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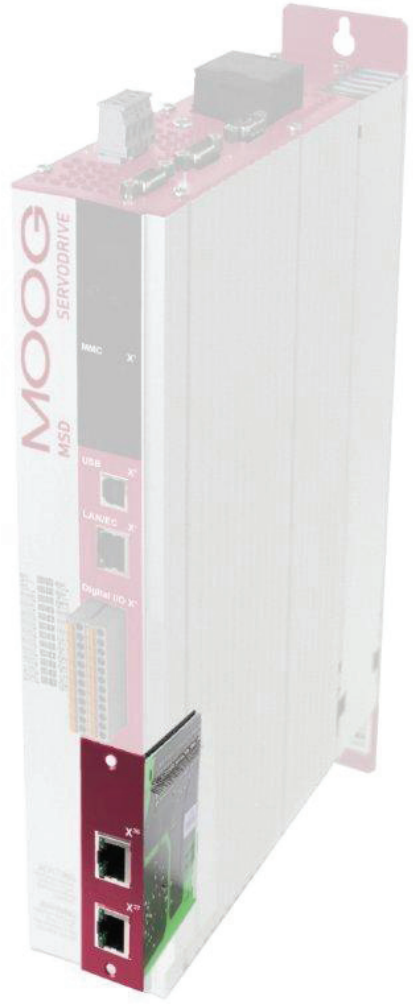


MSD Servo Drive

User Manual

SERCOS III

SERCOS interface

User Manual – SERCOS III MSD Servo Drive

ID no.: CA97557-001, Rev. 1.0

Date: 11/2011

We reserve the right to make technical changes.

Technical alterations reserved.

The contents of our documentation have been compiled with greatest care and in compliance with our present status of information.

Nevertheless we would like to point out that this document cannot always be updated parallel to the technical further development of our products.

Information and specifications may be changed at any time. For information on the latest version please refer to drives-support@moog.com.

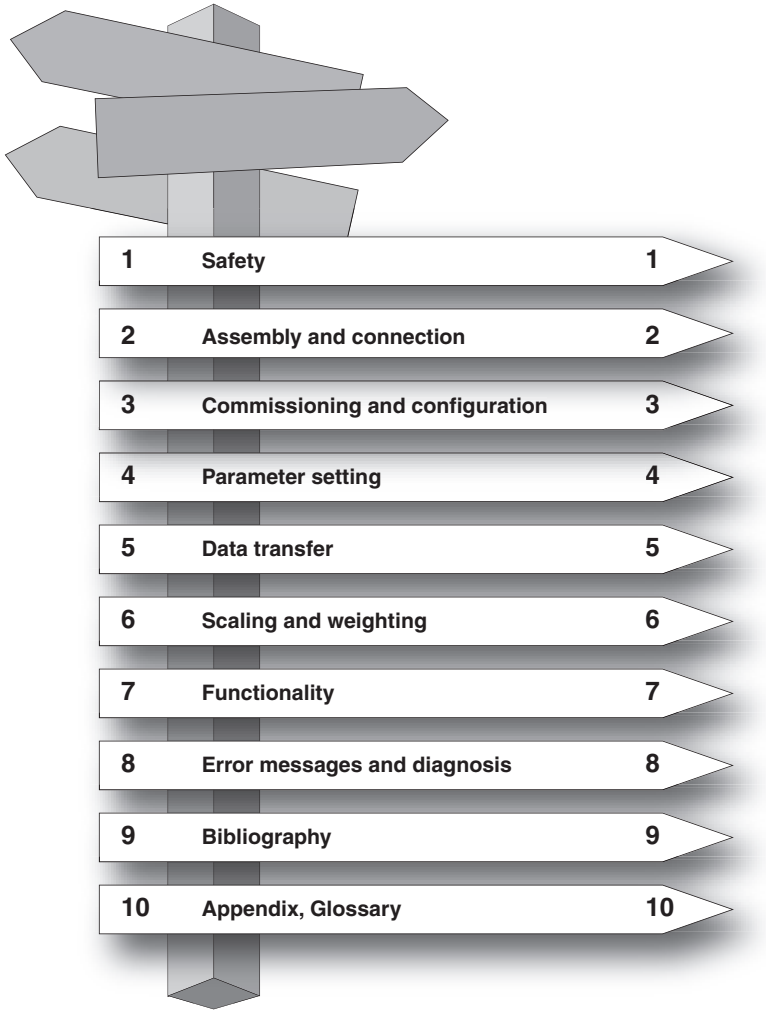
How to use this document

Dear user,

This manual is intended for you as a project engineer, commissioning engineer or programmer of drive and automation solutions on the SERCOS III fieldbus.

It is assumed that you are already familiar with this fieldbus on the basis of appropriate training and reading of the relevant literature. We assume your drive is already in operation. If it is not, you should put it into operation as described in the MSD Servo Drive Operation Manual.

This manual applies to the MSD Servo Drive servo drive system with the SERCOS III option board.



Pictograms

To provide clear guidance, this Operation 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

Table of contents

1 Safety

1.1 Measures for your safety

The instructions set out below should be read through prior to initial commissioning in order to prevent injury and/or damage to property. The safety instructions must be followed at all times.

1.2 Read the Operation Manual first!

	Read the Operation Manual first! • Follow the safety instructions! • Refer to the user information!
	Electric drives are dangerous: • Electric voltages of 230 V to 480 V **Dangerously high voltages of ≥ 50 V may still be present 10 minutes after the power is cut (capacitor charge). So check that the power has been cut!** • Rotating parts • Hot surfaces
	Protection against magnetic and/or electromagnetic fields during installation and operation. • Persons fitted with heart pacemakers, metallic implants and hearing aids etc. must not be allowed access to the following areas: – Areas where drive systems are installed, repaired and operated. – Areas where motors are installed, repaired and operated. Motors with permanent magnets pose a particular hazard.
	DANGER: If it is necessary to access such areas, suitability to do so must be determined beforehand by a doctor
	Your qualification: • In order to prevent personal injury or damage to property, only personnel with electrical engineering qualifications may work on the device. • The said qualified personnel must be familiar with the contents of the Operation Manual (see IEC364, DIN VDE0100). • Knowledge of national accident prevention regulations (e.g. BGV A3, formerly VBG 4, in Germany)
	During installation observe the following instructions: • Always comply with the connection conditions and technical specifications. • Comply with the standards for electrical installations, such as regarding cable cross-section, PE conductor and ground connections. • Do not touch electronic components and contacts (electrostatic discharge may destroy components).

Table 4.1 Safety instructions

1.3 Introduction to the SERCOS III interface

SERCOS stands for SErial Realtime COmmunication System, and is a globally standardized (IEC 61491 and EN61491) digital interface for communication between master control systems, drive units and other distributed peripherals. The real time-critical transfer of setpoints and actual values enables numerically controlled high-performance drive applications to be implemented in the engineering industry.

Services are also provided for operation mode recording, parameter setting, configuration and diagnosis.

The SERCOS III communication module for the MSD Servo Drive is executed as an interface with two RJ45 sockets, and so permits a loop or linear structure.

The hardware and software have, as far as possible, been developed in conformance to DIN/EN 61491. The basis for SERCOS III implementation in the MSD Servo Drive is the specification V1.1.1 from SERCOS International.

Further documentation

- MSD Servo Drive User Manual
- MSD Servo Drive Application Manual
- General Overview and architecture (V1.1.1.1) (SERCOS International)
- Generic Device profile (V1.1.0.6) (SERCOS International)
- SERCOS Communication (V1.1.1.5) (SERCOS International)
- Function specific profile drives (V1.1.2.11) (SERCOS International)
- SERCOS Parameter (V1.1.1.0) (SERCOS International)

Figure 4.1 SERCOS III communication module for MSD Servo Drive

The power supply to the communication module is provided by the MSD Servo Drive.

Real-time capability permits highly dynamic drive engineering applications with NC cycle times of 125µs to 65 ms (multiples of 125µs). The data to be transferred is defined in the SERCOS driver in numerous preference telegrams and parameters. They are specially tailored to the high demands of electric drive systems. A freely configurable telegram permits optimum utilization of all the possibilities offered by the line based on additional setpoint and actual value parameters such as increasing the transferred position resolution, use of the inputs and outputs in the drive in the NC cycle, and much more.

1.4 Key features

- Cyclic data exchange of references and actual values with exact time equidistance
- SERCOS cycle time of 125µs to 65 ms (multiples of 125µs programmable)
- Multi-axis synchronization between reference action times and actual value measurement times of all drives in the loop
- Full synchronization of all connected drives with the master control system
- Free configuration of telegram content
- Maximum configurable data volume in MDT: 20 bytes
- Maximum configurable data volume in DT: 20 bytes
- Programmable parameter weighting and polarity for position, velocity, acceleration and torque
- Additive velocity and torque references
- Fine-interpolation (linear or cubic) inside the drive
- Optionally master control-side (external) or in-drive generation of rotation speed and acceleration pre-control
- Service channel for parameter setting and diagnosis
- Support for touch probes 1 and 2
- Support for spindle commands
- Support for configurable real-time status and control bits
- Support for configurable signal status and control word

1.5 Abbreviations

Abbreviation	Explanation
DT	Drive Telegram. Data from drive to master (status, actual values)
IDN	Ident number **S-x-yyyy** or **P-x-yyyy** 32 bits are available to display a SERCOS III ident number.
MDT	Master Data Telegram. Data from the master to the drives (control word, setpoints)
MST	Master Sync Telegram. Provides µs-precise data synchronization of the drives by the time-slot method
SERCOS	Standardized method of real-time communication between master control systems and drives to DIN/EN 61491
SVC service channel	Subsidiary protocol in the telegrams Parameter values, attributes, scaling and names can be sequentially transferred. Transfers can also be effected in parallel with the time-critical cyclic data (MDT, DT) in phases 3 and 4. The service channel provides services for operation mode recording, parameter setting, configuration and diagnosis
Cyclic data	Time-synchronized transfer of MDT, DT as from phase 3, valid as from phase 4

Table 4.2 Abbreviations

2 Assembly and connection

2.1 Installation and wiring

In contrast to the SERCOS II (which used a fibre-optic cable), the connection between the master and slave with SERCOS III is made using standard Ethernet cables with RJ45 connectors. The SERCOS III option board features two RJ45 sockets (X36, X37), enabling a loop or linear structure.

Ethernet patch cables or crossover cables to the CAT5e-specification are suitable as connecting cables.

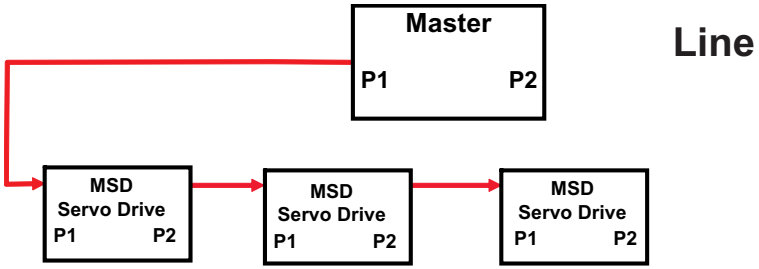


Figure 2.1 SERCOS III linear structure

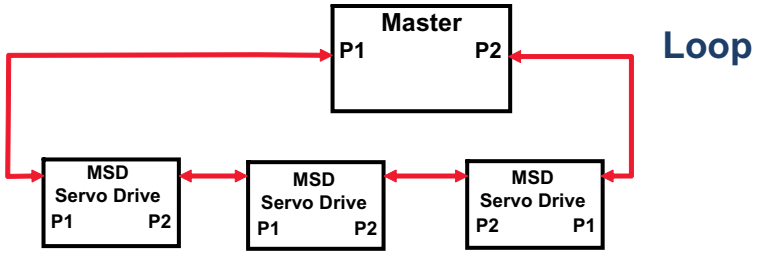


Figure 2.2 SERCOS III loop structure

The loop structure should be selected whenever possible, as in it the master sends the telegrams in both direction, so enabling redundant communication. This means breaks in the loop between two slaves, or between the master and a slave, are detected and within a bus cycle the switch is made to a linear structure with two lines, so communication is not interrupted.

This redundancy is not possible with a linear structure.

The individual ports between the bus stations can be connected in any way, meaning there is no specification of which port is the input and which the output.

2.2 Pin assignment of the RJ-45 socket

The pins on the RJ-45 socket are assigned as follows:

Pin	Colour	Cable wire pair	Function
1	White/orange	2	TxData +
2	Orange	2	TxData -
3	White/green	3	RecvData +
4	Blue	1	Unused
5	White/blue	1	Unused
6	Green	3	RecvData -
7	White/brown	4	Unused
8	Brown	4	Unused

Table 2.1 Pin assignment

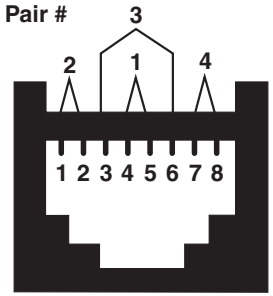


Figure 2.3 RJ-45 socket

2.3 Meanings of LEDs

There are two LEDs on each RJ-45 socket. They signify the following.

LED	Meaning
1 (green)	Link LED: • Off: No link No connection to another station • On: Link active Connection to another (bus) station active
2 (orange)	Activity: • Off: No activity No data transfer is taking place • Flashing: Activity Data transfer active

Table 2.2 Meanings of LEDs

2.4 Indication of operating states on 7-segment display

D1	D2	Meaning	Parameter
System states			
8.	8.	Device in reset state	
	0.	Self-initialization on device startup	(Start)
S.*)	1.	1) Not ready (no DC-link voltage)	(NotReadyToSwitchOn)
S.*)	2.	1) Switch-on disabled (DC-link OK, power stage not ready)	(SwitchOnDisabled)
	3.	Ready (power stage ready)	(ReadyToSwitchOn)
	4.	On (device powered up)[2)]	(SwitchedOn)
	5.	Drive ready (power applied to drive and drive ready for setpoint input) [2)]	(OperationEnable)
	6.	Quick stoP-[0-2)]	(QuickStopActive)
	7.	Error response active [2)]	(FaultReactionActive)
E	R	Errors (see below)	(Fault)
In event of an error, alternating display			
E	R.	Display for errors, or non-resettable errors	
X	Y	Error number (decimal)	
X	Y	Error localization (decimal)	

1) S. flashes when the STO (Safe Torque Off) function is active; no display when function is inactive.
**) Not a "safe indication" as specified in EN 61800-5-2.*

2) The dot flashes when the power stage is active.

Example of flash sequence:

➢ ER > 02 > 05 * ER > 02 > 05 ...

Er	Error:	ER = Error
02	Error name:	02 = Error in parameter list
05	Description of error:	05 = Function to check current parameter list

2.5 Hardware enable

The MSD Servo Drive has a control input to the hardware enable ENPO on the control terminal. This input must be configured for operation of the power stage at 24 V.

The device additionally features the STO (Safe Torque Off) function (see MSD Servo Drive User Manual or Application Manual), category 3, control terminal ISDSH. On these devices the logic for this function must be provided by the higher-order drive as detailed in the Application Manual.

Note: If the ENPO and ISDSH inputs are not configured, the device remains in state 1 = "Not Ready to Switch On" or 2 = "Switch On Disabled"). Only when the configuration has been correctly wired can the state be quit by way of a "Shutdown" command over bus.

3 Commissioning and configuration

3.1 Commissioning

The Moog DriveAdministrator user interface is a program for general commissioning of the drive system. The Moog DriveAdministrator package includes tools for identification of motor data, for servo motor access to a motor database, and for general device configuration.

A separate section is devoted to initial commissioning via the user interface as described in the device Application Manual.

3.2 Commissioning sequence

Preconditions:

- The drive unit is wired as specified in the Operation Manual and initial commissioning is complete.
- If the motor is to be powered, the hardware enable (ENPO) and STO (Safe Torque Off) must also be correctly configured.

NOTE: For more detailed information on optimization of the software functions and control circuits refer to the device application manual.

Step	Action	Comment
1.	Check the wiring. Make sure hardware enable ENPO (X4) is not connected.	
2.	Switch on the mains supply voltage.	
3.	Configure the drive unit using the Application Manual.	(Inputs/outputs, software functions, ...)
4.	Test the control quality and optimize the drive settings as necessary using the Operation Manual.	
5.	Set the communication parameters for the SERCOS III.	
6.	Test the drive on the higher-order drive, see Application Manual.	
7.	Finally save the setting.	Save device setting Non volatile in device

NOTE: On the subject of "Units and scalings" refer to Section 6

3.3 Setting the slave bus address

SERCOS parameter IDN/**S-0-1040.0.0** is used to set the bus address. This parameter can be written using Moog DriveAdministrator 5. The address setting must be unique, meaning each address may be used only once in a SERCOS loop.

SERCOS III also supports automatic slave addressing. If you enter the address 0 for all the slaves in a loop in IDN/**S-1040-0-0**, the addressing is executed automatically by the master on bus startup, provided the master supports that mode of addressing.

4 Parameter setting

4.1 Format of SERCOS III parameters

The SERCOS III parameter numbers have been extended from SERCOS II, to a length of 32 bits. A standard parameter now has the following format:

S-<DataSet>-<IdNr>.<SI>.<SE>

Key to abbreviations:

- S: Standard parameter
- DataSet: Number of the data set (currently only data set 0 is supported)
- IdNr: SERCOS ident number
- SI: Structure instance
- SE: Structure element

In a connection between master and slave there is always a "producer" and at least one "consumer". The "producer" connection is the one from the master to the slave, and the "consumer" from the slave to the master. The connections are represented within the parameter numbers by "SI" (structure instance).

Which instance is configured as the producer and which as the consumer is indicated by parameter **S-0-1050.x.1** (to be found under device parameter 21050) in Moog DriveAdministrator 5. Bit 14 of that parameter defines the connection method. If, for example, in parameter **S-0-1050.0.1** bit 14 = 0, structure instance 0 is the consumer instance. So bit 14 in parameter **S-0-1050.1.1** must be = 1, meaning structure instance 1 would be the producer instance. So according to this example the parameter structure **S-0-1050.0.20** is a consumer instance.

Multiple consumers per connection are permitted. The MSD Servo Drive supports a connection with one producer and a maximum of one consumer.

4.1.1 Standard parameters (S-0-xxxx.x.x)

All standard parameters supported by the MSD Servo Drive are mapped as Moog parameters. However, the expansion in SERCOS III parameter numbers mentioned previously means that consecutive addressing of the Moog parameters could not be retained. Only the parameters already existing previously in the parameter set as SERCOS II parameters retain their addressing:

SERCOS Idn = Moog ID – 10000

All SERCOS III-specific parameters as from Moog parameter number 11000 and 20000 are stored in the parameter set of the MSD Servo Drive.

4.1.2 Manufacturer-specific parameters P-0-xxxx

All manufacturer-specific parameters are to be found in list **S-0-1017.0.0** with an offset of 8000(hex) from the Moog parameter number.

So Moog parameter 107 (function selector ISD06), for example, is to be found in the list of all available parameters (**S-0-1017.0.0**) under number 32875. This parameter is addressed by way of its Moog parameter number – in this case **P-0-0107**.

4.2 Operation modes

The operation modes selectable in the master control word and displayed in the drive status word conforming to the SERCOS specification are coded according to the scheme set out in the following table.

Bit	Explanation
15	0: SERCOS default mode 1: Manufacturer-specific mode
14 - 10	Reserved
9	0: Without axis control word (**S-0-0520.0.0**)1: 1: With axis control word (**S-0-0520.0.0**) (not supported)
8	0: Without transition 1: With transition

Table 4.1 Operation mode coding

Bit	Explanation
7 - 4	Advanced mode 0000: No advanced mode 0001: Interpolation 0010: Positioning 0011: Block mode (not supported)0100: 0100: Synchronous mode (not supported)
3	0: with tracking error 1: without tracking error
2 - 0	Operation mode

Table 4.1 Operation mode coding

The operation modes supported by the MSD Servo Drive are listed in parameter **S-0-0292**.

Operation mode	Description
0000 0000 0000 0001	Torque control
0000 0000 0000 0010	Speed control, drive-controlled profile generation with parameterized ramps
0000 0000 0100 0010	Speed control, master control system-controlled profile generation, no tracking error
0000 0000 0000 0011	Position control with position encoder 1 (e.g. motor encoder), master control system- controlled profile generation, no use of pre-control signals, with tracking error
0000 0000 0000 0100	Position control with servo drive 2 (e.g. external encoder), master control system-controlled profile generation, no use of pre-control signals, with tracking error
0000 0000 0000 1011	Position control with servo drive 1 (e.g. motor drive), master control system-controlled profile generation, with use of pre-control signals, without tracking error
0000 0000 0000 1100	Position control with servo drive 2 (e.g. external encoder), master control system-controlled profile generation, with use of pre-control signals, without tracking error
0000 0000 0001 0011	Position control with servo drive 1 (e.g. motor encoder), drive-controlled profile generation, no use of pre-control signals, with tracking error
0000 0000 0001 0100	Position control with servo drive 2 (e.g. external encoder), drive-controlled profile generation, no use of pre-control signals, with tracking error
0000 0000 0001 1011	Position control with servo drive 1 (e.g. motor encoder), drive-controlled profile generation, with use of pre-control signals, without tracking error
0000 0000 0001 1100	Position control with servo drive 2 (e.g. external encoder), drive-controlled profile generation, with use of pre-control signals, without tracking error

Table 4.2 Supported operation modes

Using parameters **S-0-0032.0.0** to **S-0-0035.0.0**, up to four different operation modes can be configured. The mode is selected by parameter **S-0-0134.0.0** "Drive control word" (see section 5.2.1.1). This defines the configured mode in which the drive is to run.

Which of the three possible encoder interfaces of the MSD Servo Drive (Channel 1, Channel 2, Channel 3) are designated as position encoder 1 and 2 respectively is specified by parameters **P-0-0530 "**Selection of position encoder 1", and **P-0-0531 "**Selection of position encoder 2".

The position encoder for position control specified by the operation mode must also be selected via parameter **P-0-0522** as the position encoder for position control. Otherwise an error will be triggered in response to the drive enable and the switch from phase 2 to phase 3.

For further details on encoder configuration please refer to the MSD Servo Drive Operation Manual.

A valid interpolation method (**P-0-0370**) must be configured for the position-controlled operation mode. The following settings are possible:

1. Linear interpolation
   Calculation of position and rotation speed

Spline interpolation with external pre-control.
Should only be used when the master control system also calculates and transmits the pre-control signals for speed (**P-0-3055**) and torque (**P-0-3056**).

2. Spline Interpolation
   Calculation of position, rotation speed and torque

3. Spline Interpolation
   Calculation of position, rotation speed and torque

To attain a higher resolution of the pre-control signals, an additional 16-bit decimal place component (**P-0-3100**) for the position (**S-0-0047**) can be transferred.

To use the higher resolution, the advanced pre-control mode (**P-0-0379=1**) must be selected.

The advanced pre-control mode (**P-0-0379**) can deliver an improvement in pre-control signals even without calculating **P-0-3100**, though this depends heavily on the scaling (position resolution) and must be checked on the line in each individual case.

For more information on scaling and interpolation please refer to the MSD Servo Drive Operation Manual.

4.3 Real-time bits

There are two configurable real-time bits in the MDT and the DT respectively. They are located in the "connection control word" (bit numbers 6 + 7) and so in the non-configurable part of the real-time data. These real-time bits are configured using parameters:

- **S-0-1050.x.20** "IDN assignment to real-time bit": IDN of the parameter to be assigned to the real-time bit concerned.
- **S-0-1050.x.21** "Bit assignment to real-time bit": Definition of which bit number of the assigned parameter is to be mapped.

Only the parameters listed in **P-0-3003 "**Real-time control bits" or **P-0-3002** "Real-time status bits" can be assigned. Lists **P-0-3002** and **P-0-3003** are described in the following tables.

Parameter	Description
S-0-0405	Enable touchprobe 1
S-0-0406	Enable touchprobe 2
P-0-0141	Open-loop control of digital outputs via COM option

Table 4.3 Configurable real-time control bits (**P-0-3003**)

P-0-3002: Configurable real-time status bits

Parameter	Description
S-0-0011	State class 1 (C1D)
S-0-0012	State class 2 (C2D)
S-0-0014	Interface status
S-0-0144	Signal status word
S-0-0179	Touchprobes 1 + 2 status
S-0-0310	Warning threshold I2t motor exceeded
S-0-0311	Warning threshold heat sink temperature exceeded
S-0-0312	Warning threshold motor temperature exceeded
S-0-0330	Status speed setpoint reached
S-0-0331	Standstill message
S-0-0332	Speed threshold undershot
S-0-0333	Speed threshold exceeded
S-0-0334	Torque limit reached or exceeded
S-0-0335	Speed limit reached or exceeded
S-0-0336	Target position reached
S-0-0341	Status in track position
S-0-0401	Status touchprobe 1
S-0-0402	Status touchprobe 2
S-0-0403	Status actual position
S-0-0409	Touchprobe 1 positive edge recorded
S-0-0410	Touchprobe 1, negative edge recorded
S-0-0411	Touchprobe 2, positive edge recorded
S-0-0412	Touchprobe 2, negative edge recorded
S-0-0419	Status of setpoint transfer
P-0-0121	Status of the digital inputs
P-0-0143	Status of the digital outputs
P-0-0239	Functional status of the digital inputs

Table 4.4 Configurable real-time status bits (**P-0-3002**)

5 Data transfer

5.1 Communication phases

Communication over the SERCOS bus between the master and slaves is divided into six phases. As long as the slave is receiving no SERCOS telegram it is in the "NRT (Non-Realtime)" phase. Communication phases 0 and 1 identify the stations on the bus. In communication phase 2 the time and data structure of the protocols for phases 3 and 4 are prepared and the drive is configured. At the transition to communication phase 3 the drive parameter settings relating to the SERCOS profile are checked for plausibility. In the event of an error, the switch to communication phase 3 is refused with a relevant fault message. The phases are run through in ascending order. It is only possible to drop back a phase by way of communication phase 0. The communication phase is dictated by the master. On switching to communication phase 4, the initialization is completed and power-up is enabled.

The current communication phase is displayed by parameter **P 22000 COM_SERIII_ ScopeVars**, index 1.

5.2 Cyclic data transfer

In cyclic data transfer, parameters are transferred with every cycle of the bus. The cycle time is configured using IDN **S-0-1002.0.0**. Which parameters are cyclically transferred is defined by the mapping.

5.2.1 Mapping of configurable real-time data

Mapping of real-time data is usually performed in the master (that is, the higher-level control). Parameters **S-0-1050.0.6** and **S-0-1050.1.6** can be used to check which parameters have been mapped into the MDT and DT.

Generally, not all parameters can be transferred as real-time data. The parameters which can be transferred in the MDT are entered under IDN **S-0-0188.0.0**. All the parameters which can be transferred in the DT are entered under IDN **S 0 0187.0.0**.

NOTE: To operate a servo drive using SERCOS III, the drive control word (**S-0-0134.0.0**) must always be mapped into the MDT and the drive system status word (**S 0 0135.0.0**) into the DT. In contrast to SERCOS II, they are no longer a fixed component of the MDT or DT respectively.

5.2.2 Drive control word S-0-0134.0.0

The drive control word contains all the key control information for the drive, and must be mapped into the cyclic part of the MDT.

Bit no.	Description
15	Drive On / Off • Drive OFF: On switching from 1 0 the drive is shut down as best as possible (according to the setting of **P-0-2219**), then the torque is shut off as necessary at standstill; the power stage can remain active (only possible if bit 14 = 1 and with corresponding setting of **P-0-2219**), then the torque is shut off at speed nmin; the power stage can remain active (only possible if bit 14 = 1). • 1: Drive On
14	Drive enable • 0: No enable. On switching 1 0 the torque is shut off and the power stage disabled with no delay (regardless of bits 15 and 13). • 1: Drive enable
13	Drive Halt (can be used to stop the drive without reference to the current active control function) • 0: Drive stop: The drive is no longer following the settings. On switching from 1 0 the drive stops according to the setting of **P-0-2221** and taking into account the last active acceleration (by default according to acceleration parameter **P-0-2242**) and remains under control (only possible if bits 14 and 15 = 1 and with an appropriate setting of **P-0-2221**). • 1: Drive start: On switching from 0 1 the original function is resumed. If the master control system has not updated the position, setpoint jumps may occur, resulting in shut-off due to tracking error.
12	Reserved
11	Toggle bit: New setpoints The bit is valid in communication phases 3 + 4, changes synchronously to the "Producer cycle time" (**S-0-1050.0.10**) and indicates the availability of the new setpoints for the slave.

Table 5.1 Drive control word **S-0-0134**

Bit no.	Description
10 – 8	Specified operation mode • 000: Primary mode (defined in **S-0-0032.0.0**) • 001: Secondary mode (defined in **S-0-0033.0.0**) • 010: Secondary mode 2 (defined in **S-0-0034.0.0**) • 011: Secondary mode 3 (defined in **S-0-0035.0.0**) • 100: Secondary mode 4 (not supported) • 101: Secondary mode 5 (not supported) • 110: Secondary mode 6 (not supported) • 111: Secondary mode 7 (not supported)
7 – 0	Reserved

Table 5.1 Drive control word **S-0-0134**

5.2.3 Description of bits 13-15

Bit 14: Drive ENABLE (power stage enable)

The servo has a control input (X4.10) ENPO (Enable Power) for hardware enable. This input must be configured for operation of the power stage at 24 V.

The device additionally features the "STO" (Safe Torque Off) function, category 3 (see MSD Servo Drive Operation Manual and Application Manual) via control input (X4.22) ISDSH. The logic for this function (High edge at digital input ENPO (X4.10), with a High signal required at the digital input ISDSH (X4.22) at the time the edge occurs) must be fulfilled by the higher-level control system according to Application Manual.

NOTE: If the ENPO and ISDSH inputs are not configured, the device remains in state 1 = "Not Ready to Switch On" or 2 = "Switch On Disabled"). In the STO state the status indicator flashes "**S1**" or "**S2**" as appropriate.

Only after correct configuration of ENPO (X4.10) and ISDSH (X4.22) can the hardware be enabled by bit 14 in the drive control word. It is only possible to enable the drive via bit 14 in communication phase 4.

Bit 15: Control ON/OFF (drive enable)

Control of the drive via the SERCOS interface requires just a few parameter settings:

- Open-loop control setting of drive via SERCOS interface:
  Set **P-0-0159** to SERCOS III (9).
- Setpoints via SERCOS profile:
  Set **P-0-0159** to SERCOS III (8).
- Evaluation of bit 15 in drive control word state-controlled (1 = LEVEL) or edge-controlled (0 = EDGE) via **P-0-0144**.
  Note:
  If bits 14 and 15 in the drive control word are set simultaneously, **P-0-0144** should be set to LEVEL (1).

For the drive enable signal (bit 15) to be accepted - that is, for the drive to switch from the unpowered to the powered state - the following conditions must be met:

- SERCOS interface ready and in communication phase 4
- Enable power pack via hardware (ENPO and ISDSH) and bit 14 in drive control word
- Drive not in error state
- Settings of relevant parameters **P-0-0144**, **P-0-0159** and **P-0-0165**

Under these preconditions the drive shows device state "3" on the display. The drive is activated by the change of state from 0 to 1 of bit 15 (drive enable) in the drive control word. If the enable is successfully executed, the display readout changes to 5 and the relevant bits in the drive status word.

The readiness of the control (drive follows setpoints) is mapped in the status word via bit 15, bit 14 and bit 3.

Ideally, the master control system reads the actual value while control is starting and presets it as the setpoint until the closed-loop drive signals readiness in the status word. If the drive moves while control is starting (such as due to motor commutation finding by linear drives, whereby the drive does not yet signal readiness - drive state 4), the position changes are automatically adopted by the master control system.

Control systems which retrieve the current actual position "only once" prior to start of closed-loop control and preset it as the setpoint, and also do not update it even after commutation finding (no evaluation of status word) will feed forward a setpoint difference. Shut-off due to tracking error may be the consequence.

To avoid this, the drive can be moved to the position specified by the master control system at start of control under drive control with parameter **P-0-0156** (Enable operation option code) set to **MOVE_COMMAND(1)**. This aims to exclude the possibility of a shut-off or a jerky approach to the target position at start of control because of a setpoint difference in the axis.

This function also depends on the configuration of **P-0-0743** (maximum tracking error).

P-0-0743 equal to 0
Position tracking error off. The drive switches on without correction and feeds the position setpoint of the NC directly onto the drive. The drive moves to the target position with a jerk as necessary. Major differences end in a speed tracking error, depending on the parameter setting. A jerky axis motion is the consequence.

- **P-0-0743** not equal to 0
  Position tracking error off. The drive reads the target position of the master control system and moves under drive control to that position (position correction). If the difference between the position specified by the control system and the actual position is greater than the tracking error (**P-0-0743**), the drive switches to an error state, now without moving (no major axis motion). Otherwise the drive corrects the difference with the slow jog rate (**P-0-0168[1]**), and the acceleration from **P-0-2242 (**quick-stop). When the position has been reached, the drive switches to state 5 and the drive follows the setpoints of the master control system (only now is readiness signalled in the control word).

IMPORTANT:

With the scaling, the ramp setting which the system accesses must also be set correctly and to reasonable values. This involves the parameters:

- **P-0-2242** Quick-stop. This is applied in the event of an error, depending on the configuration
- **P-0-0168** (Jog, index 0: Jog rate rapid, index 1: Jog rate slow)

The position correction described above may take a very long time at a very slow jog rate, or may even not take place at all, such as if **P-0-0168[1]** = 0. In this case the drive would remain in system state 4, as the setpoint cannot be attained.

Bit 13: Drive HALT (feed hold)

The "Drive halt" signal is state-controlled and low-active, meaning in response to a "Drive halt = 0" signal the drive is in the ""Drive halt" state. The input signal is mapped in the master control word, bit 13.

5.2.4 Drive status word S-0-0135.0.0

The drive status word contains all the key status information of the drive, and must be mapped into the cyclic part of the DT.

Bit no.	Description
15 – 14	Ready to start • 00: Drive not ready to power up, as internal checks have not yet completed successfully. • Drive ready to power up. • 10: Drive control unit ready and power supply on, drive is torque-free and power stage is disabled. • 11: Drive ready, "Drive enable" set and effective, power stage active.
13	Error in C1D (**S-0-0011.0.0**) • 0: No error • 1: Drive is locked due to en error
12	Change bit of C2D (**S-0-0012.0.0**) • 0: No enable. • 1: Change
11	Toggle bit: New actuals The bit is valid in communication phases 3 + 4, changes synchronously to the "Producer cycle time" (**S-0-1050.0.10**) and indicates the availability of the new actual values for the master.
10 – 8	Current mode • 000: Primary mode (defined in **S-0-0032.0.0**) • 001: Secondary mode (defined in **S-0-0033.0.0**) • 010: Secondary mode 2 (defined in **S-0-0034.0.0**) • 011: Secondary mode 3 (defined in **S-0-0035.0.0**) • 100: Secondary mode 4 (not supported) • 101: Secondary mode 5 (not supported) • 110: Secondary mode 6 (not supported) • 111: Secondary mode 7 (not supported)

Table 5.2 Drive status word **S-0-0135**

Bit no.	Description
7 – 6	Reserved
5	Status of actual position value (bit 0 of **S-0-0403.0.0**)
4	Drive halt: • 0: Drive halt not active • 1: Drive halt active
3	Status of setpoint transfer • 0: The drive ignores the setpoints of the master, such as during drive-controlled motion (homing, ..) or parameterizable delay times. • 1: The drive follows the setpoints of the master control system
2 – 0	Reserved

Table 5.2 Drive status word **S-0-0135**

5.2.5 Non-configurable real-time data

In addition to the mapped data, the MDT and AT each contain fixed configured content. In the MDT:

- Device control: With the aid of this control word the master monitors the topology of the slave and the loop. The control word is mapped into parameter **S-0-1044.0.0**. For a detailed description refer to section 8.2.1.
- Connection control: The connection control word includes the real-time control bits. It is mapped for diagnostic purposes into parameters **S-0-1050.0.8** and **S-0-1050.1.8**, which are described in more detail in section 8.2.1.

The following data items are fixed components of the AT:

- Device status: Here the slave reports its current topology or a detected loop break. This status word is mapped into parameter "**S-0-1045.0.0**", and is described in section 8.2.1.
- Connection status: Includes the real-time status bits.

5.3 Data transfer via the service channel (SVC)

All S and P parameters can in principle be read via the service channel; write access is possible only to non-write-protected parameters.

The service channel is initialized during the communication phase 1 (CP1) and is active after the transition to CP2.

Transfer via the service channel is handled bit-by-bit in segments in the MDT and in the DT, and may extend over several bus cycles for each transferred element.

The SVC is controlled by way of the SVC control word. The status of the SVC is displayed in the SVC status word. Both status words can be displayed on the internal oscilloscope for diagnostic purposes. For a detailed description refer to section 8.2.2.

The command functions are also transferred via the service channel. At present the following commands are supported:

- **S-0-0099**: Reset state class 1 (reset error)
- **S-0-0127**: Switchover preparation phase 3
- **S-0-0128**: Switchover preparation phase 4
- **S-0-0139**: "Park axis" command
- **S-0-0148**: Drive-guided homing
- **S-0-0152**: "Position spindle" command
- **S-0-0170**: "Touchprobe" command
- **S-0-0191**: "Clear reference point" command
- **S-0-0216**: "Switch parameter set" command
- **S-0-0262**: "Parameter initialization to default values" command
- **S-0-0263**: "Parameter initialization to backup values" command
- **S-0-0264**: "Save current parameter values" command
- **S-0-0447**: "Set absolute position" command
- **S-0-1024**: "Measure synchronous delay" command

5.4 IP channel

The IP or NRT channel is used primarily for diagnostic purposes.

By way of the IP channel it is possible to access all the slaves in a SERCOS III loop using Drive Manager. This can be done in NRT mode directly with a notebook or PC connected to the free port of the last slave. In cyclic mode (CP3, CP4) a notebook or PC in a SERCOS loop or line is not permitted. In this case IP communication is only possible via the master, provided it supports the IP channel. The preconditions for this are that the IP channel has been correctly parameterized by the master and the correct IP address has been set on all slaves.

5.4.1 Parameter setting

Parameter	Description
S-0-1017	NRT channel transmission time
S-0-1019	MAC address
S-0-1020	SERCOS III IP address
S-0-1021	Subnet mask
S-0-1022	Gateway

Table 5.3 Parameter setting

To be able to use the IP channel, the master must write to parameter S-x-1017 "NRT transmission time". Only if valid values are entered there for the times t6 and t7 is the IP channel active in the MSD Servo Drive. If the settings are t6 = 0 and t7 = 0, the IP channel is not active.

The IDN/S-0-1019, IDN/S-0-1020 and IDN/S-0-1021 must also be correctly parameterized.

For the IDN/S-0-1019 "MAC address" and the IDN/S-0-1021 "Subnet mask" the factory default settings should be used. Correct setting of IDN/S-0-1020 "IP address" is detailed in section 5.4.2.

5.4.2 SERCOS III IP address

The IP address of the SERCOS III option board is set using IDN/S-0-1020. In doing so, it must be ensured that the SERCOS III IP address is not the same as the default IP address of the MSD Servo Drive (parameter 671). The two IP addresses must differ at least in their third segment, as stipulated in the factory setting for example:

Default IP: 192.168.39.5

SERCOS III IP: 192.168.38.5

Subnet mask: 255.255.255.0

If both addresses are the same at any time, when the MSD Servo Drive is then restarted an error message is activated. To enable communication via TCP/IP even in such a case, the last address changed is reset to its old value.

When the default or SERCOS III IP address has been changed, the new value is only applied after restarting the MSD Servo Drive.

6 Scaling and weighting

The weighting describes the physical unit and number of decimal places with which the numerical values of the parameters exchanged between the master control system and the drives are to be interpreted. The method of weighting is defined by the parameters for position, velocity, acceleration and torque weighting.

The MSD Servo Drive can be scaled either by the higher-level control writing the relevant parameters over the SERCOS bus or using the scaling wizard integrated into the Moog DriveAdministrator 5.

6.1 Weighting of position data

The translatory position weighting is defined by the parameters listed in the following table. All position data of the drive (e.g.: setpoint, actual and limit values) are subject to the preset weighting. If "No weighting" is selected via parameter **S-0-0076**, the weighting factor and weighting exponent are irrelevant. The position data is then subject to a differently defined weighting.

IDN	Description
S-0-0076	Weighting method for position data
S-0-0077	Weighting factor for translatory position data
S-0-0078	Weighting exponent for translatory position data
S-0-0079	Rotary position resolution
S-0-0103	Modulo value

Table 6.1 Scaling parameters for position weighting

6.1.1 Weighting of translatory position data

Translatory weighting is selected via **S-0-0076**. The significance of the LSB of the translatory position data is defined by the following equation:

LSB significance = Unit · **S-0-0077** · $10^{\text{S-0-0078}}$

When translatory preferential weighting is selected, the weighting as per the following table applies.

Weighting method (from S-0-0076)	Unit (from S-0-0076)	Weighting factor S-0-0077)	Weighting exponent (S-0-0078)	Preferential weighting
Linear	m	1	-7	0.1 MD

Table 6.2 Preferential weighting of translatory position data

6.1.2 Weighting of rotary position data

Rotary weighting is selected via **S-0-0076**. The significance of the LSB of the rotary position data is defined by the rotary position resolution (**S-0-0079**).

$$\text{LSB significance} = \text{Unit} \cdot \frac{1\ \text{revolution}}{\textbf{S-0-0079}}$$

When rotary preferential weighting is selected, the weighting as per the following table applies.

Weighting method (from S-0-0076)	Unit (from S-0-0076)	Rotary position resolution (S-0-0079)	Preferential weighting
Rotary	Degrees	3 600 000	0.0001 degrees

Table 6.3 Preferential weighting of rotary position data

Bits 2-0	Weighting method
0 0 0	No weighting
0 0 1	Translatory weighting
0 1 0	Rotary weighting
Bit 3	Weighting method
0	Preferential weighting
1	Parameter weighting
Bit 4	Unit
0	Degrees (for rotary weighting) / Metres (for translatory weighting)
1	Reserved (for rotary weighting) / Inches (for translatory weighting)
Bit 5	Reserved
Bit 6	Data source
0	On the motor shaft
1	On the load side
Bit 7	Processing format
0	Absolute format
1	Modulo format
Bit 8-15	Reserved

*Table 6.4 Bit fields in the position data weighting method parameter (**S-0-0076**)*

The following diagram shows the various position weighting options.

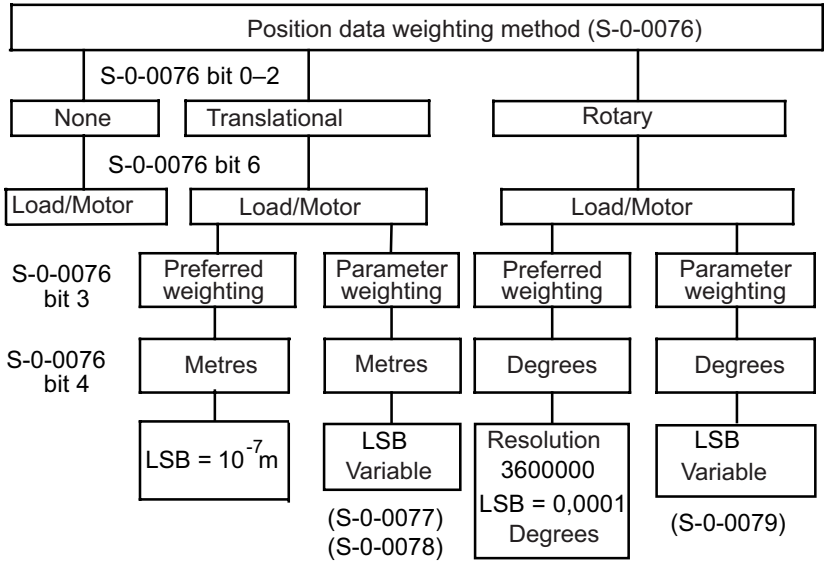


Figure 6.1 Diagram of position weighting methods

6.1.3 Modulo weighting

If modulo weighting is preset via parameter **S-0-0076** ("Position weighting"), parameters **S-0-0103** ("Modulo value") and **S-0-0294** ("Modulo value divisor") determine the value range (modulo range) within which the actual position may lie. If the travel distance exceeds the modulo range, an overshoot of the actual position occurs.

Parameter	Description
S-0-0103	MODULO VALUE When modulo format is preset in the position weighting method (**S-0-0076**), the modulo value (**S-0-0103**) defines the number range of all position data. If the modulo value is exceeded, the drive and the master control system perform the modulo calculation.
S-0-0294	MODULO VALUE DIVISOR If the modulo value (**S-0-0103**) does not match the physical modulo value, it can be corrected by the divisor **S-0-0294**. The effective modulo value is the product of **S-0-0103** and **S-0-0294**. A value of 1 renders the "modulo value divisor" parameter ineffective.

Table 6.5 Scaling parameters for position weighting

6.1.4 Position polarity

In parameter **S-0-0055** the polarities (preceding signs) of the specified position data can be inverted according to the application. The polarities are not inverted within a controlled system, but outside of it (at the input and output).
A positive torque setpoint difference with non-inverted polarity means the direction of rotation is clockwise, looking at the motor shaft.

Bit 0	Position reference
0	Not inverted
1	Inverted
Bit 1	Additive position setpoint
0	Not inverted
1	Inverted
Bit 2	Actual position 1
0	Not inverted
1	Inverted
Bit 3	Actual position 2
0	Not inverted
1	Inverted
Bit 4	Position limit values
0	Not inverted
1	Inverted
Bit 5-15	Reserved

Table 6.6 Setting of position polarity via parameter **S-0-0055**

6.2 Weighting of velocity data

The velocity weighting is defined by the parameters listed in the following table. All velocity data of the drive (e.g.: setpoint, actual and limit values) are subject to the preset weighting. If "No weighting" is selected via parameter **S-0-0044**, the weighting factor and weighting exponent are irrelevant. The velocity data is then subject to a differently defined weighting.

IDN	Description
S-0-0044	Weighting method for velocity data
S-0-0045	Weighting factor for velocity data
S-0-0046	Weighting exponent for velocity data

Table 6.7 Scaling parameters for position weighting

6.2.1 Weighting of translatory velocity data

Translatory weighting is selected via **S-0-0044**. The significance of the LSB of the translatory velocity data is defined by the following equation:

$$\text{LSB significance} = \frac{\text{Travel unit}}{\text{Time unit}} \cdot \textbf{S-0-0045} \cdot 10^{\textbf{S-0-0046}}$$

When translatory preferential weighting is selected, the weighting as per the following table applies.

Weighting method (from S-0-0076)	Unit (from S-0-0076)	Weighting factor (S-0-0045)	Weighting exponent (S-0-0046)	Preferential weighting
Linear	m/min	1	-6	0.001 mm/min

Table 6.8 Preferential weighting of translatory velocity data

6.2.2 Weighting of rotary velocity data

Rotary weighting is selected via **S-0-0044**. The significance of the LSB of the rotary velocity data is defined by the following equation:

$$\text{LSB significance} = \frac{\text{Travel unit}}{\text{Time unit}} \cdot \textbf{S-0-0045} \cdot 10^{\textbf{S-0-0046}}$$

When rotary preferential weighting is selected, the weighting as per the following table applies.

Weighting method (from S-0-0076)	Unit (from S-0-0076)	Weighting factor (S-0-0045)	Weighting exponent (S-0-0046)	Preferential weighting
Rotary	rpm	1	-4	0.001 rpm
Rotary	1/s	1	-6	0.000 001 1/s

Table 6.9 Preferential weighting of rotary position data

Bit 2-0	Weighting method
0 0 0	No weighting
0 0 1	Translatory weighting
0 1 0	Rotary weighting
Bit 3	Weighting method
0	Preferential weighting
1	Parameter weighting
Bit 4	Distance unit
0	Revolutions (for rotary weighting) / Metres (for translatory weighting)
1	Reserved (for rotary weighting) / Inches (for translatory weighting)
Bit 5	Time unit
0	Minutes (min)
1	Seconds (s)
Bit 6	Data source
0	On the motor shaft
1	On the load side
Bit 7-17	Reserved

*Table 6.10 Bit fields in the velocity data weighting method parameter (**S-0-0045**)*

The following diagram shows the various velocity weighting options.

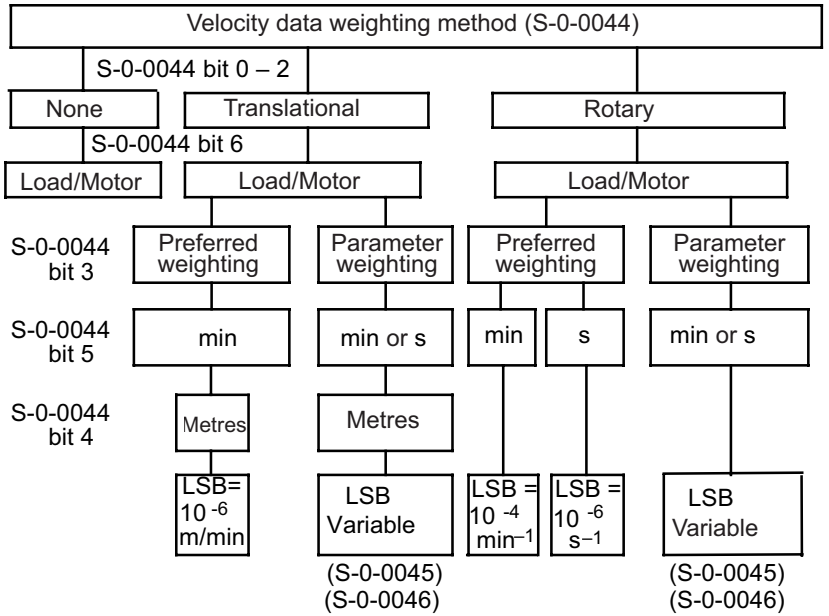


Figure 6.2 Diagram of velocity weighting methods

6.2.3 Speed polarity

In parameter **S-0-0043** the polarities (preceding signs) of the specified velocity data can be inverted according to the application. The polarities are not inverted within a controlled system, but outside of it (at the input and output). A positive velocity setpoint difference with non-inverted polarity means the direction of rotation is clockwise, looking at the motor shaft.

Bit 0	Velocity setpoint
0	Not inverted
1	Inverted
Bit 1	Additive velocity setpoint
0	Not inverted
1	Inverted
Bit 2	Actual velocity 1
0	Not inverted
1	Inverted
Bit 3	Actual velocity 2
0	Not inverted
1	Inverted
Bit 4-15	Reserved

Table 6.11 Setting of velocity polarity via parameter **S-0-0043**

6.3 Weighting of acceleration data

The acceleration weighting is defined by the parameters listed in the following table. All acceleration data of the drive (e.g.: setpoint, actual and limit values) are subject to the preset weighting. If "No weighting" is selected via parameter **S-0-0161**, the weighting factor and weighting exponent are irrelevant. The acceleration data is then subject to a differently defined weighting.

IDN	Description
S-0-0160	Weighting method for acceleration data
S-0-0161	Weighting factor for acceleration data
S-0-0162	Weighting exponent for acceleration data

Table 6.12 Scaling parameters for acceleration weighting

6.3.1 Weighting of translatory acceleration data

Translatory weighting is selected via **S-0-0161**. The significance of the LSB of the translatory acceleration data is defined by the following equation:

$$\text{LSB significance} = \frac{\text{Travel unit}}{\text{Time unit}^2} \cdot \textbf{S-0-0161} \cdot 10^{\textbf{S-0-0162}}$$

When translatory preferential weighting is selected, the weighting as per the following table applies.

Weighting method (from S-0-0076)	Unit (from S-0-0076)	Weighting factor (S-0-0161)	Weighting exponent (S-0-0162)	Preferential weighting
Translatory	m/s^2	1	-6	0.001 mm/s^2

Table 6.13 Preferential weighting of translatory acceleration data

6.3.2 Weighting of rotary acceleration data

Rotary weighting is selected via **S-0-0160**. The significance of the LSB of the rotary acceleration data is defined by the following equation:

$$\text{LSB significance} = \frac{\text{Travel unit}}{\text{Time unit}^2} \cdot \textbf{S-0-0161} \cdot 10^{\textbf{S-0-0162}}$$

When rotary preferential weighting is selected, the weighting as per the following table applies.

Weighting method (from S-0-0076)	Unit (from S-0-0076)	Weighting factor (S-0-0161)	Weighting exponent (S-0-0162)	Preferential weighting
Rotary	rad/s^2	1	-3	0.001 rad/s^2

Table 6.14 Preferential weighting of rotary position data

Bits 2-0	Weighting method
0	No weighting
1	Translatory weighting
	Rotary weighting
Bit 3	Weighting method
0	Preferential weighting
1	Parameter weighting
Bit 4	Distance unit
0	rad (for rotary weighting) / Metres (for translatory weighting)
1	Reserved (for rotary weighting) / Inches (for translatory weighting)
Bit 5	Time unit
0	Seconds
1	Reserved
Bit 6	Data source
0	On the motor shaft
1	On the load side
Bit 7-15	Reserved

*Table 6.15 Bit fields in the acceleration data weighting method parameter (**S-0-0160**)*

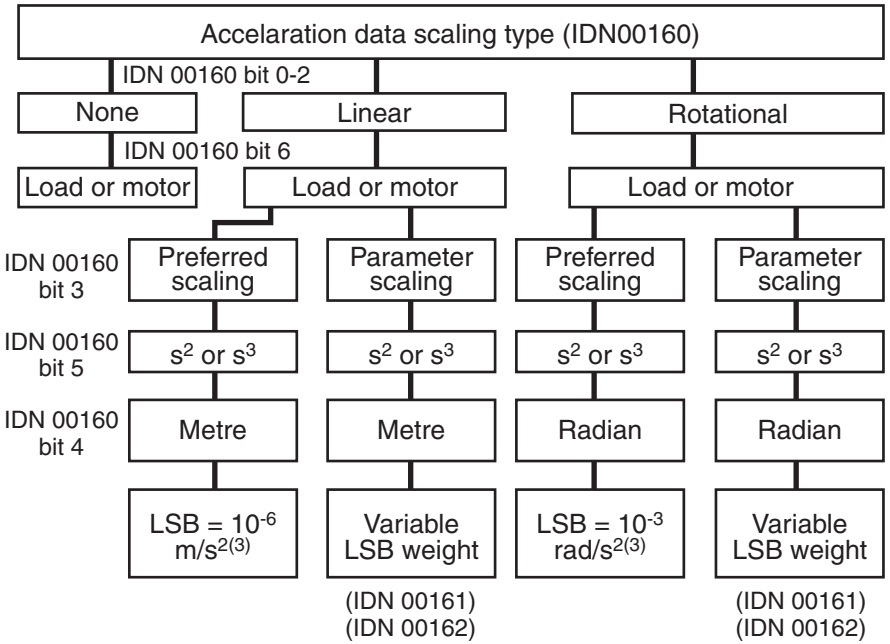


Figure 6.3 Diagram of velocity weighting methods

6.4 Weighting of torque and force data

The torque/force weighting is defined by the parameters listed in the following table. All torque/force data of the drive (e.g.: setpoint, actual and limit values) are subject to the preset weighting.

IDN	Description
S-0-0086	Weighting method for torque/force data
S-0-0093	Weighting factor for torque/force data
S-0-0094	Weighting exponent for torque/force data

Table 6.16 Scaling parameters for torque/force weighting

6.4.1 Percentage weighting of torque and force data

The percentage weighting is set via the weighting method (**S-0-0086**). No other parameters are required. In percentage weighting the permanently permissible standstill torque of the motor (**S-0-0111**) is used as the reference value. All torque/force data is given in % with one decimal place.

6.4.2 Weighting of force data

The weighting of force data is set via parameter **S-0-0086**. The significance of the LSB of the force data is defined by the following equation:

LSB significance = Unit · **S-0-0093** · $10^{\text{S-0-0094}}$

When preferential force weighting is selected, the weighting as per the following table applies.

Weighting method (from S-0-0076)	Unit (from S-0-0076)	Weighting factor (S-0-0093)	Weighting exponent (S-0-0094)	Preferential weighting
linear	NB	1	0	1 NB

Table 6.17 Preferential weighting of force data

6.4.3 Weighting of torque data

The weighting of torque data is set via parameter **S-0-0086**. The significance of the LSB of the torque data is defined by the following equation:

LSB significance = Unit · **S-0-0093** · $10^{\text{S-0-0094}}$

When preferential torque weighting is selected, the weighting as per the following table applies.

Weighting method (from S-0-0076)	Unit (from S-0-0076)	Weighting factor (S-0-0093)	Weighting exponent (S-0-0094)	Preferential weighting
Rotary	Nm	1	-2	0.01 Nm

Table 6.18 Preferential weighting of force data

Bit 2-0	Weighting method
0 0 0	No weighting
0 0 1	Translatory weighting
0 1 0	Rotary weighting
Bit 3	**Weighting method**
0	Preferential weighting
1	Parameter weighting
Bit 4	**Distance unit**
0	Nm (for rotary weighting) / NB (for translatory weighting)
1	In lbf (for rotary weighting) / lbf (for translatory weighting)
Bit 5	**Reserved**
Bit 6	**Data source**
0	On the motor shaft
1	On the load side
Bit 7-17	**Reserved**

*Table 6.19 Bit fields in the torque/force data weighting method parameter (**S-0-0086**)*

The following diagram shows the various torque/force weighting options.

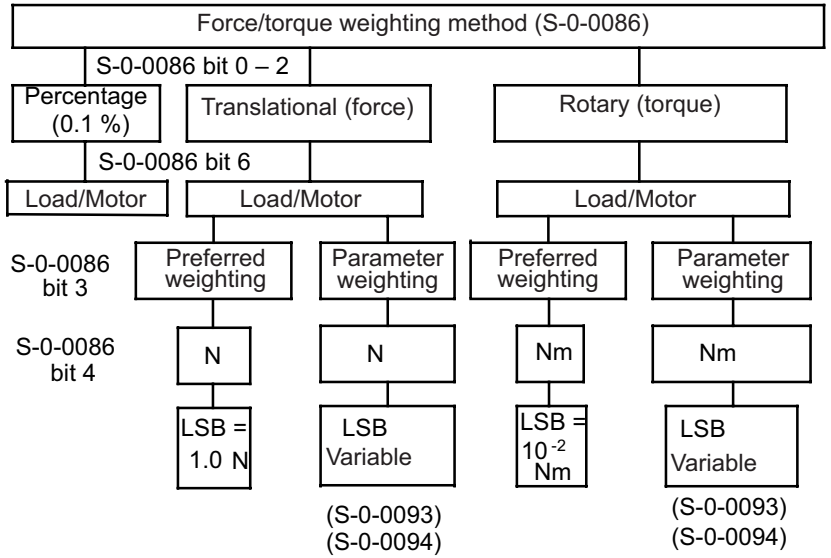


Figure 6.4 Diagram of torque/force weighting methods

6.4.4 Torque polarity

In parameter **S-0-0085** the polarities (preceding signs) of the specified torque data can be inverted according to the application. The polarities are not inverted within a controlled system, but outside of it (at the input and output). A positive torque setpoint difference with non-inverted polarity means the direction of rotation is clockwise, looking at the motor shaft.

6.5 Scaling using the scaling wizard

The scaling wizard integrated into the Moog DriveAdministrator 5 enables large numbers of parameters to be set in a user-friendly way.

To launch the scaling wizard, double-click on the "Motion profile Scaling / Units" subject area in the project tree. The following window then appears:

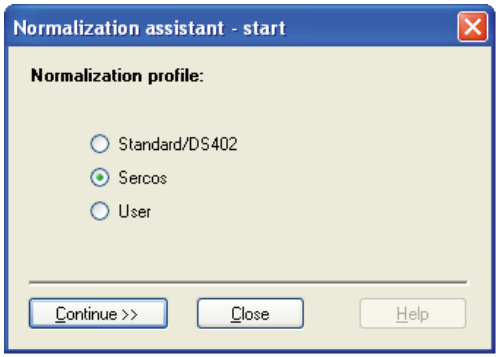


Figure 6.5 Scaling wizard start window

From the start window select the "Sercos" option.
In the window which then appears you can select which parameters to scale:

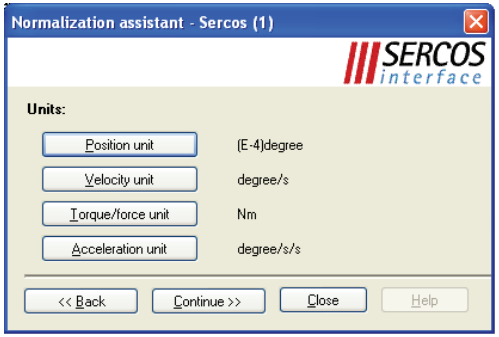


Figure 6.6 Scaling wizard, selection of scaling data

The inputs described in the following made using the wizard directly influence the parameters described in section 6 to define the scaling of the drive.

6.5.1 Scaling of position data

Click on the "Position unit" button (see figure 6.6) to access the position data scaling.

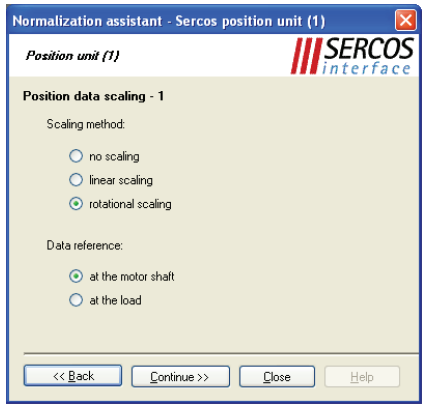


Figure 6.7 Scaling wizard, definition of scaling method and data reference

In the first position unit scaling window you must first select the scaling method and the data reference (figure 6.7).

That is to say, you must specify whether the application relates to a linear or rotary axis and whether the position data refers to the motor axis or directly to the load.

Click on the "Next" button to move on to the next window.

Here the scaling of the position data is specified.

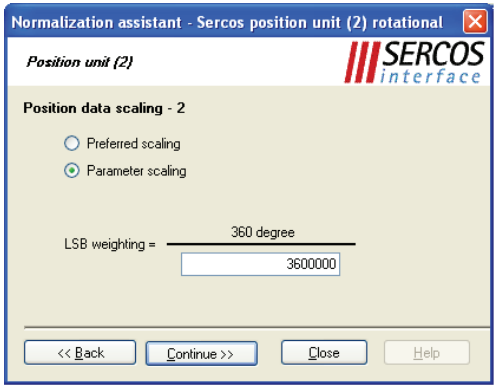


Figure 6.8 Scaling of position data

SERCOS offers two options for scaling of the position data. Choose "Preferential scaling" to set the scaling to that defined by SERCOS and described in section 6.

Choose "Parameter scaling" to set a custom scaling of the position data. The scaling shown in figure 6 would mean, for example, that the position data of this rotary axis has a resolution of 360° / 3600000 = 0.0001°.

6.5.2 Scaling of velocity data

Click on the "Velocity unit" button (see figure 6.6) to access the velocity data scaling.

In the first velocity unit scaling window you must first select the scaling method and the data reference (see figure 6.7).

That is to say, you must specify whether the application relates to a linear or rotary axis and whether the velocity data refers to the motor axis or directly to the load.

Click on the "Next" button to move on to the next window.

Here the scaling of the velocity data is specified.

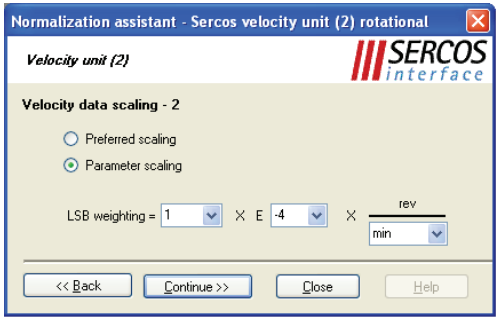


Figure 6.9 Scaling of velocity data

Choose "Preferential scaling" to set the scaling to that defined by SERCOS and described in section 6.

Choose "Parameter scaling" to set a custom scaling of the velocity data. The scaling shown in figure 6 would mean, for example, that the velocity data of is transferred with a resolution of 0.0001 rpm.

6.5.3 Scaling of torque data

Click on the "Torque/power unit" button (see figure 6.6) to access the torque and power data scaling.

In the first torque unit scaling window you must first select the scaling method and the data reference (see figure 6.7).

That is to say, you must specify whether the application relates to a linear or rotary axis and whether the torque data refers to the motor axis or directly to the load.

Click on the "Next" button to move on to the next window.

Here the scaling of the torque data is specified.

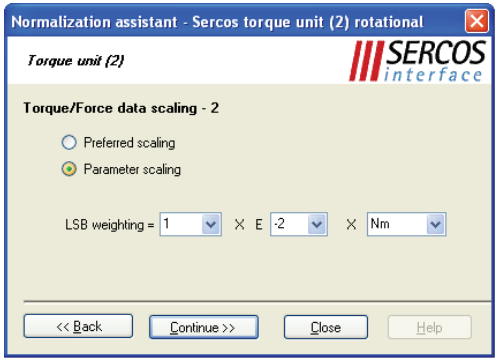


Figure 6.10 Scaling of torque/power data

Choose "Preferential scaling" to set the scaling to that defined by SERCOS and described in section 6.

Choose "Parameter scaling" to set a custom scaling of the torque data. The scaling shown in figure 6.10 would mean, for example, that the torque data of is transferred with a resolution of 0.01 Nm.

6.5.4 Scaling of acceleration data

Click on the "Acceleration unit" button (see figure 6.6) to access the acceleration data scaling.

In the first acceleration unit scaling window you must first select the scaling method and the data reference (see figure 6.7).

That is to say, you must specify whether the application relates to a linear or rotary axis and whether the acceleration data refers to the motor axis or directly to the load.

Click on the "Next" button to move on to the next window.

Here the scaling of the acceleration data is specified.

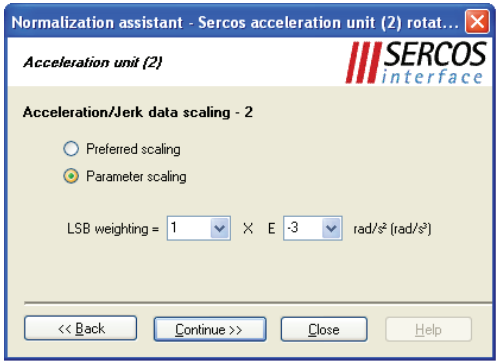


Figure 6.11 Scaling of acceleration data

Choose "Preferential scaling" to set the scaling to that defined by SERCOS and described in section 6.

Choose "Parameter scaling" to set a custom scaling of the acceleration data. The scaling shown in figure 6.11 would mean, for example, that the acceleration data of is transferred with a resolution of 0.001 rad / s².

7 Functionality

7.1 Homing

7.1.1 "Drive-controlled homing" command

To create the distance setpoint when using relative encoder systems, command **S-0-0148**, "Drive-controlled homing", must be used. As soon as this command has been set and enabled by the master, the drive moves in position control mode with an internal profile generator, taking into account **S-0-0041**: Homing velocity 1 (Move and wait for reference cam) and **P-0-3031**: Homing velocity 2 (Find zero point in zero approach run) as well as **S-0-0042**: Homing acceleration, according to the strategy defined in **P-0-2261**: Homing method. The status "Encoder system home" in parameter **S-0-0403** (Actual position status) is cleared when homing starts (if previously set) and is reset once homing has completed successfully.

For more information on homing and the available methods please refer to the MSD Servo Drive Application Manual.

7.1.2 Setting of SERCOS encoders 1 / 2

The MSD Servo Drive features a maximum of 3 independent encoder interfaces. These encoder interfaces are assigned to the logical SERCOS position encoder interfaces 1 and 2 via parameters **P-0-0530** (Selection of SERCOS encoder 1) and **P-0-0531** (Selection of SERCOS encoder 2). Homing is executed to the position encoder determined by the active operation mode (see also section 4.2).

7.1.3 Homing velocity

The homing velocity is preset via **S-0-0041** (Find reference cam) and **P-0-3031** (Find zero point). The unit and the number of decimal places correspond to the velocity weighting in **S-0-0044**.

7.1.4 Homing acceleration

The homing acceleration is preset via **S-0-0042**. The unit and the number of decimal places correspond to the acceleration weighting in **S-0-0160**.

7.1.5 Homing method

The homing method is selected via **P-0-2261**. The various methods are detailed in the MSD Servo Drive Application Manual.

SERCOS profile parameter **S-0-0147** defining the homing method is not yet currently supported.

7.1.6 Reference distance 1/2

The reference distance 1(2) (**S-0-0052, S-0-0054**) describes the distance between the machine zero point and the reference point referred to the motor measurement system. After homing, the actual position is calculated from the reference distance and the reference distance offset. The weighting is preset according to **S-0-0076**. The two parameters relate to SERCOS encoders 1 and 2 respectively.

7.1.7 Reference distance offset 1/2

The reference distance offset 1(2) (**S-0-0150, S-0-0151**) describes the distance between the reference mark of the position encoder and the reference point. The two parameters relate to SERCOS encoders 1 and 2 respectively.

7.1.8 Reference cam, limit switch

The signal of the reference cam can be optionally linked to one of the digital inputs. Inputs ISD00…ISD06 are available. Depending on the method, the limit switches can also be optionally used for homing.

7.1.9 Function selector - digital inputs and outputs

The inputs and outputs of the drive can be assigned various functions by way of so-called function selectors. The inputs can also be filtered against bounce or inverted.

For more information on the digital and analog IOs please refer to the Application Manual.

- **P-0-0100** Function selector ENPO
- **P-0-0101** Function selector ISD00
- **P-0-0102** Function selector ISD01
- **P-0-0103** Function selector ISD02
- **P-0-0104** Function selector ISD03
- **P-0-0105** Function selector ISD04
- **P-0-0106** Function selector ISD05
- **P-0-0107** Function selector ISD06
- **P-0-0108** Function selector ISDSH
- **P-0-0109** Function selector ISA00
- **P-0-0110** Function selector ISA01
- **P-0-0118** Filter for digital inputs
- **P-0-0120** Inversion of digital inputs

- **P-0-0122** Function selector OSD00
- **P-0-0123** Function selector OSD01
- **P-0-0124** Function selector OSD02
- **P-0-0125** Function selector - motor brake
- **P-0-0126** Function selector - RELOUT1
- **P-0-0142** Inversion of digital outputs

7.2 Touchprobe function

The touchprobe function permits event-controlled or continuous position measurement. Positive and negative signal edges at the two “fast” digital inputs ISD05 and ISD06 can be configured as triggers for a position measurement.

To activate the "Measurement with touchprobe" function

"Touchprobe cycle" (**S-0-0170.0.0**) is used. Parameter **S-0-0169.0.0** "Touchprobe control parameter" is used for configuration.

Setting and enabling the command activates the “Measurement” function in the drive. The drive signals this by setting the command acknowledgement (data status) to “set, enabled, not yet executed”. No “Command correctly executed” acknowledgement is made. This means that the command change bit is only set in the event of a fault.

The measurement is enabled by the “Touchprobe 1/2 enable” signals (**S-0-0405.0.0** / **S-0-0406.0.0**).

When the selected edge occurs on the touchprobe, the drive stores the actual position value to the relevant parameter **S-0-0130** to **S-0-0133** (measured value 1 or 2, positive or negative edge) and sets the associated bit in the measured value status (**S-0-0179**). The status bits in the measured value status are addressable separately via the ident numbers **S-0-0409.0.0** to **S-0-0412.0.0** and so can be assigned to the real-time status bits in fast measurements or be transferred as real-time parameters in the DT.

Two different measurement methods are supported:

- Single measurement: When an active measurement edge occurs the effect of the same edge is disabled. This block is cleared by resetting the touchprobe 1/2 enable (**S-0- 0405.0.0** / **S-0-0406.0.0**). The measurement is re-enabled by then setting the touchprobe 1/2 enable.
- Continuous measurement: If continuous measurement was configured in parameter **S-0-0169.0.0**, the current position is stored on every occurrence of an active measurement edge. The touchprobe is then immediately re-enabled for further measurement. Continuous measurement is cancelled by resetting **S-0-0405.0.0** or **S-0-0406.0.0** or by deleting command **S-0-0170.0.0** "Touchprobe cycle".

The parameters of the touchprobe function are listed in the table below.

<table>
<tr><th>Parameter</th><th>Description</th></tr>
<tr><td>S-0-0169</td><td>Touchprobe control parameter
Touchprobe control parameter The settings in this parameter define which touchprobes and edges are active in the touchprobe cycle.
Meanings of the individual bits:
<table>
<tr><th>Bit no.</th><th>Description</th></tr>
<tr><td>15 – 9</td><td>Reserved</td></tr>
<tr><td>8</td><td>Auto-activation
0: Touchprobe function is activated by command S-0-0170.0.0 "Touchprobe cycle" 1:
1: Automatic activation of the touchprobe function on phase change from CP3 to CP4 (not supported)</td></tr>
<tr><td>7</td><td>Reserved</td></tr>
<tr><td>6</td><td>Touchprobe mode 1
0: Single measurement
1: Continuous measurement</td></tr>
<tr><td>5</td><td>Touchprobe mode 2
0: Single measurement
1: Continuous measurement</td></tr>
<tr><td>4</td><td>Reserved</td></tr>
<tr><td>3</td><td>Touchprobe 2 negative edge
0: Negative edge not active
1: Negative edge active</td></tr>
<tr><td>2</td><td>Touchprobe 2 negative edge
0: Negative edge not active
1: Negative edge active</td></tr>
<tr><td>1</td><td>Touchprobe 1 negative edge
0: Negative edge not active
1: Negative edge active</td></tr>
<tr><td>0</td><td>Touchprobe 1 negative edge
0: Negative edge not active
1: Negative edge active</td></tr>
</table></td></tr>
</table>

Table 7.1 Description of parameters for the touchprobe function

<table>
<tr><th>Parameter</th><th>Description</th></tr>
<tr><td>S-0-0170</td><td>TOUCHPROBE CYCLE COMMAND
If the touchprobe cycle command is set and enabled by the master, the drive responds to the following parameters:
- Touchprobe 1/2 enable (S-0-0405, 00406) and
- Touchprobe 1/2 (S-0-0401, 00402) as
programmed in - touchprobe control parameter (S-0-0169) .
While the command is active the master control system can perform multiple measurements. The command is cleared by the control system if no further measurements are required.</td></tr>
<tr><td>S-0-0179</td><td>MEASURED VALUE STATUS
If the drive stores one or more measured values while the touchprobe cycle command (S-0-0170) is active, it simultaneously also sets the associated bit in the measured value status. If the “Touchprobe 1 enable“ (S-0-0405) is cleared by the control system, the drive clears bits 0 and 1 in the measured value status.
If the “Touchprobe 2 enable“ (S-0-0406) is cleared by the control system, the drive clears bits 2 and 3 in the measured value status. The drive clears all bits in the measured value status when the touchprobe cycle command (S-0-0170) is cleared by the control system.
Structure of measured value status:
Bit 0: Measured value 1 recorded positive (S-0-0409) 0 - Not recorded 1 - Recorded
Bit 1: Measured value 1 recorded positive (S-0-0409) 0 - Not recorded 1 - Recorded
Bit 2: Measured value 2 recorded positive (S-0-0409) 0 - Not recorded 1 - Recorded
Bit 3: Measured value 2 recorded positive (S-0-0409) 0 - Not recorded 1 - Recorded
Bit 15-4: (reserved)
Bit 15-4: (reserved)</td></tr>
<tr><td>S-0-0130</td><td>MEASURED VALUE 1, POSITIVE EDGE
With an external encoder, the drive stores the actual position value 2 to this parameter with the positive edge of touchprobe 1 (S-0-0401) during the measurement cycle. If there is no external encoder, actual position value 1 is stored.</td></tr>
</table>

Table 7.1 Description of parameters for the touchprobe function

Parameter	Description
S-0-0131	MEASURED VALUE 1, NEGATIVE EDGE With an external encoder, the drive stores the actual position value 2 to this parameter with the negative edge of touchprobe 1 (**S-0-0401**) during the measurement cycle. If there is no external encoder, actual position value 1 is stored.
S-0-0132	MEASURED VALUE 2, POSITIVE EDGE With an external encoder, the drive stores the actual position value 2 to this parameter with the positive edge of touchprobe 2 (**S-0-0401**) during the measurement cycle. If there is no external encoder, actual position value 1 is stored.
S-0-0133	MEASURED VALUE 2, NEGATIVE EDGE With an external encoder, the drive stores the actual position value 2 to this parameter with the negative edge of touchprobe 2 (**S-0-0401**) during the measurement cycle. If there is no external encoder, actual position value 1 is stored.
S-0-0405	TOUCHPROBE 1-ENABLE With this parameter the touchprobe 1 enable is assigned an IDN. As a result, the touchprobe 1 enable can be assigned to a real-time control bit (**S-0-0301**). The touchprobe 1 enable is only polled by the drive as long as the touchprobe cycle command (**S-0-0170**) is active. For a repeat measurement with the same edge of touchprobe 1, the master control system must set the touchprobe 1 enable to “0” and back to “1”. In the operation datum only bit 0 is defined. (For more information see **S-0-0179**)
S-0-0406	TOUCHPROBE 2-ENABLE With this parameter the touchprobe 2 enable is assigned an IDN. As a result, the touchprobe 2 enable can be assigned to a real-time control bit (**S-0-0301**). The touchprobe 2 enable is only polled by the drive as long as the touchprobe cycle command (**S-0-0170**) is active. For a repeat measurement with the same edge of touchprobe 2, the master control system must set the touchprobe 2 enable to “0” and back to “1”. In the operation datum only bit 0 is defined. (For more information see **S-0-0179**).

Table 7.1 Description of parameters for the touchprobe function

Parameter	Description
S-0-0409	MEASURED VALUE 1 POSITIVE RECORDED With this parameter the "Measured value 1 positive recorded" is assigned an IDN. As a result, “Measured value 1 recorded positive” can be assigned to a real-time status bit (**S-0-0305**). In the operation datum only bit 0 is defined. Bit 0 in this parameter is only set by the drive when the touchprobe cycle command (**S-0-0170**) is active, the touchprobe 1 enable signal (**S-0-0405**) is set to “1” and the positive edge of touchprobe 1 (**S-0-0401**) is signalled. At the same time, the drive stores the actual position value to measured value 1 positively (**S-0-0130**). The drive clears this bit when the master control system clears the touchprobe cycle command or the touchprobe 1 enable is set to "0”. (For more information see **S-0-0179**).
S-0-0410	MEASURED VALUE 1 NEGATIVE RECORDED With this parameter the "Measured value 1 negative recorded" is assigned an IDN. As a result, “Measured value 1 recorded negative” can be assigned to a real-time status bit (**S-0-0305**). Bit 0 in this parameter is only set by the drive when the touchprobe cycle command (**S-0-0170**) is active, the touchprobe 1 enable signal (**S-0-0405**) is set to “1” and the negative edge of touchprobe 1 (**S-0-0401**) is signalled. At the same time, the drive stores the actual position value to measured value 1 negatively (**S-0-0131**). The drive clears this bit when the master control system clears the touchprobe cycle command or the touchprobe 1 enable is set to "0”. In the operation datum only bit 0 is defined. (For more information see **S-0-0179**).
S-0-0411	MEASURED VALUE 2 POSITIVE RECORDED With this parameter the "Measured value 2 positive recorded" is assigned an IDN. As a result, “Measured value 2 recorded positive” can be assigned to a real-time status bit (**S-0-0305**). Bit 0 in this parameter is only set by the drive when the touchprobe cycle command (**S-0-0170**) is active, the touchprobe 2 enable signal (**S-0-0406**) is set to “1” and the positive edge of touchprobe 2 (**S-0-0402**) is signalled. At the same time, the drive stores the actual position value to measured value 2 positively (**S-0-0132**). The drive clears this bit when the master control system clears the touchprobe cycle command or the touchprobe 2 enable is set to "0”. In the operation datum only bit 0 is defined.

Table 7.1 Description of parameters for the touchprobe function

Parameter	Description
S-0-0412	MEASURED VALUE 2 NEGATIVE RECORDED With this parameter the "Measured value 2 negative recorded" is assigned an IDN. As a result, “Measured value 2 recorded negative” can be assigned to a real-time status bit (**S-0-0305**). Bit 0 in this parameter is only set by the drive when the touchprobe cycle command (**S-0-0170**) is active, the touchprobe 2 enable signal (**S-0-0406**) is set to “1” and the negative edge of touchprobe 2 (**S-0-0402**) is signalled. At the same time, the drive stores the actual position value to measured value 2 negatively (**S-0-0133**). The drive clears this bit when the master control system clears the touchprobe cycle command or the touchprobe 2 enable is set to "0”. In the operation datum only bit 0 is defined.

Table 7.1 Description of parameters for the touchprobe function

8 Error messages and diagnosis

SERCOS III offers a number of diagnostic options by way of state classes and status/control words. The internal oscilloscope of the MSD Servo Drive can also be used to display and observe more diagnostic parameters.

8.1 Standard parameters for error diagnosis

Various standard parameters are available for diagnosis of bus-specific and drive-specific errors.

8.1.1 Error messages in state class 1 (C1D)

Error messages are displayed using standard parameter **S-0-0011** (state class 1).

If an error is set in state class 1, the drive is shut down immediately. The drive signals the error by setting bit 13 in the drive status word (see section 5.2.4).

The following errors are defined in state class 1:

Bit no.	Error
15	User-specific error
14	Reserved
13	Position limit value exceeded
12	Communication error
11	Excessive control deviation
10	Phase error in power supply (not supported)
9	Undervoltage error
8	Overvoltage
7	Overcurrent
6	Error in autocommutation
5	Encoder error
4	Control voltage error (not supported)
3	Cooling error shut-off (not supported)
2	Motor overheating shut-off
1	Amplifier overheating shut-off
0	Overload shut-off

Table 8.1 State class

Bit = 0 error not active, Bit = 1 error active

8.1.2 Warning messages in state class 2 (C2D)

Warning messages are displayed using standard parameter **S-0-0012** (state class 2).

The drive signals the warning by altering bit 12 in the drive status word (see section 5.2.4).

The following warnings are defined in state class 2:

Bit no.	Warning
15	Manufacturer-specific warning
14	Reserved
13	Target position outside positioning range
12	Communication warning
11	Excessive velocity deviation
10	Reserved
9	Bus undervoltage warning
8 – 6	Reserved
5	Positioning velocity > nLimit
4	Reserved
3	Cooling error warning
2	Motor overheating warning
1	Amplifier overheating warning
0	Overload warning

Table 8.2 State class 2

Bit = 0 warning not active, Bit = 1 warning active

8.1.3 Interface diagnosis

Using parameter **S-0-0014.0.0**, the status of the interface and the current communication phase can be monitored.

If an error is set in the interface status, the communication error in C1D (**S-0-0011**) is reset. Setting bits 2-0 causes no error. If there is no communication error, the interface status in bits 0-2 contains the current communication phase. If there is a communication error, the error and the communication phase are saved. The communication error is only cleared by the drive and reset to "0" when there are no more interface errors occurring and the "Reset state class 1" command (**S-0-099**) has been received by the drive over the service channel.

Bit no.	Description
15 – 14	Reserved
13	Phase change without CPS bit (only SERCOS III)
12	Timeout on phase change (only SERCOS III)
11	IPO sync error (only SERCOS II)
10	Drives with same address in loop (only SERCOS II)
9	Switch to non-initialized mode
8	Phase change without ready message
7	Error in phase fallback (not phase 0)
6	Error in phase sequencing (invalid sequence)
5	Invalid phase (phase > 4)
4	MDT failure (only SERCOS II)
3	MST failure (S-0-1003 exceeded)
2 – 0	Communication phase 000: Phase 0 001: Phase 1 010: Phase 2 011: Phase 3 100: Phase 4 101: NRT

Table 8.3 Interface status

Bit = 0 error not active, Bit = 1 error active

8.1.4 Telegram failure and error counter

The drive monitors whether a valid MST / MDT has been received in each bus cycle. Also, each MST and MDT is monitored for compliance with

- the correct reception time;
- the agreed telegram length;
- the correct CRC checksum.

Parameters **S-0-1028.0.0** (error counter MST ports 1 + 2) and **S-0-1035.0.0** (error counter port 1 + 2) are used for diagnosis.

Error counter **S-0-1028.0.0** is incremented whenever no valid MST has been received at port 1 or at port 2. The maximum value which the counter can reach is 65535. When this value has been reached the counter is not incremented further. The counter is reset to zero at the transition from communication phase 2 to phase 3.

Parameter **S-0-1035.0.0** indicates whether the telegrams received at ports 1 + 2 were valid. If the length of a received telegram is incorrect or its CRC checksum invalid, the value of the parameter is incremented. The bottom 16 bits of the parameter display the erroneous telegrams at port 1 and the toP-0-16 bits the erroneous telegrams at port 2. The maximum value for each port is 65535. When this value has been reached the counter is not incremented further. The value of the parameter can be reset by writing it via the service channel or the Moog DriveAdministrator.

Parameter **S-0-1003** defines the maximum number of telegram failures after which the drive is to trigger an error. If the maximum value is exceeded, the communication error bit in state class 1 is set; the drive reverts to the NRT phase.

8.2 Diagnosis using the internal oscilloscope

8.2.1 Standard parameters

In addition to the standard parameters also available in conjunction with the SERCOS II option board on the oscilloscope, SERCOS III also offers the following standard parameters:

- **IDN-S-1044.0.0** : Device Control Word
- **IDN-S-1045.0.0** : Device Status Word
- **IDN-S-1050.00.8** : Connection Control
- **IDN-S-1050.10.8** : Connection Control

The Device Control / Status Word parameters are used for handling of the bus topology. The Device Control / Status Word is transferred with each bus cycle and is a fixed element of the MDT or AT. The two parameters described here are just a map of the Device Status / Control Word and are used for diagnostic purposes!

With the aid of the Device Control Word the master can alter the topology in a slave. This is necessary, for example, when a new slave is to be inserted into the bus (Hot Plug) or when the master wants to close the loop again after a detecting a loop break.

The individual bits have the following meanings:

Bit no.	Description
15	Identification
14	Toggle bit, master sends new topology
13 – 12	Topology specified by master • 00 : Fast-forward at both ports • 01 : Loop back & forward of P telegrams • 10 : Loop back & forward of S telegrams • 11 : Reserved
11 – 0	Reserved

Table 8.4 Device Control

With the aid of the Device Status Word the slave signals its current topology as well as communication errors such as a loop break.

The individual bits have the following meanings:

Bit no.	Description
15	Communication warning
14	Toggle bit, slave has adopted new topology
13 – 12	Topology status • 00 : Fast-forward at both ports • 01 : Loop back & forward of P telegrams • 10 : Loop back & forward of S telegrams • 11 : NRT mode
11 – 10	Status at inactive port • 00 : No link at inactive port • 01 : Link at inactive port • 10 : P telegram at inactive port • 11 : S telegram at inactive port
9	Connection error
8	Slave data valid (0 during phase change)
7 – 6	Reserved
5	Bit status command
4	Parameterization level
3 – 0	Reserved

Table 8.5 Device Status

The Connection Control Word is also a fixed element of the MDT. The parameter described here is a map of the Connection Control Word and is used only for diagnostic purposes.

Bit no.	Description
15 – 8	Reserved
7	Real-time bit 1
6	Real-time bit 2
5 – 4	Reserved
3	Synchronous with cycle time
2	Delayed data transfer
1	Toggle bit, new data available (toggles with each bus cycle)
0	Producer ready

Table 8.6 Connection Control

8.2.2 Additional scope parameters

In addition to the standard parameters for the oscilloscope, another field parameter "**COM_SERIII_ScopeVars**" is available containing 10 indices important for diagnosis. This parameter has the number **P 22000**.

Using the parameter indices, the following variables can be displayed on the oscilloscope:

- Index 0 "**COM_SERIII_State**": Status of the internal state machine; on successful initialization the status should be 3.
- Index 1 "**COM_SERIII_ActComPhase**": Current communication phase of the slave (0 – 4 = CP0 – CP4, 5 = NRT).
- Index 2 "**COM_SERIII_INT1_Cnt**": Counter for the low-priority interrupt INT1 of the SERCOS III option board.
- Index 3 "**COM_SERIII_SVC_Cnt**": Counter for access via the service channel
- Index 4 "**COM_SERIII_SVC_Control**": Control word of the service channel, corresponding to "SVCC1" in the Service Channel Control Container. The individual bits have the following meanings:

Bit no.	Description
15 – 6	Reserved
5 – 3	Data element in the MDT
2	End bit in the MDT
1	Read/write in the MDT
0	Handshake bit in the MDT

Table 8.7 Control word of the service channel

- Index 5 "**COM_SERIII_SVC_State**": Status word of the service channel, corresponding to "SVCC0" in the Service Channel Control Container. The individual bits have the following meanings:

Bit no.	Description
15 - 4	Reserved/not displayed
3	Process bit in the DT
2	Error bit in the DT
1	Busy bit in the DT
0	Handshake bit in the DT

Table 8.8 Status word of the service channel

- Index 6 "**COM_SERIII_TG_Status_P0**": Telegram status register at port P0. The register is updated with each bus cycle. The individual bits have the following meanings:

Bit no.	Description
31 – 12	Reserved/not displayed
11	One-off MST failure
10	MST outside time window
9	Not displayed
8	Valid MST
7 – 4	Valid DT3 (Bit 7) – AT0 (Bit 4)
3 – 0	Valid MDT3 (Bit 3) – MDT0 (Bit 0)

Table 8.9 Telegram status

- Index 7 "**COM_SERIII_TG_Status_P1**": Telegram status register at port P1. The register is updated with each bus cycle. Meanings of the individual bits as for index 6.
- Index 8 "**COM_SERIII_MDT_Cnt**": Counter for all received MDTs (must be incremented by 1 with each bus cycle and have the same value as index 9).
- Index 9 "**COM_SERIII_AT_Cnt**": Counter for all sent DTs (must be incremented by 1 with each bus cycle and have the same value as index 8).
- Index 10 "**COM_SERIII_PHASESR**": Status register of the communication phases. The register is used to control the phase run-up. The register is updated with each bus cycle. The individual bits have the following meanings:

Bit no.	Description
31 -16	Reserved
15	Phase change bit: Port 2 • 0: No phase change active • 1: Phase change active

Table 8.10 Communication status register

Bit no.	Description
14 – 12	Reserved/not displayed
11 – 8	Current communication phase, port 2 (0 – 4)
7	Phase change bit, port 1 • 0: No phase change active • 1: Phase change active
6 – 4	Reserved/not displayed
3 – 0	Current communication phase, port 1

Table 8.10 Communication status register

- Index 11 "**COM_SERIII_DFCSR**": Data flow control and status register. Displays the current topology of the slave. The register is updated with each bus cycle. The individual bits have the following meanings:

Bit no.	Description
31 – 2	Reserved/not displayed
1 – 0	Current topology: • 00: Loop back port 1 and forward to port 2 • 01: Loop back port 2 and forward to port 1 • 10: Forward port 1 – port 2 and port 2 – port 1 (real-time mode) • 11: Forward port 1 – port 2 and port 2 – port 1 (non-real-time mode)

Table 8.11 Communication status register

8.3 Internal error list

A complete list of all possible error messages in the drive can be found in the MSD Servo Drive User Manual.

The occurrence of a manufacturer-specific error causes bit number 15 in state class 1 to be set (see section 5.2.4), provided the error cannot be assigned to a different bit of state class 1.

In addition, the corresponding error text is entered in parameter **S-0-0095**. The parameter can be read via the service channel or using the Moog DriveAdministrator 5.

9 Bibliography

Being revised!

10 Appendix, Glossary

10.1 Appendix A: Parameter list

List of all device parameters which can be transferred via SERCOS III.

10.1.1 SERCOS III standard parameters

IDN	Description	Unit	Write protection
S-0-0011	Class 1 diagnostic (C1D)		CP2-CP4
S-0-0012	Class 2 diagnostic (C2D)		CP2-CP4
S-0-0014	Interface status		CP2-CP4
S-0-0015	Telegram type		CP3, CP4
S-0-0017	IDN-list of all operation data		CP2-CP4
S-0-0021	IDN-list of invalid operation data for CP2		CP2-CP4
S-0-0022	IDN-list of invalid operation data for CP3		CP2-CP4
S-0-0026	Configuration list for signal status word		
S-0-0027	Configuration list for signal control word		
S-0-0032	Primary operation mode		CP4
S-0-0033	Secondary operation mode1		CP4
S-0-0034	Secondary operation mode2		CP4
S-0-0035	Secondary operation mode3		CP4
S-0-0036	Velocity command value	Speed	
S-0-0037	Additive velocity command value	Speed	
S-0-0038	Positive velocity limit value	Speed	
S-0-0039	Negative velocity limit value	Speed	
S-0-0040	Velocity feedback value 1	Speed	CP2-CP4
S-0-0041	Homing velocity	Speed	
S-0-0042	Homing acceleration	Acc	
S-0-0043	Velocity polarity parameter		CP3, CP4
S-0-0044	Velocity data scaling type		CP3,CP4
S-0-0045	Velocity data scaling factor		CP3, CP4
S-0-0046	Velocity data scaling exponent		CP3, CP4
S-0-0047	Position command value	Pos	
S-0-0049	Positive position limit value		CP3, CP4
S-0-0050	Negative position limit value		CP3, CP4
S-0-0051	Position feedback value 1	Pos	CP2-CP4
S-0-0052	Reference distance 1	Pos	
S-0-0053	Position feedback value 2	Pos	CP2-CP4
S-0-0054	Reference distance 2	Pos	
S-0-0055	Position polarity parameter		CP3, CP4
S-0-0057	Position window (for target reached status)	Pos	
S-0-0076	Position data scaling type		CP3, CP4
S-0-0077	Linear position data scaling factor		CP3, CP4
S-0-0078	Linear position data scaling exponent		CP3, CP4
S-0-0079	Rotational position resolution		CP3, CP4
S-0-0080	Torque command value	Torque	
S-0-0081	Additive torque command value	Torque	
S-0-0082	Positive torque limit value	Torque	
S-0-0083	Negative torque limit value	Torque	

Table 10.1 List of supported SERCOS standard parameters

Table 10.1 List of supported SERCOS standard parameters

IDN	Description	Unit	Write protection
S-0-0084	Torque feedback value	Torque	CP2-CP4
S-0-0085	Torque polarity parameter		CP3, CP4
S-0-0086	Torque / force data scaling type		CP3, CP4
S-0-0091	Bipolar velocity limit value	Speed	
S-0-0092	Bipolar torque limit value	Torque	
S-0-0093	Torque / force data scaling factor		CP3, CP4
S-0-0094	Torque / force data scaling exponent		CP3, CP4
S-0-0095	Diagnostic message		CP2-CP4
S-0-0097	Mask class 2 diagnostic		
S-0-0099	Reset class 1 diagnostic		
S-0-0100	Velocity loop proportional gain	Nm min	
S-0-0101	Velocity loop integral action time	ms	
S-0-0103	Modulo value	Pos	CP3, CP4
S-0-0104	Position loop KV-factor	1000/min	
S-0-0106	Current loop proportional gain 1	V/A	
S-0-0107	Current loop integral action time	µs	
S-0-0108	Feedrate override	%	
S-0-0110	Amplifier peak current	mA	CP2-CP4
S-0-0112	Amplifier rated current	A	CP2-CP4
S-0-0113	Maximum motor speed	Rev/min	
S-0-0114	Load limit of the motor	%	
S-0-0115	Position feedback 2 type		CP3, CP4
S-0-0116	Resolution of feedback 1		CP2-CP4
S-0-0117	Resolution of feedback 2		CP2-CP4
S-0-0121	Input revolutions of load gear		CP3, CP4
S-0-0122	Output revolutions of load gear		CP3, CP4
S-0-0123	Feed constant	Um/rev	CP3, CP4

Table 10.1 List of supported SERCOS standard parameters

IDN	Description	Unit	Write protection
S-0-0124	Standstill window	Speed	
S-0-0125	Velocity threshold	Speed	
S-0-0126	Torque threshold	Torque	
S-0-0127	CP3 transition check		CP3, CP4
S-0-0128	CP4 transition check		CP4
S-0-0130	Probe value 1 positive edge	Pos	CP2-CP4
S-0-0131	Probe value 1 negative edge	Pos	CP2-CP4
S-0-0132	Probe value 2 positive edge	Pos	CP2-CP4
S-0-0133	Probe value 2 negative edge	Pos	CP2-CP4
S-0-0134	Drive control word		
S-0-0135	Drive status word		CP2-CP4
S-0-0144	Signal status word		CP2-CP4
S-0-0145	Signal control word		
S-0-0147	Homing parameter		CP4
S-0-0148	Drive controlled homing procedure command		
S-0-0150	Reference offset 1	Pos	
S-0-0151	Reference offset 2	Pos	
S-0-0152	Position spindle procedure command		
S-0-0153	Spindle angle position	Pos	
S-0-0154	Spindle positioning parameter		CP3, CP4
S-0-0156	Velocity feedback value 2	Speed	CP2-CP4
S-0-0157	Velocity window	Speed	
S-0-0159	Monitoring window	Pos	
S-0-0160	Acceleration data scaling type		CP3, CP4
S-0-0161	Acceleration data scaling factor		CP3, CP4
S-0-0162	Acceleration data scaling exponent		CP3, CP4

Table 10.1 List of supported SERCOS standard parameters

IDN	Description	Unit	Write protection
S-0-0169	Probe control		
S-0-0170	Probing cycle procedure command		
S-0-0179	Probe status		CP2-CP4
S-0-0180	Spindle relative offset	Pos	
S-0-0189	Following error	Pos	CP2-CP4
S-0-0192	IDN-list of all backup operation data		CP2-CP4
S-0-0200	Amplifier warning temperature	Temp	
S-0-0201	Motor warning temperature	Temp	
S-0-0208	Temperature data scaling type		
S-0-0216	Switch parameter set procedure command		CP3, CP4
S-0-0217	Parameter set preselection		CP3, CP4
S-0-0222	Spindle positioning speed	Speed	
S-0-0256	Multiplication factor 1		CP2-CP4
S-0-0257	Multiplication factor 2		CP2-CP4
S-0-0258	Target position	Pos	
S-0-0259	Positioning velocity	Speed	
S-0-0260	Positioning acceleration	Acc	
S-0-0261	Coarse position window		CP3, CP4
S-0-0262	Load defaults procedure command		CP3, CP4
S-0-0263	Load working memory procedure command		CP3, CP4
S-0-0264	Backup working memory procedure command		
S-0-0277	Position feedback 1 type		CP3, CP4
S-0-0278	Maximum travel range		CP2-CP4
S-0-0282	Positioning command value	Pos	
S-0-0292	List of supported operation modes		CP2-CP4

Table 10.1 List of supported SERCOS standard parameters

IDN	Description	Unit	Write protection
S-0-0296	Velocity feed forward gain	%	
S-0-0310	Overload warning		CP2-CP4
S-0-0311	Amplifier overtemperature warning		CP2-CP4
S-0-0312	Motor overtemperature warning		CP2-CP4
S-0-0328	Bit number allocation list for signal status word		
S-0-0329	Bit number allocation word for signal control word		
S-0-0330	Status “n_feedback” = “n-cmd”		CP2-CP4
S-0-0331	Status “n_feedack = 0”		CP2-CP4
S-0-0332	Status “n_feedback < nx”		CP2-CP4
S-0-0333	Status “T >= Tx”		CP2-CP4
S-0-0334	Status “T >= TLim”		CP2-CP4
S-0-0335	Status “n_cmd >= n_lim”		CP2-CP4
S-0-0336	Status “In position”		CP2-CP4
S-0-0341	Status “In coarse position”		CP2-CP4
S-0-0346	Position control word		
S-0-0347	Velocity error	Speed	CP2-CP4
S-0-0348	Acceleration feed forward gain	%	
S-0-0359	Position deceleration	Acc	
S-0-0372	Drive halt acceleration bipolar	Acc	
S-0-0380	DC bus voltage	V	CP2-CP4
S-0-0383	Motor temperature	Temp	CP2-CP4
S-0-0384	Amplifier temperature	Temp	CP2-CP4
S-0-0387	Power overload	%	CP2-CP4
S-0-0389	Effective current	A	CP2-CP4
S-0-0390	Diagnostic number		CP2-CP4

Table 10.1 List of supported SERCOS standard parameters

IDN	Description	Unit	Write protection
S-0-0392	Velocity feedback filter	µs	
S-0-0393	Command value mode		CP3, CP4
S-0-0400	Home switch		CP2-CP4
S-0-0401	Probe 1 status		CP2-CP4
S-0-0402	Probe 2 status		CP2-CP4
S-0-0403	Position feedback value status		CP2-CP4
S-0-0405	Probe 1 enable		
S-0-0406	Probe 2 enable		
S-0-0407	Homing enable		
S-0-0408	Reference marker pulse registered		CP2-CP4
S-0-0409	Probe 1 positive latched		CP2-CP4
S-0-0410	Probe 1 negative latched		CP2-CP4
S-0-0411	Probe 2 positive latched		CP2-CP4
S-0-0412	Probe 2 negative latched		CP2-CP4
S-0-0417	Positioning velocity threshold in modulo mode	Speed	
S-0-0418	Target position window in modulo mode	Pos	
S-0-0419	Positioning acknowledgement	Pos	CP2-CP4
S-0-0430	Active target position	Pos	CP2-CP4
S-0-0447	Set absolute position procedure command		
S-0-0448	Set absolute position control word		
S-0-1000	SCP type & version		
S-0-1002	Communication cycle time	µs	CP3, CP4
S-0-1003	Communication timeout for CP3/CP4		
S-0-1006	AT0 transmission starting time (t1)	µs	
S-0-1007	Feedback acquisition capture point (t4)	µs	

Table 10.1 List of supported SERCOS standard parameters

IDN	Description	Unit	Write protection
S-0-1009	Device control offset in MDT		
S-0-1010	Lengths of MDTs		
S-0-1011	Device status offset in AT		
S-0-1012	Lengths of ATs		
S-0-1013	SVC offset in MDT		
S-0-1014	SVC offset in AT		
S-0-1015	Ring delay	µs	
S-0-1016	Slave delay		
S-0-1017	NRT transmission time	µs	CP3, CP4
S-0-1019	MAC address		
S-0-1020	IP address		
S-0-1021	Subnet mask		
S-0-1022	Gateway address		
S-0-1023	Sync jitter	µs	
S-0-1024	Sync delay measuring procedure command		
S-0-1026	Version of communication hardware		
S-0-1028	Error counter MST P/S		
S-0-1035	Error counter port 1 & 2		
S-0-1040	SERCOS address		
S-0-1044	Device control word		
S-0-1045	Device status word		CP2-CP4
S-0-1050.x.1	Connection setup		CP3, CP4
S-0-1050.x.2	Connection number		CP3, CP4
S-0-1050.x.3	Telegram assignment		CP3, CP4
S-0-1050.x.4	Max. length of connection		CP2-CP4
S-0-1050.x.5	Actual length of connection		CP2-CP4

Table 10.1 List of supported SERCOS standard parameters

IDN	Description	Unit	Write protection
S-0-1050.x.6	Configuration list		CP3, CP4
S-0-1050.x.8	Connection control		
S-0.1050.x.10	Producer cycle time	µs	CP3, CP4
S-0-1050.x.11	Allowed data losses		
S-0-1050.x.12	Error counter data losses		
S-0-1050.x.20	IDN allocation of realtime bit		
S-0-1050.x.21	Bit allocation of realtime bit		
S-0-1051	Image of Connection control		
S-0-1300.x.1	Component name		
S-0-1300.x.2	Vendor name		
S-0-1300.x.3	Vendor code		
S-0-1300.x.4	Device name		
S-0-1300.x.5	Vendor device ID		
S-0-1300.x.8	Hardware revision		
S-0-1300.x.9	Software revision		
S-0-1300.x.12	Serial number		
S-0-1301	GDP type and version		
S-0-1302.x.1	FSP type and version		
S-0-1302.x.2	Function groups		

Table 10.1 List of supported SERCOS standard parameters

10.1.2 Manufacturer-specific parameters

IDN	Description	Unit	Write protection		
			CP2	CP3	CP4
P-0-0001	Id of device family/series		x	x	x
P-0-0002	Device name / product name		x	x	x
P-0-0003	Application specific device name alias			x	x

Table 10.2 List of supported SERCOS parameters

IDN	Description	Unit	Write protection		
			CP2	CP3	CP4
P-0-0004	Total software version of device (plain text)		x	x	x
P-0-0005	Device family name		x	x	x
P-0-0006	Total version number of device software		x	x	x
P-0-0008	Vendor name		x	x	x
P-0-0030	Programmable reaction in case of failure				
P-0-0034	Device warnings status word		x	x	x
P-0-0039	Device Error-ID (low word) and Error-Location (high word)		x	x	x
P-0-0040	Reset firmware			x	x
P-0-0041	Reset firmware and activate loader			x	x
P-0-0050	ID hardware print		x	x	x
P-0-0051	Sub-ID hardware print		x	x	x
P-0-0052	ID hardware option on X11		x	x	x
P-0-0053	ID hardware option on X12		x	x	x
P-0-0054	ID hardware CPLD		x	x	x
P-0-0055	Chip and redesign tracing identification		x	x	x
P-0-0060	ID software option on X12		x	x	x
P-0-0080	Bootloader information, version and checksum		x	x	x
P-0-0081	Checksum of firmware in flash		x	x	x
P-0-0100	Function of digital input ENPO			x	x
P-0-0101	Function of digital input ISD00			x	x
P-0-0102	Function of digital input ISD01			x	x
P-0-0103	Function of digital input ISD02			x	x
P-0-0104	Function of digital input ISD03			x	x
P-0-0105	Function of digital input ISD04			x	x
P-0-0106	Function of digital input ISD05			x	x
P-0-0107	Function of digital input ISD06			x	x
P-0-0108	Function of digital input ISDSH			x	x
P-0-0109	Function of analog input ISA00			x	x

Table 10.2 List of supported SERCOS parameters

IDN	Description	Unit	Write protection		
			CP2	CP3	CP4
P-0-0110	Function of analog input ISA01			x	x
P-0-0118	Digital inputs: Filter time	ms		x	x
P-0-0120	Input inversion: ENPO[0], ISD00..05[1..6], SH[7], ISD06[16]			x	x
P-0-0121	States of digital inputs		x	x	x
P-0-0122	Function of digital output OSD00			x	x
P-0-0123	Function of digital output OSD01			x	x
P-0-0124	Function of digital output OSD02			x	x
P-0-0125	Function of motor break (X13)			x	x
P-0-0126	Function of digital output RELOUT1			x	x
P-0-0127	Function of dig. output RELOUT2 is fixed on ‚Safety Hold'		x	x	x
P-0-0141	Control value of dig. outputs via COM access				
P-0-0142	Output inversion OSD0/1/2(0/1/2), MBRK(6), REL1/2(7/15)			x	x
P-0-0143	States of digital outputs		x	x	x
P-0-0144	DriveCom: Auto start of system				
P-0-0145	DriveCom: Quick stop check in shut down command				
P-0-0146	DriveCom: Quick stop check in ‚ReadyToSwitchOn'				
P-0-0147	DriveCom: Check EnablePower (= false for ENPO over ENMO)				
P-0-0148	DriveCom: Timeout in ‚RdyToSwitchOn' to enable motor switch	ms			
P-0-0149	DriveCom: Start initialization of system parameter				
P-0-0152	DriveCom actual state description		x	x	x
P-0-0153	DrvCom fault reset command				
P-0-0154	DriveCom: Timeout motor standstill	ms			
P-0-0159	Motion control selection				
P-0-0165	Motion profile selection				
P-0-0166	Motion profile jerk time	ms			
P-0-0167	Motion profile speed override factor	%			

Table 10.2 List of supported SERCOS parameters

IDN	Description	Unit	Write protection		
			CP2	CP3	CP4
P-0-0168	Motion profile jogging speeds				
P-0-0213	Motor brake lift time	ms			
P-0-0214	Motor brake close time	ms			
P-0-0215	Motor brake: torque rise time	ms			
P-0-0216	Motor brake: torque fade time	ms			
P-0-0217	Motor brake: factor for application of last torque	%			
P-0-0218	Motor brake: constant initial torque	Nm			
P-0-0219	Motor brake: torque sampled at last closing time	Nm	x	x	x
P-0-0220	lock brake				
P-0-0239	Functional states of digital inputs		x	x	x
P-0-0283	Factor group: Type selection CiA402(0), SERCOS(1), USER(2)			x	x
P-0-0284	Unit for position values			x	x
P-0-0287	Unit for speed values			x	x
P-0-0290	Unit for acceleration and deceleration values			x	x
P-0-0293	Unit for torque values			x	x
P-0-0300	Select control mode				
P-0-0301	Mode selection of setpoint profiling				
P-0-0302	Switching frequency			x	x
P-0-0303	Current control sampling time	ms	x	x	x
P-0-0304	Speed control sampling time	ms	x	x	x
P-0-0305	Position control sampling time	ms	x	x	x
P-0-0306	Sampling time for interpolation	ms	x	x	x
P-0-0307	Voltage supply mode (must be set correctly!)			x	x
P-0-0310	Current control gain	V/A			
P-0-0311	Current control integration time constant	ms			
P-0-0312	Actual motor voltage (rms, phase to phase)	V	x	x	x
P-0-0313	VF control, boost voltage at zero frequency	V			
P-0-0314	VF control, nominal frequency	Hz			

Table 10.2 List of supported SERCOS parameters

IDN	Description	Unit	Write protection		
			CP2	CP3	CP4
P-0-0315	VF control, voltage at nominal frequency	V			
P-0-0320	Speed control gain	Nm/rpm			
P-0-0321	Speed control integration time constant	ms			
P-0-0322	Speed control gain scaling factor	%			
P-0-0323	Advanced control structure gains				
P-0-0324	Advanced control structure filtering				
P-0-0325	Filter frequencies of digital filter	Hz		x	x
P-0-0326	Digital filter design assistant				
P-0-0327	Coefficients of digital filter				
P-0-0328	Speed control maximum speed	%			
P-0-0329	Motor torque scaling of limits	%			
P-0-0330	Motor torque scaling of negative limit	%			
P-0-0331	Motor torque scaling of positive limit	%			
P-0-0332	Motor torque scaling (online factor)	%			
P-0-0333	Motor speed scaling of negative limit	%			
P-0-0334	Motor speed scaling of positive limit	%			
P-0-0335	Direction lock for speed reference value				
P-0-0336	Adaptation of speed control gain @ zero speed			x	x
P-0-0337	Motor speed scaling	%			
P-0-0340	Magnetization current (r.m.s)	A			
P-0-0341	Speed where field-weakening starts; forces 1/n-character	%			
P-0-0342	Speed values for mag. current scaling	%			
P-0-0343	Mag. current scaling vs. speed	%			
P-0-0344	Voltage control filter time constant	ms			
P-0-0345	Voltage control gain	A/V			
P-0-0346	Voltage control integration time constant	ms			
P-0-0347	Voltage control reference (scaling of max. voltage)	%			
P-0-0348	Slip control gain for field weakening				
P-0-0349	Comutation offset of resp. encoder	deg			

Table 10.2 List of supported SERCOS parameters

IDN	Description	Unit	Write protection		
			CP2	CP3	CP4
P-0-0350	Selection of speed calculation method				
P-0-0351	Actual speed calculation filter time	ms			
P-0-0352	Observer parameter (meaning depends on CON_SCALC)				
P-0-0353	Observer design parameters	ms			
P-0-0354	Observer design assistant				
P-0-0360	Position control gain	1/min			
P-0-0370	Interpolation type control word				
P-0-0371	Speed reference filter time for speed control mode	ms			
P-0-0372	Speed feedforward filter time for position control	ms			
P-0-0374	Position delay in position control cycles (CON_PConTS)	ms			
P-0-0375	Speed feedforward scaling factor	%			
P-0-0376	Torque/Force feedforward scaling factor	%			
P-0-0377	Feedforward signals enabled		x	x	x
P-0-0379	Feedforward calculation mode				
P-0-0386	Friction compensation scaling factor	%			
P-0-0400	Additional d-current reference value	A			
P-0-0401	Additional torque/force reference value	Nm (N)			
P-0-0402	Additional speed reference value without ramp	1/min			
P-0-0404	Additional speed reference value with ramp	1/min			
P-0-0405	Analog input 0, filter time	ms			
P-0-0406	Analog input 1, filter time	ms			
P-0-0407	Analog input values, filtered, +10V gives 1.0				
P-0-0409	DC voltage filter time	ms		x	x
P-0-0410	Actual DC link voltage	V	x	x	x
P-0-0411	Actual values of ADC channels	bit	x	x	x
P-0-0412	Actual position	incr	x	x	x
P-0-0413	Reference position	incr	x	x	x
P-0-0414	Actual position diffence (RefPosition-ActPosition)	incr	x	x	x
P-0-0415	Actual speed	1/min	x	x	x

Table 10.2 List of supported SERCOS parameters

IDN	Description	Unit	Write protection		
			CP2	CP3	CP4
P-0-0416	Reference speed	1/min	x	x	x
P-0-0417	Actual speed difference (RefSpeed-ActSpeed)	1/min	x	x	x
P-0-0418	Reference torque	Nm	x	x	x
P-0-0419	Actual torque	Nm	x	x	x
P-0-0430	Weighting of voltage path in field model				
P-0-0431	Voltage limit for current drives	%			
P-0-0432	Select current control / limitation mode				
P-0-0450	Motor type			x	x
P-0-0455	Motor rated frequency	Hz		x	x
P-0-0456	Motor rated voltage	V		x	x
P-0-0457	Motor rated current	A		x	x
P-0-0458	Motor rated speed	rpm		x	x
P-0-0459	Motor rated power	kW		x	x
P-0-0460	Motor rated torque	Nm		x	x
P-0-0461	Motor inertia	kg m*m		x	x
P-0-0462	Motor rated flux	Vs		x	x
P-0-0463	Motor number of pole pairs			x	x
P-0-0470	Motor stator resistance	Ohm		x	x
P-0-0471	Motor stray/stator inductance	mH		x	x
P-0-0472	Q-stator inductance variation in % of MOT_Lsig	%		x	x
P-0-0473	Main inductancs vs. Isd (0,1*Index*LmagIdMax)	mH		x	x
P-0-0474	LmagTable: max. magnetization current (eff.)	A		x	x
P-0-0475	Motor main inductance, scaling factor	%		x	x
P-0-0476	Motor rotor resistance	Ohm		x	x
P-0-0477	Motor rotor resistance, scaling factor	%		x	x
P-0-0500	ENC CH1: Actual value: SingleTurn[0], MultiTurn[1]		x	x	x
P-0-0501	ENC CH2: Actual value: SingleTurn[0], MultiTurn[1]		x	x	x
P-0-0502	ENC CH3: Actual value: SingleTurn[0], MultiTurn[1]		x	x	x
P-0-0505	ENC CH1: Encoder type selection			x	x

Table 10.2 List of supported SERCOS parameters

IDN	Description	Unit	Write protection		
			CP2	CP3	CP4
P-0-0506	ENC CH2: Encoder type selection			x	x
P-0-0507	ENC CH3: Encoder type selection			x	x
P-0-0510	ENC CH1: Gear nominator			x	x
P-0-0511	ENC CH1: Gear denominator			x	x
P-0-0512	ENC CH2: Gear nominator			x	x
P-0-0513	ENC CH2: Gear denominator			x	x
P-0-0514	ENC CH3: Gear nominator			x	x
P-0-0515	ENC CH3: Gear denominator			x	x
P-0-0520	ENC: Channel selection for motor commutation			x	x
P-0-0521	ENC: Channel selection for speed control			x	x
P-0-0522	ENC: Channel selection for position control			x	x
P-0-0523	ENC: Channel selection for master input			x	x
P-0-0530	ENC: Channel selection as SERCOS encoder 1			x	x
P-0-0531	ENC: Channel selection as SERCOS encoder 2			x	x
P-0-0540	ENC CH1: Absolute position interface selection			x	x
P-0-0541	ENC CH1: Index pulse signal (test mode)			x	x
P-0-0542	ENC CH1: Number of lines (SinCos / TTL encoders)			x	x
P-0-0543	ENC CH1: Number of MultiTurn bits (SSI absolute)			x	x
P-0-0544	ENC CH1: Number of SingleTurn bits (SSI absolute)			x	x
P-0-0545	ENC CH1: Code selection (SSI absolute position interface)			x	x
P-0-0546	ENC CH1: Mode selection (SSI absolute position interface)			x	x
P-0-0547	ENC CH1: Lowest allowable MultiTurn position (SSI absolute)			x	x
P-0-0548	ENC CH1: Enable MultiTurn information (SSI absolute)			x	x
P-0-0549	ENC CH1: Signal correction type			x	x
P-0-0550	ENC CH1: Signal correction values			x	x
P-0-0551	ENC CH1: Encoder observation minimum, sqrt(a^2 + b^2)			x	x
P-0-0552	ENC CH1: Error and status codes of absolute encoders		x	x	x
P-0-0553	ENC CH1: Length of an analog signal period (linear SinCos)	nm		x	x

Table 10.2 List of supported SERCOS parameters

IDN	Description	Unit	Write protection		
			CP2	CP3	CP4
P-0-0554	ENC CH1: Length of an digital increment (linear absolute)	nm		x	x
P-0-0560	ENC CH2: Number of pole pairs (Resolver)			x	x
P-0-0561	ENC CH2: Signal correction type			x	x
P-0-0562	ENC CH2: Signal correction values			x	x
P-0-0563	ENC CH2: Encoder observation minimum, sqrt(a^2 + b^2)			x	x
P-0-0570	ENC CH3: Absolute position interface selection			x	x
P-0-0571	ENC CH3: Index pulse signal (test mode)			x	x
P-0-0572	ENC CH3: Number of lines (SinCos / TTL encoders)			x	x
P-0-0573	ENC CH3: Number of MultiTurn bits (SSI absolute)			x	x
P-0-0574	ENC CH3: Number of SingleTurn bits (SSI absolute)			x	x
P-0-0575	ENC CH3:Code selection (SSI absolute position interface)			x	x
P-0-0577	ENC CH3: Encoder observation minimum, sqrt(a^2 + b^2)			x	x
P-0-0590	ENC: Axis correction, selection type			x	x
P-0-0591	ENC: Axis correction, start position			x	x
P-0-0592	ENC: Axis correction, end position			x	x
P-0-0593	ENC: Axis correction, delta position			x	x
P-0-0594	ENC: Axis correction, actual position value			x	x
P-0-0595	ENC: Axis correction, position table for negative speed			x	x
P-0-0596	ENC: Axis correction, position table for positive speed			x	x
P-0-0610	ENC CH1: Nominal increment of reference marks	Signal per.		x	x
P-0-0630	ENC CH3: Nominal increment of reference marks	Signal per.		x	x
P-0-0742	Monitoring maximum position difference	POS			
P-0-0744	Monitoring speed difference threshold	rpm			
P-0-1500	Test signal generator: control word				
P-0-1501	Test signal generator: output signal selector				
P-0-1502	Test signal generator: number of cycles				
P-0-1503	Test signal generator: offsets for rectangular wave	var			
P-0-1504	Test signal generator: times for rectangular waves	s			

Table 10.2 List of supported SERCOS parameters

IDN	Description	Unit	Write protection		
			CP2	CP3	CP4
P-0-1505	Test signal generator: amplitude of sinusoidal wave	var			
P-0-1506	Test signal generator: frequency of sinusoidal wave	Hz			
P-0-1507	Test signal gen.: Initial phase for rotating current vector	degree			
P-0-1508	Test signal generator: PRBS minimum toggle time	ms			
P-0-1509	Test signal generator: PRBS signal amplitude	var			
P-0-1515	Speed and position control dynamic (stiffness)	%			
P-0-1516	Total inertia of motor and plant	kg m*m			
P-0-1517	Autotuning for Jsum estimation, control word				
P-0-1518	Autotuning Jsum, hysteresis speed control, speed limit	rpm			
P-0-1519	Autotuning for Jsum, speed hysteresis control, torque limit	Nm (N)			
P-0-1520	Autotuning, parameters for control and results				
P-0-1521	Mechanical system parameters	Hz			
P-0-1522	Self commissioning and correlation results				
P-0-1530	Determination of default motor control settings				
P-0-1531	Self-commissioning action selection				
P-0-2218	605AH CiA402 quickstop option code				
P-0-2219	605BH CiA402 shutdown option code				
P-0-2220	605CH CiA402 disable operation option code				
P-0-2221	605DH CiA402 halt option code				
P-0-2222	605EH CiA402 fault reaction option code				
P-0-2261	6098H CiA402 homing method				
P-0-3000	Sercos Address				
P-0-3001	IDN list with logon errors at sercos parameter manager		x	x	x
P-0-3002	IDN list of all data with real time status support		x	x	x
P-0-3003	IDN list of all data with real time control support		x	x	x
P-0-3004	Maximum transmission power				
P-0-3005	Speed acceleration	ACC			
P-0-3006	Speed deceleration	ACC			
P-0-3007	Actual value of I2t integrator for motor protection	%	x	x	x

Table 10.2 List of supported SERCOS parameters

IDN	Description	Unit	Write protection		
			CP2	CP3	CP4
P-0-3030	Drive controlled homing offset procedure command				
P-0-3031	Homing velocity in search of index pulse	SPEED			
P-0-3054	Gain external feed-forward signals			x	x
P-0-3055	External speed feed-forward signal	Psca-le/2^16			
P-0-3056	External acceleration feed-forward signal	Psca-le/2^16			
P-0-3100	Expanded position command value for Pico-Interpolation				

Table 10.2 List of supported SERCOS parameters

Index

P

R

S

T

V

W

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