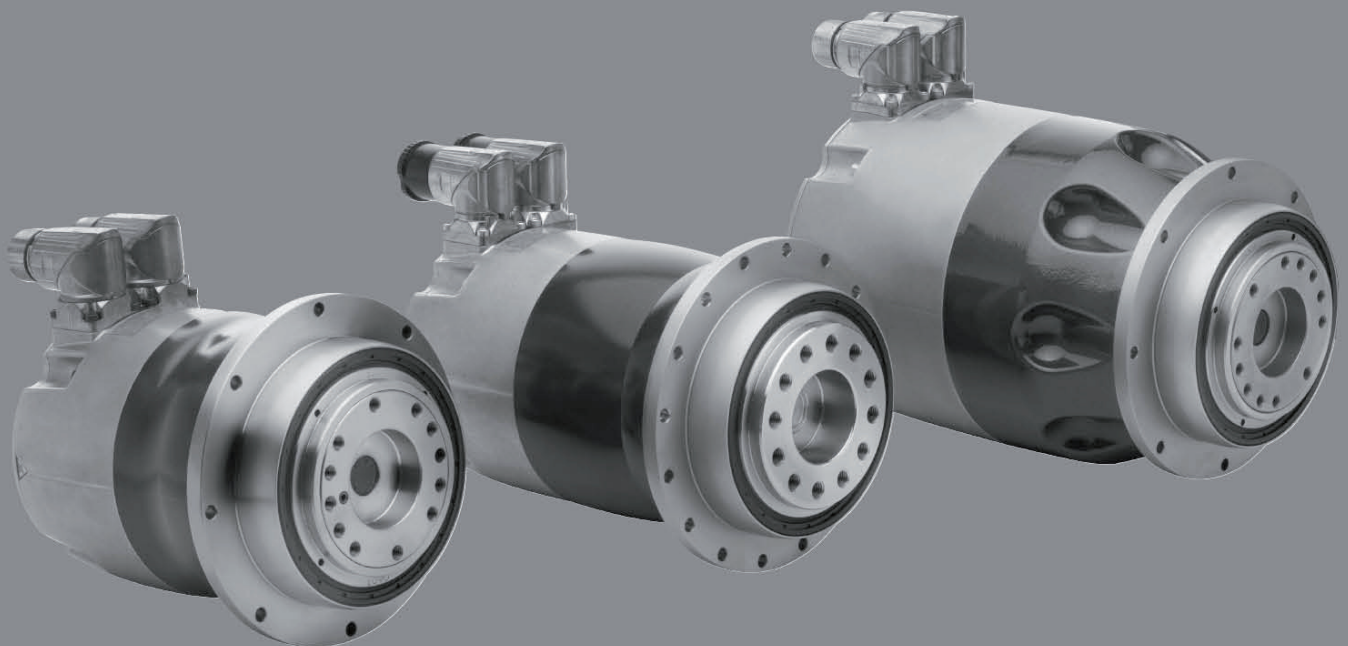


TPM⁺

Bosch Rexroth IndraDrive

Quick Startup Guide



Revision history

Revision	Date	Comment	Chapter
01	27 th July 2012	First release	All
02	27 th March 2017	Transition to Wittenstein alpha	All

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1 General Information

1.1 Description, designations

The AC servo actuator **TPM⁺** (hereafter referred to as servo actuator) is a combination of a low-backlash planetary gearhead and an AC servo motor. The following manual contains the following points:

- Safety Instructions
- Parameter lists for the **TPM⁺** series
- Connection schematic for **TPM⁺**

1.2 Whom does this manual concern?

This manual concerns all persons who install, operate, or maintain this servo actuator.

They may only carry out work on the servo actuator, if they have read and understood this operating manual. Please pass the safety instructions on to other persons as well.

1.3 Which signs and symbols are referred to in this manual?

- ➔ An “action instruction”, which requires you to carry out an action.
- ▽ With a “check” you can specify whether the device is ready for the next work stage.
- ☺ A “usage tip” shows you an option of facilitating or improving operations.

The safety instructions symbols are described in section [2 “Safety”](#).

1.4 Exclusion of liability

WITTENSTEIN alpha is not liable for damages or injury caused by:

- Improper utilization of the servo actuator and the servo amplifier or
- Incorrect setting of operating parameters.

1.5 EC low-voltage directive / EMC regulations

The servo actuator has been constructed in accordance with EC directive 73/23/EEC. During installation and connection of the electrical components, the relevant regulations have to be observed (for example wire cross sections, fuse protection, etc.). Meeting all requirements for the entire system is the responsibility of the system's manufacturer.

You may only operate the equipment if you comply to the national EMC regulations (refer to the servo amplifier documentation for installation information pertaining to EMC) as they are defined for the given application.

1.6 Copyright

© 2017, **WITTENSTEIN alpha GmbH**

All of the product brand names which appear in this manual are trademarks of the relevant companies. If the ® and/or TM symbols are omitted, this does imply that the name is a free brand name.

2 Safety

2.1 Intended use

The servo actuator is designed for industrial applications. Its purpose is to drive machines. Please refer to our catalogue or our Internet page for the maximum permitted speeds and torques: www.wittenstein-alpha.de

- ➔ Please consult our technical service if your servo actuator is more than a year old. In this way you receive valid data.
- ➔ Please be sure to read the documentation provided by the manufacturer of the servo actuator.

2.2 Improper use

Any use transgressing the above-named restrictions (especially higher torques and speeds) is not compliant with the regulations, and is thus prohibited.

The operation of the servo actuator is prohibited if:

- It was not installed according to regulations (for example fastening bolts).
- The servo actuator is very dirty, damaged or blocked.
- It is operated without lubricant.
- The cables are damaged or improperly connected.
- The operating parameters have not been set properly.

2.3 Safety Instructions

The following symbols are used in this manual to warn you of hazards:



DANGER!

This symbol warns you of danger of injury to yourself and others.



Attention

This symbol warns you of the risk of damage to the servo actuator.



Environment

This symbol warns of environmental pollution risk.

2.3.1 General safety instructions

Working on the servo actuator



DANGER!

Improperly executed work can lead to injury and damage.

- ➔ Always ensure that the servo actuator is only installed, maintained, and dismantled by trained technicians.

**DANGER!**

Current-flow through the body or arcing can lead to grave injury and death.

- Only perform tasks on the electrical system if you are:
 - A trained electrician.
 - A person trained in electro-technology, working under the supervision of a specialist electrician.
- Always adhere to the five safety rules for the de-energised state:
 - De-energise.
 - Secure against being turned on (for example by locking it).
 - Ensure that de-energised state exists.
 - Attach ground line and short-circuit the equipment.
 - Cover and safeguard any live parts in the immediate vicinity.

**DANGER!**

Impurities spinning through the air can cause grave injury.

- Before putting the servo actuator into operation, check that there are no impurities or tools near it.

Maintenance**DANGER!**

An unintentional start of the machine during maintenance work can lead to serious accidents.

- Ensure that no one can start the machine while you are working on it.

**DANGER!**

Even only briefly running the machine during maintenance work can lead to accidents if the safety devices are not operating.

- Check that all safety devices have been mounted and are activated.

Wiring**DANGER!**

Incorrect wiring can lead to injuries and damage.

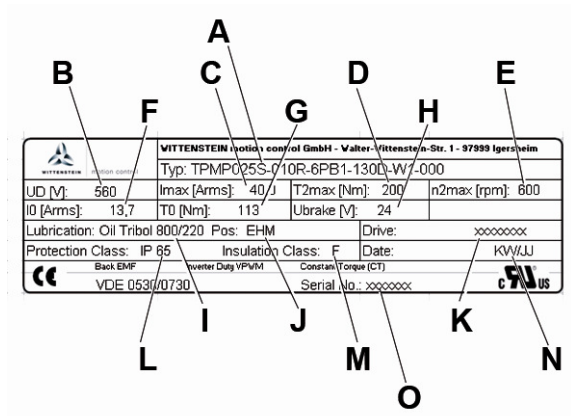
- Only use power and signal cables recommended by WITTENSTEIN alpha.
- Do not cut off power and signal cables, and do not insert extensions.
- Make sure that the U-U, V-V and W-W motor phases are correctly connected.
- Make sure that the motor encoder interface of the servo controller is compatible to the servo actuator.
- Observe the prescribed voltage for the brakes (usually 24 V DC) and the polarity.

3 Type plate information – identification

- ➔ The technical specifications can be found on your servo actuator's type plate according to the following scheme.

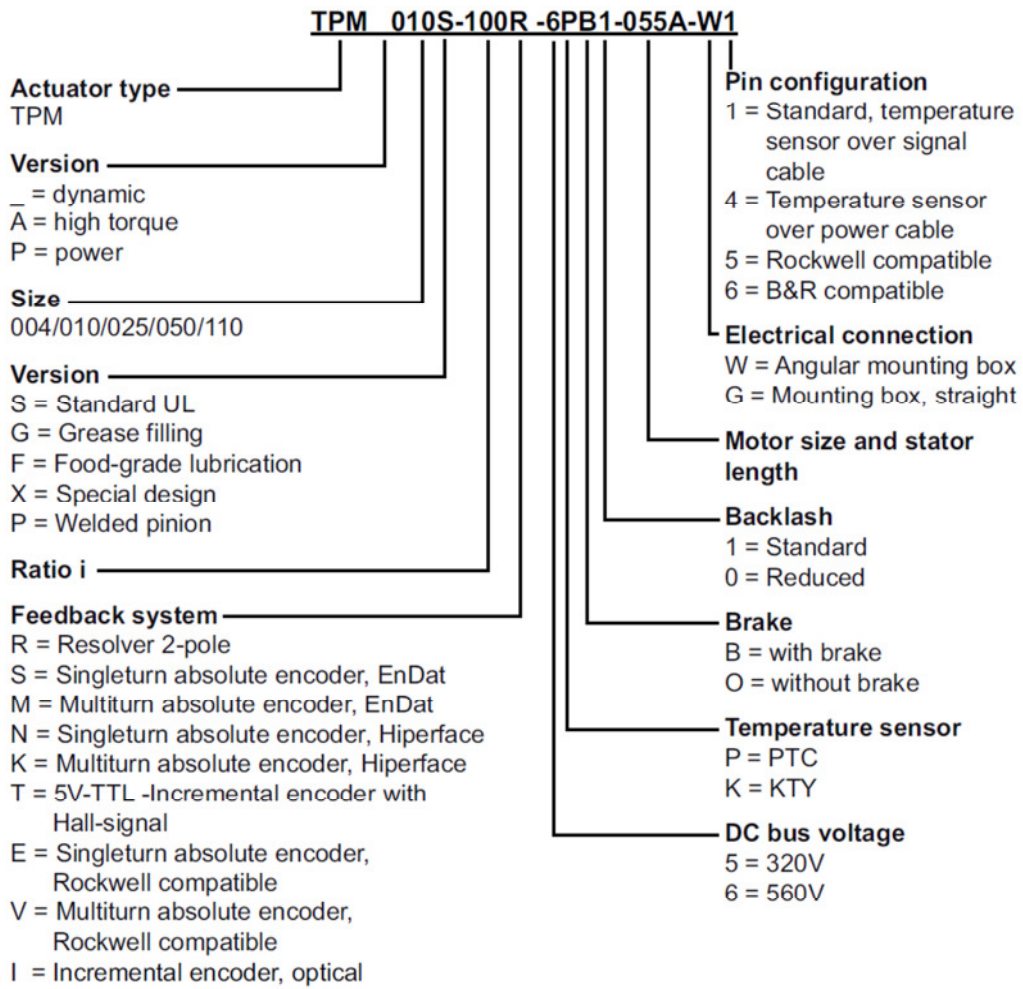
3.1 Identification plate, designation

The following specifications can be found on the identification plate:



- A Ordering code
- B DC-Bus voltage
- C Maximum current
- D Maximum torque at gear output
- E Maximum gear output speed
- F Continuous stall current
- G Continuous stall torque at gear output
- H Brake voltage
- I Lubricant
- J Mounting position
- K For use with drive
- L Type of protection
- M Insulation class
- N Manufacturing date
- O Serial number

Bild 4.2



4 Setting the parameters

The tables in chapter [4](#) contain all of the parameters that are required for the initial start-up of a TPM⁺ servo actuator from WITTENSTEIN alpha at a servo drive **Bosch Rexroth IndraDrive**.

When the servo actuator and the servo drive are properly connected, these parameters guarantee that the servo actuator can be operated at idle with speed control.

Based on these default settings, you can optimize the dynamics of the speed controller depending on the application.

Follow the details of the type plate.

Data for combinations not shown here are available on demand.

4.1 Commutation offset

For TPM⁺ with resolver the commutation offset is entered in parameter P-0-0508.

For TPM⁺ with Stegmann Hiperface and Heidenhain Endat, which are orderd for operation with Bosch Rexroth IndraDrive the commutation offset is already stored in the encoder's memory and no manual input of the commutation offset is necessary.

4.2 Parameterization of motor feedback

		Resolver	EnDat	Hiperface
P-0-0074	Encoder type 1	10	8	4
P-0-0508	Commutation offset	512	Commutation offset stored in encoder	
S-0-0043	Velocity polarity parameter	0111	0000	0000
S-0-0055	Postion polarities	1111	0000	0000
S-0-0085	Torque/force polarity parameter	0111	0000	0000
S-0-0116	Feedback 1 resolution	1	512	128

4.3 TPM⁺ with temperature sensor KTY 84-130

Code	Value
P-0-0512	3

4.4 TPM⁺ with temperature sensor PTC STM160

Code	Value
P-0-0512	100
P-0-0513 #0	20
P-0-0513 #1	30
P-0-0513 #2	40
P-0-0513 #3	50
P-0-0513 #4	60
P-0-0513 #5	70
P-0-0513 #6	80
P-0-0513 #7	90
P-0-0513 #8	100
P-0-0513 #9	110
P-0-0513 #10	120
P-0-0513 #11	130
P-0-0513 #12	140
P-0-0513 #13	150

Code	Value
P-0-0513 #14	160
P-0-0513 #15	200
P-0-0513 #16	250
P-0-0513 #17	425
P-0-0513 #18	940
P-0-0513 #19	2665
P-0-0513 #20	4000
P-0-0513 #21	4001
P-0-0513 #22	4002
P-0-0513 #23	4003
P-0-0513 #24	4004
P-0-0513 #25	4005
P-0-0513 #26	4006
P-0-0513 #27	4007

4.5 Parameter TPM+ Dynamic 004 560V

Code	Description	Unit	i=16-31 560 VDC	i=61-91 560 VDC
S-0-0141	Motor type	-	TPM 004S	TPM 004S
P-0-4014	Type of construction of motor	-	0	0
P-0-0001	Switching frequency of the power stage	kHz	8	8
P-0-0018	Number of pole pairs	-	4	4
P-0-0051	Torque/force constant	Nm/Arms	0,70	0,47
P-0-0510	Rotor inertia	kgm ²	See table below	
P-0-4016	Direct-axis inductance of motor	mH	16,65	15,00
P-0-4017	Quadrature-axis inductance of motor	mH	16,65	15,00
P-0-4048	Stator resistance	Ohm	28,20	37,40
S-0-0106	Current loop p. gain 1	V/A	87,91	79,20
S-0-0107	Current loop integral action time 1	ms	1,6	1,1
S-0-0109	Motor peak current	Arms	See table below	
S-0-0111	Motor current at standstill	Arms	1,10	0,80
S-0-0113	Maximum motor speed	1/min	6000	6000
S-0-0201	Motor warning temperature	°C	130	130
S-0-0204	Motor shutdown temperature	°C	145	145
S-0-0100	Velocity loop proportional gain	As/rad	0,03	0,02
S-0-0101	Velocity loop integral action time	ms	10	10
P-0-0004	Velocity loop smooth. time constant	μs	250	250
P-0-0525 ¹	Holding brake control word	-	100	100
S-0-0206	Drive on delay time	ms	12	12
S-0-0207	Drive off delay time	ms	10	10
P-0-0540	Torque of holding brake	Nm	1,1	1,1

¹ For actuators without brake P-0-0525 has to be set to 0.
Please refer to chapter Parameterization of motor feedback.

Ratio	Motor inertia w/o brake[kgm ²]	Motor inertia with brake[kgm ²]	$I_{\max \text{ stat}}$ [A _{rms}] ²	$I_{\max \text{ dyn}}$ [A _{rms}] ³
16	0,000021	0,000023	3,20	3,20
21	0,000020	0,000023	2,60	3,20
31	0,000020	0,000022	2,20	3,20
61	0,000012	0,000014	1,40	2,40
64	0,000011	0,000013	1,30	2,40
91	0,000012	0,000014	0,90	2,40

² Static maximum motorcurrent: Use this maximum current to protect the gear reducer from overload and to reduce the torque safely to T2B.

³ Dynamic maximum motorcurrent: For dynamic applications the maximum current can be increased to this value in dependency of the mass moment of inertia relation. We recommend a detailed calculation with Cymex.

4.6 Parameter TPM+ Dynamic 010 560V

Code	Description	Unit	i=16-31 560 VDC	i=61-91 560 VDC
S-0-0141	Motor type	-	TPM 010S	TPM 010S
P-0-4014	Type of construction of motor	-	0	0
P-0-0001	Switching frequency of the power stage	kHz	8	8
P-0-0018	Number of pole pairs	-	4	4
P-0-0051	Torque/force constant	Nm/Arms	0,97	0,78
P-0-0510	Rotor inertia	kgm ²	See table below	
P-0-4016	Direct-axis inductance of motor	mH	11,40	15,00
P-0-4017	Quadrature-axis inductance of motor	mH	11,40	15,00
P-0-4048	Stator resistance	Ohm	21,30	40,00
S-0-0106	Current loop p. gain 1	V/A	60,19	79,20
S-0-0107	Current loop integral action time 1	ms	1,4	1,0
S-0-0109	Motor peak current	Arms	See table below	
S-0-0111	Motor current at standstill	Arms	1,30	0,90
S-0-0113	Maximum motor speed	1/min	6000	6000
S-0-0201	Motor warning temperature	°C	130	130
S-0-0204	Motor shutdown temperature	°C	145	145
S-0-0100	Velocity loop proportional gain	As/rad	0,04	0,02
S-0-0101	Velocity loop integral action time	ms	10	10
P-0-0004	Velocity loop smooth. time constant	µs	250	250
P-0-0525 ¹	Holding brake control word	-	100	100
S-0-0206	Drive on delay time	ms	12	12
S-0-0207	Drive off delay time	ms	10	10
P-0-0540	Torque of holding brake	Nm	1,1	1,1

¹ For actuators without brake P-0-0525 has to be set to 0.
Please refer to chapter Parameterization of motor feedback.

Ratio	Motor inertia w/o brake[kgm ²]	Motor inertia with brake[kgm ²]	$I_{\max \text{ stat}}$ [A _{rms}] ²	$I_{\max \text{ dyn}}$ [A _{rms}] ³
16	0,000032	0,000034	5,20	5,20
21	0,000032	0,000034	5,20	5,20
31	0,000032	0,000034	4,70	5,20
61	0,000017	0,000019	2,20	3,00
64	0,000017	0,000019	2,10	3,00
91	0,000017	0,000019	1,50	3,00

² Static maximum motorcurrent: Use this maximum current to protect the gear reducer from overload and to reduce the torque safely to T2B.

³ Dynamic maximum motorcurrent: For dynamic applications the maximum current can be increased to this value in dependency of the mass moment of inertia relation. We recommend a detailed calculation with Cymex.

4.7 Parameter TPM+ Dynamic 025 560V

Code	Description	Unit	i=16-31 560 VDC	i=61-91 560 VDC
S-0-0141	Motor type	-	TPM 025S	TPM 025S
P-0-4014	Type of construction of motor	-	0	0
P-0-0001	Switching frequency of the power stage	kHz	8	8
P-0-0018	Number of pole pairs	-	6	6
P-0-0051	Torque/force constant	Nm/Arms	0,98	1,02
P-0-0510	Rotor inertia	kgm ²	See table below	
P-0-4016	Direct-axis inductance of motor	mH	3,00	9,45
P-0-4017	Quadrature-axis inductance of motor	mH	3,00	9,45
P-0-4048	Stator resistance	Ohm	2,20	13,50
S-0-0106	Current loop p. gain 1	V/A	15,84	49,90
S-0-0107	Current loop integral action time 1	ms	3,6	1,9
S-0-0109	Motor peak current	Arms	See table below	
S-0-0111	Motor current at standstill	Arms	5,70	1,90
S-0-0113	Maximum motor speed	1/min	6000	6000
S-0-0201	Motor warning temperature	°C	130	130
S-0-0204	Motor shutdown temperature	°C	145	145
S-0-0100	Velocity loop proportional gain	As/rad	0,29	0,11
S-0-0101	Velocity loop integral action time	ms	10	10
P-0-0004	Velocity loop smooth. time constant	μs	250	250
P-0-0525 ¹	Holding brake control word	-	100	100
S-0-0206	Drive on delay time	ms	30	30
S-0-0207	Drive off delay time	ms	20	20
P-0-0540	Torque of holding brake	Nm	4,5	4,5

¹ For actuators without brake P-0-0525 has to be set to 0.
Please refer to chapter Parameterization of motor feedback.

Ratio	Motor inertia w/o brake[kgm ²]	Motor inertia with brake[kgm ²]	$I_{\max \text{ stat}}$ [A _{rms}] ²	$I_{\max \text{ dyn}}$ [A _{rms}] ³
16	0,000216	0,000235	17,00	17,00
21	0,000216	0,000235	17,00	17,00
31	0,000217	0,000236	14,10	17,00
61	0,000077	0,000096	5,90	6,00
64	0,000076	0,000095	5,60	6,00
91	0,000076	0,000095	3,80	6,00

² Static maximum motorcurrent: Use this maximum current to protect the gear reducer from overload and to reduce the torque safely to T2B.

³ Dynamic maximum motorcurrent: For dynamic applications the maximum current can be increased to this value in dependency of the mass moment of inertia relation. We recommend a detailed calculation with Cymex.

4.8 Parameter TPM+ Dynamic 050 560V

Code	Description	Unit	i=16-31 560 VDC	i=61-91 560 VDC
S-0-0141	Motor type	-	TPM 050S	TPM 050S
P-0-4014	Type of construction of motor	-	0	0
P-0-0001	Switching frequency of the power stage	kHz	8	8
P-0-0018	Number of pole pairs	-	6	6
P-0-0051	Torque/force constant	Nm/Arms	1,00	0,97
P-0-0510	Rotor inertia	kgm ²	See table below	
P-0-4016	Direct-axis inductance of motor	mH	1,50	5,55
P-0-4017	Quadrature-axis inductance of motor	mH	1,50	5,55
P-0-4048	Stator resistance	Ohm	0,45	4,00
S-0-0106	Current loop p. gain 1	V/A	7,92	29,30
S-0-0107	Current loop integral action time 1	ms	8,9	3,7
S-0-0109	Motor peak current	Arms	See table below	
S-0-0111	Motor current at standstill	Arms	13,70	3,80
S-0-0113	Maximum motor speed	1/min	5000	5000
S-0-0201	Motor warning temperature	°C	130	130
S-0-0204	Motor shutdown temperature	°C	145	145
S-0-0100	Velocity loop proportional gain	As/rad	1,29	0,36
S-0-0101	Velocity loop integral action time	ms	10	10
P-0-0004	Velocity loop smooth. time constant	µs	250	250
P-0-0525 ¹	Holding brake control word	-	100	100
S-0-0206	Drive on delay time	ms	42	42
S-0-0207	Drive off delay time	ms	20	20
P-0-0540	Torque of holding brake	Nm	13	13

¹ For actuators without brake P-0-0525 has to be set to 0.
Please refer to chapter Parameterization of motor feedback.

Ratio	Motor inertia w/o brake[kgm ²]	Motor inertia with brake[kgm ²]	I _{max stat} [A _{rms}] ²	I _{max dyn} ³ [A _{rms}] ³
16	0,000907	0,001007	40,00	40,00
21	0,000907	0,001007	34,30	40,00
31	0,000894	0,000993	29,40	40,00
61	0,000251	0,000351	12,00	12,00
64	0,000249	0,000349	12,00	12,00
91	0,000249	0,000349	8,40	12,00

² Static maximum motorcurrent: Use this maximum current to protect the gear reducer from overload and to reduce the torque safely to T2B.

³ Dynamic maximum motorcurrent: For dynamic applications the maximum current can be increased to this value in dependency of the mass moment of inertia relation. We recommend a detailed calculation with Cymex.

4.9 Parameter TPM+ Dynamic 110 560V

Code	Description	Unit	i=16-31 560 VDC	i=61-91 560 VDC
S-0-0141	Motor type	-	TPM 110S	TPM 110S
P-0-4014	Type of construction of motor	-	0	0
P-0-0001	Switching frequency of the power stage	kHz	8	8
P-0-0018	Number of pole pairs	-	6	6
P-0-0051	Torque/force constant	Nm/Arms	1,00	1,00
P-0-0510	Rotor inertia	kgm ²	See table below	
P-0-4016	Direct-axis inductance of motor	mH	1,20	1,50
P-0-4017	Quadrature-axis inductance of motor	mH	1,20	1,50
P-0-4048	Stator resistance	Ohm	0,32	0,45
S-0-0106	Current loop p. gain 1	V/A	6,34	7,92
S-0-0107	Current loop integral action time 1	ms	9,9	8,9
S-0-0109	Motor peak current	Arms	See table below	
S-0-0111	Motor current at standstill	Arms	16,70	13,70
S-0-0113	Maximum motor speed	1/min	5000	5000
S-0-0201	Motor warning temperature	°C	130	130
S-0-0204	Motor shutdown temperature	°C	145	145
S-0-0100	Velocity loop proportional gain	As/rad	1,75	1,29
S-0-0101	Velocity loop integral action time	ms	10	10
P-0-0004	Velocity loop smooth. time constant	µs	250	250
P-0-0525 ¹	Holding brake control word	-	100	100
S-0-0206	Drive on delay time	ms	42	42
S-0-0207	Drive off delay time	ms	20	20
P-0-0540	Torque of holding brake	Nm	13	13

¹ For actuators without brake P-0-0525 has to be set to 0.
Please refer to chapter Parameterization of motor feedback.

Ratio	Motor inertia w/o brake[kgm ²]	Motor inertia with brake[kgm ²]	$I_{\max \text{ stat}}$ [A _{rms}] ²	$I_{\max \text{ dyn}}$ [A _{rms}] ³
16	0,001314	0,001414	70,00	70,00
21	0,001314	0,001414	70,00	70,00
31	0,001284	0,001384	70,00	70,00
61	0,000889	0,000988	30,00	40,00
64	0,000883	0,000983	28,30	40,00
91	0,000883	0,000983	18,00	40,00

² Static maximum motorcurrent: Use this maximum current to protect the gear reducer from overload and to reduce the torque safely to T2B.

³ Dynamic maximum motorcurrent: For dynamic applications the maximum current can be increased to this value in dependency of the mass moment of inertia relation. We recommend a detailed calculation with Cymex.

4.10 Parameter TPM+ Dynamic 004 320V

Code	Description	Unit	i=16-31 320 VDC	i=61-91 320 VDC
S-0-0141	Motor type	-	TPM 004S	TPM 004S
P-0-4014	Type of construction of motor	-	0	0
P-0-0001	Switching frequency of the power stage	kHz	8	8
P-0-0018	Number of pole pairs	-	4	4
P-0-0051	Torque/force constant	Nm/Arms	0,40	0,27
P-0-0510	Rotor inertia	kgm ²	See table below	
P-0-4016	Direct-axis inductance of motor	mH	5,55	5,00
P-0-4017	Quadrature-axis inductance of motor	mH	5,55	5,00
P-0-4048	Stator resistance	Ohm	9,40	12,50
S-0-0106	Current loop p. gain 1	V/A	29,30	26,40
S-0-0107	Current loop integral action time 1	ms	1,6	1,1
S-0-0109	Motor peak current	Arms	See table below	
S-0-0111	Motor current at standstill	Arms	1,90	1,40
S-0-0113	Maximum motor speed	1/min	6000	6000
S-0-0201	Motor warning temperature	°C	130	130
S-0-0204	Motor shutdown temperature	°C	145	145
S-0-0100	Velocity loop proportional gain	As/rad	0,03	0,02
S-0-0101	Velocity loop integral action time	ms	10	10
P-0-0004	Velocity loop smooth. time constant	µs	250	250
P-0-0525 ¹	Holding brake control word	-	100	100
S-0-0206	Drive on delay time	ms	12	12
S-0-0207	Drive off delay time	ms	10	10
P-0-0540	Torque of holding brake	Nm	1,1	1,1

¹ For actuators without brake P-0-0525 has to be set to 0.
Please refer to chapter Parameterization of motor feedback.

Ratio	Motor inertia w/o brake[kgm ²]	Motor inertia with brake[kgm ²]	$I_{\max \text{ stat}}$ [A _{rms}] ²	$I_{\max \text{ dyn}}$ [A _{rms}] ³
16	0,000021	0,000023	5,50	5,50
21	0,000020	0,000023	4,50	5,50
31	0,000020	0,000022	3,80	5,50
61	0,000012	0,000014	2,40	4,20
64	0,000011	0,000013	2,30	4,20
91	0,000012	0,000014	1,60	4,20

² Static maximum motorcurrent: Use this maximum current to protect the gear reducer from overload and to reduce the torque safely to T2B.

³ Dynamic maximum motorcurrent: For dynamic applications the maximum current can be increased to this value in dependency of the mass moment of inertia relation. We recommend a detailed calculation with Cymex.

4.11 Parameter TPM+ Dynamic 010 320V

Code	Description	Unit	i=16-31 320 VDC	i=61-91 320 VDC
S-0-0141	Motor type	-	TPM 010S	TPM 010S
P-0-4014	Type of construction of motor	-	0	0
P-0-0001	Switching frequency of the power stage	kHz	8	8
P-0-0018	Number of pole pairs	-	4	4
P-0-0051	Torque/force constant	Nm/Arms	0,56	0,45
P-0-0510	Rotor inertia	kgm ²	See table below	
P-0-4016	Direct-axis inductance of motor	mH	3,66	5,00
P-0-4017	Quadrature-axis inductance of motor	mH	3,66	5,00
P-0-4048	Stator resistance	Ohm	7,10	13,30
S-0-0106	Current loop p. gain 1	V/A	19,35	26,40
S-0-0107	Current loop integral action time 1	ms	1,4	1,0
S-0-0109	Motor peak current	Arms	See table below	
S-0-0111	Motor current at standstill	Arms	2,20	1,60
S-0-0113	Maximum motor speed	1/min	6000	6000
S-0-0201	Motor warning temperature	°C	130	130
S-0-0204	Motor shutdown temperature	°C	145	145
S-0-0100	Velocity loop proportional gain	As/rad	0,04	0,02
S-0-0101	Velocity loop integral action time	ms	10	10
P-0-0004	Velocity loop smooth. time constant	μs	250	250
P-0-0525 ¹	Holding brake control word	-	100	100
S-0-0206	Drive on delay time	ms	12	12
S-0-0207	Drive off delay time	ms	10	10
P-0-0540	Torque of holding brake	Nm	1,1	1,1

¹ For actuators without brake P-0-0525 has to be set to 0.
Please refer to chapter Parameterization of motor feedback.

Ratio	Motor inertia w/o brake[kgm ²]	Motor inertia with brake[kgm ²]	$I_{\max \text{ stat}}$ [A _{rms}] ²	$I_{\max \text{ dyn}}$ [A _{rms}] ³
16	0,000032	0,000034	9,00	9,00
21	0,000032	0,000034	9,00	9,00
31	0,000032	0,000034	8,10	9,00
61	0,000017	0,000019	3,80	5,20
64	0,000017	0,000019	2,50	5,20
91	0,000017	0,000019	3,60	5,20

² Static maximum motorcurrent: Use this maximum current to protect the gear reducer from overload and to reduce the torque safely to T2B.

³ Dynamic maximum motorcurrent: For dynamic applications the maximum current can be increased to this value in dependency of the mass moment of inertia relation. We recommend a detailed calculation with Cymex.

4.12 Parameter TPM+ Dynamic 025 320V

Code	Description	Unit	i=16-31 320 VDC	i=61-91 320 VDC
S-0-0141	Motor type	-	TPM 025S	TPM 025S
P-0-4014	Type of construction of motor	-	0	0
P-0-0001	Switching frequency of the power stage	kHz	8	8
P-0-0018	Number of pole pairs	-	6	6
P-0-0051	Torque/force constant	Nm/Arms	0,56	0,59
P-0-0510	Rotor inertia	kgm ²	See table below	
P-0-4016	Direct-axis inductance of motor	mH	1,00	3,15
P-0-4017	Quadrature-axis inductance of motor	mH	1,00	3,15
P-0-4048	Stator resistance	Ohm	0,73	4,50
S-0-0106	Current loop p. gain 1	V/A	5,28	16,63
S-0-0107	Current loop integral action time 1	ms	3,6	1,9
S-0-0109	Motor peak current	Arms	See table below	
S-0-0111	Motor current at standstill	Arms	9,90	3,30
S-0-0113	Maximum motor speed	1/min	6000	6000
S-0-0201	Motor warning temperature	°C	130	130
S-0-0204	Motor shutdown temperature	°C	145	145
S-0-0100	Velocity loop proportional gain	As/rad	0,29	0,11
S-0-0101	Velocity loop integral action time	ms	10	10
P-0-0004	Velocity loop smooth. time constant	μs	250	250
P-0-0525 ¹	Holding brake control word	-	100	100
S-0-0206	Drive on delay time	ms	30	30
S-0-0207	Drive off delay time	ms	20	20
P-0-0540	Torque of holding brake	Nm	4,5	4,5

¹ For actuators without brake P-0-0525 has to be set to 0.
Please refer to chapter Parameterization of motor feedback.

Ratio	Motor inertia w/o brake[kgm ²]	Motor inertia with brake[kgm ²]	$I_{\max \text{ stat}}$ [A _{rms}] ²	$I_{\max \text{ dyn}}$ [A _{rms}] ³
16	0,000216	0,000235	29,40	29,40
21	0,000216	0,000235	29,40	29,40
31	0,000217	0,000236	24,40	29,40
61	0,000077	0,000096	10,30	10,40
64	0,000076	0,000095	9,80	10,40
91	0,000076	0,000095	6,50	10,40

² Static maximum motorcurrent: Use this maximum current to protect the gear reducer from overload and to reduce the torque safely to T2B.

³ Dynamic maximum motorcurrent: For dynamic applications the maximum current can be increased to this value in dependency of the mass moment of inertia relation. We recommend a detailed calculation with Cymex.

4.13 Parameter TPM+ Dynamic 050 320V

Code	Description	Unit	i=16-31 320 VDC	i=61-91 320 VDC
S-0-0141	Motor type	-	TPM 050S	TPM 050S
P-0-4014	Type of construction of motor	-	0	0
P-0-0001	Switching frequency of the power stage	kHz	8	8
P-0-0018	Number of pole pairs	-	6	6
P-0-0051	Torque/force constant	Nm/Arms	0,58	0,56
P-0-0510	Rotor inertia	kgm ²	See table below	
P-0-4016	Direct-axis inductance of motor	mH	0,50	1,85
P-0-4017	Quadrature-axis inductance of motor	mH	0,50	1,85
P-0-4048	Stator resistance	Ohm	0,13	1,33
S-0-0106	Current loop p. gain 1	V/A	2,65	9,77
S-0-0107	Current loop integral action time 1	ms	10,3	3,7
S-0-0109	Motor peak current	Arms	See table below	
S-0-0111	Motor current at standstill	Arms	23,70	6,60
S-0-0113	Maximum motor speed	1/min	5000	5000
S-0-0201	Motor warning temperature	°C	130	130
S-0-0204	Motor shutdown temperature	°C	145	145
S-0-0100	Velocity loop proportional gain	As/rad	1,29	0,36
S-0-0101	Velocity loop integral action time	ms	10	10
P-0-0004	Velocity loop smooth. time constant	μs	250	250
P-0-0525 ¹	Holding brake control word	-	100	100
S-0-0206	Drive on delay time	ms	42	42
S-0-0207	Drive off delay time	ms	20	20
P-0-0540	Torque of holding brake	Nm	13	13

¹ For actuators without brake P-0-0525 has to be set to 0.
Please refer to chapter Parameterization of motor feedback.

Ratio	Motor inertia w/o brake[kgm ²]	Motor inertia with brake[kgm ²]	I _{max stat} [A _{rms}] ²	I _{max dyn} ³ [A _{rms}] ³
16	0,000907	0,001007	70,00	70,00
21	0,000907	0,001007	59,90	70,00
31	0,000894	0,000993	51,40	70,00
61	0,000251	0,000351	21,00	21,00
64	0,000249	0,000349	21,00	21,00
91	0,000249	0,000349	14,70	21,00

² Static maximum motorcurrent: Use this maximum current to protect the gear reducer from overload and to reduce the torque safely to T2B.

³ Dynamic maximum motorcurrent: For dynamic applications the maximum current can be increased to this value in dependency of the mass moment of inertia relation. We recommend a detailed calculation with Cymex.

4.14 Parameter TPM+ Dynamic 110 320V

Code	Description	Unit	i=16-31 320 VDC	i=61-91 320 VDC
S-0-0141	Motor type	-	TPM 110S	TPM 110S
P-0-4014	Type of construction of motor	-	0	0
P-0-0001	Switching frequency of the power stage	kHz	8	8
P-0-0018	Number of pole pairs	-	6	6
P-0-0051	Torque/force constant	Nm/Arms	1,00	0,58
P-0-0510	Rotor inertia	kgm ²	See table below	
P-0-4016	Direct-axis inductance of motor	mH	1,20	0,50
P-0-4017	Quadrature-axis inductance of motor	mH	1,20	0,50
P-0-4048	Stator resistance	Ohm	0,32	0,13
S-0-0106	Current loop p. gain 1	V/A	6,34	2,65
S-0-0107	Current loop integral action time 1	ms	9,9	10,3
S-0-0109	Motor peak current	Arms	See table below	
S-0-0111	Motor current at standstill	Arms	16,70	23,70
S-0-0113	Maximum motor speed	1/min	3700	5000
S-0-0201	Motor warning temperature	°C	130	130
S-0-0204	Motor shutdown temperature	°C	145	145
S-0-0100	Velocity loop proportional gain	As/rad	1,75	1,29
S-0-0101	Velocity loop integral action time	ms	10	10
P-0-0004	Velocity loop smooth. time constant	µs	250	250
P-0-0525 ¹	Holding brake control word	-	100	100
S-0-0206	Drive on delay time	ms	42	42
S-0-0207	Drive off delay time	ms	20	20
P-0-0540	Torque of holding brake	Nm	13	13

¹ For actuators without brake P-0-0525 has to be set to 0.
Please refer to chapter Parameterization of motor feedback.

Ratio	Motor inertia w/o brake[kgm ²]	Motor inertia with brake[kgm ²]	I _{max stat} [A _{rms}] ²	I _{max dyn} ³ [A _{rms}] ³
16	0,001314	0,001414	70,00	70,00
21	0,001314	0,001414	70,00	70,00
31	0,001284	0,001384	70,00	70,00
61	0,000889	0,000988	52,40	70,00
64	0,000883	0,000983	49,40	70,00
91	0,000883	0,000983	31,30	70,00

² Static maximum motorcurrent: Use this maximum current to protect the gear reducer from overload and to reduce the torque safely to T2B.

³ Dynamic maximum motorcurrent: For dynamic applications the maximum current can be increased to this value in dependency of the mass moment of inertia relation. We recommend a detailed calculation with Cymex.

4.15 Parameter TPM+ Power 004 560V

Code	Description	Unit	i=4-35 560 VDC	i=40-100 560 VDC
S-0-0141	Motor type	-	TPMP004S	TPMP004S
P-0-4014	Type of construction of motor	-	0	0
P-0-0001	Switching frequency of the power stage	kHz	8	8
P-0-0018	Number of pole pairs	-	4	4
P-0-0051	Torque/force constant	Nm/Arms	0,97	0,78
P-0-0510	Rotor inertia	kgm ²	See table below	
P-0-4016	Direct-axis inductance of motor	mH	11,40	15,00
P-0-4017	Quadrature-axis inductance of motor	mH	11,40	15,00
P-0-4048	Stator resistance	Ohm	21,30	40,00
S-0-0106	Current loop p. gain 1	V/A	60,19	79,20
S-0-0107	Current loop integral action time 1	ms	1,4	1,0
S-0-0109	Motor peak current	Arms	See table below	
S-0-0111	Motor current at standstill	Arms	1,60	1,00
S-0-0113	Maximum motor speed	1/min	6000	6000
S-0-0201	Motor warning temperature	°C	130	130
S-0-0204	Motor shutdown temperature	°C	145	145
S-0-0100	Velocity loop proportional gain	As/rad	0,04	0,02
S-0-0101	Velocity loop integral action time	ms	10	10
P-0-0004	Velocity loop smooth. time constant	μs	250	250
P-0-0525 ¹	Holding brake control word	-	100	100
S-0-0206	Drive on delay time	ms	12	12
S-0-0207	Drive off delay time	ms	10	10
P-0-0540	Torque of holding brake	Nm	1,1	1,1

¹ For actuators without brake P-0-0525 has to be set to 0.
Please refer to chapter Parameterization of motor feedback.

Ratio	Motor inertia w/o brake[kgm ²]	Motor inertia with brake[kgm ²]	$I_{\max \text{ stat}}$ [A _{rms}] ²	$I_{\max \text{ dyn}}$ [A _{rms}] ³
4	0,000039	0,000041	5,20	5,20
5	0,000036	0,000038	5,20	5,20
7	0,000033	0,000035	5,20	5,20
10	0,000031	0,000034	3,60	5,20
16	0,000032	0,000034	4,40	5,20
20	0,000031	0,000034	3,50	5,20
25	0,000031	0,000034	2,80	5,20
28	0,000031	0,000033	2,50	5,20
35	0,000031	0,000033	1,90	5,20
40	0,000016	0,000018	2,10	3,00
50	0,000016	0,000018	1,70	3,00
70	0,000016	0,000018	1,20	3,00
100	0,000016	0,000018	0,60	3,00

² Static maximum motorcurrent: Use this maximum current to protect the gear reducer from overload and to reduce the torque safely to T2B.

³ Dynamic maximum motorcurrent: For dynamic applications the maximum current can be increased to this value in dependency of the mass moment of inertia relation. We recommend a detailed calculation with Cymex.

4.16 Parameter TPM+ Power 010 560V

Code	Description	Unit	i=4-35 560 VDC	i=40-100 560 VDC
S-0-0141	Motor type	-	TPMP010S	TPMP010S
P-0-4014	Type of construction of motor	-	0	0
P-0-0001	Switching frequency of the power stage	kHz	8	8
P-0-0018	Number of pole pairs	-	6	6
P-0-0051	Torque/force constant	Nm/Arms	0,98	1,02
P-0-0510	Rotor inertia	kgm ²	See table below	
P-0-4016	Direct-axis inductance of motor	mH	3,00	9,45
P-0-4017	Quadrature-axis inductance of motor	mH	3,00	9,45
P-0-4048	Stator resistance	Ohm	2,20	13,50
S-0-0106	Current loop p. gain 1	V/A	15,84	49,90
S-0-0107	Current loop integral action time 1	ms	3,6	1,9
S-0-0109	Motor peak current	Arms	See table below	
S-0-0111	Motor current at standstill	Arms	5,40	1,90
S-0-0113	Maximum motor speed	1/min	6000	6000
S-0-0201	Motor warning temperature	°C	130	130
S-0-0204	Motor shutdown temperature	°C	145	145
S-0-0100	Velocity loop proportional gain	As/rad	0,29	0,11
S-0-0101	Velocity loop integral action time	ms	10	10
P-0-0004	Velocity loop smooth. time constant	µs	250	250
P-0-0525 ¹	Holding brake control word	-	100	100
S-0-0206	Drive on delay time	ms	30	30
S-0-0207	Drive off delay time	ms	20	20
P-0-0540	Torque of holding brake	Nm	4,5	4,5

¹ For actuators without brake P-0-0525 has to be set to 0.
Please refer to chapter Parameterization of motor feedback.

Ratio	Motor inertia w/o brake[kgm ²]	Motor inertia with brake[kgm ²]	$I_{\max \text{ stat}}$ [A _{rms}] ²	$I_{\max \text{ dyn}}$ [A _{rms}] ³
4	0,000238	0,000257	17,00	17,00
5	0,000222	0,000241	17,00	17,00
7	0,000208	0,000227	17,00	17,00
10	0,000200	0,000219	12,20	17,00
16	0,000202	0,000221	11,50	17,00
20	0,000199	0,000218	8,90	17,00
25	0,000198	0,000217	6,90	17,00
28	0,000196	0,000215	6,00	17,00
35	0,000196	0,000214	4,70	17,00
40	0,000072	0,000091	4,70	6,00
50	0,000072	0,000091	3,70	6,00
70	0,000072	0,000091	2,70	6,00
100	0,000072	0,000091	1,50	6,00

² Static maximum motorcurrent: Use this maximum current to protect the gear reducer from overload and to reduce the torque safely to T2B.

³ Dynamic maximum motorcurrent: For dynamic applications the maximum current can be increased to this value in dependency of the mass moment of inertia relation. We recommend a detailed calculation with Cymex.

4.17 Parameter TPM+ Power 025 560V

Code	Description	Unit	i=4-35 560 VDC	i=40-100 560 VDC
S-0-0141	Motor type	-	TPMP025S	TPMP025S
P-0-4014	Type of construction of motor	-	0	0
P-0-0001	Switching frequency of the power stage	kHz	8	8
P-0-0018	Number of pole pairs	-	6	6
P-0-0051	Torque/force constant	Nm/Arms	1,00	0,97
P-0-0510	Rotor inertia	kgm ²	See table below	
P-0-4016	Direct-axis inductance of motor	mH	1,50	5,55
P-0-4017	Quadrature-axis inductance of motor	mH	1,50	5,55
P-0-4048	Stator resistance	Ohm	0,45	4,00
S-0-0106	Current loop p. gain 1	V/A	7,92	29,30
S-0-0107	Current loop integral action time 1	ms	8,9	3,7
S-0-0109	Motor peak current	Arms	See table below	
S-0-0111	Motor current at standstill	Arms	13,70	4,00
S-0-0113	Maximum motor speed	1/min	6000	6000
S-0-0201	Motor warning temperature	°C	130	130
S-0-0204	Motor shutdown temperature	°C	145	145
S-0-0100	Velocity loop proportional gain	As/rad	1,29	0,36
S-0-0101	Velocity loop integral action time	ms	10	10
P-0-0004	Velocity loop smooth. time constant	μs	250	250
P-0-0525 ¹	Holding brake control word	-	100	100
S-0-0206	Drive on delay time	ms	42	42
S-0-0207	Drive off delay time	ms	20	20
P-0-0540	Torque of holding brake	Nm	13	13

¹ For actuators without brake P-0-0525 has to be set to 0.
Please refer to chapter Parameterization of motor feedback.

Ratio	Motor inertia w/o brake[kgm ²]	Motor inertia with brake[kgm ²]	$I_{\max \text{ stat}}$ [A _{rms}] ²	$I_{\max \text{ dyn}}$ [A _{rms}] ³
4	0,000998	0,001098	40,00	40,00
5	0,000950	0,001050	40,00	40,00
7	0,000907	0,001007	40,00	40,00
10	0,000884	0,000984	27,00	40,00
16	0,000894	0,000994	29,90	40,00
20	0,000883	0,000982	23,10	40,00
25	0,000881	0,000980	19,50	40,00
28	0,000872	0,000972	15,30	40,00
35	0,000871	0,000971	13,00	40,00
40	0,000248	0,000348	12,00	12,00
50	0,000248	0,000348	12,00	12,00
70	0,000248	0,000347	7,10	12,00
100	0,000247	0,000347	3,70	12,00

² Static maximum motorcurrent: Use this maximum current to protect the gear reducer from overload and to reduce the torque safely to T2B.

³ Dynamic maximum motorcurrent: For dynamic applications the maximum current can be increased to this value in dependency of the mass moment of inertia relation. We recommend a detailed calculation with Cymex.

4.18 Parameter TPM+ Power 050 560V

Code	Description	Unit	i=4-35 560 VDC	i=40-100 560 VDC
S-0-0141	Motor type	-	TPMP050S	TPMP050S
P-0-4014	Type of construction of motor	-	0	0
P-0-0001	Switching frequency of the power stage	kHz	8	8
P-0-0018	Number of pole pairs	-	6	6
P-0-0051	Torque/force constant	Nm/Arms	1,19	0,91
P-0-0510	Rotor inertia	kgm ²	See table below	
P-0-4016	Direct-axis inductance of motor	mH	1,05	2,55
P-0-4017	Quadrature-axis inductance of motor	mH	1,05	2,55
P-0-4048	Stator resistance	Ohm	0,27	1,81
S-0-0106	Current loop p. gain 1	V/A	5,54	13,46
S-0-0107	Current loop integral action time 1	ms	10,3	3,7
S-0-0109	Motor peak current	Arms	See table below	
S-0-0111	Motor current at standstill	Arms	19,00	7,50
S-0-0113	Maximum motor speed	1/min	5000	5000
S-0-0201	Motor warning temperature	°C	130	130
S-0-0204	Motor shutdown temperature	°C	145	145
S-0-0100	Velocity loop proportional gain	As/rad	3,26	0,91
S-0-0101	Velocity loop integral action time	ms	10	10
P-0-0004	Velocity loop smooth. time constant	μs	250	250
P-0-0525 ¹	Holding brake control word	-	100	100
S-0-0206	Drive on delay time	ms	50	50
S-0-0207	Drive off delay time	ms	40	40
P-0-0540	Torque of holding brake	Nm	23	23

¹ For actuators without brake P-0-0525 has to be set to 0.
Please refer to chapter Parameterization of motor feedback.

Ratio	Motor inertia w/o brake[kgm ²]	Motor inertia with brake[kgm ²]	$I_{\max \text{ stat}}$ [A _{rms}] ²	$I_{\max \text{ dyn}}$ [A _{rms}] ³
4	0,002642	0,002822	63,50	63,50
5	0,002480	0,002660	63,50	63,50
7	0,002334	0,002514	54,90	63,50
10	0,002254	0,002434	38,40	63,50
16	0,002307	0,002487	53,10	63,50
20	0,002261	0,002441	41,70	63,50
25	0,002255	0,002435	32,60	63,50
28	0,002220	0,002400	28,60	63,50
35	0,002217	0,002397	22,20	63,50
40	0,00063	0,00081	33,00	33,00
50	0,000628	0,000808	32,50	33,00
70	0,000627	0,000807	19,90	33,00
100	0,000626	0,000806	8,30	33,00

² Static maximum motorcurrent: Use this maximum current to protect the gear reducer from overload and to reduce the torque safely to T2B.

³ Dynamic maximum motorcurrent: For dynamic applications the maximum current can be increased to this value in dependency of the mass moment of inertia relation. We recommend a detailed calculation with Cymex.

4.19 Parameter TPM+ Power 110 560V

Code	Description	Unit	i=4-35 560 VDC	i=40-100 560 VDC
S-0-0141	Motor type	-	TPMP110S	TPMP110S
P-0-4014	Type of construction of motor	-	0	0
P-0-0001	Switching frequency of the power stage	kHz	8	8
P-0-0018	Number of pole pairs	-	6	6
P-0-0051	Torque/force constant	Nm/Arms	1,09	1,08
P-0-0510	Rotor inertia	kgm ²	See table below	
P-0-4016	Direct-axis inductance of motor	mH	0,45	0,95
P-0-4017	Quadrature-axis inductance of motor	mH	0,45	0,95
P-0-4048	Stator resistance	Ohm	0,08	0,25
S-0-0106	Current loop p. gain 1	V/A	2,38	5,02
S-0-0107	Current loop integral action time 1	ms	14,4	10,1
S-0-0109	Motor peak current	Arms	See table below	
S-0-0111	Motor current at standstill	Arms	38,60	21,90
S-0-0113	Maximum motor speed	1/min	4200	4500
S-0-0201	Motor warning temperature	°C	130	130
S-0-0204	Motor shutdown temperature	°C	145	145
S-0-0100	Velocity loop proportional gain	As/rad	16,99	8,9
S-0-0101	Velocity loop integral action time	ms	10	10
P-0-0004	Velocity loop smooth. time constant	μs	250	250
P-0-0525 ¹	Holding brake control word	-	100	100
S-0-0206	Drive on delay time	ms	200	200
S-0-0207	Drive off delay time	ms	50	50
P-0-0540	Torque of holding brake	Nm	72	72

¹ For actuators without brake P-0-0525 has to be set to 0.
Please refer to chapter Parameterization of motor feedback.

Ratio	Motor inertia w/o brake[kgm ²]	Motor inertia with brake[kgm ²]	$I_{\max \text{ stat}}$ [A _{rms}] ²	$I_{\max \text{ dyn}}$ ³ [A _{rms}] ³
4	0,014173	0,015873	100,00	100,00
5	0,013191	0,014891	100,00	100,00
7	0,012300	0,014000	100,00	100,00
10	0,011812	0,013512	62,60	100,00
16	0,011699	0,013399	100,00	100,00
20	0,011670	0,013370	92,40	100,00
25	0,011630	0,013330	72,90	100,00
28	0,011505	0,013205	64,40	100,00
35	0,011485	0,013185	50,50	100,00
40	0,006023	0,007723	46,00	50,00
50	0,006013	0,007713	36,30	50,00
70	0,006004	0,007704	25,30	50,00
100	0,005999	0,007699	15,50	50,00

² Static maximum motorcurrent: Use this maximum current to protect the gear reducer from overload and to reduce the torque safely to T2B.

³ Dynamic maximum motorcurrent: For dynamic applications the maximum current can be increased to this value in dependency of the mass moment of inertia relation. We recommend a detailed calculation with Cymex.

4.20 Parameter TPM+ Power 004 320V

Code	Description	Unit	i=4-35 320 VDC	i=40-100 320 VDC
S-0-0141	Motor type	-	TPMP004S	TPMP004S
P-0-4014	Type of construction of motor	-	0	0
P-0-0001	Switching frequency of the power stage	kHz	8	8
P-0-0018	Number of pole pairs	-	4	4
P-0-0051	Torque/force constant	Nm/Arms	0,56	0,45
P-0-0510	Rotor inertia	kgm ²	See table below	
P-0-4016	Direct-axis inductance of motor	mH	3,66	5,00
P-0-4017	Quadrature-axis inductance of motor	mH	3,66	5,00
P-0-4048	Stator resistance	Ohm	7,10	13,30
S-0-0106	Current loop p. gain 1	V/A	19,35	26,40
S-0-0107	Current loop integral action time 1	ms	1,4	1,0
S-0-0109	Motor peak current	Arms	See table below	
S-0-0111	Motor current at standstill	Arms	2,70	1,70
S-0-0113	Maximum motor speed	1/min	6000	6000
S-0-0201	Motor warning temperature	°C	130	130
S-0-0204	Motor shutdown temperature	°C	145	145
S-0-0100	Velocity loop proportional gain	As/rad	0,04	0,02
S-0-0101	Velocity loop integral action time	ms	10	10
P-0-0004	Velocity loop smooth. time constant	μs	250	250
P-0-0525 ¹	Holding brake control word	-	100	100
S-0-0206	Drive on delay time	ms	12	12
S-0-0207	Drive off delay time	ms	10	10
P-0-0540	Torque of holding brake	Nm	1,1	1,1

¹ For actuators without brake P-0-0525 has to be set to 0.
Please refer to chapter Parameterization of motor feedback.

Ratio	Motor inertia w/o brake[kgm ²]	Motor inertia with brake[kgm ²]	$I_{\max \text{ stat}}$ [A _{rms}] ²	$I_{\max \text{ dyn}}$ [A _{rms}] ³
4	0,000039	0,000041	9,00	9,00
5	0,000036	0,000038	9,00	9,00
7	0,000033	0,000035	9,00	9,00
10	0,000031	0,000034	6,20	9,00
16	0,000032	0,000034	7,60	9,00
20	0,000031	0,000034	6,10	9,00
25	0,000031	0,000034	4,80	9,00
28	0,000031	0,000033	4,20	9,00
35	0,000031	0,000033	3,30	9,00
40	0,000016	0,000018	3,60	5,20
50	0,000016	0,000018	2,90	5,20
70	0,000016	0,000018	2,00	5,20
100	0,000016	0,000018	1,10	5,20

² Static maximum motorcurrent: Use this maximum current to protect the gear reducer from overload and to reduce the torque safely to T2B.

³ Dynamic maximum motorcurrent: For dynamic applications the maximum current can be increased to this value in dependency of the mass moment of inertia relation. We recommend a detailed calculation with Cymex.

4.21 Parameter TPM+ Power 010 320V

Code	Description	Unit	i=4-35 320 VDC	i=40-100 320 VDC
S-0-0141	Motor type	-	TPMP010S	TPMP010S
P-0-4014	Type of construction of motor	-	0	0
P-0-0001	Switching frequency of the power stage	kHz	8	8
P-0-0018	Number of pole pairs	-	6	6
P-0-0051	Torque/force constant	Nm/Arms	0,56	0,59
P-0-0510	Rotor inertia	kgm ²	See table below	
P-0-4016	Direct-axis inductance of motor	mH	1,00	3,15
P-0-4017	Quadrature-axis inductance of motor	mH	1,00	3,15
P-0-4048	Stator resistance	Ohm	0,73	4,50
S-0-0106	Current loop p. gain 1	V/A	5,28	16,63
S-0-0107	Current loop integral action time 1	ms	3,6	1,9
S-0-0109	Motor peak current	Arms	See table below	
S-0-0111	Motor current at standstill	Arms	9,40	3,20
S-0-0113	Maximum motor speed	1/min	6000	6000
S-0-0201	Motor warning temperature	°C	130	130
S-0-0204	Motor shutdown temperature	°C	145	145
S-0-0100	Velocity loop proportional gain	As/rad	0,29	0,11
S-0-0101	Velocity loop integral action time	ms	10	10
P-0-0004	Velocity loop smooth. time constant	µs	250	250
P-0-0525 ¹	Holding brake control word	-	100	100
S-0-0206	Drive on delay time	ms	30	30
S-0-0207	Drive off delay time	ms	20	20
P-0-0540	Torque of holding brake	Nm	4,5	4,5

¹ For actuators without brake P-0-0525 has to be set to 0.
Please refer to chapter Parameterization of motor feedback.

Ratio	Motor inertia w/o brake[kgm ²]	Motor inertia with brake[kgm ²]	$I_{\max \text{ stat}}$ [A _{rms}] ²	$I_{\max \text{ dyn}}$ [A _{rms}] ³
4	0,000238	0,000257	29,40	29,40
5	0,000222	0,000241	29,40	29,40
7	0,000208	0,000227	29,40	29,40
10	0,000200	0,000219	21,10	29,40
16	0,000202	0,000221	19,90	29,40
20	0,000199	0,000218	15,50	29,40
25	0,000198	0,000217	11,90	29,40
28	0,000196	0,000215	10,30	29,40
35	0,000196	0,000214	8,20	29,40
40	0,000072	0,000091	8,10	10,40
50	0,000072	0,000091	6,50	10,40
70	0,000072	0,000091	4,70	10,40
100	0,000072	0,000091	2,60	10,40

² Static maximum motorcurrent: Use this maximum current to protect the gear reducer from overload and to reduce the torque safely to T2B.

³ Dynamic maximum motorcurrent: For dynamic applications the maximum current can be increased to this value in dependency of the mass moment of inertia relation. We recommend a detailed calculation with Cymex.

4.22 Parameter TPM+ Power 025 320V

Code	Description	Unit	i=4-35 320 VDC	i=40-100 320 VDC
S-0-0141	Motor type	-	TPMP025S	TPMP025S
P-0-4014	Type of construction of motor	-	0	0
P-0-0001	Switching frequency of the power stage	kHz	8	8
P-0-0018	Number of pole pairs	-	6	6
P-0-0051	Torque/force constant	Nm/Arms	0,58	0,56
P-0-0510	Rotor inertia	kgm ²	See table below	
P-0-4016	Direct-axis inductance of motor	mH	0,50	1,85
P-0-4017	Quadrature-axis inductance of motor	mH	0,50	1,85
P-0-4048	Stator resistance	Ohm	0,13	1,33
S-0-0106	Current loop p. gain 1	V/A	2,65	9,77
S-0-0107	Current loop integral action time 1	ms	10,3	3,7
S-0-0109	Motor peak current	Arms	See table below	
S-0-0111	Motor current at standstill	Arms	23,70	6,90
S-0-0113	Maximum motor speed	1/min	6000	6000
S-0-0201	Motor warning temperature	°C	130	130
S-0-0204	Motor shutdown temperature	°C	145	145
S-0-0100	Velocity loop proportional gain	As/rad	1,29	0,36
S-0-0101	Velocity loop integral action time	ms	10	10
P-0-0004	Velocity loop smooth. time constant	μs	250	250
P-0-0525 ¹	Holding brake control word	-	100	100
S-0-0206	Drive on delay time	ms	42	42
S-0-0207	Drive off delay time	ms	20	20
P-0-0540	Torque of holding brake	Nm	13	13

¹ For actuators without brake P-0-0525 has to be set to 0.
Please refer to chapter Parameterization of motor feedback.

Ratio	Motor inertia w/o brake[kgm ²]	Motor inertia with brake[kgm ²]	I _{max stat} [A _{rms}] ²	I _{max dyn} ³ [A _{rms}] ³
4	0,000998	0,001098	70,00	70,00
5	0,000950	0,001050	70,00	70,00
7	0,000907	0,001007	70,00	70,00
10	0,000884	0,000984	47,10	70,00
16	0,000894	0,000994	52,20	70,00
20	0,000883	0,000982	40,20	70,00
25	0,000881	0,000980	34,00	70,00
28	0,000872	0,000972	26,60	70,00
35	0,000871	0,000971	22,50	70,00
40	0,000248	0,000348	21,00	21,00
50	0,000248	0,000348	20,90	21,00
70	0,000248	0,000347	12,40	21,00
100	0,000247	0,000347	11,10	21,00

² Static maximum motorcurrent: Use this maximum current to protect the gear reducer from overload and to reduce the torque safely to T2B.

³ Dynamic maximum motorcurrent: For dynamic applications the maximum current can be increased to this value in dependency of the mass moment of inertia relation. We recommend a detailed calculation with Cymex.

4.23 Parameter TPM+ High Torque 010 560V

Code	Description	Unit	i=22-110 560 VDC	i=154-220 560 VDC
S-0-0141	Motor type	-	TPMA010S	TPMA010S
P-0-4014	Type of construction of motor	-	0	0
P-0-0001	Switching frequency of the power stage	kHz	8	8
P-0-0018	Number of pole pairs	-	6	6
P-0-0051	Torque/force constant	Nm/Arms	0,83	0,82
P-0-0510	Rotor inertia	kgm ²	See table below	
P-0-4016	Direct-axis inductance of motor	mH	3,00	9,45
P-0-4017	Quadrature-axis inductance of motor	mH	3,00	9,45
P-0-4048	Stator resistance	Ohm	2,36	15,70
S-0-0106	Current loop p. gain 1	V/A	15,84	49,90
S-0-0107	Current loop integral action time 1	ms	3,4	1,6
S-0-0109	Motor peak current	Arms	See table below	
S-0-0111	Motor current at standstill	Arms	5,00	1,90
S-0-0113	Maximum motor speed	1/min	4850	4850
S-0-0201	Motor warning temperature	°C	130	130
S-0-0204	Motor shutdown temperature	°C	145	145
S-0-0100	Velocity loop proportional gain	As/rad	0,3	0,1
S-0-0101	Velocity loop integral action time	ms	10	10
P-0-0004	Velocity loop smooth. time constant	μs	250	250
P-0-0525 ¹	Holding brake control word	-	100	100
S-0-0206	Drive on delay time	ms	30	30
S-0-0207	Drive off delay time	ms	20	25
P-0-0540	Torque of holding brake	Nm	4,5	1,8

¹ For actuators without brake P-0-0525 has to be set to 0.
Please refer to chapter Parameterization of motor feedback.

Ratio	Motor inertia w/o brake[kgm ²]	Motor inertia with brake[kgm ²]	I _{max stat} [A _{rms}] ²	I _{max dyn} [A _{rms}] ³
22	0,000206	0,000225	15,00	17,00
27,5	0,000203	0,000222	11,90	17,00
38,5	0,000201	0,000220	8,40	17,00
55	0,000199	0,000218	5,80	17,00
66	-	-	-	-
88	0,000201	0,000220	3,70	17,00
110	0,000200	0,000219	3,00	17,00
154	0,000068	0,000087	2,20	6,00
220	0,000067	0,000086	1,60	6,00

² Static maximum motorcurrent: Use this maximum current to protect the gear reducer from overload and to reduce the torque safely to T2B.

³ Dynamic maximum motorcurrent: For dynamic applications the maximum current can be increased to this value in dependency of the mass moment of inertia relation. We recommend a detailed calculation with Cymex.

4.24 Parameter TPM+ High Torque 025 560V

Code	Description	Unit	i=22-55 560 VDC	i=66-220 560 VDC
S-0-0141	Motor type	-	TPMA025S	TPMA025S
P-0-4014	Type of construction of motor	-	0	0
P-0-0001	Switching frequency of the power stage	kHz	8	8
P-0-0018	Number of pole pairs	-	6	6
P-0-0051	Torque/force constant	Nm/Arms	0,98	0,83
P-0-0510	Rotor inertia	kgm ²	See table below	
P-0-4016	Direct-axis inductance of motor	mH	1,50	3,00
P-0-4017	Quadrature-axis inductance of motor	mH	1,50	3,00
P-0-4048	Stator resistance	Ohm	0,47	2,36
S-0-0106	Current loop p. gain 1	V/A	7,92	15,84
S-0-0107	Current loop integral action time 1	ms	8,5	3,4
S-0-0109	Motor peak current	Arms	See table below	
S-0-0111	Motor current at standstill	Arms	13,10	5,80
S-0-0113	Maximum motor speed	1/min	4850	4850
S-0-0201	Motor warning temperature	°C	130	130
S-0-0204	Motor shutdown temperature	°C	145	145
S-0-0100	Velocity loop proportional gain	As/rad	1,3	0,28
S-0-0101	Velocity loop integral action time	ms	10	10
P-0-0004	Velocity loop smooth. time constant	µs	250	250
P-0-0525 ¹	Holding brake control word	-	100	100
S-0-0206	Drive on delay time	ms	42	30
S-0-0207	Drive off delay time	ms	20	20
P-0-0540	Torque of holding brake	Nm	13	4,5

¹ For actuators without brake P-0-0525 has to be set to 0.
Please refer to chapter Parameterization of motor feedback.

Ratio	Motor inertia w/o brake[kgm ²]	Motor inertia with brake[kgm ²]	I _{max stat} [A _{rms}] ²	I _{max dyn} ³ [A _{rms}] ³
22	0,000901	0,001000	33,40	40,00
27,5	0,000883	0,000983	26,10	40,00
38,5	0,000874	0,000974	17,80	40,00
55	0,000869	0,000969	11,80	40,00
66	0,000203	0,000222	10,50	17,00
88	0,000196	0,000215	7,80	17,00
110	0,000193	0,000212	6,20	17,00
154	0,000191	0,000210	4,40	17,00
220	0,000189	0,000208	3,10	17,00

² Static maximum motorcurrent: Use this maximum current to protect the gear reducer from overload and to reduce the torque safely to T2B.

³ Dynamic maximum motorcurrent: For dynamic applications the maximum current can be increased to this value in dependency of the mass moment of inertia relation. We recommend a detailed calculation with Cymex.

4.25 Parameter TPM+ High Torque 050 560V

Code	Description	Unit	i=22-55 560 VDC	i=66-220 560 VDC
S-0-0141	Motor type	-	TPMA050S	TPMA050S
P-0-4014	Type of construction of motor	-	0	0
P-0-0001	Switching frequency of the power stage	kHz	8	8
P-0-0018	Number of pole pairs	-	6	6
P-0-0051	Torque/force constant	Nm/Arms	1,21	1,00
P-0-0510	Rotor inertia	kgm ²	See table below	
P-0-4016	Direct-axis inductance of motor	mH	1,05	1,50
P-0-4017	Quadrature-axis inductance of motor	mH	1,05	1,50
P-0-4048	Stator resistance	Ohm	0,29	0,47
S-0-0106	Current loop p. gain 1	V/A	5,54	7,92
S-0-0107	Current loop integral action time 1	ms	9,7	8,5
S-0-0109	Motor peak current	Arms	See table below	
S-0-0111	Motor current at standstill	Arms	17,90	12,60
S-0-0113	Maximum motor speed	1/min	4500	4850
S-0-0201	Motor warning temperature	°C	130	130
S-0-0204	Motor shutdown temperature	°C	145	145
S-0-0100	Velocity loop proportional gain	As/rad	3,31	1,3
S-0-0101	Velocity loop integral action time	ms	10	10
P-0-0004	Velocity loop smooth. time constant	μs	250	250
P-0-0525 ¹	Holding brake control word	-	100	100
S-0-0206	Drive on delay time	ms	50	42
S-0-0207	Drive off delay time	ms	40	20
P-0-0540	Torque of holding brake	Nm	23	13

¹ For actuators without brake P-0-0525 has to be set to 0.
Please refer to chapter Parameterization of motor feedback.

Ratio	Motor inertia w/o brake[kgm ²]	Motor inertia with brake[kgm ²]	$I_{\max \text{ stat}}$ [A _{rms}] ²	$I_{\max \text{ dyn}}$ [A _{rms}] ³
22	0,002380	0,002560	48,10	63,50
27,5	0,002335	0,002515	37,30	63,50
38,5	0,002299	0,002479	25,10	63,50
55	0,002281	0,002461	16,40	63,50
66	0,000923	0,001022	18,20	40,00
88	0,000904	0,001003	12,50	40,00
110	0,000884	0,000983	10,10	40,00
154	0,000874	0,000974	7,20	40,00
220	0,000869	0,000969	5,00	40,00

² Static maximum motorcurrent: Use this maximum current to protect the gear reducer from overload and to reduce the torque safely to T2B.

³ Dynamic maximum motorcurrent: For dynamic applications the maximum current can be increased to this value in dependency of the mass moment of inertia relation. We recommend a detailed calculation with Cymex.

4.26 Parameter TPM+ High Torque 110 560V

Code	Description	Unit	i=22-55 560 VDC	i=66-88 560 VDC	i=110-220 560 VDC
S-0-0141	Motor type	-	TPMA110S	TPMA110S	TPMA110S
P-0-4014	Type of construction of motor	-	0	0	0
P-0-0001	Switching frequency of the power stage	kHz	8	8	8
P-0-0018	Number of pole pairs	-	6	6	6
P-0-0051	Torque/force constant	Nm/Arms	1,17	1,09	1,19
P-0-0510	Rotor inertia	kgm ²	See table below		
P-0-4016	Direct-axis inductance of motor	mH	0,34	0,45	1,05
P-0-4017	Quadrature-axis inductance of motor	mH	0,34	0,45	1,05
P-0-4048	Stator resistance	Ohm	0,05	0,08	0,29
S-0-0106	Current loop p. gain 1	V/A	1,77	2,38	5,54
S-0-0107	Current loop integral action time 1	ms	18,6	14,4	9,6
S-0-0109	Motor peak current	Arms	See table below		
S-0-0111	Motor current at standstill	Arms	tbd	40,80	20,50
S-0-0113	Maximum motor speed	1/min	4150	4150	4500
S-0-0201	Motor warning temperature	°C	130	130	130
S-0-0204	Motor shutdown temperature	°C	145	145	145
S-0-0100	Velocity loop proportional gain	As/rad	31,92	16,05	3,31
S-0-0101	Velocity loop integral action time	ms	10	10	10
P-0-0004	Velocity loop smooth. time constant	µs	250	250	250
P-0-0525 ¹	Holding brake control word	-	100	100	100
S-0-0206	Drive on delay time	ms	200	200	50
S-0-0207	Drive off delay time	ms	50	50	40
P-0-0540	Torque of holding brake	Nm	72	72	23

¹ For actuators without brake P-0-0525 has to be set to 0.
Please refer to chapter Parameterization of motor feedback.

Ratio	Motor inertia w/o brake[kgm ²]	Motor inertia with brake[kgm ²]	I _{max stat} [A _{rms}] ²	I _{max dyn} ³ [A _{rms}] ³
22	0,022037	0,023687	tbd	tbd
27,5	0,021891	0,023541	tbd	tbd
38,5	0,021763	0,023413	tbd	tbd
55	0,021694	0,023344	tbd	tbd
66	0,011182	0,012882	40,50	100,00
88	0,010824	0,012524	30,40	100,00
110	0,002286	0,002466	23,00	63,50
154	0,002248	0,002428	15,90	63,50
220	0,002225	0,002405	11,20	63,50

² Static maximum motorcurrent: Use this maximum current to protect the gear reducer from overload and to reduce the torque safely to T2B.

³ Dynamic maximum motorcurrent: For dynamic applications the maximum current can be increased to this value in dependency of the mass moment of inertia relation. We recommend a detailed calculation with Cymex.

4.27 Parameter TPM+ High Torque 010 320V

Code	Description	Unit	i=22-110 320 VDC	i=154-220 320 VDC
S-0-0141	Motor type	-	TPMA010S	TPMA010S
P-0-4014	Type of construction of motor	-	0	0
P-0-0001	Switching frequency of the power stage	kHz	8	8
P-0-0018	Number of pole pairs	-	6	6
P-0-0051	Torque/force constant	Nm/Arms	0,48	0,47
P-0-0510	Rotor inertia	kgm ²	See table below	
P-0-4016	Direct-axis inductance of motor	mH	1,00	3,15
P-0-4017	Quadrature-axis inductance of motor	mH	1,00	3,15
P-0-4048	Stator resistance	Ohm	0,81	5,23
S-0-0106	Current loop p. gain 1	V/A	5,28	16,63
S-0-0107	Current loop integral action time 1	ms	3,3	1,6
S-0-0109	Motor peak current	Arms	See table below	
S-0-0111	Motor current at standstill	Arms	8,60	3,30
S-0-0113	Maximum motor speed	1/min	4850	4850
S-0-0201	Motor warning temperature	°C	130	130
S-0-0204	Motor shutdown temperature	°C	145	145
S-0-0100	Velocity loop proportional gain	As/rad	0,3	0,1
S-0-0101	Velocity loop integral action time	ms	10	10
P-0-0004	Velocity loop smooth. time constant	µs	250	250
P-0-0525 ¹	Holding brake control word	-	100	100
S-0-0206	Drive on delay time	ms	30	30
S-0-0207	Drive off delay time	ms	20	25
P-0-0540	Torque of holding brake	Nm	4,5	1,8

¹ For actuators without brake P-0-0525 has to be set to 0.
Please refer to chapter Parameterization of motor feedback.

Ratio	Motor inertia w/o brake[kgm ²]	Motor inertia with brake[kgm ²]	I _{max stat} [A _{rms}] ²	I _{max dyn} [A _{rms}] ³
22	0,000206	0,000225	26,00	29,40
27,5	0,000203	0,000222	20,60	29,40
38,5	0,000201	0,000220	14,60	29,40
55	0,000199	0,000218	10,00	29,40
66	-	-	-	-
88	0,000201	0,000220	6,30	29,40
110	0,000200	0,000219	5,10	29,40
154	0,000068	0,000087	3,70	10,40
220	0,000067	0,000086	2,70	10,40

² Static maximum motorcurrent: Use this maximum current to protect the gear reducer from overload and to reduce the torque safely to T2B.

³ Dynamic maximum motorcurrent: For dynamic applications the maximum current can be increased to this value in dependency of the mass moment of inertia relation. We recommend a detailed calculation with Cymex.

4.28 Parameter TPM+ High Torque 025 320V

Code	Description	Unit	i=22-55 320 VDC	i=66-220 320 VDC
S-0-0141	Motor type	-	TPMA025S	TPMA025S
P-0-4014	Type of construction of motor	-	0	0
P-0-0001	Switching frequency of the power stage	kHz	8	8
P-0-0018	Number of pole pairs	-	6	6
P-0-0051	Torque/force constant	Nm/Arms	0,56	0,48
P-0-0510	Rotor inertia	kgm ²	See table below	
P-0-4016	Direct-axis inductance of motor	mH	0,50	1,00
P-0-4017	Quadrature-axis inductance of motor	mH	0,50	1,00
P-0-4048	Stator resistance	Ohm	0,16	0,81
S-0-0106	Current loop p. gain 1	V/A	2,65	5,28
S-0-0107	Current loop integral action time 1	ms	8,5	3,3
S-0-0109	Motor peak current	Arms	See table below	
S-0-0111	Motor current at standstill	Arms	22,70	10,00
S-0-0113	Maximum motor speed	1/min	4850	4850
S-0-0201	Motor warning temperature	°C	130	130
S-0-0204	Motor shutdown temperature	°C	145	145
S-0-0100	Velocity loop proportional gain	As/rad	1,3	0,28
S-0-0101	Velocity loop integral action time	ms	10	10
P-0-0004	Velocity loop smooth. time constant	µs	250	250
P-0-0525 ¹	Holding brake control word	-	100	100
S-0-0206	Drive on delay time	ms	42	30
S-0-0207	Drive off delay time	ms	20	20
P-0-0540	Torque of holding brake	Nm	13	4,5

¹ For actuators without brake P-0-0525 has to be set to 0.
Please refer to chapter Parameterization of motor feedback.

Ratio	Motor inertia w/o brake[kgm ²]	Motor inertia with brake[kgm ²]	I _{max stat} [A _{rms}] ²	I _{max dyn} ³ [A _{rms}] ³
22	0,000901	0,001000	58,30	70,00
27,5	0,000883	0,000983	45,60	70,00
38,5	0,000874	0,000974	30,90	70,00
55	0,000869	0,000969	20,40	70,00
66	0,000203	0,000222	18,10	29,40
88	0,000196	0,000215	13,60	29,40
110	0,000193	0,000212	10,80	29,40
154	0,000191	0,000210	7,70	29,40
220	0,000189	0,000208	5,40	29,40

² Static maximum motorcurrent: Use this maximum current to protect the gear reducer from overload and to reduce the torque safely to T2B.

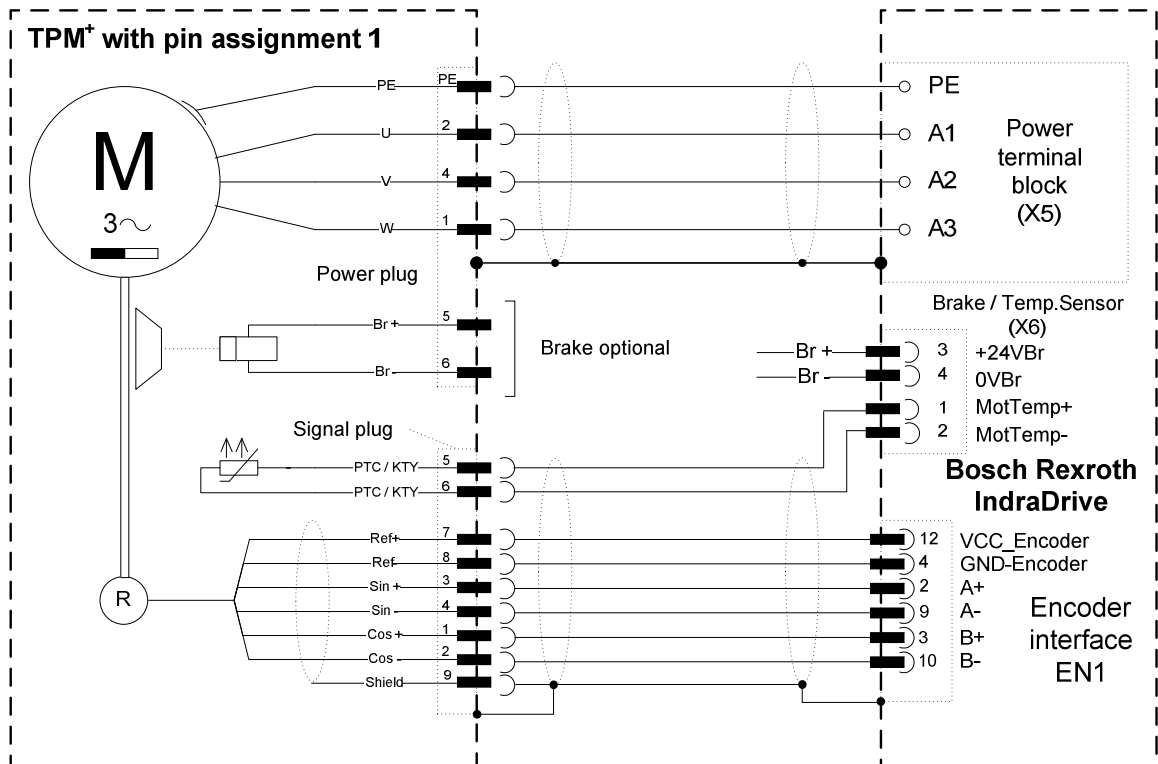
³ Dynamic maximum motorcurrent: For dynamic applications the maximum current can be increased to this value in dependency of the mass moment of inertia relation. We recommend a detailed calculation with Cymex.

5 Connection schematic TPM+

- Detailed information on cable design and the type of shielding can be found in the documentation from the servo drive manufacturer.

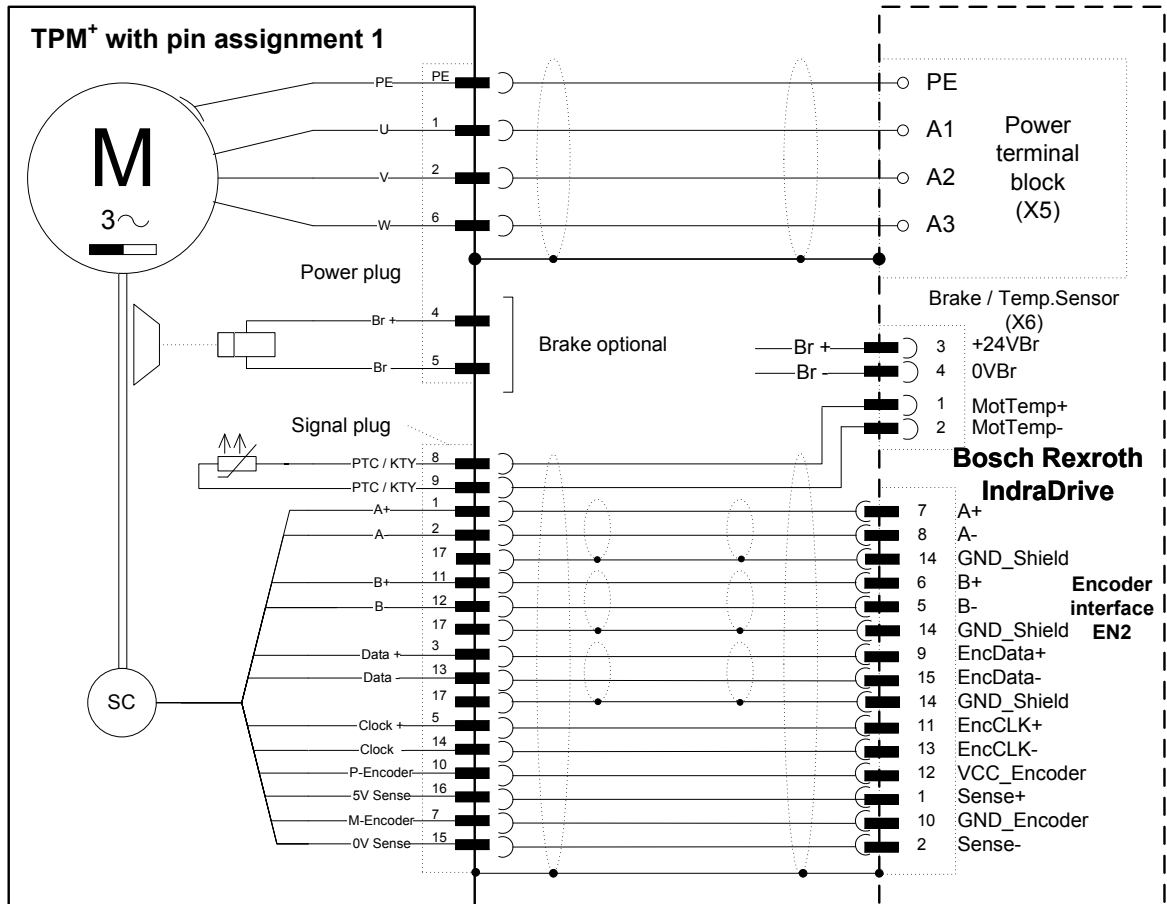
5.1 TPM+ with resolver

WITTENSTEIN alpha offers pre-manufactured and drag chain compatible cables for this servo drive. Please take the required order informations from the TPM+ catalogue.



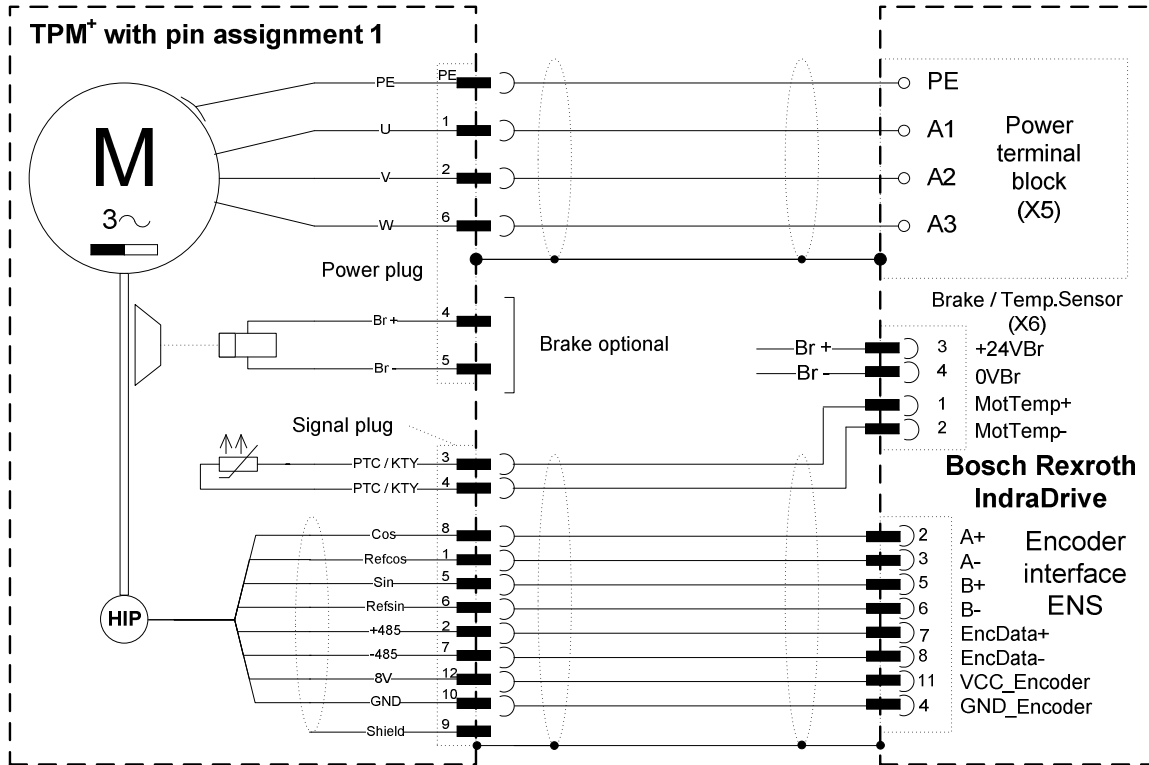
5.2 TPM+ with absolute encoder Heidenhain EnDat ECN1113 / EQN 1125

WITTENSTEIN alpha offers pre-manufactured and drag chain compatible cablessets for this servo drive. Please take the required order informations from the TPM+ catalogue.



5.3 TPM+ with absolute encoder Sick-Stegmann Hiperface SKS / SKM 36

WITTENSTEIN alpha offers pre-manufactured and drag chain compatible cablesets for this servo drive. Please take the required order informations from the TPM+ catalogue.



6 Diagnostic messages during initial start-up

During initial start-up faults may occur. Following diagnostic messages could appear with a correctly working TPM. For further investigations please consult the documentation from Bosch Rexroth.

Diagnostic message	Possible cause	Solution
F2028 Excessive deviation F8078 Velocity loop error F8079 Velocity limit S-0-0091 exceeded	Commutation angle not correct	Check wiring of motor and motor feedback. Verify that P-0-0508 was taken over correctly by the drive. If not please activate the commutation angle determination routine.
F2074 Absolute encoder out of window F2075 F2076	Initial start-up	Set absolute measurement
E2063 Velocity command value > limit S-0-0091	Speed command exceeds the value for bipolar limit in S-0-091	Adjust the value for S-0-0091 according your application. Verify the scaling of your application.
F2018 Device overtemperature shutdown F2019 Motor overtemperature shutdown F2021 Motor temperature monitor defective F2022 Device temperature monitor defective	Wrong parameterisation of temperature sensor	Reconfigure the parameters P-0-0512 and P-0-0513 according to your TPM.



alpha

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