



Pack Profile Specification

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Pack Profile for SERCOS interface

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1 Structure of Pack Profile

The Pack Profile for SERCOS interface is intended to improve the interoperability between drives and motion control for PC- and Control unit-based architectures. Interoperability is understood as a possibility to use drives (amplifier & motors) from different suppliers on a supplier-independent motion control unit.

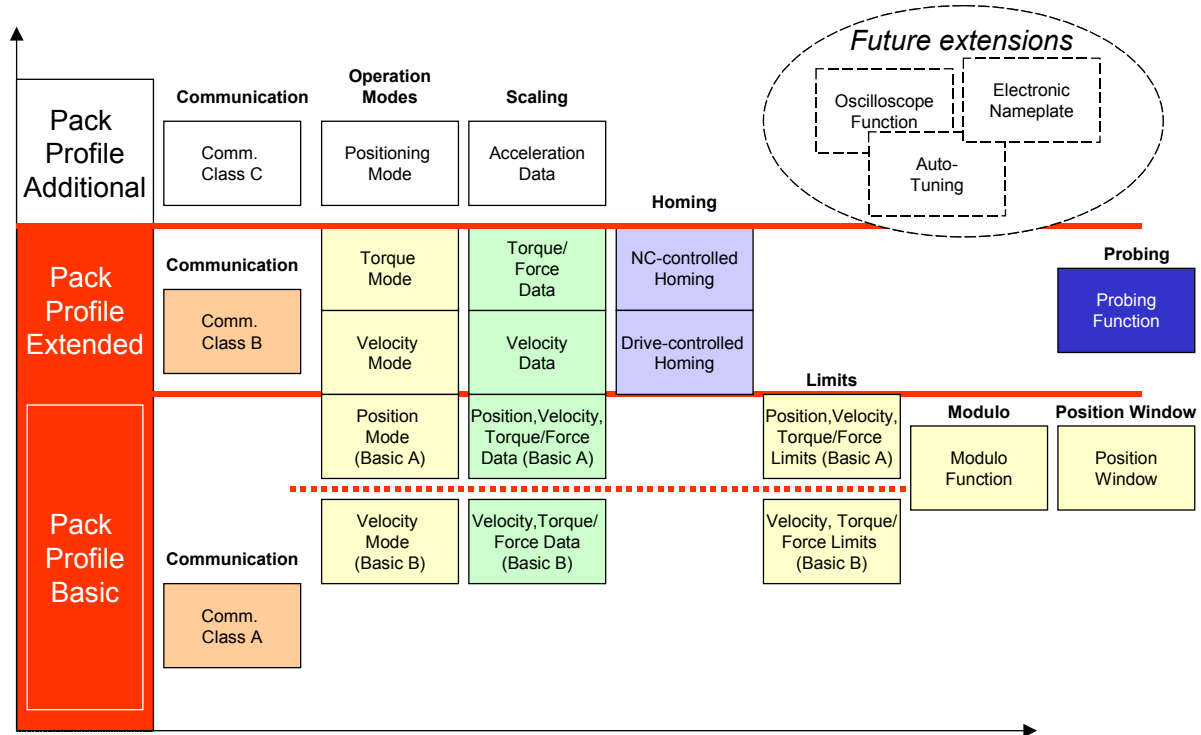


Figure 1 : Structure of Pack Profile

This document is intended as a supplement to the released SERCOS specification, not a replacement to that document. Therefore, it does NOT define the individual IDNs in detail, or even the read/write characteristics of the IDNs. It merely identifies and describes the function groups and IDNs that are required for compliance to the Pack Profile for SERCOS interface.

A profile consists of several mandatory function groups that consist of mandatory and optional parameters. The function groups will be part of the future release of the SERCOS specification. The Pack Profile only specifies the mandatory parameters.

For each function group, there is a list of IDNs, which includes the IDN number and description, a capability field and an additional comment. The capability field is defined as follows:

Capability	Comments
R = Read	The slave must, as a minimum, support the IDN for read-only purposes by the master. This does NOT necessarily mean that the IDN should be read only.
W = Write	The slave must allow the master to write to this value. Read capability is assumed.

1.1 General rules

- (1) A drive **is compliant to** a certain profile, if it provides all mandatory IDNs as defined in the profile specification and the corresponding drive function according to the released SERCOS specification. These IDNs **can** be used by a control unit.
- (2) A control unit **is compliant to** a certain profile, if it is able to handle a drive (slave) by using those IDNs that are mandatory for the pack profile. Nevertheless, the control unit may use intelligent strategies to determine if the drive supports other functions that are compliant to the released SERCOS specification. If the control unit accesses an IDN in the drive and no error occurs, the control unit can rely on the related function as described by the released SERCOS specification. If this attempt fails the control unit has to switch back to the mandatory parameters that it can rely on in order to maintain the interoperability. The responsibility to maintain the interoperability after using not mandatory parameters lies with the control unit.
If a drive and a control unit support a matching set of parameters that are not mandatory in the profile the configuration is compliant with the released SERCOS specification but the functional interoperability is not covered by the related Pack Profile.
- (3) There are parameters that will have a limited value range or even only one value that is allowed. Although this implies a default behavior the control unit has to write these values if the control unit uses a function that relies on the parameter and its mandatory value.
This will allow drives to have the wider functional range according to the “Pack Profile Extended” but to support the “Pack Profile Basic” with more restrictive value ranges, as well.
- (4) Some parameters have a mandatory value. These are parameter values that the drive and the control unit have to support in order to be compliant. Nevertheless, the control unit may use intelligent strategies to determine if the drive supports other behaviors that are compliant to the released SERCOS specification. If this attempt fails the control unit has to switch back to the mandatory values that it can rely on in order to maintain the interoperability. The responsibility to maintain the interoperability after using not mandatory values lies with the control unit.
- (5) In order to allow an efficient diagnosis, the controller should stop configuration if a drive does not support a mandatory parameter and generate an error. On the other hand, a controller shall continue configuration if a drive does not support non-mandatory parameters.
To detect if a drive supports special devices like a second registration input or absolute encoders, the controller can write the respective IDNs. If an error occurs, this shall not lead to configuration interruption.

2 Communication Classes

The communication is subdivided in 3 classes.

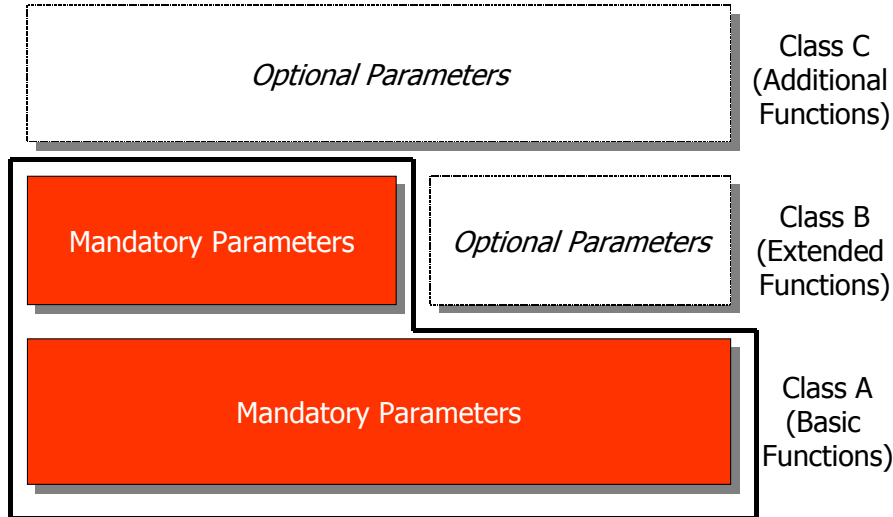


Figure 2 : Structure of Communication Classes

The Pack Profile describes the mandatory parameters only.

2.1 Communication Class A (Basic Functions)

Communication Class A includes the following basic communication-related functions:

- Ring Configuration
 - Timing
 - Standard Telegram
 - Phase run-up
- Service Channel Protocol
- Information & Diagnostics
- Status Word (RTChannel)
- Control Word (RTChannel)

FG 1A	Ring Configuration : Timing		
IDN	Description	Capability	Comments
S-0-0001	Control unit cycle time (t_{Ncyc})	W	If the control unit uses a value different from S-0-0002, this must be supported, as must the Control Unit Synchronization Bit (control word, bit 10)
S-0-0002	Communication cycle time (t_{Scyc})	W	
S-0-0003	Shortest AT transmission starting time (t_{1min})	R	
S-0-0004	Transmit/receive transition time (t_{ATMT})	R	
S-0-0005	Minimum feedback processing time (t_5)	R	

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S-0-0006	AT transmission starting time (t_1)	W	
S-0-0007	Feedback acquisition capture point (t_4)	W	
S-0-0008	Command value valid time (t_3)	W	
S-0-0087	Transmit to transmit recovery time (t_{ATAT})	R	This parameter must be provided even the slave does not support multiple devices. If the slave doesn't support multiple devices this parameter is set to "0".
S-0-0088	Receive to receive recovery time (t_{MTSY})	R	
S-0-0089	MDT transmission starting time (t_2)	W	
S-0-0090	Command value proceeding time (t_{MTSG})	R	
S-0-0096	Slave arrangement (SLKN)	R	

FG 1B	Ring Configuration : Telegram Configuration		
IDN	Description	Capability	Comments
S-0-0009	Position of data record in MDT	W	
S-0-0010	Length of MDT	W	
S-0-0015	Telegram type	W	Standard telegrams only

FG 1C	Ring Configuration : Phase run-up		
IDN	Description	Capability	Comments
S-0-0021	IDN-list of invalid operation data for CP2	R	
S-0-0022	IDN-list of invalid operation data for CP3	R	
S-0-0028	MST error counter	R	
S-0-0029	MDT error counter	R	
S-0-0127	CP3 transition check	W	
S-0-0128	CP4 transition check	W	
RTChannel	Procedure command change	R	Status word, bit 5

FG 1F	Service channel protocol		
IDN	Description	Capability	Comments
RTChannel	Service Channel AT	R	Status word, bit 0..2
RTChannel	Service Channel MDT	W	Control word, bit 0..5

FG 2	Information & Diagnostics		
IDN	Description	Capability	Comments

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S-0-0011	Class 1 diagnostic	R	Bit 12 for communication required only. Other bits defined by functional description of the profiles.
S-0-0012	Class 2 diagnostic	R	required for function part of the profiles
S-0-0013	Class 3 diagnostic	R	required for function part of the profiles
S-0-0014	Interface status	R	Bits 0..8 for communication required only.
S-0-0017	IDN-list of all operation data	R	
S-0-0025	IDN-list of all procedure commands	R	
S-0-0028	MST error counter	R	
S-0-0029	MDT error counter	R	
S-0-0030	Manufacturer version	R	
S-0-0095	Diagnostic message	R	
S-0-0096	Slave arrangement (SLKN)	R	
S-0-0099	Reset class 1 diagnostic	W	
S-0-0134	Master control word	R	
S-0-0135	Drive status word	R	
S-0-0143	SERCOS interface version	R	
RTChannel	Drive shut down error	R	Status word, bit 13

The **baud rates** and **cycle times** to be supported are defined by the detailed descriptions of the different profiles.

Remark: The scanning of baudrates by the master should be deactivated as this may interfere with the automatic baudrate recognition by the drive which is an optional feature (communication class C).

In order to avoid interoperability conflicts during startup of a SERCOS ring the Pack Profile specifies the behavior of parameter handling in CP2 and CP3 in a more restrictive way than the released SERCOS specification does:

The following IDNs have to be written by the control unit in CP2. The control unit can not rely on defaults or previously stored parameters.

The drive has to accept these parameters in CP 2.

The control unit may or may not write additional parameters in CP2.

The drive has to accept all other parameters in CP3, as well.

IDN write access in CP2:

IDN	Name	Access	Comment
S-0-0001	Control unit cycle time (t_{Ncyc})	CP2-W	Ring Timing
S-0-0002	Communication cycle time (t_{Scyc})	CP2-W	Ring Timing
S-0-0006	AT transmission starting time (t_1)	CP2-W	Ring Timing

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S-0-0007	Feedback acquisition capture point (t_4)	CP2-W	Ring Timing
S-0-0008	Command value valid time (t_3)	CP2-W	Ring Timing
S-0-0009	Position of data record in MDT	CP2-W	Telegram Configuration
S-0-0015	Telegram type	CP2-W	Telegram Configuration
S-0-0089	MDT transmission starting time (t_2)	CP2-W	Ring Timing
S-0-0127	CP3 transition check	CP2-W	Phase switch

The parameter list S-0-0021 “IDN-list of invalid operation data for CP2” will only reflect parameters from this table.

2.2 Communication Class B (Extended Functions)

Communication Class B includes

- Communication Class A with the following basic communication-related functions (see chapter 2.1):
 - Ring Configuration (Timing, Standard Telegram, Phase run-up)
 - Service Channel Protocol
 - Information & Diagnostics
 - Status Word (Real-time Channel)
 - Control Word (Real-time Channel)
- and the following extended communication functions:
 - Ring Configuration (Telegram 7)
 - Extended Information & Diagnostics
 - Real-time Control Bits
 - Real-time Status Bits

FG 1B	Ring Configuration : Telegram Configuration		
IDN	Description	Capability	Comments
S-0-0016	Configuration list of AT	W	
S-0-0024	Configuration list of MDT	W	
S-0-0185	Length of the configurable data record in the AT	R	
S-0-0186	Length of the configurable data record in the MDT	R	
S-0-0187	IDN-list of configurable data in the AT	R	
S-0-0188	IDN-list of configurable data in the MDT	R	

FG 2A	Information & Diagnostics		
IDN	Description	Capability	Comments
S-0-0097	Mask class 2 diagnostic	W	
S-0-0098	Mask class 3 diagnostic	W	

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FG 12A	Real-time Control Bits		
IDN	Description	Capability	Comments
S-0-0300	Real-time control bit 1	R	
S-0-0301	Allocation of real-time control bit 1	W	
S-0-0302	Real-time control bit 2	R	
S-0-0303	Allocation of real-time control bit 2	W	

FG 12B	Real-time Status Bits		
IDN	Description	Capability	Comments
S-0-0304	Real-time status bit 1	R	
S-0-0305	Allocation of real-time status bit 1	W	
S-0-0306	Real-time status bit 2	R	
S-0-0307	Allocation of real-time status bit 2	W	

In order to avoid interoperability conflicts during startup of a SERCOS ring the Pack Profile specifies the behavior of parameter handling in CP2 and CP3 in a more restrictive way than the released SERCOS specification does:

The following IDNs **have to** be written by the control unit in CP2. The control unit can not rely on defaults or previously stored parameters. The drive has to accept these parameters in CP 2. The control unit may or may not write additional parameters in CP2. The drive has to accept all other parameters in CP3, as well.

IDN	Name	Access	Comment
S-0-0001	Control unit cycle time (t_{Ncyc})	CP2-W	Ring Timing
S-0-0002	Communication cycle time (t_{Scyc})	CP2-W	Ring Timing
S-0-0006	AT transmission starting time (t_1)	CP2-W	Ring Timing
S-0-0007	Feedback acquisition capture point (t_4)	CP2-W	Ring Timing
S-0-0008	Command value valid time (t_3)	CP2-W	Ring Timing
S-0-0009	Position of data record in MDT	CP2-W	Telegram Configuration
S-0-0015	Telegram type	CP2-W	Telegram Configuration
S-0-0016	Configuration list of AT	CP2-W	Ring Timing
S-0-0024	Configuration list of MDT	CP2-W	Ring Timing
S-0-0089	MDT transmission starting time (t_2)	CP2-W	Ring Timing
S-0-0127	CP3 transition check	CP2-W	Phase switch

The parameter list S-0-0021 "IDN-list of invalid operation data for CP2" will only reflect parameters from this table.

2.3 Communication Class C (Additional Functions)

The communication class C contains

- Communication Class B which includes
 - Communication Class A with the following basic communication-related functions (see chapter 2.1):
 - Ring Configuration (Timing, Standard Telegram, Phase run-up)
 - Service Channel Protocol
 - Information & Diagnostics
 - Status Word (Real-time Channel)
 - Control Word (Real-time Channel)
 - and the following extended communication functions:
 - Ring Configuration (Telegram 7)
 - Extended Information & Diagnostics
 - Real-time Control Bits
 - Real-time Status Bits
- and the following additional optional functions, such as :
 - Automatic Baud Rate Recognition (FG 1D)
 - Physical Order (FG 1E)
 - Configurable Real-time Bits - Signal Control (FG 12C)
 - Configurable Real-time Bits - Signal Status Word (FG 12D)
 - Data Container - Multiplex Channel (FG 13A)
 - Data Container - List Handling via Multiplex Channel (FG 13B)
 - List Handling via Service Channel (FG 14)
 - Expanded Service Channel
 - Firmware up/download
 - File channel

Remark: A description of these optional functions is contained in the released version of the SERCOS specification.

3 Pack Profile Basic

3.1 Pack Profile Basic A

The Pack Profile Basic A is used for positioning servo drives that are connected to a control unit via SERCOS interface. Additional combinations may be supported by the drive according to the SERCOS specification. The control unit can only rely on the mandatory configuration.

The Pack Profile Basic A consists of:

- Communication Class A with the following basic communication-related functions:
 - Ring Configuration (Timing, Standard Telegram, Phase run-up)
 - Service Channel Protocol
 - Information & Diagnostics
 - Status Word (Real-time Channel)
 - Control Word (Real-time Channel)
- Position Mode / Support of standard telegram No. 4
- Position Mode with Modulo Function
- Position Window
- Position, Velocity, Torque/Force Limits
- Preferred scaling for Position, Velocity, Torque/Force Data

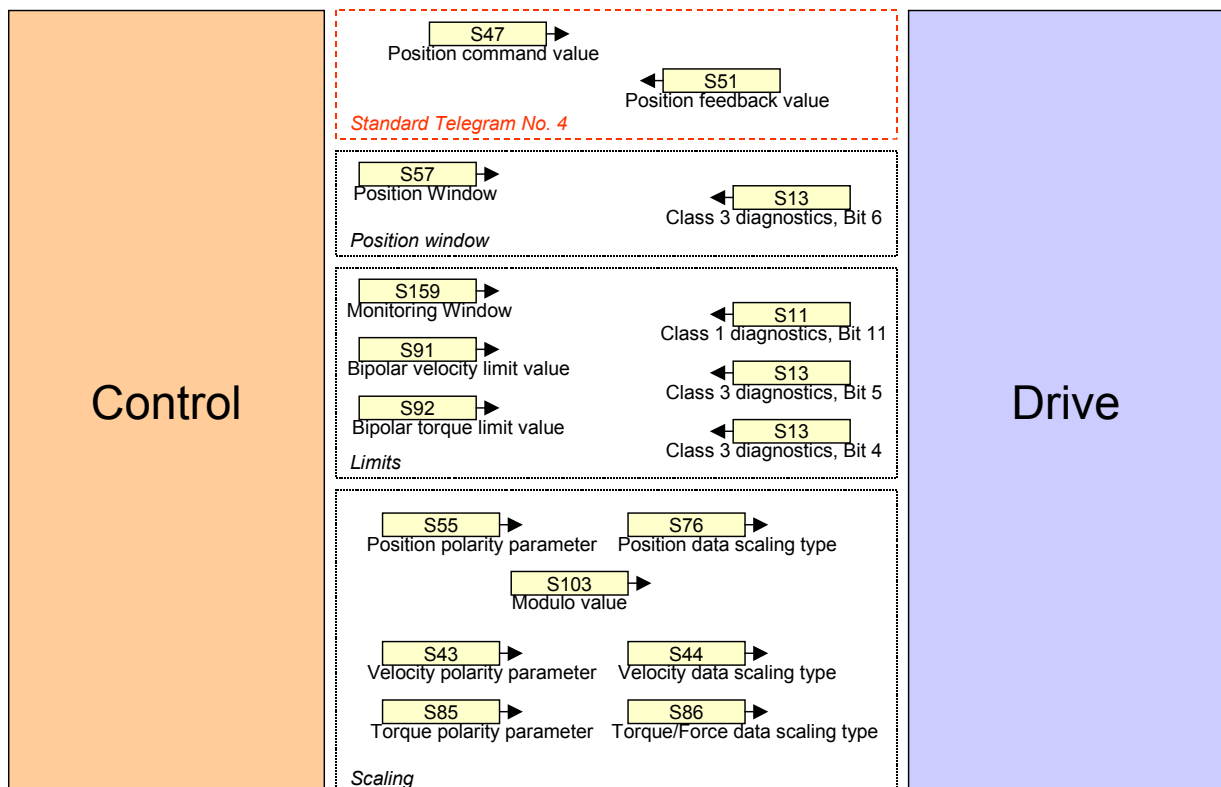


Figure 3 : Overview Pack Profile Basic A

3.1.1 Communication Class A (Basic A)

The drive has to support Communication Class A and the following mandatory communication parameters :

- Cycle Time : 2 msec.
- Baudrate : 4 Mbaud
- Support of standard telegram No. 4

Additional combinations may be supported by the drive according to the SERCOS specification. The control unit can only rely on the mandatory configuration (see rule 4).

3.1.2 Position Mode (Basic A)

The servo drive receives cyclically position command values (S-0-0047) and provides position feedback values (S-0-0051). The position loop is closed by the drive.

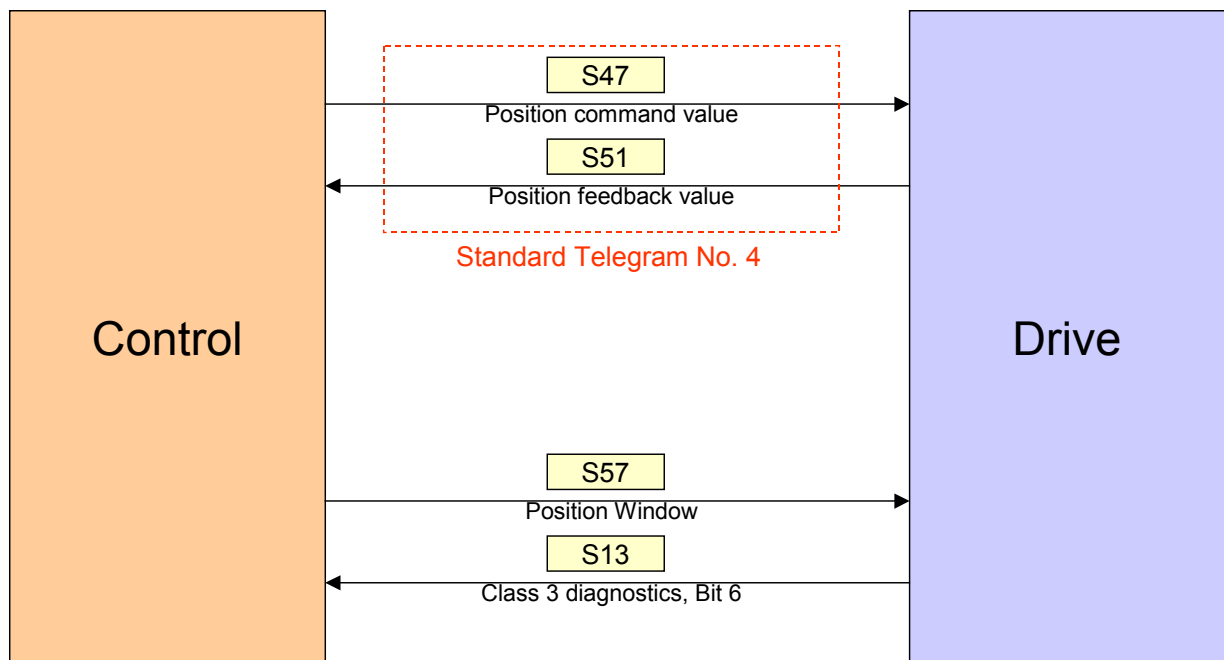


Figure 4 : Position Mode (Pack Profile Basic A)

Remark: The parameters (gains) for the control loops (position, velocity, torque) are currently not defined by the released SERCOS specifications because of too many different implementations. Therefore the Pack Profile can not specify mandatory parameters for this function. These parameters have to be set by a drive-specific tool or by generic interfaces in the control unit that provide random access to parameters within the drive via the SERCOS service channel.

Pack Profile for SERCOS interface

FG 3			
Operation Modes (Basic A)			
IDN	Description	Capability	Comments
S-0-0015	Telegram type	W	Mandatory Bitmask (15-0) : 0000 0000 0000 0100 - Standard telegram 4 - Position feedback value 1 (motor feedback) - configured position feedback value - Length of MDT and AT service channel is 2 Bytes
S-0-0032	Primary operation mode	W	Mandatory Bitmask (15-0) : 0000 0000 0000 0011 - Position control using position feedback value 1 (motor feedback) - Position control with following error - Not a complex operation mode - Cyclic command values - Operation mode defined by SERCOS interface

FG 3C			
Position Mode (Basic A)			
IDN	Description	Capability	Comments
S-0-0047	Position command value	W	
S-0-0051	Position feedback value 1 (Motor feedback)	R	

3.1.3 Position window (Basic A)

FG 16C			
Position window (Basic A)			
IDN	Description	Capability	Comments
S-0-0013	Class 3 Diagnostic	R	Bit 6 mandatory
S-0-0057	Position window	W	

Pack Profile for SERCOS interface

3.1.4 Limits (Basic A)

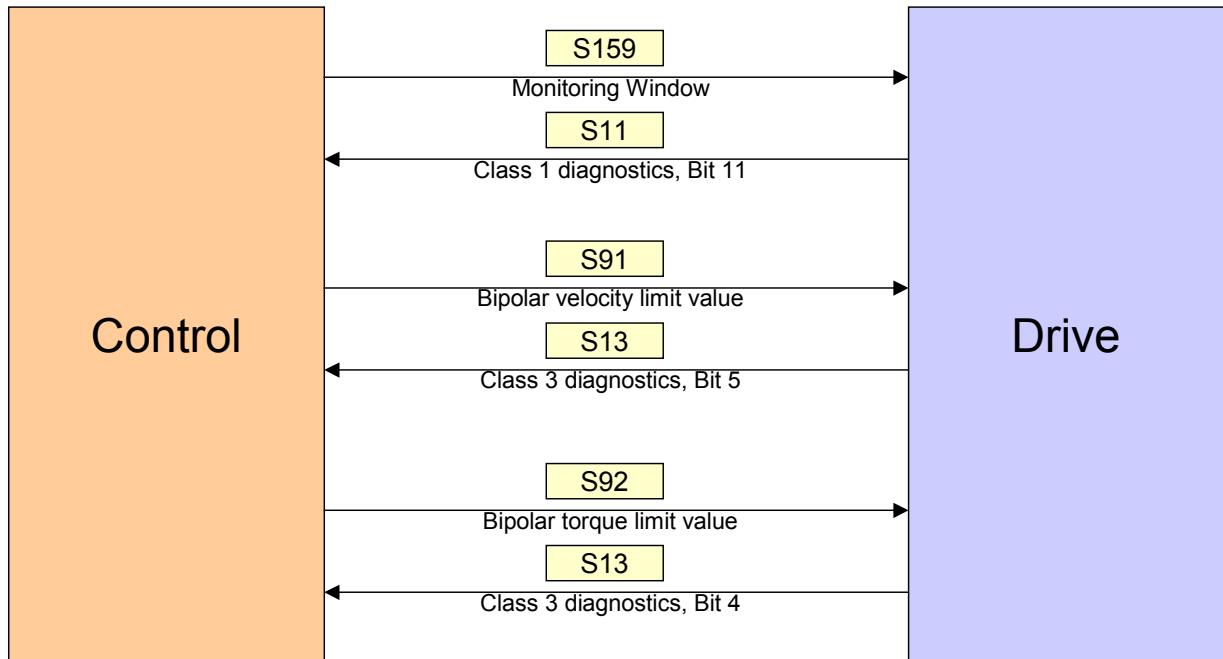


Figure 5 : Limits (Pack Profile Basic A)

FG 17C	Position limits (Basic A)		
IDN	Description	Capability	Comments
S-0-0011	Class 1 diagnostic	R	Bit 11 mandatory
S-0-0159	Monitoring window	W	

FG 17B	Velocity limits (Basic A)		
IDN	Description	Capability	Comments
S-0-0013	Class 3 diagnostic	R	Bit 5 mandatory
S-0-0091	Bipolar velocity limit value	W	

FG 17A	Torque/Force limits (Basic A)		
IDN	Description	Capability	Comments
S-0-0013	Class 3 diagnostic	R	Bit 4 mandatory
S-0-0092	Bipolar torque limit value	W	

Pack Profile for SERCOS interface

3.1.5 Data Scaling (Basic A)

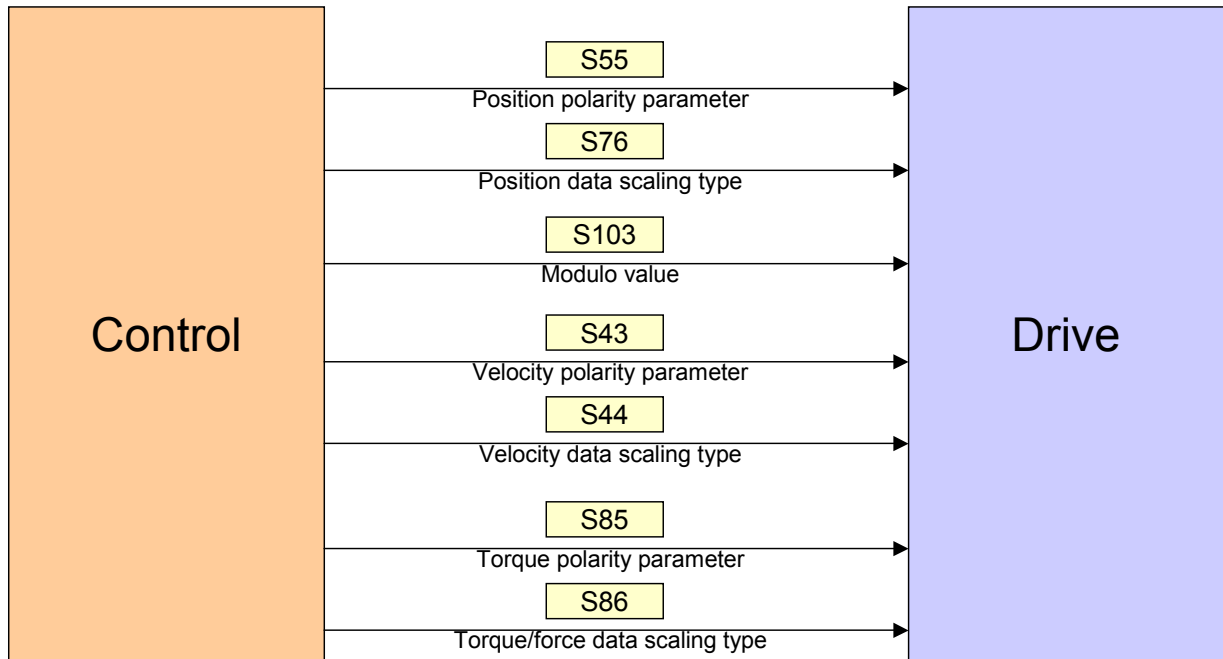


Figure 6 : Data Scaling (Pack Profile Basic A)

FG 4C	Position Data Scaling (Basic A)		
IDN	Description	Capability	Comments
S-0-0055	Position polarity parameter	W	Value=0 mandatory
S-0-0076	Position data scaling type	W	Value=0000 0000 x000 0010 mandatory - rotational scaling - preferred scaling - degrees - at the motor shaft - absolute format (x=0) - modulo format (x=1)
S-0-0103	Modulo value	W	

FG 4B	Velocity Data Scaling (Basic A)		
IDN	Description	Capability	Comments
S-0-0043	Velocity polarity parameter	W	Value=0 mandatory

Pack Profile for SERCOS interface

S-0-0044	Velocity data scaling type	W	Value=0000 0000 0000 0010 mandatory - rotational scaling - preferred scaling - revolutions - minutes - at the motor shaft
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FG 4A	Torque/Force Data Scaling (Basic A)		
IDN	Description	Capability	Comments
S-0-0085	Torque polarity parameter	W	Value=0 mandatory
S-0-0086	Torque/force data scaling type	W	Value=0 mandatory - percentage scaling - preferred scaling - at the motor shaft

3.2 Pack Profile Basic B

The Pack Profile Basic B supports the velocity control operation mode in the drive. If the position loop is to be closed in the control unit a feedback can be connected to the control unit. However, this is not part of this document.

Remark: The parameters (gains) for the control loops (position, velocity, torque) are currently not defined by the released SERCOS specifications because of too many different implementations. Therefore the Pack Profile can not specify mandatory parameters for this function. These parameters have to be set by a drive-specific tool or by generic interfaces in the control unit that can access random parameters within the drive via the SERCOS service channel.

The Pack Profile Basic B consists of:

- Communication Class A with the following basic communication-related functions:
 - Ring Configuration (Timing, Standard Telegram, Phase run-up)
 - Service Channel Protocol
 - Information & Diagnostics
 - Status Word (Real-time Channel)
 - Control Word (Real-time Channel)
- Velocity Mode / Support of standard telegram No. 6
- Velocity, Torque/Force Limits
- Data Scaling for Velocity, Torque/Force Data

Pack Profile for SERCOS interface

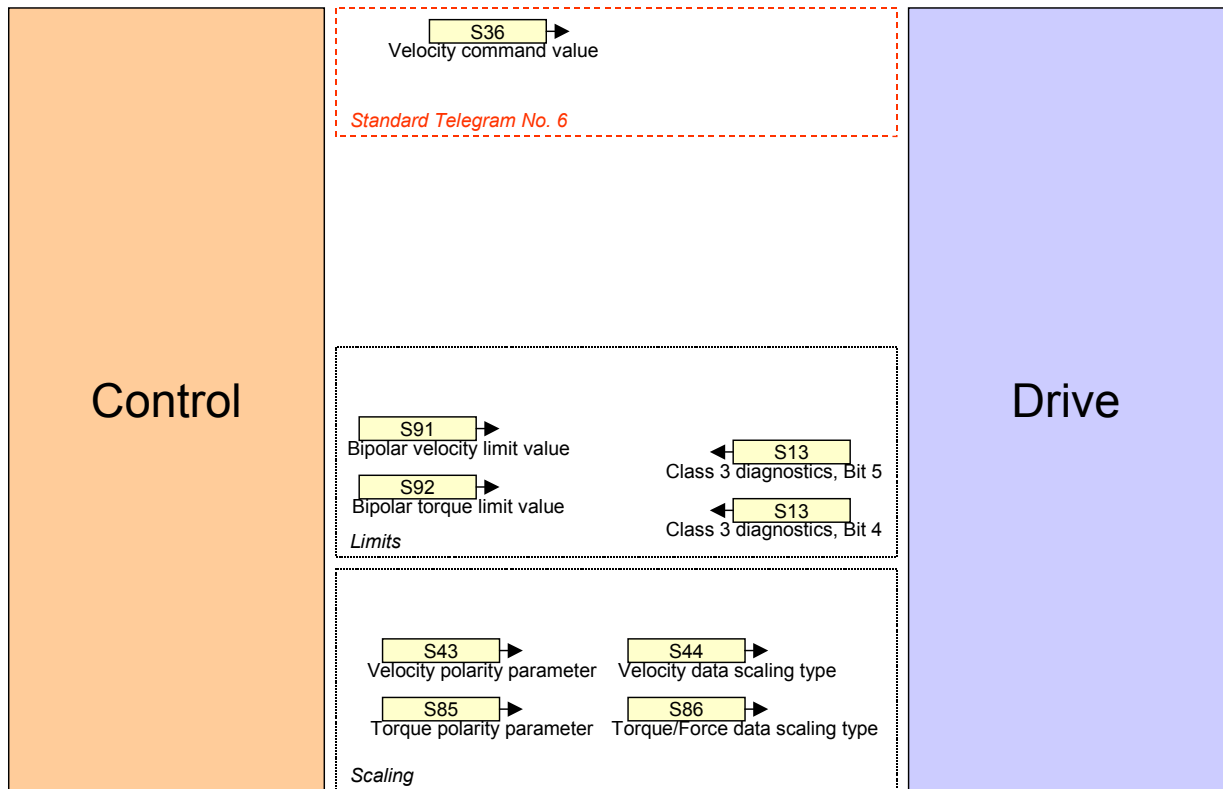


Figure 7 : Overview Pack Profile Basic B

3.2.1 Communication Class A (Basic B)

The drive has to support Communication Class A and the following mandatory communication parameters :

- Cycle Time : 2 msec.
- Baudrate : 4 Mbaud
- Support of standard telegram No. 6

Additional combinations may be supported by the drive according to the SERCOS specification. The control unit can only rely on the mandatory configuration (see rule 4).

3.2.2 Velocity Mode (Basic B)

The servo drives receives cyclically velocity command values (S-0-0036) in an open loop mode.

Pack Profile for SERCOS interface

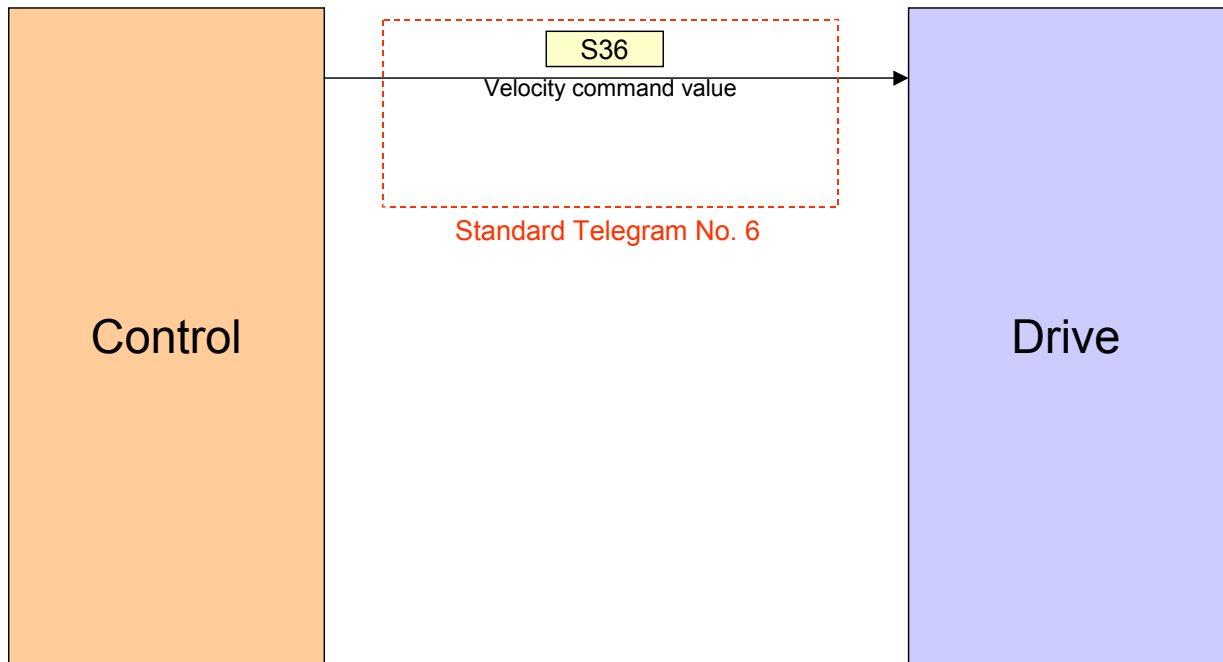


Figure 8 : Velocity Mode, Open Loop (Pack Profile Basic B)

FG 3	Operation Modes (Basic B)		
IDN	Description	Capability	Comments
S-0-0015	Telegram type	W	Mandatory Bitmask (15-0) : 0000 0000 0000 0110 - Standard telegram 6 - Length of MDT and AT service channel is 2 Bytes
S-0-0032	Primary operation mode	W	- Mandatory Bitmask (15-0) : 0000 0000 0000 0010 - Velocity control - Not a complex operation mode - Cyclic command values Operation mode defined by SERCOS interface

FG 3B	Velocity Mode (Basic B)		
IDN	Description	Capability	Comments
S-0-0036	Velocity command value	W	

3.2.3 Limits (Basic B)

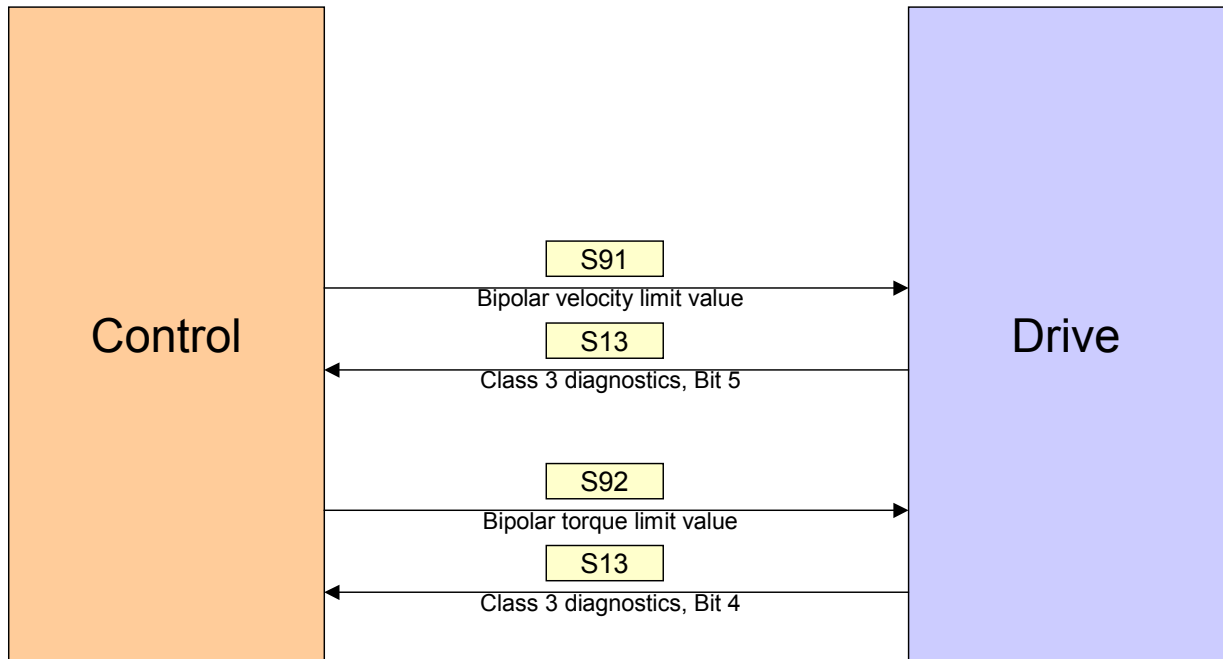


Figure 9 : Limits (Pack Profile Basic B)

FG 17B	Velocity limits (Basic B)		
IDN	Description	Capability	Comments
S-0-0013	Class 3 diagnostic	R	Bit 5 mandatory
S-0-0091	Bipolar velocity limit value	W	

FG 17A	Torque/Force limits (Basic B)		
IDN	Description	Capability	Comments
S-0-0013	Class 3 diagnostic	R	Bit 4 mandatory
S-0-0092	Bipolar torque limit value	W	

3.2.4 Data Scaling (Basic B)

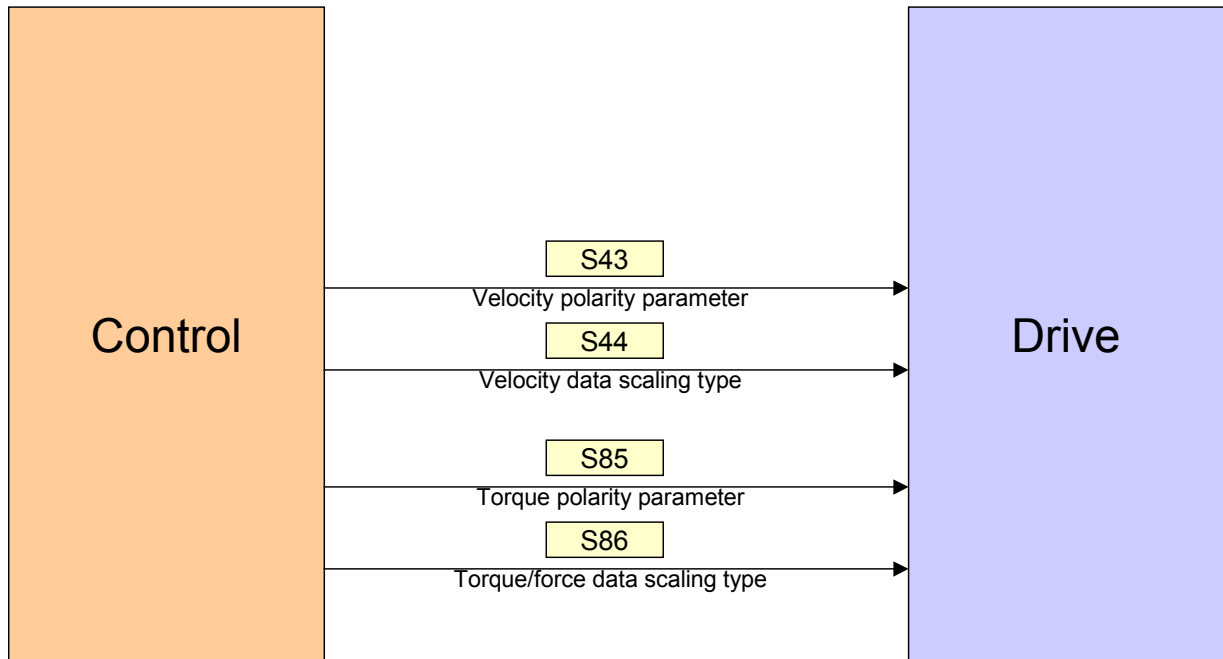


Figure 10 : Data Scaling (Pack Profile Basic B)

FG 4B	Velocity Data Scaling (Basic B)		
IDN	Description	Capability	Comments
S-0-0043	Velocity polarity parameter	W	Value=0 mandatory
S-0-0044	Velocity data scaling type	W	Value=0000 0000 0000 0010 mandatory - rotational scaling - preferred scaling - revolutions - minutes - at the motor shaft

FG 4A	Torque/Force Data Scaling (Basic B)		
IDN	Description	Capability	Comments
S-0-0085	Torque polarity parameter	W	Value=0 mandatory
S-0-0086	Torque/force data scaling type	W	Value=0 mandatory - percentage scaling - preferred scaling - at the motor shaft

4 Pack Profile Extended

The Pack Profile Extended supports the position, velocity and torque control operation mode in the drive.

The Extended Pack Profile consists of :

- Pack Profile Basic A and B
 - Communication Class A including the following basic communication functions :
 - Ring Configuration (Timing, Standard Telegram, Phase run-up)
 - Service Channel Protocol
 - Information & Diagnostics
 - Status Word (Real-time Channel)
 - Control Word (Real-time Channel)
 - Position Mode
 - Position Mode with Modulo Function
 - Position Window
 - Velocity Mode (open loop)
 - Position, Velocity, Torque/Force Limits
 - Preferred scaling for Position, Velocity, Torque/Force Data
- In addition to the Pack Profiles Basic A and B the following features are mandatory
 - Communication Class B / Support of telegram No. 7 and configurable Real-time Bits
 - Velocity Mode
 - Torque Mode
 - Torque/Force Data
 - Drive-controlled Homing
 - NC-controlled homing
 - Probing function
 - Extended data scaling

Pack Profile for SERCOS interface

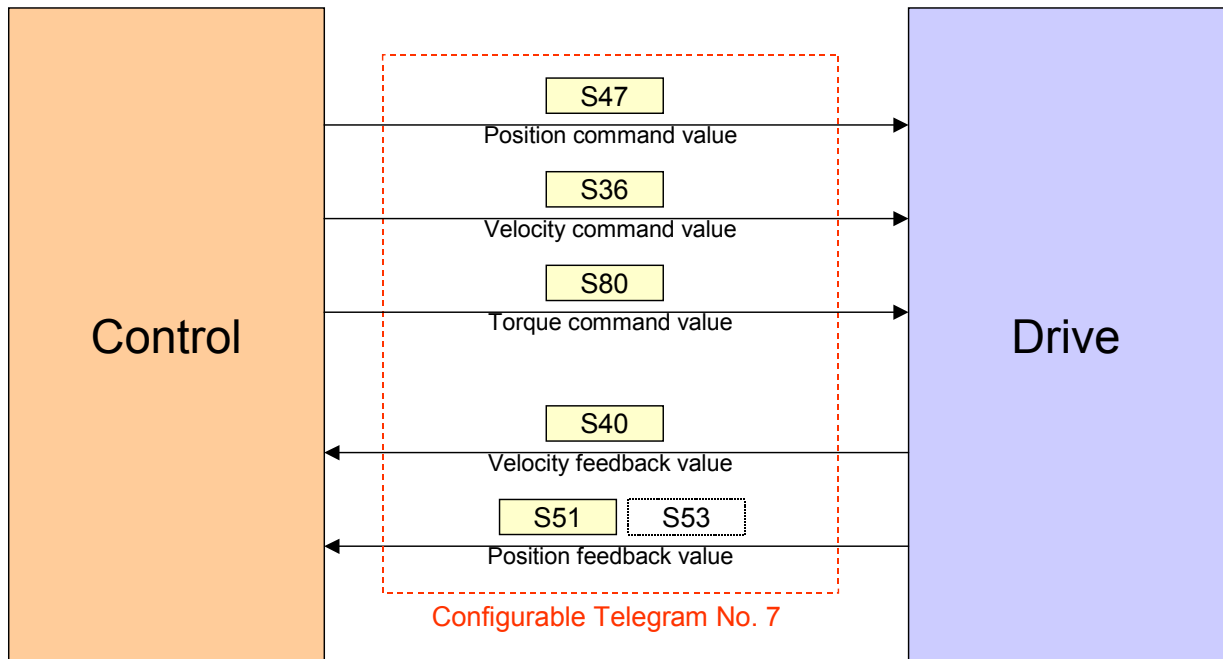


Figure 11 : Example of a Configurable Telegram (Pack Profile Extended)

4.1 Communication Class B

The drive has to support Communication Class B with the following mandatory communication parameters:

- Cycle Time : 2 msec.
- Baudrate : 4 Mbaud
- Telegram 7

Additional combinations may be supported by the drive according to the SERCOS specification. The control unit can only rely on the mandatory configuration (see rule 4).

The following parameters are mandatory real-time parameters which can be configured in the AT/MDT telegram in any combination.

Configurable MDT realtime parameters:

S-0-0047 Position Command Value
 S-0-0036 Velocity Command Value
 S-0-0080 Torque Command Value

Configurable AT realtime parameters:

S-0-0051 Position Feedback 1
 S-0-0053 Position Feedback 2 (if second encoder is supported)
 S-0-0040 Velocity Feedback Value

 S-0-0011 Class 1 diagnostics

Pack Profile for SERCOS interface

S-0-0013	Class 3 diagnostics
S-0-0179	Probe Status
S-0-0130	Probe Value 1 positive edge
S-0-0131	Probe Value 1 negative edge
S-0-0132	Probe Value 2 positive edge
S-0-0133	Probe Value 2 negative edge

Configurable Realtime Control Bits:

S-0-0407	Homing enable
S-0-0404	Position Command Value status
S-0-0405	Probe 1 enable
S-0-0406	Probe 2 enable

Configurable Realtime Status Bits:

S-0-0400	Home Switch Input
S-0-0403	Position Feedback Value Status
S-0-0408	Reference marker Pulse registered

4.2 Position/Velocity/Torque Mode (Extended)

The Pack Profile Extended supports the position, velocity and torque control operation mode in the drive.

Remark: The parameters (gains) for the control loops (position, velocity, torque) are currently not defined by the released SERCOS specification because of too many different implementations. Therefore, the Pack Profile can not specify mandatory parameters for this function. These parameters have to be set by a drive-specific tool or by generic interfaces in the control unit that provide random access to parameters within the drive via the SERCOS service channel.

FG 3	Operation Modes (Extended)		
IDN	Description	Capability	Comments
S-0-0015	Telegram type	W	Support of telegram 7
S-0-0016	Configuration list of AT	W	
S-0-0024	Configuration list of MDT	W	

Pack Profile for SERCOS interface

S-0-0032	Primary operation mode	W	<p>Support of position mode, velocity mode and torque mode</p> <p>Mandatory Bit-Masks:</p> <p>Torque control: 0000 0000 0000 0001</p> <p>Velocity control: 0000 0000 0000 0010</p> <p>Position Mode: 0000 0000 0000 0ppp</p> <p>ppp= 011 Position mode using feedback value 1 (motor encoder)</p> <p>ppp= 100 Position mode using feedback value 2 (external encoder)</p> <p>(Only, if the drive has a second encoder input the mode ppp =100 is mandatory, otherwise the drive should return an error if this mode is selected)</p> <p>remarks:</p> <ul style="list-style-type: none"> - position control with following error - not a complex operation mode - Cyclic command values - Operation mode defined by SERCOS Interface
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Pack Profile for SERCOS interface

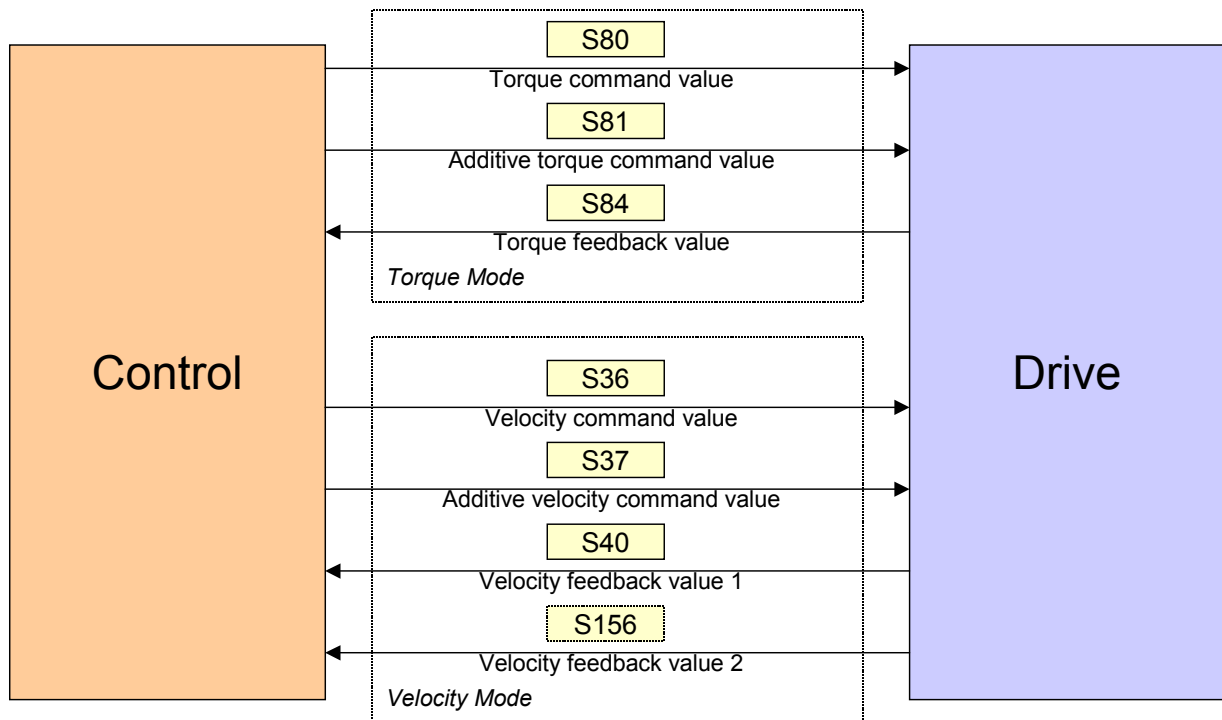


Figure 12 : Torque and Velocity Mode (Pack Profile Extended)

FG 3A	Torque Mode (Extended)		
IDN	Description	Capability	Comments
S-0-0080	Torque command value	W	
S-0-0081	Additive torque command value	W	
S-0-0084	Torque feedback value	R	If device is open-loop, the feedback can just be a reflection of command.

FG 3B	Velocity Mode (Extended)		
IDN	Description	Capability	Comments
S-0-0036	Velocity command value	W	
S-0-0037	Additive velocity command value	W	
S-0-0040	Velocity feedback value 1	R	If device is open-loop, the feedback can just be a reflection of command.
S-0-0156	Velocity feedback value 2	R	Only mandatory if an external feedback input is available!

Pack Profile for SERCOS interface

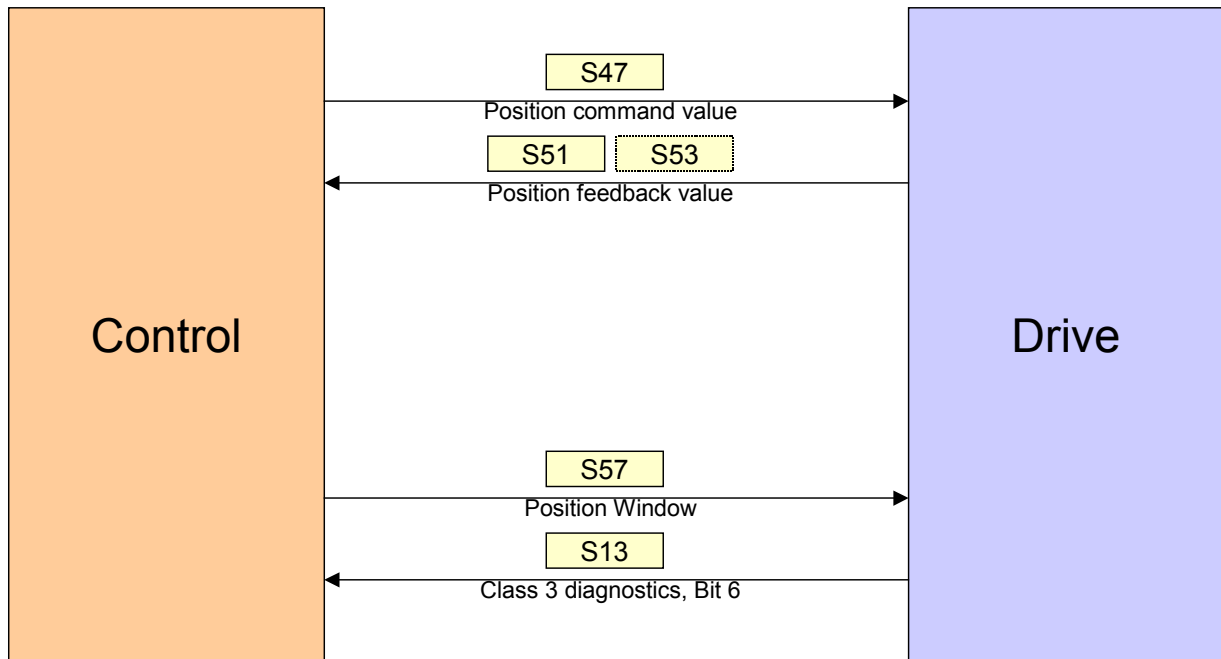


Figure 13 : Position Mode (Pack Profile Extended)

FG 3C	Position Mode (Extended)		
IDN	Description	Capability	Comments
S-0-0047	Position command value	W	
S-0-0051	Position feedback value 1 (Motor feedback)	R	Required since the control unit must have the current position as a reference before initiating any motion in position mode.
S-0-0053	Position feedback value 2 (External feedback)	R	Only mandatory if an external feedback input is available!

4.3 Position window (Extended)

FG 16C	Position windows		
IDN	Description	Capability	Comments
S-0-0013	Class 3 Diagnostic	R	Bit 6 mandatory
S-0-0057	Position window	W	

Pack Profile for SERCOS interface

4.4 Limits (Extended)

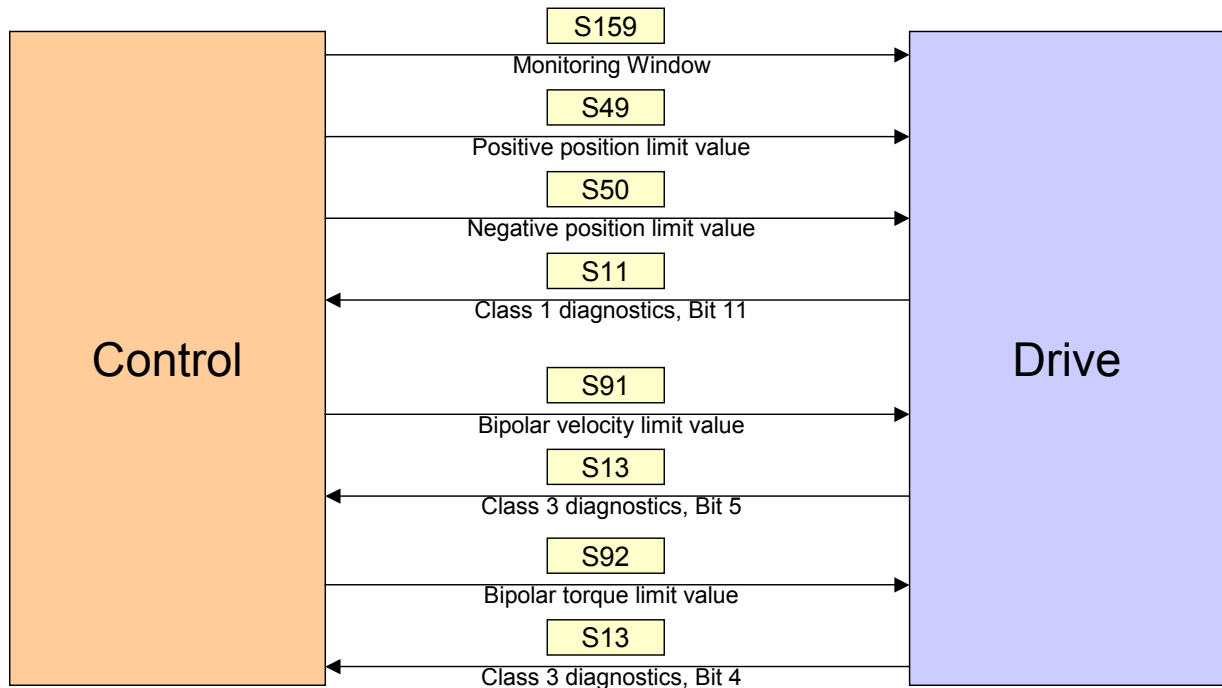


Figure 14 : Limits (Pack Profile Extended)

FG 17C	Position limits		
IDN	Description	Capability	Comments
S-0-0011	Class 1 diagnostic	R	Bit 11 mandatory
S-0-0049	Positive position limit value	W	
S-0-0050	Negative position limit value	W	
S-0-0159	Monitoring window	W	

Remark: The position limits are only active in the drive in case the drive is operated in the position mode.

FG 17B	Velocity limits		
IDN	Description	Capability	Comments
S-0-0013	Class 3 diagnostic	R	Bit 5 mandatory
S-0-0091	Bipolar velocity limit value	W	

Remark: The velocity limits are only active in the drive in case the drive is operated in the velocity mode.

FG 17A	Torque/Force limits		
IDN	Description	Capability	Comments
S-0-0013	Class 3 diagnostic	R	Bit 4 mandatory
S-0-0092	Bipolar torque limit value	W	

Pack Profile for SERCOS interface

4.5 Position, Velocity, Acceleration, Torque Data Scaling (Extended)

For position and velocity data an extended scaling according to the SERCOS specification is supported. For acceleration and torque data only preferred scaling is supported.

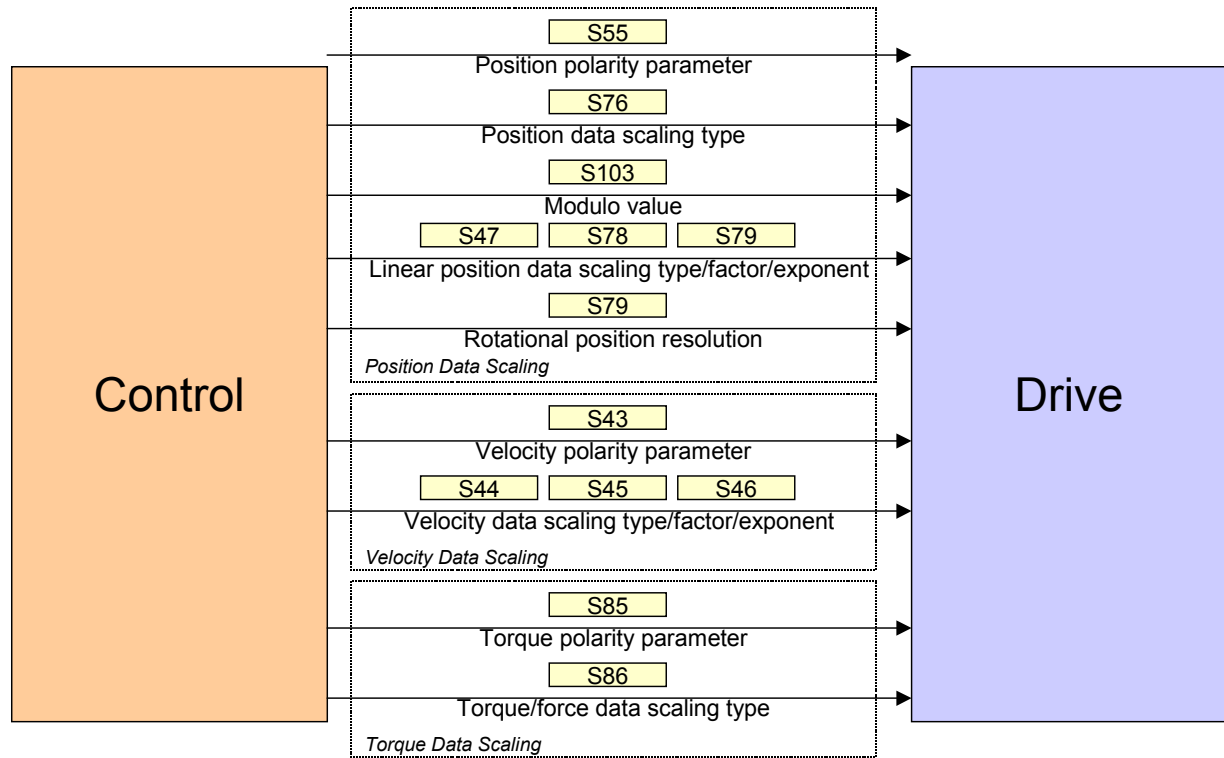


Figure 15 : Data Scaling (Pack Profile Extended)

FG 4A	Scaling Torque/Force Data		
IDN	Description	Capability	Comments
S-0-0085	Torque polarity parameter	W	Value=0 mandatory
S-0-0086	Torque/force data scaling type	W	Value=0 mandatory - percentage scaling - preferred scaling - at the motor shaft

FG 4B	Scaling Velocity Data		
IDN	Description	Capability	Comments
S-0-0043	Velocity polarity parameter	W	

Pack Profile for SERCOS interface

S-0-0044	Velocity data scaling type	W	<p>Mandatory bit-mask: 0000 0000 00dc baaa</p> <p>-Scaling method aaa=000 – no scaling aaa=001 – linear scaling aaa=010 – rotational scaling - preferred/ parameter scaling b=0 – preferred scaling b=1 – parameter scaling - Units for rotary c=0 – revolutions c=1 – (reserved) - Units linear c=0 – meters c=1 – inches - Time d=0 – minutes d=1 – seconds - Data reference at the motor shaft</p>
S-0-0045	Velocity data scaling factor	W	
S-0-0046	Velocity data scaling exponent	W	

FG 4D			
Scaling Acceleration Data			
IDN	Description	Capability	Comments
S-0-0160	Acceleration data scaling type	W	<p>The only mandatory acceleration parameter is S-0-0042 Homing acceleration for drive controlled homing.</p> <p>Mandatory bit-mask: 0000 0000 0000 0010 - scaling: 0.001 rad/s² - at the motor shaft</p>

FG 4C			
Scaling Position Data			
IDN	Description	Capability	Comments
S-0-0055	Position polarity parameter	W	

Pack Profile for SERCOS interface

S-0-0076	Position data scaling type	W	<p>Madatory bit-mask 0000 0000 f0dc baaa</p> <p>-Scaling method aaa=000 – no scaling aaa=001 – linear scaling aaa=010 – rotational scaling - preferred/ parameter scaling b=0 – preferred scaling b=1 – parameter scaling - Units for rotary scaling c=0 – degrees c=1 – (reserved) - Units for linear scaling c=0 – meters c=1 – inches - Time d=0 – minutes d=1 – seconds - Data reference at the motor shaft -Processing format f=0 – absolute format f=1 – modulo format</p>
S-0-0077	Linear position data scaling factor	W	
S-0-0078	Linear position data scaling exponent	W	
S-0-0079	Rotational position resolution	W	
S-0-0103	Modulo value	W	

4.6 Drive-controlled Homing (Extended)

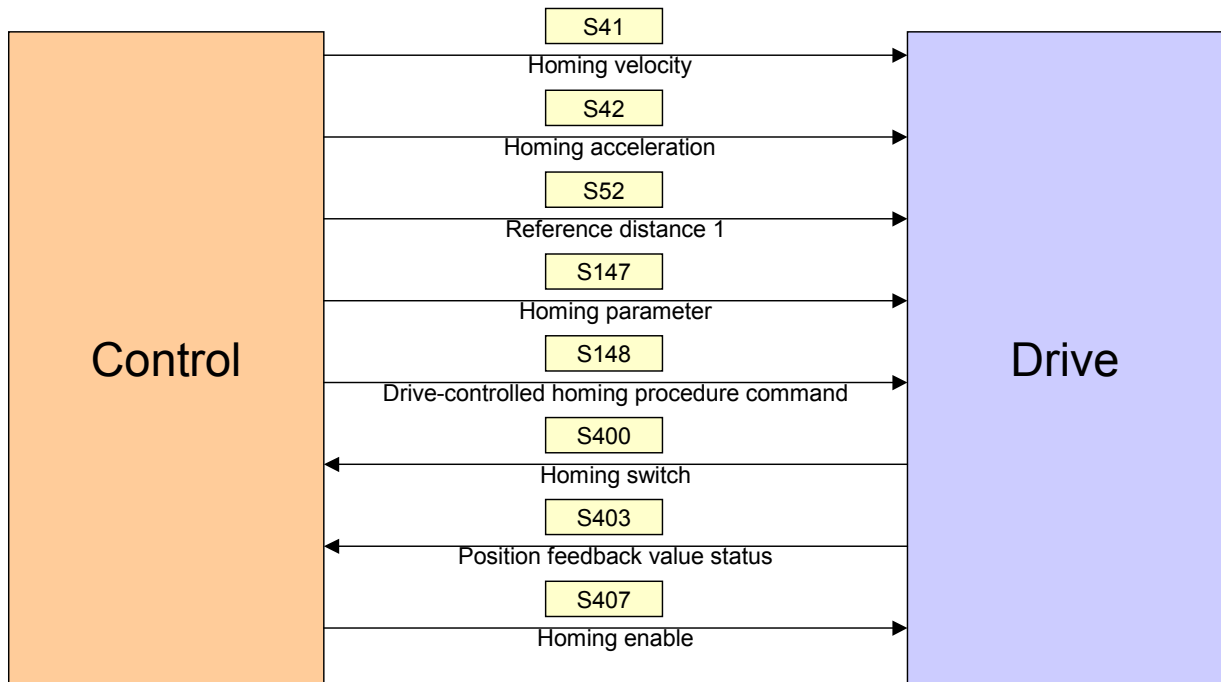


Figure 16 : Drive-controlled Homing (Pack Profile Extended)

Pack Profile for SERCOS interface

FG 7A	Drive-controlled Homing		
IDN	Description	Capability	Comments
S-0-0041	Homing velocity	W	The value has to be set by the control unit before the first homing command is executed.
S-0-0042	Homing acceleration	W	The value has to be set by the control unit before the first homing command is executed.
S-0-0052	Reference distance 1	W	
S-0-0147	Homing parameter	W	<p>Mandatory bit masks: (only drive-controlled homing, NC-controlled homing has other mandatory masks) 0000 0000 000e 01ba</p> <ul style="list-style-type: none"> - homing direction: a=0: positive; motor shaft turns clockwise a=1: negative; motor shaft turns counter-clock wise - Position feedback marker pulse b=0: first marker pulse after the positive edge of the home switch (IDN 00400) b=1: first marker pulse after the negative edge of the home switch (IDN 00400) - the home switch is connected to the drive and not to the control unit -motor feedback is used for homing and not the external feedback - Interpretation in the drive: e=0: home switch (IDN 00400) and homing enable (IDN 00407) e=1: homing enable only - The home switch is evaluated - The marker pulse is evaluated - The drive is positioned in an arbitrary position after drive-controlled homing and not at the reference position - the homing distance is not selected
S-0-0148	Drive controlled homing procedure command	W	The control unit shall allocate the necessary control and status signals to real-time bits via the service channel and set the homing velocity IDN 00041 and the homing acceleration IDN 00042 before setting and enabling the procedure command IDN 00148.
S-0-0400	Home Switch	R	
S-0-0403	Position feedback value status	R	
S-0-0407	Homing enable	W	

Pack Profile for SERCOS interface

4.7 NC-controlled Homing (Extended)

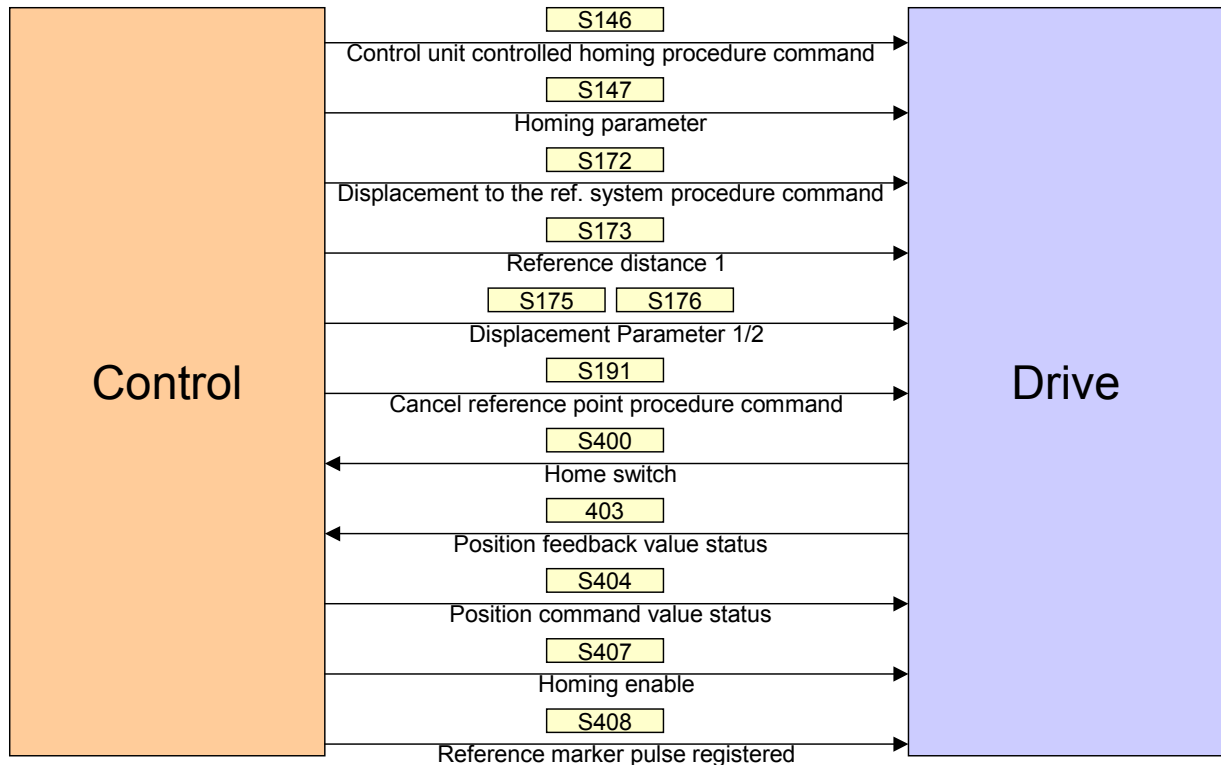


Figure 17 : NC-controlled Homing (Pack Profile Extended)

FG 7B	NC-controlled Homing		
IDN	Description	Capability	Comments
S-0-0146	Control unit controlled homing procedure command	W	The control unit shall allocate the necessary control and status signals to real-time bits via the service channel before setting and enabling the procedure command IDN 00146.
S-0-0147	Homing parameter	W	<p>Mandatory bit masks: (only NC-controlled homing, drive-controlled homing has other mandatory masks) 0000 0000 000e d1b0</p> <ul style="list-style-type: none"> - homing direction is not selectable. - Position feedback marker pulse b=0: first marker pulse after the positive edge of the home switch (IDN 00400) b=1: first marker pulse after the negative edge of the home switch (IDN 00400) - the home switch is connected to the drive and not to the control unit - feedback 1 / 2 select d=0: using the motor feedback d=1: using the external feedback <p>The selection of the feedback has to match the selection</p>

Pack Profile for SERCOS interface

			<p>of the primary operation mode for positioning in IDN 00032.</p> <ul style="list-style-type: none"> - Interpretation in the drive: e=0: home switch (IDN 00400) and homing enable (IDN 00407) e=1: homing enable only - The home switch is evaluated - The marker pulse is evaluated - The drive is positioned in an arbitrary position after drive-controlled homing and not at the reference position - the homing distance is not selected
S-0-0172	Displacement to the referenced system procedure command	W	
S-0-0173	Reference distance 1	W	
S-0-0175	Displacement Parameter 1	W	
S-0-0176	Displacement Parameter 2	W	
S-0-0191	Cancel reference point procedure command	W	
S-0-0400	Home Switch	R	
S-0-0403	Position feedback value status	R	
S-0-0404	Position command value status	W	
S-0-0407	Homing enable	W	
S-0-0408	Reference marker pulse registered	R	

See appendix A for the implementation for NC-controlled homing.

4.8 Absolute Homing (Extended)

For drives that support absolute encoders and absolute homing the following absolute homing procedure is defined :

Pack Profile for SERCOS interface

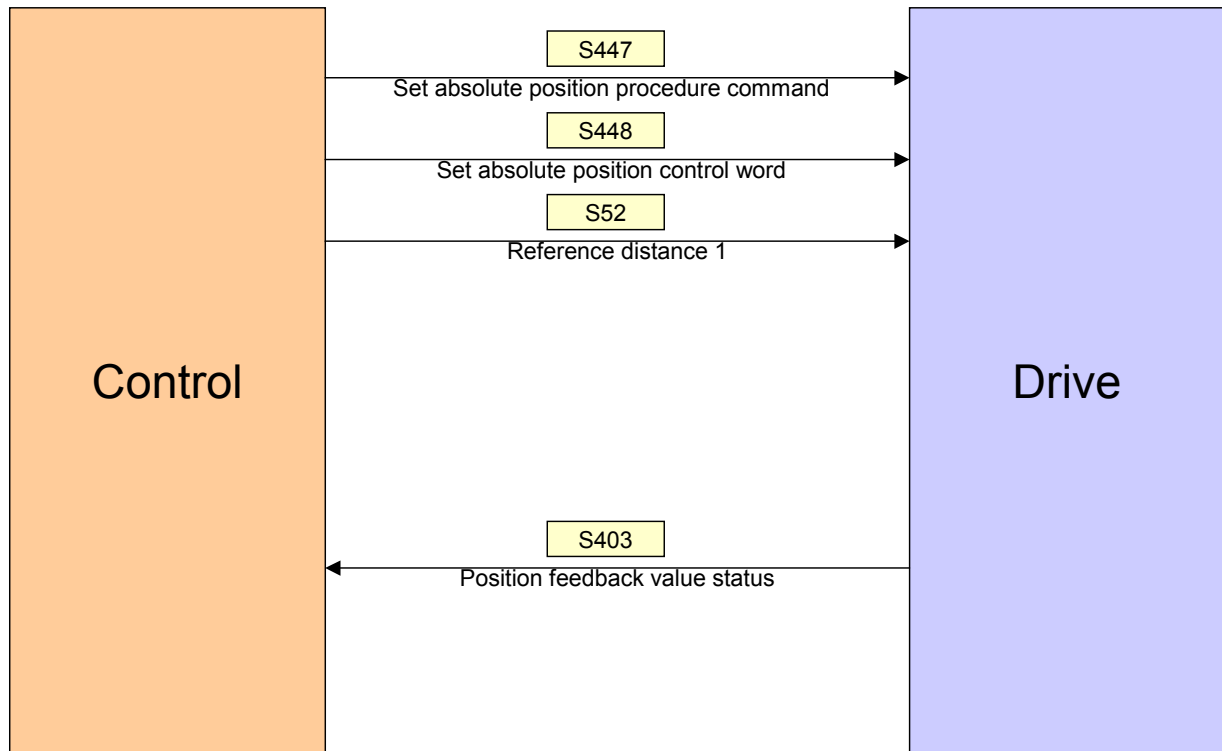


Figure 18 : Absolute Homing (Pack Profile Extended)

FG 7C	Absolute Homing		
IDN	Description	Capability	Comments
S-0-0052	Reference distance 1	W	
S-0-0403	Position feedback value status	R	Bit 14 in IDN S-0-0013 Class 3 diagnostics reflects to Bit 0 of IDN S-0-0403
S-0-0447	Set absolute position procedure command	W	
S-0-0448	Set absolute position control word	W	bit 0 = 1 -> encoder 1 (bit 0 = 1 is mandatory) bit 1 = 1 -> encoder 2 (optional) bit 2 = 1 -> request homing while drive is enabled and or running / 0 = request homing while drive is disabled (bit 2 = 0 is mandatory)

4.9 Probing Function (Extended)

Probing functionality is a more advanced function, but one that may often be used in high performance packaging applications. The ability to register axis position based upon a reference or registration mark/event is often a critical piece of functionality. This is especially true when using SERCOS interface drives that are performing servo position loop closure within the drive itself. The registration position measurement is accomplished through the use of the probe functions IDNs as defined in function group 8 (FG8). It is desired to have both Probe 1 and Probe 2 inputs supported for each drive axis, though at minimum Probe 1 must be supported by each drive axis.

Pack Profile for SERCOS interface

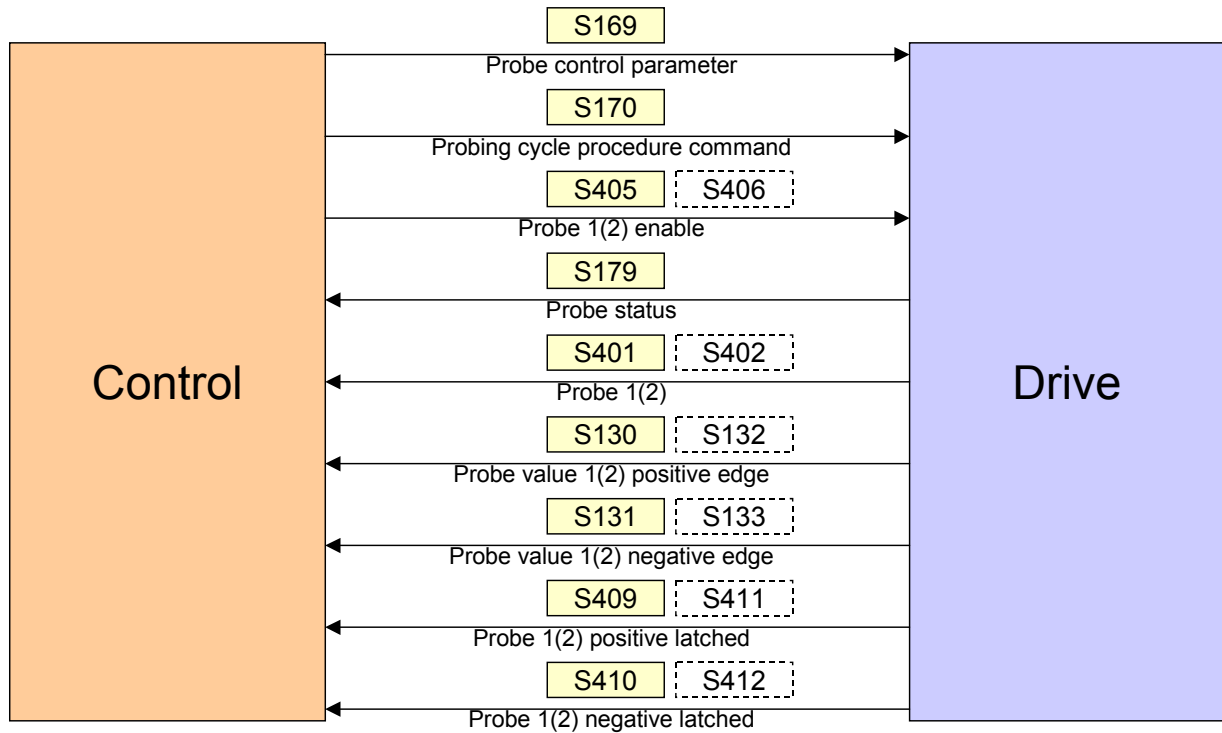


Figure 19 : Probing (Pack Profile Extended)

FG 8	Probing Function		
IDN	Description	Read/Write /Optional	Comments
S-0-0130	Probe value 1 positive edge	R	
S-0-0131	Probe value 1 negative edge	R	
S-0-0132	Probe value 2 positive edge	R	The IDN is only mandatory, if the drive has a second probe input.
S-0-0133	Probe value 2 negative edge	R	The IDN is only mandatory, if the drive has a second probe input.
S-0-0169	Probe control parameter	W	Range for 1 probe : 0x00, 0x01, 0x02, 0x03 Typically for 2 probes : 0x0F
S-0-0170	Probing cycle procedure command	W	
S-0-0179	Probe status	R	Range for 1 probe : 0x00, 0x01, 0x02, 0x03 Typically for 2 probes : 0x0F
S-0-0401	Probe 1	R	1: active, 0: inactive
S-0-0402	Probe 2	R	The IDN is only mandatory, if the drive has a second probe input. 1: active, 0: inactive
S-0-0405	Probe 1 enable	W	

Pack Profile for SERCOS interface

S-0-0406	Probe 2 enable	W	The IDN is only mandatory, if the drive has a second probe input.
S-0-0409	Probe 1 positive latched	R	
S-0-0410	Probe 1 negative latched	R	
S-0-0411	Probe 2 positive latched	R	The IDN is only mandatory, if the drive has a second probe input.
S-0-0412	Probe 2 negative latched	R	The IDN is only mandatory, if the drive has a second probe input.

To implement high speed/high performance registration, it is desired to reduce the amount of time needed to enable and disable the probe measurement. A preferred method for implementing this capability within the SERCOS specification is to map the Probe 1 Enable and Probe 2 Enable IDNs into the real-time Control bits 1 and 2 of the control word sent to the drive in the Master Data Telegram (MDT). These IDNs are part of the function group 12 (Real-time Control Bits) which is mandatory for the Communication Classes B and C.

By including Probe 1 (minimum required) and Probe 2 (if supported by the drive) positive and negative position values, along with the Probe Status (IDN 179) in the cyclic Amplifier Telegram (AT) the high-speed performance of registering the probe value positions in the control can be further improved. This configuration capability is supported in Type 7 telegram which is mandatory for Communication Classes B and C.

Appendix A: Implementation of NC-controlled homing

The homing sequences described in the document outline the basic sequences for homing to marker pulse event or a switch event under control unit (NC) controlled homing. In all cases, the feedback, switch, or marker inputs are connected to the target SERCOS drive.

The following list describes the control unit-controlled homing for an axis as it is determined by its configuration, application requirements and user selection. The split of the function in control unit / drive is listed with a short comment:

1. Home Mode: Active (initiates motion), Passive (doesn't initiate motion)
 - This selection lies in the control unit and depends on the features of the path planner.
2. Home Sequence: Home to Switch, Home to Marker pulse, or Home to Switch-then-Marker pulse.
 - The sequence and the homing process is described in the following chapters
3. Home Direction: Unidirectional or Bi-directional (shortest path).
 - This selection lies in the control unit and depends on the features of the path planner.
4. Home Speed.
 - This selection lies in the control unit and depends on the features of the path planner.
5. Switch Polarity.
 - Lies in the drive and can be selected by parameter IDN#147
6. Home Position, Home Offset
 - Is a combined function of control unit and drive. How to maintain the actual and command positions is described in the following chapters

The NC controlled homing within the SERCOS Pack Profile supplies these modes with the respective IDNs listed:

- Home to marker
- Home to Switch
- Home to Switch-then-marker

Home to marker:

7B : NC Controlled Homing		Access
S-0-0146	Control unit controlled homing procedure command	W
S-0-0147	Homing parameter	W
S-0-0173	Marker position A	R
S-0-0407	Homing enable	W
S-0-0408	Reference marker pulse registered	R
S-0-0172	Displacement to the referenced system procedure command	W
S-0-0175	Displacement parameter 1	W
S-0-0176	Displacement parameter 2	W
S-0-0191	Cancel reference point procedure command	W
S-0-0403	Position feedback value status	R
S-0-0404	Position command value status	W

Pack Profile for SERCOS interface

Home to switch:

7B : NC Controlled Homing		Access
S-0-0147	Homing parameter	W
S-0-0172	Displacement to the referenced system procedure command	W
S-0-0175	Displacement parameter 1	W
S-0-0176	Displacement parameter 2	W
S-0-0191	Cancel reference point procedure command	W
S-0-0400	Home switch	R
S-0-0403	Position feedback value status	R
S-0-0404	Position command value status	W

The required mandatory IDNs are part of the function groups 7B (Home to marker/ Home to switch).

The following real-time bit allocation is used in these sequences:

Real-time control bit 2

IDN 407 Homing enable

IDN 404 Position command value status

Real-time status bit 2

IDN 400 Home Switch Input

IDN 403 Position feedback value status

IDN 408 Reference marker pulse registered

Homing of drive axis sequences – Home to Switch or Home to Marker

In all cases, the control unit will first check that axis is not in shutdown, is not moving and has no faults.

If “Active” Homing type is selected, and the control unit has not already detected that the drive is in enabled with its power system engaged, the control unit (NC) sets bits 14, 15 ON(=1) in the control word of the MDT (Drive ON, Enable Drive) and waits for the drive to respond with bits 14 and 15 ON (=1) in the drive status word of the AT. This indicates that the drive is read to operate. The drive must be capable of following command position from the master control unit in active homing modes.

Control unit Actions	SERCOS Ring	Drive Actions
<p>The control unit applies Home Type and Event Condition settings to the Homing parameter (IDN#147).</p> <p>Homing parameter bits 1 to 4 apply.</p>	<p>→ IDN Write IDN#147</p> <p>→ Data Write Home Config</p>	<p>Drive processes the service channel IDN writes, and sets its home modes according to IDN#147</p>

Pack Profile for SERCOS interface

<p>Bit 1 establishes switch input edge polarity for Switch-Marker homing event type based on the event condition.</p> <p>Bit 2 = 1 for homing when the home switch input is connected to the drive.</p> <p>Bit 3 is determined by Primary Op Mode setting.</p> <p>Bit 4 is set for Marker event type (homing enable only) and is clear for Switch-Marker event type (home switch and homing enable)</p> <p>The control unit sends the proper value of IDN#147 to the drive based on the desired configuration.</p>		
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The homing sequence then proceeds according to “Home to Marker Sequence” or “Home to Switch Sequence” which follows:

Home to Marker Sequence:

Control unit Actions	SERCOS Ring	Drive Actions
<p>The control unit updates the allocation of Real-time Control Bit 2 (IDN#303) to reference Homing Enable (IDN#407), then updates Allocation of Real-time Status Bit 2 (IDN#307) to Reference Marker Pulse Registered (IDN#408).</p>	<p>→ IDN Write IDN#303</p> <p>→ Data Write IDN#407</p> <p>→ IDN Write IDN#307</p> <p>→ Data Write IDN#408</p>	<p>Drive processes the service channel IDN writes, and assigns Homing Enable (IDN#407) to the Real-time Control bit 2 of the MDT Control word, and then assigns the Reference Marker Pulse Registered (IDN#408). to the Real-time Status bit 2 of the AT Status word.</p>
<p>The control unit sends “Control Unit Controlled Homing” procedure (IDN#146) to the drive axis.</p>	<p>→ IDN Write IDN#146 Proc.</p> <p>→ Data Write Set & Enable Proc.</p>	
<p>The control unit sets Homing Enable bit to allow drive to process marker pulses.</p>	<p>→ MDT Ctrl Word “real-time control bit 2” = 1.</p>	<p>The drive regularly updates the Real-time Status bit 2 with the current state of the Reference Marker Pulse Registered</p>

Pack Profile for SERCOS interface

		(IDN#408)
<p>If the homing mode is selected as “Active” the control unit then proceeds to generate a movement profile through the issuing of new command trajectory data in the MDT. If the mode is selected as “Passive”, the control unit does not generate a movement profile, but continues to monitor the AT status bits. It examines the state of the status bits in the AT to detect the occurrence of a home event.</p>		
	<p>← AT Status Word “real-time status bit 2” = 1 ← AT Status Word “proc change” = 1</p>	<p>Drive detects a marker transition and stores the position feedback value in Marker Position A parameter (IDN#173). The drive then sets the Reference Marker Pulse Registered bit (IDN#408) which is also returned in the real-time status bit of the next AT. Finally the drive sets the procedure change bit which is reflected in the AT Control Word, and by setting bit 2 of the associated procedure command acknowledgement.</p>
<p>The control unit recognizes that the “Control Unit Controlled Homing” procedure (IDN#146) has completed and the marker event has occurred. The control unit then obtains the marker position from the drive.</p>	<p>→ IDN Write IDN#173 ← Data Read Marker Pos A</p>	
<p>Control unit then stops the movement process, and starts a “new” move to the user specified Home Position at its homing return speed. It checks to verify that the homing procedure hasn’t errored on the drive prior to terminating or cancelling the procedure.</p>	<p>→ IDN Write IDN#146 Proc. ← Data Read Executed Error (Control unit executes reads to determine procedure acknowledgement or error status)</p>	

Pack Profile for SERCOS interface

	→ IDN Write IDN#146 Proc. → Data Write Cancel Proc. →	
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The homing process sequence then advances to “Redefine Position Phase” below.

Home to Switch Sequence:

Control unit Actions	SERCOS Ring	Drive Actions
The control unit updates the allocation of real-time status bit 2 (IDN#307) and assigns it to the Home Switch input (IDN#400)	→ IDN Write IDN#307 → Data Write IDN#400	Drive processes the service channel IDN writes, and assigns the Home Switch input (IDN#400) to the Real-time Status bit 2 of the AT Status word.
If the homing mode is selected as “Active” the control unit then proceeds to generate a movement profile through the issuing of new command trajectory data in the MDT. If the mode is selected as “Passive”, the control unit does not generate a movement profile, but continues to monitor the status of the AT status bits. It examines the state of the status bits in the AT to detect the occurrence of a home event.		
The control unit monitors and detects that the Home Switch input has transitioned to the specified Event Condition based on the AT status word information. It then loads the Event Position value which is the Feedback Position value as read from the same AT in which the home switch input event is first indicated by the drive.	← AT Cyclic Data IDN#51/53 (new) ← AT Status Word “real-time status bit 2” = event cond.	The drive regularly updates the Real-time Status bit 2 with the current state of the Home Switch input (IDN#400)
Control unit then stops the active move in process, and then starts a new move to Home Position at its homing	←	

Pack Profile for SERCOS interface

return speed, and then processing advances to Redefine Position Phase.		
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The homing process sequence then advances to “Redefine Position Phase” below.

This concludes the homing sequence for “Marker” or “Switch” based homing procedures.

In all cases, the control unit will first check that axis is not in shutdown, is not moving and has no faults.

The control unit may still check to see that the drive is in enabled with its power system engaged, the Control unit (NC) sets bits 14, 15 ON(=1) in the control word of the MDT (Drive ON, Enable Drive) and waits for the drive to respond with bits 14 and 15 ON (=1) in the drive status word of the AT. This indicates that the drive is ready to operate.

Redefine Position Sequence

Redefine Position instruction in the control (NC) has options which can change the command, actual, relative, or absolute position of the axis in the control unit. The associated position data is interpreted, thus, as either a new absolute position or an offset to the current position. A displacement is calculated between the old and the new position values. This value is stored locally on the control unit. The redefine position operation can interact with the SERCOS interface drive axis in the following manner. This allows the same sequence to be used with a SERCOS drive, regardless of the type of feedback device employed on the axis for the application.

Control unit Actions	SERCOS Ring	Drive Actions
Control unit updates Displacement (IDN#175/176) for the specified drive axis. Locally stored Operation Mode (IDN#32) value determines the specific IDN# used.	<ul style="list-style-type: none"> → IDN Write IDN#175/176 → Data Write Displacement 	Drive processes the service channel IDN write and updates Displacement parameter (IDN#175/176).
Control unit sends “Cancel Reference Point” procedure (IDN#191) to the drive axis.	<ul style="list-style-type: none"> → IDN Write IDN#191 Proc. → Data Write Set & Enable Proc. ← Data Read Executing Error 	Drive processes “Cancel Reference Point” procedure and clears the Position Feedback Value Status bit (IDN#403) which is reflected in the Real-time Status bit of the next AT.
Control unit sees the procedure change bit and solicits status for “Cancel Reference Point” procedure to check procedure	<ul style="list-style-type: none"> ← AT Status Word “proc change” = 1 → IDN Write IDN#191 Proc. 	Once the drive has cleared the

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<p>command acknowledgement.</p>	<p>← Data Read Executed Error</p>	<p>Position Feedback Value Status bit (IDN#403) it then indicates that the “Cancel Reference Point” procedure is complete via the procedure command change bit and by setting bit 2 of the associated procedure command acknowledgement</p>
<p>It then cancels the “Cancel Reference Point” procedure.</p>	<p>→ IDN Write IDN#191 Proc. → Data Write Cancel Proc.</p>	<p>Drive cancels the “Cancel Reference Point” procedure, which clears the “proc change” if no other active procedures have also set the change bit.</p>
<p>Control unit updates Allocation of Real-time Control Bit 2 (IDN#303) to reference Position Command Value Status (IDN#404), then updates Allocation of Real-time Status Bit 2 (IDN#307) to reference Position Feedback Value Status (IDN#403)</p>	<p>→ IDN Write IDN#303 → Data Write 404 → IDN Write IDN#307 → Data Write 403</p>	<p>Drive processes the service channel IDN writes, and assigns the Position Command Value Status bit (IDN#404) to the Real-Time Control bit of the MDT Control word, and then assigns the Position Feedback Value Status bit (IDN#403) to the Real-time Status bit of the AT Status word.</p>
<p>In a later SERCOS cycle the controller receives the new actual position in the AT and detects that the real time status bit 2 is set =1. It computes a position difference and the displacement is applied its command position to compensate for the position reference change. The control then sends the new (compensated) position to the drive in the next MDT, with real time control bit 2 set =1.</p>	<p>← AT Status Word “real-time status bit 2” = 0 → MDT Ctrl Word “real-time control bit 2” = 0.</p>	
<p>Control unit sends “Displacement to Referenced System” procedure (IDN#172) to the drive.</p>	<p>→ IDN Write IDN#172 Proc. → Data Write Set & Enable Proc. ← Data Read Executing Error</p>	<p>Drive processes “Displacement to Referenced System” procedure and adds the Displacement to the Feedback (a.k.a. Actual) Position. Simultaneously, the drive sets the Position Feedback Value Status bit (IDN#403) which is reflected in the Real-time Status bit of the next AT.</p>

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<p>Control unit receives AT from the drive with the real time status bit set =1.</p>	<p>← AT Cyclic Data IDN#51/53 (new) ← AT Status Word “real-time status bit 2” = 1</p>	
<p>Control unit sends new command value (compensated for calculated displacement) in the MDT to the drive. It sets the real time control bit 2 = 1 to indicate to the drive that the command value is based on the new reference.</p>	<p>→ MDT Cyclic Data IDN#47 (new) → MDT Ctrl Word “real-time control bit 2” = 1.</p>	<p>Drive detects the Position Command Value Status bit is set which indicates that the passed absolute Command Position is based on the new reference system. When computing the command position delta the Displacement is applied to compensate for the position reference change.</p>
<p>Control unit sees the procedure change bit and solicits status for “Displacement to Referenced System” procedure to check procedure command acknowledgement. It then cancels the “Displacement to Referenced System” procedure.</p>	<p>← AT Status Word “proc change” = 1 → IDN Write IDN#172 Proc. ← Data Read Executed Error → IDN Write IDN#172 Proc. → Data Write Cancel Proc.</p>	<p>With both the Position Command and Feedback Value Status bits set, the drive indicates that the “Displacement to Referenced System” procedure is complete via the procedure command change bit and by setting bit 2 of the associated procedure command acknowledgement. Drive cancels the “Displacement to Referenced System” procedure, which clears the “proc change” if no other active procedures have also set the change bit.</p>
<p>Control unit forces the “change pos reference bit” to zero, indicating that the redefine position operation is complete.</p>	<p>→ MDT Ctrl Word “real-time control bit 2” = 0. ← AT Status Word “real-time status bit 2” = 1</p>	<p>Note that both the Position Command and Feedback Value Status bits will remain set until the next redefine position or homing operation. This indicates that the axis has been referenced to the machine.</p>

Appendix B: Explanations for Probing Function

Using the probing cycle procedure is regarded as a configuration function.

Therefore a drive has to accept the probing cycle configuration in CP3.

The probing cycle configuration uses parameters S-169 and S-170 and the position configuration parameters.

To minimize efforts for SERCOS implementations, which only accept S-170 (probing cycle procedure command) after all parameters have been checked and the drive has transitioned to CP4, parameter S-169 bit 8 (Auto-Activate probing in phase switch from CP3 to CP4) may be used instead of S-170 to configure probing in CP3.

The following procedure for controllers configuring the probing cycle in CP3 is used to support different drive implementations.

Compliant / non compliant drive reactions are also noted for clarification.

Activate Probing Sequence Pack Profile:

- C1) Write relevant parameters for probing
- C2) Write S-169 with Bit 8 = 0 and desired measurement settings
- C3) Activate S-170 procedure command

Compliant drive reaction:

- D3) Command is acknowledged by the drive and probing activated

If the command is not acknowledged by the drive:

- C4) Controller writes S-169 with Bit 8 = 1 (Auto-Activate probing in phase change CP3 -> CP4)

Non compliant drive reaction:

- D4) Drive does not accept S-169 with Bit 8 = 1

- C5) After configuration is completed the controller activates procedure command S-128

Compliant drive reactions:

- D5-1) - Drive acknowledges S-128
 - Phase change CP3 -> CP4 drive activates "probing cycle"
- D5-2) - S-128 not acknowledged because of configuration faults
 - Configuration faults may be wrong probing relevant parameters.

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Non compliant drive reaction

D5-3) - Command S-128 acknowledged but "probing cycle" not activated in phase change CP3 -> CP4

Remark:

Extension of Figure 19: Probing (Pack Profile Extended):

Parameter 169 bit 8 =1 is mandatory for drives that do not accept S-170 in Phase 3