MSD ServoDrive
User Manual

Field Bus Systems
PROFIBUS and PROFINET

MSD Servo Drive Single-Axis System
MSD Servo Drive Multi-Axis System
MSD Single-Axis Servo Drive Compact

In this documentation the functionality of the following devices is described:

MSD Servo Drive Single-Axis System
MSD Servo Drive Multi-Axis System
MSD Single-Axis Servo Drive Compact

MSD Servo Drive User Manual
Field Bus Systems PROFIBUS and PROFINET

ID no.: CA65645-001, Rev. 5.1

Date: 03/2019

Applicable as from firmware version:

MSD Servo Drive	124.25
MSD Single-Axis Servo Drive Compact	124.25

The German version is the original of this user manual.

Subject to technical change without notice.

The content of our user manual was compiled with the greatest care and attention based on the latest information available to us.

We should point out that this document will not always be updated simultaneously with the ongoing technical development of our devices.

Information and specifications may change.
For information on the latest version please visit drives-support@moog.com.

Table of contents

1 General information

1.1 Target group

Dear user,

The user manual forms part of the product and contains important information on operation and service. The user manual is aimed at all persons who undertake mounting, installation, commissioning and servicing work on the product.

1.2 Prerequisites for the usage of the device

Prerequisites for the usage of the PROFIBUS and PROFINET fieldbus systems:

- The documents related to the devices are legible and accessible.
- Read and understand the operation manual for your drive system first.
- You are familiar with the PROFIBUS and PROFINET fieldbus systems through training courses.

Following the documentation on the devices from Moog is a prerequisite for trouble-free operation and therefore for any claims for defects.

NOTE:
This user manual applies to the MSD Servo Drive Single-Axis and Multi-Axis System and the MSD Single-Axis Servo Drive Compact. This document does not replace the operation manuals for the MSD Servo Drive and MSD Single-Axis Servo Drive Compact.

1.3 Reference documents

Document	Contents	ID no. Format
MSD Servo Drive Single-Axis Servo Drive Compact-Operation Manual	Safety, mechanical installation, electrical installation, commissioning, diagnostics, specifications, certification and applicable standards, technical data	CA97555-001 PDF
MSD Servo Drive AC-AC Servo Drive Single-Axis System - Operation Manual	Safety, mechanical installation, electrical installation, commissioning, diagnostics, specifications, certification and applicable standards, technical data	CA65642-001 PDF
MSD Servo Drive DC-AC Servo Drive Multi-Axis System-Operation Manual	Safety, mechanical installation, electrical installation, commissioning, diagnostics, STO, operation with AC-AC Servo Drive as supply, planning, application example, specifications, certification and applicable standards, technical data	CA97554-001 PDF
MSD Power Supply Unit Multi-Axis System-Operation Manual	Safety, mechanical installation, electrical installation, commissioning, diagnostics, specification, certification and applicable standards, technical data	CA97556-001 PDF
MSD Servo Drive Sercos II - User Manual	Safety, commissioning, communication phases, parameter interface, error, warning and status messages, operation modes, weighting, referencing, touchprobe, parameter lists	CA65648-001 PDF
MSD Servo Drive Sercos III - User Manual	Safety, installation and connection, commissioning and configuration, setting parameters, data transmission, scaling and weighting, functionality, error message and diagnostics, parameter lists	CA97557-001 PDF
MSD Servo Drive Fieldbus systems CANopen/EtherCAT - User Manual	Safety, commissioning, data transmission, operation modes, referencing, parameters, technical data	CA65647-001 PDF
MSD Servo Drive Fieldbus systems PROFIBUS/PROFINET - User Manual	Description and configuration of the parameters for the MSD Servo Drive on the PROFIBUS/PROFINET fieldbus system	CA65645-001 PDF
Modular Multi-Axis Servo Drive System - MSD - Ordering Catalog	Information, notes on ordering, specifications and technical data on: MSD Single-Axis Servo Drive Compact, MSD Single-Axis System, MSD Multi-Axis System, safety technology, communication, technology, function packages, accessories and motors	CDL 29950-en PDF
MSD Servo Drive - Device Help	Description of the software functionality MSD Servo Drive, firmware versions: - MSD Single-Axis Servo Drive Compact from V124.25-00 - MSD Single-Axis System from V124.25-00 - MSD Multi-Axis System from V124.25-00	CB40859-001 PDF and HTML
Program help Moog DriveAdminsitrator 5 PC user software	Context-sensitive help for Moog DriveAdministrator version 5.x graphic PC user software for initial commissioning and serial commissioning, operation, diagnostics and project management	CB19692-001 PDF and HTML

Application descriptions are also available. These are available in the download area from Moog. http://www.moogsoftwaredownload.com/msd.html

1.3.1 Documentation from PROFIBUS Nutzerorganisation (PI)

You will find important documents on the PROFIBUS and PROFINET fieldbus systems in the download area for your language on the web site of PROFIBUS Nutzerorganisation e.V. (PI) - http://www.profibus.com.

Documents as download	Contents	Version/ format
PROFIBUS - Installation Guideline for Planning	The PROFIBUS installation guideline for planning: • Supports PROFIBUS installation planners. • Eases the professional planning of an installation. • Is used as a guideline for the step-by-step planning of the installation.	V 1.0 08. 2009 PDF
PROFIBUS - System Description	Technology and application	V 11. 2010 PDF
PROFIBUS - Installation Guideline		V 1.0.6 05. 2006 PDF
PROFIBUS - Commissioning Guideline		V 1.0.2 11. 2006 PDF
PROFINET - System Description	Technology and application	V 10. 2014 PDF
PROFINET Commissioning Guideline		V 1.0.1 07. 2010 PDF
PROFINET - Installation Guideline		V 1.0 01. 2011 PDF
PROFIdrive - System Description	Technology and application	V 02. 2011 PDF
PROFIdrive - Technical Specification	Technical specification PROFIdrive for PROFIBUS and PROFINET,	V 4.2, October 2015 PDF

Other documents: installation guidelines, commissioning logs and check lists, supplements, technical guidelines, profiles, specifications, software and tools, among others.

Table 1.1 Selection of documents from PROFIBUS Nutzerorganisation

Note:
The documents from PI are available based on a warranty exclusion. The documents are subject to change without specific notice from PI or Moog.

1.4 Pictograms for useful information

The pictograms used in this document for useful information and actions to be taken signify for the user the following:

Instructions and actions to be taken	
	NOTE: Useful information or reference to other documents.
Digit	**ACTION TO BE TAKEN:** Action undertaken by the user or the system.

Table 1.2 Pictograms used for instructions and actions to be taken

1.5 Disclaimer

Following the documents on the devices from Moog is a prerequisite:
- For safe operation.
- To achieve stated performance features and product characteristics.

Moog does not accept any liability for injuries, damage or financial losses that result from the failure to follow the documents.

1.6 Transport, storage

Follow the instructions on the transport, storage and correct usage of the devices stated in the operation manual in "Technical data".

1.7 Disposal

Follow the applicable national regulations! If necessary, dispose of individual parts, depending on their characteristics and existing national regulations,
e.g. as

- Electrical waste
- Plastic
- Metal

or engage a certified disposal organisation with scrapping.

1.8 Helpline/ Support & Service

Our Helpline will help you with fast, specific assistance if you have any technical queries relating to project planning or commissioning your device.

Address:	Moog GmbH Hanns-Klemm Straße 28 D-71034 Böblingen
Phone:	+49 7031 622-0
Fax:	+49 7031 622-100
E-mail:	drives.support@moog.com

If you need service assistance, the Moog specialists will be pleased to be of assistance.

Service - Please contact us:

Phone:	+49 7031 622-0
E-mail:	info.gemany@moog.com

1.9 Normative references

The following standards apply to the PROFIBUS and PROFINET fieldbus system:

IEC/EN 61158 -
Industrial communication networks. Fieldbus specifications.

IEC 61508-4 (1998-12) -
Functional safety of electrical/electronic/ programmable electronic safety related systems – Part 4: Definitions and abbreviations.

IEC 61784-1 (2004-7) -
Digital data communications for measurement and control – Part 1: Profile sets for continuous and discrete manufacturing relative to fieldbus use in industrial control systems.

2 Safety

2.1 Overview

Our devices are state-of-the-art and comply with recognised safety regulations, nevertheless hazards can arise. In this chapter:

- We provide information on residual risks and hazards that can emanate from our devices on usage as intended.
- We warn about the foreseeable misuse of our devices.
- We refer to the necessary care and measures to be taken to prevent risks.

2.2 Measures for safety

NOTE:
Only install and place in operation your device taking into account the documents for the related device family!

Our devices are designed for quick, safe commissioning. For your own safety and for the safe function of your device, please be sure to observe the following points:

1. **Follow safety instructions for the devices!**
   Follow safety instructions and warnings in the information products related to the devices!
2. **Electrical drives are dangerous due to:**
   - Electrical voltages > 230 V/460 V! Dangerous voltages may be present 10 Minutes after the power is switched off. So check that electrical power is not present!
   - Rotating parts.
   - Automatically starting drives.
   - Hot components and surfaces.
   - Electrostatic discharge.
3. **Protection against magnetic and electromagnetic fields during installation and operation**
   Persons fitted with heart pacemakers, metallic implants and hearing aids must not be allowed access to the following areas:
   - Areas in the immediate vicinity of electrical equipment!
   - Areas in which electronics components and servo drives are installed, repaired and operated!
   - Areas where motors are installed, repaired and operated!
     Particular hazards emanate from motors with permanent magnets.
4. **Your qualifications**
   To prevent injury or damage, personnel may only work on the device if they have electrical engineering qualifications and knowledge of:
   - National health and safety regulations (BGV A3 4 in Germany).
   - Erection, installation, commissioning and operation of the device.

   All work in other areas, such as transport, storage and disposal is only allowed to be undertaken by trained personnel.
   The warranty will be rendered void on failure to follow these instructions!
5. **During installation observe the following:**
   - Comply with connection conditions and technical data as per the information product and the rating plate!
   - Comply with standards and directives on electrical installation, such as cable cross-section, shielding, etc.!
   - Do not touch electronic components and contacts!
     Electrostatic discharge can harm people and destroy components!
   - Take protection measures and use protective devices as per the applicable regulations (e.g. IEC/EN 60204 or IEC/EN 61800-5-1)!
   - Take “device earthing” protection measure!

2.3 General safety instructions and warnings

Hazards may emanate from our devices. For this reason pay attention to:

- The safety instructions and warnings in this document!
- Safety instructions and warnings in other documents, in particular the operation manuals related to the device product ranges!

Generally applicable safety instructions and warnings for the users of devices from Moog:

DANGER!	Risk of injury due to electrical power!
	· **Carelessness will result in serious injuries or death.** Follow safety instructions and warnings in this document and on the device.

WARNING!	Risk of injury due to electrical power!
	· **Carelessness may result in serious injuries or death.** Follow safety instructions and warnings in this document and on the device.

CAUTION!	Risk of injury or damage to the device due to incorrect operation!
	· **Carelessness may result in minor injuries or damage.** Follow safety instructions and warnings in this document and on the device.

WARNING!	Risk of injury due to hot surfaces and components!
	· **Carelessness may result in serious burns.** Electronic components may become hot during operation! Follow safety instructions and warnings in this document and on the device!

WARNING!	Risk of injury or damage due to electrostatic discharge!
	· **Electrostatic discharge can destroy components and, in the worst case, cause injury or death.** Do not touch electronic components and contacts! Follow safety instructions and warnings in this document and on the device!

Pay attention to **special safety instructions and warnings** that are given here in the document before a specific action and that warn the user about a **specific hazard**!

2.3.1 Safety instructions related to this documentation

The PROFIBUS and PROFINET fieldbus systems are **communication systems that are to be adapted at the boundaries of the drive systems MSD Servo Drive Single-Axis and Multi-Axis System and MSD Single-Axis Servo Drive Compact to the situation in the installation.**

CAUTION!	The user may not be aware of changes to the parameters in the fieldbus system!
	· This situation can result in uncontrolled behaviour of the drive system! Prior to system start, check parameters!

2.4 Important information

In the operation manuals for the drive product ranges you will find detailed information on the following areas:

- Intended use.
- Important instructions on the installation of your device.
- Responsibilities of installers and organisations operating complete machines or installations.
- Relevant laws, standards and directives applied.

3 Device descriptions

3.5 PROFIBUS fieldbus system

Characteristics of PROFIBUS fieldbus system:

- Open fieldbus standard for a wide variety of applications in manufacturing and process automation.
- Manufacturer-independent and open, safeguarded by the international standard IEC/EN 61158.
- Data transfer via differential signals with bus termination.
- No real-time support.

PROFIBUS-DP (decentralised peripherals):

- Communication system for usage at the field level in which a controller (PROFIBUS master) cyclically exchanges data with several slaves (e.g. servo drives, input/output modules “IO”, …).

3.6 PROFINET fieldbus system

Characteristics of PROFINET fieldbus system:

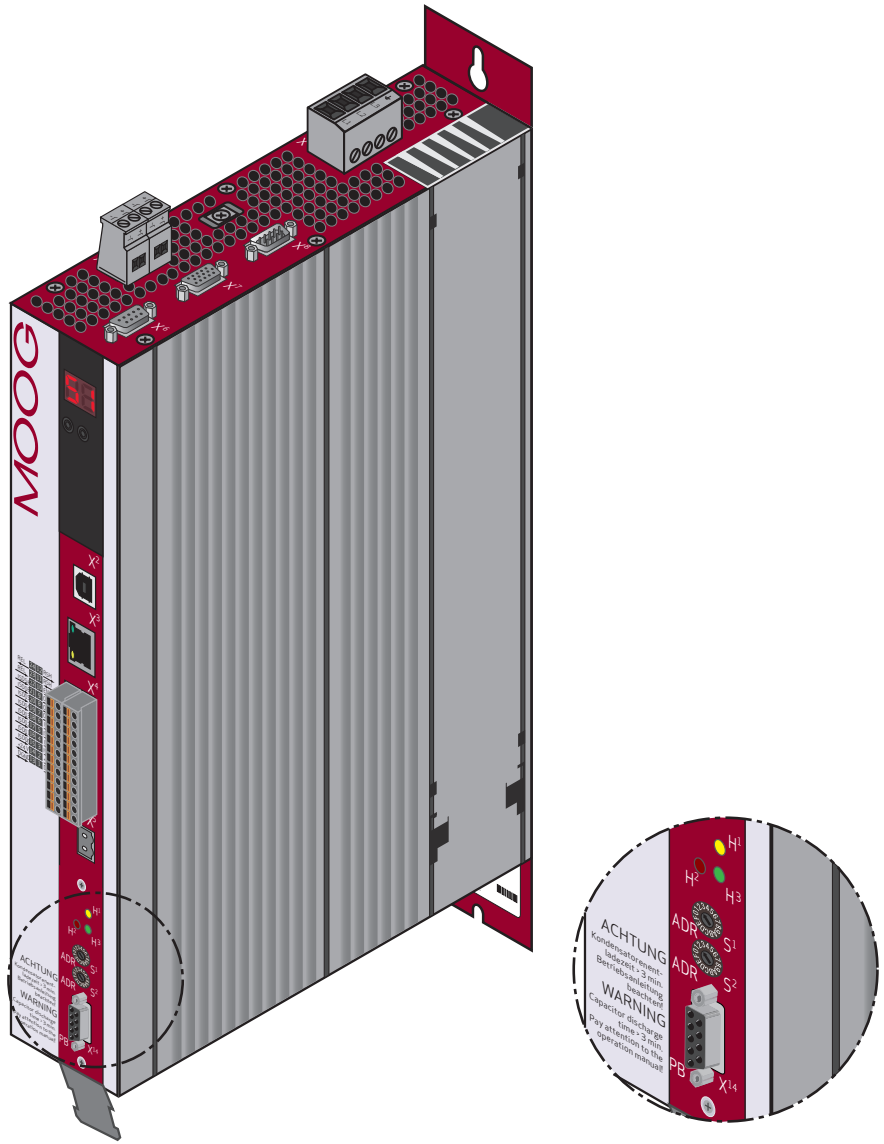
- Expands the PROFIBUS fieldbus system with applications that:
  - Improve the data communication (data-intensive parameter assignments, synchronised data transmission).
  - Contain industrial IT functions.
- The communication is based on Ethernet (TCP/IP).
- Tackles simple control tasks and highly dynamic motion control of drive axes equally well.
- Permits in the network, in parallel with the real-time communication, comprehensive diagnostics on the drive system via a control room or the Internet.

3.7 PROFIdrive device profile

The PROFIdrive device profile ensures that drive devices behave identically on a fieldbus system, independent of the manufacturer.

Characteristics of the PROFIdrive device profile:

- Manufacturer-independent for drive devices.
- Developed by the PROFIBUS and PROFINET International (PI) working group with the involvement of numerous device manufacturers.
- Modular structure.
- Contains standardised definitions (syntax and semantics) for the communication between drives and automation systems.
- In addition to the PROFIBUS standard (IEC/EN 61158), contains standardised device behaviour and access procedures for the drive data.
- Places limits on the options for the PROFINET and PROFIBUS services and supplements the application with requirements for data exchange.



4 Installation and connection of the PROFIBUS fieldbus system

4.1 Position

The illustration (left) shows the position of the PROFIBUS fieldbus system in the MSD Servo Drive. The position of the PROFIBUS fieldbus system in the MSD Single-Axis Servo Drive Compact is identical.

4.2 Connections and controls

NOTE:
The PROFIBUS fieldbus system is designed as a variant for the product ranges MSD Servo Drive Single-Axis and Multi-Axis System and MSD Single-Axis Servo Drive Compact !

Caution!	Risk of injury and/or damage due to electrical power!
	• Touching bare, electrically live wires or wires from which the insulation has been stripped can cause an electric shock and burns! • Short circuits can cause damage to the device! On mounting electrical components, e.g. wires and cables, make sure electrical power is not present! If necessary, replace damaged cables!

The figure below shows the position of the connections and controls for the PROFIBUS fieldbus system on the MSD Servo Drives.

MSD Servo Drive Single-Axis and Multi-Axis System **MSD Single-Axis Servo Drive Compact**

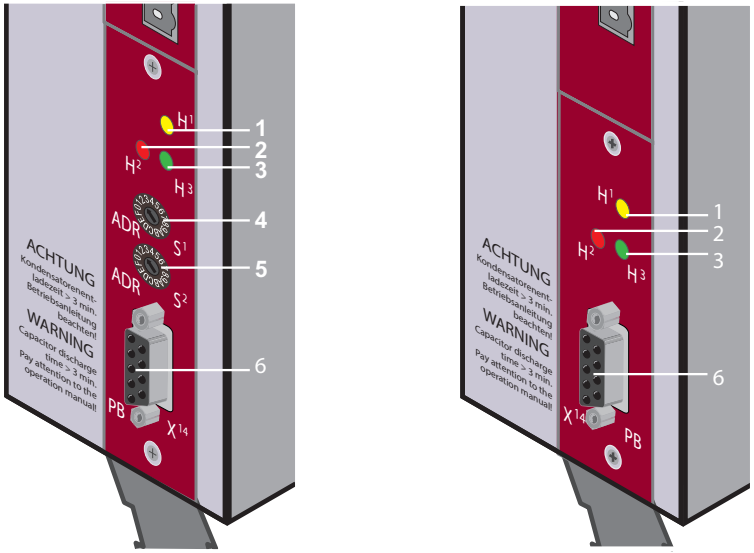


Figure 4.1 Layout, connections and controls PROFIBUS

Item	Designation	Function
1	H1	Yellow LED - operating state indication (data exchange)
2	H2	Red LED - operating state indication (chap. 4.2.1 on page 16)
3	H3	Green LED - operating state indication (chap. 4.2.1 on page 16)
4	S1	Coding switch - set PROFIBUS drive address = 0x(S2)(S1)
5	S2	Coding switch - set PROFIBUS drive address = 0x(S2)(S1)
6	X14	PROFIBUS cable connection (9-pin D-Sub socket)

Table 4.1 Connections and controls for the PROFIBUS fieldbus system

4.2.1 Light emitting diodes - fieldbus system flashing codes

Three light emitting diodes (H1, H2, H3) indicate the operating state of the PROFIBUS fieldbus system. The following table explains the flashing codes:

1. Self-test while the fieldbus system "boots"

H2 (red)	H3 (green)	Operating state
ON	ON	Reset (after power on).
ON	OFF	ASIC RAM - test and initialisation.
OFF	ON	End of ASIC RAM test and initialisation.

2. Diagnostics on the operating state

H2 (red)	H3 (green)	Operating state
OFF	FLASHING	“Seeking baud rate” - after switching on the fieldbus system without connection.
FLASHING	OFF	“Seeking baud rate ” - after switching on the fieldbus system and after connection has already been established once.
OFF	ON	Waiting for parameter data.
OFF	OFF	“Communication” - data exchange without acyclic master class 2 connection. Yellow LED (H1) illuminates!
OFF	2 x FLASHES, PAUSE *	“Communication” - data exchange "clear state".
2 x FLASHES, PAUSE *	OFF	Incorrect parameter data.
3 x FLASHES, PAUSE *	OFF	Incorrect configuration data
OFF	3 x FLASHES, PAUSE *	“Communication” - data exchange with acyclic master class 2 connection.

Table 4.2 The flashing cycles are in a loop.

3. Data exchange

H1 (yellow)	Operating state
ON	Device is cyclically exchanging data.

4.2.2 PROFIBUS address assignment

There are 3 ways of assigning the address for the PROFIBUS fieldbus system for the MSD Servo Drive, via the:

1. Coding switches S1 and S2 for the PROFIBUS fieldbus system.
2. Bus address parameter in the Moog DriveAdministrator 5 PC user software.
3. Integrated control unit on the servo drive.

NOTE:
All 3 types of address assignment require a device restart to activate the new address.

Address assignment via the coding switches S1 and S2 for the PROFIBUS fieldbus system

NOTE:
Address assignment via the coding switches applies to the MSD Servo Drives:

- Single-Axis System.
- Multi-Axis System.

Set a valid address between 0 and 125 using the coding switches S1 and S2:

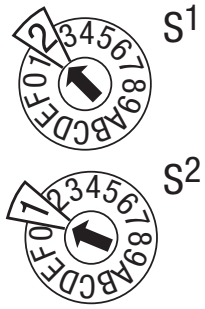


Figure 4.2 Coding switches for PROFIBUS address

Address assignment via bus address parameter in the Moog DriveAdministrator 5 PC user software

NOTE:
Address assignment via bus address parameter in the Moog DriveAdministrator 5 PC user software applies to the MSD Servo Drives:

- Single-Axis Servo Drive Compact.
- Single-Axis System.
- Multi-Axis System.

In the bus address parameter "P-0918-COM_DP_Adress" in the Moog DriveAdministrator 5 PC user software, set a valid address between 0 and 125 in decimal. It is to be noted that no slave address is allowed to occur or be assigned twice in the fieldbus network.

NOTE:
This parameter setting only applies to the MSD Servo Drive Single-Axis and Multi-Axis System if the coding switches S1 and S2 are set to an address >125, e.g. 0xFF (S1 = S2 = F).

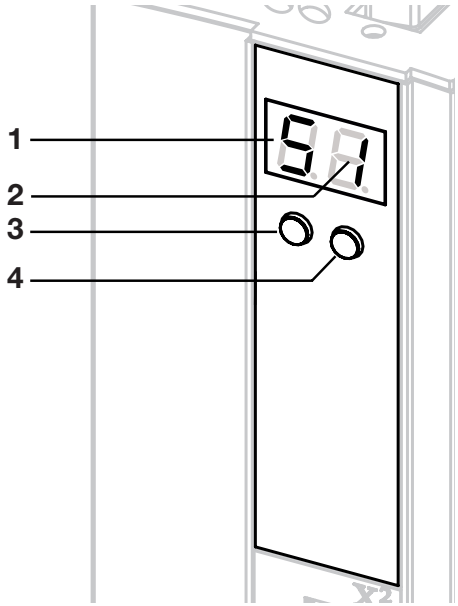
You will find further information on the Moog DriveAdministrator 5 PC user software in the online Program Help.

Address assignment via the integrated control unit on the MSD Servo Drive

NOTE:
Address assignment via the integrated control unit applies to the MSD Servo Drives:

- Single-Axis Servo Drive Compact.
- Single-Axis System.
- Multi-Axis System.

Integrated control unit on the MSD Servo Drive:



Item	Des.	Function
1	D1	7-segment display, 1st digit
2	D2	7-segment display, 2nd digit
3	T1	Button
4	T2	Button

Table 4.3 Items on the integrated control unit on the MSD Servo Drive

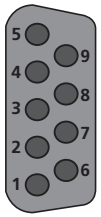
Using the two buttons on the integrated control unit, select the setting “Fb” (display).

- Press T1 until Fb is indicated on the display.
- Then press T2 twice until there is a number on the display.
- You can now use T1 to set the most significant part of the address.
- You can now use T2 to set the least significant part of the address.
- The number appears in hexadecimal form.
- Once the required address has been set, press T1 and T2 until “oK” is indicated on the display.
- The servo drive now saves the valid address in parameter **P-0918**.
- Restart device.

NOTE:
You will find all functions and displays on the integrated control unit and an example configuration for a fieldbus system in the operation manual for your MSD Servo Drive.

4.2.3 D-Sub socket (X14) - pin assignment

The PROFIBUS fieldbus system for the MSD Servo Drive has a 9-pin D-Sub socket for connection as a field device. The pin assignment is as per the interface standard for data transmission EIA-485 (RS-485).

9-pin D-Sub socket	Pin	EIA-485/ RS-485 [1]	Signal/ pin assign-ment	Function	Specification
X14 	1		Not connected	An earthed shield is connected via the housing for X14.	–
	2		RP	Reserved for power supply via fieldbus system (ground)	Optional
	3	B/B‘ (red)	RxD / TxD-P	Transmit data/receive data positive	**Required**
	4		CNTR-P	Control signal repeater positive (transmit direction control)	Optional
	5 [2]	C/C‘	DGND	Ground for data signals and VP terminating resistor	**Required**
	6 [2]		VP	Supply voltage VP terminating resistor (+5 V)	**Required**
	7		RP	Reserved for power supply via fieldbus system (+24 V)	Optional
	8	A/A‘ (green)	RxD / TxD-N	Transmit data/receive data negative	**Required**
	9		CNTR-N	Control signal repeater negative (transmit direction control)	Optional

1) Definition in the PROFIBUS guideline "Interconnection Technology". You will find more detailed information on EIA-485 connection technology for D-Sub connectors in the following chapters and in the documentation from the PI (e.g. PROFIBUS - Installation Guideline) on the PROFIBUS fieldbus system at http://www.profibus.com.

2) The supply voltage for the terminating resistor is provided by the servo drive.

Table 4.4 Pin assignment, D-Sub socket - connection X14 for the PROFIBUS fieldbus system

5 Installation and connection of the PROFINET fieldbus system

5.1 Position

The illustration (right) shows the position of the PROFINET fieldbus system in the MSD Servo Drive. The position of the PROFINET fieldbus system in the MSD Single-Axis Servo Drive Compact is identical.

5.2 Connections and controls

NOTE:
The PROFINET fieldbus system is designed as a variant for the product ranges MSD Servo Drive Single-Axis and Multi-Axis System and MSD Single-Axis Servo Drive Compact!

Caution!	Risk of injury and/or damage due to electrical power!
	• Touching bare, electrically live wires or wires from which the insulation has been stripped can cause an electric shock and burns! • Short circuits can cause damage to the device! • On mounting electrical components, e.g. wires and cables, make sure electrical power is not present! If necessary, replace damaged cables!

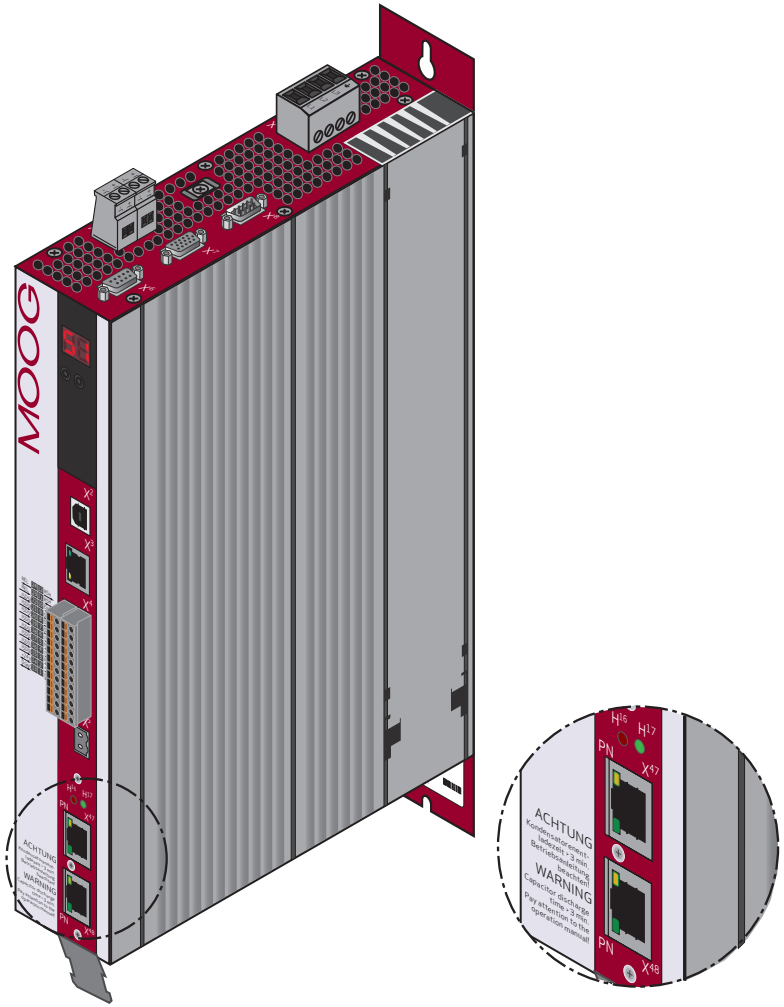


Figure 5.1 Layout, MSD Servo Drive model PROFINET

The following figure shows the positions of the connections and controls for the PROFINET fieldbus system for the MSD Servo Drive:

PROFINET for the **MSD Servo Drive Single-Axis and Multi-Axis System**	PROFINET for the **MSD Single-Axis Servo Drive Compact**

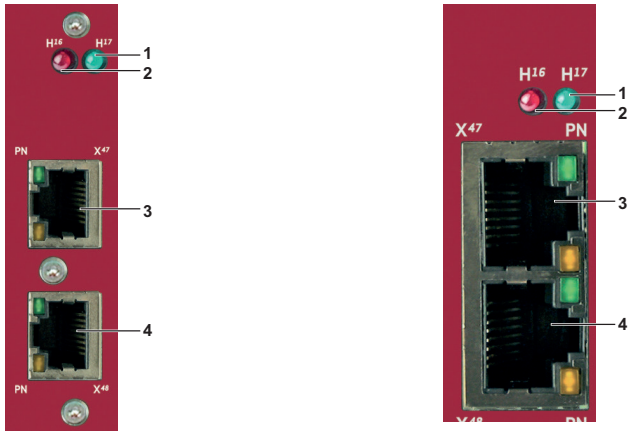


Figure 5.2 Layout, connections and controls PROFINET

Item	Designation	Function
1	H17	Status indication LED (green)
2	H16	Status indication LED (red)
3	X47	PROFINET cable connection (RJ45 sockets, communication direction can be configured): 2 multiports PHY (Physical Layer Transceiver), with the functions: • Autonegotiation - Automatic detection of functionality of the other interface. • Auto Crossing - Through cabling that prevents malfunctions due to mixed up transmit and receive wires. No cross-over cables are required. • Auto Polarity - Fault detection on mixed up cable connection assignment (e.g. RecvData+ with RecvData-).
4	X48	

Table 5.1 Connections and controls for the PROFINET fieldbus system

5.2.1 Light emitting diodes - fieldbus system flashing codes

Two light emitting diodes (H16, H17) indicate the operating state of the PROFINET fieldbus system:

1. Self-test while the fieldbus system “boots”

H16 (red)	H17 (green)	Operating state
ON	ON	Reset (after power on).
ON	OFF	Device test and initialisation.
ON	ON	End of device test and initialisation. Fieldbus system ready.

2. Diagnostics on the operating state

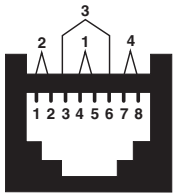
H16 (red)	H17 (green)	Operating state
ON	ON	Fieldbus system ready. No cyclic data exchange with PROFINET master.
OFF	ON	Fieldbus system ready. Cyclic data exchange with PROFINET master, RT class 2 and 3
ON	FLASHING	The fieldbus system is loading the PROFINET software from the memory in the servo drive. The PROFINET software is part of the firmware archive in the memory in the servo drive.
1 s ON 1 s OFF (1 Hz)	1 s ON 1 s OFF (1 Hz)	Flashing function of the PROFINET master (is used for device identification).
OFF	ON with short interruption (0.5 s)	Cyclic data exchange, RT class 1

Table 5.2 The flashing cycles are in a loop.

5.2.2 RJ45 socket (X47/X48)

Pin assignment

EIA/TIA-568A and EIA/TIA-568B are standards for the contact assignment on 8-pin RJ45 plugs and sockets. The difference between the two standards is that core pairs 2 and 3 are reversed. The pin assignment given below shows the colour code for the standard EIA/TIA-568B.



Pin	EIA/TIA-568B Core pair number	Function	EIA/TIA-568B colour
1	2	Tx Data+	White/orange dash
2	2	Tx Data-	Orange/white dash or orange
3	3	Rx Data+	White/green dash
4	1	Not used	Blue/white dash or blue
5	1	Not used	White/blue dash
6	3	Rx Data-	Green/white dash or green
7	4	Not used	White/brown dash
8	4	Not used	Brown/white dash or brown

Table 5.3 Pin assignment for the RJ45 socket from the standard EIA/TIA-568B

Light emitting diodes - flashing codes

The 2 RJ45 sockets (X47/X48) for the connection of the PROFINET cables each have 2 integrated status LEDs (green and yellow) with the following flashing codes:

LED	Function	Meaning
Green	Link / Activity	Off = no link ⇨ No connection to the bus user.
		On = Link ⇨ Connection to the bus user. No data exchange.
		Flashing = Activity ⇨ Data exchange with bus user.
Yellow	RUN	Off = Initialisation ⇨ Device state = “Initialisation”.
		Flashing = Pre-Operational ⇨ Device state = “Pre-Operational”.
		Single flash = Safe-Operational ⇨ Device state = “Safe-Operational”.
		On = Operational ⇨ Device state = “Operational”.

Table 5.4 Meaning of the LEDs

6 Installation of the PROFIBUS fieldbus system

6.1 GSD file (general station description file)

To achieve a simple “Plug-and-Play configuration” for the PROFIBUS fieldbus system, all communication settings for a device that participates in the PROFIBUS communication are defined in a general station description file.

The GSD file contains:

- Standard telegrams from the “PROFIdrive profile”.
- Manufacturer-specific telegram types.

By means of defined file formats, each PROFIBUS device acquires the general station description and automatically takes into account this data during the configuration of the PROFIBUS fieldbus system. The GSD file contains, e.g., important device parameters:

- The device name.
- The bus timing.
- The extended services available.
- The modules that can be selected (telegram types).

Integrating MSD Servo Drive in the PROFIBUS network:

- During the configuration phase, import the GSD file into the engineering tool for the fieldbus controller (master).
- You will find the GSD file on our web site (http://www.moogsoftwaredownload.com/msd.html).

6.2 Specification of the connectors and cables

We recommend the following connectors and cables for wiring the PROFIBUS fieldbus system:

PROFIBUS D-Sub connector	
Siemens article number	6GK1500-0FC10
Siemens type designation	PROFIBUS FC bus connection connector EIA-485
Siemens article description	Bus connector with axial cable outlet (180°). PB FC EIA-485 PLUG 180, PB-plug with Fastconnect connector and axial cable outlet for industry PC, SIMATIC OP, OLM, transmission rate: 12 Mbit/s, terminating resistor with separating function, plastic housing.

PROFIBUS cable	
Siemens article number	6XV1830-0EH10
Siemens type designation	PROFIBUS FC standard cable GP
Siemens article description	SIMATIC NET, PB FC standard cable GP, 2-core, shielded, special design for rapid installation, maximum 1000 m, minimum ordering quantity 20 m, sold by the metre.

You will find technical data on the D-Sub connector and PROFIBUS cables on the manufacturer's web site.

6.3 Topology

On the usage of EIA-485 (RS-485) transmission technology, connect all field devices in a line or tree structure. In some cases there are several masters on one fieldbus (multi-master operation). They form either

- Independent sub-systems consisting of one DP master class 1 and the related slaves, or
- Additional planning or diagnostic devices DP master class 2.

All DP masters can read the input and output images on the slaves.

Only the DP master class 1 can write outputs:

- Assign the DP-M1 during the planning of the system.

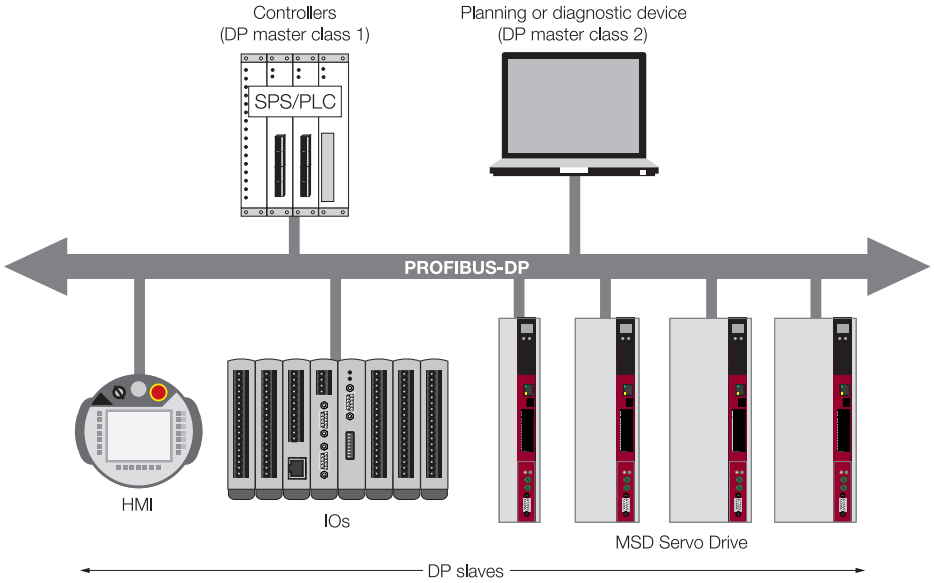
Repeater

The repeater:

- Expands a network topology (line and tree structure).
- Its usage multiplies the cable lengths. Please pay attention to the maximum lengths of the fieldbus cables and the data transfer rates!
- Divides the network into physical segments, the logical bus topology is retained.
- Increases the reliability of the entire network, as on the failure of one sub-network the others can operate independently (tree structure).

Example line structure (without repeater):

Profibus is based on the EIA-485 standard and therefore permits only a “pure” line structure (maximum 32 bus users, repeaters make possible other installation concepts):



DP master class 1 (controllers):

- Control the cyclic data traffic.
- Exchange process data with the slaves in defined message cycles.

DP masters class 2 (planning or diagnostic devices):

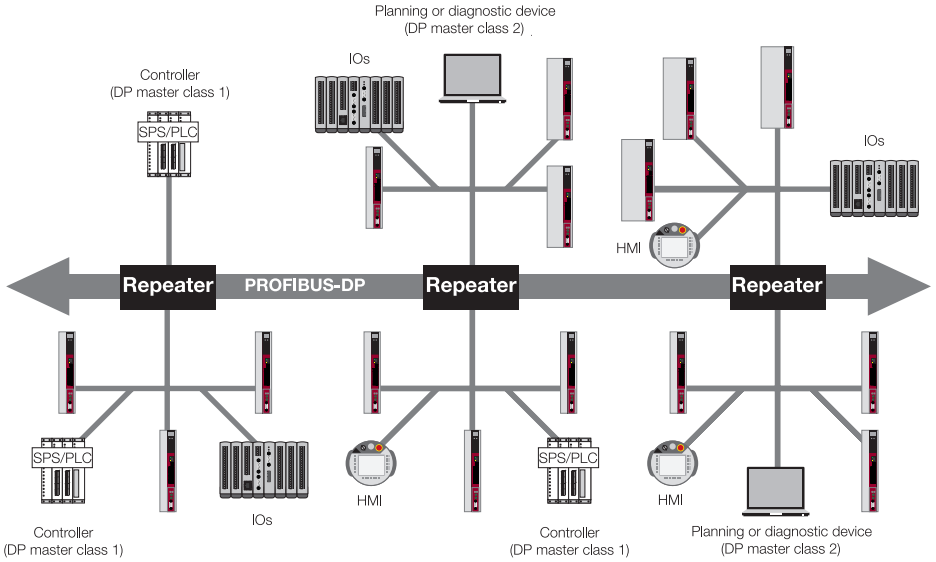
- Communicate acyclically with the fieldbus.
- Configure and set parameters on intelligent field devices.

PROFIBUS-DP slaves (e.g. IO, servo drives, HMI, and others):

- Transfer input and output information from and to the peripheral.
- The amount of information is device-dependent. See “Table 8.10 Identifiers for user-specific telegrams” on page 37.

Example tree structure (with repeaters):

Tree structures with complex, extensive cable lengths can be realised in the PROFIBUS fieldbus system by using repeaters:



6.4 Bus termination

For reliable signal transmission, a bus termination as per EIA-485 is provided at both ends of the line structure for a PROFIBUS segment. In the tree structure the two fieldbus devices furthest apart have a bus termination.

The bus termination is as follows:

- D-Sub connector with cable terminating resistor “Rt” in accordance with EIA-RS standard.
- Pull-down resistor "Rd" connected to the data reference potential DGND.
- Pull-up resistor "Ru" connected to the power supply potential VP (+5 V).

This design results in a defined quiescent potential (no bus user transmitting) of 1.1 V between pin 3 (RxD / TxD-P) and pin 8 (RxD / TxD-N).

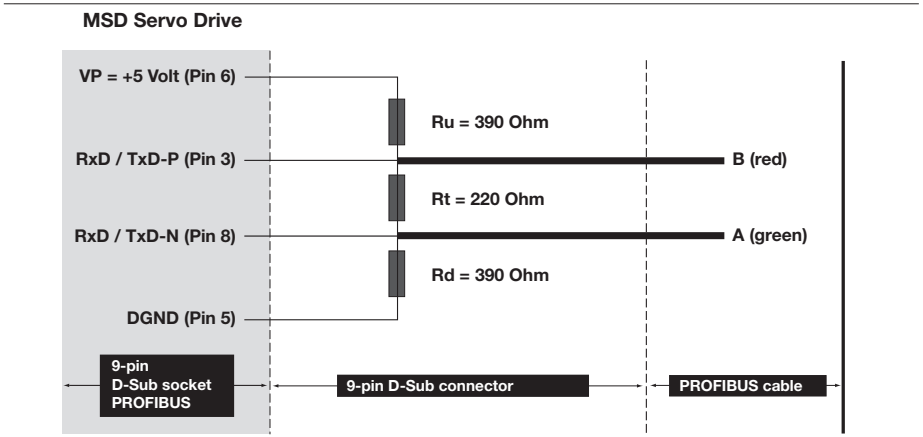


Figure 6.1 Bus termination in the 9-pin D-Sub connector

On ready made PROFIBUS cables the bus terminating resistors are integrated into the 9-pin D-Sub connector (EIA-485). The bus termination is activated via a switch on the D-Sub connector.

NOTE:
Pay attention to the function and operation of bus terminations from other manufacturers of PROFIBUS connectors and PROFIBUS cables.

CAUTION!	Incorrectly configured D-Sub connectors (EIA-485) in the PROFIBUS segment
	D-Sub connectors (EIA-485) in the PROFIBUS segment inadvertently configured as bus terminations can cause malfunctions or make it impossible to contact the bus user! • Only use a bus termination at the two ends of a PROFIBUS segment. Pay attention to correct switch settings on your D-Sub connector (EIA-485)!

6.5 Configuration

The configuration of the PROFIBUS fieldbus system is described in more detail in “14 Commissioning with manufacturer-specific telegrams” on page 85.

7 Installation of the PROFINET fieldbus system

7.1 GSDML file - general station description (xml)

Similar to the GSD file for the PROFIBUS fieldbus system, the GSDML file (Generic Station Description Markup Language file) contains data and communication features for the PROFINET fieldbus system. These XML-based data are imported into the engineering tool for the IO controller (master) during the configuration of your PROFINET network. The data contain, for example:

- Descriptions of the individual input and output assemblies.
- Options for the usage of I/O modules in the slots.
- Important parameters for the operation of the field devices.
- Diagnostics (and their significance) on field devices.
- Description of several devices in a family in one file.

7.1.1 Properties of the GSDML file

- The content of the GSDML file follows the standard ISO 15745.
- In a GSDML file for PROFINET IO a complete device family (several device access points and peripheral modules) can be described.
- For each device access point (DAP) available in the device family the manufacturer can define a series of peripheral modules.

NOTE:
During the configuration of your MSD Servo Drive in the PROFINET network, select the related DAP:

- DAP2 for MSD Servo Drive Single-Axis and Multi-Axis System, MSD Servo Drive FS (Functional Safety) and MSD Single-Axis Servo Drive Compact.

The name of GSDML file is based on the following schematic:

Schematic:	GSDML-<version> <Manufacturer> <Device_name> <Date>.xml
Example:	GSDML-V2.34-Moog-MSD-Servo-Drive-20180530.xml

You will find the GSDML file in the firmware package for your devices or on the Moog web site (http://www.moogsoftwaredownload.com/msd.html).

Overview of the IO modules

0 - 0x79	RT modules
0x101- 0x179	IRT modules
0x1001 - 0x1079	Profile- compliant modules for RT and IRT

The profile-compliant modules should be used for all applications.

All newly added modules have been created according to the PROFIdrive profile and have the following structure:

	Slot 0				Slot 1	
Subslot	1	32768	32769	32770	1, PAP	2
Module ID	2, DAP	2, DAP	2, DAP	2, DAP	MOD ID	MOD ID
API	0	0	0	0	0x3A00	0x3A00
Submodule ID	1	2	3	3	0xFFFF	SUB ID
Data length in words	0	0	0	0	0	Inputs/ outputs

Table 7.1 Structure of the newly added modules according to PROFIdrive profile

Example for STD telegram 1:

MOD ID: 0x1001, SUB ID = 0x0001, 2 input words, 2 output words

PAP (Parameter Access Point): access point to parameters for a drive object (DO).

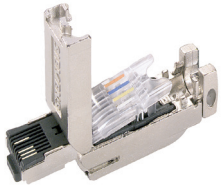
List of the new modules

Description	Inputs, outputs in words	Module ID	Submodule ID
Std telegram 1	2/2	0x1001	1
Std telegram 2	4/4	0x1002	2
Std telegram 3	5/9	0x1003	3
Std telegram 5	9/9	0x1005	5
Std telegram 7	2/2	0x1007	7
Std telegram 8	5/5	0x1008	8
Std telegram 9	10/5	0x1009	9
PKW + 4 IO	6/6	0x1065	0x65
PKW + 12 IO	10/10	0x1066	0x66
4 IO	2/2	0x1067	0x67
12 IO	6/6	0x1068	0x68
PKW + 20 IO	14/14	0x1069	0x69
28 IO	14/14	0x106F	0x6F
PKW + 28 IO	18/18	0x1070	0x70

Figure 7.1 List of the new modules

7.2 Specification of the connectors and cables

Moog recommends the usage of certified connectors and cables! Recommended connectors for the PROFINET fieldbus system:

RJ45 connector	Designations	
	Siemens article designation:	6GK1901-1BB10-2AA0
	Siemens article description	IE FC RJ45 PLUG 180 2X2, RJ45 plug connector (10/100MBIT/S) with rugged metal housing and FC connecting method.

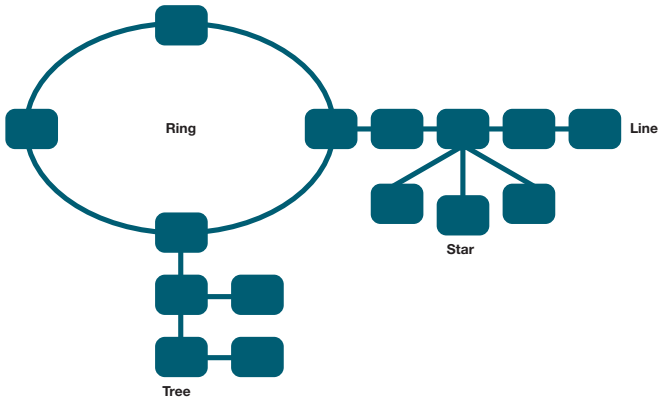
Recommended cables for the PROFINET fieldbus system:

Ethernet cable	Designations	
	Siemens article designation:	6XV1840-2AH10
	Siemens article description	SIMATIC NET, IEFC TP standard cable, GP2X2

7.3 Topology

The PROFINET fieldbus system permits the following topologies (network structures):

- Line
- Star
- Tree
- Ring.



As result there is maximum flexibility during machine and installation planning.

The PROFINET network:

- Can be installed without specialist knowledge and meets all relevant requirements in the industrial environment.
- Follows the layout of the machine, as a consequence the wiring effort is reduced and the commissioning easier.
- Can be expanded without additional measures.
- Can be realised preferably using line and ring structures with cross-over cables. Due to switches integrated into the field devices no additional network components are required.
- Permits several PROFINET IO controllers (masters) to access one field device (shared device) or to communicate with each other (I device).

7.4 Configuration

The configuration of the PROFINET fieldbus system is described in more detail in chapter “14 Commissioning with manufacturer-specific telegrams” on page 85.

8 Cyclic data transmission

8.1 Parameter process data objects (PPO)

Communication between a class 1 master and the MSD Servo Drive is established in 3 phases:

1. The bus parameters, monitoring times and drive-specific parameters for the MSD Servo Drive are set.
2. The master verifies the MSD Servo Drive using telegram types (PPOs) in the fieldbus communication.
3. The cyclic user data traffic commences.

The GSD/GSDML file contains different telegram types, PPOs (parameter process data objects). The PPOs form the basis for the configuration of the servo drive.
The GSD/GSDML file:

- Has, along with standardised standard telegrams (PROFIdrive profile), user-specific telegrams with process data channel (PZD) and parameter channel (PKW).

8.2 Standard telegrams and manufacturer-specific process data channels

Standard telegrams in accordance with "PROFIdrive" contain process data objects. A process data object is grouped in words and each process data object has an abbreviation:

Abbreviation	Designation	Number of words
STW1	Control word 1	1
STW2	Control word 2	1
ZSW1	Status word 1	1
ZSW2	Status word 2	1
NSOLL_A	Speed reference value	1
NIST_A	Speed actual value	1
SATZANW	Set selection (from driving set table)	1
AKTSATZ	Actual set selection (from driving set table)	1
XSOLL_A	Reference position	2
XIST_A	Actual position	2
TARPOS_A	Target position	2
VELOCITY_A	Reference velocity	2
E_DIGITAL	Input	1
A_DIGITAL	Output	1
NSOLL_B	Speed reference value B	2
NIST_B	Speed actual value B	2
G1_STW	Sensor 1 control word	1
G1_ZSW	Sensor 1 status word	1
G1_XIST1	Sensor 1 position value 1	2
G1_XIST2	Sensor 1 position value 2	2
XERR	Position reference value, tracking error	2
KPC	Position control gain factor, unit: (1/1 000) s–1	2

Table 8.1 Abbreviations for process data objects in the standard telegram

8.2.1 Standard telegrams (PPOs) according to “PROFIdrive”

NOTE:
Output words: data from the controller to the drive
Input words: data from the drive to the controller

The servo drive family MSD Servo Drive/MSD Single-Axis Servo Drive Compact supports the following, defined standard telegrams:

- **Standard telegram 1 (application class 1) for speed control**, consisting of 2 input words and 2 output words:

PZD number	1	2
Output words/setpoints	STW1	NSOLL_A
Input words/actual values	ZSW1	NIST_A

Table 8.2 Standard telegram 1

- **Standard telegram 2 (application class 1) for speed control,** consisting of 4 input words and 4 output words:

PZD number	1	2 3	4
Output words/setpoints	STW1	NSOLL_B	STW2
Input words/actual values	ZSW1	NIST_B	ZSW2

Table 8.3 Standard telegram 2, applies only for PROFINET

- **Standard telegram 3 (application class 1, 4) for speed control,** isochronous, consisting of 5 output words and 9 input words:

PZD number	1	2 3	4	5	6 7	8 9
Output words/setpoints	STW1	NSOLL_B	STW2	G1_STW		
Input words/actual values	ZSW1	NIST_B	ZSW2	G1_ZSW	G1_XIST1	G1_XIST2

Table 8.4 Standard telegram 3, applies only for Profinet

- **Standard telegram 5 (application class 4) for speed control,** isochronous, DSC (Dynamic Servo Control) consisting of 9 input words and 9 output words:

PZD number	1	2 3	4	5	6 7	8 9
Output words/setpoints	STW1	NSOLL_B	STW2	G1_STW	XERR	KPC
Input words/actual values	ZSW1	NIST_B	ZSW2	G1_ZSW	G1_XIST1	G1_XIST2

Table 8.5 Standard telegram 5, applies only for Profinet

NOTE:
The standard telegrams 2, 3 and 5 can also be used to operate a “velocity axis” or “positioning axis” technology object in the TIA portal.

- **Standard telegram 7 (application class 3) for driving set selection**, consisting of 2 input words and 2 output words:

PZD number	1	2
Output words/setpoints	STW1	SATZANW
Input words/actual values	ZSW1	AKTSATZ

Table 8.6 Standard telegram 7

The MSD Servo Drive has 16 driving sets that can be selected ("Reference value table" in Moog DriveAdministrator 5).

- **Standard telegram 8 (application class 5) for positioning and specification of the positioning velocity**, consisting 5 input words and 5 output words:

PZD number	1	2 3	4	5
Output words/setpoints	STW1	XSOLL_A	STW2	NSOLL_A
Input words/actual values	ZSW1	XIST_A	ZSW2	NIST_A

Table 8.7 Standard telegram 8

- **Standard telegram 9 for positioning**, consisting of 6 output words and 5 input words.

PZD number	1	2 3	4	5	6
Output words/setpoints	STW1	TARPOS_A	STW2	VELOCITY_A	
Input words/actual values	ZSW1	XIST_A	ZSW2	NIST_A	-

Table 8.8 Standard telegram 9

Signal lists with process data, as described in chapter “8.2.1 Standard telegrams (PPOs) according to “PROFIdrive”” on page 34, are automatically configured for the standard telegrams using the firmware. The following parameters are also configured:

Parameters configured in addition to the process data signal lists	Meaning
P-0300	Selection of control mode
P-0301	Selection of how the reference value profile is created:
P-0165	Setpoint selector
P-0159	Control location selector

Table 8.9 List of the parameters configured in addition to the process data signal lists.

8.2.2 User-specific telegrams (PPOs)

Along with the standard telegrams there are user-specific telegrams.
User-specific telegrams (PPOs):

- Are transmitted cyclically.
- Contain process data objects (PZD).
- In some instances contain a parameter channel PKW enabling access to the servo drive's parameters.

8.2.3 Process data signal lists for user-specific telegrams

The servo drive has two field parameters that contain all writeable and readable process data for PROFIBUS/PROFINET communication DP-V0 in the form of signal lists:

1. Parameter **P-1284** (COM_DP_SignalList_Write) - contains all writeable process data (also readable).
2. Parameter **P-1285** (COM_DP_SignalList_Read) - contains all readable process data.

Configuring process data

Configure the process data to be written in the process data selection parameter **P-0915** (COM_DP_PZDSelectionWrite). The related PPO type defines the number of items of process data to be written.

Process data defined as field parameters can also be mapped using the parameter **P-1253** (COM_DP_PZDSelectionWrite_Idx). For this purpose the corresponding field element (sub index) is entered in the list. The related parameter is in **P-0915**.

Configure the process data to be read in the process data selection parameter **P-0916** (COM_DP_PZDSelectionRead). The related PPO type defines the number of items of process data to be read.

Using the parameter **P-1254** (COM_DP_ PZDSelectionRead _Idx), process data defined as field parameters can also be mapped. For this purpose the corresponding field element (sub index) is entered in the list. The related parameter is in **P-0916**.

In the standard telegrams the signal numbers for the process data are automatically written to the selection parameters. Manual entry is then not possible.

Example:

Mappable index for process data (example for reading process data):

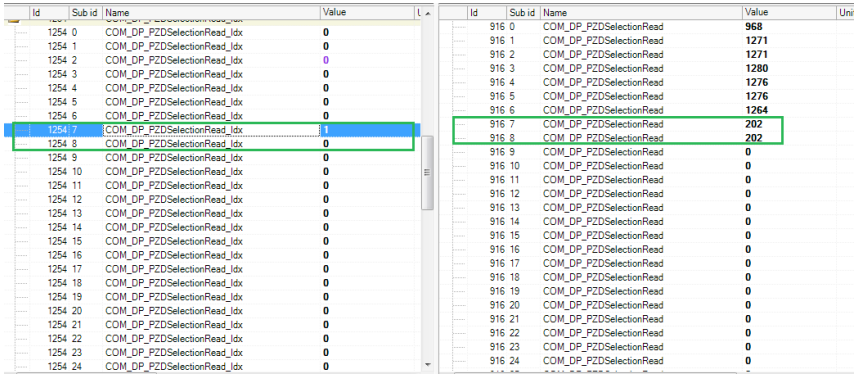


Figure 8.1 Mappable index for process data (example for a reading process data)

The parameter **P-0202**, sub index 1 is mapped as a double word. The entry in **P-1254**, sub index 8 is ignored because parameter **P-0202** is a double word.

A maximum of 32 items of process data can be “mapped” in the process data signal lists (write and read). Here you can use both words and double words.

Telegram selection P-0922	Profibus identifier according to GSD file	PROFINET module ID	PROFINET module ID IRT	PROFI-NET module ID Profidrive	Data length for the process data	Data channels
1	0xC3 0xC1 0xC1 0xFD, 0x00 0x01	1	0x101	0x1001	2 words input/output data (consistent overall length)	STD telegram 1
2	-	-	-	0x1002	4 words input/output data (consistent overall length)	STD telegram 2
3	-	-	-	0x1003	9 words input data/5 words output data (consistent overall length)	STD telegram 3
5	-	-	-	0x1005	9 words input/output data (consistent overall length)	STD telegram 5
7	0xC3 0xC1 0xC1 0xFD, 0x00 0x07	7	0x107	0x1007	2 words input/output data (consistent overall length)	STD telegram 7
8	0xC3 0xC4 0xC4 0xFD, 0x00 0x08	8	0x108	0x1008	5 words input/output data (consistent overall length)	STD telegram 8
9	0xC3 0xC5 0xC4 0xFD, 0x00 0x09	9	0x109	0x1009	5 words input data/ 6 words output data (consistent overall length)	STD telegram 9
101	0xF3 0xF1	0x65	0x165	0x1065	4 words input/output data (consistent overall length) 2 words input/output data (consistent overall length)	PKW channel PZD channel
102	0xF3 0xF5	0x66	0x166	0x1066	4 words input/output data (consistent overall length) 6 words input/output data (consistent overall length)	PKW channel PZD channel
103	0xF1	0x67	0x167	0x1067	2 words input/output data (consistent overall length)	PZD channel
104	0xF5	0x68	0x168	0x1068	6 words input/output data (consistent overall length)	PZD channel
105	0xF3 0xF9	0x69	0x169	0x1069	4 words input/output data (consistent overall length) 10 words input/output data (consistent overall length)	PKW channel PZD channel
106	0xF3	0x6A	0x16A	-	4 words input/output data (consistent overall length)	PZD channel
107	0xF3 0xF3	0x6B	0x16B	-	4 words input/output data (consistent overall length) 4 words input/output data (consistent overall length)	PKW channel PZD channel
108	0xF7	0x6C	0x16C	-	8 words input/output data (consistent overall length)	PZD channel
109	0xF3 0xF7	0x6D	0x16D	-	4 words input/output data (consistent overall length) 8 words input/output data (consistent overall length)	PKW channel PZD channel
110	0xF9	0x6E	0x16E	-	10 words input/output data (consistent overall length)	PZD channel
111	0xC0 0xCD 0xCD	0x6F	0x16F	0x106F	14 words input/output data (consistent overall length)	PZD channel
112	0xF3 0xC0 0xCD 0xCD	0x70	0x170	0x1070	4 words input/output data (consistent overall length) 14 words input/output data (consistent overall length)	PKW channel PZD channel
113	0xC0 0xD1 0xD1	0x71	0x171	-	18 words input/output data (consistent overall length)	PZD channel

Table 8.10 Identifiers for user-specific telegrams

Telegram selection P-0922	Profibus identifier according to GSD file	PROFINET module ID	PROFINET module ID IRT	PROFI-NET module ID Profidrive	Data length for the process data	Data channels
114	0xF3 0xC0 0xD1 0xD1	0x72	0x172	-	4 words input/output data (consistent overall length) 18 words input/output data (consistent overall length)	PKW channel PZD channel
115	0xC0 0xD5 0xD5	0x73	0x173	-	22 words input/output data (consistent overall length)	PZD channel
116	0xF3 0xC0 0xD5 0xD5	0x74	0x174	-	4 words input/output data (consistent overall length) 22 words input/output data (consistent overall length)	PKW channel PZD channel
117	0xC0 0xD9 0xD9	0x75	0x175	-	26 words input/output data (consistent overall length)	PZD channel
118	0xF3 0xC0 0xD9 0xD9	0x76	0x176	-	4 words input/output data (consistent overall length) 26 words input/output data (consistent overall length)	PKW channel PZD channel
119	0xC0 0xDD 0xDD	0x77	0x177	-	30 words input/output data (consistent overall length)	PZD channel
120	0xF3 0xC0 0xDD 0xDD	0x78	0x178	-	4 words input/output data (consistent overall length) 30 words input/output data (consistent overall length)	PKW channel PZD channel
121	-	0x79	0x176	-	32 words input/output data (consistent overall length)	PZD channel

Table 8.10 Identifiers for user-specific telegrams

8.2.4 Parameter channel PKW

Some PPOs have a cyclic parameter channel (PKW). This channel allows drive parameters to be read or written:

PKW							
1st byte	2nd byte	3rd byte	4th byte	5th byte	6th byte	7th byte	8th byte
PKE (1 word)		SUB (1 word)	LEN (1 word)	Data (1 word)		Data (1 word)	

Table 8.11 Structure of the parameter channel PKW

The parameter channel has 4 words:

- The parameter identifier PKE
  - **1 word, 1st and 2nd byte**
- The sub index SUB
  - **1 word, 3rd byte**
- The length information LEN
  - **1 word, 4th byte**
- The data area Data
  - **1 word, 5th and 6th byte**
  - **1 word, 7th and 8th byte**

Parameter identifier (PKE)

Parameter identifier (PKE) in bit-wise notation and significance of the bits:

AK - task or response identifier (value range 0 ... 15)				PNU - parameter number (value range 1 ... 4095)											
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Table 8.12 Parameter identifier (PKE) in bit-wise notation

Sub index (SUB)

The sub index (3rd byte) 0 and 1 signifies that a field parameter is addressed using the element 0, correspondingly 2 is element 1 etc.

Length information (LEN)

The length information (4th byte) is only required for the task identifiers 9-12. The sub index (SUB) and the length information (LEN) are shown in the following table by bits.

Sub index SUB								Length information LEN							
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Table 8.13 Sub index SUB and length information LEN

Task identifier (master)

The following table explains the task identifier (master):

Task identifier (AK)	Function
0	No task
1	Request parameter value
2	Change parameter value (word)
3	Change parameter value (double word)
4	Read parameter description
5	-
6	Request parameter value (array)
7	Change parameter value (array) (word)
8	Change parameter value (array) (double word)
9	Write the data from the bus to the cache
10	Write the data from the cache to the destination parameter
11	The cache reads the data in the destination parameter
12	The bus reads the data in the cache

Table 8.14 Task identifier AK (Master ⇨ Slave)

Task identifier 4

In addition, a parameter description can be read via task identifier 4. The parameter description contains relevant information on the related parameter.

Table 8.15 shows the sub indices that access parameter structure elements (see ""Table 8.11 Structure of the parameter channel PKW" on page 39). The 3rd byte defines the sub index:

Sub index	Meaning	Data type
1	Identifier (ID)	V2
2	Number of field elements or string length	Unsigned 16
3	Standardisation factor	Floating point
4	Variable attributes	OctetString 2
5	Reserved	OctetString 4
6	Name (only the first four bytes are transferred)	VisibleString 16
7	Lower limit	OctetString 4
8	Upper limit	OctetString 4
9	Reserved	OctetString 2
10	ID extension	Extension V2
11	PZD reference parameter	Unsigned 16
12	PZD standardisation	V2

Table 8.15 Sub indices for the 3rd byte of the parameter channel PKW - parameter description

Sub index 1 "Identifier (ID)" in the table above describes characteristics of the related parameter. Contents of sub index 1 "Identifier (ID)":

Bit	Meaning	Explanation
15	Reserved	
14	Array	
13	Parameter value can only be reset	If this bit is set the related parameter value can only be set to zero from the exterior.
12	Parameter value has been changed to a value different from the factory settings	If this bit is set, the parameter value is different to the factory setting.
11	Reserved	
10	Additional text array can be retrieved	
9	Parameter cannot be written	
8	Standardisation factor and variable attribute not relevant	This bit is set if the parameter is of a data type that cannot be used to calculate any physical values (e. g. data type string).
0 - 7	Data type for the parameter value	Values as per PROFIdrive specification

Table 8.16 Contents of the identifier (ID)

Data type identifier

The following table shows the data type identifier. The data type identifier is transferred in the 8th byte (bit 0-7). The number is always transferred, e.g. 6 for "Unsigned16".

Data type identifier	Data type
1	Boolean
2	Integer8
3	Integer16
4	Integer32
5	Unsigned8
6	Unsigned16
7	Unsigned32
8	FloatingPoint
9	VisibleString
10	OctetString

Table 8.17 Data types

Response identifier (slave)

The following table explains the response identifier (slave):

Response identifier	Function
0	No response
1	Transfer parameter value (word)

Table 8.18 Response identifier AK (slave ⇨ master)

Response identifier	Function
2	Transfer parameter value (word)
3	Transfer parameter description
4	Transfer parameter value (array) (word)
5	Transfer parameter value (array) (double word)
6	-
7	Task cannot be implemented (for error no. see Table 8.19 on page 41)
8	-
9	The data have been written from the bus to the cache
10	The data have been written from the cache to the destination parameter
11	The cache has read the data in the destination parameter
12	The bus has read the data in the cache

Table 8.18 Response identifier AK (slave ⇨ master)

Response identifier 7

Response identifier 7 indicates, in the area PKW1 to PKW2, the error numbers sent from the drive to the master.

Explanation of error numbers:

Error no.	Message
0	PNU not allowed
1	Parameter value cannot be changed
2	Lower or upper parameter value limit passed
3	Erroneous sub index
4	No array
5	Incorrect data type
...	
17	Task cannot be implemented due to operating state
18	Other error

Table 8.19 Response identifier 7 - error messages (slave ⇨ master)

Transmission of character strings

To transfer character strings in the PKW channel, the task and response identifiers (AK9, AK10, AK11 and AK12) have been expanded to "tunnel" these data in 4 bytes of user data in the channel.

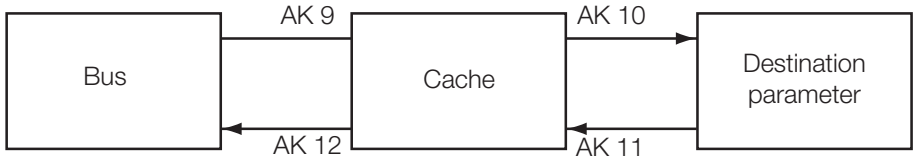


Figure 8.2 Task and response identifiers AK9, AK10, AK11 and AK12

The function of the task and response identifiers is explained in the two following tables.

Request from the master:

Task identifier (AK)	Function
9	Write the data from the bus to the cache
10	Write the data from the cache to the destination parameter
11	The cache reads the data in the destination parameter
12	The bus reads the data in the cache

Table 8.20 Task identifier AK (Master ⇨ Slave)

Response from the slave:

Response identifier (AK)	Function
9	The data have been written from the bus to the cache
10	The data have been written from the cache to the destination parameter
11	The cache has read the data in the destination parameter
12	The bus has read the data in the cache

Table 8.21 Response identifier AK (slave ⇨ master)

Reading character string

Task identifier 11

- Write the task identifier 11 to the 1st byte (PKE), bit 12-15 (AK).
- Write the parameter number to the 1st byte (PKE), bit 0-11 (PNU).
- Write the maximum number of data bytes (255) to the 4th byte (LEN).
- Set the SUB index (3rd byte) to 1.
- In the response telegram the 1st - 3rd byte are repeated.
- The 4th byte contains the number of characters to be read.

Task identifier 12

- Write the task identifier 12 to the 1st byte (PKE), bit 12-15 (AK).
- Write the parameter number to the 1st byte, bit 0-11 (PNU).
- Write the maximum number of data bytes (255) to the 4th byte (LEN).
- Set the SUB index (3rd byte) to the required element.
  - 0 and 1 signify parameter element 0.
  - 2 signifies element 2 etc.
- In the response telegram only the 3rd byte is repeated.
- The 4th byte (LEN) contains the number of valid items of data from SUB index (3rd byte).
- 1st byte and 2nd byte contain the value 0xC00.

Writing character string

Task identifier 9

- Write the task identifier 9 to the 1st byte (PKE), bit 12-15 (AK).
- Write the parameter number to the 1st byte, bit 0-11 (PNU).
- Write the number of items of data to be transferred to the 4th byte. The number must be larger than the total length by one. The last data byte must be 0, e.g. byte 9 (=0), if the number of valid data bytes is 9.
- Set the SUB index (3rd byte) to the required element.
  - 0 and 1 signify parameter element 0.
  - 2 signifies element 2 etc.
- In the response telegram the 3rd byte is repeated.
- 1st byte and 2nd byte contain 0x900.

NOTE:
As only 4 data bytes can be ever be written, the data must be placed in the PKW channel in succession. On writing the next 4 data bytes, set the response identifier to 0 so that incorrect data are not written inadvertently. Then the data can be written and the SUB index modified. Once this has been done, the response identifier can be set to 9 again.
The character string must contain a 0 as the last element.

Task identifier 10

- Write the task identifier 10 to the 1st byte (PKE), bit 12-15 (AK).
- Write the parameter number to the 1st byte, bit 0-11 (PNU).
- Set the SUB index (3rd byte) to 1 and write the required number of bytes to the 4th byte.
- In the response telegram the 1st - 4th byte are repeated.
- The string is now written to the parameter.
- If there is an error, the value 7 is given in the response identifier.

NOTE:
For more information please contact Moog.

8.3 Monitoring

The servo drive family MSD Servo Drive/MSD Single-Axis Servo Drive Compact monitors the cyclic communication with the functions:

1. Watchdog and
2. Sign of life (only PROFINET)

8.3.1 Watchdog

The MSD Servo Drive monitors whether the controller is active using a watchdog. If the servo drive does not receive any cyclic telegrams in a defined time (parameter COM_DP_BUS_Timeout), the watchdog triggers the error (32-1).

Configure the watchdog in parameter **P-1283** (COM_DP_BUS_Timeout):

Parameter no.	Name	Meaning	Data type	Unit
P-1283	COM_DP_BUS_Timeout	Watchdog for cyclic communication	INT32 (0 – 4294967295)	ms

Table 8.22 Watchdog

The value 0 in parameter **P-1283** (COM_DP_BUS_Timeout) deactivates the watchdog function.

8.3.2 Sign of life

The sign of life function in the MSD Servo Drive:

- Monitors the synchronism of the cycle counters in the master (controller) and slave (MSD Servo Drive).
- Is implemented as per PROFIdrive profile 4.2.

Parameter no.	Name	Meaning
P-0925	COM_PN_Sign_of_life_limit	Number of SOL (sign of life) errors permitted until error shutdown type U16: 0 – 0xfffe, 0xffff = switch off
P-1296	COM_PN_Sign_of_life_err_cnt	Indication of the actual error counter
P-1280	Control word 2	Bit 12-15 sign of life master
P-1281	Status word 2	Bit 12-15 sign of life slave

Table 8.23 Sign of life

The sign of life function becomes active:

- Reception of 15 cyclic telegrams in which the value for bits 12-15 is incremented by one.
- During this process the error counter, parameter **P-1296** (COM_PN_Sign_of_life_err_cnt), is set to 0.

With each newly received telegram the counter (bits 12-15) in the 2nd status word parameter **P-1281** (COM_DP_Statusword2) is incremented by the value 1.

The counter for the 2nd status word:

- In each cycle the counter in the 2nd control word is checked for synchronism.

If the counter in the 2nd status word:

- Is not equal to the counter in the 2nd control word, the error counter parameter **P-1296** (COM_PN_Sign_of_life_err_cnt) is incremented by the value 10.
- Is equal to the counter in the 2nd control word, the error counter parameter **P-1296** (COM_PN_Sign_of_life_err_cnt) is decremented by the value 1.

The error counter for parameter **P-1296** (COM_PN_Sign_of_life_err_cnt):

- Cannot be less than 0.
- If greater than or equal to 10x parameter **P-0925** (COM_PN_Sign_of_life_ limit), the error message (32-03 Profinet IRT: Sign of life fault) is triggered and bit 4 in parameter **P-0953** (COM_DP_Warning) is set.

If the cyclic communication stops and restarts:

- The error counter in parameter **P-1296** COM_PN_Sign_of_life_err_cnt) is deleted.
- Bit 4 in parameter **P-0953** (COM_DP_Warning) is reset.

The value 0xFFFF in parameter **P-0925** (COM_PN_Sign_of_life_limit) deactivates the sign of life function (factory setting).

Normal operation sign of life

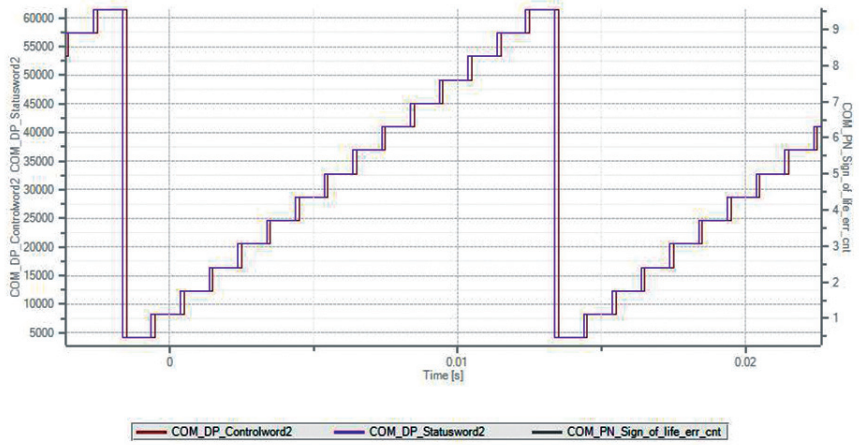


Figure 8.3 Normal operation sign of life

3 sign of life errors triggered

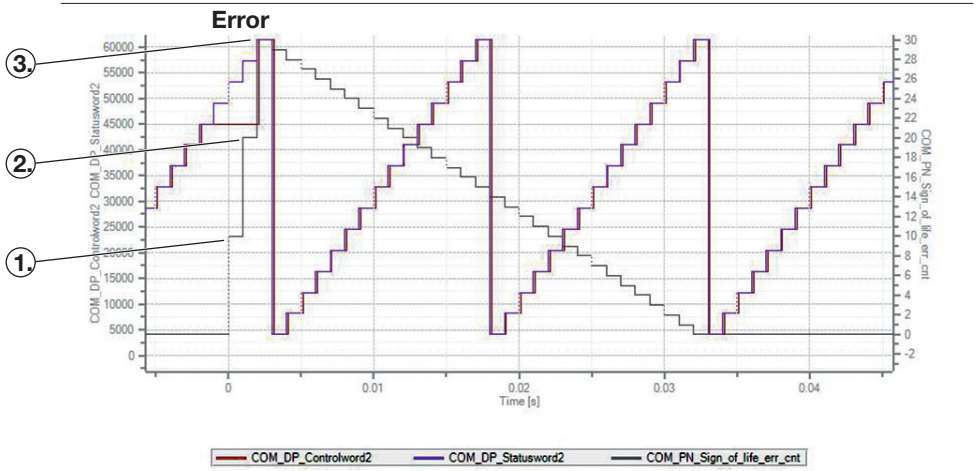


Figure 8.4 3 sign of life errors triggered

If in three cycles the sign of life in control word 2 (bit 12-15) from the master is not increased:

- The error counter parameter **P-1296** (COM_PN_Sign_of_life_err_cnt) increments its value by 10 per cycle.

After the master generates the sign of life again:

- The error counter parameter **P-1296** (COM_PN_Sign_of_life_err_cnt) decrements its value by 1 per cycle.

4 sign of life errors triggered with error reaction

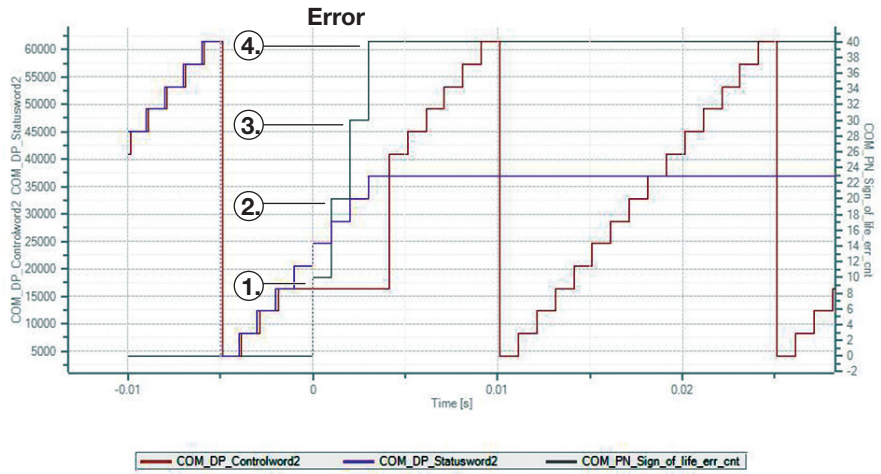


Figure 8.5 4 sign of life errors triggered with error reaction

If the parameter **P-0925** (COM_PN_Sign_of_life_limit) has the value 4 and in four cycles the control word 2 (bit 12-15) from the master is not increased

- The error counter parameter **P-1296** (COM_PN_Sign_of_life_err_cnt) increments its value by 10 per cycle.

If the error counter parameter **P-1296** (COM_PN_Sign_of_life_err_cnt) reaches the maximum value (40), the error reaction starts.

NOTE:
The sign of life function is also used if bit 10 (control sovereignty via PLC) is not set in control word 1!

9 Acyclic data transmission

The “Base Mode Parameter Access”

- Provides acyclic data transfer in the PROFIdrive profile
- And is used for PROFIBUS and for PROFINET.

9.1 Parameter access PROFIBUS/PROFINET

In addition to the cyclic data communication, which updates the I/O process data, acyclic services are provided for one-off events. Reading or writing parameters acyclically does not degrade the cyclic data traffic.

NOTE:
Alongside the older PKW method, this is the 2nd method for acyclic access.

Telegram type SD2 as set out in the following table is used for the PROFIBUS DP extension DP-V1:

SD	LE	LEr	SD	DA	SA	DSAP	SSAP	DU	FCS	ED
Start Delimiter	Length	Length repeat	Start Delimiter	Destination Address	Source Address	Destination Service Access Point	Source Service Access Point	Data Unit Comprises 5 areas	Frame Check Sequence	End Delimiter
68H	X	X	68H	xx	xx	xx	xx	X..		

Table 9.1 PROFIBUS SD2 telegram for DP-V1 services

Class 1 masters (PLCs etc.) and class 2 masters (PC tool) use acyclic services.
The following table gives an overview of the acyclic services available in relation to the respective master class:

Acyclic services	Master class	Meaning	DSAP	SSAP
Initiate request	2	Establishment of an acyclic connection	32H	31H
Abort request	2	Termination of an acyclic connection	32H	0..30H
Read request	2	Read task via DP-V1	32H	0..30H
Write request	2	Write task via DP-V1	32H	0..30H
Data request	2	Data transfer	32H	0..30H
Read request	1	Read task via DP-V1	33H	33H
Write request	1	Write task via DP-V1	33H	33H
Alarm	1	Alarm handling	33H	33H

Table 9.2 Overview of the acyclic services provided

DP-V1 access is according to the following schematic:

1. Write request (5F):
   - The master requests read or write access from the slave via a write service based on data unit index 47 (2F hex):

SD	..	DSAP	SSAP	DU Req. id	DU Slot	DU Index	DU Length	DU User-Data	FCS	ED
68H	xx	32	30	5F	0	2F	n+1	0..n	xx	16H

   - The slave receives the information as to which task is to be processed.
2. Write response (5F):
   - The slave sends an acknowledgement for the request to the master using the mirrored DP-V1 header from the write request:

SD	..	DSAP	SSAP	DU Req. id	DU Slot	DU Index	DU Length	FCS	ED
68H	xx	32	30	5F	0	2F	n+1	xx	16H

   - In the event of an error, the slave sends a negative response.

3. Read request (5E):
   - To read data from the slave, the master sends a read request:

SD	..	DSAP	SSAP	DU Req. id	DU Slot	DU Index	DU Length	FCS	ED
68H	xx	32	30	5E	0	2F	MAX	xx	16H

4. Read response (5E):
   - The slave sends a negative read response to the master:

SD	..	DSAP	SSAP	DU Req. id	DU Slot	DU Index	DU Length	DU User-Data	FCS	ED
68H	xx	32	30	5E	0	2F	n+1	0..n	Xx	16H

   This means that the slave cannot provide the user data.
   - Only in the following cycle has the slave executed the read request and sends a positive read response to the master with the requested user data.
   - The master can use the user data.

Explanation of point 3 "Read request schematic" (master to slave)

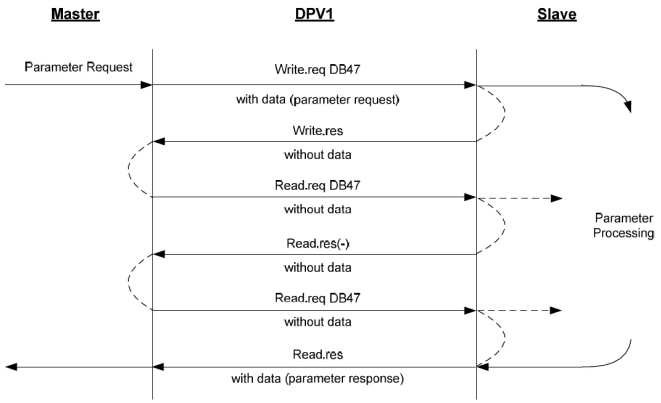


Figure 9.1 DP-V1 read request

Transmission format:

- "Big Endian" from Motorola.
- Transmits the highest byte first.

Word format:

0 byte	1st byte
High byte	Low byte

Double word format

0 byte	1st byte	2nd byte	3rd byte
High byte High word	Low byte High word	High byte Low word	Low byte Low word

The data unit of the telegram type SD2 (see "Table 9.1 PROFIBUS SD2 telegram for DP-V1 services" on page 47) is split into 5 areas:

- Req.id (1 byte) - function number of the DP-V1 service.
  Describes the function of the parameter (e.g. read or write).
  For further functions see "Table 9.3 Data unit assignment" on page 49.
- Slot (1 byte)
  DP-V1 slaves consist of a number of physical or virtual slots. The servo drive does not have any slot addressing, as a consequence there is no slot address evaluation.
- Index (1 byte) - address of the data area
  The slave makes available in this area the data for parameter access. PROFIdrive specifies parameter access with data area number 47.
- Length (1 byte)
  Byte length for the user data that follow. Note: In the case of a read access, select appropriate byte length for the data to be read (maximum 240 bytes).
- User (1 byte…N byte)
  Contains the user data.

Data unit (DU) byte	Data unit parameter	Value	Meaning	
0	Req.id	48H	Idle REQ, RES	Leerlauf ANF, ANTW
		51H	Data Transport REQ, RES	Datentransport ANF,
ANTW				
		56H	Resource Manager, REQ	Ressourcen Manager ANF
		57H	Initiate REQ, RES	Einleiten ANF, ANTW
		58H	Abort REQ	Abbrechen ANF
		5CH	Alarm REQ, RES	Alarm ANF, ANTW
		5EH	Read REQ, RES	Lesen ANF, ANTW
		5FH	Write REQ, RES	Schreiben ANF, ANTW
		D1H	Data Transport NEG RES	Datentransport negative ANTW
		D7H	Initiate NEG RES	Einleiten negative ANTW
		DCH	Alarm NEG RES	Alarm negative ANTW
		DEH	Read NEG RES	Lesen negative ANTW
		DFH	Write NEG RES	Schreiben negative ANTW
1	Slot	00H..FEH	Slot number	
2	Index	2FH	Index	
3	Length	xx	Length of the user data (max 240 bytes)	
4..n	UserData	xx	User data	
[Alarms are not currently supported]				

Table 9.3 Data unit assignment

Parameter access PROFINET

The “Record Data CR (connection relationship)” organise the acyclic PROFINET data exchange via read and write commands.

Master	Slave
Parameter request “Write Data Record” with index 0xB02E	Read response OK or error message (0xDF)
Parameter request “Read Data Record” with index 0xB02E	Write response OK or error message (0xDE)

9.2 “Base Mode Parameter Access” data format

Data format for a parameter request:

Base Mode Parameter Access - request			Byte address
Task header	Request reference	Request identifier	0
	Axis no.	No. of parameters (n)	2
1st parameter address	Attribute	No. of elements	3
	Parameter number (PNU)		
	Sub index		
nth parameter address	.....		4+6*(n-1)
	Format	No. of values	4+6*n
	Values		
	...		
	... ...		
			4+6*n +…+ (format_n *amount_n)

Table 9.4 Data format, parameter request

Data format for a parameter response:

Base Mode Parameter Response - reply			Byte address
Response header	Request reference (mirror)	Response identifier	0
	Axis no. (mirror)	No. of parameters (n)	2
1st parameter value	Format	No. of values	4
	Value / error code		
	...		
nth parameter value	... ...		
			4+…+ (format_n *amount_n)

Table 9.5 Data format, parameter response

9.3 User data explanation

- **Request reference**
  - Specified by the master and mirrored back by the slave in the response telegram.
  - The master allocates each response telegram to a task telegram based on this reference request.
  - The master changes the request reference with each new task.
- **Request ID**
  - This identifier describes the type of parameter handling.
    There are 2 types of identifier:
    1. Request parameter
    2. Change parameter
- **Response ID**
  - Mirror of the request ID with the information (identifier) as to whether the parameter request is positive or negative.
  - Positive request: the response ID corresponds to the request ID.
  - Negative request: it was not possible to implement the request. The identifiers in the response ID are as described in Table “Table 9.6 User data parameters” on page 50.
- **Axis no.**
  - This entry addresses specific individual axes in a Multi-Axis System (Axis no. ⇨ 0 Single-Axis System).
- **No. of parameters**
  - This value contains the number of parameters processed per task.
- **Attribute**
  - Describes the access to a parameter structure, e.g. to the value, descriptive text or manufacturer-specific data. You will find more detailed information in Table “Table 9.6 User data parameters” on page 50.
- **Number of elements**
  - The entry contains the number of arrays (field elements) or the length of the strings (character strings).
- **Parameter number**
  - Parameter number addressed (PNU) in the value range from 1 ... 65535.
- **Sub index**
  - Addresses:
    - The 1st array element for a parameter.
    - The start of a character sequence.
    - The text array or descriptive element accessed.
- **Format**
  - Specifies the related parameter and ensures unambiguous allocation of the parameter value in the telegram.
- **Number of values**
  - Number of values that follow or number of data type elements
- **Values**
  - Parameter values (see “Technical specification PROFIdrive for PROFIBUS and PROFINET”, chapter 6.2.3.4 “Parameter requests and responses”)

Meaning of the user data in base mode parameter access

Field name	Data type	Value	Meaning	Comment
Request reference	Unsigned8	0x00 0x01..0xFF	Reserved	
Request ID	Unsigned8	0x00 0x01 0x02 0x03..0x03F 0x40..0x7F 0x80..0xFF	Reserved Request parameter Change parameter Reserved Manufacturer-specific Reserved	
Response ID	Unsigned8	0x00 0x01 0x02 0x03..0x3F 0x40..0x7F 0x80 0x81 0x82 0x83..0xBF 0xC0..0xFF	Reserved Request parameter (+) Change parameter (+) Reserved Manufacturer-specific Reserved Request parameter (-) Change parameter (-) Reserved Manufacturer-specific	
Axis no.	Unsigned8	0x00 0x01..0xFE 0xFF	Device representative Axis number 1..254 Reserved	Null = single-axis

Table 9.6 User data parameters

Field name	Data type	Value	Meaning	Comment
No. of parameters	Unsigned8	0x00 0x01..0x27 0x28..0xFF	Reserved Quantity 1..39 Reserved	Limited by DP-V1 telegram length
Attribute	Unsigned8	0x00 0x10 0x20 0x30 0x40..0x70 0x80..0xF0	Reserved Value Description Text Reserved Manufacturer-specific	
No. of elements	Unsigned8	0x00 0x01..0xEA 0xEB..0xFF	Special Function Quantity 1..234 Reserved	Limited by DP-V1 telegram length
Parameter number	Unsigned16	0x0000 0x0001… 0xFFFF	Reserved Number 1..65535	
Sub index	Unsigned16	0x0000… 0xFFFF	Number 1..65535	
Format	Unsigned8	0x00 0x01..0x36 0x37..0x3F 0x40 0x41 0x42 0x43 0x44 0x45..0xFF	Reserved Data types Reserved Zero Byte Word Double Word Error Reserved	
No. of values	Unsigned8	0x00..0xEA 0xEB..0xFF	Quantity 0..234 Reserved	Limited by DP-V1 telegram length
Error number	Unsigned16	0x0000… 0x00FF	Error numbers	See “Table 9.7 Error numbers in the “Base Mode Parameter Response”” on page 51

Table 9.6 User data parameters

Error numbers in the "Base Mode Parameter Response"

Error numbers	Meaning
0x00	Parameter number not allowed.
0x01	Parameter value cannot be changed.
0x02	Below or above value range for the parameter.
0x03	Erroneous parameter sub index
0x04	Not an array (range) - access with sub index to un-indexed parameter
0x05	Incorrect parameter data type
0x06	Setting data is not allowed with this parameter data type (only reset) - Change access with value not equal to zero that is not allowed.
0x07	Change access to a description element that cannot be changed.
0x08	Reserved.
0x09	No descriptive text available (parameter value is available).
0x0A	Reserved.
0x0B	No priority. Illegal change access to parameter.
0x0C, 0x0D, 0x0E	Reserved.
0x0F	Access to non-existent text field (parameter text is available).
0x10	Reserved.
0x11	Request will not be implemented due to the system state.
0x12, 0x13	Reserved.
0x14	Value not allowed.
0x15	Response telegram too long.
0x16	Parameter address not allowed.
0x17	Format not allowed.
0x18	Number of parameter values inconsistent.
0x19	Task for an axis/DO (Drive Object) that does not exist.
0x20	Parameter text element cannot be changed.
To 0x64	Reserved.
0x65 ... 0xFF	Manufacturer-specific.

Table 9.7 Error numbers in the “Base Mode Parameter Response”

9.4 Examples of task and response telegrams

Write word.

Refer.	Req. ID	Axis	No. param.	Attr.	No. ele.	Pnu high	Pnu low	Sub high	Sub low	Format	No. Values	Value high	Value low
0	2	0	1	0x10	0..1	3	0x96	0	0	0x42	1	0	7

Table 9.8 ID:2 Change parameter, attr. 0x10: value; Pnu = 918 = 0x396, format word=0x42

Positive response.

Refer.	Req. ID	Axis	No. param.
0	2	0	1

Table 9.9 ID:2 Change parameter

The parameter **P-0918** has the value 7.

Write double word.

Refer.	Req. ID	Axis	No. param.	Attr.	No. ele.	Pnu high	Pnu low
0	2	0	1	0x10	0..1	4	0xFA
Sub high	**Sub low**	**Format**	**No. Values**	**Value high**	**Value low**	**Value I high**	**Value I low**
0	0	0x43	1	1	2	3	4

Table 9.10 ID:2 Change parameter, attr. 0x10: value; PNU = 1274 = 0x396, format word=0x43

Positive response.

Refer.	Req. ID	Axis	No. param.
0	2	0	1

Table 9.11 ID:2 Change parameter

The parameter **P-1274** has the value 16909060.

Read single parameter value

Read word.

Refer.	Req. ID	Axis	No. param.	Attr.	No. ele.	Pnu high	Pnu low	Sub high	Sub low
0	1	0	1	0x10	0..1	3	0x9A	0	0

Table 9.12 ID:1 Request parameter, attr. 0x10: value; Pnu = 922 = 0x39A

Positive response.

Refer.	Req. ID	Axis	No. param.	Format	No values	Value high	Value low
0	1	0	1	0x42	1	0	9

Table 9.13 Format word = 0x42; parameter value = 9

Read double word.

Refer.	Req. ID	Axis	No. param.	Attr.	No. ele.	Pnu high	Pnu low	Sub high	Sub low
0	1	0	1	0x10	0..1	4	0xFA	0	0

Table 9.14 ID:1 Request parameter, attr. 0x10: value; Pnu = 1274 = 0x4FA

Positive response.

Refer.	Req. ID	Axis	No. param.	Format	No values	Value H high	Value H Low	Value I high	Value I low
0	1	0	1	0x43	01	01	02	03	04

Table 9.15 Format word = 0x43; parameter value = 0x01020304 = 16909060

Access errors

Erroneous parameter number.

Refer.	Req. ID	Axis	No. param.	Attr.	No. ele.	Pnu high	Pnu low	Sub high	Sub low
0	1	0	1	0x10	0..1	0	9	0	0

Table 9.16 ID:1 Request parameter, attr. 0x10: value; Pnu = 9

Negative response

Refer.	Req. ID	Axis	No. param.	Format	No values	Value high	Value low
0	0x81	0	1	0x44	1	0	0

Table 9.17 Format error=0x44; parameter value = 0 = incorrect parameter number

Write array parameter values

Refer.	Req. ID	Axis	No. param.	Attr.	No. ele.	Pnu high	Pnu low	Sub high	Sub low	Format	No. Values	Value 0 high	Value 0 Low	-	Value 4 high	Value 4 low
0	2	0	1	0x10	5	3	0x93	0	0	0x42	5	3	C7		0	0

Table 9.18 ID:2 Change parameter, attr. 0x10: value; Pnu = 915 = 0x393, format word=0x42

Parameter values = 0x03C7, 0x04F6, 0x04F6, 0x04F6, 0

OK response

Refer.	Req. ID	Axis	No. param.
0	2	0	1

The parameter **P-0915** contains the entries for the parameter values.

No standard telegram smaller than 10 may be set in the device, because then it could not be overwritten; to rectify set PPO5.

Read array parameter values

Read process data reference values allocated

Refer.	Req. ID	Axis	No. param.	Attr.	No. ele.	Value 0 high	Value 0 Low	Value 4 high	Value 4 low
0	2	0	1	0x10	5	3	C7	0	0

Table 9.19 ID:1 Attr. : 0x10 Pnu = 915=0x393

OK response

Refer.	Req. ID	Axis	No. param.	Format	No values	Value 0 high	Value 0 low	Value 1 high	Value 1 Low	Value 2 high	Value 2 Low	Value 3 high	Value 3 Low	Value 4 high	Value 4 low
0	1	0	1	0x42	5	3	0xC7	4	0xF6	4	0xF6	5	0	0	0

Table 9.20 ID: 1 format: 0x42

9.5 Expanded diagnostics

The device diagnostics are used to inform the controller about device errors or warnings.

9.5.1 Expanded diagnostics PROFIBUS

The PROFIBUS diagnostics data are transferred to the master via the diagnostics request. The diagnostics can be selected using parameter **P-1256**, COM_PN_DIAG_MODE:

0: No additional diagnostic data are sent via the bus, only 6 bytes as per the DP Norm, see below.

1-3: The following diagnostic data are sent via the bus:

byte	Meaning MSD Servo Drive
	DP Norm
0	Station status 1 (Norm)
1	Station status 2 (Norm)
2	Station status 3 (Norm)
3	Station address device
4	Ident number high byte
5	Ident number low byte
	DPV1 header
6	DPV1 header length of ext. data (12)
7	DPV1 status type (0x81)
8	DPV1 slot (0)
9	DPV1 status info (0)
	Manufacturer-specific data
10	ERR_ErrorID byte 3 (error location)
11	ERR_ErrorID byte 2 (error location)
12	ERR_ErrorID byte 1 (device error number)
13	ERR_ErrorID byte 0 (device error number)
14	ERR_WRN_State byte 3 (device warning)
15	ERR_WRN_State byte 2 (device warning)
16	ERR_WRN_State byte 1 (device warning)
17	ERR_WRN_State byte 0 (device warning)

Table 9.21 Diagnostic data PROFIBUS

9.5.2 Expanded diagnostics PROFINET

The PROFINET diagnostics data are transferred acyclically to the master via the alarm channel.

The diagnostics can be selected using parameter **P-1256**, COM_PN_DIAG_MODE:

0: No diagnostic data are sent via the bus.

1: Standard diagnostic data are sent via the bus.

2: Expanded diagnostic data are sent via the bus

3: The manufacturer-specific diagnostic data are sent via the bus.

Byte	Value	Standard diagnostics	Value	Expanded diagnostics	Value	Manufacturer-specific diagnostic data
0	0x0010	Block header IEC	0x0010	Block header IEC	0x0010	Block header IEC
2	0x0016	Block header IEC, length (22)	0x001C	Block header IEC, length (28)	0x0018	Block header IEC, length (24)
4	0x0001	Block header IEC, alarm type 1: DIAG	0x0001	Block header IEC, alarm type 1:DIAG	0x0001	Block header IEC, alarm type 1:DIAG
6	0x0000	API high word	0x0000	API high word	0x0000	API high word
8	0x3A00	API, [8]=3A [9]=00 (low)	0x3A00	API, [8]=3A [9]=00 (low)	0x3A00	API, [8]= 3A [9] =00 (low)
10	0x0001	Slot	0x0001	Slot	0x0001	Slot
12	0x0001	Subslot	0x0001	Subslot	0x0002	Subslot
14	0x8000	Channel number, (submodule ID)	0x8000	Channel number, (submodule ID)	0x8000	Channel number, (submodule ID)
16	0x0800	Channel properties, bit 11, 12 = appears	0x0800	Channel properties, bit 11, 12 = appears	0x6800	Channel properties, bit 11, 12 = appears, bit 13-15 In/Out
18	0x8000	User structure ID USI (STD)	0x8002	User structure ID USI (STD)	1-0x7FFF	User structure ID USI manufacturer-specific diagnostic data
20	0x8000	Channel number	0x8000	Channel number	00 01	ERR_ErrorID byte 3, error location high byte ERR_ErrorID byte 2, error location low byte
22	0x6800	Channel properties, bit 11, 12 = appears, bit 13-15 In/Out	0x6800	Channel properties, bit 11, 12 = appears, bit 13-15 In/ Out	00 0B	ERR_ErrorID byte 1, error number high byte ERR_ErrorID byte 0, error number low byte
24	0x900F	Channel error type, see table	0x900F	Channel error type, see table	00	ERR_WRN_State byte 3 (high) ERR_WRN_State byte 1
26		-	0x0000	Ext channel error type	00	ERR_WRN_State byte 1 ERR_WRN_State byte 0 (low)
28		-	0x0001	Ext channel add value (error location)		-
30		-	0x000B	Ext channel add value low (error number)		-
Len		26 = 6 header + 14 + 6		32 = 6 header + 14 + 12		28 = 6 header + 14 + 8 manu

Table 9.22 Diagnostic data PROFINET

Example for manufacturer-specific error display: external error on the input:

ERR_ErrorID = 0x0001000B
Error number = 000B = 11
Error location =0001 = 1
Other errors, see error list.

Channel error type, see PROFIdrive profile, chap. 8.8.4.

Channel error type	Meaning
-	No error
0x9000	Microcontroller SW or HW
0x9001	Mains supply
0x9002	Low voltage supply
0x9003	DC link overvoltage
0x9004	Power electronics
0x9005	Over temperature electronic device
0x9006	Earth/ground fault
0x9007	Motor overload
0x9008	Fieldbus system
0x9009	Safety channel
0x900A	Feedback
0x900B	Internal communication
0x900C	Infeed
0x900D	Brake resistor
0x900E	Line filter
0x900F	External
0x9010	Technology
0x9011	Engineering
0x9012	Other errors
0x9013	Auxiliary device

Table 9.23 Channel error type

10 Operation modes PROFIdrive (profile 4.2)

10.1 Operation modes

The devices of the MSD Servo Drive family support the following operation modes:

- Speed control jog mode
- Position control jog mode
- Speed control (application class 1)
- Position control (application class 3)
- Position control (interpolating mode, application class 5 - PROFINET)
- Speed control with isochronous real time (application class 4)
- Position control with Dynamic Servo Control, isochronous real time (application class 4, DSC)

Select the operation modes:

- By selecting in the standard telegrams in the master or
- By using non-standard telegrams and configuring the following parameters:

Parameter No.	Name	Meaning
P-0300	CON_CfgCon	Selection of control mode: (0): U/F operation (1): Torque control (2): Speed control (3): Position control
P-0301	CON_REF_Mode	Selection of how the reference value profile is created: (0): Reference value acts on profile generator (1): Reference value acts directly on control (interpolating mode): in this mode the interpolation method can be selected using parameter CON_IP (**P-0370**). The default is cubic spline interpolation.

Table 10.1 Parameters for the operation mode

Parameter No.	Name	Meaning
P-1258	COM_DP_PLC_MODE	Control mode (0): No special control (1): Control word and setpoint interface for PROFIdrive compliant control (2): Setpoint interface for PROFIdrive compliant control (3): Control word interface for PROFIdrive compliant control

Table 10.1 Parameters for the operation mode

The following standard telegrams automatically set the parameter CON_REF_MODE to the interpolating mode:

- Standard telegram 1, only PROFINET IRT modules with the module ID >= 0x100
- Standard telegram 2
- Standard telegram 3
- Standard telegram 5
- Standard telegram 8

The following standard telegrams automatically set the parameter CON_REF_MODE to the profile generating mode:

- Standard telegram 1, only Profinet modules ID < 0x100, Profibus modules
- Standard telegram 7
- Standard telegram 9

The standard telegrams 1, 2 and 3 automatically set the control mode to speed control, all others to position control. If an encoder is not configured, U/F operation is configured in the parameters.

The standard telegrams 2, 3 and 5 automatically set the control mode to a PROFIdrive compliant mode. This means these telegrams cannot be used with a standard controller and are also not supported by the Profibus.

If standard telegrams are not set on the controller, but instead user-specific telegrams are set, all the parameters described above must be set by the user. These also include the process data selection parameters **P-0915** and **P-0916**.

10.2 Servo Drive state machine

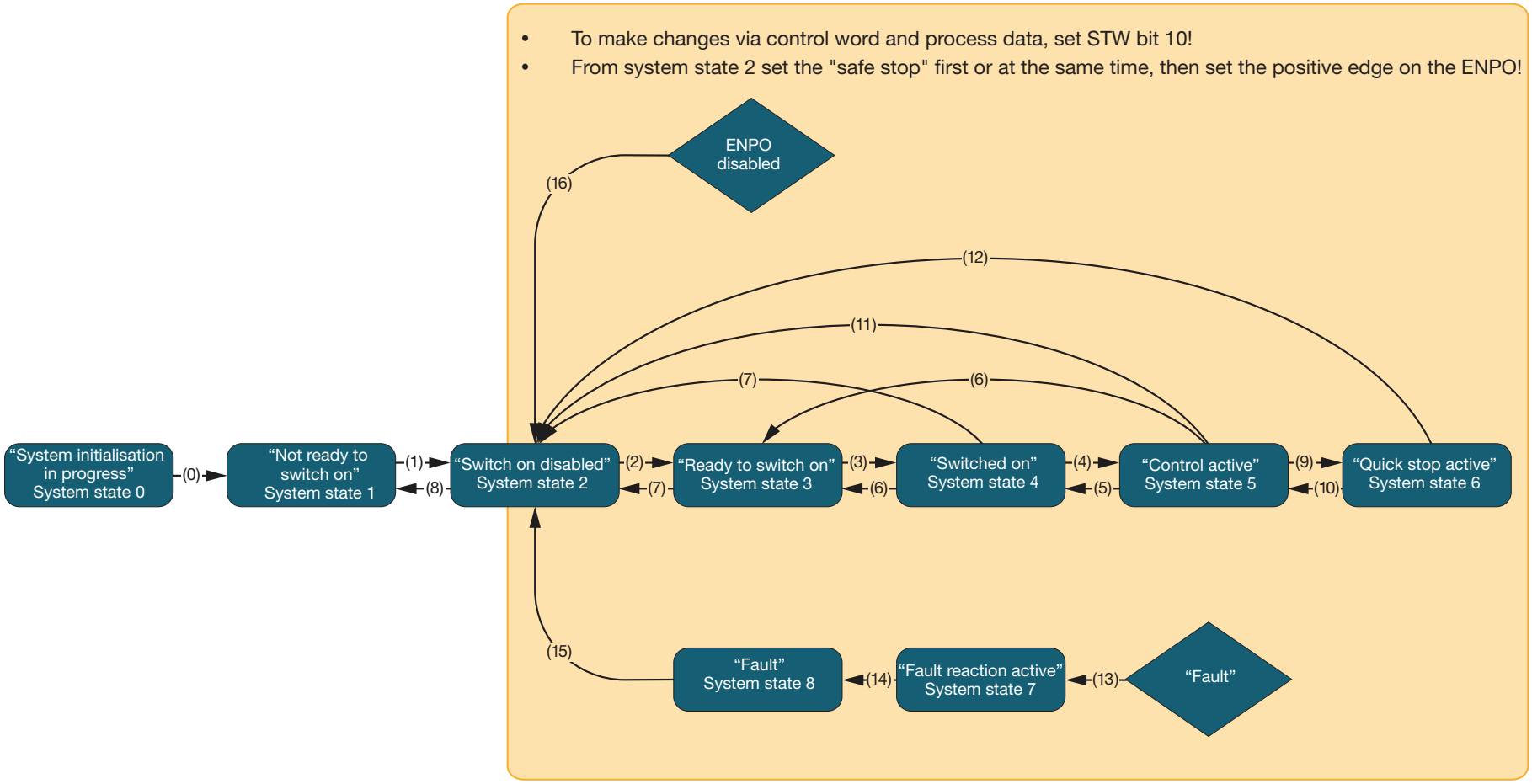


Figure 10.1 General system state machine (control via PROFIBUS and PROFINET)

System state	Designation	Description
0	System initialisation in progress (start)	Initialisation after device reset (e. g. hardware, parameter list, drive, …).
1	Not ready to switch on	Initialisation completed. No power supply, or DC link voltage less than switch-on threshold.
2	Switch on disabled	DC link voltage greater than switch-on threshold.
3	Ready to switch on	Optional conditions satisfied (e.g. homing run, quick stop inactive …).
4	Switched on	Power stage enabled.
5	Operation enabled	Power supplied to motor, control active.
6	Quick stop active	Quick stop is active. *
7	Fault reaction active	Fault reaction is active, reference values from the PROFIBUS master are ignored.
8	Fault	Drive in fault state, reference values from the PROFIBUS master are ignored.
* ... The types of quick stop ("Quick stop option codes") can be selected via parameter **P-2218** (MP_QuickStopOC) (see “Table 10.3 Quick stop option codes” on page 61).		

Table 10.2 System states

Quick stop option codes P-2218 (MPRO_402_QuickStop_OC)		Description
0	Disable drive function	Disable power stages. The drive coasts to a stop.
1	Slow down on slow down ramp	The drive brakes with deceleration ramp, then the power stage is disabled.
2	Slow down on quick stop ramp	Braking with quick stop ramp, then the power stage is disabled.
3	Slow down on the current limit	Braking with maximum dynamic performance at the current limit. The speed reference value is set to 0, then the power stage is disabled.
4	-	-
5	Slow down on slow down ramp and stay in quick stop	Braking with programmed deceleration ramp. The drive remains in the quick stop state, power is applied to the axis with speed zero.
6	Slow down on quick stop ramp and stay in quick stop	Braking with quick stop ramp. The drive remains in the quick stop state, power is applied to the axis with speed 0. *
7	Slow down on the current limit and stay in quick stop	Braking with maximum dynamic performance at the current limit, the speed reference value is set to 0. The drive remains in the quick stop state, power is applied to the axis with speed 0.
8	-	-
* ... Transition to the "Ready to switch on" state ⇨ first reset quick stop request. In the "quick stop" state first reset the quick stop request, only then is the withdrawal of the “Start control/ drive” effective.		

Table 10.3 Quick stop option codes

System state transition	Designation	Description
0	Start	Initialisation after boot complete
1	UZK OK	DC link voltage greater than switch-on threshold
2	Quick stop and coast stop deactivated	Coast stop deactivated ⇨ STW bit 1 = 1 Quick stop deactivated ⇨ STW bit 2 = 1
3	Power stage switched on	Switch power stage on ⇨ STW bit 0 = 1
4	Drive enable	Drive enable ⇨ STW bit 3 = 1
5	Control disabled	Disable control ⇨ STW bit 3 = 0 *
6	Power stage disabled	Disable power stage ⇨ STW bit 0 = 0
7	Quick stop or coast stop activated	Coast stop activated ⇨ STW bit 1 = 0 Quick stop activated ⇨ STW bit 2 = 0
8	UZK too low	DC link voltage lower than switch-on threshold
9	Quick stop activated	Activate quick stop ⇨ STW bit 2 = 0
10	Quick stop deactivated	Deactivate quick stop ⇨ STW bit 2 = 1
11	Coast stop activated	Activate coast stop ⇨ STW bit 1 = 0
12	Standstill detected	Standstill is detected
13	Error	Fault event occurred (can occur in any system state)
14	Fault reaction complete	Fault reaction is complete (e.g. error stop ramp)
15	Error acknowledgement	Reset the active fault ⇨ STW bit 7 = 1 or with a rising edge on ENPO
16	ENPO disabled	ENPO disabled (can occur in any system state)

* ... Parameter **P-0144** (Autostart) determines whether the controller enable is edge triggered (0) or status-dependent (1)
[Parameter List ⇨ Motion Profile ⇨ Basic Settings].

Table 10.7 System state transitions

10.2.1 Master control word (STW)

Bit	Value	Operation mode: Speed control	Operation mode: Position control
15 (MSB)	0		Not used
	1		
14	0		Normal positioning
	1		Speed mode
13	0	Not used	New reference values activated by toggling master control word bit 6
	1	Not used	New reference values are applied directly. Special function: feed enable is deactivated.
12	0	Not used	Positioning reference value = absolute
	1	Not used	Positioning reference value = relative
11	0	Not used	Stop homing run
	1	Not used	Start homing run
10	0	No access permission via the PLC	
	1	Access permission via the PLC	
9	0	Jog mode 2 off	Jog mode 2 off
	1	Jog mode 2 on	Jog mode 2 on
8	0	Jog mode 1 off	Jog mode 1 off
	1	Jog mode 1 on	Jog mode 1 on
7	0	Error acknowledgement on rising edge 0 ⇨ 1	
	1		
6	0	Deactivate reference value	Activate positioning set via rising and falling edge (0 ⇨ 1 and 1 ⇨ 0) (in interpolating operation modes enable interpolation)
	1	Activate reference value	
5	0	Freeze ramp generator	No feed enable
	1	Enable ramp generator	Feed enable
4	0	Reset ramp generator	Abort positioning set
	1	Activate ramp generator	Do not abort positioning set

Table 10.4 Master control word

Bit	Value	Operation mode: Speed control	Operation mode: Position control
3	0	No drive enable	
	1	Drive enable (operation enable)	
2	0	Quick stop active	
	1	Quick stop inactive	
1	0	Coast stop active	
	1	Coast stop inactive	
0	0	Switch off power stage (OFF)	
	1	Switch on power stage (ON)	

Table 10.4 Master control word

10.2.2 Master control word 2

Bit	Meaning
0 - 11	Not used
12 - 15	Master sign of life (SOL)

Table 10.5 Master control word 2

Configure bits 6 and 8 using parameter **P-1267** COM_DP_CtrlConfig:

Bit	Value = 0 (default value)	Value = 1
6	Start positioning task with the negative or positive edge (PROFIdrive profile 4.2).	Start positioning task with the positive edge (PROFIdrive profile 4.2).
8	The jog mode is manufacturer-specific	The jog mode is compliant with PROFIdrive.

*Table 10.6 Parameter **P-1267** COM_DP_CtrlConfig*

For explanations on the manufacturer-specific and profile-compliant jog mode see chapter “10.3 Jog mode” on page 65.

10.2.3 Drive status word (ZSW)

Bit	Value	Operation mode: Speed control	Operation mode: Position control
15 (MSB)		Not used	
14	0	"ENPO" or "safe stop" not set	
	1	"ENPO" and "safe stop" set	
13	0	Drive rotating	
	1	Drive stationary	
12	0	Not used	Movement task confirmation ⇨ Toggle bit
	1	Not used	
11	0	Not used	Homing point not set
	1	Not used	Homing point set
10	0	Frequency or speed not reached	Target position not reached
	1	Frequency or speed reached or exceeded	Target position reached
9	0	No access permission via PLC	
	1	Access permission via PLC	
8	0	Speed error - out of tolerance band	Positioning tracking error - out of tolerance band
	1	Speed error - within tolerance band	Positioning tracking error - within tolerance band
7	0	No warning	
	1	Warning	
6	0	Switch on enabled	
	1	Switch on disabled	
5	0	Quick stop activated	
	1	Quick stop deactivated	
4	0	Coast stop activated	
	1	Coast stop deactivated	

Table 10.8 Drive status word

Bit	Value	Operation mode: Speed control	Operation mode: Position control
3	0	No error	
	1	Error	
2	0	Control disabled	
	1	Operation enabled (in operation / drive follows the reference values)	
1	0	Power stage inactive (not ready)	
	1	Power stage active (ready)	
0	0	Not ready to switch on	
	1	Ready to switch on	

Table 10.8 Drive status word

10.2.4 Drive status word 2

Bit	Meaning
0-1	Profile generator status 0: Stop 1: Acceleration 2: Positioning with sel. speed 3: Deceleration
2	Torque limit positive direction of movement
3	Torque limit negative direction of movement
4	ISD00
5	ISD01
6	ISD02
7	ISD03
8	Reserved
9	Reserved
10	Reserved
11	Reserved
12-15	Slave sign of life (SOL)

Table 10.9 Drive status word 2

The flow diagram below shows an example of a switch-on process.

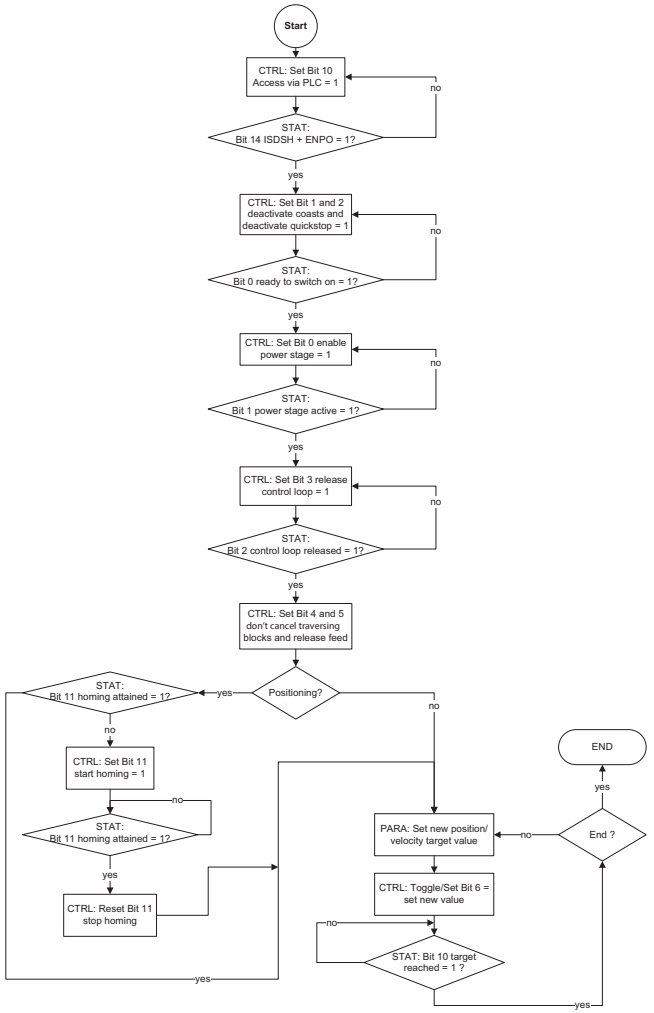


Figure 10.2 Example flow diagram, switch-on process

10.3 Jog mode

10.3.1 Manufacturer-specific jog mode

Bit 8 and 9 of the control word make it possible to use a manufacturer-specific jog mode in the speed mode.

NOTE:
The jog mode can only be activated if the motor is stopped.

Bit 8 of the parameter COM_DP_CtrlConfig is set to 0 for the manufacturer-specific jog mode. Changes to bit 8 and 9 of the parameter COM_DP_CtrlConfig result in the following behaviour of the drive:

Sequence	Value bit 8	Value bit 9	Situation	Behaviour of the drive
1.	0	0	Bit 8 and bit 9 have the value 0	Initial setting manufacturer-specific operation.
2.	1	0	Set bit 8 to 1. Bit 9 has the value 0.	The drive applies the value entered in parameter **P-1268 COM_DP_RefJogSpeed1** as the speed.
3.	1	1	Bit 8 has the value 1. Set bit 9 to 1.	The drive applies the value in parameter **P-1269 COM_DP_RefJogSpeed2** as the reference value.
4.	1	0	Bit 8 has the value 1. Set bit 9 to 0.	The value in parameter **P-1268 COM_DP_RefJogSpeed1** is again the reference.
	0	1	Set bit 8 to 0. Bit 9 has the value 1.	No change.
5.	0	1	Bit 8 has the value 0. Set bit 9 to 1.	The drive applies the negated value in parameter **P-1268 COM_DP_RefJogSpeed1**. The direction of rotation is inverted.
6.	1	1	Set bit 8 to 1. Bit 9 has the value 1.	The drive applies the negated value in parameter **P-1269 COM_DP_RefJogSpeed2** as the reference value. On the entry of negative reference values the direction of rotation is inverted again.
7.	0	1	Set bit 8 to 0. Bit 9 has the value 1.	The drive applies the negated value in parameter **P-1268 COM_DP_RefJogSpeed2** as reference.
8.	1	0	Bit 8 has the value 1. Set bit 9 to 0.	No change.

Table 10.10 Manufacturer-specific jog mode

10.3.2 Profile-compliant jog mode (PROFIdrive 4.2)

Bit 8 of the parameter COM_DP_CtrlConfig is set to 1 for the profile-compliant jog mode. See PROFIdrive profile 4.2, chap. 6.3.2.

The jog mode can only be activated if the motor is stopped.

Bits 4 to 6 of the control word are 0.

Sequence	Value bit 8	Value bit 9	Situation	Behaviour of the drive
1.	1	0	Set bit 8 to 1. Bit 9 has the value 0.	The drive applies the value entered in parameter **P-1268 COM_DP_RefJogSpeed1** as the speed.
2.	0	1	Bit 8 has the value 0. Set bit 9 to 1.	The drive applies the value entered in parameter **P-1269 COM_DP_RefJogSpeed2** as the speed.
3.	1	1	Bit 8 has the value 1. Bit 9 has the value 1.	No change, the old reference value is retained.

Table 10.11 Profile-compliant jog mode

10.3.3 Jog mode reference value parameters

- Parameters **P-1268 COM_DP_RefJogSpeed1** and **P-1296 COM_DP_RefJogSpeed2** are of type Int32 and can be mapped as process data.
- The acceleration and deceleration from the parameters **P-1278 COM_DP_ACC** and **P-1279 COM_DP_DEC** are used in jog mode.
  These parameters are of type uint16 and can be mapped in the process data.

10.4 Speed control (application class 1)

Bit 4, 5 and 6 in the master control word (chapter “10.2.1 Master control word (STW)” on page 62) control the speed reference value in the speed mode.

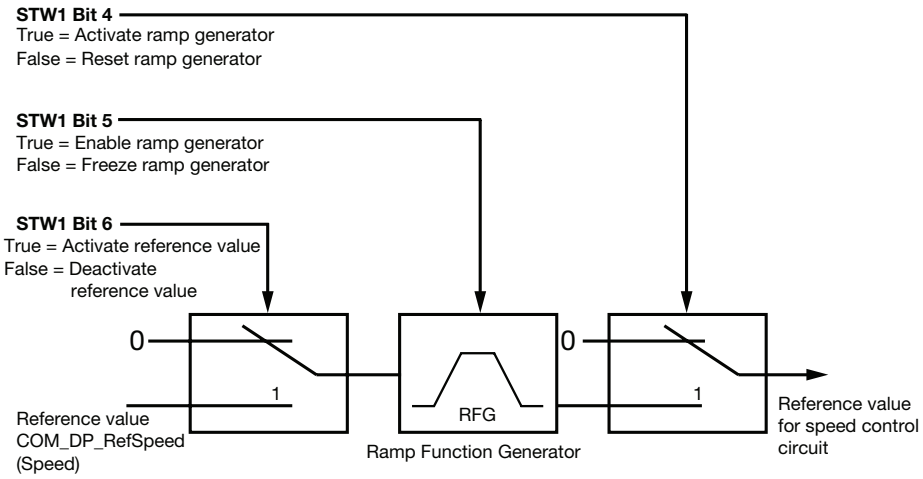


Figure 10.3 Speed control (application class 1)

The ramp generator provides the speed reference value if bit 4 of the master control word is activated. Bit 5 of the master control word controls the ramp generator:

- Enable, activate bit 5.
- Freeze, deactivate bit 5.

Bit 6 of the master control word controls the ramp generator input.

Speed reference value

- Forward speed reference value, activate bit 6.
- Forward 0, activate bit 6.

10.4.1 Speed control loop and control parameters

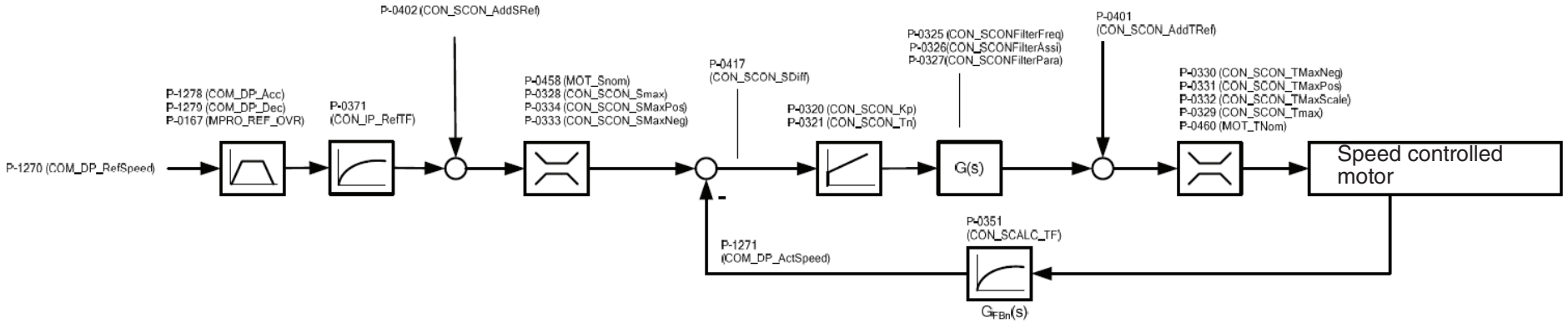


Figure 10.4 Speed control loop

P no.:	Parameter name	Meaning
P-0167	MPRO_REF_OVR	Speed override
P-0320	CON_SCON_Kp	PI speed controller gain
P-0321	CON_SCON_Tn	PI_speed controller integral action time
P-0325	CON_SCONFilterFreq	Cut-off frequencies torque reference value filter
P-0326	CON_SCONFilterAssi	Torque reference value design parameter
P-0327	CON_SCONFilterPara	Torque reference value filter parameter
P-0328	CON_SCON_SMax	Speed limit (reference variable: motor nominal speed)
P-0329	CON_SCON_SMax	Torque limit (reference value: nominal torque)
P-0330	CON_SCON_TMaxNeg	Negative torque limit (reference variable: nominal torque)
P-0331	CON_SCON_TMaxPos	Positive torque limit (reference variable: nominal torque)
P-0332	CON_SCON_TMaxScale	Torque scaling factor

Table 10.12 Control parameters

P no.:	Parameter name	Meaning
P-0333	CON_SCON_SMaxNeg	Negative speed limit (reference variable: motor nominal speed)
P-0334	CON_SCON_SMaxPos	Positive speed limit (reference variable: motor nominal speed)
P-0351	CON_SCALC_TF	Actual speed filter time constant
P-0371	CON_IP_RefTF	Speed reference value filter time constant
P-0401	CON_SCON_AddTRef	Additive torque reference value
P-0402	CON_SCON_AddSRef	Additive speed reference value
P-0417	CON_SCON_SDiff	Speed controller control difference
P-0458	MOT_Snom	Motor nominal speed
P-0460	MOT_TNom	Motor nominal torque
P-1270	COM_DP_RefSpeed	Speed reference value
P-1271	COM_DP_ActSpeed	Actual speed
P-1278	COM_DP_Acc	Acceleration ramp
P-1279	COM_DP_Dec	Deceleration ramp

Table 10.13 Control parameters

10.5 Position control (application class 3)

In system state 5 “Control active” of the position control operation mode for the servo drive, defined bits in the master control word control the status transitions (see chapter “10.2 Servo drive state machine” on page 60 and 10.2.1):

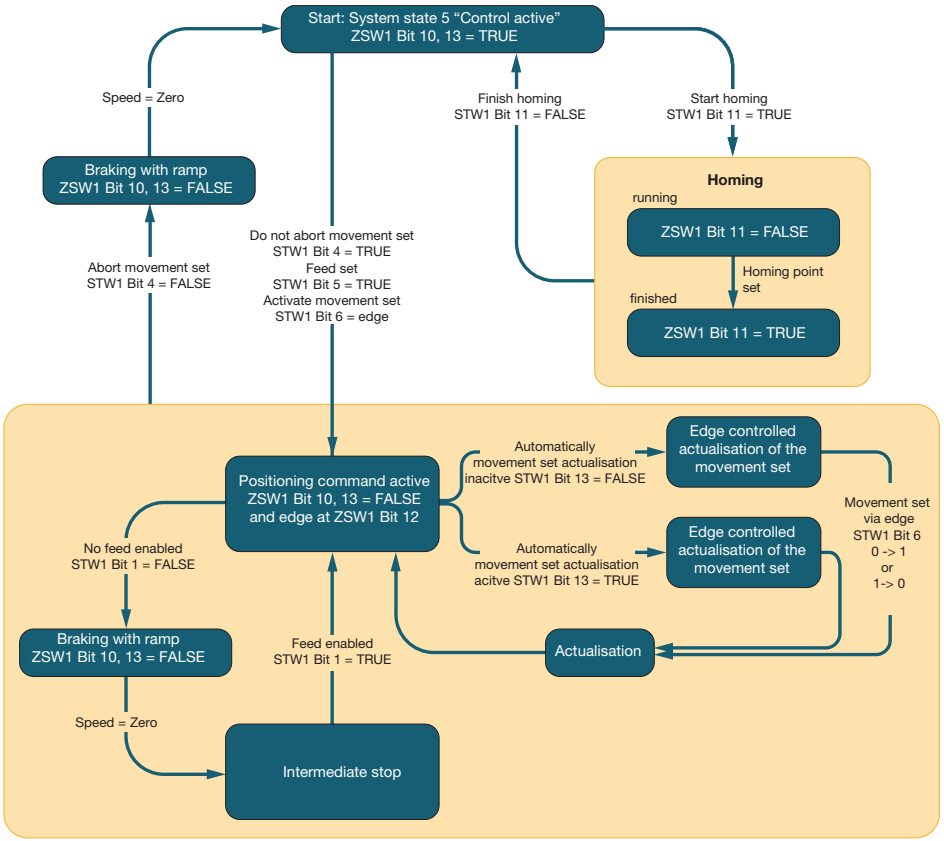


Figure 10.5 Position control (application class 3)

Activate positioning command:

1. **Set control word bit 4.**
2. **Set feed enable via control word bit 5.**
3. **Set edge on control word bit 6.**

Further and new positioning commands are applied via control word bit 6, rising or falling edge:

1. **Change the reference position, positioning velocity or positioning acceleration.**
2. **A new positioning command is set by the edge on control word bit 6.**

If bit 13 is not set, a new positioning command is activated only via a positive or negative edge on control word bit 6.

If control word bit 13 is set, new reference values are applied and implemented immediately without an edge on bit 6.

If bit 6 in parameter **P-1267** (COM_DP_CtrlConfig) is set, the positioning command is only activated on a positive edge. This corresponds to the PROFIDrive profile 4.2.

If the feed enable is reset while a positioning command is active, the drive is braked to a standstill on a ramp and switches to the Intermediate Stop state.

The current positioning command is not executed until the feed enable is set again.

A positioning command can be cancelled by resetting control word bit 4:

- In this case the drive is also braked to a standstill and changes to system state 5 “Operation enabled”.
- Additionally, from system state 5 a homing run can be triggered by control word bit 11.

10.6 Position control (interpolating mode, application class 5 - PROFINET)

In system state 5 “Operation enabled” of the position control operation mode for the servo drive, defined bits in the master control word control the status transitions:

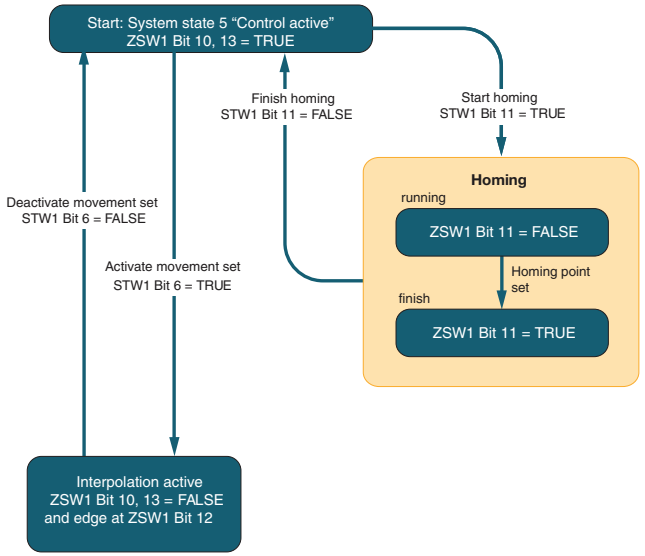


Figure 10.6 Position control (interpolating mode - PROFINET)

Activate positioning command:

1. **Set control word bit 4.**
2. **Set feed enable via control word bit 5.**
3. **Set edge on control word bit 6.**

In the interpolating mode, the reference values are transferred directly to the control without the need for a start enable.

10.6.1 Position control loop and associated control parameters

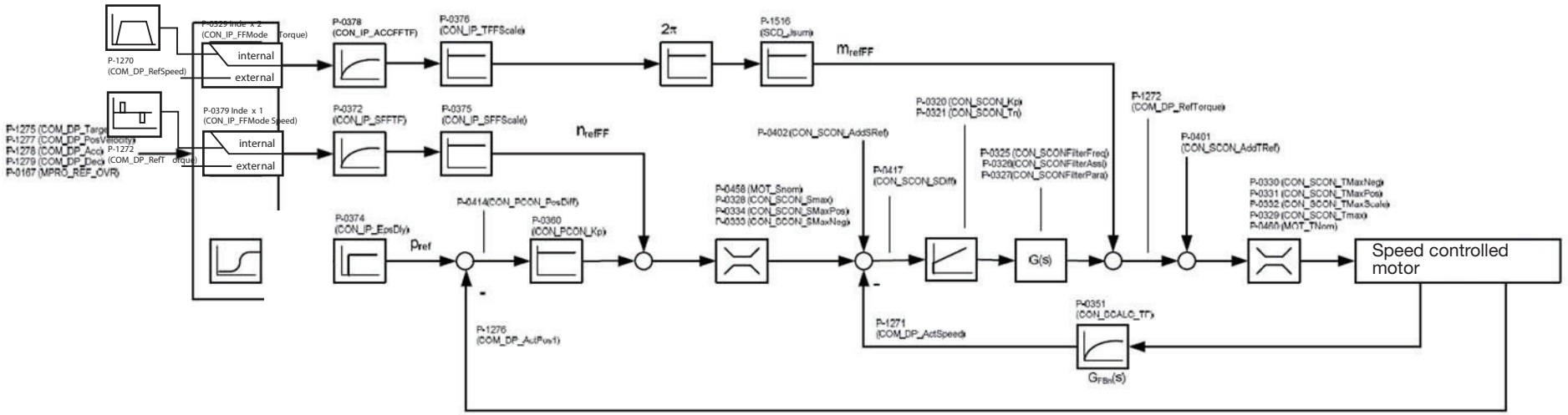


Figure 10.7 Position control loop

Parameter no.:	Parameter name	Meaning
P-0167	MPRO_REF_OVR	Speed override
P-0320	CON_SCON_Kp	PI speed controller gain
P-0321	CON_SCON_Tn	PI speed controller integral action time
P-0325	CON_SCONFilterFreq	Cut-off frequencies torque reference value filter
P-0326	CON_SCONFilterAssi	Torque reference value filter parameter
P-0327	CON_SCONFilterPara	Torque reference value filter parameter
P-0328	CON_SCON_Smax	Speed limit
P-0329	CON_SCON_Tmax	Velocity control maximum torque

Table 10.14 Control parameters

Parameter no.:	Parameter name	Meaning
P-0330	CON_SCON_TMaxNeg	Negative torque limit (reference variable: nominal torque)
P-0331	CON_SCON_TMaxPos	Positive torque limit (reference variable: nominal torque)
P-0332	CON_SCON_TMaxScale	Torque scaling factor
P-0333	CON_SCON_SMaxNeg	Negative speed limit (reference variable: motor nominal speed)
P-0334	CON_SCON_SMaxPos	Positive speed limit (reference variable: motor nominal speed)
P-0351	CON_SCALC_TF	Actual speed filter time constant
P-0351	CON_SCALC_TF	Actual speed filter time constant
P-0360	CON_PCON_Kp	P position controller gain

Table 10.14 Control parameters

Parameter no.:	Parameter name	Meaning
P-0372	CON_IP_SFFTF	Speed feed forward control filter time constant
P-0374	CON_IP_EpsDly	Position reference value delay
P-0375	CON_IP_SFFScale	Speed feed forward control scaling
P-0376	CON_IP_TFFScale	Acceleration feed forward control scaling
P-0379	CON_IP_FFMode	Configuration of feed forward control
P-0401	CON_SCON_AddTRef	Additive torque reference value
P-0402	CON_SCON_AddSRef	Additive speed reference value
P-0414	CON_PCON_PosDiff	Position controller control difference (tracking error)
P-0417	CON_SCON_SDiff	Speed controller control difference
P-0460	MOT_TNom	Motor nominal torque
P-0458	MOT_Snom	Motor nominal speed
P-1270	COM_DP_RefSpeed	Speed reference value
P-1271	COM_DP_ActSpeed	Actual speed
P-1272	COM_DP_RefTorque	Torque reference value
P-1274	COM_DP_RefPos	Reference position in the interpolating mode
P-1275	COM_DP_TargetPos	Target position in the profile generating mode
P-1276	COM_DP_ActPos1	Current actual position
P-1277	COM_DP_PosVelocity	Positioning velocity
P-1278	COM_DP_Acc	Acceleration ramp
P-1279	COM_DP_Dec	Deceleration ramp
P-1516	SCD_Jsum	Total moment of inertia

Table 10.14 Control parameters

10.7 Speed control with isochronous real time (application class 4)

Standard telegram 3 is defined especially for this operation mode. The reference value and actual value interface is designed for PROFIdrive compliant controllers (e.g. Simotion). Profibus does **not** support this operation mode!

The parameter COM_DP_PLC_MODE (**P-1258**) is set automatically to a PROFIdrive compliant mode (1).

Standard telegram 3 (application class 1, 4) for speed control, isochronous, consisting of 5 output words and 9 input words:

PZD number	1	2	3	4	5	6	7	8	9
Output words/setpoints	STW1	NSOLL_B		STW2	G1_STW				
Input words/actual values	ZSW1	NIST_B		ZSW2	G1_ZSW	G1_XIST1		G1_XIST2	

Table 10.15 Standard telegram 3, applies only for Profinet

Drive status word (ZSW) in the PROFIdrive compliant mode

The significance of the status bits 0 to 8 has already been described in chapter 10.2.3. The status bits 9 to 15 are used differently in the PROFIdrive compliant mode.

Bit	Meaning	Value
15 - 11	-	0
10	Speed reached	0: Speed not reached or motor stationary 1: Speed reached and motor rotating
9	Control requested by PLC	always 1

Table 10.16 Drive status word (ZSW) in the PROFIdrive compliant mode

Drive status word 2 (ZSW2) in the PROFIdrive compliant mode

The status bits 2 to 11 are used differently in the PROFIdrive compliant mode.

Bit	Meaning	Value
15 - 12	Slave sign of life (SOL)	0 - 15
11	Reserved	0
10	Pulse enable	0: Power stage not active (bit 1, ZSW) or no drive enable (bit 3, STW) 1: Power stage active (bit 1, ZSW) or drive enable (bit 3, STW)
9	Reserved	0
8	Reserved	0
0 - 7	-	0
0 - 1	Profile generator status	0: Halt 1: Acceleration 2: Positioning with sel. speed 3: Deceleration

Table 10.17 Drive status word 2 (ZSW) in the PROFIdrive compliant mode

The bit number for the status “Pulse enable” can be selected between 8 and 11 using the parameter 924, index 1, COM_DP_PulsesEnabled. Bit 10 is pre-set.

The signals NSOLL_B, NIST_B have the following format:

Entry in [%], where 100 % correspond to the value 0x40000000. As such there is a value range of –200 % ≤ i ≤ (200-2^{-30}) %. The percentage 100 % corresponds to the maximum speed, parameter **P-0338**, index 0.

Overview of Profinet reference and actual values

P no.:	Parameter name	Meaning
P-0967	COM_DP_Controlword	Control word (STW1)
P-1261	COM_DP_NSOLL_B	Speed reference value in percent
P-1280	COM_DP_Controlword2	Control word 2 (STW2)
P-1263	COM_DP_G1_STW	Sensor control word, see chapter Sensor interface
P-0968	COM_DP_Statusword	Status word 1 (ZSW2)
P-1262	COM_DP_NIST_B	Speed actual value in percent
P-1281	COM_DP_Statusword2	Status word 1
P-1264	COM_DP_G1_ZSW	Sensor control word
P-1265	COM_DP_G1_XIST1	Sensor actual position value 1, see chapter Sensor interface
P-1266	COM_DP_G1_XIST2	Sensor actual position value 2, see chapter Sensor interface

Table 10.18 Overview of Profinet reference and actual values

10.8 Position control with Dynamic Servo Control, isochronous real time (application class 4, DSC)

Standard telegram 5 is defined especially for this operation mode. The reference value and actual value interface is designed for PROFIdrive compliant controllers (e.g. Simotion). Profibus does **not** support this operation mode!

The parameter COM_DP_PLC_MODE (**P-1258**) is set automatically to the PROFIdrive compliant mode (1).

Standard telegram 5 (application class 4) for speed control, isochronous, DSC (Dynamic Servo Control) consisting of 9 input words and 9 output words:

PZD number	1	2	3	4	5	6	7	8	9
Input words/setpoints	STW1	NSOLL_B		STW2	G1_STW	XERR		KPC	
Output words/actual values	ZSW1	NIST_B		ZSW2	G1_ZSW	G1_XIST1		G1_XIST2	

Table 10.19 Standard telegram 5, applies only for Profinet

Overview of Profinet reference and actual values

P no.:	Parameter name	Meaning
P-0967	COM_DP_Controlword	Control word (STW1)
P-1261	COM_DP_NSOLL_B	Speed reference value in percent
P-1280	COM_DP_Controlword2	Control word 2 (STW2)
P-1263	COM_DP_G1_STW	Sensor control word, see chapter Sensor interface
P-1259	COM_DP_XERR	Position tracking error reference value
P-1260	COM_DP_KPC	Position controller gain factor
P-0968	COM_DP_Statusword	Status word 1 (ZSW2)
P-1262	COM_DP_NIST_B	Speed actual value in percent
P-1281	COM_DP_Statusword2	Status word 1
P-1264	COM_DP_G1_ZSW	Sensor control word
P-1265	COM_DP_G1_XIST1	Sensor actual position value 1, see chapter Sensor interface
P-1266	COM_DP_G1_XIST2	Sensor actual position value 2, see chapter Sensor interface

Table 10.20 Overview of Profinet reference and actual values

The difference compared to speed control with isochronous real time is that the drive operates in position control. The actual reference values are therefore the reference value XERR and the gain factor KPC.

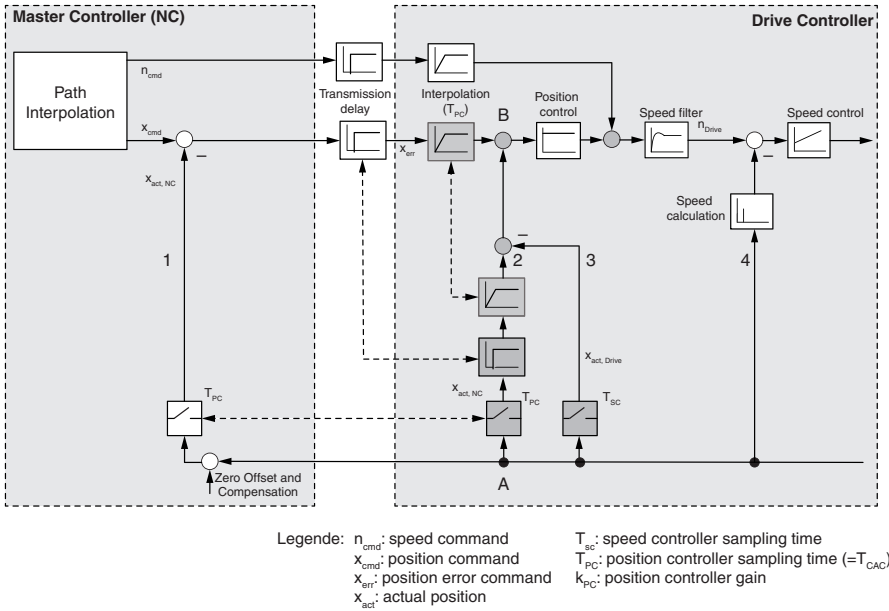


Figure 10.8 Position control with Dynamic Servo Control

10.9 Error memory mechanism

A detailed description of the error memory mechanism is given in the PROFIdrive profile in chapter 6.3.8.3.

The error memory is a matrix comprising a number of error events and error situations. This matrix is pre-defined in the Profidrive profile as 8x8. In the MSD Servo Drive the error memory is set to 1 error event and 20 error situations (parameter **P-0950**).

This means that 20 different errors can be saved one after the other (after acknowledgement). It is only possible to save one error event for an error situation.

Overview of the parameters supported:

Sub index	Error number, 947	Error code, 945	Error value, 949, Moog-specific
0	Points to the index for **P-0951**	Value between 0-19	Contains P-39, ERR_ErrorID
1			
..			
19			

Table 10.21 Error numbers

The sub index 0 always contains the latest entry, sub index 19 the oldest.

Error number list, parameter **P-0951**:

The error numbers and texts for the parameter **P-0951** can be read via the acyclic parameter interface.

Sub index	Error parameter number	Error code	Text
0	59000	0	No error
1	59001	1	Microcontroller SW or HW
2	59002	2	Mains supply
3	59003	3	Low voltage supply

*Table 10.22 Error number list, parameter **P-0951***

Sub index	Error parameter number	Error code	Text
4	59004	4	DC link overvoltage
5	59005	5	Power electronics
6	59006	6	Over temperature electronic device
7	59007	7	Earth/ground fault
8	59008	8	Motor overload
9	59009	9	Fieldbus system
10	59010	10	Safety channel
11	59011	11	Feedback
12	59012	12	Internal communication
13	59013	13	Infeed
14	59014	14	Brake resistor
15	59015	15	Line filter
16	59016	16	External
17	59017	17	Technology
18	59018	18	Engineering
19	59019	19	Other errors

Table 10.22 Error number list, parameter **P-0951**

Error code, parameter **P-0945**:

Saves the last 20 error codes. The entry in sub index 0 is always the latest error code.

Error number, parameter **P-0947**:

Saves the last 20 error numbers. The entry in sub index 0 is always the latest error number. The number is the related index of **P-0951**.

Error value, parameter **P-0949**:

Saves the last 20 manufacturer-defined error numbers. The entry in sub index 0 is always the latest entry.

The device error number is given in the lower word.

The error location is given in the upper word.

You will find the exact numbers in the MSD Servo Drive error list.

Error counter, parameter **P-0944**:

The error counter is incremented by one after each error event.

Number of error situations, parameter **P-0952**:

This parameter indicates the number of all error situations since the last "Reset".

If a '0' is written to this parameter by the master, all error counters and the entire error memory are cleared.

The error counter and the error situation counter are always the same, as the error event memory has the size 1.

11 Sensor interface

A sensor is a position encoder for the drive.

The sensor interface is used for application class 4. A detailed description of the sensor interface is given in the PROFIdrive profile in chapter 6.3.6.

The sensor interface describes how a sensor is structured in the form of parameters. These parameters include a control and status word, 2 sensor actual values, as well as a general description of how the sensor is structured.

11.1 Sensor control word G1_STW, parameter **P-1263**

Using the sensor control word, the master sensor can trigger functionality such as searching for reference marks and measuring fast inputs.

11.2 Sensor status word G1_ZSW, parameter **P-1264**

The sensor status word contains sensor statuses, actuations and errors.

11.3 Sensor format, parameter **P-0979**

This parameter describes the properties of a sensor. On the MSD Servo Drive this parameter is read-only because it is calculated automatically from the encoder data configured.

11.3.1 Overview the sensor format parameter

Sub index	Meaning	Comment
0	Header	Information for sub index 1 – 10, always 00005111h
1	Sensor type	1st sensor (G1)
2	Sensor resolution	1st sensor (G1)
3	"Shift factor" for G1_XIST1	1st sensor (G1)
4	"Shift factor" for G1_XIST2	1st sensor (G1)
5	Absolute revolutions	1st sensor (G1)
6 to 10	Reserved	1st sensor (G1)

Table 11.1 Sensor format parameter

Sub index 0, header

Bit	Meaning
Bit 0 - 3:	Version of the data structure from the sensor format = 1 (lower value)
Bit 4 - 7:	Version of the data structure from the sensor format = 1 (upper value)
Bit 8 - 11:	Number of sensors supported = 1
Bit 12 - 15:	Number of valid entries, from sub index 1 = 5
Bit 16 - 31:	Reserved

Table 11.2 Sub index 0, header

Sub index 1, sensor type

Bit	Meaning
Bit 0:	0: Rotary sensor 1: Linear sensor
Bit 1-30:	Reserved
Bit 31:	0: Data in parameter **P-0979** for sensor 1 are invalid 1: Data in parameter **P-0979** for sensor 1 are valid

Table 11.3 Sub index 1, sensor type

Sub index 2, sensor resolution

Rotary sensors: Number pulses per revolution.

Linear sensors: Length of the signal period in [nm].

Sub index 3, shift factor for G1_XIST1

Defines how much quadrant information and fine resolution is shown in the sensor actual value G1_XIST1.

Sub index 4, shift factor for G1_XIST2

Defines how much quadrant information and fine resolution is shown in the sensor actual value G1_XIST2.

Sub index 5, absolution position

Defines the absolute position that can be provided by the sensor.

Rotary sensors:

- The value 0 means that the sensor does not provide an absolute position. The position is not greater than one revolution.
- If the value is greater than 0 it indicates the maximum number of revolutions, e.g. 4096 corresponds to an absolute position of 4096 revolutions.

Linear sensors:

- The value 0 means that the sensor does not provide an absolute position.
- A value greater than 0 indicates that the sensor has absolute information.

Example sensor interface setting in PROFIdrive compliant controller (e.g. Simotion)

Rotary sensor

Sub index for P-0979	Indication in DM5	PROFIdrive compliant controllers (e.g. Simotion)	Value
0: Header	00005111h		
1: Sensor type	80000000h		
2: Sensor resolution	1048576	Number of encoder pulses	1048576
3: Shift factor G1_XIST1	0	Fine resolution G1_XIST1	1
4: Shift factor G1_XIST2	0	Fine resolution absolute value Gn_XIST_2	1
5: Absolution position	4096	Data switch, absolute value	32

Table 11.4 Rotary sensor

Linear sensor

Index P-0979	Indication in DM5	PROFIdrive compliant controllers (e.g. Simotion)	Value
0: Header	00005111h		
1: Sensor type	80000001h		
2: Sensor resolution	32000000(nm)	Graduation	32 mm
3: Shift factor G1_XIST1	20	Fine resolution G1_XIST1	1048576
4: Shift factor G1_XIST2	20	Fine resolution absolute value Gn_XIST_2	1048576
5: Absolution position	12	Data switch, absolute value	12

Table 11.5 Linear sensor

Sensor actual position 1, G1_XIST1, parameter **P-1265**:

G1_XIST1 contains the actual position of the sensor.

Sensor actual position 2, G1_XIST2, parameter **P-1266**:

G1_XIST2 contains the additional actual position of the sensor.

For information on the general structure of the sensor actual position G1_XIST1, see also PROFIdrive profile chapter 6.3.6.2.3 on page 132.

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	15	11	10	9	8	7	6	5	4	3	2	1	0
R	R	R	R	R	R	R	R	R	R	R	R	P	P	P	P	P	P	P	P	P	Q	Q	F	F	F	F	F	F	F	F	F

F (Fine resolution): Fine resolution, **P-0979**, sub index 3, shift factor
Q (Quadrant information): Quadrant Information
P (Pulses): Sensor resolution **P-0979**, sub index 2
R (Revolution): Absolution position, **P-0979**, sub index 5

Rotary sensor:

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	15	11	10	9	8	7	6	5	4	3	2	1	0
R	R	R	R	R	R	R	R	R	R	R	R	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P

F (Fine resolution): Fine resolution: 0 (value 1)
P (Pulses): Sensor resolution: 1048576 (20 bits)
R (Revolution): Absolution position: 4096 (12 bits)

Linear sensor:

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	15	11	10	9	8	7	6	5	4	3	2	1	0
R	R	R	R	R	R	R	R	R	R	R	R	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P

F (Fine resolution): Fine resolution: 32000000 [nm]
P (Pulses): Sensor resolution: 20 bits (1048576)
R (Revolution): Absolution position: 12 bits (4096)

On the MSD Servo Drive the sensor actual position G1_XIST2 is identical to the position G1_XIST1.

NOTE
On the MSD Servo Drive the sensor actual position G1_XIST2 is identical to the position G1_XIST1.

11.4 Homing runs via a PROFIdrive compliant controller

Certain bits in the control and status word for the sensor interface are used to trigger a homing run via a PROFInet controller.

Control word: G1-STW:

Bit	Value	Meaning
0 1 2 3	1 1 1 1	Function request 1, reference mark 1 Function request 2, reference mark 2 Function request 3, reference mark 3 Function request 4, reference mark 4
4-6	1 2 3 4-7	Activate function Read value Cancel function Reserved
7-12		See PROFIdrive profile, chap. 6.3.6.5
13	1	Request for the cyclic transfer of the absolute actual position in G1_XIST2
14-15		See PROFIdrive profile, chap. 6.3.6.5

Figure 11.1 Bit in the control word during a homing run

Status word: G1-ZSW:

Bit	Value	Meaning
0 1 2 3	1 1 1 1	Function request 1, reference mark 1, selected Function request 2, reference mark 2, selected Function request 3, reference mark 3, selected Function request 4, reference mark 4, selected
4 5 6 7	1 2 3 4-7	Value for function 1 is available Value for function 2 is available Value for function 3 is available Value for function 4 is available
8-12		See PROFIdrive profile, chap. 6.3.6.6
13	1	Indication of the cyclic transfer of the absolute actual position in G1_XIST2
14-15		See PROFIdrive profile, chap. 6.3.6.6

Figure 11.2 Bit in the status word during a homing run

Parameter P-1255 during homing run

To configure the homing run via the drive's digital inputs you will need the parameter **P-1255**, COM_PN_ReferenceMark:

Sub index	Meaning
Input selection	
0: Input selection function 1	Configuration reference mark 1 0: No function 1: TP0 (touchprobe 0) is used, digital input ISD05 * 2: TP1 (touchprobe 1) is used, digital input ISD06 *
1: Input selection function 2	Configuration reference mark 2 0: No function 1: TP0 (touchprobe 0) is used, digital input ISD05 * 2: TP1 (touchprobe 1) is used, digital input ISD06 *
2: Input selection function 3	Configuration reference mark 3 0: No function 1: TP0 (touchprobe 0) is used, digital input ISD05 * 2: TP1 (touchprobe 1) is used, digital input ISD06 *
3: Input selection function 4	Configuration reference mark 4 0: No function 1: TP0 (touchprobe 0) is used, digital input ISD05 * 2: TP1 (touchprobe 1) is used, digital input ISD06 *
* On MSD Servo Drive FS: TP0 digital input ISD04; TP1 digital input ISD05.	
Edge selection	
4: Edge selection for function 1	0: Positive edge 1: Negative edge
5: Edge selection for function 2	0: Positive edge 1: Negative edge
6: Edge selection for function 3	0: Positive edge 1: Negative edge
7: Edge selection for function 4	0: Positive edge 1: Negative edge
8-11	Reserved

*Table 11.6 Parameter **P-1255** during homing run*

With the setting TP0 the following parameters are changed:

- The digital input function for ISD05 is set to “Probe” (MPRO_INPUT_ISD05 = 15).
- The parameter MPRO_TP_Channel, **P-1402[0**] is set to 1, actual position in increments).

With the setting TP1, the following parameters are changed:

- The digital input function for ISD06 is set to “Probe” (MPRO_INPUT_ISD06 = 15).
- The parameter MPRO_TP_Channel, **P-1402[1]** is set to 1, actual position in increments).

The parameter MPRO_TP_Config, **P-1400** must be set to TP_TP(0, factory setting).

IMPORTANT
If the parameters MPRO_TP_Channel and MPRO_INPUT_ISD05/06 have been changed via the reference mark configuration, they are **not** automatically reset to the previous state once the reference mark configuration is deactivated again.

Sequence of a homing run

The homing run search on a PROFIdrive compliant controller functions as follows:

- The controller sets the function number of the reference mark search via the encoder control word.
- The corresponding digital input (ISD05 or ISD06) for the homing run is activated.
- On the detection of an edge change on the digital input, the position measured is written to the encoder actual value G1_XIST2.

12 Homing

12.1 Drive-controlled homing runs

A rising edge on bit 11 in the master control word activates the drive-controlled homing run.

A falling edge ends a homing run that has not been completed.

Bit 11 set in a status word indicates a completed homing run.

If the drive is operating in the interpolating mode, parameter **P-0301** (CON_REF_MODE) switches from the interpolating mode (IP) to the profile generating mode (PG).

12.2 Controller-controlled homing run

The touchprobe function enables:

- Controller-controlled homing of an axis.
- Recording of the position of the reference pulse.

The drive continues to operate with interpolation.
For further information please refer to the chapter "Touchprobe" in the "MSD Device Help".

NOTE:
You will find the latest detailed information on “Homing" in the “MSD Device Help” (CB40859-001) for the MSD Servo Drive from Moog in the Download area on our web site (http://www.moogsoftwaredownload.com/msd.html).

13 Standardisation

13.1 Conversion of reference and actual values via the factor group parameters

In positioning applications the reference values are usually entered and the actual values usually returned in user units (mm, degrees, …). So-called factor group parameters calculate the reference and actual values for the drive [dialog box in Moog DriveAdministrator 5: Parameter list ⇨ Motion profile ⇨ Standardisation/units]

You can select between 3 groups of factor group parameters. Each group has the task of converting user units to the internal variables in the servo drive:

1. **“STD/402” - Factor group parameters based on the CANopen specification DSP402.**
2. **“SERCOS” - Factor group parameters based on the specification “SERCOS interface” (Version 2.4 / February 2005).**
3. **“USER” - user-specific factor group parameters.**

The 3rd factor group “USER” is manufacturer-specific. How the parameters in this group are used is explained in the following descriptions:

You can select the factor group parameters via the parameter “MPRO_FG_Type”.

Parameter no.	Parameter name	Meaning
P-0283	MPRO_FG_Type	Factor group selection (0) = STD/402 (1) = SERCOS (2) = USER

Table 13.1 Parameter "MPRO_FG_Type"

Parameters for the factor group "USER":

Parameter no.	Parameter name	Meaning	Unit
P-0270	MPRO_FG_PosNorm	Encoder resolution	[incr/rev]
P-0271	MPRO_FG_Num	Numerator (position)	[rev]
P-0272	MPRO_FG_Den	Denominator (position)	[POS]
P-0274	MPRO_FG_SpeedFac	Speed factor	[rev/(min*SPEED)]
P-0275	MPRO_FG_AccFac	Acceleration factor	[rev/(sec*sec*ACC)]
P-0284	MPRO_FG_PosUnit	Position unit	String
P-0285	MPRO_FG_PosExp	Position exponent	-
P-0286	MPRO_FG_PosScaleFac	Position factor	-
P-0287	MPRO_FG_SpeedUnit	Speed unit	String
P-0288	MPRO_FG_SpeedExp	Speed exponent	-
P-0289	MPRO_FG_SpeedScaleFac	Speed factor	-
P-0290	MPRO_FG_AccUnit	Acceleration unit	String
P-0291	MPRO_FG_AccExp	Acceleration exponent	-
P-0292	MPRO_FG_AccScaleFac	Acceleration factor	-
P-0293	MPRO_FG_TorqueUnit	Torque unit	String
P-0294	MPRO_FG_TorqueExp	Torque exponent	-
P-0295	MPRO_FG_TorqueScaleFac	Torque factor	-

Table 13.2 “USER” factor group

Internal resolution of the device:

Position: incr

Speed: incr/s

Acceleration: incr/s^2

The profile defines the units with the setting “STD/402” or “SERCOS”.
The units can be assigned manually with the setting “USER”.

The parameters for unit and exponent are only used for display and do not affect the scaling of the variables.

13.2 Example: Setting for the “USER” factor group

The position is specified in degrees. 1 motor revolution corresponds to 360° (65536 increments per motor revolution). The speed is specified with the unit rev/min and the acceleration specified with rev/(min*sec). The relevant parameters for the factor group “USER” have the following values:

Parameter number and name		Meaning	Value and unit
P-0270	MPRO_FG_PosNorm	Encoder resolution	= 65536 [incr/rev]
P-0271	MPRO_FG_Num	Numerator (position)	= 1 [rev]
P-0272	MPRO_FG_Den	Denominator (position)	360 [POS] **
P-0274	MPRO_FG_SpeedFac	Speed factor	= 1 [rev/(min*SPEED)] ***
P-0275	MPRO_FG_AccFac	Acceleration factor	1/60 [rev /(sec*sec*ACC)] ****
P-0284	MPRO_FG_PosUnit	Position unit (string)	= "Degree"
P-0287	MPRO_FG_SpeedUnit	Speed unit (string)	= "1/min"
P-0290	MPRO_FG_AccUnit	Acceleration unit (string)	= "1/(min*sec)"
** POS	= User unit for position		
*** SPEED	= User unit for speed		
**** ACC	= User unit for acceleration		

Table 13.3 Relevant parameters for the factor group "USER"

The following 3 formulae describe the conversion of user units to the units used internally in the positioning mode. Taking into account reference position, positioning speed and acceleration:

Reference position:

$$\text{Reference position}_{\text{intern}}\ [\text{rev}] = \text{COM\_DP\_REFPos}\ [\text{User unit}] * \frac{\text{MPRO\_FG\_Num}\ [\text{rev}]}{\text{MPRO\_FG\_Den}\ [\text{User unit}]}$$

The quotient of parameters “MPRO_FG_Num” and “MPRO_FG_Den” describes the ratio of user unit to motor revolutions. It also integrates existing gear ratios or feed constants.

Positioning speed:

$$\text{Positioning velocity}_{\text{intern}}\ \frac{[\text{rev}]}{[\text{min}]} = \text{COM\_DP\_REFSpeed}\ [\text{User unit}] * \text{MPRO\_FG\_SpeedFac}\ \frac{[\text{rev}]}{[\text{Min} * \text{User unit}]}$$

Using the parameter “MPRO_FG_SpeedFac” you can change the number of digits after the decimal separator or the unit for the positioning velocity.

Positioning acceleration:

$$\text{Positioning acceleration}_{\text{intern}}\ \frac{[\text{rev}]}{[\text{sec}^2]} = \text{COM\_DP\_ACC}\ [\text{User unit}] * \text{MPRO\_FG\_AccFac}\ \frac{[\text{rev}]}{[\text{sec}^2 * \text{User unit}]}$$

Using the parameter “MPRO_FG_AccFac” you can change the number of digits after the decimal separator or the unit for the positioning acceleration.

14 Commissioning with manufacturer-specific telegrams

14.1 Position control with user-specific telegram

14.1.1 Commissioning a servo drive in the control mode “Position control in the profile generating mode”

GSD file / GSDML file

The GSD file is used for PROFIBUS, the GSDML file for PROFINET. Both files are termed the GSD file in the following. First the related GSD file must be integrated during the bus configuration phase and then the required telegram type selected.

Note
You will find the GSD file on our web site (http://www.moogsoftwaredownload.com/msd.html).

1. **Integrate the GSD file in the destination project.**
2. **E.g. select the telegram type 105 (this selection will be indicated in parameter P-0922 later, when the bus has booted).**

Example: telegram type 105:

- Consists of a PKW channel (8 bytes) and
- 10 process data channels (20 bytes).
- The process data area can be freely configured using a manufacturer-specific telegram. Reference and actual values can be mapped to a defined process data area.

The parameters **P-1284** and **P-1285** contain all the signals that can be mapped.
You can achieve this using the project tree:
Device ⇨ Device setting ⇨ Fieldbus ⇨ PROFIBUS/PROFINET.

This folder contains all signal lists:

- **P-1284** (COM_DP_SignalList_Write), all writeable signals.
- **P-1285** (COM_SignalList_Read), all readable signals.

You can freely assign the process data channels.

The actual allocation of the signals is made using the process data selection parameter **P-0915** and **P-0916** [dialog box in Moog DriveAdministrator 5:
Parameter list ⇨ Fieldbus ⇨ PROFIBUS/PROFINET]:

- Parameter data selection parameter **P-0915** (COM_DP_PZDSelectionWrite) contains all signals that can be sent by the control master to the drive.
- Parameter data selection parameter **P-0916** (COM_DP_PZDSelectionRead) contains all signals that can be sent by the drive to the control master.

In the following the process data area from the master to the drive is configured as an example.

P-0915 with PCON				
Process data selection P-0915 sub index	**PZD area**	**Parameter number**	**Parameter name**	**Data type for the parameter entered**
0	1	**P-0967[0]**	Control word	uint16
1	2	**P-1275[0]**	Target position [user units]	int32 [1)]
2	3	**P-1277[0]**	Target velocity [user units]	Int32 [1)]
3	4	**P-1278[0]**	Acceleration	uint16
4	5	**P-1279[0]**	Deceleration	uint16

[1)] For 32-bit values it is to be ensured that the parameter 2x is entered in **P-0915/P-0916**.

∑ [bit]	112
∑ [words]	7
∑ [byte]	14

Table 14.1 Example usage of the process data channel master-slave

Each entry represents a 16-bit wide process data channel. The target position (Int32) is mapped to sub indices 1 and 2 so that 32 bits are transferred. You will find the parameters that can be selected and their data type in chapter “9 Acyclic data transmission” on page 47.

You can select the sequence of the signal assignments in the configuration of the process data channels.

Note
Please note: keep to the format for the data type! For 32-bit values it is to be ensured that the parameter 2x is entered in **P-0915/P-0916**.

In the following table the process data area from the drive to the master is configured as an example.

P-0916 with PCON				
Process data selection P-0916 sub index	**PZD area**	**Parameter number**	**Parameter name**	**Data type for the parameter entered**
0	1	**P-0968**	Status word	uint16
1	2	**P-1276**	Act. position [user units]	int32 [1]
2	3	**P-1271**	Act. velocity [user units]	Int32 [1]
3	4	**P-0700**	Act. current [A]	float32 [1]
4	5	-	-	-
[1] For 32-bit values it is to be ensured that the parameter 2x is entered in P-0915/P-0916.				
∑ [bit]				112
∑ [words]				7
∑ [byte]				14

Table 14.2 Example usage of the process data channels slave-master

During the hardware configuration you can use the telegram PPO5 for this mapping example with 14 bytes (7 words) of I/O data.

For the “Positioning” control mode set following parameters:

1. **CON_CfgCon (300) : PCON(3)**
   [dialog box in Moog DriveAdministrator 5: Parameter list ⇨ Control]
   - This parameter controls the operation mode.
   - The setting PCON (Position Control Mode) means that the drive is in the position control mode.
2. **CON_REF_Mode (301) : RFG(0)**
   [Parameter list ⇨ Motion profile ⇨ Basic setting].
   - This parameter controls the mode for defining the position reference value.
   - The position reference value is defined directly or via a ramp generator.
   - The setting RFG (Ramp Function Generator) means that the position reference value is defined via a ramp generator.
3. **MPRO_CTRL_SEL (159): PROFIBUS(7)**
   [Parameter list ⇨ Motion profile ⇨ Basic setting].
   - This parameter defines the control location. Here control location "PROFIBUS / PROFINET".
4. **MPRO_REF_SEL (165): PROFI(9)**
   [Parameter list ⇨ Motion profile ⇨ Basic setting].
   - This parameter defines the reference value selector. Select PROFIBUS / PROFINET here.

These parameter settings are a prerequisite for the communication between the master and drive.

14.2 Speed control with a user-specific telegram

The following section describes the commissioning of a drive in the control mode speed control.

GSD file / GSDML file

The GSD file is used for PROFIBUS, the GSDML file for PROFINET. Both files are termed the GSD file in the following. First the related GSD file must be integrated during the bus configuration phase and then the required telegram type selected.

Note
You will find the GSD file on our web site (http://www.moogsoftwaredownload.com/msd.html).

1. **Integrate the GSD file / GSDML file in the destination project.**
2. **E.g. select the telegram type 102 (this selection will be indicated in parameter P-0922 later, when the bus has booted).**

Example: telegram type 102:

- Consists of a PKW channel (8 bytes) and
- 6 process data channels (12 bytes).
- The process data area can be freely configured using a manufacturer-specific telegram. Reference and actual values can be mapped to a defined process data area.

The parameters **P-1284** and **P-1285** contain all the signals that can be mapped. You can achieve this using the project tree:

Device ⇨ Device setting ⇨ Fieldbus ⇨ PROFIBUS/PROFINET.

This folder contains all signal lists:

- **P-1284** (COM_DP_SignalList_Write), all writeable signals.
- **P-1285** (COM_SignalList_Read), all readable signals.

You can freely assign the process data area.

The actual allocation of the signals is made using the process data selection parameter **P-0915** and **P-0916** [dialog box in Moog DriveAdministrator 5:
Parameter list ⇨ Fieldbus ⇨ PROFIBUS/PROFINET]:

- Parameter data selection parameter **P-0915** (COM_DP_PZDSelectionWrite) contains all signals that can be sent by the control master to the drive.
- Parameter data selection parameter **P-0916** (COM_DP_PZDSelectionRead) contains all signals that can be sent by the drive to the control master.

In the following the process data area from the master to the drive is configured as an example. For this purpose assign the parameter numbers stated to the sub indices in list **P-0915**:

P-0915 with PCON				
Process data selection P-0915 sub index	**PZD area**	**Parameter number**	**Parameter name**	**Data type for the parameter entered**
0	1	**P-0967**	Control word	uint16
1	2	**P-1270**	Speed reference value	int32
2	3	**P-1278**	Acceleration	uint16
3	4	**P-1279**	Braking	uint16
∑ [bit]				80
∑ [words]				5
∑ [byte]				10

Table 14.3 Example usage of the process data channel master-slave

As each sub index represents a 16-bit wide process data channel, an Int32 parameter for instance is mapped to two sub indices. You will find the parameters that can be selected and their data type in “Table 14.1 Example usage of the process data channel master-slave” on page 85.

You can select the sequence of the signal assignments in the configuration of the process data objects. Please note: keep to the format for the data type!

This means a 32-bit variable requires 2 process data objects.

In the following the process data area from the drive to the master is configured as an example. For this purpose assign the parameter numbers stated to the sub indices in list **P-0916**:

P-0916 with PCON				
Process data selection P-0916 sub index	**PZD area**	**Parameter number**	**Parameter name**	**Data type for the parameter entered**
0	1	**P-0968**	Status word	uint16
1	2	**P-1271**	Actual speed	int32
∑ [bit]				48
∑ [words]				3
∑ [byte]				6

Table 14.4 Example usage of the slave-master process data channel

For the “Speed control” control mode set following parameters:

1. **CON_CfgCon (300) : SCON(2)**
   [dialog box in Moog DriveAdministrator 5: Parameter list ⇨ Control]
   - This parameter controls the operation mode.
   - The setting SCON (Speed Control Mode) means that the drive is in the speed control mode.
2. **CON_REF_Mode (301) : RFG(0)**
   [Parameter list ⇨ Motion profile ⇨ Basic settings].
   - This parameter controls the mode for defining the reference value.
   - The speed reference value is defined directly or via a ramp generator.
   - The setting RFG (Ramp Function Generator) means that the speed reference value is defined via a ramp generator.
3. **MPRO_CTRL_SEL (159): PROFIBUS(7)**
   [Parameter list ⇨ Motion profile⇨ Basic settings]
   - This parameter defines the control location. Here: Control location “PROFIBUS / PROFINET”.
4. **MPRO_REF_SEL (165): PROFI(9)**
   [Parameter list ⇨ Motion profile⇨ Basic settings]
   - This parameter defines the reference value selector. Select PROFIBUS / PROFINET here.

These parameter settings are a prerequisite for the communication between the master and drive.

14.2.1 Speed specification

Procedure:

1. **Undertake scaling.**
2. **Specify the scaled speed reference value.**
3. **Using the master control word (see chap. “10.2.1 Master control word (STW)” on page 62) place the drive in speed-controlled operation.**

14.3 Mappable Profibus / Profinet parameters

Parameter number	Parameter name	Write (P-1284)	Read (P-1285)	PZD Length
P-0967	COM_DP_Controlword	X	X	1
P-0968	COM_DP_Statusword	-	X	1
P-1280	COM_DP_Controlword2	X	X	1
P-1281	COM_DP_Statusword2	-	X	1
P-1270	COM_DP_RefSpeed	X	X	2
P-1271	COM_DP_ActSpeed	-	X	2
P-0121	MPRO_Input_State	-	X	1
P-0143	MPRO_Output_State	-	X	1
P-1274	COM_DP_RefPos	X	X	2
P-1276	COM_DP_ActPos1	-	X	2
P-0207	MPRO_TAB_ActIdx	X	X	1
P-1275	COM_DP_TargetPos	X	X	2
P-1277	COM_DP_PosVelocity	X	X	2
P-1278	COM_DP_Acc	X	X	1
P-1279	COM_DP_Dec	X	X	1
P-1287	COM_DP_TMaxPos	X	X	1
P-1288	COM_DP_TMaxNeg	X	X	1
P-1259	COM_DP_XERR	X	X	2
P-1260	COM_DP_KPC	X	X	2
P-1261	COM_DP_NSOLL_B	X	X	2
P-1263	COM_DP_G1_STW	X	X	1
P-1262	COM_DP_NIST_B	-	X	1
P-1264	COM_DP_G1_ZSW	-	X	2
P-1265	COM_DP_G1_XIST1	-	X	2
P-1266	COM_DP_G1_XIST2	-	X	2

Table 14.5 Mappable parameters

Other mappable parameters
[dialog box in Moog DriveAdministrator 5: Parameter List ⇨ Fieldbus ⇨ PROFIBUS/PROFINET parameters]:

- Signal list **P-1284** (COM_DP_SignalList_Write).
- Signal list **P-1285** (COM_DP_SignalList_Read).

14 Commissioning with manufacturer-specific telegrams

15 PROFIBUS/PROFINET parameters and their description

Parameter name	Number	Value range	Default value	Can be changed	Data type	Description
PROFIBUS/PROFINET parameters						
COM_DP_PZDSelectionWrite	**P-0915**	0 – 65535	967	Yes	U16	Links incoming process data to specific device parameters. You will find the list of parameters to be entered (process data reference values) in parameter **P-1284**. Sub index 0 contains the first process data word PZD1, etc.
COM_DP_PZDSelectionRead	**P-0916**	0 – 65535	968	Yes	U16	Links outgoing process data to specific device parameters. You will find the list of parameters to be entered (process data actual values) in parameter **P-1285**. Sub index 0 contains the first process data word PZD1, etc.
COM_DP_Address*	**P-0918**	0 – 126	126	Yes	U16	Station address of the inverter.
COM_DP_TelegramSelection	**P-0922**	0 – 65535	0	Yes	U16	
COM_DP_SignalList	**P-0923**	0 – 65535	0	No	U16	All “mappable” parameters and signals for parameters **P-0915** and **P-0916**.
COM_DP_PulsesEnabled	**P-0924**	0 - 65535	410	Yes	U16[2]	Bit position for pulse enable [0]: Signal number [1]: Bit position
COM_PN_sign_of_life_limit	**P-0925**	0 - 65535	0	Yes	U16	Number of SOL (sign of life) errors permitted until error shutdown. Type U16: 00-65534, 65535 = switch off.
COM_DP_ControlPriority	**P-0928**	0 - 65535	1	No	I32	Control priority
COM_DP_OperatingMode	**P-0930**	0 - 65535	0	No	U16	Operation mode
COM_DP_FaultCounter	**P-0944**	0 - 65535	0	No	U16	Error counter
COM_DP_FaultCode	**P-0945**	0 - 65535	1	No	U16[20]	Error code
COM_DP_FaultNumber	**P-0947**	0 - 65535	0	No	U16[20]	Error number
COM_DP_FaultValue	**P-0949**	0 - 65535	0	No	U32[20]	Error value, manufacturer defined
COM_DP_FaultScaling	**P-0950**	0 - 65535	201	No	U16[2]	Error memory size. Number of error situations to occur Number of messages per error event
COM_DP_FaultNumber List	**P-0951**	0 - 65535	0	No	U16[20]	Error number list
COM_DP_FaultSituationCounter	**P-0952**	0 - 65535	20	Yes	U16	Number of error situations
COM_DP_Warning	**P-0953**	0 – 0xFFFF	0	No	U16	Indicates warnings from the PROFIBUS, such as bus timeout and PLC stop mode.
COM_DP_Baudrate*	**P-0963**	9.6 – 45.45 kbits/s	9.6 kbit/s	No	U16	Current baud rate for bus communication.
COM_DP_DeviceId	**P-0964**	0 – 65535	0	No	U16	Device identification.
COM_DP_ProfileNo	**P-0965**	0 – 65535	0	No	U16	Profile number

Table 15.1 PROFIBUS and PROFINET parameters

Parameter name	Number	Value range	Default value	Can be changed	Data type	Description
PROFIBUS/PROFINET parameters						
COM_DP_Controlword	**P-0967**	0 – 0xFFFF	0	Yes	U16	Control word for the internal state machine.
COM_DP_Statusword	**P-0968**	0 – 0xFFFF	0	No	U16	Status word for the internal state machine.
COM_DP_DataStore	**P-0971**	0 – 255	0	Yes	U16	Permits storage of data in the non-volatile memory.
COM_DP_ParamAccess	**P-0974**	0 – 65535	378 20 3	No	U16[3]	Information on the acyclic parameter channel: Maximum block length Maximum number of parameter requests Delay in [10ms]
COM_DP_DO_Ident	**P-0975**	0 – 65535	380 1 SW YYYY DDMM 1 29 0	No	U16[10]	Drive object (DO) identification Manufacturer identification Drive object type, manufacturer-dependent Actual device firmware Firmware year Firmware day/month Drive object type class, 1 = axis Drive object classes identification, 29=0x1D: Application classes 1, 3, 4 and 5 supported. Drive object identification
COM_DP_SensorFormat	**P-0979**	0 – 0xFFFFFFFF	0	No	U32[32]	Encoder format
COM_DP_DefinedParameter	**P-0980**	0 – 65535	0	No	U16	Describes the defined parameters in the servo drive.
COM_DP_DefinedParameter 1	**P-0981**	0 – 65535	0	No	U16	Describes the defined parameters in the servo drive.
COM_DP_DefinedParameter 2	**P-0982**	0 – 65535	0	No	U16	Describes the defined parameters in the servo drive.
COM_DP_DefinedParameter 3	**P-0983**	0 – 65535	0	No	U16	Describes the defined parameters in the servo drive.
COM_DP_DefinedParameter 4	**P-0984**	0 – 65535	0	No	U16	Describes the defined parameters in the servo drive.
COM_DP_DefinedParameter 5	**P-0985**	0 – 65535	0	No	U16	Describes the defined parameters in the servo drive.
COM_DP_DefinedParameter 6	**P-0986**	0 – 65535	0	No	U16	Describes the defined parameters in the servo drive.
COM_DP_DefinedParameter 7	**P-0987**	0 – 65535	0	No	U16	Describes the defined parameters in the servo drive.
COM_DP_DefinedParameter 8	**P-0988**	0 – 65535	0	No	U16	Describes the defined parameters in the servo drive.
COM_DP_DefinedParameter 9	**P-0989**	0 – 65535	0	No	U16	Describes the defined parameters in the servo drive.
COM_DP_ModifiedParameter	**P-0990**	0 – 65535	0	No	U16	Describes all the parameters in the servo drive that are not set to the default values.
COM_DP_PZDSelectionWrite_Idx	**P-1253**	0 – 65535	0	Ja	U16	Links incomming process data to specific device parameters.
COM_DP_PZDSelectionRead_Idx	**P-1254**	0 – 65535	0	Ja	U16	Links outgoing process data to specific device parameters.
COM_PN_ReferenceMark	**P-1255**	0 - 2		Yes	U16[12]	Configuration reference marks
COM_DP_DIAG_MODE	**P-1256**	0-65535	0	Yes	U16	Selection of the bus diagnostic modes
COM_DP_PLC_MODE	**P-1258**	0-65535	0	Yes	U16	Control mode

Table 15.1 PROFIBUS and PROFINET parameters

Parameter name	Number	Value range	Default value	Can be changed	Data type	Description
PROFIBUS/PROFINET parameters						
COM_DP_XERR	**P-1259**	-2147483648 – 2147483647	0	Yes	I32	Position tracking error reference value
COM_DP_KPC	**P-1260**	-2147483648 – 2147483647	0	Yes	I32	Position controller gain factor
COM_DP_NSOLL_B	**P-1261**	-2147483648 – 2147483647	0	Yes	I32	Reference speed percentage, -200% to 200%
COM_DP_NIST_B	**P-1262**	-2147483648 – 2147483647	0	No	I32	Actual speed percentage, -200% to 200%
COM_DP_G1_STW	**P-1263**	0 – 0xFFFF	0	Yes	U16	Sensor 1 control word
COM_DP_G1_ZSW	**P-1264**	0 – 0xFFFF	0	No	U16	Sensor 1 status word
COM_DP_G1_XIST1	**P-1265**	0 – 0xFFFFFFFF	0	No	U32	Sensor 1 position value 1
COM_DP_G1_XIST2	**P-1266**	0 – 0xFFFFFFFF	0	No	U32	Sensor 1 position value 2
COM_DP_CtrlConfig	**P-1267**	0 – 65535	0	Yes	U16	Describes the function of each bit in the control word, parameter **P-0967**.
COM_DP_RefJogSpeed1	**P-1268**	-2147483648 – 2147483647	0	Yes	I32	Contains the reference speed 1 in the jog mode.
COM_DP_RefJogSpeed2	**P-1269**	-2147483648 – 2147483647	0	Yes	I32	Contains the reference speed 2 in the jog mode.
COM_DP_RefSpeed	**P-1270**	-32768 – 32767	0	Yes	I16	Speed reference value written via PROFIBUS.
COM_DP_ActSpeed	**P-1271**	-32768 – 32767	0	No	I16	Speed actual value.
COM_DP_RefTorque	**P-1272**	-32768 – 32767	0	Yes	I16	Torque reference value that is written via the PROFIBUS.
COM_DP_ActTorque	**P-1273**	-32768 – 32767	0	No	I16	Actual torque.
COM_DP_RefPos	**P-1274**	-2147483648 – 2147483647	0	Yes	I32	Position reference value (ramp mode) written via PROFIBUS.
COM_DP_TargetPos	**P-1275**	-2147483648 – 2147483647	0	Yes	I32	Position reference value (direct mode) written via PROFIBUS.
COM_DP_ActPos1	**P-1276**	-2147483648 – 2147483647	0	No	I32	Actual position value from the 1st position encoder.
COM_DP_PosVelocity	**P-1277**	-2147483648 – 2147483647	0	Yes	I32	Speed reference value (ramp mode) written via PROFIBUS.
COM_DP_Acc	**P-1278**	0 – 0xFFFF	100	Yes	U16	Acceleration reference value (ramp mode) written via PROFIBUS.
COM_DP_Dec	**P-1279**	0 – 0xFFFF	100	Yes	U16	Deceleration reference value (ramp mode) written via PROFIBUS.
COM_DP_Controlword2	**P-1280**	0 – 0xFFFF	0	Yes	U16	2. control word, initially not used.
COM_DP_Statusword2	**P-1281**	0 – 0xFFFF	0	No	U16	2. status word, initially not used.
COM_DP_Bus_Timeout	**P-1283**	0 – 4294967295	5000	Yes	U32	Bus timeout.
COM_DP_SignalList_write	**P-1284**	0 – 65535	0	No	U16	List of parameters with process data reference values.
COM_DP_SignalList_Read	**P-1285**	0 – 65535	0	No	U16	List of parameters with process data actual values.
COM_DP_TMaxScale	**P-1286**	0 – 2000	1000	Yes	U16	Online torque scaling.
COM_DP_TMaxPos	**P-1287**	0 – 2000	1000	Yes	U16	Positive online torque scaling.
COM_DP_TMaxNeg	**P-1288**	0 – 2000	1000	Yes	U16	Negative online torque scaling.
COM_PN_Sign_of_life_err_cnt	**P-1296**	0-65535	0	No	U16	Indication of the actual error counter.

Table 15.1 PROFIBUS and PROFINET parameters

Parameter name	Number	Value range	Default value	Can be changed	Data type	Description
PROFIBUS/PROFINET parameters						
PROFINET parameters						
COM_PN_StationName	**P-1289**		DRIVE	YES	string	Station name for the PROFINET device.
COM_PN_StationIP	**P-1290**	0-FFFFFFFF	0	No	U32	IP address for the PROFINET device.
COM_PN_StationSubnet	**P-1291**	0-FFFFFFFF	0	No	U32	Subnet mask for the PROFINET device.
COM_PN_StationMAc	**P-1292**	[0] -[5] 0-FF	0	No	U8	Station MAC address for the PROFINET device.
COM_PN_StationMAc	**P-1292**	[6] -[11] 0-FF	0	No	U8	Station MAC address for the PROFINET device.
COM_PN_StationMAc	**P-1292**	[12] -[17] 0-FF	0	No	U8	Station MAC address for the PROFINET device.
COM_PN_ProductFamily	**P-1293**		DRIVE	No	string	Product family.
COM_PN_IM	**P-1294**	0-FFFF	0	No	U16	Identification and maintenance (IM).
COM_PN_DefaultGateway	**P-1295**	0-FFFFFFFF	0	No	U32	Gateway (factory setting).
COM_PN_BusInfo	**P-1297**	0-65535	0	No	U16[40]	Profinet additional information
* Only PROFIBUS parameters						

Table 15.1 PROFIBUS and PROFINET parameters

The parameter **P-1294** is based on the standard Profile Guidelines Part 1: Identification & Maintenance Functions, 1.2, Oct 2009, Order No. 3.502 for I & M record 0.

16 Behaviour of the output data from the PROFINET master

The output data from the master represent the device setpoints:

Behaviour of the outputs with IOPS=BAD:

All output data are set to zero.

Behaviour of the outputs on loss of connection:

All output data are set to zero.

Behaviour of the outputs on power on:

All output data are set to zero.

17 Appendix

17.1 Glossary

AK	(Auftragskennung) Task identifier (master-slave) or response identifier (slave-master)
Drive profile	Specifies how an electrical drive is operated via a fieldbus. It defines the device behaviour and the access method for the drive data. The following sub-areas are defined: • Control and status monitoring • Standardised parameter configuration • Changing operation modes
Application data set	Parameter data set predefined in the factory for solving typical applications
Bus segments	To achieve the full physical extent of the PROFIBUS and the maximum number of bus users, for physical reasons the PROFIBUS is divided into segments that are connected via repeaters.
Diagnostic data	The master reads the diagnostic data from the slave and in this way makes possible a central reaction to malfunctions in the slave.
DAP	(Device access point) Access point for the communication with the Ethernet interface and the data processing program.
DO	Drive Object
DP	Decentralised Peripherals
DP-V0	Protocol that defines the functions for the cyclic exchange of data and diagnostics. Devices that support this functionality are used in automation technology and machine control.
DP-V1	Protocol that defines the functions for the acyclic exchange of data and how alarms are handled. Devices that support this functionality are used in process technology.
DP-V2	Protocol that defines the functions for the isochronous exchange of data, the cross slave traffic and the time synchronisation. This expansion is used in production technology and robot control.
GSD file	General station description file (page 25), usage for PROFIBUS
GSDML file	General station description file (xml) (page 29), usage for PROFINET
IEC 61158	Standard for PROFIBUS DP applicable across Europe. Successor to the national standard DIN 19245.
Input words	Data from the drive to the controller
Interpolation	A continuous function, the so-called interpolating function, is found from given data and represent these data. It is said the function interpolates the data.
IOCS	Input Output Consumer Status
IOPS	Input Output Provider Status
Master	The master controller that handles communication.
Master class 1	The master that handles the user data traffic (also called the parameter configuration master).
Master class 2	Master for control/commissioning and planning tasks.
Mappable parameters	Writeable and readable parameters in the cyclic process data (DP-V0)
Moog DriveAdministrator 5 (MDA5)	PC software from Moog for (initial) commissioning and process diagnostics on the devices in the MSD Servo Drive family
Output words	Data from controller to the drive
PAP	Parameter Access Point: access point to parameters for a drive object (DO).
PCON	Position Control Mode
PI	PROFIBUS International
PKW	(Parameter-Kennung-Wert) Parameter identifier value
PNU	Parameter number
PPO	Parameter process data objects
PROFIdrive mode	Configuration of the process data channel, compliant with the PROFIdrive profile. Unlike the EasyDrive mode, the system states are changed by a defined set of control sequences. The system state machine defined in the PROFIBUS standard defines the individual system state transitions.
PROFINET	Ethernet-based communication concept from the PNO (PI). The focus is on a manufacturer-independent engineering concept that is based on the component model from Microsoft. PROFIBUS and PROFINET are used in parallel.
PZD	(Prozessdaten) Process data: the process data channel contains the functions - control and apply status, predefine reference values and indicate actual values.
RAM	Random Access Memory
Repeater	Electrical (or also optical) signal amplifier or signal conditioner to increase the range of a signal. Is used to condition signals for connecting the individual bus segments.
RFG	Ramp Function Generator
RT class 1	RT class 1 defines the unsynchronised RT communication within a subnet. No special addressing information is necessary. [1)]

RT class 2	With RT class 2 the frames can be synchronised or unsynchronised. The unsynchronised communication is as for RT class 1 communication. The start of a bus cycle is defined for all bus users during synchronised communication. The time slots when the field devices are allowed to send is defined in this manner. For all field devices that take part in the communication this is the start of the bus cycle in RT class 2. [1)]
RT class 3	RT class 3 describes the synchronised communication within a subnet. Here the process data are sent based on an exact sequence with very high precision defined during the planning (the maximum deviation from the start of a bus cycle allowed is 1 µs). The data transfer optimised in this manner is also termed IRT functionality. IRT: Isochronous Real Time [1)]
SCON	Speed Control Mode
Sign of life	Monitors the synchronism of the cycle counters on the master (controller) and slave (MSD Servo Drive). You will find more information on the sign of life function on page 43.
Slave	A slave is a device on the PROFIBUS-DP bus which, in contrast to the master, responds only to the requests directed to it.
SPM	Spontaneous message
Switch	Coupling element (or network switch/distributor) that connects together the network segments.
TCP/IP	Transmission Control Protocol/Internet Protocol (TCP/IP)
TIA	Totally Integrated Automation. Totally Integrated Automation, development environment from SIEMENS for their control systems.
Topology/ network topology	Way in which the components are connected together. You will find more information on the PROFIBUS topology from page 26. You will find more information on the PROFINET topology from page 31
Watchdog	The MSD Servo Drive monitors whether the controller is active using a watchdog. You will find more information on the watchdog function on page 43.
State machine	This describes the transitions between the various system states. A state transition is triggered by a defined event, e.g. a control sequence or setting an input.
	[1)] Source: www.feldbusse.de

17.2 Technical data

The PROFIBUS/PROFINET implementation in MSD Servo Drive conforms to the PROFIdrive profile "PROFIBUS PROFIdrive-Profile Version 4.2" dated August 2015.

	PROFIBUS	PROFINET
Data transfer	Two-core cable (EIA-485)	Standard Ethernet patch cable (e.g. S/FTP Cat. 5e)
Maximum transfer rate	12 MBaud	100 MBaud
Automatic baud rate detection	Yes	Fixed
Maximum cable length	1000 m (3280.84 ft) @ 9.6 to 187.5 KBaud 400 m (1312.34 ft) @ 500 KBaud 200 m (656.17 ft) @ 1.5 MBaud 100 m (328.08 ft) @ 3 to 12 Mbaud Please use the specified PROFIBUS cables (see chapter “6.2 Specification of the connectors and cables” on page 25)	100 m (328.08 ft) on usage of specified PROFINET cable (see chapter “7.2 Specification of the connectors and cables” on page 30) Maximum 40 m (131.23 ft) with commercially available Ethernet cables.
Network topology	Line without repeater Line and tree with repeater	Tree, star and line
Adjustable PROFIBUS address	MSD Servo Drive: via rotary coding switch/ addressing parameter MSD Servo Drive Compact: via addressing parameter	-
Cyclic exchange of reference and actual values	Yes via DP-V0	Yes (up to 64 bytes)
Acyclic data exchange	Yes via DP-V1	Yes
Sampling time	≥ 1 ms	≥ 1 ms for RT ≥ 0.5 ms for IRT
Write and read drive parameters	Yes via PKW channel or DPV1	Yes
Synchronisation	-	Yes
Fieldbus devices	Slave	IO device with real-time (RT), synchronised communication IRT (isochronous real-time)
Specification	See chapter “1.3.2 Documentation from PROFIBUS Nutzerorganisation (PI)” on page 8	

Table 17.1 Technical data

18 Glossary

Symbols

A

B

C

D

N

O

P

Q

R

S

T

U

V

W

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