	2^{32}-1	-	R
Enc 1 last time high [ENC_TIM] *	205	U16	0	65535	-	R
Enc 2 last time {ENC_TIM] *	206	U32	0	2^{32}-1	-	R
Enc 2 last time high {ENC_TIM] *	207	U16	0	65535	-	R
Speed reg output [CURR]	236	I16	-2 * TOP_CURR	+2 * TOP_CURR	-	R
Lock speed reg	322	U16	0	1	0	R/W
Enc 2 speed [SPD] *	420	I16	-37767	32767	-	R
Enc 1 speed [SPD] *	427	I16	-37767	32767	-	R
Flux current max	467	U16	819	16384	16384	R/W
Flux reference	500	U16	0	16384	16384	R
Pad 0	503	I16	-32768	32767	0	R/W
Pad 1	504	I16	-32768	32767	0	R/W
Pad 2	505	I16	-32768	32767	0	R/W
Pad 3	506	I16	-32768	32767	0	R/W
Pad 4	507	I16	-32768	32767	0	R/W
Pad 5	508	I16	-32768	32767	0	R/W
Pad 6	509	I16	-32768	32767	0	R/W
Pad 7	510	I16	-32768	32767	0	R/W
Pad 8	511	I16	-32768	32767	0	R/W
Pad 9	512	I16	-32768	32767	0	R/W
Pad 10	513	I16	-32768	32767	0	R/W

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Parameter	No.	Format	Value			Read/ Write
			min	max	factory	
Pad 11	514	I16	-32768	32767	0	R/W
Pad 12	515	I16	-32768	32767	0	R/W
Pad 13	516	I16	-32768	32767	0	R/W
Pad 14	517	I16	-32768	32767	0	R/W
Pad 15	518	I16	-32768	32767	0	R/W
Bitword pad A	519	U16	0	65535	0	R/W
Bitword pad B	536	U16	0	65535	0	R/W
Dig input term	564	U16	0	65535	-	R
Dig output term	581	U16	0	65535	-	R
Load comp [CURR]	698	I16	-2 * TOP_CURR	+2 * TOP_CURR	-	R
Ind store ctrl	912	U16	0	65535	0	R/W
Index storing	913	U16	0	$+2^{32}-1$	-	R
Out vlt level	921	U16	0	16384	16384	R/W
F act speed (rpm) [spd]	924	I16	-32768	32767	-	R
F act speed (d) [spd]	925	I16	-32768	32767	-	R
F T curr % [curr]	928	I16	-2 * TOP_CURR	+2 * TOP_CURR	-	R
Speed ratio	1017	I16	0	32767	+10000	R/W
Spd draw out (d) [SPD]	1018	I16	-32768	32767	-	R

T1004bi

NOTE !

1) [**SPD**] = Speed settings are xpressed in RPM · 4

2) [**CURR**] = Current settings are expressed: European Drive rated current / 2000 [CURR] = Motor Amps (2000 is **TOP_CURR**

3) [**ENC_PLS**] = Encoders positions are expressed in pulses · 4

4) [**ENC_TIM**] = Encoders **last time**(s) are expressed in 50nS units (1=50nS)

5) Encoder 2 parameters (marked with "*" in the table) can be read by the DGFC only if the parameter **Speed fbk sel** = encoder 2

6) Encoder 1 parameters (marked with "*" in the table) can be read by the DGFC only if
   - The parameter **Speed fbk sel** = Encoder 2
   - A digital encoder is used as encoder 1 (interfacing with the converter by means of the DEII card).

11. REPLACEMENT PARTS

11.1. HARDWARE CONFIGURATION (CARDS / DIP SWITCHES / JUMPERS)

The functionality and use of the TPD32 converter are the same for the whole device range. Different power and control cards are mounted depending on the output rated current. The following table indicates the card range for each converter type.

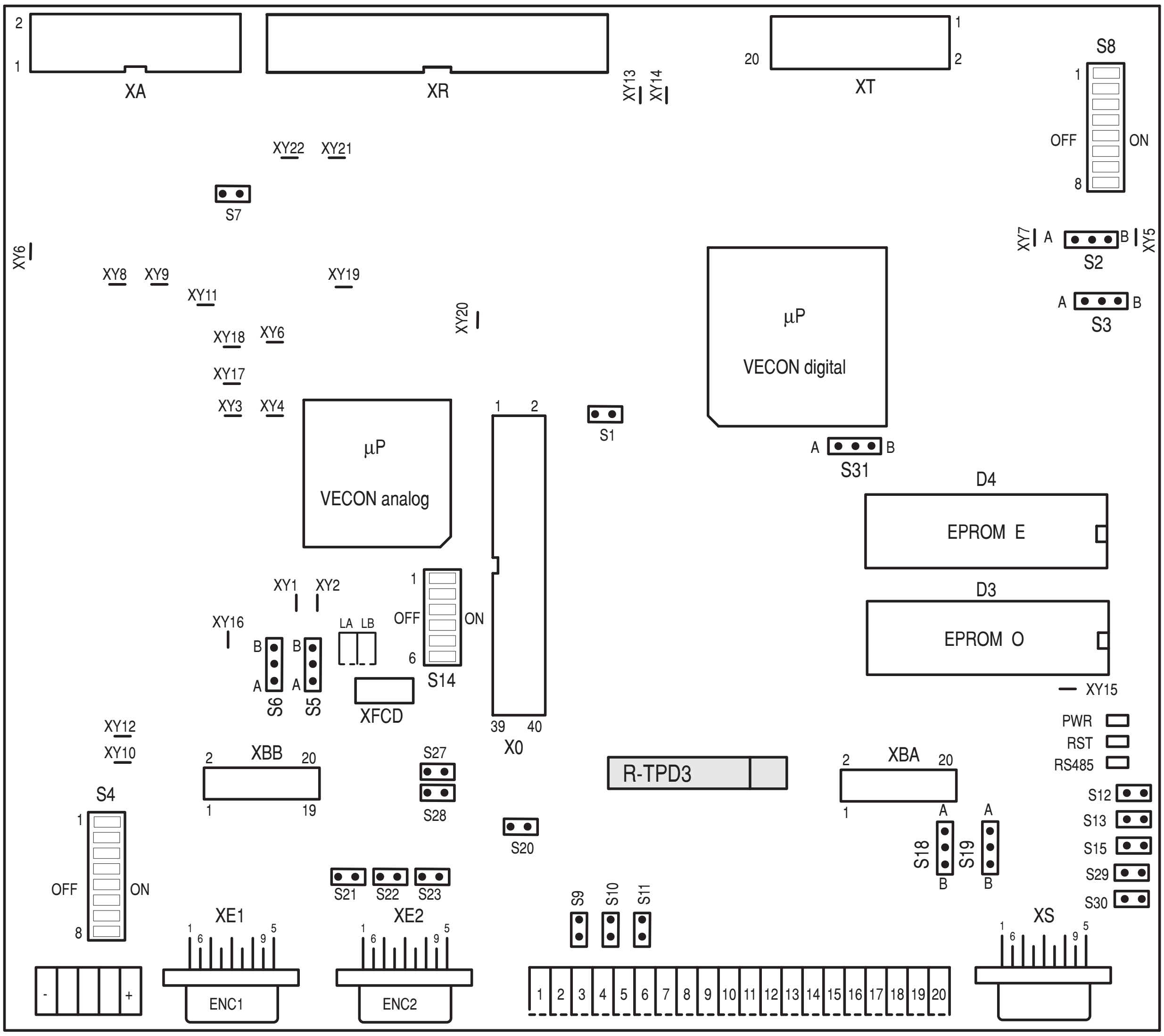
TPD32-400/... , TPD32-500/...

Function	Type	Drawing	Converter size [A]				
			20...40	70	110...185	280...650	770...1050
Regulation	R-TPD3	ESE 2283	X	X	X	X	X
Power / Control	FIR1-41(-2B)	ESE 2135	X	-	-	-	-
	FIR1-51(-2B)*	ESE 2135	X*	-	-	-	-
	FIR1-42(-2B)	ESE 2135	-	X	X	-	-
	FIR1-52(-2B)*	ESE 2135	-	X*	X*	-	-
	FIR2-41(-2B)	ESE 2238	-	-	-	X	-
	FIR2-51(-2B)*	ESE 2238	-	-	-	X*	-
	FIR3-32(-2B)	ESE 2260	-	-	-	-	X
	PBB(-2B)	ESE 2275	X	X	-	-	-
	SW1-31	ESE 2192	X	X	X	-	-
	SW2-32	ESE 2239	-	-	-	X	-
	SW3-32	ESE 2239	-	-	-	-	X
Field	PFC1-32	ESE 2213	X	X	X	-	-
	PFC1A-32*	ESE 2213	X*	X*	X*	-	-
	PFC2-31	ESE 2271	-	-	-	X	-
	SN-FC	ESE 2265	-	-	-	-	X
FIlter	FL-31	ESE 2253	-	-	-	-	X
Snubber	SN4-31	ESE 2246	-	-	-	X	X
	SN5-31*	ESE 2246	-	-	-	X*	X*
I/O expansion	TBO (opt.)	ESE 2121	X	X	X	X	X

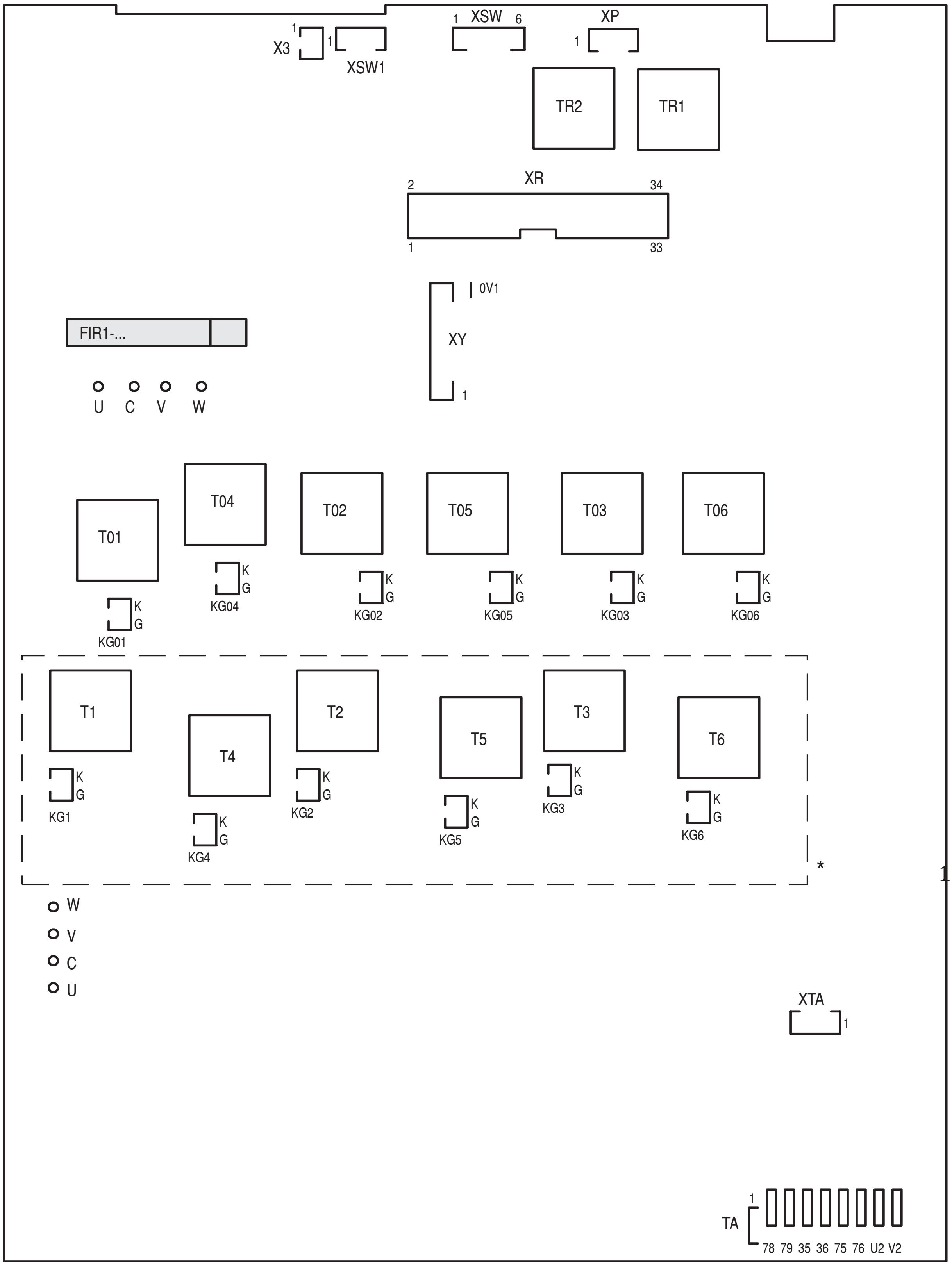
T1101gb

* Used only for TPD32-500/...

11.2. REGULATION CARD R-TPD3G

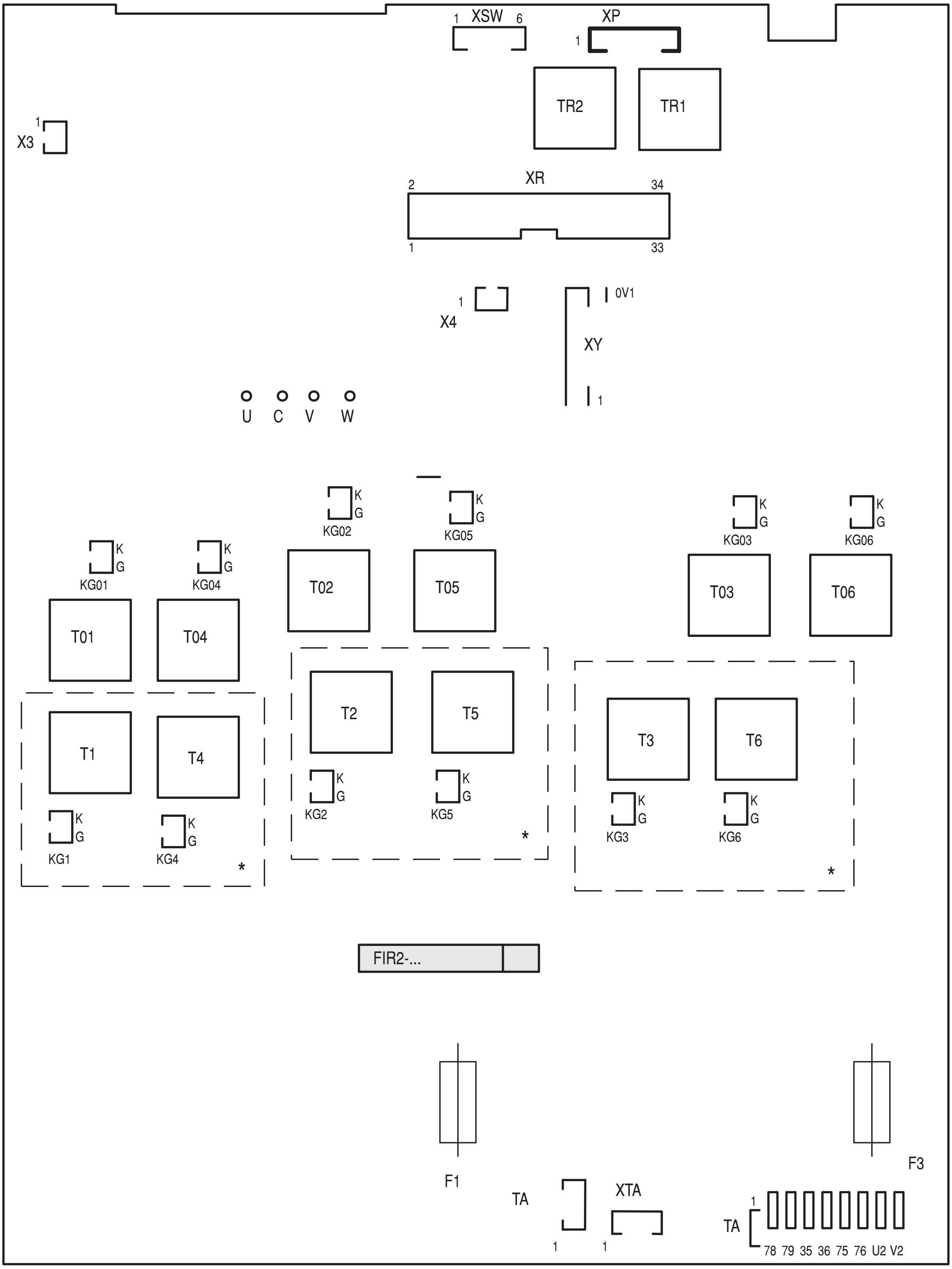


11.3. FIR1-... POWER/DRIVER CARD



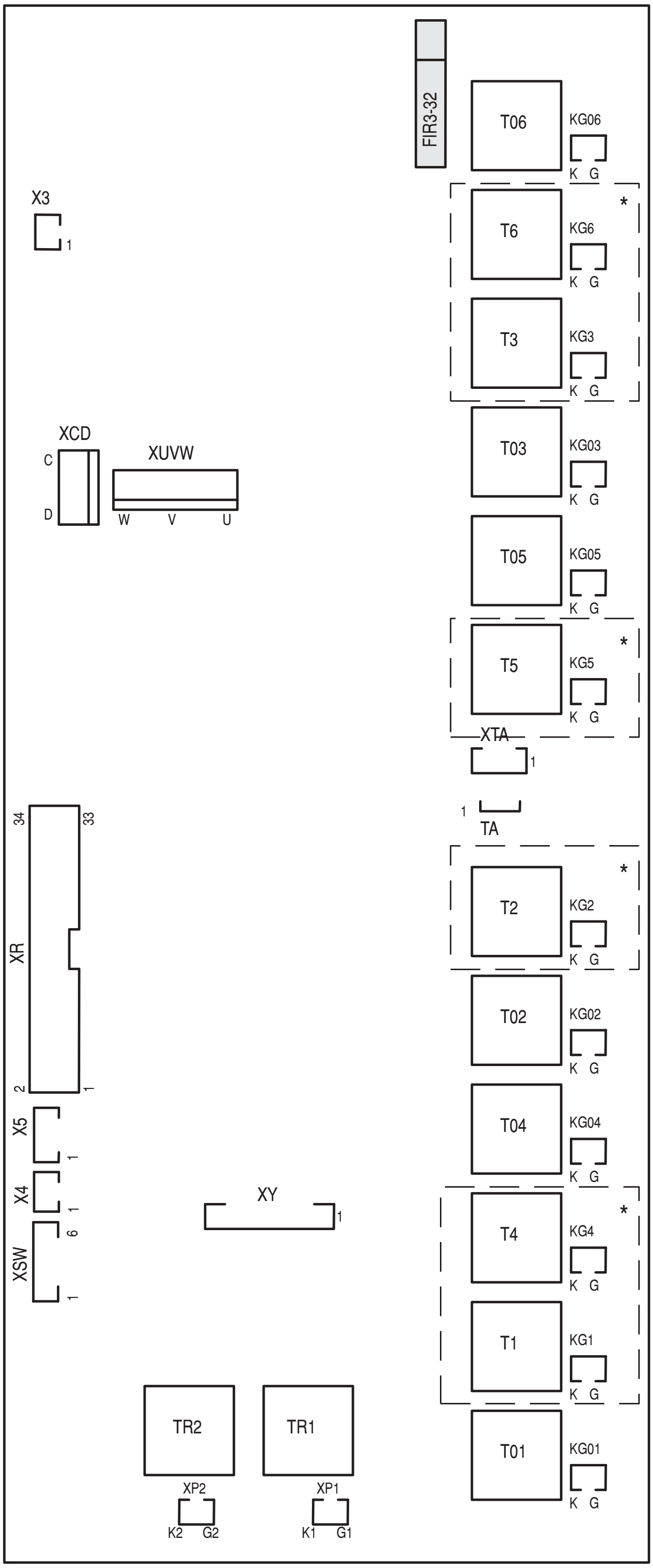
* These components are mounted only on TPD32...-4B version

11.4. FIR2-... POWER/DRIVER CARD



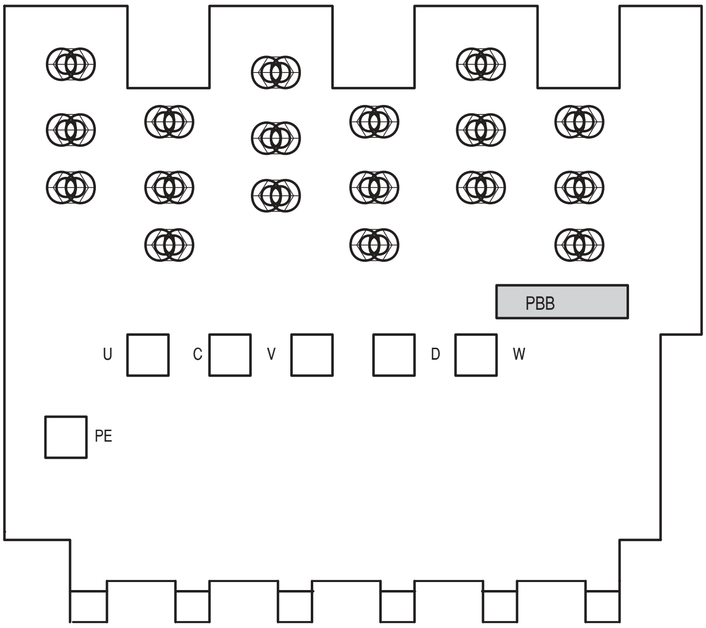
* These components are mounted only on TPD32...-4B version

11.5. FIR3-32 POWER/DRIVER CARD

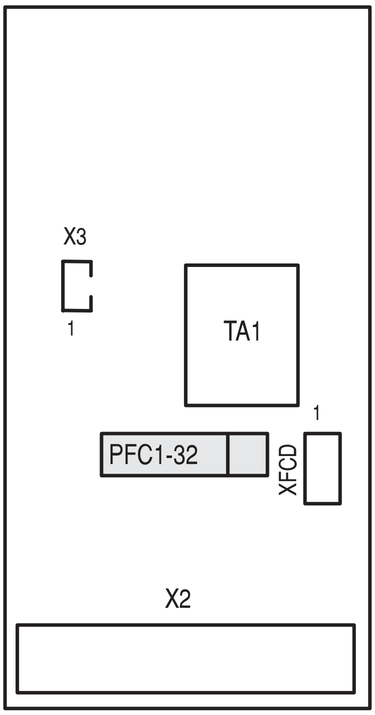


* These components are mounted only on TPD32...-4B version

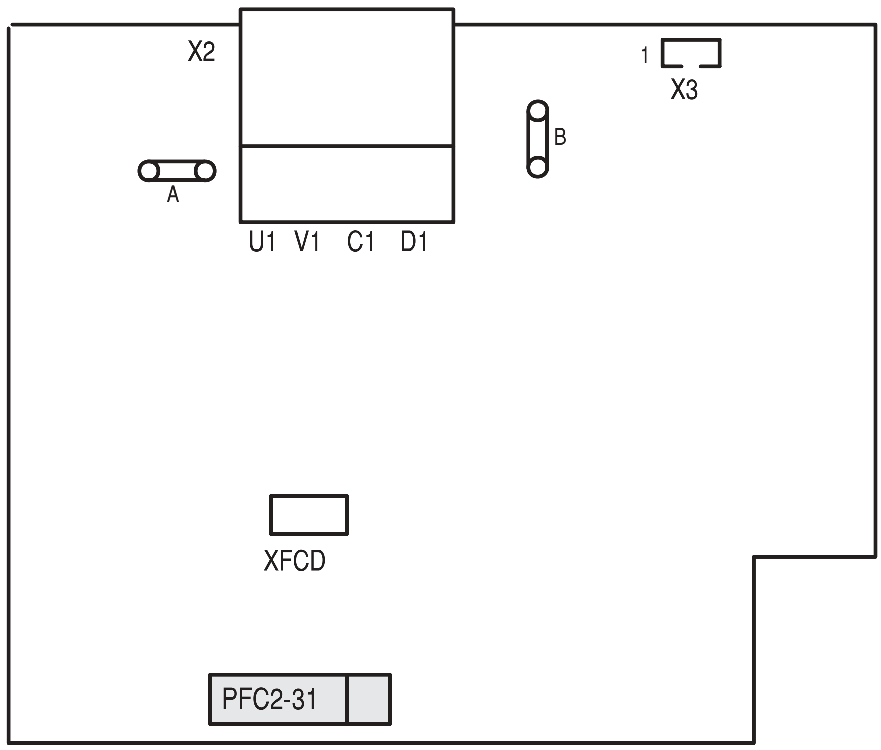
11.6. PBB POWER CONNECTION CARD



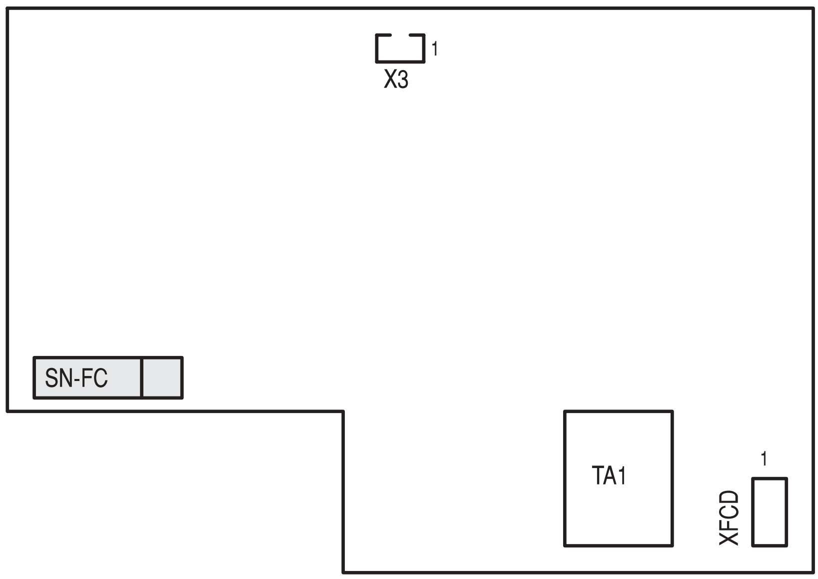
11.7. PFC1-32 FIELD CONVERTER



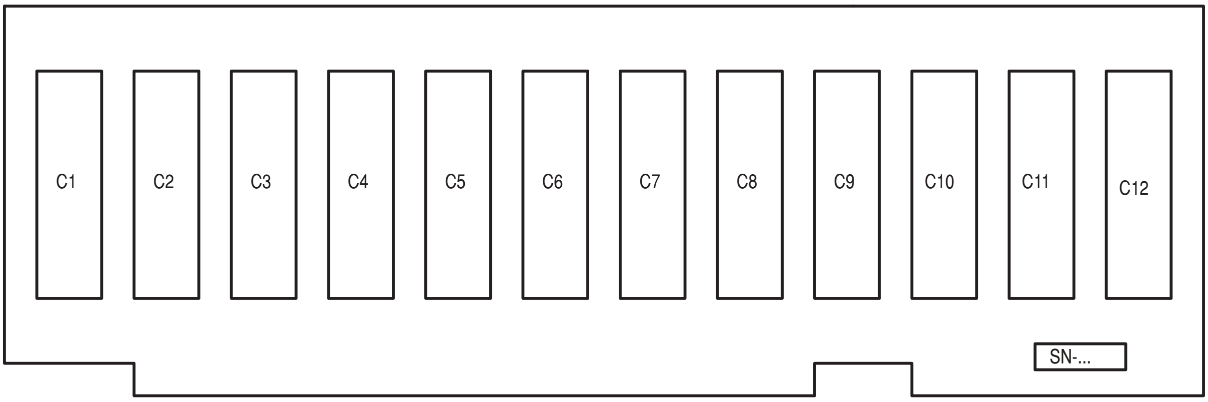
11.8. PFC2-31 FIELD CONVERTER



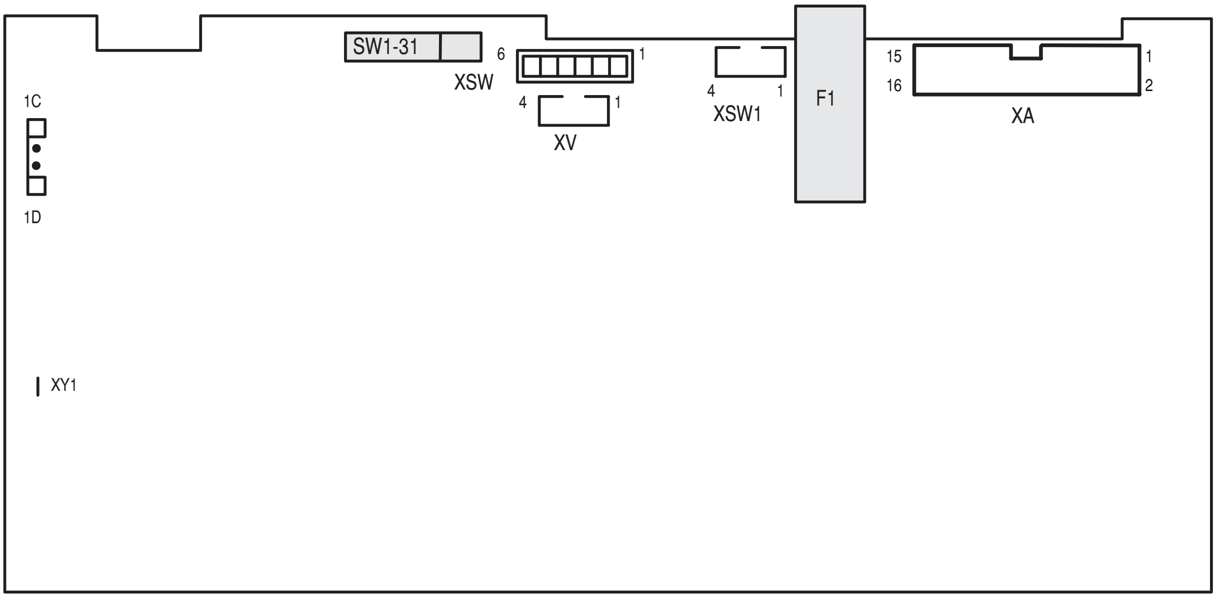
11.9. SN-FC FIELD SNUBBER



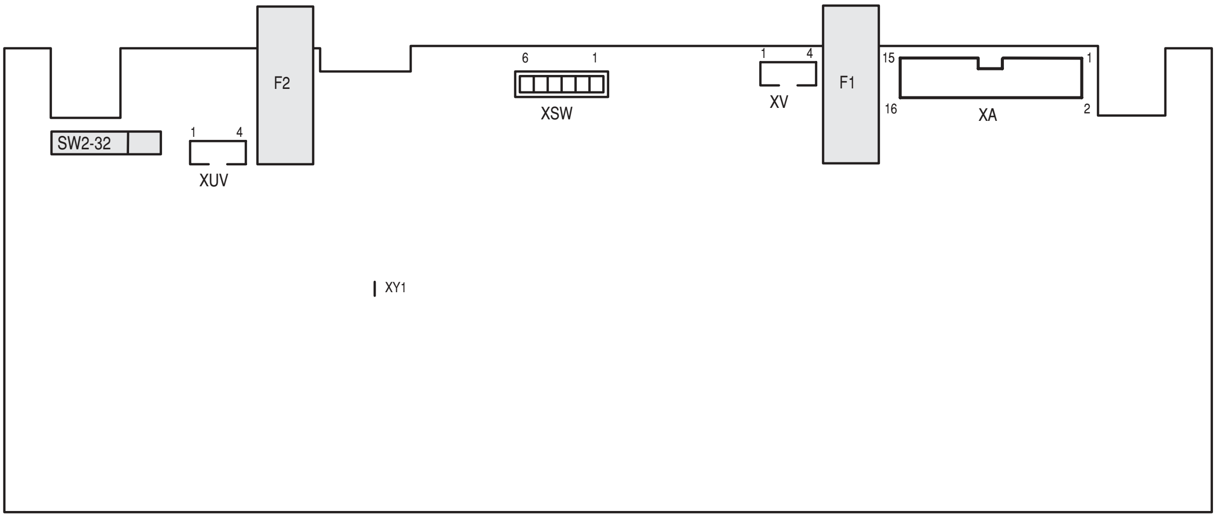
11.10. SN4-31, SN5-31 SNUBBER



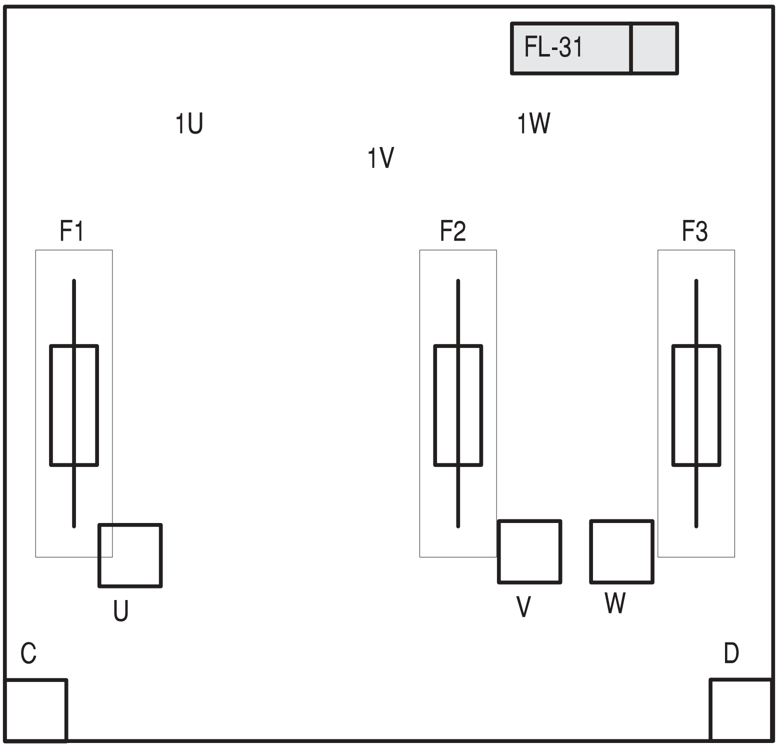
11.11. SW1-31 POWER SUPPLY CARD



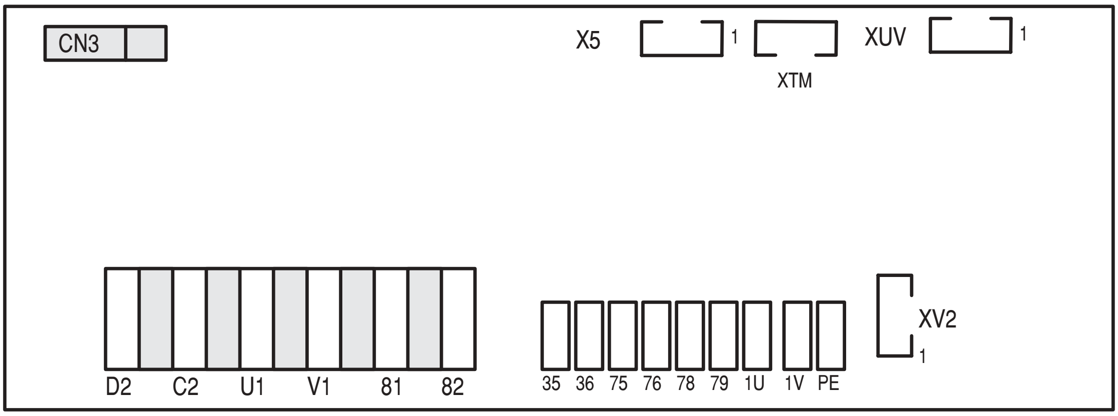
11.12. SW2-32 POWER SUPPLY CARD



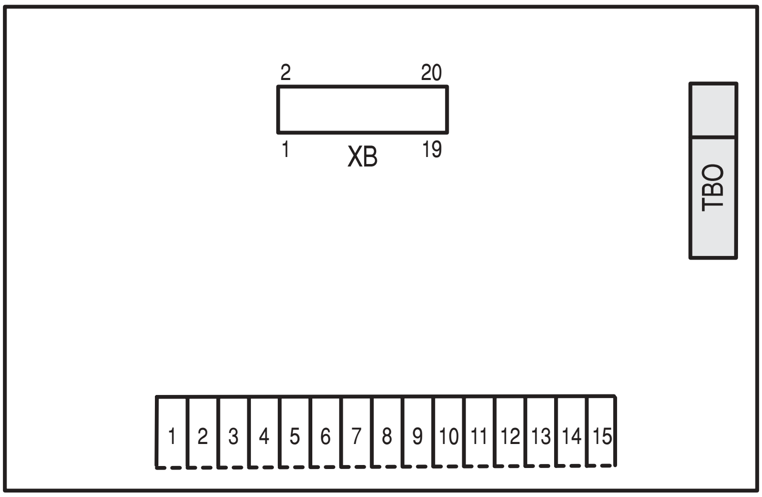
11.13. FL-31 FILTER CARD



11.14. CN3 CONNECTION CARD



11.15. I/O OPTION CARD TBO



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