LUST

ServoOne

Parameter Description

Base software

ServoOne High-performance drives

The modularity of the ServoOne guarantees you optimum integration into the machine process. Whether in high-speed field bus communication with the central multi-axis machine controller or with distributed programmable Motion Control intelligence in the drive controller, the ServoOne is a master of both.

Parameter Description – ServoOne

ID no.: 1100.03B.0-00
Date: 10/2007
Applicable as from firmware version: V1.10

We reserve the right to make technical changes.

The content of this Application Manual was compiled with the greatest care and attention, and based on the latest information available to us.

We should nevertheless point out that this document cannot always be updated in line with ongoing technical developments in our products. We would therefore request that you contact us if you have any specific queries.

Table of contents

Summary

Since the drive controller software offers a wide range of functions, including the facility to interface different field buses, the documentation is spread across a number of individual documents, as shown in figure 1.

Documentation system:

Document	Contents	Description
Operation Manual	Device mounting, installation, safety, specification	Hardware
Application Manual	Function description	Base software
CANopen User Manual	Description and parameter setting on the ServoOne	Hardware and software of the field bus configuration
EtherCAT User Manual	Description and parameter setting on the ServoOne	Hardware and software of the field bus configuration
SERCOS User Manual	Description and parameter setting on the ServoOne	Hardware and software of the field bus configuration
PROFIBUS-DPV User Manual	Description and parameter setting on the ServoOne	Hardware and software of the field bus configuration
Parameter Description	Short description of all parameters	Base software

Fig. 1: Overview of drive controller documents.

How do I read the documents?

First be sure to read the Operation Manual, so as to install the device correctly.

Refer to the Application Manual with regard to the basic configuration and operation of the motor.

If the device is controlled by way of a field bus option card, please use the separate user manuals for the individual bus systems.

The parameter list sets out all the parameters at the Local Administrator level (the user level of the DriveManager) in table form. Their sequencing is oriented to the layout of subject areas in the DriveManager DM 5.x. Consequently, the parameters are not numbered consecutively. A key to the symbols used and a description of the parameter tables are set out on the following pages.

Attention
Failure to comply with the safety instructions during commissioning may pose a danger to life for the operating personnel and lead to destruction of the device.

We hope you will enjoy working with this device!

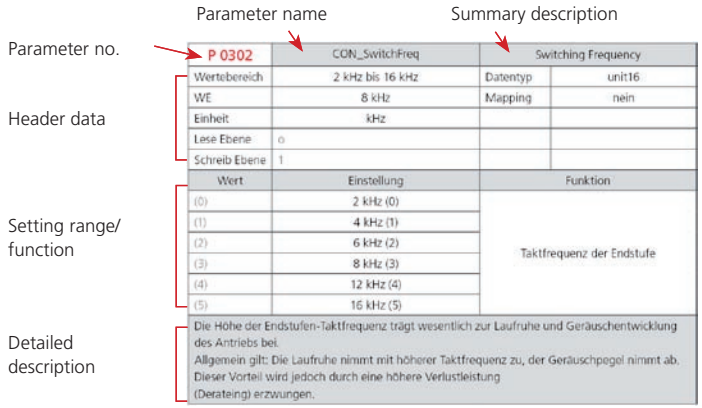
Key

Key to parameters

The individual parameter tables (see illustration on right) contain the following information:

Parameter number and index	An index is only given for field parameters.
Parameter designation from DriveManager 5.x	This information is to be found in the DriveManager under Introduction..
Parameter name	Short name of parameter, e.g. CON_SwitchFreq
Value range	Setting range from/to
FS	Factory setting / Default
Unit	
Read Write	Read/write access to the parameter (depending on the preset user level: FS Local Administrator)
Data type	See below, “Data types” table
Mapping	“Mapping“ indicates whether a parameter can be used as process information.
Value (0), (1), ...	Sequence from DriveManager.
Setting	Settings selectable in the DriveManager
Function	Description of function

Parameter overview with all information



Attetion:
These descriptions in the parameter list are not intended to provide an exact functional description of the procedures for setting drive controller parameters! Detailed functional descriptions are to be found in the ServoOne Application Manual.

Abbreviations

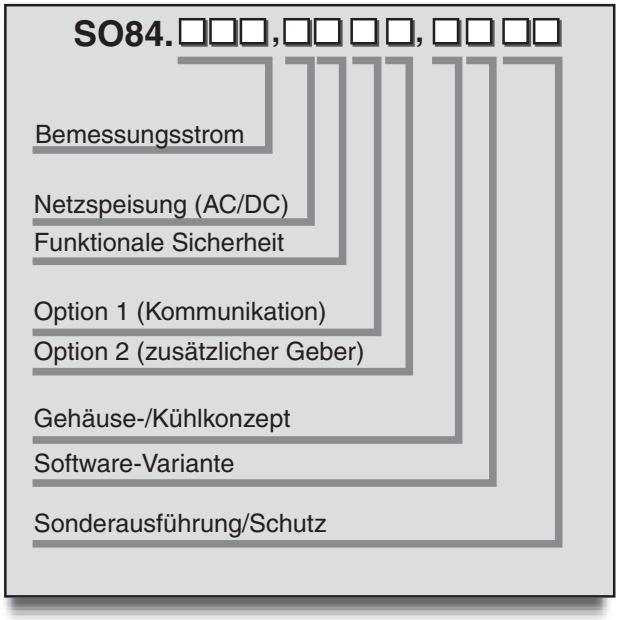
X	Wildcard, e.g.:ISA0X stand for ISA00 or ISA01
Index	Field parameters are assigned a parameter number and index.
G	Dependent on device
ni	Not implemented
P XXXX	Variables for parameter numbers
incr	Increments

Data types

usign8	Natural integer, unsigned (8 bits)
usign16	Natural integer, unsigned (16 bits)
usign32	Natural integer, unsigned (32 bits)
int8	Integer, signed (8 bits)
uint16	Integer, unsigned (16 bits)
int32	Integer, signed (32 bits)
float32	Floating point number in IEEE format (32 bits)
string	ASCII characters, max. 100 bytes in bus operation incl. Zero terminator

Order code

The order designation provides information on the configuration variant of the servocontroller supplied to you. For details on the order code refer to the Order Catalogue.



Pictograms

To provide clear guidance, this Application Manual uses pictograms. Their meanings are set out in the following table. The pictograms always have the same meanings, even where they are placed without text, such as next to a connection diagram.

	Attention! Misoperation may result in damage to the drive or malfunctions.
	Danger from electrical tension! Improper behaviour may endanger human life.
	Danger from rotating parts! Drive may start up automatically.
	Note: Useful information.

1 Power Stage

The device supports the infeed of various mains voltages and switching frequencies. Consequently, in initial commissioning the mains voltage setting must be checked and adjusted as necessary. By way of parameter P 0302 CON_SwitchFreq the clock frequency of the power stage can be additionally tailored to your application.

P 0307	CON_VoltageSupply	Voltage Supply Mode	
Value range	0 – 4	Data type	uint16
FS	3x400 V	Mapping	Yes
Unit	V		
Read	0		
Write	1		
Value	Setting	Function	
(0)	1 x 230 V (0)	Selection of mains input voltage	
(1)	3 x 230 V (1)		
(2)	3 x 400 V (2)		
(3)	3 x 460 V (3)		
(4)	3 x 480 V (4)		
Adjustment of the device voltage to the local voltage system; after setting the parameter the setting must be stored in the device. It only takes effect following another Power Off / On cycle of the 24 V control voltage.			

Attention: The rated currents and overload factors and the voltage thresholds for overvoltage, undervoltage and switch-on of the braking chopper are altered by the choice of mains power feed. An incorrectly set mains voltage may result in destruction of the device.

P 0302	CON_SwitchFreq	Switching Frequency	
Value range	2 kHz – 16 kHz	Data type	unit16
FS	8 kHz	Mapping	No
Unit	kHz		
Read	0		
Write	1		
Value	Setting	Function	
(0)	2 kHz (0)	Clock frequency of power stage	
(1)	4 kHz (1)		
(2)	6 kHz (2)		
(3)	8 kHz (3)		
(4)	12 kHz (4)		
(5)	16 kHz (5)		
The level of the power stage clock frequency is a key factor in terms of the smooth and quiet running of the drive. General rule: The higher the clock frequency rises, the smoother the drive runs; the noise level decreases. This advantage is enforced by a higher power loss (derating) however.			

2 Motor

For optimum performance and ease of commissioning of the drive system, we recommend operating the device with standard motors from the catalogue. A database of motor data sets, encoder data sets and default control settings is available. The drive controller can be used to control both synchronous and asynchronous motors. Rotary and linear designs are supported.

P 0450	Motor Type	MOT_Type	
Value range	OFF – ASM	**Data type**	uint16
FS	PSM	**Mapping**	No
Unit			
Read	0		
Write	1		
Value	Setting	Function	
(0)	OFF	No motor selected	
(1)	PSM	Permanently excited synchronous machine	
(2)	ASM	Asynchronous machine	
(3)	not defined	Reserve	
Selection of motor type			

P 0490	Selection if linear or rotatory motor data are valid	MOT_IsLinMot	
Value range	ROT – LIN	**Data type**	uint16
FS	ROT	**Mapping**	No
Unit			
Read	0		
Write	2		
Value	Setting	Function	
(0)	ROT	Rotary motor system	
(1)	LIN	Linear motor system	
Selection of the motor system to be used (rotary, linear)			

P 1530	Determination of default motor control settings	SCD_SetMotorControl	
Value range	READY – FAULT	Data type	uint16
FS	READY	Mapping	No
Unit			
Read	1		
Write	2		
Unit	Setting	Function	
(0)	READY	End of calculation	
(1)	CALC	Start calculation	
(2)	FAULT	Error during calculation	

Calculation of motor data sets:
To perform the calculation, the nominal (rated) data and characteristic quantities from the data sheet of the motor used must be entered in the following parameters:
By setting parameter P 1530 SCD_SetMotorControl to "CALC", the controller calculates the required motor and controller parameters and enters the values automatically in the corresponding parameters.

Then the parameter is reset to "READY". The torque control should be adequately set. An adjustment to the machine mechanism and to the motion profile is also required.

2.1 PS synchronous motor:

2.1.1 Parameter list for setting of PS motor field model:

Number	Parameter	Description
P 0450	MOT_Type	Motor type (0= no motor, 1=PSM, 2=ASM)
P 0490	MOT_IsLinMot	Selection if linear or rotary motor data are valid
P 1530	SCD_SetMotor-control	1 = Start calculation of motor and control parameters
P 0451	MOT_Name	Motor name
P 0455	MOT_FNom	Rated frequency
P 0456	MOT_VNom	Rated voltage
P 0457	MOT_CNom	Rated current
P 0458	MOT_SNom	Rated speed
P 0459	MOT_PNom	Motor power
P 0460	MOT_TNom	Rated torque
P 0461	MOT_J	Mass moment of inertia
P 0463	MOT_PolePairs	Number of pole pairs
P 0462	MOT_FluxNom	Motor rated flux
P 0470	MOT_RStat	Stator resistance of a phase
P 0471	MOT_LSig	Stator inductance of a phase
P 0472	MOT_Lsigdiff	Scaling of stator inductance
0	Lsig_q@I0	q-stator inductance at current I0
1	Lsif_q@I1	q-stator inductance at current I_{Rated}

P 0451	Name of motor parameter set	MOT_Name	
Value range		Data type	string
FS		Mapping	No
Unit			
Read	0		
Write	1		
The motor can be assigned a dedicated name (data type String = Text)			

P 0455	Motor rated frequency	MOT_FNom	
Value range	0 – 10000	Data type	float32
FS	50	Mapping	No
Unit	Hz		
Read	0		
Write	1		
Rated frequency of the motor			

P 0456	Motor rated voltage	MOT_VNom	
Value range	0 – 1000	Data type	float32
FS	400	Mapping	No
Unit	V		
Read	0		
Write	1		
Rated voltage of the motor			

P 0457	Motor rated current	MOT_CNom	
Value range	0 – 1000	Data type	float32
FS	0.5	Mapping	No
Unit	A		

P 0457	Motor rated current	MOT_CNom	
Read	0		
Write	1		
Rated current of the motor			

P 0458	Motor rated speed	MOT_SNom	
Value range	0 – 200000	Data type	float32
FS	3000	Mapping	No
Unit	rpm		
Read	0		
Write	1		
Rated speed of the motor			

P 0459	Motor rated power	MOT_PNom	
Value range	0 – 1000	Data type	float32
FS	4	Mapping	No
Unit	kW		
Read	0		
Write	1		
Rated power of the motor			

P 0460	Motor rated torque	MOT_TNom	
Value range	0 – 10000	Data type	float32
FS	0.5	Mapping	No
Unit	Nm		
Read	0		
Write	1		
Rated torque of the motor			

P 0461	Motor inertia	MOT_J	
Value range	0 – 1000	Data type	float32
FS	0	Mapping	No
Unit	kg*m²		
Read	0		
Write	1		
Mass inertia of the motor			

P 0463	Motor number of pole pairs	MOT_VNom	
Value range	1 – 4096	Data type	uint16
FS	1	Mapping	No
Unit			
Read	0		
Write	1		
Number of pole pairs of the motor			

P 0462	Motor rated flux	MOT_FluxNom	
Value range	0 – 10	Data type	float32
FS	0.25	Mapping	No
Unit	Vs		
Read	0		
Write	1		
Magnetic flux of the motor			

P 0470	Motor stator resistance	MOT_RStat	
Value range	0 – 1000	Data type	float32
FS	1	Mapping	No
Unit	Ohm		

P 0470	Motor stator resistance	MOT_RStat	
Read	0		
Write	1		
Stator resistance of the motor. Only the value of one phase is entered. Attention: On the motor data sheet double the value (phase / phase) is often quoted.			

P 0471	Motor stray/stator inductance	MOT_VNom	
Value range	0 – 1000	Data type	float32
FS	0	Mapping	No
Unit	mH		
Read	0		
Write	1		
Stator inductance: Only the value of one phase is entered. Attention: On the motor data sheet double the value (phase / phase) is often quoted.			

P 0472 Index 00	q-Stator inductance variation in % of MOT_Lsig q-stator inductance @ 0*MOT_CNom	MOT_LsigDiff Lsig_q@I0	
Value range	0 – 1000	Data type	float32
FS	100	Mapping	No
Unit	%		
Read	0		
Write	1		
Scaling of q-stator inductance at current I0			

P 0472 Index 01	q-Stator inductance variation in % of MOT_Lsig q-stator inductance @ 1*MOT_CNom	MOT_LsigDiff Lsig_q@I1	
Value range	0 – 1000	Data type	float32
FS	100	Mapping	No
Unit	%		
Read	0		
Write	1		
Scaling of q-stator inductance at current I_{Rated}			

The following values are calculated:

- Flux settings (including for torque constant)
- V/F characteristic
- Control settings for PI current controller: The current controller is dimensioned dependent on the current switching frequency setting.
- PI values for the speed controller and the P value for the position controller gain

2.2 PS linear motor

To perform the calculations based on the characteristic quantities for the linear motor, parameter P 0490 must be set to the value "LIN". This automatically sets the number of pole pairs of the motor to "1" (P 0463). As a result, a North to North pole pitch corresponds to one virtual revolution, which is configurable in parameter P 0492 (Magnet Pitch).

List of key parameters for setting of PS motor field model:

Note: The grey-backed parameters are identical to the parameters described in section 2.1 for the PS synchronous motor.

Number	Parameter	Description
P 0451	MOT_Name	Motor name
P 0457	MOT_CNom	Motor rated current
P 0462	MOT_FluxNom	Magnetic flux
P 0472	MOT_LSigDiff	Scaling of stator inductance
P 0490	MOT_IsLinMot	Parameter 490 MOT_IsLinMot must be set to the value Lin1. This automatically sets the number of pole pairs of the motor to 1. As a result, a North to North pole pitch corresponds to one virtual revolution.
P 0491	MOT_CalcLin2Rot	Calculation of motor data from a linear to a rotary motor system
P 0492	MOT_MagnetPitch	Distance between two magnetic poles (North/North)
P 0493	MOT_SpeedMax	Maximum motor speed
P 0494	MOT_ForceNom	Rated force of the motor
P 0496	MOT_MassMotor	Mass of the active part of the motor (slide)
P 0497	MOT_MassSum	Total mass to be moved
P 0498	MOT_EncoderPeriod	Signal period of the encoder
P 0470	MOT_RStat	Stator resistance of a phase
P 0471	MOT_LSig	Stator inductance of a phase
P 1530	SCD_SetMotorcontrol	1 = Start calculation of motor and control parameters

P 0491	Calculate from linear to rotary motor data	MOT_CalcLin2Rot	
Value range	READY – CALC	Data type	uint16
FS	READY	Mapping	No
Unit			
Read	0		
Write	2		
Value	Setting	Function	
(0)	READY	Calculation ended	
(1)	CALC	Start of calculation	
Calculation of the field model of a linear drive; translation of a linear field model into a rotary field model			

P 0492	Width of one motor pole	MOT_MagnetPitch	
Value range	0 – 1000	Data type	float32
FS	20	Mapping	No
Unit	mm		
Read	0		
Write	1		
Pole pitch of the magnets (Magnet Pitch)			

P 0493	Maximum motor speed	MOT_SpeedMax	
Value range	0 – 100	Data type	float32
FS	2	Mapping	No
Unit	m/s		
Read	0		
Write	2		
Rated velocity			

P 0494	Nominal force motor	MOT_ForceNom	
Value range	0 – 1000000	Data type	float32
FS	1000	Mapping	No
Unit	N		
Read	0		
Write	2		
Rated force of the motor			

P 0496	Mass of motor slide	MOT_MassMotor	
Value range	0 – 100000	Data type	float32
FS	10	Mapping	No
Unit	kg		
Read	0		
Write	1		
Mass of the active part of the motor + slide			

P 0497	Mass of total mass, moved by the motor	MOT_MassSum	
Value range	0 – 1000000	Data type	float32
FS	10	Mapping	No
Unit	kg		
Read	0		
Write	2		
Sum total of moved mass			

P 0498	Period of line signals	MOT_EncoderPeriod	
Value range	0 – 1000	Data type	float32
FS	20	Mapping	No
Unit	µm		
Read	0		
Write	2		
Length of one signal period of the encoder			

The following values are calculated:

- Translation of the linear nominal quantities to virtual rotary nominal quantities
- Default values for auto-commutation
- Lines per encoder per virtual revolution
- Flux settings (torque constant)
- V/F characteristic
- Control settings for PI current controller: The current controller is dimensioned dependent on the current switching frequency setting.
- PI values for the speed controller and the P value for the position controller gain: In this, a moderately rigid mechanism and a 1:1 mass moment of inertia adjustment from the load to the motor are assumed.

2.3 AS motor – asynchronous motor

The parameter descriptions for parameters P0451 to P 0472 are set out in section 2.1, PS motor.

Other parameters are:

P 0473 Index 00 – 10	Main inductans vs. Isd (0.1"Index"LmagIdMax)	MOT_LmagTab	
Value range	0 – 1000	Data type	float32
FS	0	Mapping	No
Unit	mH		
Read	0		
Write	1		
Scaling table for main inductance			

P 0474	Lmag table max. magnetization current	MOT_LmagIdMax	
Value range	0 – 1000	Data type	float32
FS	0	Mapping	No
Unit	A		
Read	0		
Write	1		
Maximum magnetization current			

P 0475	Motor main inductance, scaling factor	MOT_Lmagscale	
Value range	0 – 1000	Data type	float32
FS	0	Mapping	No
Unit	%		

P 0475	Motor main inductance, scaling factor	MOT_Lmagscale	
Read	0		
Write	1		
Scaling factor for main inductance			

P 0476	Motor rotor resistance	MOT_Rrot	
Value range	0 – 3.4E 38	Data type	float32
FS	0	Mapping	No
Unit	Ohm		
Read	0		
Write	1		
Rotor resistance of the motor			

P 0477	motor rotor resistance, scaling factor	MOT_RrotScale	
Value range	0 – 1000	Data type	float32
FS	100	Mapping	No
Unit	%		
Read	0		
Write	1		
Scaling factor for the rotor resistance			

2.4 Motor protection by temperature sensor – Protection

Motors can be thermally monitored by the controller and so protected against damage. Preconditions for this are:

- Motor has a built-in temperature sensor. The temperature is monitored by temperature sensors or temperature-sensitive switches. The setting is made by way of parameter P 0732 MON_Motor_PTC:

  Possible error messages:

  E06 / 01 Calculated motor temperature above threshold value
  E06 / 02 PTC to DIN2 has tripped
  E06 / 03 PTC to DIN3 has tripped
  E06 / 04 PTC to DIN1 has tripped

- Motor protection by I^2xt monitoring

  I^2xt monitoring protects the motor against overheating over its entire speed range. This is especially important for internally cooled motors. When IEC asynchronous standard motors are operated for a prolonged period of time at low speed, the cooling provided by the fan and the housing is insufficient. Consequently, for internally cooled ASMs a reduction of the maximum permissible continuous current dependent on the rotation frequency is required. When set correctly, this function replaces a motor circuit-breaker. The characteristic can be adapted to the operating conditions by way of the interpolation points.

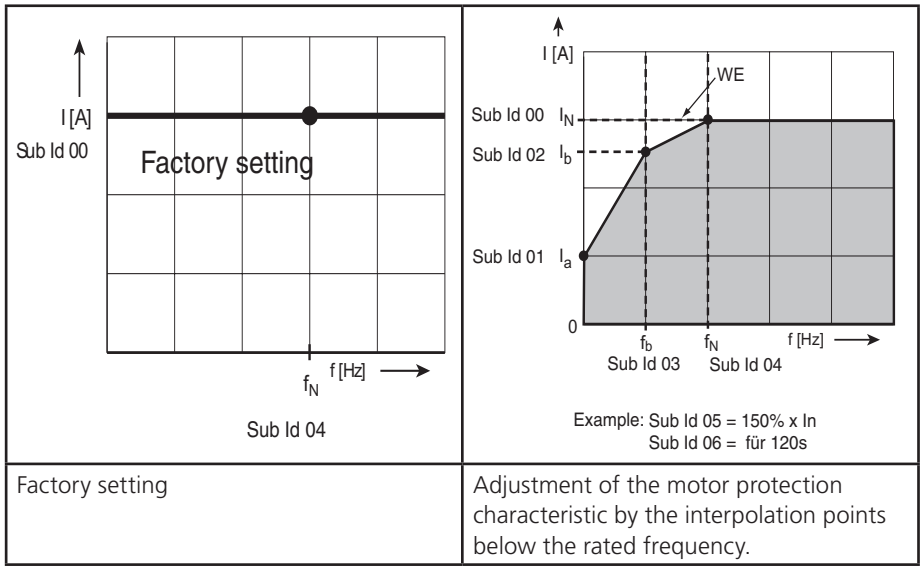
  In the event of a shut-off by the I2xt monitor the following error message appears:
  E09 / 01 I^2xt shut-off to protect the motor
  (permissible current/time range exceeded)

Limits:

The limits are specified in the servocontroller as percentages of the rated quantities (current, torque, speed,...), so that following calculation logical default settings are available. The defaults relate to 100 % of the rated quantities. That is why the parameters must be adjusted to the application and the motor.

Setting of I^2xt characteristic:

The I^2xt motor protection is set in the Motor/Protection subject area with parameter P 0733 MON_MotorI2t.



Factory setting	Adjustment of the motor protection characteristic by the interpolation points below the rated frequency.

Fig.2.4-1: Motor protection characteristic

Explanatory notes on setting of the motor protection characteristic

P 0733 Sub Id 00 – 06 MON_MotorI2t

P 0733	Units	Meaning
P 0733 – 00	I_n [%]	Rated current of the motor
P 0733 – 01	I_a [%]	1. Current interpolation point of the motor protection characteristic (referred to the max. characteristic current)
P 0733 – 02	I_b [%]	2. Current interpolation point of the motor protection characteristic (referred to the max. characteristic current)
P 0733 – 03	f_b [Hz]	2. Frequency interpolation point of the motor protection characteristic
P 0733 – 04	f_N [Hz]	Rated frequency
P 0733 – 05	I_{max} [%]	Max. overload current (referred to the motor rated current)
P 0733 – 06	t_{max} [sec]	Overload time (t_{max} for I_{max})

To protect the motor, as a rule of thumb the motor protection characteristic and operation of the IEC standard asynchronous motor should conform to the following limit values:

Frequency (Hz)	Rated motor current (%)
0	30 (Ia)
25 (fb)	80 (Ib)
50 (fN)	100 (IN)

The shut-off point defines the permissible current/time range until shut-off. For IEC standard asynchronous motors the shut-off point to VDE0530 is set as 150 % of the motor rated current for 120 s. For servomotors, refer to the motor manufacturers' specifications.

Note:
For servomotors, it is advisable to set a constant characteristic.
Observe the motor manufacturers' specifications.

P 0731	max. motor temperature, switch off value	MON_MotorTempMax	
Value range	0 – 1000	Data type	float32
FS	100	Mapping	No
Unit			
Read	0		
Write	1		
Setting of shut-off threshold (KTY84-130 only)			

P 0732 Index 00	Select motor temperature sensor Type	MON_MotorPTC sensor type	
Value range	OFF – PT100	Data type	uint16
FS	OFF	Mapping	No
Unit			
Read	0		
Write	1		
Value	**Setting**	**Function**	
(0)	OFF	No evaluation selected	
(1)	KTY	KTY84-130 Sensor	
(2)	PTC	PTC with short-circuit monitoring	
(3)	TSS	Switch (Klixon)	
(4)	PTC1	PTC without short-circuit monitoring	
(5)	PT100	PT100 Sensor	
Selection of temperature sensors supported by the drive			

P 0732 Index 01	Select motor temperature sensor Sensor connection	MON_MotorPTC Contact	
Value range	X5 – X6	Data type	uint16
FS	X5	Mapping	No
Unit			
Read	0		
Write	1		
Value	Setting	Function	
(0)	X5	Connection of the sensor to terminal X5	
(1)	X6	Connection of the sensor to terminal X6	
There are two methods of connecting the motor temperature sensor to the device. The temperature sensor cable included in the motor cable is connected directly to terminal X5. The other variant involves connecting the temperature sensor along with the 9-pin Sub D plug of the resolver at X6.			

P 0733 Index 00	Motor I2t protection parameters Rated current FNom(% of MOT_CNom)	MON_MotorI2t INom	
Value range	0 – 1000	Data type	float32
FS	100	Mapping	No
Unit	%		
Read	0		
Write	1		
Percentage rated current to be permitted (in %).			

P 0733 Index 01	Motor I2t protection parameters rated current 0Hz (% of INom)	MON_MotorI2t IO	
Value range	0 – 100	Data type	float32
FS	100	Mapping	No
Unit	%		
Read	0		
Write	1		
1. Current interpolation point: (I_a in %)			

P 0733 Index 02	Motor I2t protection parameters rated current F1 (% of INom)	MON_MotorI2t I1	
Value range	0 – 1000	Data type	float32
FS	100	Mapping	No
Unit	%		
Read	0		
Write	1		
2. Current interpolation point: (I_b in %)			

P 0733 Index 03	Motor I2t protection parameters interpolation point	MON_MotorI2t F1	
Value range	0 – 500	Data type	float32
FS	25	Mapping	No
Unit	Hz		
Read	0		
Write	1		
Frequency interpolation point: (f_b in Hz)			

P 0733 Index 04	Motor I2t protection parameters nominal frequency	MON_MotorI2t FNom	
Value range	0 – 500	Data type	float32
FS	50	Mapping	No
Unit	Hz		
Read	0		
Write	1		
Rated frequency: (f_N in Hz)			

P 0733 Index 05	Motor I2t protection parameters- Motor maximum current	MON_MotorI2t Imax	
Value range	0 – 1000	Data type	float32
FS	150	Mapping	No
Unit	%		
Read	0		
Write	1		
Permissible current in % referred to I_nMotor			

P 0733 Index 06	Motor I2t protection parameters Time during which max. current is allowed	MON_MotorI2t Time	
Value range	0 – 6000	Data type	float32
FS	120	Mapping	No
Unit	s		
Read	0		
Write	1		
Permissible time in which the maximum current may be injected.			

3 Motion profiles

3.1 Scaling – Standardization/Units

It is always necessary to adapt the scaling of the drive to the application. In this, a distinction is made between three different scaling sources. The selection is made via P 0283.

P 0283	Factorgroup Type selection	MPRO_FG_Type	
Value range	STD 402 – USER	Data type	uint16
FS	USER	Mapping	No
Unit			
Read	0		
Write	0		
Value	Setting	Function	
(0)	STD_402	Standard CANopen DS 402	
(1)	SERCOS	SERCOS profile	
(2)	USER	User-defined	
Selection of scaling via SERCOS, DS 402 or USER. Parameter details are to be found in the manuals for SERCOS and DS402. The parameters for scaling by way of the USER setting are described in the following.			

3.1.1 Description of user specific scaling parameters:

Note: At the end of the section examples of parameter setting for a rotary and a linear drive are presented by way of illustration.

P 0270	Internal position resolution	MPRO_FG_Type	
Value range	0 – 4294967295	Data type	uint32
FS	1048576	Mapping	No
Unit	incr/rev		
Read	0		
Write	1		
Internal position resolution: Number of increments per motor revolution			

P 0271	Factor group: Numerator	MPRO_FG_Num	
Value range	1 – 4294967295	Data type	uint32
FS	1	Mapping	No
Unit	rev		
Read	0		
Write	1		
To avoid rounding errors, the transmission ratio is given as a fraction. Numerator for the transmission ratio			

Note: Additional information on scaling is to be found in the SERCOS User Manual.

P 0272	Factor group: Denominator	MPRO_FG_Den	
Value range	1 – 4294967295	Data type	uint32
FS	360000	Mapping	No
Unit	rev		
Read	0		
Write	1		
Denominator for the transmission ratio			

P 0273	Factor Group: Position and speed Reverse	MPRO_FG_Reserve	
Value range	false – true	Data type	uint64
FS	false	Mapping	No
Unit			
Read	0		
Write	1		
Value	Setting	Function	
(0)	false	Clockwise	
(1)	true	Anti-clockwise	
Reverse direction			

P 0274	Factor group: speed factor	MPRO_FG_SpeedFac	
Value range	-3.4E+38 to 3.4E+38e	Data type	float32
FS	1	Mapping	No
Unit	rev/min		
Read	0		
Write	1		
Velocity factor			

P 0275	Factor group: acceleration factor	MPRO_FG_AccFac	
Value range	-3.4E+38 to 3.4E+38e	Data type	float32
FS	0.016667	Mapping	No
Unit	rev/s^2/rev/min/s		
Read	0		
Write	1		
Acceleration factor: 1/ 60 = 0.016667 (translation of rpm into 1/s)			

P 0284	Unit for position values	MPRO_FG_PosExp	
Value range		Data type	string
FS	milli degree	Mapping	No
Unit			
Read level	0		
Write level	1		
Position unit, displayed as plain text			

P 0285	Factor Group: Position unit exponent	MPRO_FG_PosExp	
Value range	atto – exa	Data type	int32
FS		Mapping	No
Unit			
Read	0		
Write	1		
Value	Setting	Function	
(-18)	a(-18)=atto	atto	
(-17)	E-17		
(-16)	E-16		
(-15)	f(-15)=femto	femto	

P 0285	Factor Group: Position unit exponent	MPRO_FG_PosExp
(-14)	E-14	
(-13)	E-13	
(-12)	p(-12)=pico	pico
(-11)	E-11	
(-10)	E-10	
(-9)	n(-9)	nano
(-8)	E-8	
(-7)	E-7	
(-6)	µ(-6	micro
(-5)	E-5	
(-4)	E-4	
(-3)	m(-3)=milli	milli
(-2)	c(-2)=centi	centi
(-1)	d(-1)=deci	deci
0	(0)=	0
(1)	E+1	
(2)	E+2	
(3)	k(3)=kilo	kilo
(4)	E+4	
(5)	E+5	
(6)	m(6)=mega	mega
(7)	E+7	
(8)	E+8	
(9)	g(9)=giga	giga
(10)	E-10	
(11)	E-11	
(12)	t(12)=terra	terra
(13)	E+13	
(14)	E+14	
(15)	p(15)=peta	peta

P 0285	Factor Group: Position unit exponent	MPRO_FG_PosExp
(16)	E+16	
(17)	E+17	
(18)	e(18)=exa	exa
Exponent of the position unit		

P 0286	Factor group: Position unit scaling factor	MPRO_FG_PosScaleFac	
Value range	-2147483648 to 2147483647	Data type	int32
FS	1	Mapping	No
Unit			
Read	0		
Write	1		
Scaling factor of the position unit			

P 0287	Unit for speed values	MPRO_FG_SpeedUnit	
Value range		Data type	string
FS	rev/min	Mapping	No
Unit			
Read	0		
Write	1		
Velocity unit, given in plain text			

P 0288	Factor Group: Velocity unit exponent	MPRO_FG_SpeedExp	
Value range	atto – exa	Data type	uint32
FS		Mapping	No

P 0288	Factor Group: Velocity unit exponent	MPRO_FG_SpeedExp	
Unit			
Read	0		
Write	1		
Exponent of the velocity unit			

P 0289	Factor group: Velocity unit scaling factor	MPRO_FG_SpeedScaleFac	
Value range	-2147483648 to 2147483647	Data type	int32
FS	1	Mapping	No
Unit			
Read	0		
Write	1		
Scaling factor of the velocity			

P 0290	Unit for acceleration and deceleration values	MPRO_FG_AccUnit	
Value range		Data type	string
FS	rev/min/s	Mapping	No
Unit			
Read	0		
Write	1		
Acceleration unit, given in plain text			

P 0291	Factor Group: Acceleration unit exponent	MPRO_FG_AccExp	
Value range	atto – Exa	Data type	int32
FS		Mapping	No
Unit			
Read	0		
Write	1		
Exponent of the acceleration unit			

P 0292	Factor group:Acceleration unit scaling factor	MPRO_FG_AccScaleFac	
Value range	-2147483648 to 2147483647	Data type	int32
FS	1	Mapping	No
Unit			
Read	0		
Write	1		
Scaling factor of the acceleration unit			

P 0293	Unit for torque values	MPRO_FG_TorqueUnit	
Value range		Data type	string
FS	Nm	Mapping	No
Unit			
Read	0		
Write	1		
Torque unit, given in plain text			

P 0294	Factor Group: Torque unit exponent	MPRO_FG_TorqueExp	
Value range	alto – exa	Data type	int32
FS		Mapping	No
Unit			
Read	0		
Write	1		
Exponent of the torque unit			

P 0295	Factor group: Torque unit scaling factor	MPRO_FG_TorqueScaleFac	
Value range	-2147483648 to 2147483647	Data type	int32
FS	1	Mapping	No
Unit			
Read	0		
Write	1		
Scaling factor of the torque unit			

3.1.2 Rotary motor:

Example

Scaling of the rotary motor:

- Positioning in milli-degrees

  One motor revolution corresponds to 360000 milli-degrees or 1048576 increments
- Velocity in [rpm]
- Acceleration in [rpm/s]

P-Nr.	Parameter name	Meaning	Default setting for rotary motor:	Internal unit
P 0270	MPRO_FG_PosNom	Increments per revolution	1048576	[incr/rev] Internal resolution 20 bits
P 0271	MPRO_FG_Nom	Numerator	1	[rev]
P 0272	MPRO_FG_Den	Denominator	360000	milli-degrees
P 0273	MPRO_FG_Reverse	Reverse direction	False = clockwise	
P 0274	MPRO_FG_Speed-Fac	Velocity factor	rpm	1[rpm]
P 0275	MPRO_FG_AccFac	Acceleration factor	1[rpm] rpm	1/60 = 0.01667 [rpm/s] U/s2

3.1.3 Linear motor:

Example

Scaling of the linear motor:

- Travel in [µm]
- Velocity in [mm/s]
- Acceleration in [mm/s²]

One revolution corresponds to a distance of 32 mm (pitch MSL)

P-Nr.	Parameter name	Meaning	Default setting for linear motor:	corresponding to
P 0270	MPRO_FG_PosNom	Increments per revolution	1048576	[incr/rev]
P 0271	MPRO_FG_Nom	Numerator	1	[rev]
P 0272	MPRO_FG_Den	Denominator	32000	incr/Umin
P 0273	MPRO_FG_Reverse	Reverse direction	False	Clockwise
P 0274	MPRO_FG_Speed-Fac	Velocity factor	0.03125 [U/s2]*60[s] = 1.875 U/s	
P 0275	MPRO_FG_AccFac	Acceleration factor	1/32 = 0.03125 rev/s² corresponds to 1mm/s²	

3.2 Basic Settings

P 0144	DriveCom: Auto start of system	MPRO_DRVCOM_Auto_START	
Value range	EDGE – LEVEL	Data type	uint16
FS	EDGE	Mapping	No
Unit			
Read	1		
Write	1		
Value	Setting	Function	
(0)	EDGE (0)	START by edge change (edge-triggered)	
(1)	LEVEL (1)	Autostart: START by change of state (level-triggered)	

The start signal is evaluated depending on the signal level.

Edge-triggered“ EDGE(0)

The start is executed after a Low-High transition of the signal. If the start signal level is High directly after power-up, the control is not started. A Low-High transition is first required.

Level-triggered“ LEVEL(1)

The start is executed when the start signal level has “HIGH” potential. If the start signal level is High on power-up, the control is started immediately.

The function is also used for autostarting after power-up.

Attention: The drive starts up automatically with the Autostart function after power-up or resetting of an error message dependent on the error response.

P 0159	Motion control selection	MPRO_CTRL_SEL	
Value range	OFF – Profibus	Data type	uint16
FS	OFF	Mapping	No
Unit			
Read	1		
Write	1		
Value	Setting	Function	
(0)	OFF	No control location selected	
(1)	TERM	Control via terminal	
(2)	PARA	Control via DRIVEMANAGER	
(3)	not defined	Not defined	
(4)	PLC	Control via PLC / IEC 61131	
(5)	DS 402	Control via DS 402 motion profile (CANopen / EtherCAT)	
(6)	SERCOS	Control via SERCOS	
(7)	PROFIBUS	Control via PROFIBUS	
The control location determines the interface via which the drive is to be controlled.			

P 0165	Motion profile selection	MPRO_REF_SEL	
Value range	OFF – Profibus	Data type	uint16
FS	OFF	Mapping	No
Unit			
Read	1		
Write	1		
Value	Setting	Function	
(0)	OFF	No reference source	
(1)	ANA0	Analog input ANA0	
(2)	ANA1	Analog input ANA1	
(3)	TAB	Table values	

P 0165	Motion profile selection	MPRO_REF_SEL
(4)	reserve	Reserve
(5)	PLC	Reference from PLC / IEC 61131
(6)	PARA	DRIVEMANAGER
(7)	DS 402	CAN bus / EtherCAT
(8)	SERCOS	SERCOS
(9)	PROFI	PROFIBUS
By way of the reference selector the reference source is defined via which the reference values are to be transferred from the controller to the drive.		

P 0166	Motion profile jerk time	MPRO_REF_JTIME	
Value range	0 – 2000	Data type	uint16
FS	0	Mapping	No
Unit	ms		
Read	1		
Write	1		
As a result of the jerk limitation the acceleration and deceleration times are increased by the smoothing time JTIME.			

P 0167	Motion profile speed override factor	MPRO_REF_OVR	
Value range	0 – 100	Data type	float32
FS	100	Mapping	No
Unit	%		
Read	0		
Write	1		
Percentage weighting of the current applied velocity reference.			

P 0301	select reference mode (PG-Mode/IP-Mode)	CON_REF_Mode	
Value range	PG – IP	Data type	uint16
FS	PG	Mapping	No
Unit			
Read	0		
Write	1		

Value	Setting	Function
(0)	PG	[1]
(1)	IP	[2]

Two methods of reference value generation are available. Firstly, reference generation by way of the Profile Generator PG; and secondly, transfer of reference values directly to the Fine Interpolator IP. This enables time-optimized positioning of a single axis to be realized.

[1] PG(0): The internal reference generation is effected by way of the so-called Profile Generator. In it all ramp functions, such as ramps, jerk and smoothing, are implemented. The internal generation is always executed at a sampling time of 1 ms.

[2] IP(1): The reference input of the higher-level PLC is routed directly to the Fine Interpolator. It is essential to adapt the sampling time between the PLC and the drive controller. Default settings are 125 µs (see ServoOne Application Manual).

P 0306	Sampling time for interpolation	CON_IpRefTS	
Value range	0 – 1000	Data type	float32
FS	0.125	Mapping	No
Unit	ms		
Read	0		
Write	1		

Adaptation of transfer rate between external PLC and drive controller

P 0335	direction lock for speed reference value	CON_SCON_DirLock	
Value range	OFF – Pos	Data type	uint16
FS	OFF	Mapping	No
Unit			
Read	0		
Write	1		

Value	Setting	Function
(0)	OFF	No lock
(1)	NEG	Lock of negative direction
(2)	POS	Lock of positive direction

Direction lock for speed reference value

P 0370	Interpolation Type control word	CON_IP	
Value range	Nolp – NonIPSpline	Data type	uint16
FS	SplineII	Mapping	No
Unit			
Read	0		
Write	1		

Value	Setting	Function
(0)	Nolp	No interpolation
(1)	Lin	Linear interpolation
(2)	SplineExtFF	Spline interpolation + input of external pre-control values
(3)	Spline	Cubic spline interpolation
(4)	NonIPSpline	Cubic spline approximation

Selection of different interpolation methods. By the choice of an appropriate method, the contouring and noise can be influenced (see Application Manual section 1.2.3).

3.3 Stop ramps

Each reference source has its own acceleration, braking and stop ramps. The special deceleration ramps listed below exist in accordance with the DS 402 standard.
The ramp functions are only effective in certain system states.

Response to quick-stop option code: "Quick stop"

The quick stop brakes an ongoing movement. The drive controller is in the "Quick stop" system state. During braking, and depending on the response, acceleration is again possible in the old "Control active" state.

P 2218	605AH DS 402 quickstop option code	MP_QuickStopOC	
Value range	POFF – VLIM_QS	**Data type**	int16
FS	POFF	**Mapping**	No
Unit			
Read	0		
Write	0		
Value	Setting	Function	
(0)	POFF	Disable power stages; drive coasts to a stop	
(1)	SDR	The drive brakes with the programmed deceleration ramp, then the power stage is disabled	
(2)	QSR	Brake with quick stop ramp, then the power stage is disabled	
(3)	CLIM	Braking with max. dynamics at current limit. The speed reference value is set equal to 0, then the power stage is disabled.	
(4)	Reserve	Reserve	
(5)	SDR_QS	Braking with programmed deceleration ramp. The drive remains in the quick stop state, current is applied to the axis at zero speed. [1)]	
(6)	QSR_QS	Braking with emergency stop ramp. The drive remains in the quick stop state, current is applied to the axis at 0 speed. [1)]	
(7)	CLIM_QS	Braking with max. dynamics at current limit. The speed reference is set equal to 0. The drive remains in the quick stop state, current is applied to the axis at 0 speed. [1)]	
(8)	Reserve	Reserve	

Response to quick-stop option code: "Quick stop"
[1)] The transition to the "Ready to switch on" state is only possible by resetting the quick stop request. In the "Quick stop" state the cancellation of the "Start control/drive" signal has no effect before the quick stop request has also been reset.

Response to Shutdown Option Code: "Control off"

The "Control off" state transition is passed when the power stage is switched off.
The control is switched off by way of various control channels (terminals, bus, PLC).

P 2219	605B H DS402 shutdown option code	MP_ShutdownOC	
Value range	QSOPC – SDR	**Data type**	int16
FS	POFF	**Mapping**	No
Unit			
Read	0		
Write	0		
Value	Setting	Function	
(-1)	QSOPC	In response to a "Shutdown" command the stop variant selected in the quick stop option code is executed.	
(0)	POFF	Disable power stages; drive coasts to a stop	
(1)	SDR	The drive brakes with a programmed deceleration ramp. Then the power stage is disabled.	
Response to Shutdown Option Code: "Control off"			

Reaktion to Disable operation Option Code

The "disable operation option code" parameter determines which action is to
be executed at the transition from "Operation enable" to "Switched on" (4 and 5).

P 2220	605CH DS402 disable operation option code	MP_DisableOpOC	
Value range	POFF – SDR	**Data type**	int16
FS	POFF	**Mapping**	No
Unit			
Read	0		
Write	0		
Value	Setting	Function	
(0)	POFF	Disable power stages; drive coasts to a stop	
(1)	SDR	The drive brakes with a programmed deceleration ramp. Then the power stage is disabled	
Response to Disable Operation Option Code			

Response to Halt Option Code / "Halt feed"

The "Halt feed" state brakes an ongoing movement for as long as the state is active. During braking the drive can be accelerated back to the previous state. When deactivated, the programmed acceleration ramp is again applied.

P 2221	605CH DS402 halt option code	MP_HaltOC	
Value range	SDR – VLIM	**Data type**	int16
FS	SDR	**Mapping**	No
Unit			
Read	0		
Write	0		
Value	Setting	Function	
(1)	SDR	The drive brakes with the programmed deceleration ramp, then the power stage is disabled	
(2)	QSR	Braking with emergency stop ramp	
(3)	CLIM	Braking with max. dynamics at current limit. The speed reference is set equal to 0. Then the power stage is disabled.	
(4)	VLIM	Braking with max. dynamics at voltage limit. The speed reference is set equal to 0. Then the power stage is disabled.	
Response to Halt Option Code / "Halt feed"			

Response to Fault Reaction Option Code / "Fault"

P 2222	605EH DS 402 fault reaction option code	MP_FaultReactionOC	
Value range	POFF – VLIM	**Data type**	int16
FS	POFF	**Mapping**	No
Unit			
Read	0		
Write	0		
Value	Setting	Function	
(0)	POFF	Disable power stages; drive coasts to a stop	
(1)	SDR	The drive brakes with a programmed deceleration ramp. Then the power stage is disabled.	
(2)	QSR	Braking with emergency stop ramp	
(3)	CLIM	Braking with max. dynamics at current limit. The speed reference is set equal to 0. Then the power stage is disabled.	
(4)	VLIM	Braking with max. dynamics at voltage limit. The speed reference is set equal to 0. Then the power stage is disabled.	
Response to Fault Reaction Option Code / "Fault"			

Braking ramp for quick stop

P 2242	6085H DS 402 Quickstop deceleration	MP_402_QuickStopDec	
Value range	0 – 4294967295	Data type	uint32
FS	3000	Mapping	Yes
Unit	rev/min/s		
Read	0		
Write	0		
Braking ramp setting in the case of quick stop			

3.4 Homing

Homing serves to establish an absolute position reference for the entire axis, and must usually be performed once after power-up. Homing becomes necessary when absolute positioning operations are carried out without absolute value encoders (e.g. SSI multiturn encoders). For all other positioning operations (relative, infinite) no referencing is required. For zero position adjustment of absolute encoders homing method 5 is available.

There are 41 different methods, which can be set according to the application.

Homing can be triggered by way of a bus system (SERCOS, CANopen, EtherCAT DS 402) or by way of the terminals.

By selecting homing (method -5 to 35) and defining the settings,

- the reference signal
  (positive limit switch, negative limit switch, reference cam)
- the direction of the drive and
- the position of the zero pulse

are defined.

Note: These drive-controlled homing runs with the corresponding parameters are also used in the case of control via the SERCOS and PROFIBUS field buses and in conjunction with internal reference generation.

P 2261	6098H DS 402 homing method	MPRO_402_HomingMethod	
Value range	Type -5 – Type 35	Data type	int8
FS	OFF	Mapping	Yes
Unit			
Read	0		
Write	0		
Value	Setting	Function	
(-5)	Act. position + homing offset(multiturn-encoder)	Homing (absolute value encoder)	
(-4)	Homing mode type 22 with continuous reference	Continuous homing, negative edge of reference cam	
(-3)	Homing mode type 20 with continuous reference	Continuous homing, positive edge of reference cam	
(-2)	No homing mode (act. position + homing offset)	No homing	
(-1)	Reference position = homing offset (parameter HOOFF)	Actual position=Zero	
(0)	Not defined	Reserve	
(1)	Neg. end switch, zero pulse	Homing negative limit switch and zero pulse	
(2)	Pos. end switch, zero pulse	Homing positive limit switch and zero pulse	
(3)	Pos. reference cams, zero pulse at RefNock=Low	Homing to cam negative edge, positive direction and zero pulse	
(4)	Pos. reference cams, zero pulse at RefNock=High	Homing to cam positive edge, positive direction and zero pulse	
(5)	Neg. reference cams, zero pulse at RefNock=Low	Homing to cam negative edge, negative direction + zero pulse	
(6)	Neg. reference cams, zero pulse at RefNock=High	Homing to cam positive edge, negative direction + zero pulse	

P 2261	6098H DS 402 homing method	MPRO_402_HomingMethod
(7) to (14)	left reference cam polarity, zero pulse at RefNock=Low	Various homing runs to cam
(15), (16)	not determined	Reserved
(17)	Neg. end switch	Homing negative limit switch
(18)	Pos. end switch	Homing positive limit switch
(19)	Pos. reference cams, Stop at RefNock=Low	Homing to cam negative edge, positive direction
(20)	Pos. reference cams, Stop at RefNock=High	Homing to cam positive edge, positive direction
(21)	Neg. reference cams, Stop at RefNock=Low	Homing to cam negative edge, negative direction
(22)	Neg. reference cams, Stop at RefNock=High	Homing to cam positive edge, negative direction
(23) to (30)	left reference cam polarity, Stop at RefNock=Low	Various homing runs to cam
(31) to (32)	Not defined	Reserved
(33)	Next left zero pulse	Zero pulse in negative direction
(34)	Next right zero pulse	Zero pulse in positive direction
(35)	Actual position = Reference position	Zero is current position
The homing method specifies the event to set the reference point. The descriptions of the various homing methods are given in section 3.3 of the ServoOne Application Manual.		

P 2262 Index 00	6099H DS 402 homing speeds Speed during search for switch	MPRO_402_HomingSpeeds SpeedSwitch	
Value range	0 – 4294967295	Data type	uint32
FS	100	Mapping	Yes
Unit	user		
Read	0		
Write	0		
Homing velocity V1 at which the drive moves until the first homing event (reference cam, zero pulse, limit switch).			

P 2262 Index 01	6099H DS 402 homing speeds homing speeds Speed during search for zero	MPRO_402_HomingSpeeds Speed Zero	
Value range	0 – 4294967295	Data type	uint32
FS	5	Mapping	Yes
Unit	user		
Read	0		
Write	0		
Homing velocity V2 at which the drive slowly approaches the reference position.			

Reference cam, limit switch

The reference cam signal can be optionally linked to one of the digital inputs. Inputs ISD00 to ISD06 are available. In homing to a limit switch, the digital input must be selected with the available selection parameter LCW(5) for a positive or LCCW(6) negative limit switch. In homing to a cam, the selection parameter HOMSW(10) must be chosen (see parameters P 0101 – P 0107).

P 2263	609AH DS 402 homing accelera-tion	MPRO_402_HomingACC	
Value range	0 – 4294967295	Data type	uint32
FS	100	Mapping	Yes
Unit	user		
Read	0		
Write	0		
Acceleration of homing velocity V1 and V2			

P 2234	607CH DS 402 home offset	MPRO_402_HomeOffset	
Value range	-2147483648 to 2147483647	Data type	int32
FS	0	Mapping	Yes
Unit	user		
Read	0		
Write	0		
The reference point is always set with the zero offset.			

3.5 Manual/Jog mode

Manual mode is only applicable to the Positioning operation mode. When jog mode is active, however, the drive is operated in velocity-controlled mode (infinite). For this mode two velocities are selectable. They can be activated via terminal or field bus. The drive is controlled in jog mode via two signals/inputs either in positive or negative direction.
If one of these signals becomes active, and if loop control is active, the drive moves in slow jog mode. Quick jog is activated by additionally actuating the second jog input while in slow jog mode. If the first signal is deactivated in quick jog mode, the drive stops.
If it is set again, the drive again moves in slow jog mode, even when a quick jog request is actuated. An example of a jog in positive direction is shown in the following table 3-5.1.

P 0168 Index 00	Motion profile jogging speeds Speed fast joging	MPRO_REF_JogSpeeds FastJogSpeed	
Value range	0 – 4294967295	Data type	uint32
FS	100	Mapping	No
Unit			
Read	0		
Write	1		
Quick jog mode			

P 0168 Index 01	Motion profile jogging speeds Speed slow jogging	MPRO_REF_JogSpeeds SlowJogSpeed	
Value range	0 – 4294967295	Data type	uint32
FS	10	Mapping	No
Unit			
Read	0		
Write	1		
Slow jog mode			

No	Jog pos.	Jog neg.	Velocity
1	0	0	Standstill
2	1	0	Slow jog
3	1	1	Quick jog
4	0	1	Standstill
5	1	1	Slow jog
6	1	0	Slow jog
7	1	1	Quick jog
8	1	0	Slow jog
9	0	0	Standstill

Tab.: 3-5.1 Examples of jog mode in positive direction

3.6 Setpoint table

The driving sets in a table can be selected by way of terminals or field bus. Fixed speeds, fixed torques or a table position can be preset by way of a table. The travel profile is generated using the Profile Generator. For each table value there is an acceleration and a braking ramp. Each position value additionally has a velocity and the positioning mode (absolute, relative,..) linked to it.

The binary significance (2^0, 2^1 , 2^2 , 2^3) results from the TABx assignment. The TAB0 setting has the lowest significance (2^0), and the TAB3 the highest (2^3). A Logical 1 level at the input activates the significance. For each control mode 16 table driving sets are available.

Note:
The driving sets have predefined standard units. So before configuring the driving set parameters the units and scaling must first be checked. If the table is selected as the reference source, parameter P 0283 MPRO_FG_Type (selection of scaling) should be set to USER (see section 1.2.9).

3.6.1 Driving sets for max. 16 torque reference values:

P 0193 Index 0-15	Torque mode acceleration	MPRO_TAB_TAcc	
Value range	-3.4E+38 to +3.4E+38	Data type	float32
FS	100	Mapping	No
Unit	Nm/s		
Read	0		
Write	0		
Acceleration ramp setting for max. 16 torque values			

P 0194 Index 0-15	Torque mode deceleration	MPRO_TAB_TDec	
Value range	-3.4E+38 to +3.4E+38	Data type	float32
FS	100	Mapping	No
Unit	Nm/s		
Read	0		
Write	0		
Braking ramp setting for max. 16 torque values			

P 0195 Index 0-15	Torque mode reference value	MPRO_TAB_TRef	
Value range	-3.4E+38 to +3.4E+38	Data type	float32
FS	100	Mapping	No
Unit	Nm		
Read	0		
Write	0		
Entry of max. 16 torque reference values			

3.6.2 Driving sets for max. 16 speed reference values:

P 0196 Index 0-15	Speed mode acceleration	MPRO_TAB_SAcc	
Value range	-3.4E+38 to 3.4E+38	Data type	float32
FS	100	Mapping	No
Unit	rev/min/s		
Read	0		
Write	0		
Acceleration ramp setting for max. 16 speed values			

P 0197 Index 0-15	Speed mode deceleration	MPRO_TAB_SDec	
Value range	-3.4E+38 to 3.4E+38	Data type	float32
FS	100	Mapping	No
Unit	rev/min/s		
Read	0		
Write	0		
Braking ramp setting for max. 16 speed values			

P 0198 Index 0-15	Speed mode reference value	MPRO_TAB_SRef	
Value range	-3.4E+38 to 3.4E+38	Data type	float32
FS	100	Mapping	No
Unit	rev/min		
Read	0		
Write	0		
Entry of max. 16 speed reference values			

3.6.3 Driving sets for max. 16 position reference values

P 0199 Index 0-15	Position mode acceleration	MPRO_TAB_PAcc	
Value range	-3.4E+38 to 3.4E+38	Data type	float32
FS	100	Mapping	No
Unit	rev/min/s		
Read	0		
Write	0		
Acceleration ramp setting for max. 16 position reference values			

P 0200 Index 0-15	Position mode deceleration	MPRO_TAB_PDec	
Value range	-3.4E+38 to 3.4E+38	Data type	float32
FS	100	Mapping	No
Unit	rev/min/s		
Read	0		
Write	0		
Braking ramp setting for max. 16 position reference values			

P 0201 Index 0-15	Position mode speed	MPRO_TAB_PSpd	
Value range	-3.4E+38 to 3.4E+38	Data type	float32
FS	100	Mapping	No
Unit	rev/min		
Read	0		
Write	0		
Velocity input for the position reference values			

P 0202 Index 0-15	Position mode reference position	MPRO_TAB_PPos	
Value range	-3.4E+38 to 3.4E+38	Data type	int32
FS	100	Mapping	No
Unit	Degree		
Read	0		
Write	0		
Entry of max. 16 position reference values			

P 0203 Index 0-15	Position mode	MPRO_TABPMod	
Value range	ABS – SPEED	Data type	uint16
FS	ABS	Mapping	No
Unit			
Read	0		
Write	0		

P 0203 Index 0-15	Position mode	MPRO_TABPMod
Value	Setting	Function
(0)	ABS	Absolute positioning
(1)	REL	Relative positioning
(2)	REL at once	The setting REL (at Once) offers the possibility to abort a driving set from the table before reaching the target position and approaching a new position without having completed the old one.
(3)	SPEED	Speed infinite drive job If a table value is set to Speed, an infinite driving job is transmitted. If a table value with the setting ABS or REL is additionally selected, the infinite job is terminated and the newly selected table value is approached from the current position.
Table positioning mode		

P 0204 Index 0-15	Max time for position or speed control	MPRO_TAB_Wait Time	
Value range	0 – 65535	Data type	uint16
FS	0	Mapping	No
Unit	ms		
Read	0		
Write	0		
Configurable time after which a follow-up job can be transmitted (wait time)			

P 0205	Operation Mode	MPRO_TAB_Mode	
Value range	PARA – BUS	Data type	uint16
FS	PARA	Mapping	No
Unit			
Read	0		
Write	0		
Value	Setting	Function	
(0)	PARA	Control via parameter P 0207	
(1)	TERM	Control via terminal	
(2)	AUTO	Control via timer parameter P 0204	
(3)	BUS	Control via the selected bus system	
Selection of the control location for the table			

P 0206	Max index in AUTO mode	MPRO_TAB_MaxIdx	
Value range	0 – 15	Data type	uint16
FS	0	Mapping	Yes
Unit			
Read	0		
Write	0		
Number of table values from the table to be worked through in sequence from top to bottom. Example: If the value is set to 6, six reference values from the table are worked through in sequence. This operation is repeated until the table enable is stopped or the start contact is opened.			

P 0207	Actual Index	MPRO_TAB_ActIdx	
Value range	0 – 15	Data type	uint16
FS	0	Mapping	Yes
Unit			
Read	0		
Write	0		
Display of current table value to be worked through			

3.7 Analog channel ANA0/1

With Analog channel ANA0 and ANA1 the analog input signals can be conditioned by additional functions. The input signals can be scaled or assigned an offset, and threshold values can be defined. The ramps can also be altered.

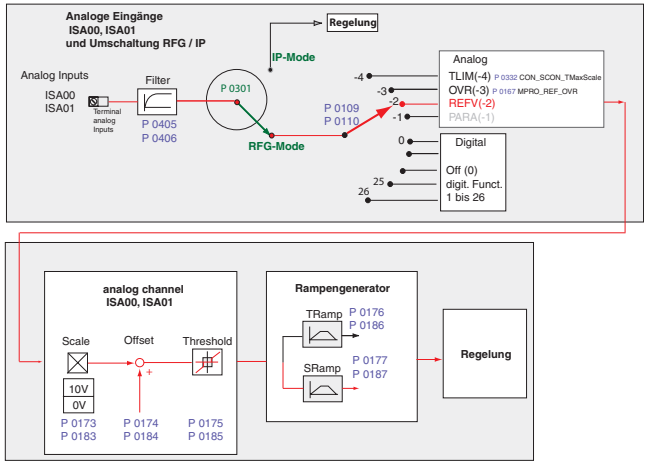


Fig.: 3.7-1 Analog reference processing

P 0173 Index 00	ANA0: scale factors scale factor for torque reference	Analog channel ISA00 MPRO_ANA0_TScale	
Value range	-3.4E+38 to 3.4E+38	Data type	float 32
FS	1	Mapping	No
Unit	Nm/10 V		
Read	0		
Write	0		
Scaling of the torque reference value			

P 0173 Index 01	ANA0: scale factors scale factor for speed reference	Analog channel ISA00 MPRO_ANA0_SScale	
Value range	-3.4E+38 to 3.4E+38	Data type	float 32
FS	3000	Mapping	No
Unit	ref/min/10 V		
Read	0		
Write	0		
Scaling of the speed reference value			

P 0173 Index 02	ANA0: scale factors scale factor for position reference	Analog channel ISA00 MPRO_ANA0_PScale	
Value range	-3.4E+38 to 3.4E+38	Data type	float 32
FS	3000	Mapping	No
Unit	ref/min/10 V		
Read	0		
Write	0		
Scaling of the reference value for positions; 10 V corresponds to n speed units			

Note: The same settings also apply to parameter P 0183-(00, 01, 02) of analog channel ANA1, and so are not listed separately.

P 0174 Index 00	ANA0: offsets ANA0: offsets for torque reference	ANA0: Offsets MPRO_ANA0_TOffset	
Value range	-3.4E+38 to 3.4E+38	Data type	float 32
FS	0	Mapping	No
Unit	Nm		
Read	0		
Write	0		
Setting of a torque offset to compensate for any component spread or to synchronize with a higher-level PLC.			

P 0174 Index 01	ANA0: offsets ANA0: offsets for speed reference	ANA0: Offsets MPRO_ANA0_SOffset	
Value range	-3.4E+38 to 3.4E+38	Data type	float 32
FS	1	Mapping	No
Unit	rev/min		
Read	0		
Write	0		
Setting of a speed offset to compensate for any component spread or to synchronize with a higher-level PLC.			

P 0174 Index 02	ANA0: offsets ANA0: Offsets for position refe-rence	ANA0: Offsets MPRO_ANA0_POffset	
Value range	-3.4E+38 to +3.4E+38	Data type	float 32
FS	1	Mapping	No
Unit	rev/min		
Read	0		
Write	0		
Setting of a position offset to compensate for any component spread or to synchronize with a higher-level PLC.			

Note: The same settings also apply to parameter P 0184-(00, 01, 02) of analog channel ANA1, and so are not listed separately.

P 0175 Index 00	ANA0: thresholds ANA0: threshold for torque reference	MPRO_ANA0_Threshold MPRO_ANA0_TThreshold	
Value range	0 – 100000	Data type	float 32
FS	0	Mapping	No
Unit	Nm		
Read	0		
Write	0		
Definition of a torque threshold to ensure the motor shaft comes to a standstill at reference zero.			

P 0175 Index 01	ANA0: thresholds ANA0: threshold for speed refe-rence	MPRO_ANA0_Threshold MPRO_ANA0_SThreshold	
Value range	0 – 100000	Data type	float 32
FS	0	Mapping	No
Unit	Nm		
Read	0		
Write	0		
Definition of a speed threshold to ensure the motor shaft comes to a standstill at reference zero.			

P 0175 Index 02	ANA0: thresholds ANA0: threshold for position reference	MPRO_ANA0_Threshold MPRO_ANA0_PThreshold	
Value range	0 – 100000	Data type	float 32
FS	0	Mapping	No
Unit	rev/min		
Read	0		
Write	0		
Definition of a position threshold to ensure the motor shaft comes to a standstill at reference zero.			

Note: The same settings also apply to parameter P 0185-(00, 01, 02) of analog channel ANA1, and so are not listed separately.

P 0176 Index 00	ANA0: torque mode acceleration [0] and deceleration [1]	MPRO_ANA0_TRamp	
Value range	0 – 1000	Data type	float 32
FS	0.1	Mapping	No
Unit	Nm/s		
Read	0		
Write	0		
Definition of the acceleration ramp in torque-controlled mode			

P 0176 Index 01	ANA0: torque mode acceleration [0] and deceleration [1]	MPRO_ANA0_TRamp	
Value range	0 – 1000	Data type	float 32
FS	0.1	Mapping	No
Unit	Nm/s		
Read	0		
Write	0		
Definition of the settings in torque-controlled mode			

Note: The same settings also apply to parameter P 0186-(00, 01, 02) of analog channel ANA1, and so are not listed separately.

P 0177 Index 00	ANA0: speed mode acceleration [0] and deceleration [1]	MPRO_ANA0_SRamp	
Value range	0 – 100000	Data type	float 32
FS	1000	Mapping	No
Unit	rev/min/s		
Read	0		
Write	0		
Definition of the acceleration ramp in speed-controlled mode			

P 0177 Index 01	ANA0: speed mode acceleration [0] and decelleration [1]	MPRO_ANA0_SRamp	
Value range	0 – 100000	Data type	float 32
FS	1000	Mapping	No
Unit	rev/min/s		
Read	0		
Write	0		
Definition of the braking ramp in speed-controlled mode			

Note: The same settings also apply to parameter P 0187-(00, 01, 02) of analog channel ANA1, and so are not listed separately.

P 0405	Analog input 0, filter time	CON_ANA_Filt0	
Value range	0-100	Data type	float 32
FS	0	Mapping	No
Unit	ms		
Read	0		
Write	1		
The reference value can be filtered if required. The filter time is disabled in the factory setting.			

Note: The same settings also apply to parameter P 0406 of analog channel ANA1, and so are not listed separately.

3.8 State machine – DRIVECOM

P 0145	DriveCom: Quick stop check in shut down command	MPRO_DRVCOM_QSCHK_SHDC	
Value range	OFF – ON	Data type	uint16
FS	ON	Mapping	No
Unit			
Read	1		
Write	1		
Value	Setting	Function	
(0)	OFF	inaktive	
(1)	ON	activated	
Activation of the check of the Quick Stop command: Transition from state 2 (switch on disabled) to state 3 (ready to switch on)			

P 0146	DriveCom: Quick stop check in „Ready to switch on“	MPRO_DRVCOM_QSCHK_RSWO	
Value range	OFF – ON	Data type	uint16
FS	ON	Mapping	No
Unit			
Read	1		
Write	1		
Value	Setting	Function	
(0)	OFF	inaktive	
(1)	ON	activated	
Activation of the check of the Quick Stop command: Transition from state 3 (ready to switch on) to state 4 (switch on)			

P 0147	DriveCom: Check enable power	MPRO_DRVCOM_EPCHK	
Value range	OFF – ON	Data type	uint16
FS	ON	Mapping	No
Unit			
Read	1		
Write	1		
Value	Setting	Function	
(0)	OFF	ENPO is switched on by way of the motor contactor ENMO	
(1)	ON	activated	
Check of transition from Ready to switch on (3) or Switch on disabled (2), if hardware contact ENPO is switched via the motor contactor.			

P 0149	DriveCom: Start initialisaton of system parameter	MPRO_DRVCOM_Init	
Value range	DONE – ERROR2	Data type	int16
FS	DONE	Mapping	No
Unit			
Read	0		
Write	0		
Value	Setting	Function	
(-2)	ERROR2	General error during initialization	
(-1)	ERROR1	This message is triggered when, during an initialization, a change to a parameter which itself triggers an initialization causes that initialization to be additionally triggered.	
(0)	DONE	Initialization is complete	
(1)	START	Trigger initialization manually	
Manual triggering of device initialization			

4 Encoder interfaces

The controller features a flexible encoder interface. It permits parallel evaluation of up to three encoders simultaneously. Two are provided as standard and one is available as an option by way of a configuration variant.

- Channel 1 (SinCos X[7]): For use of high-resolution SinCos encoders
- Channel 2 (Resolver X[6]): For connection of resolvers
- Channel 3: (external encoder X[8])
  The position measurement must be performed on the motor. It may, however, be additionally performed on the axis mechanism (measurement via motor encoder and “external” or “optional” encoder).

Note: Position measurement via motor encoder is always required; measurement on the axis mechanism is optional. Consequently, the encoder on the axis mechanism is termed an “optional” encoder. This encoder is also called an “external” encoder, because it is mounted not internally on the motor but “externally” on the axis.

4.1 The encoder structure:

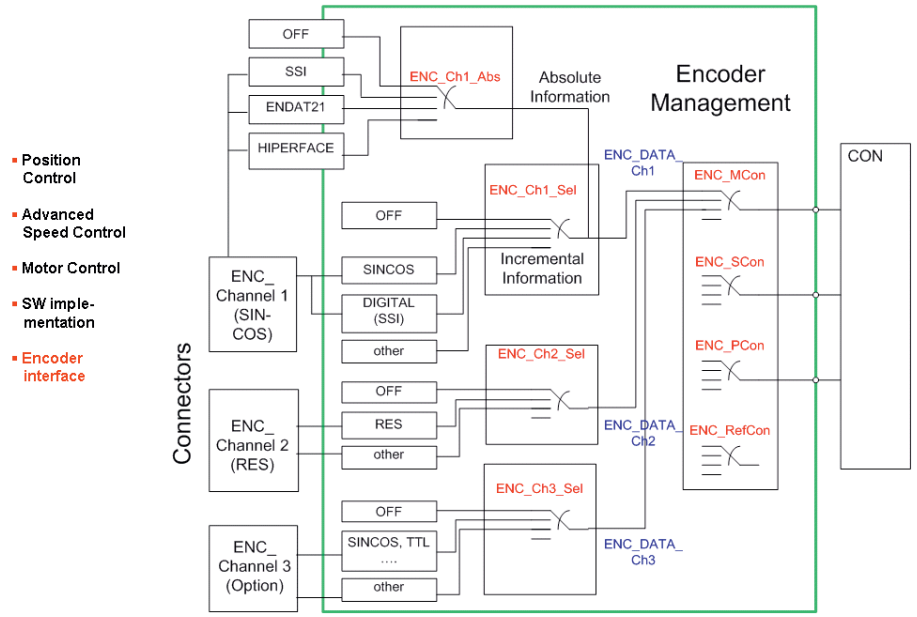


Fig.4-1.1: Encoder structure with three encoder systems

The drive controller can evaluate signals by way of both absolute and relative measurement systems, provided the encoder signals conform to the specification.

Regardless of the encoders used, or their combinations, the actual position values are evaluated by the firmware with a resolution of maximum 32 bits.

- Axes with relative position encoders must perform a homing run after power-up to enable them to operate in position control mode.
- Relative encoders are unsuitable as encoders for synchronous motors because every time the drive is restarted a procedure to set the commutation offset has to be run through. This means the immediate readiness of synchronous motors is not guaranteed.

P 0520	Encoder Channel Select for Motor Commutation	ENC_MCon	
Value range	OFF – CH3	**Data type**	uint16
FS	OFF	**Mapping**	No
Unit			
Read	0		
Write	1		
Value	Setting	Function	
(0)	OFF	No encoder selected	
(1)	CH1	Selection for high-resolution SinCos encoder (connection to X7)	
(2)	CH2	Selection of a resolver (connection to X6)	
(3)	CH3	Selection for high-resolution "external" SinCos encoder (connection to X8)	
Selection of the encoder channel to use for motor commutation With the Off setting no encoder evaluation takes place. With a setting other than OFF the wire break detection is active.			

P 0521	Encoder Channel Select for Speed Control	ENC_SCon	
Value range	OFF – CH3	**Data type**	uint16
FS	OFF	**Mapping**	No
Unit			
Read	0		
Write	1		
Value	Setting	Function	
(0)	OFF	No encoder selected	
(1)	CH1	Selection for high-resolution SinCos encoder (connection to X7)	
(2)	CH2	Selection of a resolver (connection to X6)	
(3)	CH3	Selection for high-resolution "external" SinCos encoder (connection to X8)	
Selection of the encoder channel to use for speed control			

P 0522	Encoder Channel Select for Positi-on Control	ENC_PCon	
Value range	OFF – CH3	**Data type**	uint16
FS	OFF	**Mapping**	No
Unit			
Read	0		
Write	1		
Value	Setting	Function	
(0)	OFF	No encoder selected	
(1)	CH1	Selection for high-resolution SinCos encoder (connection to X7)	
(2)	CH2	Selection of a resolver (connection to X6)	
(3)	CH3	Selection for high-resolution "external" SinCos encoder (connection to X8)	
Selection of the encoder channel to use for position control			

P 0523	Encoder Channel Select for Master In	ENC_RefCon	
Value range	OFF – CH3	Data type	uint16
FS	OFF	Mapping	No
Unit			
Read	0		
Write	1		
Value	Setting	Function	
(0)	OFF	No encoder selected	
(1)	CH1	Selection for high-resolution SinCos encoder (connection to X7)	
(2)	CH2	Selection of a resolver (connection to X6)	
(3)	CH3	Selection for high-resolution "external" SinCos encoder (connection to X8)	
If an encoder is to be used as the master encoder, the channel to use is selected here.			

P 0349	comutation offset of resp. encoder	CON_FM_MConOffset	
Value range	-180 to +180	Data type	float32
FS	0	Mapping	No
Unit	deg		
Read	0		
Write	1		
Encoder offset			

4.2 SinCos X7 – channel 1

P 0505	Encoder Channel 1: Select	ENC_CH1_Sel	
Value range	OFF – SINCOS	Data type	uint16
FS	OFF	Mapping	No
Unit		Terminal	X7
Read	0		
Write	1		
Value	Setting	Function	
(0)	OFF	No encoder selected	
(1)	SinCos	Selection of a high-resolution SinCos encoder	
Configuration of the incremental interface.			

P 0542	Encoder Channel 1: Number of Lines (sincos/TTL)	ENC_CH1_Lines	
Value range	1 – 65535	Data type	uint32
FS	2048	Mapping	No
Unit			
Read	0		
Write	1		
Setting of the incremental number of lines. For encoders with the EnDat 2.1 and Hiperface protocols, the number of lines is read from the encoder and automatically parameterized.			

P 0510	Encoder Channel 1: Gear Nominator	ENC_CH1_Num	
Value range	-2147483648 to 2147483647	Data type	int32
FS	1	Mapping	No
Unit			
Read	0		
Write	1		
Numerator of transmission ratio for the encoder gearing (e.g. adaptation of a load-side encoder to the motor shaft).			

P 0511	Encoder Channel 1: Gear Denominator	ENC_CH1_Denum	
Value range	1 – 4294967295	Data type	uint32
FS	1	Mapping	No
Unit			
Read	0		
Write	1		
Denominator of transmission ratio for the encoder gearing (e.g. adaptation of a load-side encoder to the motor shaft).			

P 0540	Encoder Channel 1: Absolute Position Interface Select	ENC_CH1_Abs	
Value range	OFF – Hiper	Data type	uint16
FS	OFF	Mapping	No
Unit			
Read	0		
Write	1		

P 0540	Encoder Channel 1: Absolute Position Interface Select	ENC_CH1_Abs
Value	Setting	Function
(0)	OFF	Purely incremental encoder without absolute value information
(1)	SSI	Heidenhain SSI protocol, input of number of lines, multi- and single-turn information
(2)	ENDAT2.1	Evaluation based on Heidenhain EnDat protocol
(3)	HIPER	Evaluation based on Stegmann-Hiperface protocol
To obtain correct evaluation of the absolute position, this parameter must be set to the encoder protocol method used. For absolute value encoders which use EnDat 2.1 or Hiperface, the single- and multi-turn information, the coding and the number of lines are read from the encoder (see parameters: P 0542, P 0543, P 0544, P 0545).		

P 0541	Encoder Channel 1: Index Puls Test Mode	ENC_CH1_Np	
Value range	OFF – ON	Data type	uint16
FS	OFF	Mapping	No
Unit			
Lese Ebene	0		
Schreib Ebene	1		
Value	Setting	Function	
(0)	OFF	Evaluation disabled	
(1)	ON	Evaluation enabled	
Evaluation of zero pulse			

4.2.1 Encoder correction (GPOC)

For each channel a correction method for the analog track signals can be inserted. This calculates and corrects the mean systematic errors in the offset, the gain and the phase. Where multiple encoders are in use, it is advisable to set the method for the encoder used to determine the velocity signal.

P 0549 P 0561	Encoder Channel 1/2: Signal correction	ENC_CH1_Corr	
Value range	OFF – RESET	**Data type**	uint16
FS	OFF	**Mapping**	No
Unit			
Read	0		
Write	1		
Value	Setting	Function	
(0)	OFF	Track signal correction off	
(1)	CORR	Track signal correction with fixed, stored values	
(2)	ADAPT	Track signal correction adaptive, values are calculated and updated online	
(3)	RESET	Reset to factory setting	
Selection of correction method			

Note: By way of parameters ENC_CHx_Corr the method is controlled for each encoder channel. For channel 3 the encoder correction will be available as from V 2.0.

P 0550 P 0562 Index 00	Encoder Channel 1/2: Signal correction Values Offset, track A-cos	ENC_CH1_CorrVal Offset A	
Value range	-3.4E+38 to 3.4E+38	**Data type**	Float32
FS	0	**Mapping**	Yes
Unit			
Read	0		
Write	1		
Calculated offset of track A			

P 0550 P 0562 Index 01	Encoder Channel 1/2: Signal correction Values Offset, track B-sin	ENC_CH1_CorrVal Offset B	
Value range	-3.4E+38 to 3.4E+38	**Data type**	Float32
FS	0	**Mapping**	Yes
Unit			
Read	0		
Write	1		
Calculated offset of track B			

P 0550 P 0562 Index 02	Encoder Channel 1/2: Signal correction Values Gain, track A cos	ENC_CH1_CorrVal GAIN A	
Value range	-3.4E+38 to 3.4E+38	**Data type**	Float32
FS	1	**Mapping**	Yes
Unit			
Read	0		
Write	1		
Calculated gain factor of track A			

P 0550 P 0562 Index 03	Encoder Channel 1: Signal correction Values Gain, track B-cos	ENC_CH1_CorrVal GAIN B	
Value range	-3.4E+38 to 3.4E+38	Data type	Float32
FS	1	Mapping	No
Unit			
Read	0		
Write	1		
Calculated gain factor of track B			

P 0550 P 0562 Index 04	Encoder Channel 1: Signal correction Values phase	ENC_CH1_CorrVal Phase	
Value range	-3.4E+38 to 3.4E+38	Data type	Float32
FS	1	Mapping	No
Unit			
Read	0		
Write	1		
Calculated phase correction between track signals A and B			

P 0543	Encoder Channel 1: Number of Multi Turn Bits (Absolute Position Interface)	ENC_CH1_MultiT	
Value range	0 – 25	Data type	uint16
FS	12	Mapping	No
Unit			
Read	0		
Write	1		
Number of bits of multi-turn information			

P 0544	Encoder Channel 1: Number of Single Turn Bits (Absolute Position Interface)	ENC_CH1_SingleT	
Value range	0 – 25	Data type	uint16
FS	13	Mapping	No
Unit			
Read	0		
Write	1		
Number of bits of single-turn information			

P 0545	Encoder Channel 1: Code select (SSI Absolute Position interface)	ENC_CH1_Code	
Value range	BINARY – GRAY	Data type	uint16
FS	GRAY	Mapping	No
Unit			
Read	0		
Write	1		
Value	Setting	Function	
(0)	BINARY	Selection of binary coding	
(1)	GRAY	Selection of gray coding	
Selection of coding: (SSI interface)			

P 0546	Encoder Channel 1:Mode select (SSI Absolute Position interface)	ENC_CH1_Mode	
Value range	0 – 11	Data type	uint16
FS	0	Mapping	No
Unit			
Read	0		
Write	1		
Selection of mode (SSI interface)			

P 0547	Encoder Channel 1: Lowest allowable Multi Turn Position (Absolute Position interface)	ENC_CH1_MTBase	
Value range	-2147483648 to 2147483647	Data type	int32
FS	0	Mapping	No
Unit			
Read	0		
Write	1		
Lowest multi-turn information			

P 0548	Encoder Channel 1: Enable the use of Multi Turn Position (SSI Absolute Position interface)	ENC_CH1_MTEnable	
Value range	0 – 1	Data type	uint16
FS	0	Mapping	No
Unit			
Read	0		
Write	1		
Evaluation of multi-turn information			

P 0552 Index 00 – 13	Encoder Channel 1: Error- and Status-Codes from the interface to absolute Encoders	ENC_CH1_AbsEncStatus	
Value range	0000H – ffffH	Data type	uint16
FS	0	Mapping	No
Unit			
Read	0		
Write	1		
Display parameters: Error and status codes of the absolute interface			

4.3 Resolver X6 – channel 2

P 0506	Encoder Channel 2 select	ENC_CH2_Sel	
Value range	OFF – RES	Data type	uint16
FS	OFF	Mapping	No
Unit			
Read	0		
Write	1		
Value	Setting	Function	
(0)	OFF	Channel is off	
(1)	Resolver	Selection for evaluation of a resolver	
Selector for encoder channel selection on channel 2; (the resolver is connected to X6)			

P 0512	Encoder Channel 2 Gear Numerator	Encoder Channel2_Num	
Value range	-1 to 1	Data type	int32
FS	1	Mapping	No
Unit			
Read	0		
Write	1		
Numerator of the encoder gearing (channel 2, connection to X6)			

P 0513	Encoder Channel 2 Gear Denominator	Encoder Channel2_Denom	
Value range	1	Data type	uint32
FS	1	Mapping	No
Unit			
Read	0		
Write	1		
Denominator of the encoder gearing (channel 2, connected to X6) For encoder channel 2 it is assumed that the resolver is always mounted on the motor shaft. Only the setting +/- 1 makes sense for reversal of direction.			

P 0560	Encoder Channel 2 Number of Pole Pairs (Resolver)	Encoder Channel 2_Lines	
Value range	1 – 128	Data type	uint16
FS	1	Mapping	No
Unit			
Read	0		
Write	1		
Setting of number of pole pairs or resolver			

4.4 Encoder Option X8 – channel 3

P 0507	Encoder Channel 3: Select	ENC_CH3_Sel	
Value range	OFF – SinCos	Data type	uint16
FS	OFF	Mapping	No
Unit			
Read	0		
Write	1		
Value	Setting	Function	
(0)	OFF	Channel is off	
(1)	SinCos	Evaluation of a high-resolution SinCos encoder	
Selector for encoder selection on channel 3 (option X8)			

P 0514	Encoder Channel 3: Gear Numerator	Encoder Channel 3_Num	
Value range	-2147483648 to 2147483647	Data type	int32
FS	1	Mapping	No
Unit			
Read	0		
Write	1		
Numerator of the encoder gearing (option X8)			

P 0515	Encoder Channel 3: Gear Denominator	Encoder Channel 3_Denum	
Value range	1 – 4294967295	Data type	uint32
FS	1	Mapping	No
Unit			

P 0515	Encoder Channel 3: Gear Denominator	Encoder Channel 3_Denum	
Read	0		
Write	1		
Denominator of the encoder gearing (option X8)			

P 0570	Encoder Channel 3: Absolut Position Interface Select	ENC_CH3_Abs	
Value range	OFF	Data type	uint16
FS	OFF	Mapping	No
Unit			
Read	0		
Write	1		
Value	Setting	Function	
(0)	OFF	Incremental encoder with zero pulse	
Selection of the absolute position interface (as from V 2.0)			

P 0571	Encoder Channel 3: Index Pulse Test Mode	ENC_CH3_Np	
Value range	OFF – ON	Data type	uint16
FS	OFF	Mapping	No
Unit			
Read	0		
Write	1		
Value	Setting	Function	
(0)	OFF	Channel is off	
(1)	ON	Evaluation of zero pulse	
Selection of the zero pulse evaluation			

P 0572	Encoder Channel 3: Number of lines	ENC_CH3_Lines	
Value range	1 – 65535	Data type	uint16
FS	2048	Mapping	No
Unit			
Read	0		
Write	1		
Number of lines of the optical encoder per motor revolution (option X8)			

P 0573	Encoder Channel 3: Number of Multi Turn Bits	Encoder Channel 3_MultiT	
Value range	0 – 25	Data type	uint16
FS	12	Mapping	No
Unit			
Read	0		
Write	1		
Number of bits of multi-turn information			

P 0574	Encoder Channel 3: Number of Single Turn Bits	Encoder Channel 3_SingleT	
Value range	0 – 25	Data type	uint16
FS	13	Mapping	No
Unit			
Read	0		
Write	1		
Number of bits of single-turn information			

P 0576	Encoder Channel 3: Type of TTL-Signals	ENC_CH3_TypeTTL	
Value range	A_B to A_DIR	Data type	uint16
FS	A_B	Mapping	No
Unit			
Read	0		
Write	1		
Value	Setting	Function	
(0)	A_B	Encoder track A/B (TTL encoder tracks)	
(1)	A-DIR	Pulse/direction signal	
Selection of the signal type of the TTL signals (option X8) (as from V 2.0)			

P 0575	Encoder Channel 3: Code select	ENC_CH3_Code	
Value range	Gray – Binary	Data type	uint16
FS	A_B	Mapping	No
Unit			
Read	0		
Write	1		
Value	Setting	Function	
(0)	BINARY	Evaluation of the binary code	
(1)	Gray	Evaluation of the gray code	
Selection of the coding (protocol type) for SSI absolute value encoders			

5 Control

5.1 Block diagram of control

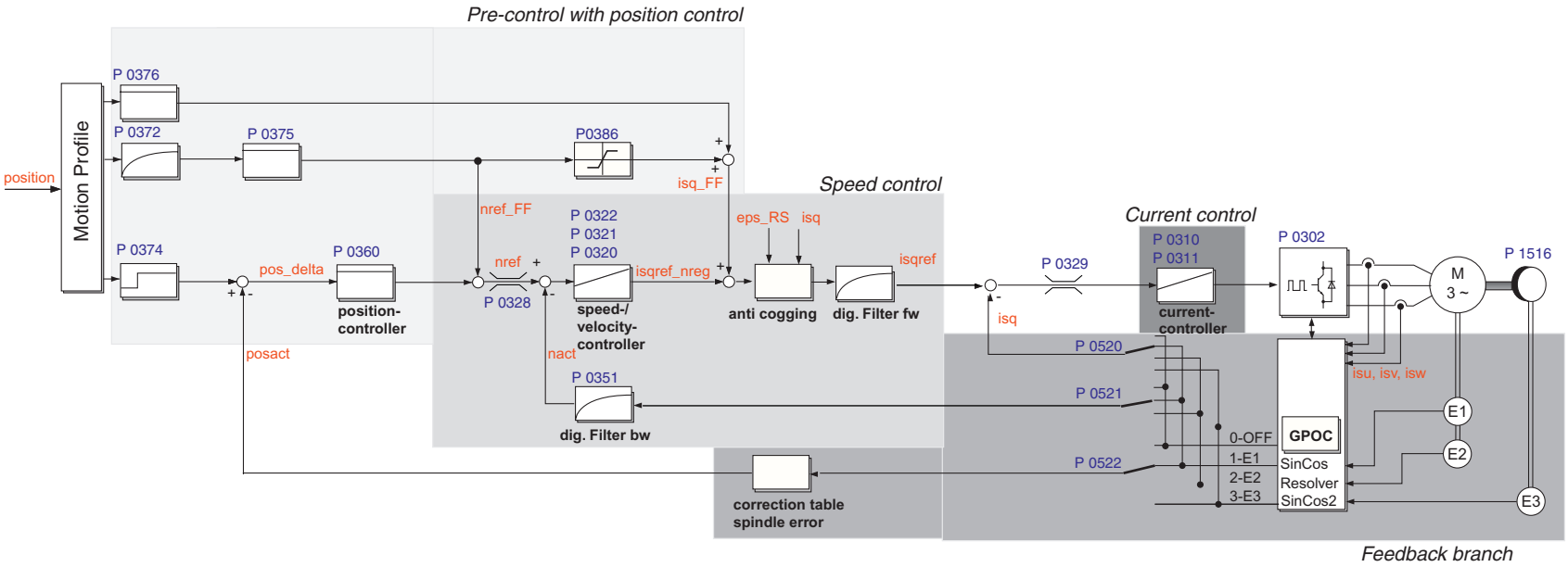


Fig. 5-1.1: Block diagram of control

5.2 Control parameters

P 0300	Select Control Mode	CON_CFCon	
Value range	VFCON – ICON	Data type	uint16
FS	SCON	Mapping	No
Unit			
Read	0		
Write	1		
Value	Setting	Function	
(0)	VFCON	VFC mode: This mode is used only for test operation	
(1)	TCON	Torque control	
(2)	SCON	Flux Control	
(3)	PCON	Position control	
(4)	ICON	Current control: This mode is used only for test operation	
Selection of control mode: The drive controller features a cascade structure. Consequently, the following sequence must be observed in controller optimization: 1. Optimization of torque controller 2. Optimization of speed controller 3. Optimization of position controller The VFCON and ICON settings are for use only in test operation			

P 1516	Total inertia of motor and plant	SCD_Jsum	
Value range	0 – 100	Data type	float 32
FS	0	Mapping	No
Unit	kgm^2		
Read	0		
Write	1		
Total mass moment of inertia (motor and load of plant).			

5.2.1 VFC mode (open loop)

P 0313	Voltage frequency control, boost voltage (at zero frequency)	CON_VFC_VBoost	
Value range	0 – 100	Data type	float 32
FS	4	Mapping	No
Unit	V		
Read	0		
Write	1		
Boost voltage in VFC mode			

P 0314	Voltage frequency control, nominal frequency	CON_VFC_FNom	
Value range	1 – 30000	Data type	float 32
FS	150	Mapping	No
Unit	Hz		
Read	0		
Write	1		
Rated frequency in VFC mode			

P 0315	Voltage frequency control, voltage at nominal frequency	CON_VFCVBoost	
Value range	0 – 1000	Data type	float 32
FS	400	Mapping	No
Unit	V		
Read	0		
Write	1		
Rated voltage in VFC mode			

5.2.2 Torque control

P 0310	Current Control Gain	CON_CCON_Kp	
Value range	0 – 3.4E+38	Data type	float 32
FS	0	Mapping	No
Unit	V/A		
Read	0		
Write	1		
Setting of the gain for the torque controller (see also section 2.5 of the Application Manual).			

P 0311	Current Control Integration time constant	CON_CCON_Tn	
Value range	0.01 – 1000	Data type	float 32
FS	4	Mapping	No
Unit	ms		
Read	0		
Write	1		
Setting of the lag time for the torque controller (see also section 2.5 of the Application Manual).			

5.2.3 Anti-cogging

P 0380 Index 00-249	Anti Cogging-compensation current table	CON_TCoggAddTab	
Value range	-1000 to 1000	Data type	float 32
FS	0	Mapping	No
Unit	A		
Read	0		
Write	1		
Anti-cogging: To compensate for detent torques, a teach mode is run to enter the torque-forming q-current for a pole pitch in the 250-value table. To compensate for the offset, the q-current is inverted and forwarded as a pre-control value to the control (see section 2.10 in the Application Manual).			

P 0382	Anti Cogging-compensation on/off	CON_TCoggComp	
Value range	ON – OFF	Data type	uint16
FS	OFF	Mapping	No
Unit			
Read	0		
Write	1		
Value	Setting	Function	
(0)	OFF	Compensation On	
(1)	ON	Compensation Off	
Activation of anti-cogging			

P 0383 Index 00 – 249	Anti Cogging-recorded currents at teaching	CON_TCoggComp Teach1	
Value range	-2000 to 2000	Data type	float32
FS	2000	Mapping	No
Unit	A		
Read	1		
Write	1		
The characteristic of the q-current is averaged with a filter and recorded in this table. The table should be completely filled. The motor should have moved through several pole pitch units during the teach mode.			

P 0385	Anti Cogging – teach control word	CON_TCoggTeachCon	
Value range	READY – RESET	Data type	uint16
FS	READY	Mapping	No
Unit			
Read	1		
Write	1		
Value	Setting	Function	
(0)	READY	Ready for start	
(1)	Teach Tab1	The values for table 1 are taught	
(2)	Teach Tab2	The values for table 2 are taught (not implemented)	
(3)	CalcCorrTab	The table values are prepared for compensation	
(4)	RESET	Reset table entries	
Selector for anti-cogging			

5.2.4 Flux control

P 0320	Speed control gain	CON_SCON_Kp	
Value range	0 – 100000	Data type	float32
FS	0	Mapping	
Unit	Nm/rpm		
Read	0		
Write	1		
Speed controller gain			

P 0321	Speed control integration time constant	CON_SCON_Tn	
Value range	0.01 – 10000	Data type	float32
FS	10	Mapping	
Unit	ms		
Read	0		
Write	1		
Speed controller lag time			

P 0322	Speed control gain scaling factor	CON_SCON_KpScale	
Value range	0 – 10000	Data type	float32
FS	100	Mapping	
Unit	%		
Read	0		
Write	1		
Scaling factor for the speed controller gain			

5.2.5 Digital filter/ Notch filter in pre-control branch of control structure

Attention: The filter settings act immediately on the controller. Recommended: The parameters should only be set with the controller switched off! Note that the filters influence not only the amount, but also the phase angle. Consequently, the use of filters of higher orders (PT3, PT4) should be avoided in conjunction with low frequencies (<200 Hz), as the phase angle approaches 0 °.

P 0325 Index 00	Filter frequencies of digital filter 1st center/cutoff	CON_SCON_FilterFreq	
Value range	1 – 8000	Data type	float32
FS	100 Hz	Mapping	
Unit	Hz		
Read	0		
Write	1		
Filter 1: Locking frequency of the notch filter / Limit frequency of the low-pass filter			

P 0325 Index 01	Filter frequencies of digital filter 1st width	CON_SCON_FilterFreq	
Value range	1 – 1000	Data type	float32
FS	10 Hz	Mapping	
Unit	Hz		
Read	0		
Write	1		
Filter 1: Bandwidth of the notch filter			

P 0325 Index 02	Filter frequencies of digital filter 2st center/cutoff	CON_SCON_FilterFreq	
Value range	1 – 8000	Data type	float32
FS	100 Hz	Mapping	
Unit	Hz		
Read	0		
Write	1		
Filter 2: Locking frequency of the notch filter / Limit frequency of the low-pass filter			

P 0325 Index 03	Filter frequencies of digital filter 2st width	CON_SCON_FilterFreq	
Value range	1 – 1000	Data type	float32
FS	10 Hz	Mapping	
Unit	Hz		
Read	0		
Write	1		
Filter 2: Bandwidth of the notch filter			

P 0326	Digital filter design assistant	CON_SCON_FilterAssi	
Value range	OFF – PT4	Data type	uint16
FS	OFF	Mapping	No
Unit			
Read	0		
Write	1		
Value	Setting	Function	
(0)	OFF	Reset and switch off the filter	
(1)	USER	User-defined setting of filter coefficients (see also P 0327)	
(2)	Notch	1. Filter = Notch 2. Filter = OFF	
(3)	Notch_Notch	1. Filter = Notch 2. Filter = Notch	
(4)	Notch_PT1	1. Filter = Notch 2. Filter = PT1	
(5)	Notch_PT2	1. Filter = Notch 2. Filter = PT2	
(6)	PT1	1. Filter = OFF 2. Filter = PT1	
(7)	PT2	1. Filter = OFF 2. Filter = PT2	
(8)	PT3	1. Filter = OFF 2. Filter = PT3	
(9)	PT4	1. Filter = OFF 2. Filter = PT4	
Assistant for digital filter design			

P 0327 Index 00-08	Coefficients of digital filter	CON_SCON_FilterPara	
Value range	-1000 – 1000	Data type	float32
FS	1	Mapping	No
Unit			
Read	0		
Write	1		
Coefficients of time-discrete transfer function: y(k)=B(4)*x(k-4)+x(k-3)....			

P 0351	Actual speed calculation filter time	CON_SCALC_TF	
Value range	0 – 1000	Data type	float32
FS	0.6	Mapping	No
Unit	ms		
Read	0		
Write	1		
Filter time for the actual speed			

P 0371	Speed reference filter time for speed control mode	CON_IP_RefTF	
Value range	0 – 1000	Data type	float32
FS	1	Mapping	No
Unit	ms		
Read	0		
Write	1		
Filter time for the reference speed			

5.2.6 Observer

P 0323 Index 00	Advanced control structure gains D control / acceleration feedback	CON_SCON_Kd	
Value range	-3.4E+38 – 3.4+38	Data type	float32
FS	0	Mapping	No
Unit			
Read	0		
Write	1		
Expanded control structure: Gain factor for the acceleration sensor			

P 0323 Index 01	Advanced control structure gains Speed difference feedback	CON_SCON_K_dvlm	
Value range	-3.4E+38 – 3.4+38	Data type	float32
FS	0	Mapping	No
Unit			
Read	0		
Write	1		
Expanded control structure: Gain factor for the speed difference feedback			

P 0323 Index 02	Advanced control structure gains torsional torque feedback	CON_SCON_K_dmlm	
Value range	-3.4E+38 – 3.4+38	Data type	float32
FS	0	Mapping	No
Unit			
Read	0		
Write	1		
Expanded control structure: Gain factor for torsional torque feedback			

P 0323 Index 03	Advanced control structure gains load torque compensation	CON_SCON_K_mload	
Value range	-3.4E+38 – 3.4+38	Data type	float32
FS	0	Mapping	No
Unit			
Read	0		
Write	1		
Expanded control structure: Gain factor for load torque compensation			

P 0324 Index 00	Advanced control structure filtering D control/accelleration feedback	CON_SCON_K_d	
Value range	-3.4E+38 – 3.4+38	Data type	float32
FS	0	Mapping	No
Unit			
Read	0		
Write	1		
Expanded control structure: Filtering for the acceleration sensor			

P 0324 Index 01	Speed difference feedback	CON_SCON_K_dvlm	
Value range	-3.4E+38 – 3.4+38	Data type	float32
FS	0	Mapping	No
Unit			
Read	0		
Write	1		
Expanded control structure: Filtering for speed difference feedback			

P 0324 Index 02	Torsional torque feedback	CON_SCON_K_dmlm	
Value range	-3.4E+38 – 3.4+38	Data type	float32
FS	0	Mapping	No
Unit			
Read	0		
Write	1		
Expanded control structure: Filtering for torsional torque feedback			

P 0324 Index 03	Load torque compensation	CON_SCON_K_mload	
Value range	-3.4E+38 – 3.4+38	Data type	float32
FS	0	Mapping	No
Unit			
Read	0		
Write	1		
Expanded control structure: Filtering for torque difference feedback			

P 0350 Index 00	Selection of speed calculation method Select method	CON_SCALC_SEL ObserverMethod	
Value range	Filter OBS2	Data type	uint16
FS	Filter	Mapping	No
Unit			
Read	0		
Write	1		
Value	Setting	Function	
(0)	FILTER	PT1 filter	
(1)	OBS1	Single-mass observer	
(2)	OBSACC	Observer with acceleration sensor	
(3)	OBS2	Dual-mass observer	
Selection of observer method			

P 0350 Index 01	Selection of speed calculation method Select test or operational mode	CON_SCALC_SEL FeedbackMethod	
Value range	OBS – Filter	Data type	uint16
FS	OBS	Mapping	No
Unit			
Read	0		
Write	1		
Value	Setting	Function	
(0)	OBS	Feedback via single-mass observer	
(1)	FILTER	Feedback via filter	
Selection whether feedback via PT1 filter or via single-mass observer			

P 0352 Index 01-21	Observer Parameter (meaning despends on CON_SCALC)	CON SCALC_ObsPara	
Value range	-3.4E+38 – 3.4+38	Data type	uint16
FS	0	Mapping	No
Unit			
Read	0		
Write	1		
Internal parameter of the observer			

P 0353 Index 00	Observer design parameters time constant of observer	CON SCALC_ObsDesignPara TF	
Value range	0.05 – 1000	Data type	float32
FS	1	Mapping	No
Unit	ms		
Read	1		
Write	1		
Time constant of the observer			

Note: The grey-backed parameters will only be available as from firmware version V 2.0

P 0353 Index 01	Observer design parameters Damping coefficient	CON_SCA:LC_ObsDesignPara alpha	
Value range	0.25 – 10	Data type	float32
FS	2	Mapping	No
Unit			
Read	1		
Write	1		
Damping coefficient			

P 0353 Index 02	Observer design parameters Damping coefficient Load torque is applied: (0) at motor (1) at load, (2) equally	CON_SCA:LC_ObsDesignPara loadpoint	
Value range	0 -2	Data type	float32
FS	1	Mapping	No
Unit			
Read	1		
Write	1		
Load point			

P 0353 Index 03	Observer design parameters Damping coefficient Time constant of speed filtering	CON_SCALC_ObsDesignPara TF1	
Value range	0.05 – 1000	Data type	float32
FS	1	Mapping	No
Unit			
Read	1		
Write	1		
Time constant of speed filtering			

P 0353 Index 04	Observer design parameters Damping coefficient Time constant of load torque adaption	CON_SCALC_ObsDesignPara TF2	
Value range	0.05 – 1000	Data type	float32
FS		Mapping	No
Unit	ms		
Read	1		
Write	1		
Time constant of load torque adaptation			

P 0353 Index 05	Observer design parameters Damping coefficient Time constant of oscillation adaption	CON_SCALC_ObsDesignPara TFosc	
Value range	0.05 – 1000	Data type	float32
FS		Mapping	No
Unit	ms		
Read	1		
Write	1		
Time constant of vibration damping/adaptation			

P 0353 Index 06	Observer design parameters Damping coefficient Acceleration measurement gain	CON_SCALC_ObsDesignPara AccGain	
Value range	-10000 – 10000	Data type	float32
FS	0	Mapping	No
Unit	(rpm/s)W		
Read	1		
Write	1		
Gain of acceleration measurement			

P 0354	Observer design assistant	CON_SCALC_ObsDesignAssi	
Value range	USER – TIMES	Data type	uint16
FS	USER	Mapping	No
Unit			
Read	0		
Write	1		
Value	Setting	Function	
(0)	USER	User-defined design	
(1)	DEF	Location design for the selected observer type	
(2)	DR	Design based on dual conditions	
(3)	TIMES	Design based on time constant	
Assistant for observer design: (as from V 2.0)			

5.2.7 Field weakening

For more information on field weakening refer to the Application Manual section 2.7.

P 0340	Magnetisation current (rms)	CON_FM_Imag	
Value range	0 – 1000	Data type	float32
FS	0	Mapping	No
Unit	A		
Read	0		
Write	1		
Magnetizing current			

P 0341	Speed where field weaking starts	CON_FM_ImagSLim	
Value range	0 – 10000	Data type	float32
FS	100	Mapping	No
Unit	%		
Read	0		
Write	1		

Applicable only to ASMs: For field weakening two combinable methods are available.

- Field weakening by way of a PI voltage regulator
- (a) Static characteristic of d-current as a function of motor speed from table values
  (b) 1/n characteristic

P 0341 = zero: Evaluation based on static characteristic
P 0341 > zero, then as from speed ImagSlim the flux is controlled according to a 1/n characteristic.

P 0342 Index 00-07	Speedvalue for mag. current scaling	CON_FM_SpeedTab	
Value range	10 – 1000	Data type	float32
FS	100	Mapping	No
Unit	%		
Read	0		
Write	1		

The current matching the speed table element “P0342 Index xx” is injected.
Then the current is interpolated by way of the speed in linear mode between the interpolation points.
The speeds in the parameter must become continuously higher from index 00 to 07!

P 0343 Index 00-07	Mag. current scaling vs. speed	CON_FM_ImagTab	
Value range	0 – 200	Data type	float32
FS	100	Mapping	No
Unit	%		
Read	0		
Write	1		
Scaling for the magnetization current			

P 0344	Voltage control filter time constant	CON_FM_VConTF	
Value range	0.01 – 1000	Data type	float32
FS	10	Mapping	No
Unit	ms		
Read	0		
Write	1		
Filter time for the PI voltage regulator			

P 0345	Voltage control gain	CON_FM_VConKp	
Value range	0 – 3.4E38	Data type	float32
FS	0	Mapping	No
Unit	A/V		
Read	0		
Write	1		
P-gain for the PI voltage regulator			

P 0346	Voltage control integration time constant	CON_FM_VConTn	
Value range	0.01 – 1000	Data type	float32
FS	10	Mapping	No
Unit	ms		
Read	0		
Write	1		
Lag time (I-component) for the PI voltage regulator			

P 0347	Voltage control reference (Scaling of max. voltage)	CON_FM_VRef	
Value range	10 – 110	Data type	float32
FS	90	Mapping	No
Unit	%		
Read	0		
Write	1		
With this parameter the voltage reference is preset. The threshold must be reduced as the dynamic requirements rise, as this provides a kind of voltage reserve for dynamic control operations.			

P 0348	Slip control gain for field weakening	CON_FM_SlipCon	
Value range	0 – 3.4E+38	Data type	float32
FS	0	Mapping	No
Unit			
Read	0		
Write	1		
Gain of position controller			

5.2.8 Position control

P 0360	Position control gain	CON_PCON_Kp	
Value range	0 – 200000	Data type	float32
FS	4000	Mapping	No
Unit	rpm		
Read	0		
Write	1		
Gain of slip control			

P 0372	Speed feedforward filter for position control	CON_IP_SFFTF	
Value range	0 – 1000	Data type	float32
FS	0.5	Mapping	No
Unit	ms		
Read	0		
Write	1		
Filter for velocity pre-control: Prediction of the speed controller			

P 0374	Position delay in position control cycles (CON_PConTS)	CON_IP_EpsDly	
Value range	0 – 1000	Data type	float32
FS	0	Mapping	No
Unit	ms		
Read	0		
Write	1		
Prediction of the position controller			

P 0375	Speed feedforward scaling factor	CON_IP_SFFScale	
Value range	0 – 1000	Data type	float32
FS	100	Mapping	No
Unit	%		
Read	0		
Write	1		
Scaling factor for speed pre-control			

P 0376	Torque/Force feedforward scaling factor	CON_IP_TFFScale	
Value range	0 – 10000	Data type	float32
FS	100	Mapping	No
Unit	%		
Read	0		
Write	1		
Scaling factor for torque/force pre-control			

P 0377	Feed forward signals enabled	CON_IP_EnableFF	
Value range	0 – 1	Data type	float32
FS	1	Mapping	No
Unit			
Read	0		
Write	1		
Activation of pre-control			

P 0386	Friction compensation scaling factor	CON_SCON_TFric	
Value range	0 – 100	Data type	float32
FS	0	Mapping	No
Unit	%		
Read	0		
Write	1		
Scaling factor for friction compensation			

5.2.9 Auto-commutation

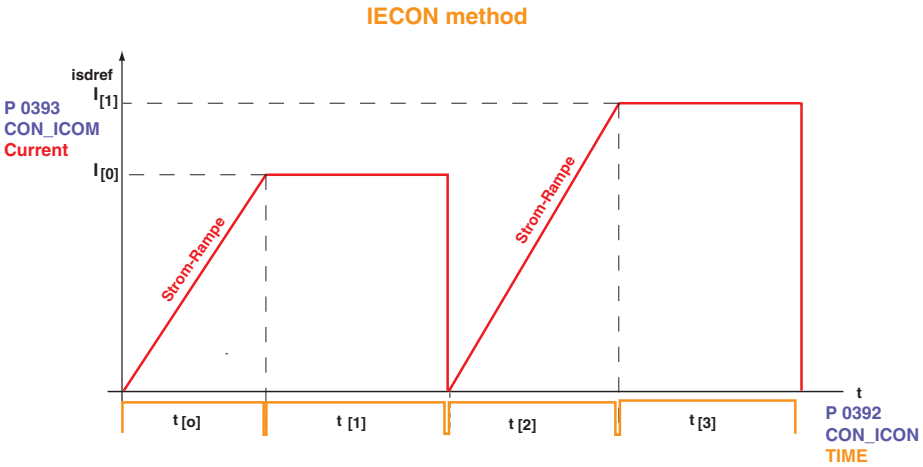


Fig. 5.2.9-1: Synchronization of the current rotor position to the zero of the incremental encoder.

P 0390	Commutation detection: control word for selection	CON_ICOM	
Value range	OFF – HALLS	Data type	uint16
FS	OFF	Mapping	No
Unit			
Read	0		
Write	1		
Value	Setting	Function	
(0)	OFF	Function is disabled	
(1)	IENCC	Commutation with motion: In this method the rotor may move by as much as half a rotor revolution or half a pole pitch unit.	
(2)	LHMES	Commutation with braked machine: The machine must be blocked by a suitable brake during auto-commutation. The occurring torques and forces may attain the rated torque and force of the machine.	
(3)	IECSC	Not implemented	
(4)	IECON	Auto-commutation with minimized motion: Here, too, the rotor must be able to move. However, an appropriate parameter setting can reduce the rotor motion to a few degrees/mm.	
(5)	HALLS	Evaluation of analog Hall sensors (as from V 2.0)	
Selection of the commutation methods for various application requirements			

P 0391	Commutation detection scaling of control gain	CON_ICOM_KPScale	
Value range	0 – 1000	Data type	float32
FS	20	Mapping	No
Unit	%		
Read	0		
Write	1		
Percentage scaling of the gain factor (of the angle controller). The precondition is a well adjusted speed control loop. Increasing the gain results in a reduction of the motion. An excessively high gain will result in oscillation and noise.			

P 0392 index 00-03	Commutation detection: times	CON_ICOM_Time	
Value range	0 – 10000	Data type	float32

P 0392 index 00-03	Commutation detection: times	CON_ICOM_Time	
FS	0	Mapping	No
Unit	ms		
Read	0		
Write	1		
Time setting t[0] to t[3]			

P 0393 index 00-01	Commutation detection: currents	CON_ICOM_Current	
Value range	0 – 1000	Data type	float32
FS	0	Mapping	No
Unit	A		
Read	0		
Write	1		
Setting of current I_0 and I_1			

5.2.10 Commissioning

P 0400	Additional d-current reference value	CON_FM_AddIsdRef	
Value range	-1000 to 1000	Data type	float32
FS	0	Mapping	No
Unit	A		
Read	0		
Write	1		
Additional d-current reference value			

P 0401	Additional torque/force reference value	CON_SCON_AddTRef	
Value range	-3.4+E38 to 3.4+E38	Data type	float32
FS	0	Mapping	No
Unit	Nm/N		
Read	0		
Write	1		
Additional torque/force reference value			

P 0402	Additional speed reference value without ramp	CON_SCON_AddSRef	
Value range	-3.4+E38 to 3.4+E38	Data type	float32
FS	0	Mapping	No
Unit	rpm		
Read	0		
Write	1		
Additional speed reference value without ramp			

P 0403	Additional position reference value	CON_IP_AddEpsRef	
Value range	-2147480000 to 2147480000	Data type	float32
FS	0	Mapping	No
Unit	INCR		
Read	0		
Write	1		
Additional position reference value			

P 0404	Additional speed reference value with ramp	CON_SCON_AddSRamp	
Value range	-10000 to 10000	Data type	float32
FS	0	Mapping	No
Unit	rpm		
Read	0		
Write	1		
Additional speed reference value with ramp			

5.2.11 Autotuning

P 1515	Speed and position control dynamic (stiffness)	SCD_ConDesign	
Value range	0 – 200	Data type	float32
FS	100	Mapping	No
Unit	%		
Read	0		
Write	1		
Rigidity assistant			

P 1516	Total inertia of motor and plant	SCD_JSum	
Value range	0 – 100	Data type	float32
FS	0	Mapping	No
Unit	kg m*m		
Read	0		
Write	1		
Total mass inertia (motor and plant)			

P 1517	Autotuning for Jsum estimation, control word	SCD_AT_JsumCon	
Value range	Ready – Start	Data type	uint16
FS	Ready	Mapping	No
Unit			
Read	1		
Write	1		
Value	Setting	Function	
(0)	Ready	Assistant ready	
(1)	Stop	Deactivation of test signal/calculation	
(2)	Start	Activation of test signal/calculation	
Assistant for calculating mass inertia (control word)			

P 1518	Autotuning Jsum, hysteresis speed control, speed limit	SCD_AT_SConHysSpeed	
Value range	0 – 100000	Data type	float32
FS	0	Mapping	No
Unit	rpm		
Read	1		
Write	1		
Speed limit for determining the mass inertia			

P 1519	Autotuning for Jsum, speed hysteresis control, torque limit	SCD_AT_SConHysTorque	
Value range	0 to 10000	Data type	float32
FS	0	Mapping	No
Unit	Nm		
Read	1		
Write	1		
Torque for determining the mass inertia			

P 1520 Index 00-19	Autotuning, parameters for control and results	SCD_AT_Para	
Value range	-3.4+E38 to 3.4+E38	Data type	float32
FS	0	Mapping	No
Unit			
Read	1		
Write	1		
Internal parameter of the autotuning function			

P 1521 Index 00	Mechanical system parameters resonant frequency	SCD_MechPara f_res	
Value range	1 – 2000	Data type	float32
FS	1	Mapping	No
Unit			
Read	1		
Write	1		
Resonance frequency			

P 1521 Index 01	Mechanical system parameters mass or inertia ratio (load/motor)	SCD_MechPara m	
Value range	0.01 to 100	Data type	float32
FS	1	Mapping	No
Unit			
Read	1		
Write	1		
Mass or inertia ratio (load/motor)			

P 1521 Index 02	Mechanical system parameters Load point	SCD_MechPara load_point	
Value range	0 to 2	Data type	float32
FS	1	Mapping	No
Unit			
Read	1		
Write	1		
Load point			

P 1521 Index 03	Mechanical system parameters constant load torque	SCD_MechPara m_const	
Value range	-1000 to 1000	Data type	float32
FS	0	Mapping	No
Unit	Nm		
Read	1		
Write	1		
Load torque (constant)			

P 1521 Index 04	Mechanical system parameters friction torque	SCD_MechPara m_frict	
Value range	0 to 1000	Data type	float32
FS	0	Mapping	No
Unit	Nm		
Read	1		
Write	1		
Friction torque			

5.2.13 Test signal generator

P 1500	Test signal generator: control word	SCD_TSIG_Con	
Value range	OFF to START	Data type	uint16
FS	OFF	Mapping	No
Unit			
Read	1		
Write	1		
Value	Setting	Function	
(0)	OFF	Generator deactivated	
(1)	STOP	Deactivate test signal	
(2)	START	Activation of test signal	
Control word of test signal generator			

P 1501	Test signal generator: output signal selector	SCD_TSIG_OUTSel	
Value range	OFF to SRAMP	Data type	uint16
FS	OFF	Mapping	No
Unit			
Read	1		
Write	1		

P 1501	Test signal generator: output signal selector	SCD_TSIG_OUTSel
Value	Setting	Function
(0)	OFF	Generator deactivated
(1)	ISDREF	d-current reference
(2)	MREF	Torque reference
(3)	SREF	Speed reference
(4)	EPSREF	Position reference
(5)	SRAMP	Speed reference via ramps
Selector for test signal generator output		

P 1502	Test signal generator: number of cycles	SCD_TSIG_Cycles	
Value range	0 to 1000	Data type	uint16
FS	1	Mapping	No
Unit			
Read	1		
Write	1		
Number of cycles			

P 1503 Index 00 – 01	Test signal generator: offsets for rectangular wave	SCD_TSIG_Offset	
Value range	-1000000 to 1000000	Data type	float 32
FS	0	Mapping	No
Unit	var		
Read	1		
Write	1		
Offset for square-wave signal			

P 1504 Index 00-01	Test signal generator: offsets for rectangular wave	SCD_TSIG_Time	
Value range	0 to 100000	Data type	float 32
FS	0	Mapping	No
Unit	s		
Read	1		
Write	1		
Times for square-wave signal			

P 1505	Test signal generator: amplitude of sinusoidal wave	SCD_TSIG_Amp	
Value range	-1000000 to 1000000	Data type	float 32
FS	0	Mapping	No
Unit	var		
Read	1		
Write	1		
Setting of amplitude for a sinusoidal signal			

P 1506	Test signal generator: frequency of sinusoidal wave	SCD_TSIG_Freq	
Value range	0 to 8000	Data type	float 32
FS	0	Mapping	No
Unit	Hz		
Read	1		
Write	1		
Setting of frequency for a sinusoidal signal			

P 1507	Test signal generator: initial phase for rotating current vector	SCD_TSIG_SetPhase	
Value range	-180 to 180	Data type	float 32
FS	0	Mapping	No
Unit	degree		
Read	1		
Write	1		
Start phase of current vector in VFCON and ICON mode			

P 1508	Test signal generator: PRBS minimum toggle time	SCD_TSIG_PRBSTime	
Value range	0.125 to 1000	Data type	float 32
FS	0	Mapping	No
Unit	ms		
Read	1		
Write	1		
Setting of clock time for the PRBS signal generator			

P 1509	Test signal generator: PRBS signal amplitude	SCD_TSIG_PRBSAmp	
Value range	-1000000 to 1000000	Data type	float 32
FS	0	Mapping	No
Unit	var		
Read	1		
Write	1		
Setting of amplitude for the PRBS signal generator			

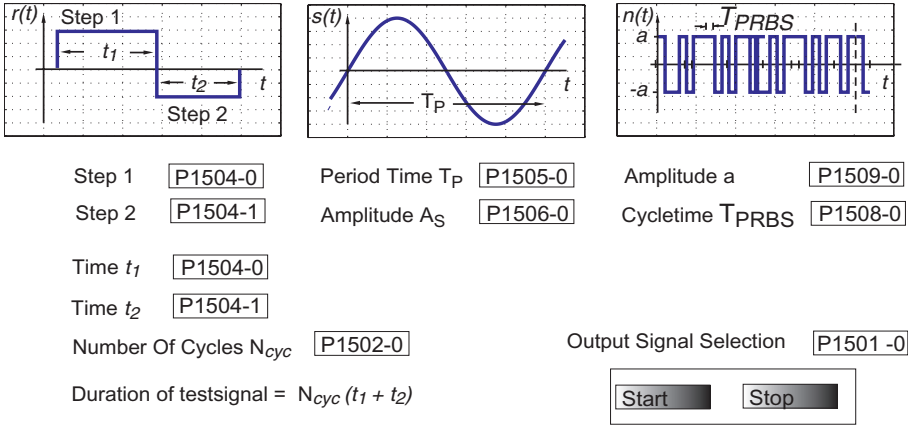


Fig.: 5.2.13-1: Parameters for the test signal generator

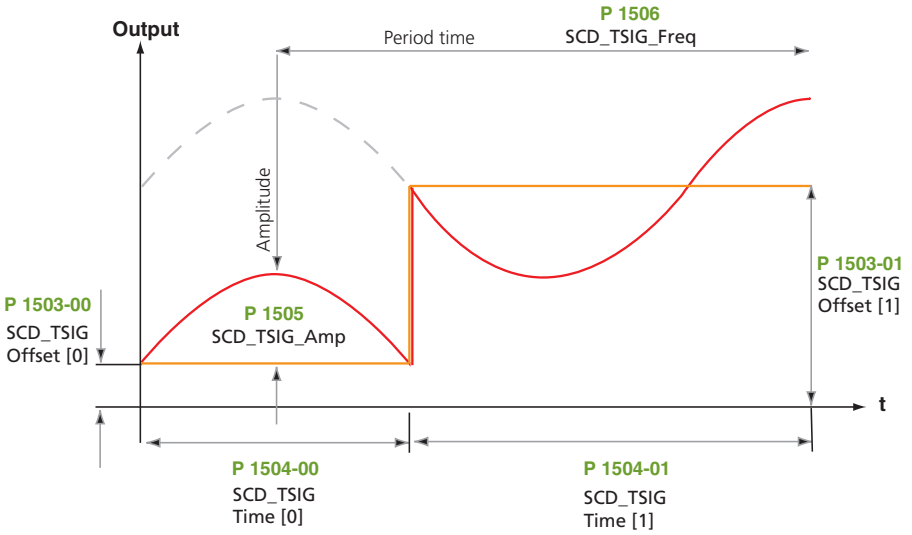


Fig.: 5.2.13-2: Addition of square and sinusoidal signal

6 Inputs (output I/Os)

6.1 Digital inputs

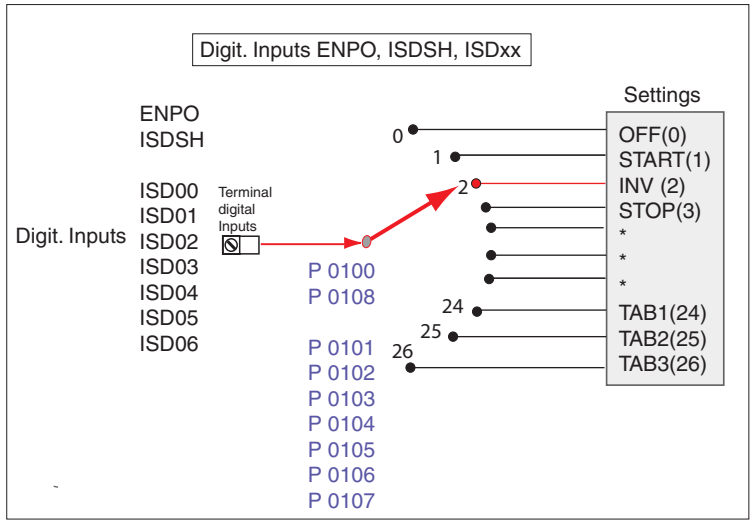


Fig. 6.1-1: Function selector of the digital inputs

6.1.1 Function selectors of the digital inputs

P 0100	Function of digital input ENPO	MPRO_INPUT_FS_ENPO	
Value range	OFF – START	Data type	int16
FS	OFF	Mapping	No
Unit			
Read	1		
Write	1		
Value	Setting	Function	
(0)	OFF	Hardware enable via ENPO "ON"	
(1)	START	Hardware enable and motor start via ENPO "ON"	
Function selector for input Hardware enable ENPO			

P 0101 to P 0107	Function of digital input ISD00 to ISD06	MPRO_INPUT_FS_ISD00 – 06	
Value range	OFF – TAB3	Data type	int16
FS	OFF	Mapping	No
Unit			
Read	1		
Write	1		
Value	Setting	Function	
(0)	OFF	Input not active	
(1)	START	START control; current is applied to the motor; the direction depends on the reference value.	
(2)	reserve	Reserved	
(3)	STOP	QUICK STOP as per quick stop response "Low active", [1)]	
(4)	HALT	FEED HOLD: The ongoing axis movement is interrupted as per the "HALT" response1) and resumed following resetting.	
(5)	LCW	LIMIT SWITCH EVALUATION RIGHT: Limit switch evaluation without override protection; the response to interchanged limit switches is programmable.	
(6)	LCCW	LIMIT SWITCH EVALUATION LEFT: Limit switch evaluation without override protection; the response to interchanged limit switches is programmable.	
(7)	INCH_P	JOG IN POSITIVE DIRECTION: In manual positioning mode an axis can be moved at slow or quick jog speed.	

P 0101 to P 0107	Function of digital input ISD00 to ISD06	MPRO_INPUT_FS_ISD00 – 06
(8)	INCH_N	JOG IN NEGATIVE DIRECTION: In manual positioning mode an axis can be moved at slow or quick jog speed.
(9)	HOMST	START HOMING: According to the homing method set in P 2261
(10)	HOMSW	REFERENCE CAM to determine the zero for positioning
(11)	E-Ext	EXTERNAL ERROR: Error messages from external devices produce an error message with response as defined in P 0030.
(12)	WARN	EXTERNAL COLLECTIVE WARNING
(13)	RSERR	RESET ERROR: Error messages are reset with a rising edge. Attention: The error must no longer be occurring when the reset is performed!
(14)	reserve	Reserve
(15)	PROBE	TOUCHPROBE: The Touchprobe function should only be used for the two fast inputs ISD05 and ISD06.
(16)	PLC	INPUT USABLE IN SEQUENCE PROGRAM; inputs can always be read regardless of the setting.
(17)	PLC_IR	PLC INTERRUPT: Interruption of the program
(18)	MP_UP	MOTOR POTENTIOMETER: Increase reference value
(19)	MP_DOWN	MOTOR POTENTIOMETER: Reduce reference value
(20)	reserve	Reserve
(21)	TBEN	TABLE ENABLE: Import the current driving set and execute it

P 0101 to P 0107	Function of digital input ISD00 to ISD06	MPRO_INPUT_FS_ISD00 – 06
(22)	TBTEA	DRIVING SET POSITIONING: "TEACH_IN" for the position driving set table
(23)	TAB0	DRIVING SET0: Binary selection of driving set
(24)	TAB1	DRIVING SET 1
(25)	TAB2	DRIVING SET 2
(26)	TAB3	DRIVING SET 3
Function selector for digital inputs ISD00 – ISD06 1) see section 3.1 of the Application Manual		

P 0108	Function of digital input ISDSH	MPRO_INPUT_FS_ISDSH	
Value range	ISDSH	Data type	int16
FS	ISDSH	Mapping	No
Unit			
Read	1		
Write	1		
Value	Setting	Function	
(0)	ISDSH	Activation of Safe Standstill STO	
Hardware enable "Safely disabled torque" STO (Save Torque Off) as per EN 954-1 category 3 (see section 4.2 of the Application Manual)			

P 0120	Input inversion mask	MPRO_INPUT_INV	
Value range	00000000 – 01111111	Data type	uint32
FS		Mapping	No
Unit			
Read	1		
Write	1		

P 0120	Input inversion mask	MPRO_INPUT_INV
Bit 0 = ENPO Bit 1-6 = ISD00 to ISD05 Bit 7 = ISDSH Bit 17 = ISD06 Function selector to invert the digital inputs		

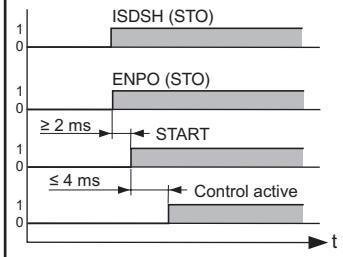
Power-up sequence	Command	System state
	STO / ISDSH „ENPO" Enable Power ISD0x = START Control active	Switch-on inhibit Ready to switch on Switched on Control active

Fig. 6.1-1: Power-up sequence

6.2 Digital outputs

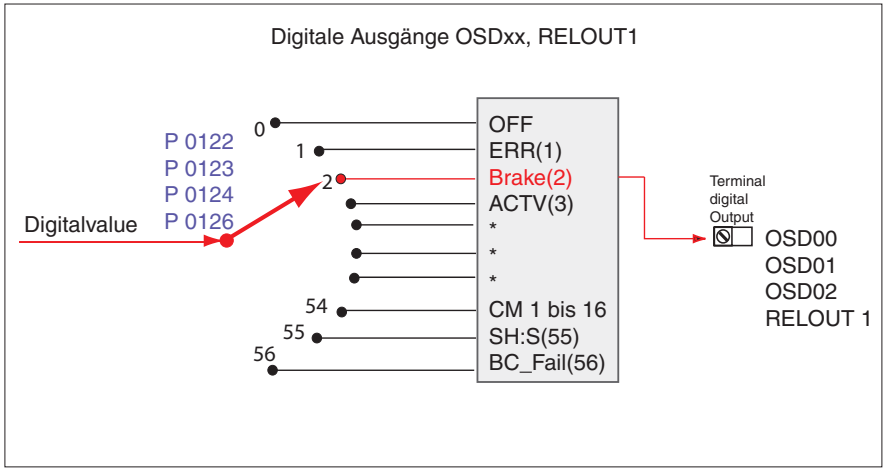


Fig. 6.1-1: Function selector digital outputs

P 0122 to P 0126	Function of digital output OSD00 to RELOUT1	MPRO_OUTPUT_FS_OSD00 – RELOUT1	
Value range	OFF – BC_FAIL	Data type	int16
FS	OFF	Mapping	No
Unit			
Read	1		
Write	1		
Value	Setting	Function	
(0)	OFF	Input not active	
(1)	ERR	ERROR: Collective error message	

P 0122 to P 0126	Function of digital output OSD00 to RELOUT1	MPRO_OUTPUT_FS_OSD00 – RELOUT1
(2)	BRAKE	MOTOR BRAKE: Output is activated according to holding brake function (see Application Manual, section 4.6).
(3)	ACTIV	POWER STAGE ACTIVE: Closed-loop and open-loop control activated
(4)	S_RDY	Output is activated if the device completed initialization after power-up.
(5)	C_RDY	Output is activated if by setting the signal ENPO the device is “ready to start” and there are no error messages. Device “Ready to switch on” flag in DRIVECOM status word is set (in states: 3, 4, 5, 6, 7).
(6)	REF	REFERENCE REACHED
(7)	HOMATD	HOMING ENDED
(8)	E_FLW	TRACKING ERROR
(9)	ROT_R	Motor rotating clockwise
(10)	ROT_L	Motor rotating anti-clockwise
(11)	ROT_0	Motor in standstill window, depending on actual value
(12)	STOP	The drive is in the “Quick stop” state
(13)	HALT	Display system is in the “HALT” state (activated via: DS 402, input or PROFIBUS Intermediate STOP, SERCOS as from V 2.0)
(14)	LIMIT	The “LIMIT” output function detects when a reference value reaches its limit. In this case the output is set.
(15)	N_GT_NX	N_{act} > Nx where Nx = value in P 0740
(16)	N_LT_NX	N_{act} < Nx where Nx = value in P 0740

P 0122 to P 0126	Function of digital output OSD00 to RELOUT1	MPRO_OUTPUT_FS_OSD00 – RELOUT1
(17)	P_LIM_ACTIV	Position reference limited (e.g. with parameterized limit switches)
(18)	N_LIM_ACTIV	Limitation of speed reference is active
(19)	I_LIM_ACTIV	Limitation of current active
(20)	COM	Set output via COM Option (as from V 2.0)
(21)	ENMO	Activate motor contactor (motor wiring via a motor contactor)
(22)	PLC	Use output via PLC program
(23)	WARN	Warning: "Collective message"
(24)	WUV	Warning: "Undervoltage in DC link"
(25)	WOV	Warning: "Overvoltage in DC link"
(26)	WIIT	Warning: "I2t power stage protection threshold reached"
(27)	WOTM	Warning: "Motor temperature"
(28)	WOTI	Warning: "Heat sink temperature of device"
(29)	WOTD	Warning: "Interior temperature of device"
(30)	WLIS	Warning "Apparent current limit exceeded"
(31)	WLS	Warning "Speed limit exceeded"
(32)	WIT	Warning: "I2t motor protection threshold reached"
(33)	WLTQ	Warning "Torque limit exceeded"
(34)	TBACT	Table positioning in AUTO and activated state
(35)	TB0	Table value 0 active: 2^0
(36)	TB1	Table value 1 active: 2^1
(37)	TB2	Table value 2 active: 2^2
(38)	TB3	Table value 3 active: 2^3

P 0122 to P 0126	Function of digital output OSD00 to RELOUT1	MPRO_OUTPUT_FS_OSD00 – RELOUT1
(39)-(54)	CM1 – CM16	Cam gear (as from V 2.0)
(55)	SH_S	STO function activated
(56)	BC_Fail	Braking chopper error
Function selector for digital outputs OSD00 – RELOUT1 1) see section 3.1 of the Application Manual		

P 0127	Function of digital input RELOUT2 is fixes on „Safety Hold"	MPRO_OUTPUT_FS_RELOUT2	
Value range	SH_S	**Data type**	uint16
FS		**Mapping**	No
Unit			
Read	0		
Write	5		
The digital output RELOUT2 is fixed on the STO SH_S function and cannot be changed. For additional information see Operation Manual, sections 1 and 6.			

P 0142	Output inversion	MPRO_OUTPUT_INV	
Value range	00000000... to 01111111...	Data type	uint16
FS	00000000...	Mapping	No
Unit			
Read	1		
Write	1		
Function selector to invert the digital outputs: Bit 0/1/2 = Output OSD00 / 01 / 02 Bit 6 = MBRK (motor brake) Bit 7 = RELOUT1 Bit 15 = RELOUT2			

6.3 Analog inputs

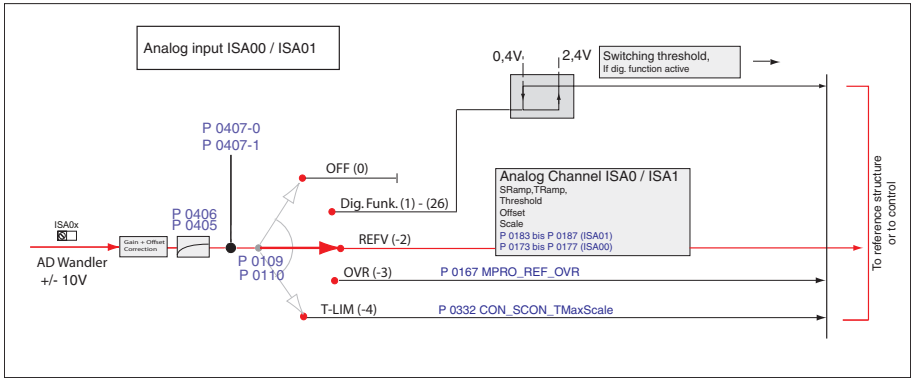


Fig. 6.3-1: Selector for the analog inputs

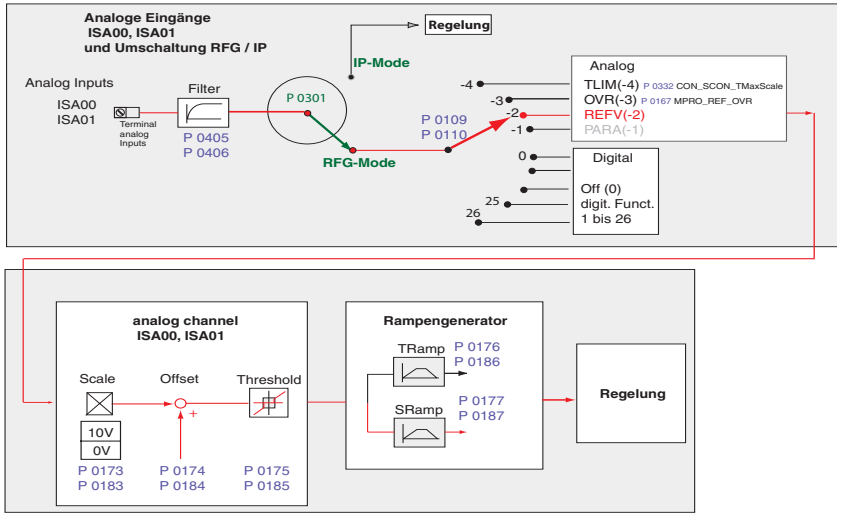


Fig. 6.3-3: Reference values via the analog inputs (analog channel ISA00 and ANA01)

P 0109 P 0110	Function of analog input ISA00/1	MPRO_INPUT_FS_ISA00/1	
Value range	TLIM to TAB3	**Data type**	int16
FS	OFF	**Mapping**	No
Unit			
Read	1		
Write	1		
Value	Setting	Function	
analog (-4)	TLIM	TORQUE SCALING 0-100 %: 0 to 10V corresponds to 0-100 % of the maximum preset torque. The torque scaling is recorded directly after the analog filter and before the backlash (threshold, offset). The analog input writes to parameter P 0332 SCON_ TMaxScale Torque limitation. The backlash is therefore not effective for this function.	
analog (-3)	OVR	OVERRIDE 0-100 % 0-10 V corresponds to 0-100%. Scaling of the configured velocity during positioning. The override is tapped directly after the analog filter and before the backlash. At this point the program branches to parameter P 0167 Profile override speed factor. The backlash, threshold and offset functions are not in effect.	
analog (-2)	REFV	REFERENCE INPUT +/- 0-10 V. Pay attention to scaling and adapt reference structure via reference selector.	
analog (-1)	PARA (write to P 0407)	Analog values appear as actual values in parameter P0407. This value can then be mapped in the process channel. This setting is always active and does not need to be additionally activated.	

P 0109 P 0110	Function of analog input ISA00/1	MPRO_INPUT_FS_ISA00/1
(0)	OFF	Input not active
(1)	START	START control; current is applied to the motor; the direction depends on the reference value.
(2)	reserve	Reserved
(3)	STOP	QUICK STOP as per quick stop response "Low active", [1)]
(4)	HALT	FEED HOLD: The ongoing axis movement is interrupted as per the "HALT" response[1)] and resumed following resetting.
(5)	LCW	LIMIT SWITCH EVALUATION RIGHT: Limit switch evaluation without override protection; the response to interchanged limit switches is programmable.
(6)	LCCW	LIMIT SWITCH EVALUATION LEFT: Limit switch evaluation without override protection; the response to interchanged limit switches is programmable.
(7)	INCH_P	JOG IN POSITIVE DIRECTION: In manual positioning mode an axis can be moved at slow or quick jog speed.
(8)	INCH_N	JOG IN NEGATIVE DIRECTION: In manual positioning mode an axis can be moved at slow or quick jog speed.
(9)	HOMST	START HOMING: According to the homing method set in P 2261
(10)	HOMSW	REFERENCE CAM to determine the zero for positioning
(11)	E-Ext	EXTERNAL ERROR: Error messages from external devices produce an error message with response as defined in P 0030.
(12)	WARN	EXTERNAL COLLECTIVE WARNING

P 0109 P 0110	Function of analog input ISA00/1	MPRO_INPUT_FS_ISA00/1
(13)	RSERR	RESET ERROR: Error messages are reset with a rising edge. Attention: The error must no longer be occurring when the reset is performed!
(14)	reserve	Reserve
(15)	PROBE	TOUCHPROBE: The Touchprobe function should only be used for the two fast inputs ISD05 and ISD06.
(16)	PLC	INPUT USABLE IN SEQUENCE PROGRAM; inputs can always be read regardless of the setting.
(17)	PLC_IR	PLC INTERRUPT: Interruption of the program
(18)	MP_UP	MOTOR POTENTIOMETER: Increase reference value
(19)	MP_DOWN	MOTOR POTENTIOMETER: Reduce reference value
(20)	reserve	Reserve
(21)	TBEN	TABLE ENABLE: Import the current driving set and execute it
(22)	TBTEA	DRIVING SET POSITIONING: "TEACH_IN" for the position driving set table
(23)	TAB0	2^0 Binary selection of driving set 0
(24)	TAB1	2^1 Binary selection of driving set 2
(25)	TAB2	2^2 Binary selection of driving set 4
(26)	TAB3	2^3 Binary selection of driving set 8
Function selector of analog inputs ISA00 / 01 (marked in grey). With 4 digital inputs 16 driving sets can be selected		

P 0405 P 0406	Analog input 0/1, filter time	CON_ANA_Filt0/1	
Value range	0 – 100	**Data type**	float32
FS	0	**Mapping**	No
Unit	ms		
Read	0		
Write	1		
Filter time for analog inputs ISA00 and ISA01			

6.4 Analog outputs

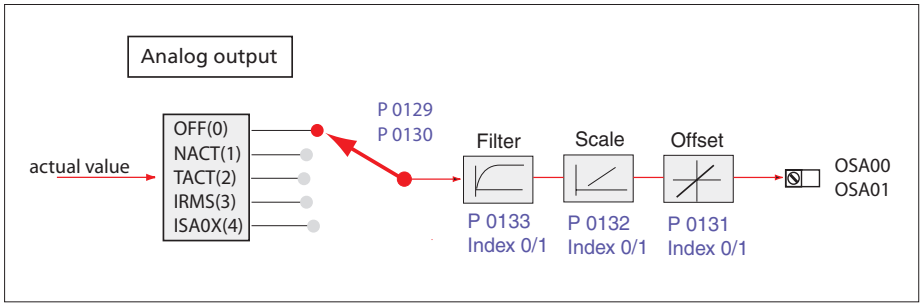


Fig. 6.4-1: Selector for the analog outputs

P 0129 P 0130	Function of analog output OSA00/01	MPRO_INPUT_FS_OSA00/01	
Value range	OFF – ISA00 OFF – ISA01	Data type	uint16
FS	OFF	Mapping	No
Unit			
Read	1		
Write	1		
Value	Setting	Function	
(0)	OFF	Not activated	
(1)	NACT	Output of the current speed	
(2)	TACT	Output of the current torque/force	
(3)	IRMS	Output of the effective current	
(4)	ISA00	Output of the current value of ISA00/01	
Function selector of analog outputs OSA00 / 01: Reference readout always corresponds to an output of 0 – 10 V.			

P 0131 Index 00 – 01	Voltage offset for analog output OSA00/01	MPRO_OUTPUT_OSA00/01_Offset	
Value range	-10 to 10	Data type	float32
FS	0	Mapping	No
Unit	V		
Read	1		
Write	1		
Setting of the voltage offset			

P 0132 Index 00 – 01	Scale factor for analog output OSA00/01	MPRO_OUTPUT_OSA00/01_Scale	
Value range	-3.4E+38 to 3.4E+38	Data type	float32
FS	1	Mapping	No
Unit	V/DIM		
Read	1		
Write	1		
Scaling of the analog output			

P 0133 Index 00 – 01	Filter times for analog output OSA00/01	MPRO_OUTPUT_OSA00/01_Filter	
Value range	0 – 65	Data type	float32
FS	0	Mapping	No
Unit	ms		
Read	1		
Write	1		
Filter time for the analog output			

6.5 Motor brake

P 0125	Function of motor brake (x13)	MPRO_INPUT_FS_Motor_Brake	
Value range	OFF – BC_Fail	Data type	uint16
FS	OFF	Mapping	No
Unit			
Read	1		
Write	1		
This configures the output for use of a motor holding brake "BRAKE". If no brake is used, the output can be used for a wide variety of other functions (see section 6.2, parameters P 0122-P 0126).			

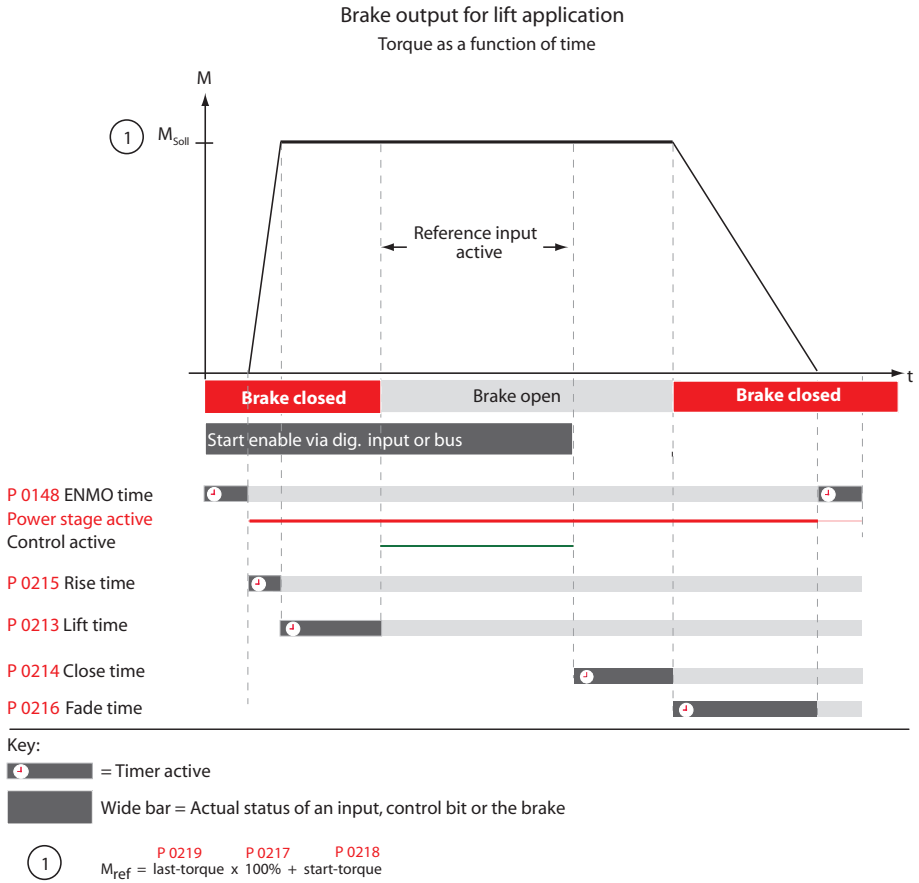


Fig. 6.5-1: Parameters to set the brake

P 0213	Motor brake lift time	MPRO_BRK_LiftTime	
Value range	0 – 10000	Data type	uint16
FS	100	Mapping	No
Unit	ms		
Read	0		
Write	1		
The “lift time“ takes account of the mechanically dictated opening time of the brake. A waiting reference value is only activated when the timer has elapsed.			

P 0214	Motor brake close time	MPRO_BRK_CloseTime	
Value range	0 – 10000	Data type	uint16
FS	100	Mapping	No
Unit	ms		
Read	0		
Write	1		
When the start condition is cancelled or in the event of an error, the “close time“ starts. It is the mechanically dictated time which a brake takes to close.			

P 0215	Motor brake torque rise time	MPRO_BRK_RiseTime	
Value range	0 – 10000	Data type	uint16
FS	100	Mapping	No
Unit	ms		
Read	0		
Write	1		
The “rise time“ is the rise of the ramp with which the reference torque is built up.			

P 0216	Motor brake torque fade time time	MPRO_BRK_FadeTime	
Value range	0 – 10000	Data type	uint16
FS	100	Mapping	No
Unit	ms		
Read	0		
Write	1		
The “fade time“ is the braking ramp with which the reference torque is reduced to 0.			

P 0217	Motor brake factor for application of last torque	MPRO_BRK_LastTorqueFact	
Value range	0 – 100	Data type	float32
FS	0	Mapping	No
Unit	%		
Read	0		
Write	1		
If the loads change on restarting, a restart with the LastTorque (torque on shutdown) is recommended. In this, the actual parameter is assigned a factor 1 – 100 %. (0 % = off). Note: On the very first power-up a StartTorque P 0218 must be set.			

P 0218	Motor brake constant initial torque	MPRO_BRK_StartTorq	
Value range	0 – 10000	Data type	float32
FS	0	Mapping	No
Unit	Nm		
Read	0		
Write	1		

P 0218	Motor brake constant initial torque	MPRO_BRK_StartTorq
If the moving load always remains constant, Mref is set by way of parameter P 0218 “StartTorque”. M_{ref} = LastTorque + LastTorque factor + StartTorque If LastTorque factor is set = 0 as per the formula, only the Start Torque setting is used. If StartTorque is set = 0, the LastTorque is used. On the very first operation there is no LastTorque though. In this case Start Torque is set = 0, the LastTorque factor is set unequal to 0 and then the control is started. The last torque applied is adopted.		

P 0219	Motor brake torque sampled at last closing time	MPRO_BRK_LastTorq	
Value range	-10000 to 10000	**Data type**	float32
FS	0	**Mapping**	No
Unit	Nm		
Read	0		
Write	1		
This parameter is only a display parameter. In it, the last torque applied is entered on shutdown and the scale factor P 0217 is applied to it as a percentage where necessary.			

P 0220	Lock brake	MPRO_BRK_Lock	
Value range	false to true	**Data type**	uint64
FS	false	**Mapping**	No
Unit			
Read	1		
Write	1		
Value	Setting	Function	
(0)	False	Vent brake	
(1)	True	Close brake	
For testing only: The brake can be closed in a defined manner during operation by setting this parameter.			

7 Limits

7.1 Warnings and limits

7.1.1 Warning levels

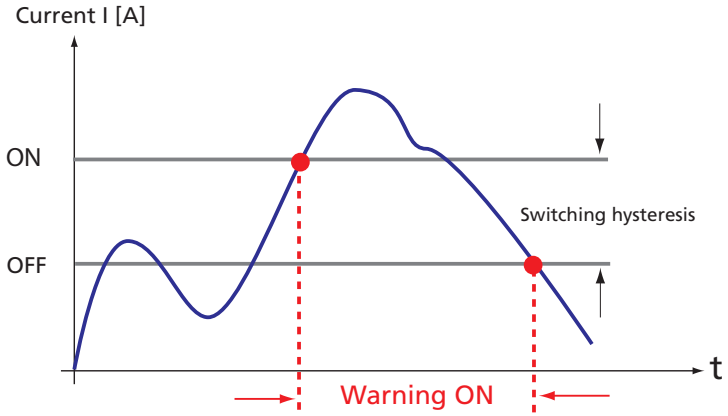


Fig. 7.1.1-1: Example of a switching hysteresis for a defined current threshold

P 0730 Index 00-01	Warning level DC link undervoltage ON/OFF	MON_WarningLevel Undervoltage_ON/OFF	
Value range	0 – 1000	Data type	float32
FS	0	Mapping	No
Unit	V		
Read	0		
Write	1		
Warning: Undervoltage in DC link			

P 0730 Index 02-03	Warning level DC link overvoltage ON/OFF	MON_WarningLevel overvoltage_ON/OFF	
Value range	0 – 1000	Data type	float32
FS	1000	Mapping	No
Unit	V		
Read	0		
Write	1		
Warning: voltage overload in DC link			

P 0730 Index 04-05	Warning level Motor current ON/OFF	MON_WarningLevel I_ON/OFF	
Value range	0 – 1000	Data type	float32
FS	1000	Mapping	No
Unit	A		
Read	0		
Write	1		
Warning: Motor current threshold reached			

P 0730 Index 06-07	Warning level I^2t internal device protection ON/OFF	MON_WarningLevel Device I^2t_ON/OFF	
Value range	0 – 110	Data type	float32
FS	0	Mapping	No
Unit	%		
Read	0		
Write	1		
Warning: I^2t integrator activated to protect device			

P 0730 Index 08-09	Warning level I^2t motor protection ON/OFF	MON_WarningLevel I^2t_motor protection ON/OFF	
Value range	0 – 110	Data type	float32
FS	0	Mapping	No
Unit	%		
Read	0		
Write	1		

P 0730 Index 08-09	Warning level I^2t motor protection ON/OFF	MON_WarningLevel I^2t_motor protection ON/OFF
Warning: I^2t integrator activated to protect motor		

P 0730 Index 10-11	Warning level Torque ON/OFF	MON_WarningLevel motor torque_ON/OFF	
Value range	0 – 1000	Data type	float32
FS	0	Mapping	No
Unit	Nm		
Read	0		
Write	1		
Warning: Torque threshold reached			

P 0730 Index 12-13	Warning level Speed ON/OFF	MON_WarningLevel motor actual speed_ON/OFF	
Value range	0 – 10000	Data type	float32
FS	0	Mapping	No
Unit	rpm		
Read	0		
Write	1		
Warning: Speed threshold reached			

P 0730 Index 14-15	Warning level TC ON/OFF	MON_WarningLevel cooler (power electronics) temperature_ON/OFF	
Value range	0 – 200	Data type	float32
FS	0	Mapping	No
Unit	deg C		
Read	0		
Write	1		
Warning: Temperature threshold reached (heat sink temperature)			

P 0730 Index 16-17	Warning level Tint ON/OFF	MON_WarningLevel imternal (control electronics) temperature_ON/OFF	
Value range	0 – 200	Data type	float32
FS	0	Mapping	No
Unit	deg C		
Read	0		
Write	1		
Warning: Temperature threshold reached (internal device temperature)			

P 0730 Index 18-19	Warning level motor temperature ON/OFF	MON_WarningLevel Motor Temp_CN_ON/OFF	
Value range	0 – 200	Data type	float32
FS	0	Mapping	No
Unit	deg C		
Read	0		
Write	1		

P 0730 Index 18-19	Warning level motor temperature ON/OFF	MON_WarningLevel Motor Temp_CN_ON/OFF	
Warning: Temperature threshold reached (motor temperature)			

P 0745	Speed-Window for motor standstill or target reached	MON_RefWindow	
Value range	0 – 3.4E+38	Data type	float32
FS	10	Mapping	No
Unit	rpm		
Read	0		
Write	1		
Speed window for “axis standstill” (n = 0 rpm)			

P 0746	Position window for “target reached” status	MON_RefWindow	
Value range	0 – 4294967295	Data type	uint32
FS	100	Mapping	No
Unit	milli degree/USER		
Read	0		
Write	1		
“Position-reached” window			

P 0747	Voltage limit for power fail reaction	MON_PF_OnLimit	
Value range	0 – 1000	Data type	float32
FS	0	Mapping	No
Unit	V		
Read	0		

P 0747	Voltage limit for power fail reaction	MON_PF_OnLimit	
Write	1		
Voltage limit for “power failure“ warning response			

7.1.2 Torque/force limit

P 0329	Motor torque scaling of limits	CON_SCON_TMax	
Value range	0 – 1000	Data type	float32
FS	100	Mapping	No
Unit	%		
Read	0		
Write	1		
Scaling of the torque limit			

P 0330	Motor torque scaling of negative limit	CON_SCON_TMaxNeg	
Value range	0 – 100	Data type	float32
FS	100	Mapping	Yes
Unit	%		
Read	0		
Write	1		
Scaling of the torque limit in negative direction			

P 0331	Motor torque scaling of positiv limits	CON_SCON_TMaxPos	
Value range	0 – 100	Data type	float32
FS	100	Mapping	Yes

P 0331	Motor torque scaling of positiv limits	CON_SCON_TMaxPos	
Unit	%		
Read	0		
Write	1		
Scaling of the torque limit in positive direction			

P 0332	Motor torque scaling online factor	CON_SCON_TMaxScale	
Value range	0 – 100	Data type	float32
FS	100	Mapping	Yes
Unit	%		
Read	0		
Write	1		
Scaling factor of torque limit (variable online)			

P 0741	Monitoring torque/force threshold	Mon_TorqueThresh	
Value range	0 – 3.4E+38	Data type	float32
FS	0	Mapping	No
Unit	Nm		
Read	0		
Write	1		
Torque threshold value for digital outputs			

7.1.3 Velocity/speed limits

P 0328	Speed control maximum speed	CON_SCON_SMax	
Value range	0 – 1000	Data type	float32
FS	100	Mapping	No
Unit	%		
Read	0		
Write	1		
Scaling of the speed limit			

P 0333	Motor speed scaling of negative limit	CON_SCON_SMaxNeg	
Value range	0 – 100	Data type	float32
FS	100	Mapping	No
Unit	%		
Read	0		
Write	1		
Scaling of the speed limit in negative direction			

P 0334	Motor speed scaling of positive limit	CON_SCON_SMaxPos	
Value range	0 – 100	Data type	float32
FS	100	Mapping	No
Unit	%		
Read	0		
Write	1		
Scaling of the speed limit in positive direction			

P 0740	Monitoring speed threshold	MON_SpeedThresh	
Value range	0 – 3.4E+38	Data type	float32
FS	0	Mapping	No
Unit	rpm		
Read	0		
Write	1		
Speed threshold value for digital outputs			

P 0744	Monitoring speed difference threshold	MON_SDiffMax	
Value range	0 – 3.4E+38	Data type	float32
FS	3000	Mapping	No
Unit	rpm		
Read	0		
Write	1		
Speed tracking error monitoring			

7.1.4 Position limits

P 0743	Monitoring position difference threshold	MON_UsrPosDiffMax	
Value range	0 – 4294967295	Data type	uint32
FS	0	Mapping	No
Unit	user		
Read	0		
Write	1		
Position tracking error monitoring			

8. Alarm & Warnings

8.1 Error Reactions

The settings in parameter P 0030-00 are applicable to all 36 error messages!

P 0030 Index 00	Programmable reaction in case of failure	ErrorReaction	
Value range	Ignore – WaitERSAndReset	Data type	uint8
FS	ServoHalt	Mapping	Yes
Unit			
Read	1		
Write	1		
Value	Setting	Function	
(0)	Ignore	An error message is ignored	
(1)	Specific1	The user can program an initial specific error response by way of the internal PLC.	
(2)	Specific2	The user can program a second specific error response by way of the internal PLC.	
(3)	FaultReactionOptionCode	The error is registered. The error response is made according to the preset error "Opti-onCode"	
(4)	ServoStop	"Quick stop", wait for control restart	
(5)	ServoStopAndLock	"Quick stop", block power stage, secure against restarting	
(6)	ServoHalt	Block power stage	
(7)	ServoHaltAndLock	Block power stage, disable	
(8)	WaitERSAndReset	Block power stage, reset only by switching the 24 V control voltage off and back on	

P 0030 Index 00	Programmable reaction in case of failure	ErrorReaction
These programmable error responses apply to all error messages from index 00 to index 35 (see Application Manual, section 7, Diagnosis)		

8.1.2 Error description (Actual Error)

P 0033 Index 00	Actual device error Error cause	ActualError Cause	
Value range		Data type	string
FS		Mapping	Yes
Unit			
Read	0		
Write	5		
Error cause			

P 0033 Index 01	Actual device error Error remedy	ActualError Remedy	
Value range		Data type	string
FS		Mapping	Yes
Unit			
Read	0		
Write	5		
Suggested remedy			

P 0033 Index 02	Actual device error Error identification	ActualError Id	
Value range	0 – 36	Data type	uint16
FS	0	Mapping	Yes
Unit			
Read	0		
Write	5		
The error is clearly defined by the displayed number: Example: "External error" has the ID no. 11 (see list in Application Manual, section 7, Diagnosis)			

P 0033 index 03	Actual device error Error location	ActualError Location	
Value range	0 – 9	Data type	uint16
FS	0	Mapping	Yes
Unit			
Read	0		
Write	5		
Error location			

P 0033 index 04	Actual device error Time stamp of error event	ActualError Time	
Value range	0 – 4294967295	Data type	uint32
FS	0	Mapping	Yes
Unit			
Read	0		
Write	5		
Error time which has elapsed since last power-up			

Note: The grey-backed parameters will only be available as from firmware version V 2.0.

P 0033 index 05	Actual device error Additional Error comment (id)	ActualError CommentId	
Value range	- 2147483648 to 2147483647	Data type	int32
FS	0	Mapping	Yes
Unit			
Read	0		
Write	5		
Additional error commentary (id). Not supported			

P 0033 index 06	Actual device error Additional Error comment (text)	ActualError CommentText	
Value range		Data type	string
FS		Mapping	Yes
Unit			
Read	0		
Write	5		
Additional error commentary. Text not supported!			

P 0033 index 07	Actual device error Line of error occurrence	ActualError Line	
Value range	0 – 2147483647	Data type	int32
FS	0	Mapping	Yes
Unit			
Read	0		
Write	5		
Program number in which the error occurred. Only relevant for Service personnel.			

P 0033 index 08	Actual device error Additional error comment (text)	ActualError Source file of error occurrence	
Value range		Data type	string
FS	0	Mapping	Yes
Unit			
Read	0		
Write	5		
Additional error commentary			

9 Bus systems (field bus)

9.1 Description of the field bus systems

All information and descriptions of the bus systems can be found in the relevant user manuals.

9.1.1 User manuals for bus systems

User Manual:	CANopen	ID no.: 1100.10B.0-00
User Manual:	EtherCAT	ID no.: 1100.08B.0-00
User Manual:	SERCOS	ID no.: 1100.09B.0-00
User Manual:	PROFIBUS	ID no.: 1100.07B.0-00

10 Device information (Drive description)

10.1 Content of the device information

When contacting our Service department, please always quote the device type, the software version and the serial number.

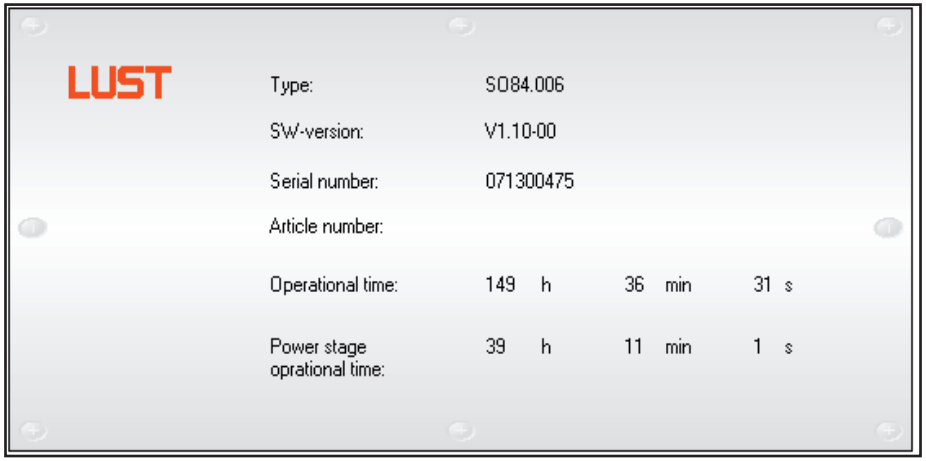


Fig. 10.1-1: Dialog box for device information

1. Type: Device type
2. SW-Version: Software-Version
3. Serial number: Serial number of device
4. Articel number: Not supported!
5. Operational time: Total operating hours since last switch-on of the 24V control voltage
6. Power stage: Total power stage operating hours

11 Passwords and user levels

11.1 User levels

There are five user levels selectable directly on the DriveManager (dialog box below menu bar in DriveManager).

0	"Observer"-Level 0	No password required: Read only
1	"Fitter"-Level 1	No password required: Restricted parameter access, sufficient only to rotate a drive
2	"Local administrator"-Level 2 Default setting:	No password required: At this parameter level the parameters are available for 99 % of all applications.
3	"Global administrator"-Level 3 Custom user level	Password required: This parameter level is available only to LUST commissioning specialists
4	"Internal"-Level4 Custom user level	Password required: This parameter level is available only to LUST development specialists Development level

11.2 Passwords

Protection against misoperation:

All drive controllers, including those in multi-axis systems, can be protected by passwords. The passwords can be generated by users themselves, and prevent unrestricted access to the device.

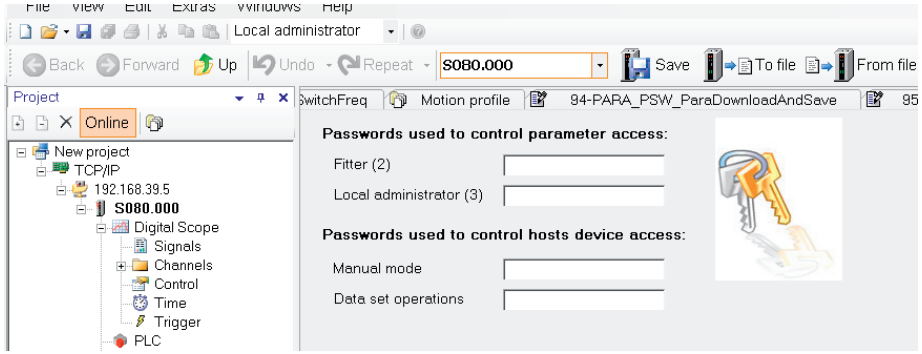


Fig.11.1-1: Password form

In the top section of the form a password can be assigned for the "Fitter" and "Local administrator" level, thereby restricting access to specific parameters.

Protection can be extended by a password for:

Manual mode: "Control" (manual mode) by way of the DriveManager can be protected by a password.

Data set operations: Protection of the user data set
The original data set can be edited for test purposes, but cannot be saved. This enables an existing data set to be protected against unwanted changes.

12 Actual values

12.1 Actual values – Motion Profile

P 0276	Actual position in user units	MPRO_FG_UsrActPos	
Value range	-2147483648 to 2147483647	Data type	int32
FS	0	Mapping	Yes
Unit	USER		
Read	0		
Write	5		
Actual position in user units			

P 0277	Reference position in user units	MPRO_FG_UsrRefPos	
Value range	-2147483648 to 2147483647	Data type	int32
FS	0	Mapping	Yes
Unit	USER		
Read	0		
Write	5		
Position reference in user units			

P 0278	Position command in user units	MPRO_FG_UsrCmdPos	
Value range	-2147483648 to 2147483647	Data type	int32
FS	0	Mapping	Yes
Unit	USER		
Read	0		
Write	5		
Position input (target position) in user units			

P 0279	Position tracking error in user units	MPRO_FG_UsrPosDiff	
Value range	-2147483648 to 2147483647	Data type	int32
FS	0	Mapping	Yes
Unit	USER		
Read	0		
Write	5		
Position tracking error in user units			

P 0280	Reference speed in user units	MPRO_FG_UsrRefSpeed	
Value range	-3.4E+38 to 3.4E+38	Data type	float32
FS	0	Mapping	Yes
Unit	USER		
Read	0		
Write	5		
Speed reference in user units			

P 0281	Actual speed in user units	MPRO_FG_UsrActSpeed	
Value range	-3.4E+38 to 3.4E+38	Data type	float32
FS	0	Mapping	Yes
Unit	USER		
Read	0		
Write	5		
Actual speed in user units			

P 0282	Speed command in user units	MPRO_FG_UsrCmdSpeed	
Value range	-3.4E+38 to 3.4E+38	Data type	float32
FS	0	Mapping	Yes
Unit	USER		
Read	0		
Write	5		
Speed input			

P 0312	Actual motor voltage (rms, phase to phase)	CON_CCON_VMot	
Value range	-3.4E+38 to 3.4E+38	Data type	float32
FS	0	Mapping	Yes
Unit	V		
Read	0		
Write	5		
Current effective motor voltage measured between phase-phase			

P 0410	Actual DC link voltage	CON_ACT_VDC	
Value range	-3.4E+38 to 3.4E+38	Data type	float32
FS	0	Mapping	Yes
Unit	V		
Read	0		
Write	5		
Current DC link voltage			

P 0412	Actual position	CON_PCON_ActPosition	
Value range	-2147483648 to 2147483647	Data type	int32
FS	0	Mapping	Yes
Unit	incr		
Read	0		
Write	5		
Actual position			

P 0413	Reference position	CON_PCON_RefPosition	
Value range	-2147483648 to 2147483647	Data type	int32
FS	0	Mapping	Yes
Unit	incr		
Read	0		
Write	5		
Position reference			

P 0414	Actual position difference (RefPosition-ActPosition)	CON_PCON_PosDiff	
Value range	-2147483648 to 2147483647	Data type	int32
FS	0	Mapping	Yes
Unit	incr		
Read	0		
Write	5		
Reference/actual variation of the current position			

P 0415	Actual speed	CON_SCALC_ActSpeed	
Value range	-3.4E+38 to 3.4E+38	Data type	float32
FS	0	Mapping	No
Unit	rpm		
Read	0		
Write	5		
Actual speed			

P 0416	Reference speed	CON_SCON_RefSpeed	
Value range	-3.4E+38 to 3.4E+38	Data type	float32
FS	0	Mapping	No
Unit	rpm		
Read	0		
Write	5		
Speed reference			

P 0417	Actual speed difference (RefSpeed-ActSpeed)	CON_PCON_SDiff	
Value range	-2147483648 to 2147483647	Data type	float32
FS	0	Mapping	No
Unit	rpm		
Read	0		
Write	5		
Reference/actual variation of the current speed			

P 0418	Reference torque	CON_SCON_RefTorque	
Value range	-3.4E+38 to 3.4E+38	Data type	float32
FS	0	Mapping	No
Unit	Nm		
Read	0		
Write	5		
Torque reference			

P 0419	Actual torque	CON_SCON_ActTorque	
Value range	-3.4E+38 to 3.4E+38	Data type	float32
FS	0	Mapping	No
Unit	Nm		
Read	0		
Write	5		
Actual torque			

P 0700	Actual current (rms)	MON_CurrentRMS	
Value range	-3.4E+38 to 3.4E+38	Data type	float32
FS	0	Mapping	Yes
Unit	A		
Read	0		
Write	5		
Actual current			

P 0701 Index 00	Monitoring, actual values of motor and inverter I²t_integrator for motor protection	MON_ActValues I²t_Motor	
Value range	-3.4E+38 to 3.4E+38	Data type	float32
FS	0	Mapping	Yes
Unit	%		
Read	0		
Write	5		
Current state of I²t integrator for motor protection			

P 0701 Index 01	Monitoring, actual values of motor and inverter I²t_integrator for inverter protection	MON_ActValues I²t_Inverter	
Value range	-3.4E+38 to 3.4E+38	Data type	float32
FS	0	Mapping	Yes
Unit	%		
Read	0		
Write	5		
Current state of I²t integrator for device protection			

P 0701 Index 02	Monitoring, actual values of motor and inverter actual motor current amplitude	MON_ActValues IPhasor	
Value range	-3.4E+38 to 3.4E+38	Data type	float32
FS	0	Mapping	Yes
Unit	A		
Read	0		
Write	5		
Current motor current (peak value)			

P 0701 Index 03	Monitoring, actual values of motor and inverter actual magnetisation (d-)current amplitude	MON_ActValues IPhasor	
Value range	-3.4E+38 to 3.4E+38	Data type	float32
FS	0	Mapping	Yes
Unit	A		
Read	0		
Write	5		
Current amplitude of magnetization current (d-current)			

P 0701 Index 04	Monitoring, actual values of motor and inverter actual torque constant	MON_ActValues Km	
Value range	-3.4E+38 to 3.4E+38	Data type	float32
FS	0	Mapping	Yes
Unit	Nm/A		
Read	0		
Write	5		
Current torque constant			

P 0702	Device status word	MON_State	
Value range	0 to 4294967295	Data type	uint32
FS		Mapping	Yes
Unit			
Read	0		
Write	5		
Device status (status word of device)			

P 0703	Power stage temperature of cooling block	MON_Powerstage_TKK	
Value range	-100 to 200	Data type	float32
FS	0	Mapping	Yes
Unit	deg C		
Read	0		
Write	5		
Heat sink temperature			

P 0704	Power stage temperature of interior	MON_Device_Tint	
Value range	-100 to 200	Data type	float32
FS	0	Mapping	Yes
Unit	deg C		
Read	0		
Write	5		
Device interior temperature			

P 0734	Motor temperature	MON_MotorTemp	
Value range	-3.4E+38 to 3.4E+38	Data type	float32
FS	0	Mapping	Yes
Unit	deg C		
Read	0		
Write	5		
Motor temperature (only if sensor connected)			

P 0742	Monitor maximum position difference	MON_UsrPosDiffHistory	
Value range	0 to 4294967295	Data type	uint32
FS	0	Mapping	No
Unit	USER		
Read	0		
Write	1		
Position tracking error			

12.1.1 Operating hours

P 0705 Index 00	Operational timer seconds	MON_OpTime sec	
Value range	0 to 65535	Data type	uint16
FS	0	Mapping	No
Unit	s		
Read	0		
Write	5		
Seconds timer			

P 0705 Index 01	Operational timer minutes	MON_OpTime min	
Value range	0 to 65535	Data type	uint16
FS	0	Mapping	No
Unit	min		
Read	0		
Write	5		
Minutes timer			

P 0705 Index 02	Operational timer hours	MON_OpTime h	
Value range	0 to 65535	Data type	uint16
FS	0	Mapping	No
Unit	h		
Read	0		
Write	5		
Hours timer			

P 0706 Index 00	Operational enabled time seconds	MON_OpEnTime sec	
Value range	0 to 65535	Data type	uint16
FS	0	Mapping	No
Unit	s		
Read	0		
Write	5		
Seconds timer (active power stage)			

P 0706 Index 01	Operational enabled time minutes	MON_OpEnTime min	
Value range	0 to 65535	Data type	uint16
FS	0	Mapping	No
Unit	min		
Read	0		
Write	5		
Minutes timer (active power stage)			

P 0706 Index 02	Operational enabled time hours	MON_OpEnTime h	
Value range	0 to 65535	Data type	uint16
FS	0	Mapping	No
Unit	h		
Read	0		
Write	5		
Hours timer (active power stage)			

12.1.2 I/O status

P 0121	I/O status States of digital inputs	I/O status MPRO_INPUT_STATE	
Value range	00000000.. to 01111111...	Data type	uint32
FS		Mapping	Yes
Unit			
Read	0		
Write	5		
Status of the digital inputs			

P 0143	I/O status States of digital outputs	I/O status MPRO_OUTPUT_STATE	
Value range	00000000.. to 01111111...	Data type	uint16
FS		Mapping	Yes
Unit			
Read	0		
Write	5		
Status of the digital outputs			

P 0407 Index 00	Analog input values actual value of analog input0, filtered, +10 V gives 1.0	CON_ANA_Isaf ANA0	
Value range	-100 to 100	Data type	float 32
FS	0	Mapping	Yes
Unit			
Read	0		
Write	5		
Value of analog input ISA00			

P 0407 Index 01	Analog input values actual value of analog input1, filtered, +10 V gives 1.0	CON_ANA_Isaf ANA1	
Value range	-100 to 100	Data type	float 32
FS	0	Mapping	Yes
Unit			
Read	0		
Write	5		
Value of analog input ISA01			

P 0134 Index 00	Values of analog outputs set by parameter Values of analog output 0	MPRO output _OSA_values OSA0_Value	
Value range	-10000 to 10000	Data type	float 32
FS	0	Mapping	Yes
Unit			
Read	1		
Write	1		
Value of analog output OSA00			

P 0134 Index 01	Values of analog outputs set by parameter Values of analog output 1	MPRO output _OSA_values OSA1_Value	
Value range	-10000 to 10000	Data type	float 32
FS	0	Mapping	Yes
Unit			
Read	1		
Write	1		
Value of analog output ISA01			

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