USER MANUAL
FIRMWARE

RADIAL PISTON PUMP (RKP-D) WITH CAN BUS INTERFACE

(B99224-DV007-CE400; Version 1.1, 09/08)

WHAT MOVES YOUR WORLD

MOOG

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Hanns-Klemm-Straße 28
71034 Böblingen
Germany
Telephone: +49 7031 622-0
Fax: +49 7031 622-191
E-mail: sales@moog.com
Internet: http://www.moog.com/Industrial

Subject to change without notice.

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1 General information

1.1 About this manual

This document describes all accessible parameters used by our radial piston pumps with CANopen interface. Most parameters follow the DSP 408.

The manual is part of the complete documentation available for the radial piston pump.
⇨ Chapter "1.3 Further documentation for the device", page 2

ⓘ This document is not a replacement for the CANopen standards as listed in the references.
⇨ Chapter "1.4 References", page 3

This manual was prepared with great care and the contents reflect the authors' best knowledge. However, the possibility of error remains and improvements are possible.
Please feel free to submit any comments regarding errors or incomplete information to us.

1.1.1 Reservation of changes and validity

The information contained in this manual is valid at the time of this version's release. See footer for version number and release date of this manual.
We reserve the right to make changes to this manual at any time without specified reasons.

1.1.2 Completeness

This manual is complete only when used in conjunction with the product related hardware and software documentation required for the relevant application.

1.1.3 Place of storage

This manual and all other associated documentation for hardware and software must always be kept in a location where they will be readily accessible and close to the RKP-D or the equipment in which they are installed.

1.1.4 Warranty and liability

This manual only describes the functionality and influence of the CANopen parameters. The described software functionality can be used in various pump models which can be implemented in a vast range of applications. Hence it is not possible to assume liability for the influence of the parameters. Please refer to the safety instructions and remarks in the related operating instructions.

1.1.5 Typographical conventions

DANGER	**Identifies safety instructions that are intended to warn of an immediate and impending danger to life and limb or major property damage.** **Failure to observe these safety instructions will lead inevitably to death, serious personal injury (disablement) or major property damage!**
WARNING	**Identifies safety instructions that are intended to warn of potential danger to life and limb or the potential for major property damage.** Failure to observe these safety instructions might lead to death, serious personal injury (disablement) or major property damage!
CAUTION	Identifies safety instructions that are intended to warn of slight personal injury or minor property damage. Failure to observe these safety instructions might lead to slight personal injury or minor property damage.
ⓘ	Identifies important information
• / -	Identifies listings
⇨	Identifies references to another chapter, another page, table or figure in this manual
blue text	Identifies a hyperlink within the PDF file
1., 2., …	Identifies steps in a procedure that should be performed in consecutive order
'ACTIVE'	Identifies the valve status
«MS»	Identifies LEDs of the valve (for example, «MS»)
< >	Identifies a parameter name
"…"	Used for references

1.2 Selection and qualification of personnel

Only qualified users may work with the device. Qualified users are properly trained experts with the required knowledge and experience. In particular, these experts must have the authorization to bring into operation systems and power circuits in accordance with safety engineering standards. Those people working on a project must be familiar with safety concepts common in automation.

1.3 Further documentation for the device

The manual is part of the complete documentation for the device which includes the following:

- CA57130
  User Manual Mounting and Installation Notes
- CA53461-001
  User Manual RKP-II
- CA57626
  User Manual RKP-II Explosion-Proof
- CA63420
  Benutzerinformation Elektrische Schnittstellen

1.4 References

- CANopen - Application Layer and Communication Profile
  CiA Draft Standard 301
  Version 4.1
  August 15, 2006
- CANopen - Device Profile Fluid Power Technology Proportional Valves and Hydrostatic Transmissions
  CiA Draft Standard Proposal 408
  Version 1.5.2
  April 30, 2005
- CANopen - Layer Setting Services and Protocol (LSS)
  CiA Draft Standard Proposal 305
  Version 1.1.1
  November 5, 2002
- Profile Fluid Power Technology
  Proportional Valves and Hydrostatic Transmissions
  Version 1.5

1.5 Definitions

Internal resolution (iR)

The internal resolution is 16384 (4000 hex) at 100 % and -16384 (C000 hex) at -100 % of the value range.

Position

Position always refers to the stroke ring position. Other positions are named explicitly.

Volume flow direction

A positive stroke ring demand value will result in a volume flow from connection A to the connection B of the pump.

1.6 Representation of parameters

Parameters are described in this document in the following tabular form:

Block name							
Index	Subindex	Parameter name	Data type	Access	Persistence	Value range	Default

Table 1: Representation of objects

where the table columns have the following meaning:

Column name	Meaning
Block name	Describes the family of parameters. If the parameter does not belong to a block, the parameter name is taken as block name.
Index	16 bit index that addresses the entry in the object dictionary. In case of a simple variable this references the value of this variable directly. In case of records and arrays, the index addresses the whole data structure. Then the 8 bit subindex allows access to individual elements in the structure.
Subindex	If the object is defined as a record or array, the subindex defines an element in the structure.
Name	Defined name of the object.
Data type	Data type of the parameter.
Access	Access permission for the parameter.
Persistence	Defines whether the parameter can be saved in non-volatile memory. If the persistence is set to "Y", the saved value stays in memory even after the device is turned off. Parameters not marked as persistent ("N") loose their settings after the device is turned off.
Value range	Allowed value range for the object.
Default	The value listed is a typical value. It varies depending on the pump model (DSV). To obtain reliable information on the default value, read the value from the pump. The default values are loaded after the restore command. ⇨ Chapter "9 Storing / restoring parameters", page 131

Table 2: Meaning of object entries

List of data types:

- INTn
- FLOAT32
- char
- STRING
- UINTn

1.6.1 Representation of parameters in the object dictionary

In addition to the table columns described in the chapter above, the object dictionary contains the following columns:

Column name	Meaning
PDO mapping	If set to "Y", the parameter can be mapped into a PDO. If set to "N", the parameter cannot be mapped into a PDO.
Short name	Unique short name.
Specification	Specification that contains the parameter description. Possible entries: DIV: MOOG-defined parameters DS301: parameters correspond to DS 301 DS408: parameters correspond to DSP 408

Table 3: Meaning of entries in object dictionary

1.6.2 Definition of unit and prefix

This chapter describes the coding of units and prefixes. If unit and prefix are configurable, the associated sub-components have rw access, otherwise ro.

1.6.2.1 Unit representation

Name of unit	International symbol	Notation index (hex)
none	dimensionless or iR	00
metre	m	01
second	s	03
hertz	Hz	20
litre	l[1]	44
minute (time)	min	47
hour	h	48
day	d	49
year	a	4A
bar	bar	4E
meter per square second	m/s^2	55

Table 4: Code table for units

[1] The symbol L can be used as an alternative to the symbol l.

1.6.2.2 Prefix representation

Prefix	Factor	Symbol	Notation index (hex)
-	10^0	-	00
deci	10^{-1}	d	FF
centi	10^{-2}	c	FE
milli	10^{-3}	m	FD
-	10^{-4}	-	FC

Table 5: Code table for prefixes

1.7 Abbreviations

Abbreviation	Explanation
ADC	**A**nalog **D**igital **C**onverter
CAN	**C**ontroller **A**rea **N**etwork
CAN_GND	**CAN Gr**ou**nd**
CAN_H	**CAN H**igh (CAN bus signal (dominant high))
CAN_L	**CAN L**ow (CAN bus signal (dominant low))
CANopen	Device and manufacturer-independent description language for communication over the CAN bus
char	Characters
CiA	**C**AN **i**n **A**utomation e. V. (international organization of CAN users; http://www.can-cia.org)
COB	**C**ommunication **O**bject; a unit of transportation on a CAN network. Data is sent across a network inside a COB.
COB ID	The COB ID is the object specifying the CAN identifier and function code.
CPU	**C**entral **P**rocessing **U**nit
DIV	**D**igital **I**nterface **V**alve

Table 6: Abbreviations (part 1 of 3)

Abbreviation	Explanation
DOMAIN	Arbitrary large block of data
DS 301	CANopen - Application Layer and Communication Profile CiA Draft Standard 301 Version 4.1 August 15, 2006
DSP	**D**igital **S**ignal **P**rocessor
DSP 305	CANopen - Layer Setting Services (LSS) and protocols CiA Draft Standard Proposal 305 Version 2.0 January 16, 2006
DSP 408	CANopen - Device Profile Fluid Power Technology Proportional Valves and Hydrostatic Transmissions CiA Draft Standard Proposal 408 Version 1.5.2 April 30, 2005
DSV	**D**evice-**S**pecific **V**alue
EDS	**E**lectronic **D**ata **S**heet
EMCY	Emergency object
EPROM	**E**rasable **P**rogrammable **R**ead **O**nly **M**emory
EPROM	**E**lectrically **E**rasable **P**rogrammable **R**ead **O**nly **M**emory
FLOAT32	32 bit floating point value
Hydraulic profile	Profile Fluid Power Technology Proportional Valves and Hydrostatic Transmissions Version 1.5
I/O	**I**nput/**O**utput
ID	Identifier
INTn	n-bit signed Integer value, value range: $-2^{n-1}-1 \ldots 2^{n-1}-1$
INF	Infinite
iR	**I**nternal **R**esolution ⇨ Chapter "1.5 Definitions", page 3
LED	**L**ight **E**mitting **D**iode
LSB	**L**east **S**ignificant **B**it
LSS	**L**ayer **S**etting **S**ervices
LVDT	**L**inear **V**ariable **D**ifferential **T**ransformer
ms	Milliseconds
MSB	**M**ost **S**ignificant **B**it
NMT	**N**etwork **M**anagemen**T**
p	Symbol for pressure
PCB	**P**rinted **C**ircuit **B**oard
PDO	**P**rocess **D**ata **O**bject; a type of COB. Used for transmitting time-critical data, such as control commands, references and actual values.
PE	**P**rotective **E**arth
Q	Symbol for volumetric flow
RAM	**R**andom **A**ccess **M**emory
RKP-D	Radial piston pump with digital control
ro	Denotes read-only access
RPDO	**R**eceive **P**rocess **D**ata **O**bject. Communication object that is received by a CANopen device.
rw	Denotes read/write access
SDO	**S**ervice **D**ata **O**bject; a type of COB. Used for transmitting non time critical data, such as parameters.
SSI	**S**ynchronous **S**erial **I**nterface
STRING	Array of Unsigned8 (ASCII coded)
SYNC	Synchronization object

Table 6: Abbreviations (part 2 of 3)

Abbreviation	Explanation
TPDO	**T**ransmit **P**rocess **D**ata **O**bject. Communication object that is transmitted by a CANopen device.
UINTn	n-bit unsigned Integer value, value range: 0…2^n-1
URL	**U**niform **R**esource **L**ocator
VDMA	**V**erband **D**eutscher **M**aschinen- und **A**nlagenbau - German Engineering Federation
wo	Denotes write-only access

Table 6: Abbreviations (part 3 of 3)

For your notes.

2 Access over CANopen

2.1 Introduction

The device communicates via CANopen interface according to DS 301. This chapter is providing an overview of the capabilities over CANopen. A CANopen device can be divided into the following parts:

- Communication objects
- Object dictionary
- Application

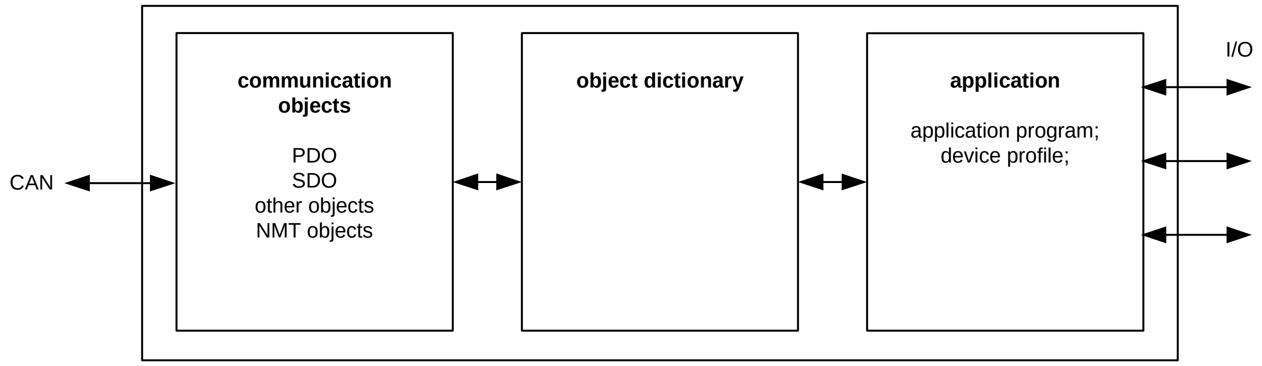


Figure 1: Device model

The access to the object dictionary is provided by the communication objects. The object dictionary is the interface to the application. The application holds the device specific program.

Object dictionary structure

Index (hex)	Object	Reference
0000	Not used	Not used
0001…009F	Data types	DS 301
00A0…0FFF	Reserved for further use	Not used
1000…1FFF	Communication profile area	According DS 301 ⇨ Chapter "2.2 Communication profile area", page 10
2000…5FFF	Manufacturer-specific profile area	Described in this document
6000…9FFF	Standardized device profile area	According DSP 408 Described in this document
A000…BFFF	Standardized interface profile area	Not used
C000…FFFF	Reserved for further use	Not used

Table 7: Object dictionary structure

CANopen defines communication objects and protocols, which allow the configuration of parameter settings, to process data exchange, synchronization mechanisms and emergency messages.

- Access to the object dictionary objects is done via the Service Data Objects (SDO).
- Exchange of real-time process data via the Process Data Objects (PDO).
- Synchronization of process data by the Synchronization Object (SYNC).
- The Emergency Object (EMCY) to indicate errors.

2.2 Communication profile area

The following table gives an overview over the object dictionary entries defined by the communication profile.

Index (hex)	Name	Reference
1000	Device type	⇨ Chapter "4.1.1 Object 0x1000: Device type", page 17
1001	Error register	⇨ Chapter "8.1.1 Object 0x1001: Error register", page 109
1002	manufacturer status register	DS 301
1003	Predefined error field	⇨ Chapter "8.1.2 Object 0x1003: Predefined error field", page 110
1005	COB-ID SYNC	DS 301 ⇨ Chapter "2.5 Synchronization Object (SYNC)", page 12
1006	communication cycle period	DS 301 (value not processed)
1007	synchronous window length	DS 301 (value not processed)
1008	Manufacturer device name	⇨ Chapter "4.1.3 Object 0x1008: Manufacturer device name", page 18
1009	Manufacturer hardware version	⇨ Chapter "4.1.4 Object 0x1009: Manufacturer hardware version", page 18
100A	Manufacturer software version	⇨ Chapter "4.1.5 Object 0x100A: Manufacturer software version", page 18
100B	Node ID	DS 301 (present due to compatibility reason)
100C	guard time	DS 301 ⇨ Chapter "2.8 Node Guarding", page 13
100D	life time factor	DS 301 ⇨ Chapter "2.8 Node Guarding", page 13
1010	Store parameters	⇨ Chapter "9.1.1 Object 0x1010: Store parameters", page 132
1011	Restore default parameters	⇨ Chapter "9.2.1 Object 0x1011: Restore default parameters", page 134
1012	COB-ID TIME	DS 301 (not processed)
1013	high resolution time stamp	DS 301 (not processed)
1014	COB-ID EMCY	DS 301 ⇨ Chapter "2.6 Emergency Object (EMCY)", page 12
1015	Inhibit Time EMCY	DS 301 (not processed)
1017	Producer heartbeat time	DS 301 (not processed)
1018	Identity object	⇨ Chapter "4.1.2 Object 0x1018: Identity", page 18
Client SDO parameter		
1280	1st SDO client parameter	DS 301 ⇨ Chapter "2.3 Service Data Objects (SDOs)", page 11
RPDO communication parameter		
1400…1403	RPDO communication parameter	DS 301 ⇨ Chapter "2.4 Process Data Objects (PDOs)", page 11
RPDO mapping parameter		
1600…1603	RPDO mapping parameter	DS 301
TPDO communication parameter		
1800…1803	TPDO communication parameter	DS 301
TPDO mapping parameter		
1A00…1A03	TPDO mapping parameter	DS 301

Table 8: Object entries in the communication profile area

2.3 Service Data Objects (SDOs)

Service Data Objects are used to configure the communication parameters and for setting up the application parameters.

There is one SDO channel available on the device. A channel consists of two COB IDs:

- One for reception.
- One for transmission.

Requests go from client to server. Confirmations go from server to client. The device is the server.

Object	**COB ID**	**Index/Subindex (hex)**	**Description**
Client SDO	0x600 + Node-ID	1200/01	Service data from client to server (valve)
Server SDO	0x580 + Node-ID	1200/02	Service data from server to client

Table 9: Service Data Objects (SDOs)

2.4 Process Data Objects (PDOs)

Process Data Objects are used to transfer process data. There are 4 transmission and 4 receive channels available on the device. Communication via PDOs allows data transfer without protocol overhead and provides a data-length of up to 8 bytes per transmission.

Object	**COB ID**	**Index/Subindex (hex)**	**Description**
RPDO 1 (Receive PDO)	0x200 + Node-ID[1]	1400	Process data received
RPDO 2 (Receive PDO)	0x300 + Node-ID[1]	1401	Process data received
RPDO 3 (Receive PDO)	0x400 + Node-ID[1]	1402	Process data received
RPDO 4 (Receive PDO)	0x500 + Node-ID[1]	1403	Process data received
TPDO 1 (Transmit PDO)	0x180 + Node-ID[1]	1800	Process data transmitted
TPDO 2 (Transmit PDO)	0x280 + Node-ID[1]	1801	Process data transmitted
TPDO 3 (Transmit PDO)	0x380 + Node-ID[1]	1802	Process data transmitted
TPDO 4 (Transmit PDO)	0x480 + Node-ID[1]	1803	Process data transmitted

Table 10: Process Data Objects (PDOs)

[1] The COB IDs according to the predefined connection set can be changed manually.

2.4.1 Object 0x3012: Receive PDO counter

This is a PDO counter. The subindex of the counter corresponds to the PDO channel number. The counter is not prevented from overflow!

CAN							
Index	Subindex	Name	Data type	Access	Persistence	Value range	Default
0x3012	1	1stReceivePdoCounter	UINT32	rw	N	UINT32	0
0x3012	2	2ndReceivePdoCounter	UINT32	rw	N	UINT32	0
0x3012	3	3rdReceivePdoCounter	UINT32	rw	N	UINT32	0
0x3012	4	4thReceivePdoCounter	UINT32	rw	N	UINT32	0

2.5 Synchronization Object (SYNC)

The Synchronization Object controls the time dependencies of process data. By means of SYNC transmission, the reception of PDO data can be synchronized and transmit PDOs can be triggered. The Synchronization Object does not contain any data and has a high priority on the bus.

By default, the device acts as SYNC consumer. The device can act also as SYNC producer.

Object	COB ID	Index/Subindex (hex)	Description
SYNC	0x80 (broadcast message)[1]	1005	Synchronization message which can trigger events. E.g., send TPDO.

Table 11: Synchronization object (SYNC)

[1] The COB IDs according to the predefined connection set can be changed manually.

2.5.1 Object 0x3013: Synchronization timer

This is the time period for the SYNC signal. This has only influence if the device is a SYNC producer.

CAN							
Index	Subindex	Name	Data type	Access	Persistence	Value range	Default
0x3013	0	SyncTimer	UINT16	rw	Y	UINT16	DSV

2.6 Emergency Object (EMCY)

The Emergency Object is a high priority message triggered by the event of an error in the device. The CANopen communication profile (DS 301) defines the emergency error codes.

Description of the coding of the emergency message:
⇨ Chapter "8.2.2 Emergency message", page 117

Object	COB ID	Index/Subindex (hex)	Description
EMCY	0x80 + Node-ID[1]	1014	Used to communicate emergencies

Table 12: Emergency object (EMCY)

[1] The COB IDs according to the predefined connection set can be changed manually.

2.7 Network Management (NMT)

Our hydraulic servo valves and radial piston pumps act as NMT slaves, thus a NMT master must be present within the network to achieve the desired functionality.

Each module within a CAN network can be uniquely identified by its NMT address. The NMT address corresponds to the node ID. The node ID is essential for the operation of the module within a CAN network, which is a number between 1…127.

ⓘ The node ID can be configured via the LSS.
⇨ Chapter "2.9 The device Layer Setting Services (LSS)", page 14.

Object	COB ID	Index/Subindex (hex)	Description
NMT	0 (broadcast message)	None	Used to control the network status of a participant

Table 13: Network Management object (NMT)

2.8 Node Guarding

The Node Guarding object is used to monitor the network status. The NMT master transmits the object cyclically to the NMT slaves. If a NMT slave does not respond within a defined span of time (node life time) or if the NMT slave's communication status has changed, an according event is triggered.

Object	**COB ID**	**Index/Subindex (hex)**	**Description**
Node Guarding	0x1792 + Node-ID	None	Checks if master and slave are allive and connected

Table 14: Node Guarding object

The objects 0x100C and 0x100D indicate the configured guard time respectively the life time factor. The life time factor multiplied with the guard time gives the life time for the life guarding protocol. The guard time is given in multiple of ms (the value 0x0000 disables the life guarding).

Guard time / Life time factor							
Index	Subindex	Name	Data type	Access	Persistence	Value range	Default
0x100C	0	GuardTime	UINT16	rw	Y	UINT16	DSV
0x100D	0	LifeTimeFactor	UINT8	rw	Y	UINT8	DSV

2.9 The device Layer Setting Services (LSS)

The device supports LSS according the DSP 305. The necessary data to perform the LSS switch mode selective service can be read from the name plate of the device (see figure 2).

The LSS offer the possibility to change the node ID bit-timing of the CAN module and the inquiry of the LSS address (via remote access).

The LSS functionality is modelled using two objects:

- LSS master
  The module, that configures other modules via a CAN network, is called the LSS master. There may be only one LSS master in a network.
- LSS slave
  The module, that is configured by the LSS master via a CAN Network, is called the LSS slave. Our valves and pumps act as LSS slaves. The LSS slave can be uniquely addressed by its LSS address. There is no other module in the world with the same LSS address, which is assigned to the module by the manufacturer.

Information about the LSS address is available from the name plate of the device or can be inquired by a LSS. The LSS slave can be in two states, either in the Operation Mode or in the Configuration Mode. The LSS are activated when the LSS slave is in Configuration Mode. This ensures that only the desired module listens to the LSS.

The LSS are used to set the node ID and baud rate of the CANopen device. Before a configuration over LSS can take place, the slaves need to be in configuration mode. In configuration mode, protocols such as the configure node ID protocol can be used.

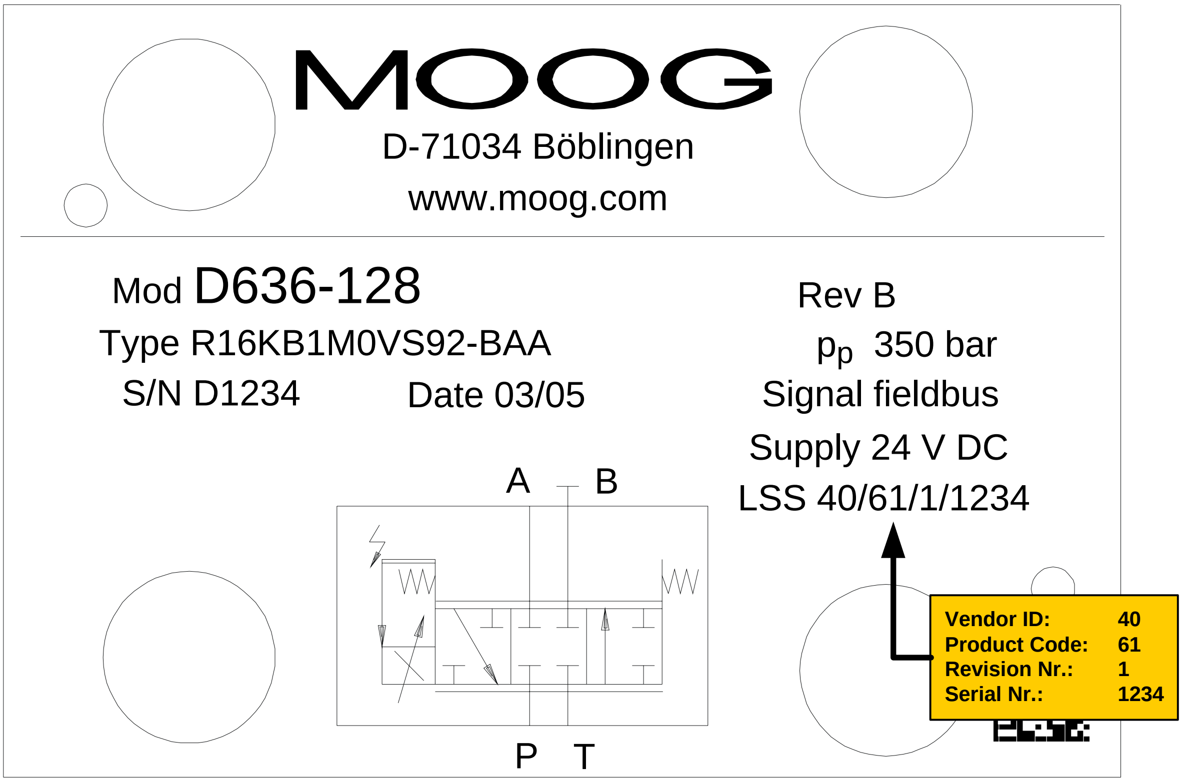


Figure 2: Name plate of a valve

3 Device structure

The complete device functionality is based on the DSP 408. This device profile defines the behavior of the device within the CANopen network and describes the device functionality and the object dictionary of the parameters.

The following figure shows the general architecture.

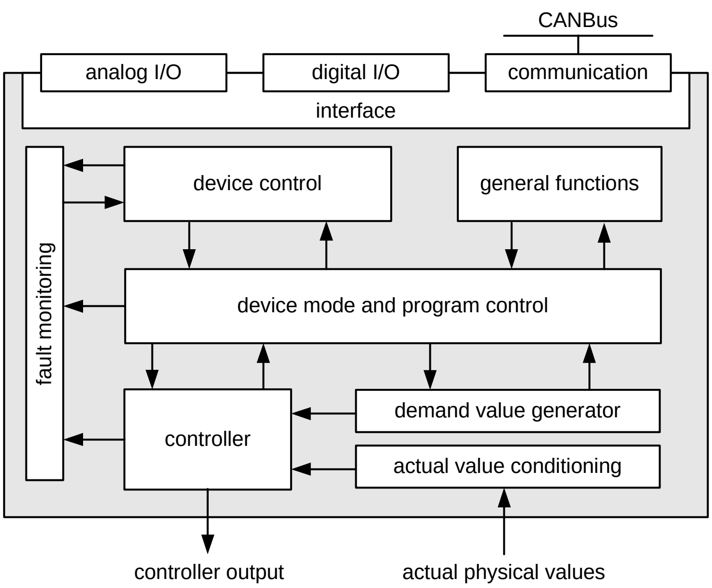


Figure 3: The device's logical structure

Device control

The device control block controls all functions of the device and contains a state machine by which the device functions can be activated or deactivated.
⇨ Chapter "5 Device control", page 23

Device mode and program control

The device mode is used to change the mode in which the device operates, i.e., it defines how the setpoints are put in (switching from bus to local mode) and how to set the control mode (controller functions p, Q, or p/Q).
⇨ Chapter "6.2.1.7 Object 0x6042: Device mode", page 45

Demand value generator

The demand value generators produce the demand values for the position controller and the pressure controller. Functions within the demand value generators calculate the demand values from the setpoint signals.
⇨ Chapter "7.1.2 Position demand value generator", page 55
⇨ Chapter "7.1.3 Pressure demand value generator", page 66

Controller

Depending on the device model and variant, the device will have a position controller and/or a pressure controller and/or a p/Q controller.
⇨ Chapter "7.2.4 Control position closed loop", page 81
⇨ Chapter "7.2.6 Pressure control closed loop", page 85
⇨ Chapter "7.2.7 p/Q closed loop", page 93

Actual value conditioning

The actual value conditioning block uses the signals from the position sensor and the pressure sensor to generate the corresponding actual values.
⇨ Chapter "6.3.3 Interface assignment", page 48

General functions

The operational parameters of all valve functions are monitored on a continuous basis. All errors which have occurred on the device are stored to a specific error field.
Description of this behavior:
⇨ Chapter "8 Diagnostics", page 109

Control monitoring

The control monitoring function makes it possible to detect a device malfunction in order to define an error reaction for the corresponding control mode.
⇨ Chapter "7.2.2 Monitoring", page 77

4 Device identification

The device has informational parameters that allow the identification of the device and permit the administration of the device within the machinery. The following chapter includes the descriptions of the parameters providing this information.

4.1 Object descriptions

The following objects are described in this chapter:

4.1.1 Object 0x1000: Device type

Indicates the code of the underlying device profile. The default value 408 specifies the device profile DSP 408.

DeviceType							
Index	Subindex	Name	Data type	Access	Persistence	Value range	Default
0x1000	0	DeviceType	UINT32	ro	N	UINT32	408

Values description

<DeviceType>	Meaning
0	Manufacturer-specific device profile.
408	This device is a valve or a pump. Device profile according to DSP 408.

Table 15: <DeviceType> values

4.1.2 Object 0x1018: Identity

These parameters contain a code for the worldwide unique identification of the device on the CAN bus. Identification by means of these parameters is necessary if the CAN node ID or the CAN bit rate will be transmitted over a CAN bus with multiple nodes. The transmission is done by means of LSS.

IdentityObject							
Index	Subindex	Name	Data type	Access	Persis-tence	Value range	Default
0x1018	1	VendorId	UINT32	ro	N	UINT32	40
0x1018	2	ProductCode	UINT32	ro	N	UINT32	DSV
0x1018	3	RevisionNumber	UINT32	ro	N	UINT32	DSV
0x1018	4	SerialNumber	UINT32	ro	N	UINT32	DSV

Values description

Subindex	Parameter	Meaning
1	<VendorId>	Unique vendor ID, 0x28 reserved for Moog
2	<ProductCode>	Product number
3	<RevisionNumber>	Revision number
4	<SerialNumber>	Serial number of the device

Table 16: Identity object values

4.1.3 Object 0x1008: Manufacturer device name

Indicates the name of the device.

Device							
Index	Subindex	Name	Data type	Access	Persis-tence	Value range	Default
0x1008	0	ManufacturerDeviceName	STRING	ro	Y	64 char	DSV

4.1.4 Object 0x1009: Manufacturer hardware version

Indicates the current hardware version of the device.

Device							
Index	Subindex	Name	Data type	Access	Persis-tence	Value range	Default
0x1009	0	ManufacturerHardwareVersion	STRING	ro	Y	64 char	DSV

4.1.5 Object 0x100A: Manufacturer software version

Indicates the current software version of the device.

Device							
Index	Subindex	Name	Data type	Access	Persis-tence	Value range	Default
0x100A	0	ManufacturerSoftwareVersion	STRING	ro	Y	64 char	DSV

4.1.6 Object 0x6050: Device version

Indicates the version of the device.

Device							
Index	Subindex	Name	Data type	Access	Persis-tence	Value range	Default
0x6050	0	DeviceVersion	STRING	ro	Y	64 char	DSV

4.1.7 Object 0x6051: Code number

The user can enter into this parameter any value he chooses.

Device							
Index	Subindex	Name	Data type	Access	Persis-tence	Value range	Default
0x6051	0	CodeNo	UINT16	rw	Y	UINT16	DSV

4.1.8 Object 0x6052: Serial number

Indicates the serial number of the device.

Device							
Index	Subindex	Name	Data type	Access	Persis-tence	Value range	Default
0x6052	0	SerialNo	STRING	ro	Y	64 char	DSV

4.1.9 Object 0x6053: Description

The user can enter into this parameter any device description he chooses.

Device							
Index	Subindex	Name	Data type	Access	Persis-tence	Value range	Default
0x6053	0	Description	STRING	rw	Y	64 char	DSV

4.1.10 Object 0x6054: Model description

This parameter contains a description of the device.

Device							
Index	Subindex	Name	Data type	Access	Persis-tence	Value range	Default
0x6054	0	ModelDescription	STRING	ro	Y	64 char	DSV

4.1.11 Object 0x6055: Model URL

This parameter contains an Internet address where additional information about the device is available.

Device							
Index	Subindex	Name	Data type	Access	Persis-tence	Value range	Default
0x6055	0	ModelURL	STRING	ro	Y	64 char	www.moog.com

4.1.12 Object 0x6056: Parameter set code

This parameter is used to identify the current device parameter set. If the received device parameter values are not saved, then the identification of the device parameter set will be automatically set to 0 after the device is switched on.

Device							
Index	Subindex	Name	Data type	Access	Persis-tence	Value range	Default
0x6056	0	ParameterSetCode	UINT8	rw	Y	0…254	0

Values description

<ParameterSetCode>	**Meaning**
0	No parameter set has been transferred to the device.
1…254	The device was parameterized. The parameter set identification can be set to a freely definable number within the range of 1…254.

Table 17: Value definition of the parameter set identification

4.1.13 Object 0x6057: Vendor name

Indicates the name of the device vendor.

Device							
Index	Subindex	Name	Data type	Access	Persis-tence	Value range	Default
0x6057	0	VendorName	STRING	ro	N	64 char	MOOG GmbH, Hanns-Klemm-Strasse 28, D-71034 Boeblingen, Germany

4.1.14 Object 0x605F: Capability

This object provides information on the capabilities of the used device, i.e., it displays the device's capability with the supported control types.

Device							
Index	Subindex	Name	Data type	Access	Persis-tence	Value range	Default
0x605F	0	Capability	UINT32	ro	N	16777216… 1057001472	0x3F009000

Values description

<table>
<tr><td colspan="18"><Capability></td></tr>
<tr><td colspan="8">MSB</td><td colspan="8"></td><td></td><td>LSB</td></tr>
<tr><td colspan="16">Additional information</td><td colspan="2">Specific information</td></tr>
<tr><td>31</td><td>30</td><td>29</td><td>28</td><td>27</td><td>26</td><td>25</td><td>24</td><td>23</td><td>22</td><td>21</td><td>20</td><td>19</td><td>18</td><td>17</td><td>16</td><td colspan="2">Reserved</td></tr>
</table>

Table 18: <Capability> data structure

Bit	**Meaning**
Bit 16…21	Reserved
Bit 24 = 1	Hydraulic valve or hydraulic pump
Bit 25 = 1	Supports the position open loop control type
Bit 26 = 1	Supports the position closed loop control type
Bit 27 = 1	Supports the pressure control open loop control type
Bit 28 = 1	Supports the pressure control closed loop control type
Bit 29 = 1	Supports the p/Q closed loop control type
Bit 30…31	Reserved

Table 19: Device capability values

For your notes.

5 Device control

5.1 Structure

The device control block controls all functions of the device. It contains a state machine by which the device functions can be activated or deactivated. The control word is used to control the device status and the current device condition is indicated by the status word.

The source of the control word acting on the device state machine is set with the parameter <Local> (0x604F) as shown in the following figure. By writing the value 1 to this parameter, the local control word is acting on the device state machine. Setting the <Local> parameter to 0, the control word transferred via bus is enabled.

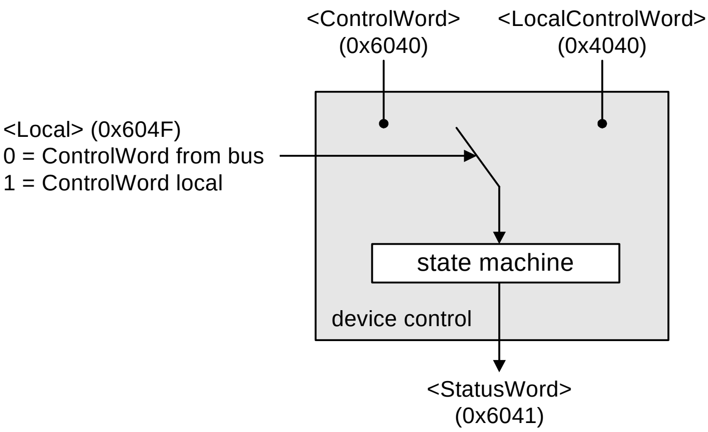


Figure 4: Device control block

5.2 State machine

The state machine describes the status of the device. Any state represents a certain internal and external behavior. Status changes result from device control commands and other events (for example switching on the supply voltage or in case of a device fault). The current device status can be read by means of the status word (bits 0…3 of the status word indicate the device condition).

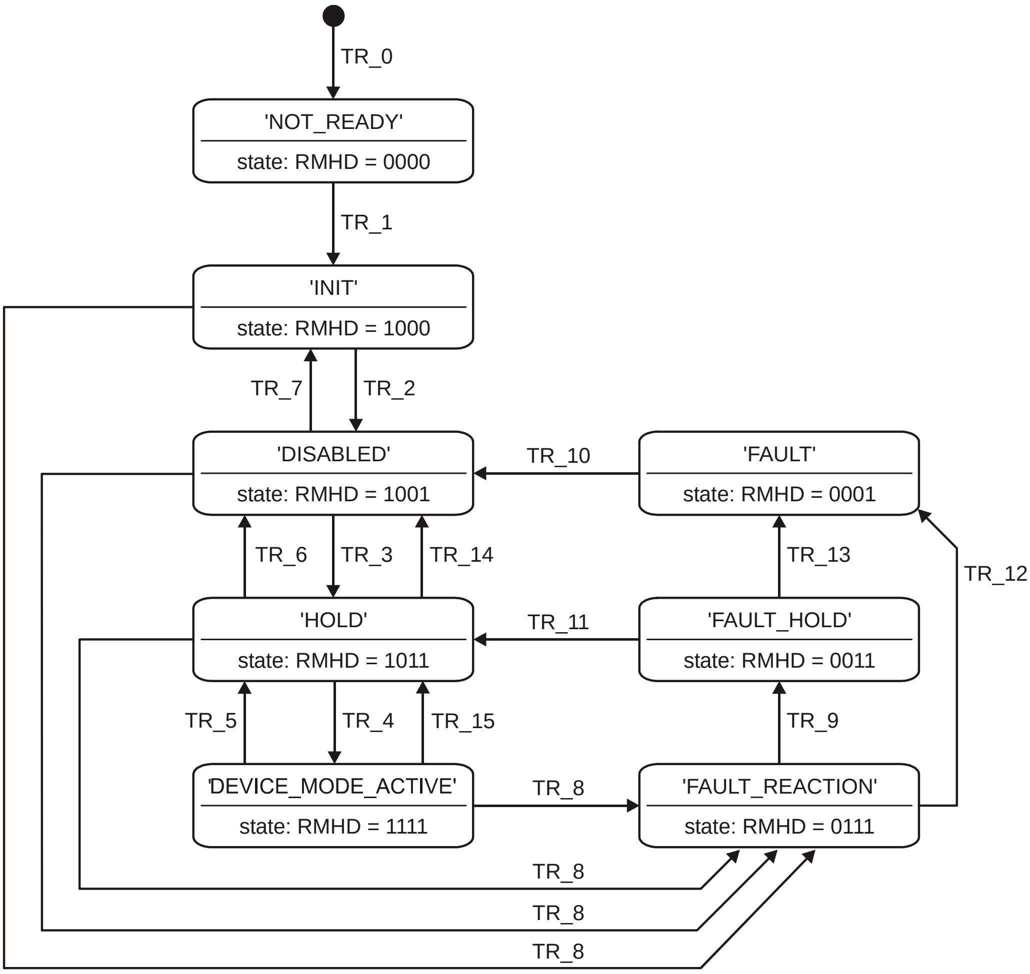


Figure 5: Device state machine

Meaning of RMHD:
R: Status word Ready (Bit 3)
M: Status word Device Mode Active Enable (Bit 2)
H: Status word Hold activated (Bit 1)
D: Status word Disabled (Bit 0)

5.2.1 Device states

The following device states are possible:

'NOT_READY':

- The electronics are supplied with power.
- Self test is running.
- Device initialization is running.
- The valve function is disabled.

'INIT' (initialization):

- Initialization of the device parameters with the values saved in the device.
- The valve function is disabled.

'DISABLED':

- All functions necessary for control are activated.
- The actuator of the valve is turned off. Depending on the device, the hydraulic fail safe position is taken in.

'HOLD':

- The selected control type is active.
  ⇨ Chapter "7.2.1 Control modes", page 75
- The specified hold setpoint is active.
  Position hold setpoint: ⇨ Chapter "6.2.1.3 Object 0x6314: Position hold setpoint", page 42
  Pressure hold setpoint: ⇨ Chapter "6.2.1.6 Object 0x6394: Pressure hold setpoint", page 44
- The setpoints according to the chosen device mode (set with parameter <DeviceMode>) are not effective.

'DEVICE_MODE_ACTIVE':

- The device is enabled. The configured setpoint of the activated controller (according to the chosen device mode) is fed through the demand value generator to the controller.
- This is the default state after power on if local control mode is activated.

'FAULT_HOLD':

- A fault reaction has occurred.
- The control type selected with the parameter <ControlMode> is active.
- The specified hold setpoint is active.
  Position hold setpoint: ⇨ Chapter "6.2.1.3 Object 0x6314: Position hold setpoint", page 42
  Pressure hold setpoint: ⇨ Chapter "6.2.1.6 Object 0x6394: Pressure hold setpoint", page 44
- The setpoints according to the chosen device mode (set with parameter <DeviceMode>) are not effective.

'FAULT':

- A fault reaction has occurred.
- The actuator of the valve is turned off. Depending on the device, the hydraulic fail safe position is taken in.

'FAULT_REACTION':

- This status will be assumed when the device detects a functional fault.
  Description of the fault reaction settings: ⇨ Chapter "8.2.1 Fault reaction settings", page 112
- The faults will be handled appropriately.

5.2.2 State transitions

State transitions are caused by

- device control commands or
- internal events which lead automatically to status changes

5.2.2.1 State transitions depending on the control word

The device control commands, which cause a state transition, are formed by the four low-order bits of the control word or local control word.

⇨ Chapter "5.3.1 Object 0x6040: Control word", page 27
⇨ Chapter "5.3.2 Object 0x4040: Local control word", page 28

Table 20 only lists the transitions depending on the control word. It shows the conditions which the control word needs to fulfill. Only the fields holding numbers are being verified.
The transitions 10 and 11 are only executed if the reset bit changes from 0 to 1. Transitions 10 and 11 are triggered on the rising edge.

The bits designated with an "x" are irrelevant for the corresponding state transition.

		Control word bit			
		3	**2**	**1**	**0**
State transition (TR)	**Device control command**	**R**	**M**	**H**	**D**
2	Activate 'DISABLED'	x	x	x	1
3	Activate 'HOLD'	x	x	1	1
4	Activate 'DEVICE_MODE'	x	1	1	1
5	Deactivate 'DEVICE_MODE'	x	0	x	x
6	Deactivate 'HOLD'	x	0	0	x
7	Deactivate 'DISABLED'	x	0	0	0
10	Reset 'FAULT' (disabled)	1	x	x	x
11	Reset 'FAULT_HOLD'	1	x	x	x

Table 20: Device control commands

5.2.2.2 State transitions through internal events

The following events will lead automatically to status changes:

Transition	Meaning
0	Switch on supply voltage
1	Device initialization completed
8	Fault detected
9	Fault reaction executed (fault hold)
12	Fault reaction executed (fault)
13	Electrical enable signal on digital input (release) low
14	Electrical enable signal on digital input (release) low
15	Electrical enable signal on digital input (release) low

Table 21: Status transitions through internal events

5.3 Object descriptions

The objects described in this chapter are:

Object number [hex]	Name	Page
6040	<ControlWord>	27
4040	<LocalControlWord>	28
403F	<LocalControlWordDefault>	28
604F	<Local>	28
6041	<StatusWord>	29

5.3.1 Object 0x6040: Control word

The bit-coded control word controls the device status where bits 0…3 of the object form the device control command, i.e., the command which causes a status change.

ⓘ The control word is only effective if the parameter <Local> is set to 0 (= control word from bus).
⇨ Chapter "5.3.4 Object 0x604F: Local", page 28

Device							
Index	Subindex	Name	Data type	Access	Persis-tence	Value range	Default
0x6040	0	ControlWord	UINT16	rw	N	UINT16	None

Control word values

Bit	<ControlWord>	Description	Specification
0	Disabled (D)	These bits form the device control command. ⇨ Chapter "5.2.2.1 State transitions depending on the control word", page 26	DS 408 (mandatory)
1	Hold enable (H)		
2	Device mode active enable (M)		
3	Reset fault (R)		
4…7	Reserved	These bits are reserved for future use. They must be set to 0 in order to ensure upward compatibility.	Reserved
8	Pressure controller enabled (p/Q closed loop control-type only)	If bit 8 is activated, then the pressure controller is enabled in the p/Q control type. **Note:** This function is applicable only in the p/Q control type.	DS 408
9	Slave mode enable	This bit is used to enable the slave mode of the pump. ⇨ Chapter "7.2.9 Master/Slave operation", page 98	DS 408
10	Leakage compensation enable	This bit is used to enable/disable the leakage compensa-tion. ⇨ Chapter "7.2.4.1 Leakage compensation", page 82	DS 408
11	Power limitation enable	Enables/disables the power limitation function. ⇨ Chapter "7.2.8 Power limitation", page 95	RKP-D specific
12	Reserved	See bits 4…7.	Reserved
13	Hold pressure enable	Enables/disables the local holding pressure switchover function. ⇨ Chapter "7.2.10 Local holding pressure switchover", page 102.	RKP-D specific
14	Hold pressure forced	Enables/disables externally forcing of the holding pressure switchover. ⇨ Chapter "7.2.10 Local holding pressure switchover", page 102	RKP-D specific
15	Ramp stop	If this bit is activated, ramp output is frozen. ⇨ Chapter "7.1 Demand Value Generator", page 55	RKP-D specific

Table 22: Control word value definition

5.3.2 Object 0x4040: Local control word

The functionality of the local control word and the <ControlWord> needs to be distinguished. In local mode, the local control word is applied. In bus mode, the <ControlWord> is applied. Local mode is typically chosen to run the device without bus.

The local control word default (0x403F) defines the status after startup.

Device							
Index	Subindex	Name	Data type	Access	Persis-tence	Value range	Default
0x4040	0	LocalControlWord	UINT16	rw	N	UINT16	<LocalControl-WordDefault>

5.3.3 Object 0x403F: Local control word default

The parameter <LocalControlWordDefault> can be used to save the set control word on the device as default value. Default values are always applied when starting the device.

Device							
Index	Subindex	Name	Data type	Access	Persis-tence	Value range	Default
0x403F	0	LocalControlWordDefault	UINT16	rw	Y	UINT16	DSV

Description on how to restore the factory default values:
⇨ Chapter "9.2 Restoring default parameters", page 133

5.3.4 Object 0x604F: Local

The device local parameter specifies the source of the control word that is affecting the status machine (either local or from bus), i.e., whether the device status shall be controlled by the <ControlWord> (0x6040) or the <LocalControlWord> (0x4040).

Status word bit
Bit 4 of the status word indicates whether local control is active.

Bit 4 = 1 : local operation is active
Bit 4 = 0 : the control word is active via bus

⇨ Chapter "5.3.5 Object 0x6041: Status word", page 29

Device							
Index	Subindex	Name	Data type	Access	Persis-tence	Value range	Default
0x604F	0	Local	INT8	rw	Y	-128…1	1

Values description

<Local>	**Meaning**
0	Control word from bus The control word is active, the Control word local <ControlWordLocal> has no influence. ⇨ Chapter "5.3.1 Object 0x6040: Control word", page 27
1	Control word local The local control word is active, the control word <ControlWord> has no influence. ⇨ Chapter "5.3.2 Object 0x4040: Local control word", page 28
-1…-128	Reserved

Table 23: <Local> values

5.3.5 Object 0x6041: Status word

The bit-coded status word indicates the current device status.

Device							
Index	Subindex	Name	Data type	Access	Persis-tence	Value range	Default
0x6041	0	StatusWord	UINT16	ro	N	UINT16	None

Values description

Bit	<StatusWord>	Specification
0	Disabled (D)	DS 408 (mandatory)
1	Hold activated (H)	DS 408 (mandatory)
2	Device mode active enable (M)	DS 408 (mandatory)
3	Ready (R)	DS 408 (mandatory)
4	Local control	DS 408 (mandatory)
5…7	Reserved	Reserved
8	Pressure controller effective	DS 408
9	Ramp running	DS 408
10	Limit value reached	DS 408
11	Control deviation	DS 408
12	Reserved	Reserved
13	Flushing mode active	RKP-D
14	Hold pressure set values active	RKP-D
15	Ramp output frozen	RKP-D

Table 24: Status word values

Bits 0, 1, 2, 3 - Disabled, Hold, Device Mode Active, Ready
These bits indicate the status of the state machine.
Description of the device states and the associated bit values:
⇨ Chapter "5.2 State machine", page 24

Bit 4 - Local control
This bit is activated during local control.
⇨ Chapter "5.3.4 Object 0x604F: Local", page 28

Bit 8 - Pressure controller effective
This bit indicates whether the pressure controller is active in the p/Q control type.

Bit = 0 : pressure controller disabled
Bit = 1 : pressure controller enabled

ⓘ This bit is active, if, and only if, the p/Q control type is active.

Bit 9 - Ramp running
If this bit is activated, one of the active Ramp functions has not yet reached its end value.

Position demand value generator:
⇨ Chapter "7.1.2.5 Ramp", page 59
Pressure demand value generator:
⇨ Chapter "7.1.3.5 Ramp", page 70

Bit 10 - Limit value reached
If this bit is activated, one of the setpoints is limited by the corresponding limit function set with the demand value generator functions.

Position demand value generator:
⇨ Chapter "7.1.2.3 Limit function", page 57
Pressure demand value generator:
⇨ Chapter "7.1.3.3 Limit function", page 68

Bit 11 - Control deviation
If this bit is activated, a control deviation is indicated by one of the control monitoring functions, i.e., the control deviation has been outside the set tolerance band for the duration of the delay time.
⇨ Chapter "7.2.2 Monitoring", page 77

Bit 13
If this bit is activated, flushing mode is active.
⇨ Chapter "7.2.11 Flushing mode", page 104

Bits 14
If this bit is activated, the hold pressure set values are active.
⇨ Chapter "7.2.10 Local holding pressure switchover", page 102

Bit 15 - Ramp frozen
If this bit is activated, one of the ramp outputs is frozen.

Position demand value generator:
⇨ Chapter "7.1.2.5 Ramp", page 59
Pressure demand value generator:
⇨ Chapter "7.1.3.5 Ramp", page 70

5.4 Bootup of the device

The bootup procedure is according to the DS 301. The parameter 0x200F (<PowerOnDelay>) allows to delay the bootup procedure before establishing the communication and pump function. The power on delay time is provided in seconds.

System							
Index	Subindex	Name	Data type	Access	Persis-tence	Value range	Default
0x200F	0	PowerOnDelay	UINT8	rw	Y	0…10	0

5.5 Status display LEDs

The valve's operating mode and the network status are displayed on multicolor light emitting diodes (status display LEDs) on the electronics housing.

ⓘ After the valve's power supply is switched on, the valve electronics perform a self-test, indicated by red and green blinking LEDs.

Network status LED «NS»

The network status LED displays the status of the CAN network.

Network status LED «NS»	Description	Network Management State (NMT) (according to CANopen)
Off	No supply power or in state 'Stopped'.	No supply power or in state 'Stopped'.
Blinking green	This status is reached after bootup. SDO communication is possible.	'Pre-Operational'
Green	This status has to be demanded by the CANopen master. SDO and PDO communication is possible.	'Operational'

Table 25: Network status LED «NS»

Module status LED «MS»

The module status LED displays an available power supply and possible operational and error states.

Module status LED «MS»	Description	Valve State Machine (status word) (according to VDMA profile)
Off	No supply power	
Blinking green	Valve standby mode	'INIT' or 'DISABLED'
Green	Normal operation	'HOLD' or 'DEVICE_MODE_ACTIVE'
Blinking red	Recoverable error Fault reactions 'FAULT', 'FAULT_HOLD': ⇨ Chapter "8.2.1 Fault reaction settings", page 112	'FAULT' or 'FAULT_HOLD'
Red	Unrecoverable error Fault reaction 'NOT_READY': ⇨ Chapter "8.2.1 Fault reaction settings", page 112	'NOT_READY'

Table 26: Module status LED «MS»

For your notes.

6 Signal routing and scaling

The following figure shows the routing of the command values (demand values) and actual values. This concept applies on the position control as well as on the pressure control.

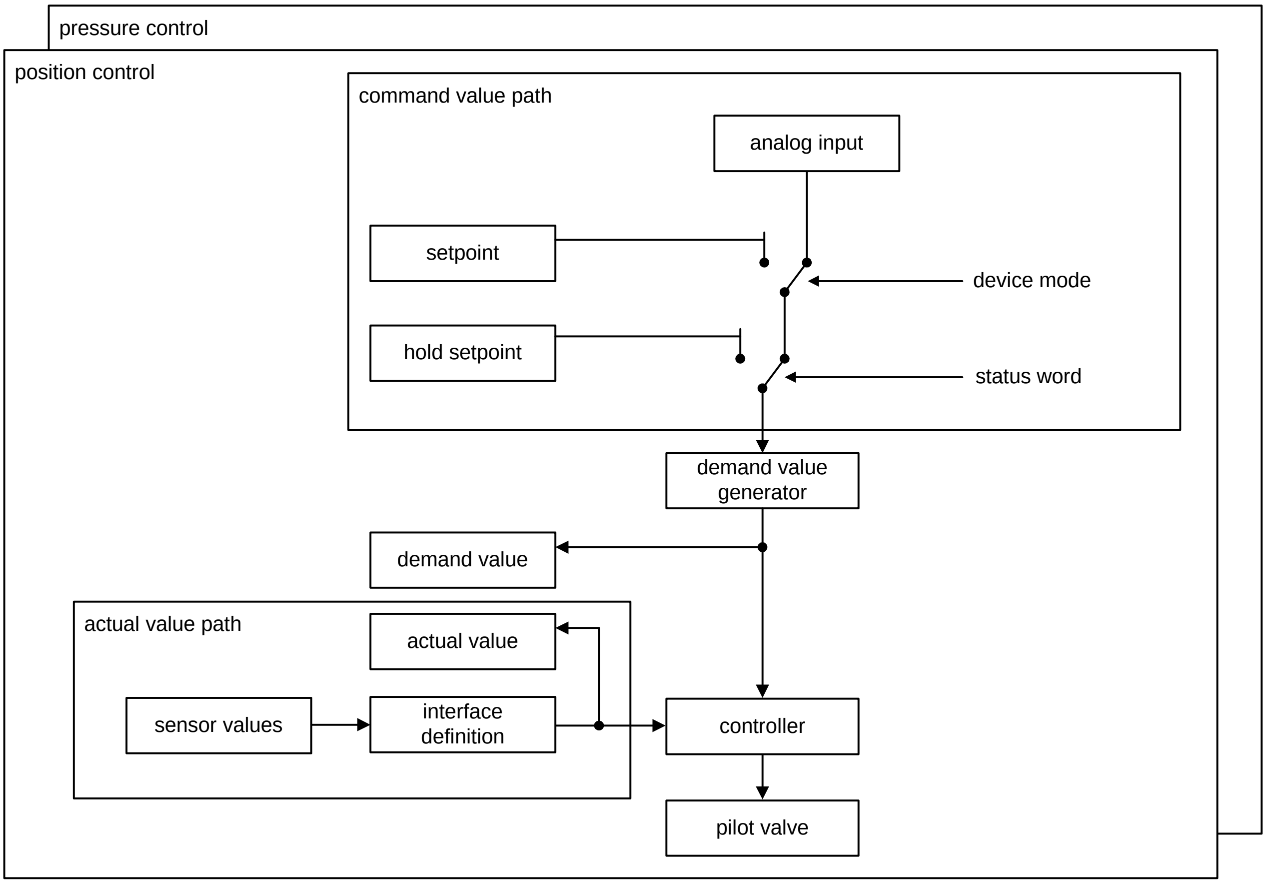


Figure 6: Signal routing

Description of the command value path:
⇨ Chapter "6.2 Command value path", page 39
Description of the actual value path:
⇨ Chapter "6.3 Actual value path", page 46

6.1 Physical pump interfaces

The pump consists of the following physical interfaces:

Interface	Reference
Analog input 0	➪ Chapter "6.1.1.1 Objects: 0x3200 / 0x3204 Analog input 0", page 34
Analog input 1	➪ Chapter "6.1.1.2 Objects: 0x3208 / 0x320C Analog input 1", page 35
Analog input 2	➪ Chapter "6.1.2.1 Objects: 0x3210 / 0x3214 Analog input 2", page 36
Analog input 3	➪ Chapter "6.1.2.2 Objects: 0x3218 / 0x321C Analog input 3", page 37
Analog input 4	➪ Chapter "6.1.2.3 Objects: 0x3220 / 0x3224 Analog input 4", page 37
Analog outputs 0, 1	➪ Chapter "6.1.3 Analog outputs", page 38
Digital input	➪ Chapter "5.2.2.2 State transitions through internal events", page 26
Supply 24 V	➪ Chapter "8.2.5.2 Object 0x2804: Power supply voltage", page 126
Master/slave communication	➪ Chapter "7.2.9 Master/Slave operation", page 98
CAN	➪ Chapter "2 Access over CANopen", page 9

Table 27: Physical pump interfaces

ⓘ For a description of the pump connectors, see Benutzerinformation Elektrische Schnittstellen.

6.1.1 Analog inputs 0 and 1

The analog inputs 0 and 1 are intended for analog setpoints. They are used if the <DeviceMode> (0x6042) is 2. Analog input 0 holds the input for the analog stroke ring command. Analog input 1 holds the input for the analog pressure command.
➪ Chapter "6.2.1.7 Object 0x6042: Device mode", page 45
➪ Figure 9, page 40

6.1.1.1 Objects: 0x3200 / 0x3204 Analog input 0

AnalogInput0							
Index	Subindex	Name	Data type	Access	Persis-tence	Value range	Default
0x3200	0	InputType	INT8	rw	Y	INT8	1
0x3204	0	ActualValue	INT16	ro	N	INT16	None

<InputType>
Type of the analog input:

<InputType>	Type of analog input
1	±10 V potential-free
3	±10 mA potential-free
5	4…20 mA potential-free 0…100 %
11	4…20 mA potential-free ± 100 %

Table 28: <InputType> values analog input 0

ⓘ Other types are not to be selected.

<ActualValue>
In case of <DeviceMode> (0x6042) = 2, this is the actual value for the stroke ring command. Otherwise the analog value can be assigned to any interface.

➪ Chapter "6.3.3 Interface assignment", page 48

6.1.1.2 Objects: 0x3208 / 0x320C Analog input 1

AnalogInput1							
Index	Subindex	Name	Data type	Access	Persis-tence	Value range	Default
0x3208	0	InputType	INT8	rw	Y	INT8	1
0x320C	0	ActualValue	INT16	ro	N	INT16	None

<InputType>
Type of the setpoint input:

<InputType>	**Type of analog input**
1	±10 V potential-free
3	±10 mA potential-free
5	4…20 mA potential-free 0…100 %
11	4…20 mA potential-free ± 100 %

Table 29: <InputType> values analog input 1

ⓘ Other types are not to be selected.

<ActualValue>
In case of <DeviceMode> (0x6042) = 2, this is the actual value for the pressure command. Otherwise the analog value can be assigned to any interface.

⇨ Chapter "6.2.1.7 Object 0x6042: Device mode", page 45
⇨ Chapter "6.3.3 Interface assignment", page 48

6.1.2 Analog inputs 2, 3 and 4

6.1.2.1 Objects: 0x3210 / 0x3214 Analog input 2

AnalogInput2							
Index	Subindex	Name	Data type	Access	Persis-tence	Value range	Default
0x3210	0	InputType	INT8	rw	Y	INT8	2
0x3214	0	ActualValue	INT16	ro	N	INT16	None

<InputType>
Type of the analog input:

<InputType>	**Type of analog input**
2	0…10 V potential-free
4	0…10 mA potential-free
5	4…20 mA potential-free
7	0…10 mA grounded
8	4….20 mA grounded
10	0…10 V grounded

Table 30: <InputType> values analog input 2

ⓘ Other types are not to be selected.

<ActualValue>
Actual analog input value.

Description of cable break monitoring:
⇨ Chapter "8.3 Cable break monitoring", page 128

6.1.2.2 Objects: 0x3218 / 0x321C Analog input 3

AnalogInput3							
Index	Subindex	Name	Data type	Access	Persis-tence	Value range	Default
0x3218	0	InputType	INT8	rw	Y	INT8	2
0x321C	0	ActualValue	INT16	ro	N	INT16	None

<InputType>
Type of the analog input:

<InputType>	**Type of analog input**
2	0…10 V potential-free
4	0…10 mA potential-free
5	4…20 mA potential-free
7	0…10 mA grounded
8	4…20 mA grounded
10	0…10 V grounded

Table 31: <InputType> values analog input 3

ⓘ Other types are not to be selected.

<ActualValue>
Actual analog input value.

Description of cable break monitoring:
⇨ Chapter "8.3 Cable break monitoring", page 128

6.1.2.3 Objects: 0x3220 / 0x3224 Analog input 4

AnalogInput4							
Index	Subindex	Name	Data type	Access	Persis-tence	Value range	Default
0x3220	0	InputType	INT8	rw	Y	INT8	2
0x3224	0	ActualValue	INT16	ro	N	INT16	None

<InputType>
Type of the analog input:

<InputType>	**Type of analog input**
2	0…10 V potential-free
10	0…10 V grounded

Table 32: <InputType> values analog input 4

ⓘ Other types are not to be selected.

<ActualValue>
Actual analog input value.

Description of cable break monitoring:
⇨ Chapter "8.3 Cable break monitoring", page 128

6.1.3 Analog outputs

An analog output provides access to a parameter value.

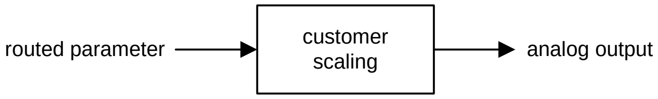


Figure 7: Access to parameter value via analog output

There are 2 analog outputs. Both outputs have the type 4…20 mA grounded.

Each output has it's scaling parameter as shown in the following table:

Output	Scaling parameter	Parameter name	Short name	Routed parameter
0	0x3244	Scaling	da0ref	0x6301 ⇨ Chapter "6.3.1.1 Object 0x6301: Actual position value", page 46
1	0x3265	Scaling	da1ref	0x6381 ⇨ Chapter "6.3.2.2 Object 0x6381: Actual pressure value", page 48

Table 33: Scaling parameters of analog outputs

The customer scaling is done according to the following formula:

$$\text{output} = \text{input} \times \frac{\text{daNref[1]}}{\text{daNref[2]}} + \text{daNref[3]}$$

Where:

N: Represents the analog output number
[1], [2], [3]: Parameter subindex

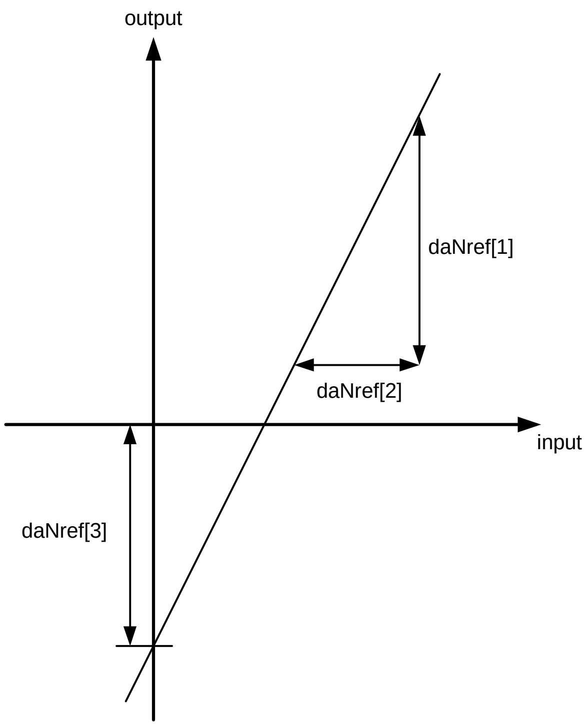


Figure 8: Analog output scaling

AnalogOutput0							
Index	Subindex	Name	Data type	Access	Persis-tence	Value range	Default
0x3244	1	Scaling	INT16	rw	Y	INT16	16384
0x3244	2	Scaling	INT16	rw	Y	INT16	16384
0x3244	3	Scaling	INT16	rw	Y	INT16	0

AnalogOutput1							
Index	Subindex	Name	Data type	Access	Persis-tence	Value range	Default
0x3265	1	Scaling	INT16	rw	Y	INT16	16384
0x3265	2	Scaling	INT16	rw	Y	INT16	16384
0x3265	3	Scaling	INT16	rw	Y	INT16	0

6.2 Command value path

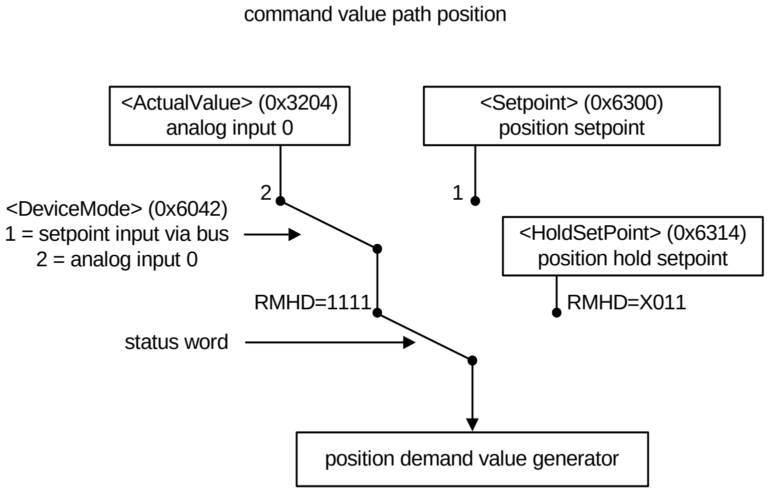
The commands for pressure and position are received via the CAN bus or as analog signals. The following applies:

- The position command via bus is delivered by the parameter 0x6300 (<Setpoint>).
  ⇨ Chapter "6.2.1.1 Object 0x6300: Position setpoint", page 41
- The pressure command via bus is delivered by the parameter 0x6380 (<Setpoint>).
  ⇨ Chapter "6.2.1.4 Object 0x6380: Pressure setpoint", page 43
- The position command from local source is coming from the analog input 0.
  ⇨ Chapter "6.1.1.1 Objects: 0x3200 / 0x3204 Analog input 0", page 34
- The pressure command from local source is coming from the analog input 1.
  ⇨ Chapter "6.1.1.2 Objects: 0x3208 / 0x320C Analog input 1", page 35

ⓘ For a description of the pump connectors, see Benutzerinformation Elektrische Schnittstellen.

Which command is forwarded to the demand value generator depends on the set device mode (0x6042) and the status of the device which is controlled using the control word (<ControlWord>, 0x6040 or <LocalControlWord>, 0x4040) as shown in the figure below. The following applies:

- Device mode = 1, device status = 'DEVICE_MODE_ACTIVE'
  The command transferred over the bus is forwarded to the demand value generator.
- Device mode = 2, device status = 'DEVICE_MODE_ACTIVE'
  The command received from the analog input is forwarded to the demand value generator.
- Device mode = 1 or 2, device status = 'HOLD'
  The hold setpoint stored to the parameter <HoldSetPoint> is forwarded to the demand value generator.



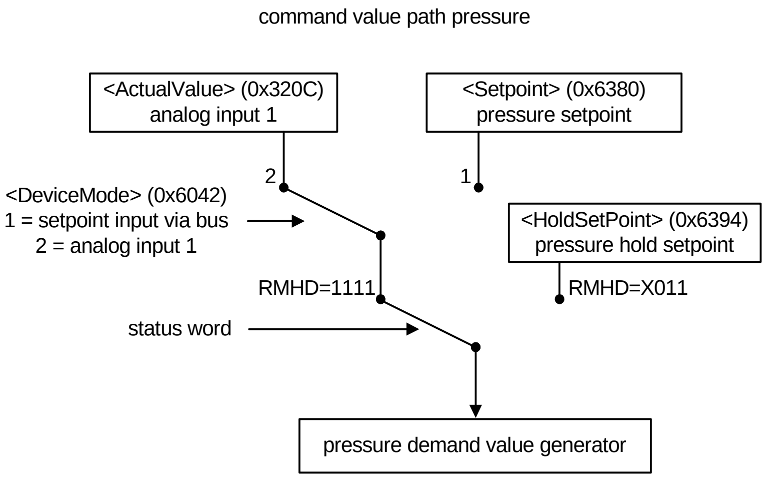


Figure 9: Command value paths position and pressure

Description of the hold setpoint parameters:

⇨ Chapter "6.2.1.3 Object 0x6314: Position hold setpoint", page 42
⇨ Chapter "6.2.1.6 Object 0x6394: Pressure hold setpoint", page 44

Description of the device mode and control words:

⇨ Chapter "6.2.1.7 Object 0x6042: Device mode", page 45
⇨ Chapter "5.3.1 Object 0x6040: Control word", page 27
⇨ Chapter "5.3.5 Object 0x6041: Status word", page 29

6.2.1 Object descriptions

6.2.1.1 Object 0x6300: Position setpoint

This parameter corresponds to the setpoint that is transferred via the bus for the control modes:

- Control position closed loop
- Control position open loop
- p/Q closed loop

The setpoint takes only effect in case the device is in the device status 'DEVICE_MODE_ACTIVE' and the device mode is set to 1 (setpoint input via bus).

ValvePositionControl							
Index	Subindex	Name	Data type	Access	Persistence	Value range	Default
0x6300	1	Setpoint	INT16	rw	N	INT16	0
0x6300	2	Unit	UINT8	ro	N	UINT8	0
0x6300	3	Prefix	INT8	ro	N	INT8	0

⇨ Chapter "1.6.2 Definition of unit and prefix", page 5

ⓘ Whether this parameter will affect the control is influenced by the following:

- Device mode
  ⇨ Chapter "6.2.1.7 Object 0x6042: Device mode", page 45
- Control mode
  ⇨ Chapter "7.2.1.1 Object 0x6043: Control mode", page 76
- Device status
  ⇨ Chapter "5.3.5 Object 0x6041: Status word", page 29

6.2.1.2 Object 0x3320: Position setpoint parameter

The position control setpoint parameter indicates the input where the set values are coming from, i.e., that delivers the position setpoint. This is a read-only parameter.
The setpoint takes only effect in case the device is in the device status 'DEVICE_MODE_ACTIVE' and the device mode is set to 2 (setpoint input locally).

ValvePositionControl							
Index	Subindex	Name	Data type	Access	Persis-tence	Value range	Default
0x3320	0	SetpointParameter	UINT32	ro	N	UINT32	0x32040010

Whether this parameter will affect the control is influenced by the following:

- Device mode
  ⇨ Chapter "6.2.1.7 Object 0x6042: Device mode", page 45
- Control mode
  ⇨ Chapter "7.2.1.1 Object 0x6043: Control mode", page 76
- Device status
  ⇨ Chapter "5.3.5 Object 0x6041: Status word", page 29

Values description

Bit	**31**	24	**23**	16	**15**	8	**7**	0
Meaning	Index LSB		Index MSB		Subindex		Parameter bit length	

Table 34: Definition of the position setpoint source

Index / Subindex
The <SetpointParameter> carries the index and subindex of the input where the position set values are coming from. For example the parameter can carry the index and subindex of analog input 0 (0x3204).

6.2.1.3 Object 0x6314: Position hold setpoint

This parameter defines the position hold setpoint that is transferred via the bus in the control modes:

- Control position closed loop
- Control position open loop
- p/Q closed loop

It corresponds to the position setpoint in the device states 'HOLD' and 'FAULT_HOLD'.

ValvePositionControl							
Index	Subindex	Name	Data type	Access	Persis-tence	Value range	Default
0x6314	1	HoldSetPoint	INT16	rw	Y	INT16	0
0x6314	2	Unit	UINT8	ro	N	UINT8	0
0x6314	3	Prefix	INT8	ro	N	INT8	0

⇨ Chapter "1.6.2 Definition of unit and prefix", page 5

6.2.1.4 Object 0x6380: Pressure setpoint

This parameter corresponds the setpoint that is transferred via the bus for the control modes:

- Control pressure closed loop
- Control pressure open loop
- p/Q closed loop

The setpoint takes only effect if the device is in the device status 'DEVICE_MODE_ACTIVE' and the device mode is set to 1 (setpoint input via bus).

ValvePressureControl							
Index	Subindex	Name	Data type	Access	Persis-tence	Value range	Default
0x6380	1	Setpoint	INT16	rw	N	INT16	0
0x6380	2	Unit	UINT8	ro	N	UINT8	0
0x6380	3	Prefix	INT8	ro	N	INT8	0

⇨ Chapter "1.6.2 Definition of unit and prefix", page 5

ⓘ Whether this parameter will affect the control is influenced by the following:

- Device mode
  ⇨ Chapter "6.2.1.7 Object 0x6042: Device mode", page 45
- Control mode
  ⇨ Chapter "7.2.1.1 Object 0x6043: Control mode", page 76
- Device status
  ⇨ Chapter "5.3.5 Object 0x6041: Status word", page 29

6.2.1.5 Object 0x3310: Pressure setpoint parameter

The pressure control setpoint parameter indicates the input where the set values are coming from, i.e., that delivers the pressure setpoint. This is a read-only parameter.

The setpoint takes only effect if the device is in the device status 'DEVICE_MODE_ACTIVE' and the device mode is set to 2 (setpoint input locally).

ValvePressureControl							
Index	Subindex	Name	Data type	Access	Persis-tence	Value range	Default
0x3310	0x00	SetpointParameter	UINT32	ro	N	UINT32	0x320C0010

ⓘ Whether this parameter will affect the control is influenced by the following:

- Device mode
  ⇨ Chapter "6.2.1.7 Object 0x6042: Device mode", page 45
- Control mode
  ⇨ Chapter "7.2.1.1 Object 0x6043: Control mode", page 76
- Device status
  ⇨ Chapter "5.3.5 Object 0x6041: Status word", page 29

Values description

Bit	**31** 24	**23** 16	**15** 8	**7** 0
Meaning	Index LSB	Index MSB	Subindex	Parameter bit length

Table 35: Definition of the pressure setpoint source

Index / Subindex

The <SetpointParameter> carries the index and subindex of the input where the pressure set values are coming from. For example the parameter can carry the index and subindex of analog input 1 (0x320C).

6.2.1.6 Object 0x6394: Pressure hold setpoint

This parameter defines the pressure hold setpoint that is transferred via the bus in the control modes:

- Control pressure closed loop
- Control pressure open loop
- p/Q closed loop

It corresponds to the position setpoint in the device states 'HOLD' and 'FAULT_HOLD'.

ValvePressureControl_DemandValueGenerator							
Index	Subindex	Name	Data type	Access	Persis-tence	Value range	Default
0x6394	1	HoldSetPoint	INT16	rw	Y	INT16	0
0x6394	2	Unit	UINT8	ro	N	UINT8	0
0x6394	3	Prefix	INT8	ro	N	INT8	0

⇨ Chapter "1.6.2 Definition of unit and prefix", page 5

Whether this parameter will affect the control is influenced by the following:

- Device mode
  ⇨ Chapter "6.2.1.7 Object 0x6042: Device mode", page 45
- Control mode
  ⇨ Chapter "7.2.1.1 Object 0x6043: Control mode", page 76
- Device status
  ⇨ Chapter "5.3.5 Object 0x6041: Status word", page 29

6.2.1.7 Object 0x6042: Device mode

The device mode is used to switch the setpoints from local input (e.g., an analog input) to setpoint input via bus.

ⓘ The set device mode can be stored on the device as a default value using the device mode default object. When restoring the default values, the factory default values will be applied (see parameter <DeviceModeDefault>, 0x4042).

Device							
Index	Subindex	Name	Data type	Access	Persistence	Value range	Default
0x6042	0	DeviceMode	INT8	rw	N	1…4	<DeviceMode-Default>

Values description

<DeviceMode>	**Meaning**
1	Setpoint input via the bus
2	Setpoint input locally
3…4	Reserved

Table 36: Device mode values

Setpoint input via bus
In this device mode, the setpoints transferred over the bus are provided to the demand value generators.
⇨ Chapter "6.2.1.1 Object 0x6300: Position setpoint", page 41
⇨ Chapter "6.2.1.4 Object 0x6380: Pressure setpoint", page 43

Setpoint input locally
In this device mode, the setpoints are defined locally, i.e., they are taken from the analog inputs 0 and 1.
⇨ Chapter "6.2.1.2 Object 0x3320: Position setpoint parameter", page 42
⇨ Chapter "6.2.1.5 Object 0x3310: Pressure setpoint parameter", page 43

6.2.1.8 Object 0x4042: Device mode default

The parameter <DeviceModeDefault> can be used to save the set device mode on the device as default value. Default values are always applied when starting the device.

The restore command sets the default values to factory defaults.

Device							
Index	Subindex	Name	Data type	Access	Persistence	Value range	Default
0x4042	0x00	DeviceModeDefault	INT8	rw	Y	1…2	2

6.3 Actual value path

The actual values are 16 bit integers. A 100 % signal corresponds to 16384 decimal.
⇨ Chapter "1.5 Definitions", page 3

6.3.1 Position actual value path

The following figure shows the position actual value path and the parameters influencing this behavior. The parameter 0x6301 holds the position of the main stage.
The parameter 0x3235 holds the value of the RKP-D stroke ring position (the External LVDT value). After the scaling, the value becomes the actual value.

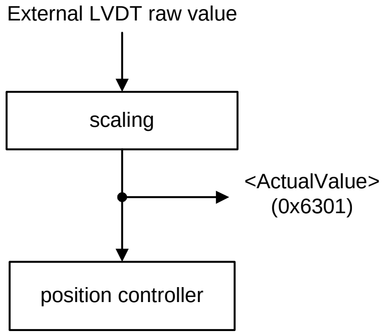


Figure 10: Position actual value path

Scaling of the External LVDT raw value is done according to the following formula:

$$\text{ActualValue} = (\text{External LVDT raw value} + \text{CustomerScalingOffset}) \times \frac{\text{CustomerScalingFactorNumerator}}{\text{CustomerScalingFactorDenominator}}$$

$$\text{ActualValue} = \text{External LVDT value}$$

6.3.1.1 Object 0x6301: Actual position value

This parameter indicates the actual position value returned from the position transducer to the controller.

ValvePositionControl							
Index	Subindex	Name	Data type	Access	Persis-tence	Value range	Default
0x6301	1	ActualValue	INT16	ro	N	INT16	None
0x6301	2	Unit	UINT8	ro	N	UINT8	0
0x6301	3	Prefix	INT8	ro	N	INT8	0

⇨ Chapter "1.6.2 Definition of unit and prefix", page 5

6.3.1.2 Object 0x3235: Actual External LVDT value

This parameter holds the actual External LVDT value forwarded to the position controller. Scaling of this value is done according to formula shown above.

ExternalLVDT							
Index	Subindex	Name	Data type	Access	Persis-tence	Value range	Default
0x3235	1	ActualValue	INT16	ro	N	INT16	None

6.3.1.3 Object 0x3237: Scaling External LVDT raw value

The subindexes of this parameter are used to scale the External LVDT raw value that is forwarded to the position controller. Scaling is done according to the formula given in:
⇨ Chapter "6.3.1 Position actual value path", page 46

ExternalLVDT							
Index	Subindex	Name	Data type	Access	Persis-tence	Value range	Default
0x3237	1	CustomerScalingFactorNu-merator	INT16	rw	Y	INT16	16384
0x3237	2	CustomerScalingFactorDe-nominator	INT16	rw	Y	INT16	16384
0x3237	3	CustomerScalingOffset	INT16	rw	Y	INT16	0

6.3.2 Pressure actual value path

The following figure shows the pressure actual value path and the parameters influencing this behavior.

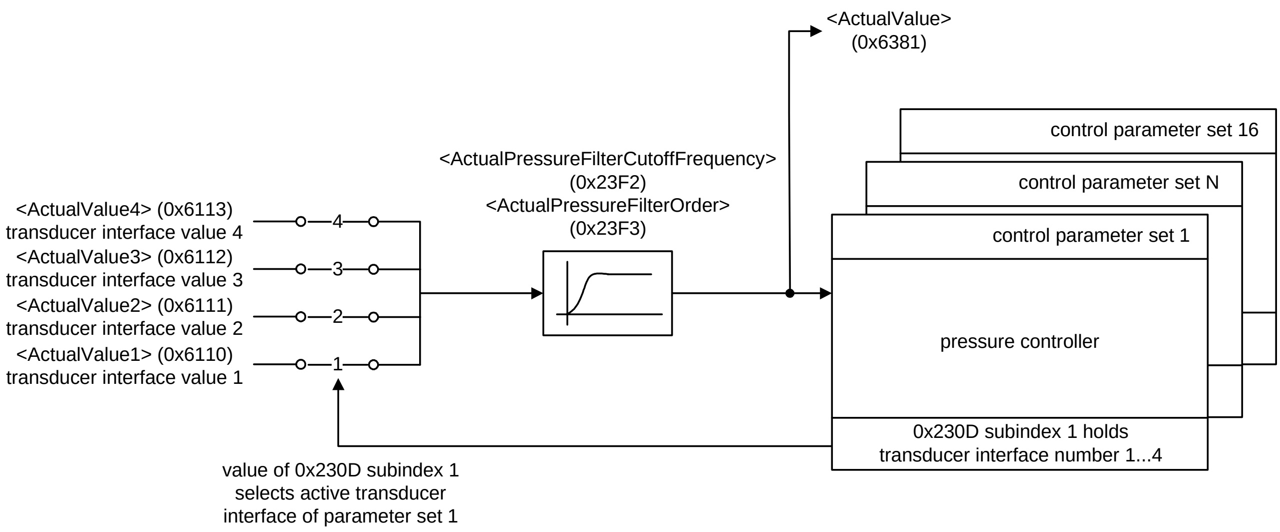


Figure 11: Pressure actual value path

6.3.2.1 Objects 0x23F2 / 0x23F3: Actual pressure filter cutoff frequency / Actual pressure filter order

The parameters 0x23F2 and 0x23F3 are used to set the behavior of the Butterworth filter. 0x23F2 specifies the cutoff frequency of the filter in Hz. The order of the filter is set with the parameter 0x23F3 (possible values: 1…3).

For a frequency of 0 Hz, the Butterworth filter is switched off. In this case, the parameters 0x6104 and 0x6381 both hold the actual pressure value.
Description of the parameter 0x6104:
⇨ Chapter "6.3.3.1.1 Objects 0x6100 - 0x6104: Actual value routing", page 49

ValvePressureControl							
Index	Subindex	Name	Data type	Access	Persis-tence	Value range	Default
0x23F2	0	ActualPressureFilterCutoff-Frequency	FLOAT32	rw	Y	0…5000	0
0x23F3	0	ActualPressureFilterOrder	UINT8	rw	Y	1…3	1

6.3.2.2 Object 0x6381: Actual pressure value

This parameter indicates the actual pressure value returned from the pressure transducer to the controller.

ValvePressureControl							
Index	Subindex	Name	Data type	Access	Persis-tence	Value range	Default
0x6381	1	ActualValue	INT16	ro	N	INT16	None
0x6381	2	Unit	UINT8	ro	N	UINT8	0
0x6381	3	Prefix	INT8	ro	N	INT8	0

⇨ Chapter "1.6.2 Definition of unit and prefix", page 5

6.3.3 Interface assignment

Any of the 5 available analog inputs (analog input 0…4) can be used as actual value interface from which the measured values are taken that are forwarded to the controller. The following figure shows how routing and scaling of the actual value is done for the available analog inputs.

ⓘ Analog input 0 and 1 could be used as analog setpoints.
⇨ Chapter "6.1.1 Analog inputs 0 and 1", page 34

Description on how the according interface is selected and which parameters are used:
⇨ Chapter "6.3.3.1 Interface definition", page 49

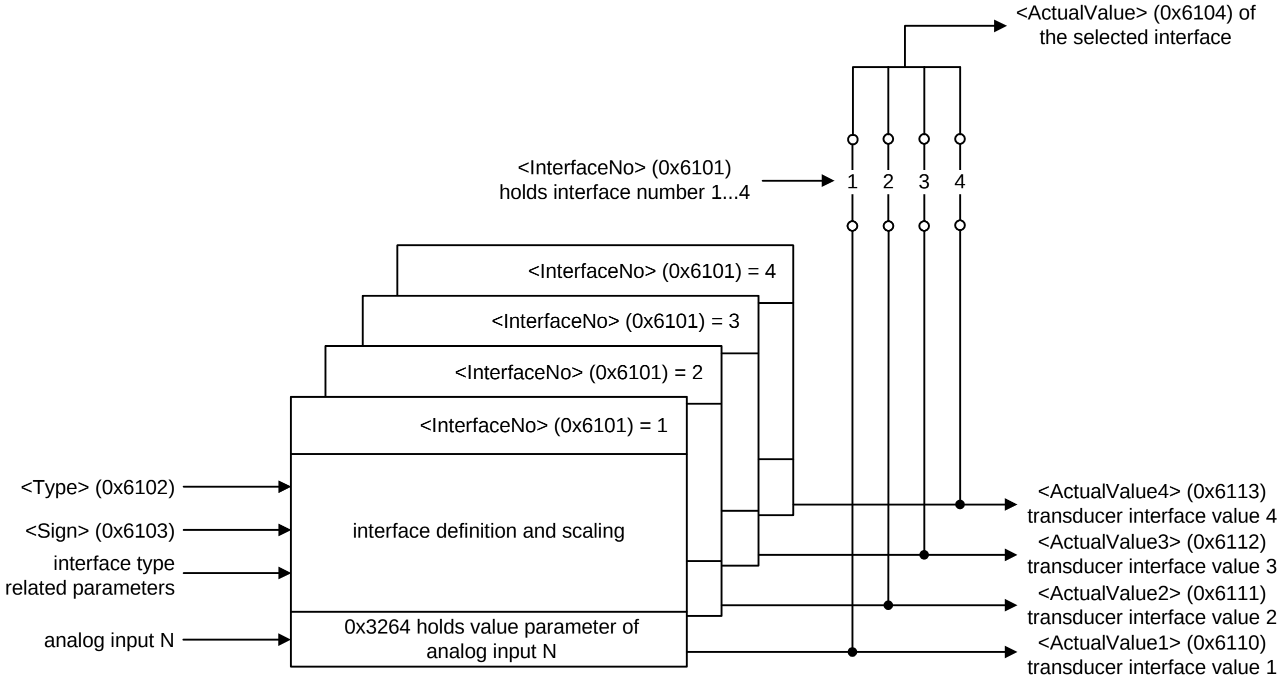


Figure 12: Actual value conditioning

These parameters indicate the output values of the transducer interface.

Valve_ActualValueConditioning							
Index	Subindex	Name	Data type	Access	Persis-tence	Value range	Default
0x6110	1	ActualValue1	INT16	ro	N	INT16	None
0x6111	1	ActualValue2	INT16	ro	N	INT16	None
0x6112	1	ActualValue3	INT16	ro	N	INT16	None
0x6113	1	ActualValue4	INT16	ro	N	INT16	None

6.3.3.1 Interface definition

The assignment of an actual value source to an interface has to be started with the selection of the interface number. This is done by writing a value to the parameter <InterfaceNo> (0x6101). All interface parameters that are specified afterwards are attributes to the parameter <InterfaceNo>, i.e., they always relate to the interface set with <InterfaceNo>. All parameters configuring the interface only apply to the interface selected by the parameter 0x6101.
The parameterization is stored in an internal data structure representation in the parameter <ValveTransducerStructure> (0x3270).

The following interface parameters are available:

Parameter	**Description**
<Type> (0x6102)	Selection of the sensor type (interface type) by writing the parameter <Type> (0x6102).
<Sign> (0x6103)	Setting the sign of the interface (actual value sign) by writing the parameter <Sign> (0x6103).
<TransducerPort> (0x3264)	Selection of the transducer port by writing the parameter <TransducerPort> (0x3264). This parameter carries the index of the input where the actual physical values are coming from. For example, <TransducerPort> can carry the index of the actual value of analog input 3 (0x3204).

Table 37: Interface parameters

6.3.3.1.1 Objects 0x6100 - 0x6104: Actual value routing

Valve_ActualValueConditioning							
Index	Subindex	Name	Data type	Access	Persis-tence	Value range	Default
0x6100	0	MaxInterfaceNo	UINT8	ro	N	UINT8	4
0x6101	0	InterfaceNo	UINT8	rw	N	1…4	DSV
0x6102	0	Type	INT8	rw	N	INT8	DSV
0x6103	0	Sign	INT8	rw	N	-1…1	1
0x6104	1	ActualValue	INT16	ro	N	INT16	None

<MaxInterfaceNo>
This parameter indicates the number of available interfaces in the device.

<InterfaceNo>
This parameter defines the number of the referenced interface. The parameters as stated in the procedure described in chapter 6.3.3.1 relate to the interface defined with this parameter.
The following interfaces are available on the device:

<InterfaceNo>	**Connection**
0, 5…255	Reserved
1	1st referenced interface
2	2nd referenced interface
3	3rd referenced interface
4	4th referenced interface

Table 38: <InterfaceNo> values

<Type>

This parameter defines the type of actual value conditioning currently selected by the interface number parameter (0x6101).

<Type>	**Meaning**
0	Interface deactivated (no function)
1	Reserved
2	Pressure sensor (Scaling: ⇨ Chapter "6.3.3.3 Objects 0x6120 - 0x6125: Actual value conditioning for pressure transducer", page 53)
3…127	Reserved
-1	Reserved
-2	Analog direct (no further scaling possible)
-3…-128	Reserved

Table 39: Interface types

<Sign>

Using this parameter the sign of the actual value interface currently selected by the interface number parameter (0x6101) can be changed.

<Sign>	**Meaning**
1	Positive
-1	Negative
0	Reserved

Table 40: Interface sign values

<ActualValue>

This parameter contains the conditioned actual value of the interface currently selected by the interface number parameter (0x6101).

6.3.3.1.2 Object 0x3264: Transducer port

This parameter defines the transducer port currently selected by the interface number parameter (0x6101) that carries the index of the input where the actual physical values are coming from.

Valve_ActualValueConditioning							
Index	Subindex	Name	Data type	Access	Persis-tence	Value range	Default
0x3264	0	TransducerPort	UINT32	rw	N	UINT32	DSV

Assignment of an analog input to the transducer port

There are 5 analog inputs (0…4). Each input has its value parameter and its type parameter (as shown in the following table). The value parameters can be assigned to a transducer port, i.e., written to the <Transducer-Port> parameter as described in the example below. The type of the analog input (e.g., ±10 mA, 4…20 mA, etc.) is set by writing the corresponding value to the type parameter.
⇨ Chapter "6.1 Physical pump interfaces", page 34

Input No	Connector	Actual value index	Input type index	Transducer port value
0	Analog input 0	0x3204	0x3200	0x32040010
1	Analog input 1	0x320C	0x3208	0x320C0010
2	Analog input 2	0x3214	0x3210	0x32140010
3	Analog input 3	0x321C	0x3218	0x321C0010
4	Analog input 4	0x3224	0x3220	0x32240010

Table 41: Analog inputs with value parameters

⇨ Chapter "6.1.1 Analog inputs 0 and 1", page 34
⇨ Chapter "6.1.2 Analog inputs 2, 3 and 4", page 36

Example for transducer port value:
<TransducerPort> = 0x32240010

Bit	**31** 24	**23** 16	**15** 8	**7** 0
Meaning	Index LSB	Index MSB	Subindex	Parameter bit length
Contents	32	24	00	10

Table 42: Bit coding of the transducer port value

This means, the actual physical values are provided by analog input 4 (0x3224).

6.3.3.1.3 Object 0x3270: Valve transducer structure

This parameter stores the interface parameterization in an internal data structure representation. It is to be used to transfer or store a configuration only. Hence, only values, which were once obtained by this parameter, are to be written into this parameter.

Valve_ActualValueConditioning							
Index	Subindex	Name	Data type	Access	Persis-tence	Value range	Default
0x3270	0	ValveTransducerStructure	DOMAIN	rw	Y	100 bytes	DSV

6.3.3.2 Object 0x230D: Pressure controller active transducer interface

This parameter selects the transducer interface that is to be used as actual pressure value input. The pressure signal source is defined with the actual value routing.

Each subindex of this parameter stands for a control parameter set, e.g., subindex 1 stands for control parameter set 1, subindex 2 for control parameter set 2, etc. The value of the subindex holds the actual transducer interface.

Example:
Subindex 1 of 0x230D holds the value 4.
This means, control parameter set 1 uses interface 4 as actual value input.

ValvePressureControl							
Index	Subindex	Name	Data type	Access	Persis-tence	Value range	Default
0x230D	1…16	PressureControllerActiveTransducer-Interface	INT8	rw	Y	1…4	DSV

6.3.3.3 Objects 0x6120 - 0x6125: Actual value conditioning for pressure transducer

The actual value conditioning of the pressure transducer interface provides the actual pressure value which is given to the controller. Using the parameters described here, the scaling and offset of the pressure value can be set as shown in the following figure.

Precondition: The type of actual value conditioning needs to be configured to "pressure sensor" type. This is done by writing the value 2 to the parameter <Type> (0x6102).
⇨ Chapter "6.3.3.1.1 Objects 0x6100 - 0x6104: Actual value routing", page 49
⇨ Table 39, page 50

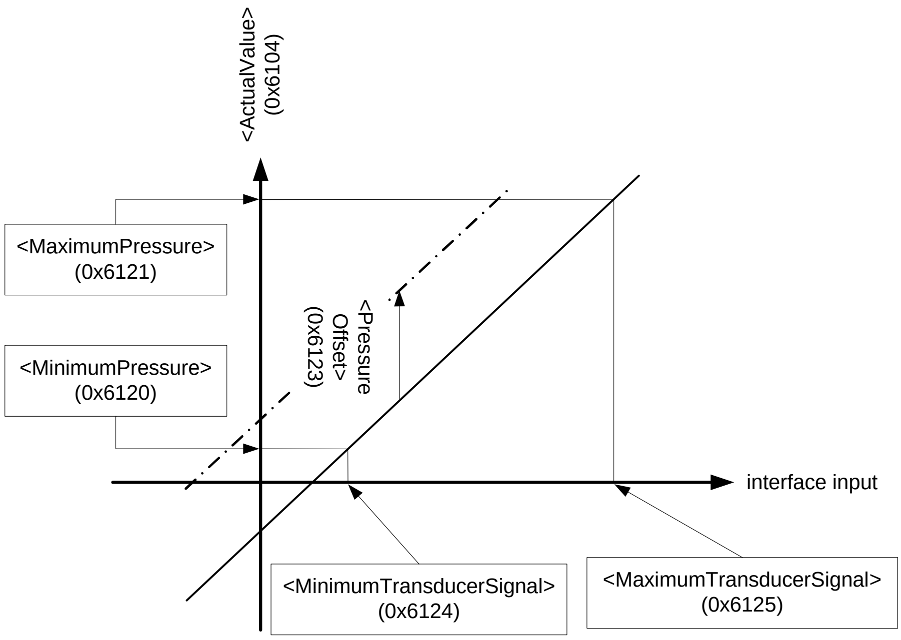


Figure 13: Scaling and offset of the pressure value

Valve_ActualValueConditioning							
Index	Subindex	Name	Data type	Access	Persis-tence	Value range	Default
0x6120	1	MinimumPressure	INT16	rw	N	INT16	0
0x6121	1	MaximumPressure	INT16	rw	N	INT16	16384
0x6123	1	PressureOffset	INT16	rw	N	INT16	0
0x6124	1	MinimumTransducerSignal	INT16	rw	N	INT16	0
0x6125	1	MaximumTransducerSignal	INT16	rw	N	INT16	16384

<MinimumPressure>
Pressure value referring to the minimum sensor signal (when pressure offset equals 0).

<MaximumPressure>
Pressure value referring to the maximum sensor signal (when pressure offset equals 0).

<PressureOffset>
Value of this parameter is added to the actual value.

<MinimumTransducerSignal>
The sensor's measured pressure signal at the minimum pressure.

<MaximumTransducerSignal>
The sensor's measured pressure signal at the maximum pressure.

For your notes.

7 Pump functions

7.1 Demand Value Generator

7.1.1 Structure

Before a setpoint reaches the controller, it is preprocessed using the demand value generator. Preprocessing means, the input signal can be scaled and limited in order to keep it in a defined value and dynamic range.

The set signal (position or pressure) is preprocessed by one of the following demand value generators (or both in case p/Q mode is activate) and then forwarded to the subsequent controller as shown in the following figure. The used set signal is defined by the selected control mode.

- **Position demand value generator**
  ⇨ Chapter "7.1.2 Position demand value generator", page 55
- **Pressure demand value generator**
  ⇨ Chapter "7.1.3 Pressure demand value generator", page 66

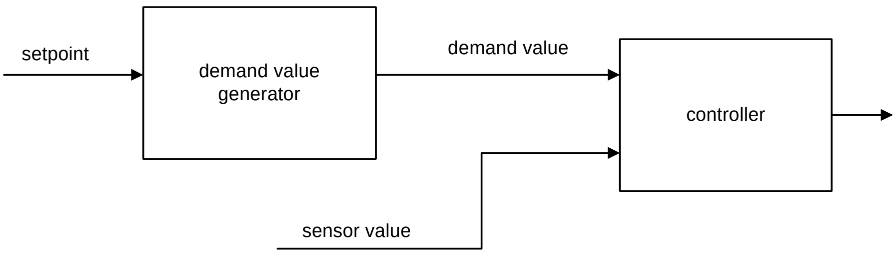


Figure 14: Demand Value Generator

7.1.2 Position demand value generator

The position demand value generator comprises the following functions:

- Limit - limits the demand signal.
  ⇨ Chapter "7.1.2.3 Limit function", page 57
- Scale - gain and offset manipulation of the set signal.
  ⇨ Chapter "7.1.2.4 Scaling", page 58
- Ramp - limits the rate at which the input signal changes.
  ⇨ Chapter "7.1.2.5 Ramp", page 59
- Zero correction - defines a zero offset by which the input signal is shifted.
  ⇨ Chapter "7.1.2.6 Zero correction", page 64
- Hybrid mode correction - the hybrid mode factor manipulates the demand value in order to compensate the flow generated by a constant pump connected to the same volume.
  ⇨ Chapter "7.1.2.7 Hybrid mode correction", page 65

The following figure shows the inner structure of the position demand value generator with the implemented functions.

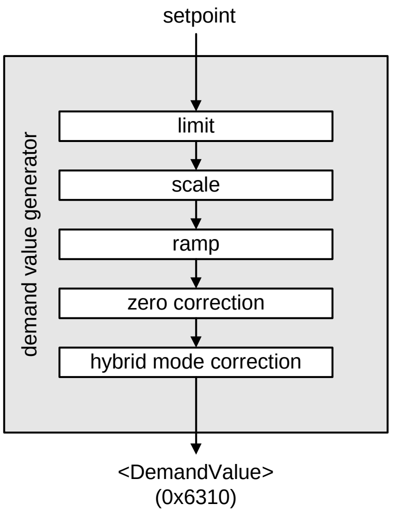


Figure 15: Position demand value generator

Detailed description of the signal flow of the demand signal and the parameters influencing this behavior:
⇨ Chapter "6.2 Command value path", page 39

Forwarding the demand value to the controller
The position demand value (0x6310) is forwarded to the position controller in the control modes 1, 2 and 5.
⇨ Chapter "7.2.1.1 Object 0x6043: Control mode", page 76

7.1.2.1 Object 0x6310: Demand value

The demand value indicated by this parameter is generated from the setpoint by means of the functions in the demand value generator and forwarded to the position controller.

ValvePositionControl_DemandValueGenerator							
Index	Subindex	Name	Data type	Access	Persis-tence	Value range	Default
0x6310	1	DemandValue	INT16	ro	N	INT16	None
0x6310	2	Unit	UINT8	ro	N	UINT8	0
0x6310	3	Prefix	INT8	ro	N	INT8	0

⇨ Chapter "1.6.2 Definition of unit and prefix", page 5

7.1.2.2 Object 0x6311: Reference value

The reference value is the value that corresponds to 100 % of the setpoint.

ValvePositionControl_DemandValueGenerator							
Index	Subindex	Name	Data type	Access	Persis-tence	Value range	Default
0x6311	1	ReferenceValue	INT16	ro	N	INT16	16384
0x6311	2	Unit	UINT8	ro	N	UINT8	0
0x6311	3	Prefix	INT8	ro	N	INT8	0

⇨ Chapter "1.6.2 Definition of unit and prefix", page 5

7.1.2.3 Limit function

This function limits the value range of the input signal. The limit is defined by setting the upper limit and lower limit parameters.

Bit 10 of the status word indicates whether the input signal is being limited or not.
⇨ Chapter "5.3.5 Object 0x6041: Status word", page 29

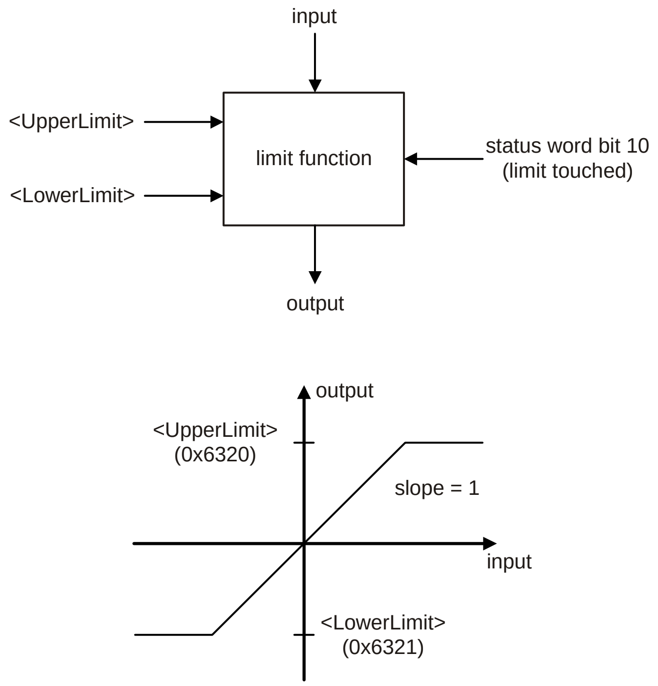


Figure 16: Limit function

ValvePositionControl_DemandValueGenerator_Limit							
Index	Subindex	Name	Data type	Access	Persistence	Value range	Default
0x6320	1	UpperLimit	INT16	rw	Y	<LowerLimit>…32767	16384
0x6320	2	Unit	UINT8	ro	N	UINT8	0
0x6320	3	Prefix	INT8	ro	N	INT8	0
0x6321	1	LowerLimit	INT16	rw	Y	-32768…<UpperLimit>	-16384
0x6321	2	Unit	UINT8	ro	N	UINT8	0
0x6321	3	Prefix	INT8	ro	N	INT8	0

⇨ Chapter "1.6.2 Definition of unit and prefix", page 5

ⓘ The <LowerLimit> value cannot be greater than the <UpperLimit> value.

Status (limit reached)
The status is used to indicate whether the input signal is being limited. This information is mapped to the status word bit 10.

Status	Meaning
0	Input signal not limited
1	Input signal limited

Table 43: Definition of the limit value status

7.1.2.4 Scaling

This function is used to scale the position setpoint, i.e., to influence the input signal's value range. The output signal is derived from an offset and the multiplication of the input signal with a factor (sets the signal's slope) according to the following function:

$$\text{output} = (\text{input} \times \text{Factor}) + \text{Offset}$$

$$\text{Factor} = \frac{\text{numerator}}{\text{denominator}}$$

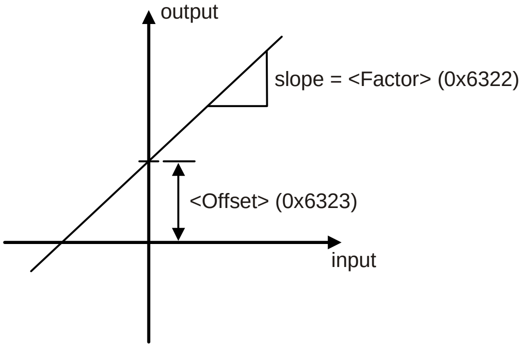


Figure 17: Scaling function

ValvePositionControl_DemandValueGenerator_Scaling							
Index	Subindex	Name	Data type	Access	Persis-tence	Value range	Default
0x6322	0	Factor	UINT32	rw	Y	UINT32	0x00010001
0x6323	1	Offset	INT16	rw	Y	INT16	0
0x6323	2	Unit	UINT8	ro	N	UINT8	0
0x6323	3	Prefix	INT8	ro	N	INT8	0

⇨ Chapter "1.6.2 Definition of unit and prefix", page 5

<Factor>

Factor by which the input is multiplied. It is calculated from a numerator (upper 16 bits of the parameter) and a denominator (lower 16 bits of the parameter).

Bit	**31 … 16**	**15 … 0**
Meaning	Numerator	Denominator

Table 44: Data structure of the scaling factor

The default value 0x00010001 corresponds to the factor 1.

<Offset>

The offset is added to the scaled input value.

7.1.2.5 Ramp

The ramp function limits the rate at which the input signal changes. The type parameter is used to activate a one-quadrant, two-quadrant or four-quadrant ramp or to deactivate the ramp function.

Whether the ramping function is running is indicated by the status word bit 9. Bit 15 of the status word is set, if the ramp function was stopped.

Status word bit 9
Bit 9 = 1: If ramp input is limited.

Status word bit 15
Bit 15 = 1: The output of the ramp is held.

Description of the status word:
⇨ Chapter "5.3.5 Object 0x6041: Status word", page 29

Control word bit 15
Whether the output of the ramp is to be frozen is set with the control word bit 15.
Control word bit 15 = 1: Ramp output frozen.

Description of the control word:
⇨ Chapter "5.3.1 Object 0x6040: Control word", page 27

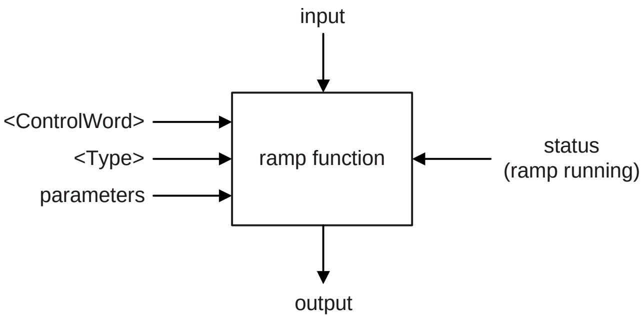


Figure 18: Ramp function

ValvePositionControl_DemandValueGenerator_Ramp							
Index	Subindex	Name	Data type	Access	Persis-tence	Value range	Default
0x6330	0	Type	INT8	rw	Y	0…3	0

<Type>
This parameter defines the progression of the ramp.

<Type>	Meaning
0	Ramp deactivated
1	Linear (ramping time the same for all quadrants) ⇨ Chapter "7.1.2.5.1 Ramp type 1 - one-quadrant ramp", page 60
2	Linear (ramping times for acceleration and deceleration) ⇨ Chapter "7.1.2.5.2 Ramp type 2 - two-quadrant ramp", page 61
3	Linear (ramping times for acceleration and deceleration, separated for positive and negative sides) ⇨ Chapter "7.1.2.5.3 Ramp type 3 - four-quadrant ramp", page 62

Table 45: Possible ramp type values

Status (ramp running)
The status indicates a ramp that is running. This information is mapped to the corresponding bit in the status word.
⇨ Chapter "5.3.5 Object 0x6041: Status word", page 29

Status	Meaning
0	The ramping function is deactivated or the ramping function does not influence the output signal.
1	The ramping function influences the output signal.

Table 46: Ramp status indicated in the status word

7.1.2.5.1 Ramp type 1 - one-quadrant ramp

This function limits the input signal's rate of change to a definable acceleration time.

Activated with ramp type (0x6300) = 1.
⇨ Chapter "7.1.2.5 Ramp", page 59

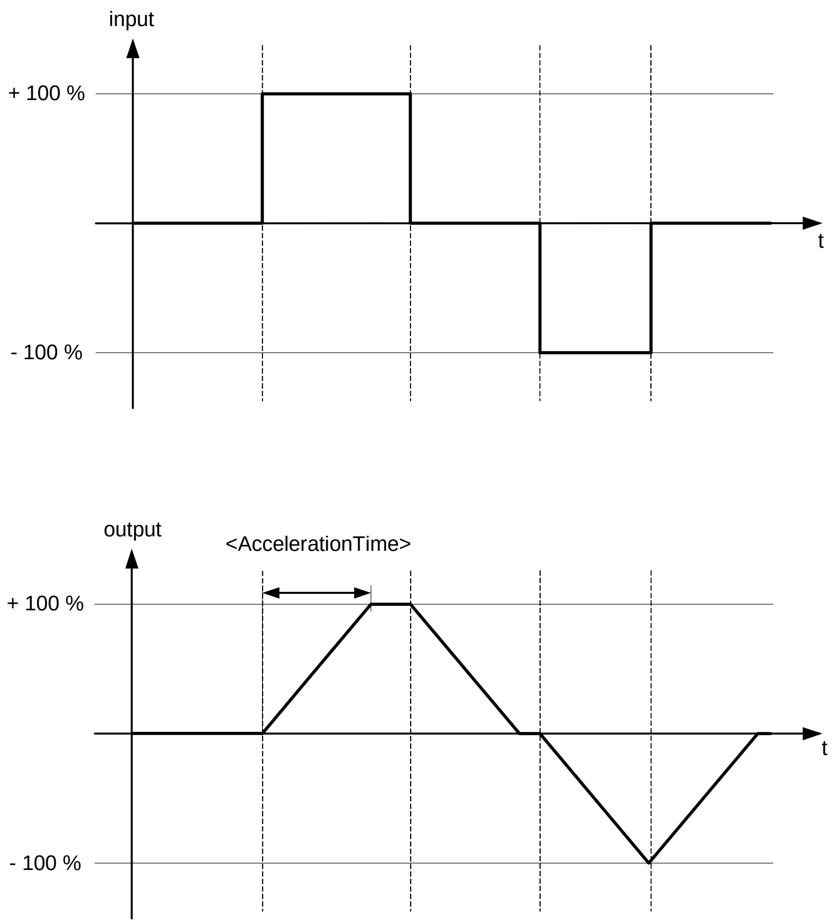


Figure 19: Ramp type 1

ValvePositionControl_DemandValueGenerator_Ramp							
Index	Subindex	Name	Data type	Access	Persis-tence	Value range	Default
0x6331	1	AccelerationTime	UINT16	rw	Y	UINT16	0
0x6331	2	Unit	UINT8	ro	N	UINT8	3
0x6331	3	AccelerationTime_Prefix	INT8	rw	Y	-4…0	-3

⇨ Chapter "1.6.2 Definition of unit and prefix", page 5

<AccelerationTime>
This parameter defines the output signal's maximum rate of change. The acceleration time corresponds to the time that the signal needs for a change of 0 to 100 % as shown in the figure above.
The acceleration time can be specified in seconds with the gradation 1 s, 100 ms, 10 ms, 1 ms.

7.1.2.5.2 Ramp type 2 - two-quadrant ramp

This function limits the input signal's rate of change to an acceleration time and a deceleration time.

Activated with ramp type (0x6330) = 2.
⇨ Chapter "7.1.2.5 Ramp", page 59

Description of the acceleration time parameter:
⇨ Chapter "7.1.2.5.1 Ramp type 1 - one-quadrant ramp", page 60

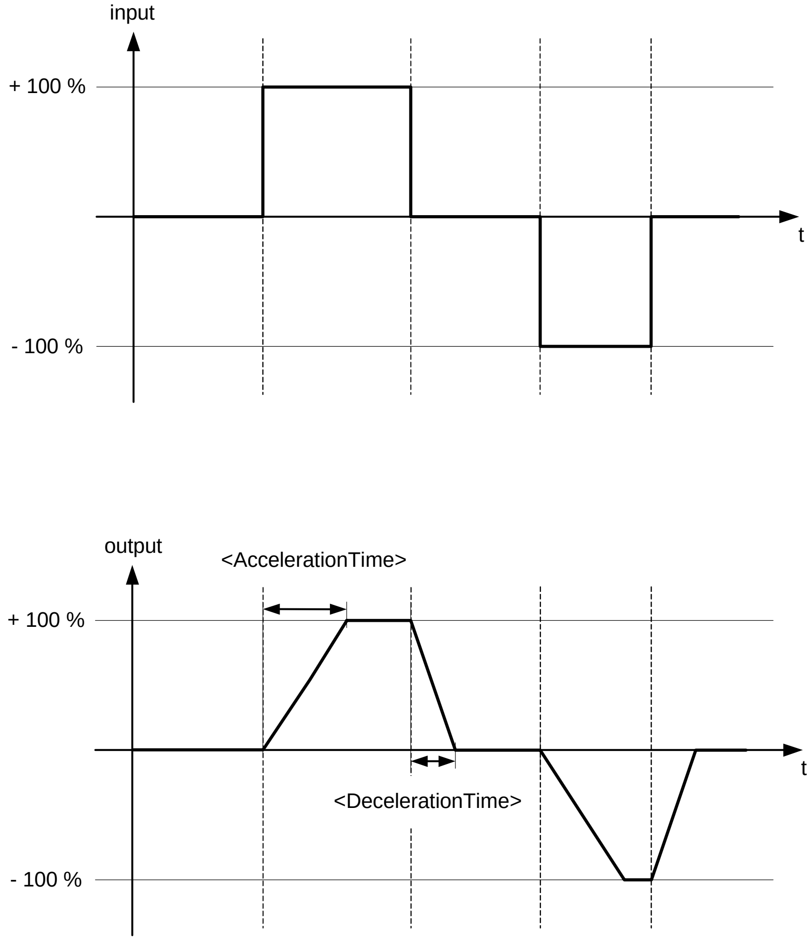


Figure 20: Ramp type 2

ValvePositionControl_DemandValueGenerator_Ramp							
Index	Subindex	Name	Data type	Access	Persis-tence	Value range	Default
0x6334	1	DecelerationTime	UINT16	rw	Y	UINT16	0
0x6334	2	Unit	UINT8	ro	N	UINT8	3
0x6334	3	DecelerationTime_Prefix	INT8	rw	Y	-4…0	-3

⇨ Chapter "1.6.2 Definition of unit and prefix", page 5

<DecelerationTime>
This parameter defines the output signal's maximum rate of change. The deceleration time corresponds to the time that the signal needs for a change of 100 to 0 %.
The deceleration time can be specified in seconds with the gradation 1 s, 100 ms, 10 ms, 1 ms.

7.1.2.5.3 Ramp type 3 - four-quadrant ramp

This function limits the input signal's rate of change to an acceleration time and a deceleration time, each separated for the positive and negative sides.

Activated with ramp type (0x6330) = 3.
⇨ Chapter "7.1.2.5 Ramp", page 59

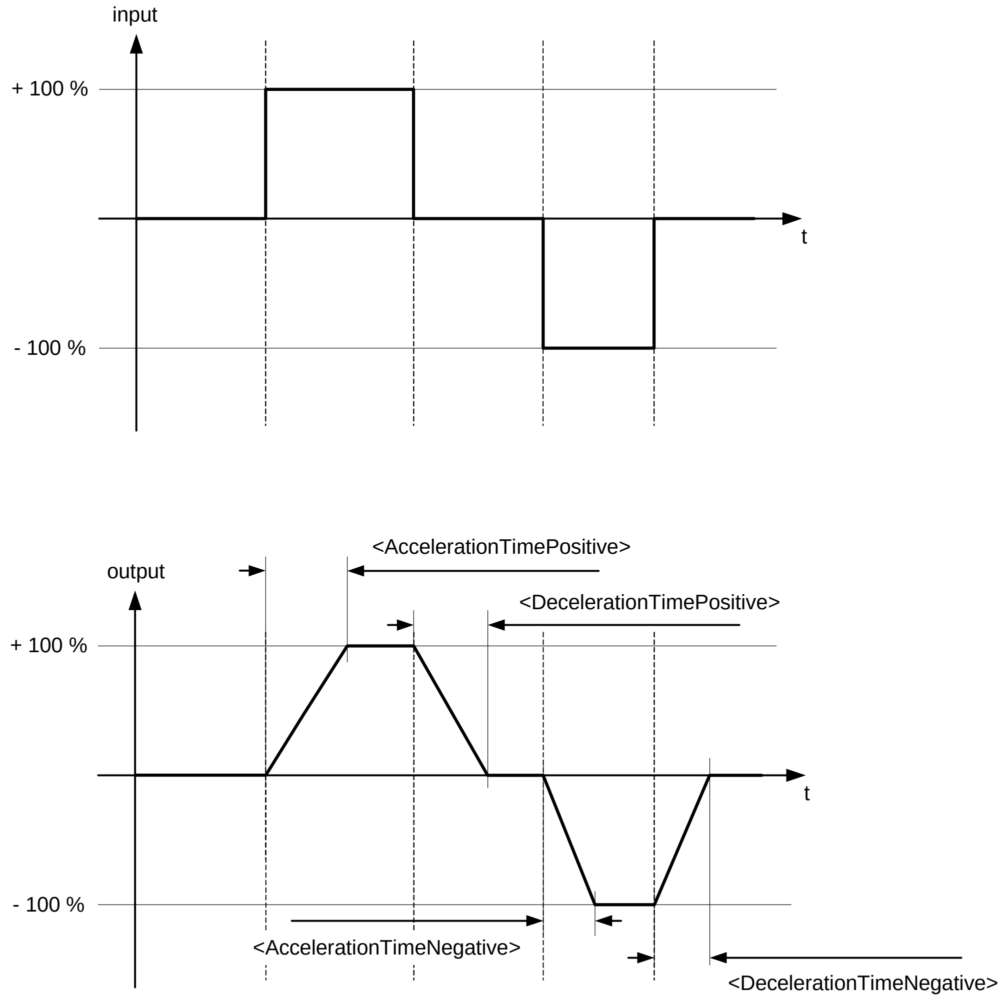


Figure 21: Ramp type 3

ValvePositionControl_DemandValueGenerator_Ramp							
Index	Subindex	Name	Data type	Access	Persis-tence	Value range	Default
0x6332	1	AccelerationTimePositive	UINT16	rw	Y	UINT16	0
0x6332	2	Unit	UINT8	ro	N	UINT8	3
0x6332	3	AccelerationTimePositive_Prefix	INT8	rw	Y	-4…0	-3
0x6333	1	AccelerationTimeNegative	UINT16	rw	Y	UINT16	0
0x6333	2	Unit	UINT8	ro	N	UINT8	3
0x6333	3	AccelerationTimeNegative_Prefix	INT8	rw	Y	-4…0	-3
0x6335	1	DecelerationTimePositive	UINT16	rw	Y	UINT16	0
0x6335	2	Unit	UINT8	ro	N	UINT8	3
0x6335	3	DecelerationTimePositive_Prefix	INT8	rw	Y	-4…0	-3
0x6336	1	DecelerationTimeNegative	UINT16	rw	Y	UINT16	0
0x6336	2	Unit	UINT8	ro	N	UINT8	3
0x6336	3	DecelerationTimeNegative_Prefix	INT8	rw	Y	-4…0	-3

⇨ Chapter "1.6.2 Definition of unit and prefix", page 5

<AccelerationTimePositive>
This parameter defines the output signal's maximum rate of change on the positive side. The acceleration time corresponds to the time that the signal needs for a change of 0 to 100 %.
The acceleration time can be specified in seconds with the gradation 1 s, 100 ms, 10 ms, 1 ms.

<DecelerationTimePositive>
This parameter defines the output signal's maximum rate of change on the positive side. The deceleration time corresponds to the time that the signal needs for a change of 100 to 0 %.
The deceleration time can be specified in seconds with the gradation 1 s, 100 ms, 10 ms, 1 ms.

<AccelerationTimeNegative>
This parameter defines the output signal's maximum rate of change on the negative side. The acceleration time corresponds to the time that the signal needs for a change of 0 to 100 %.
The acceleration time can be specified in seconds with the gradation 1 s, 100 ms, 10 ms, 1 ms.

<DecelerationTimeNegative>
This parameter defines the output signal's maximum rate of change on the negative side. The deceleration time corresponds to the time that the signal needs for a change of 100 to 0 %.
The deceleration time can be specified in seconds with the gradation 1 s, 100 ms, 10 ms, 1 ms.

7.1.2.6 Zero correction

The zero correction enables shifting of the input signal up and down by any desired offset. The offset set with the parameter 0x6324 is added to the input signal according to the following formula:

$$\text{output} = \text{input} + \text{Offset}$$

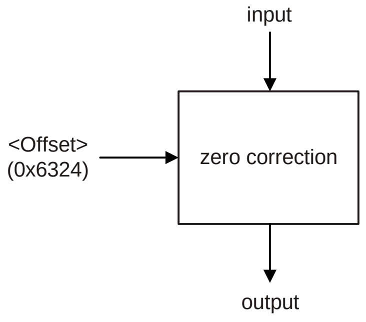


Figure 22: Zero correction

ValvePositionControl_DemandValueGenerator_ZeroCorrection							
Index	Subindex	Name	Data type	Access	Persis-tence	Value range	Default
0x6324	1	Offset	INT16	rw	Y	INT16	0
0x6324	2	Unit	UINT8	ro	N	UINT8	0
0x6324	3	Prefix	INT8	ro	N	INT8	0

⇨ Chapter "1.6.2 Definition of unit and prefix", page 5

7.1.2.7 Hybrid mode correction

In the hybrid mode, a constant pump (typically not connected to the bus) and a solo pump operate to the same volume. This functionality requires the knowledge of the constant pump's flow volume. This flow volume (volume of the hybrid pump) is set with the parameter <HybridFlow> (0x2147) and is given as percentage of the solo pump maximum volume.
⇨ Chapter "1.5 Definitions", page 3

The hybrid adjustment is done within the demand value generator before the position controller. The transfer behavior is as follows:

$$\text{output} = \text{input} \times (16384 + \text{hybridflow}) - \text{hybridflow}$$

Figure 23 shows the transfer behavior for the hybrid mode and also the solo mode for comparison purposes. The calculation of the flow demand for the servo pump (servo demand) is as follows:

$$\text{servo demand} = \text{total demand} \times \left(1 + \frac{\text{flow constant pump}}{16384}\right) - \text{flow constant pump}$$

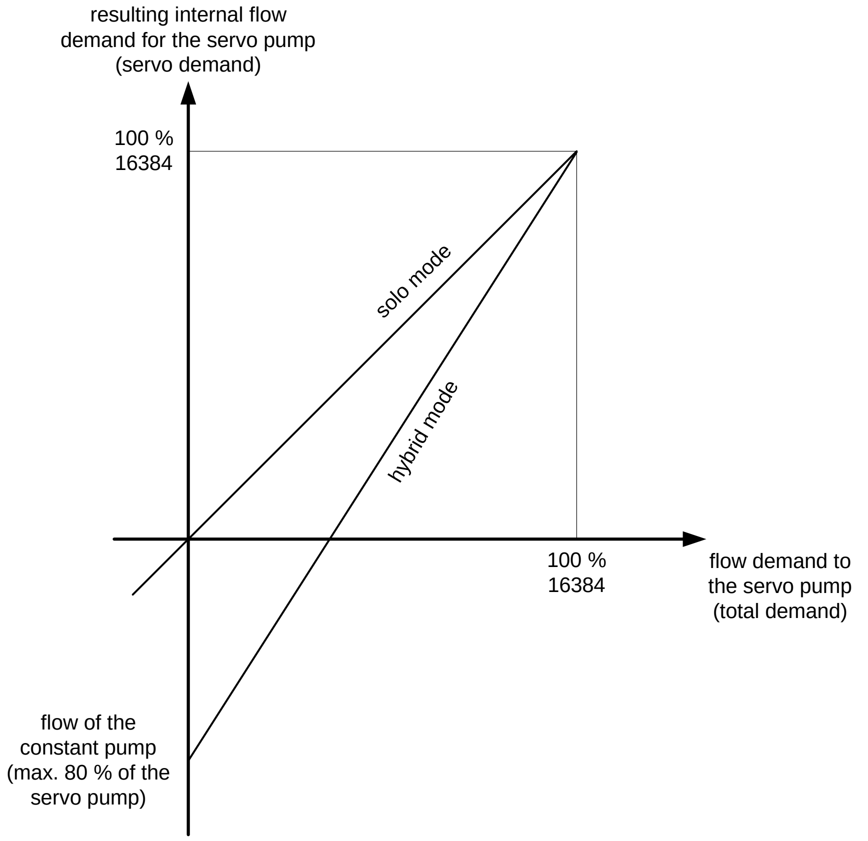


Figure 23: Transfer behavior hybrid mode / solo mode

Enabling hybrid operation

The hybrid mode is selected through the parameter <Mode> (0x2148). Writing the value 1 to the parameter activates the hybrid mode. 0 means hybrid mode is deactivated. The hybrid mode can be activated/deactivated for every parameter set by writing the corresponding value (0 or 1) to the subindexes (1…16) of 0x2148.

Description of parameter set switching:
⇨ Chapter "7.3 Analog parameter set switching", page 105

7.1.2.7.1 Object 0x2147: Hybrid flow

This parameter holds the flow of the hybrid pump (constant pump). The unit is relative to the nominal flow of the servo pump.

Example:
The servo pump has a nominal flow of 140 l/min. This corresponds to a set signal of 16384. The constant pump has a flow of 80 l/min. On the scale of the servo pump this corresponds to:

$$16384 \times \frac{80}{140} = 9362.3$$

AnalogParameterSetSwitching							
Index	Subindex	Name	Data type	Access	Persistence	Value range	Default
0x2147	0	HybridFlow	INT16	rw	Y	INT16	DSV

7.1.3 Pressure demand value generator

The pressure demand value generator comprises the following functions:

- Limit - limits the demand signal
  ⇨ Chapter "7.1.3.3 Limit function", page 68
- Scale - multiplies the set signal by a definable slope
  ⇨ Chapter "7.1.3.4 Scaling", page 69
- Ramp - limits the rate at which the input signal changes
  ⇨ Chapter "7.1.3.5 Ramp", page 70

The following figure shows the inner structure of the pressure demand value generator with the implemented functions.

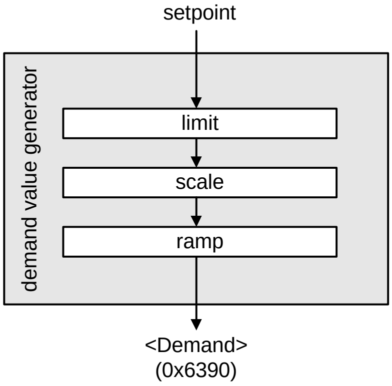


Figure 24: Pressure demand value generator

Detailed description of the signal flow of the demand signal and the parameters influencing this behavior:
⇨ Chapter "6.2 Command value path", page 39

Forwarding the demand value to the controller
The pressure demand value (0x6390) is forwarded to the pressure controller in the control modes 3, 4 and 5.
⇨ Chapter "7.2.1.1 Object 0x6043: Control mode", page 76

7.1.3.1 Object 0x6390: Demand value

The demand value indicated by this parameter is generated from the setpoint by means of the functions in the demand value generator and forwarded to the pressure controller.

ValvePressureControl_DemandValueGenerator							
Index	Subindex	Name	Data type	Access	Persis-tence	Value range	Default
0x6390	1	Demand	INT16	ro	N	INT16	None
0x6390	2	Unit	UINT8	ro	N	UINT8	0
0x6390	3	Prefix	INT8	ro	N	INT8	0

⇨ Chapter "1.6.2 Definition of unit and prefix", page 5

7.1.3.2 Object 0x6391: Reference value

The reference value is the value that corresponds to 100 % of the setpoint.

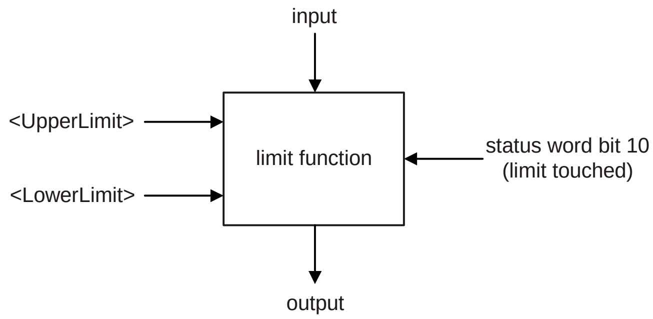
ValvePressureControl_DemandValueGenerator							
Index	Subindex	Name	Data type	Access	Persis-tence	Value range	Default
0x6391	1	ReferenceValue	INT16	rw	N	0…32767	DSV
0x6391	2	Unit	UINT8	ro	N	UINT8	78
0x6391	3	Prefix	INT8	ro	N	INT8	0

⇨ Chapter "1.6.2 Definition of unit and prefix", page 5

7.1.3.3 Limit function

This function limits the value range of the input signal. The limit is defined by setting the upper limit and lower limit parameters.

Bit 10 of the status word indicates whether the input signal is being limited or not.
⇨ Chapter "5.3.5 Object 0x6041: Status word", page 29



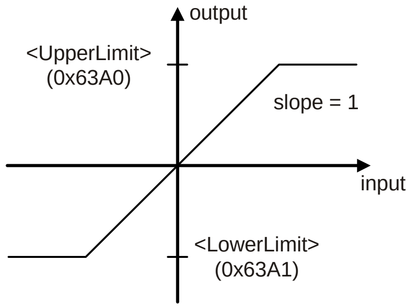


Figure 25: Limit function

ValvePressureControl_DemandValueGenerator_Limit							
Index	Subindex	Name	Data type	Access	Persis-tence	Value range	Default
0x63A0	1	UpperLimit	INT16	rw	Y	<LowerLimit>…32767	16384
0x63A0	2	Unit	UINT8	ro	N	UINT8	0
0x63A0	3	Prefix	INT8	ro	N	INT8	0
0x63A1	1	LowerLimit	INT16	rw	Y	-32768…<UpperLimit>	-16384
0x63A1	2	Unit	UINT8	ro	N	UINT8	0
0x63A1	3	Prefix	INT8	ro	N	INT8	0

⇨ Chapter "1.6.2 Definition of unit and prefix", page 5

ⓘ The <LowerLimit> value cannot be greater than the <UpperLimit> value.

Status (limit reached)
The status is used to indicate whether the input signal is being limited. This information is mapped to the status word bit 10.

Status	Meaning
0	Input signal not limited
1	Input signal limited

Table 47: Definition of the limit value status

7.1.3.4 Scaling

This function is used to scale the pressure setpoint, i.e., to influence the input signal's value range. The output signal is derived from an offset and the multiplication of the input signal with a factor (sets the signal's slope) according to the following function:

$$\text{output} = (\text{input} \times \text{Factor}) + \text{Offset}$$

$$\text{Factor} = \frac{\text{numerator}}{\text{denominator}}$$

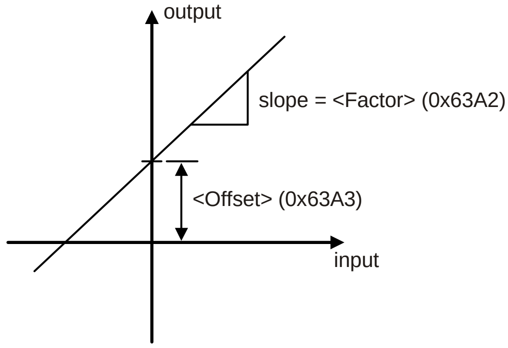


Figure 26: Scaling function

ValvePressureControl_DemandValueGenerator_Scaling							
Index	Subindex	Name	Data type	Access	Persis-tence	Value range	Default
0x63A2	0	Factor	UINT32	rw	Y	UINT32	0x00010001
0x63A3	1	Offset	INT16	rw	Y	INT16	0
0x63A3	2	Unit	UINT8	ro	N	UINT8	0
0x63A3	3	Prefix	INT8	ro	N	INT8	0

⇨ Chapter "1.6.2 Definition of unit and prefix", page 5

<Factor>
Factor by which the input is multiplied. It is calculated from a numerator (upper 16 bits of the parameter) and a denominator (lower 16 bits of the parameter).

Bit	**31 16**	**15 0**
Meaning	Numerator	Denominator

Table 48: Data structure of the scaling factor

The default value 0x00010001 corresponds to the factor 1.

<Offset>
The offset is added to the scaled input value.

7.1.3.5 Ramp

The ramp function limits the rate at which the input signal changes. The type parameter is used to activate a one-quadrant, two-quadrant or four-quadrant ramp or to deactivate the ramp function.

Whether the ramping function is running is indicated by the status word bit 9. Bit 15 of the status word is set, if the ramp function was stopped.

Status word bit 9
Bit 9 = 1: If ramp input is limited.

Status word bit 15
Bit 15 = 1: The output of the ramp is held.

Description of the status word:
⇨ Chapter "5.3.5 Object 0x6041: Status word", page 29

Control word bit 15
Whether the output of the ramp is to be frozen is set with the control word bit 15.
Control word bit 15 = 1: Ramp output frozen.

Description of the control word:
⇨ Chapter "5.3.1 Object 0x6040: Control word", page 27

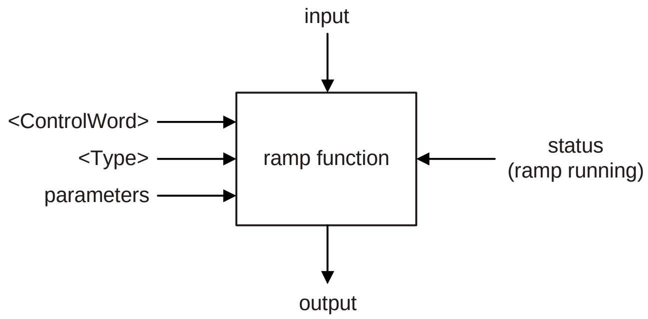


Figure 27: Ramp function

ValvePressureControl_DemandValueGenerator_Ramp							
Index	Subindex	Name	Data type	Access	Persis-tence	Value range	Default
0x63B0	0	Type	INT8	rw	Y	0…3	0

<Type>
This parameter defines the progression of the ramp.

<Type>	Meaning
0	Ramp deactivated
1	Linear (ramping time the same for all quadrants) ⇨ Chapter "7.1.3.5.1 Ramp type 1 - one-quadrant ramp", page 71
2	Linear (ramping times for acceleration and deceleration) ⇨ Chapter "7.1.3.5.2 Ramp type 2 - two-quadrant ramp", page 72
3	Linear (ramping times for acceleration and deceleration, separated for positive and negative sides) ⇨ Chapter "7.1.3.5.3 Ramp type 3 - four-quadrant ramp", page 73

Table 49: Possible ramp type values

Status (ramp running)
The status indicates a ramp that is running. This information is mapped to the corresponding bit in the status word.
⇨ Chapter "5.3.5 Object 0x6041: Status word", page 29

Status	Meaning
0	The ramping function is deactivated or the ramping function does not influence the output signal.
1	The ramping function influences the output signal.

Table 50: Ramp status indicated in the status word

7.1.3.5.1 Ramp type 1 - one-quadrant ramp

This function limits the input signal's rate of change to a definable acceleration time.

Activated with ramp type (0x63B0) = 1.
⇨ Chapter "7.1.3.5 Ramp", page 70

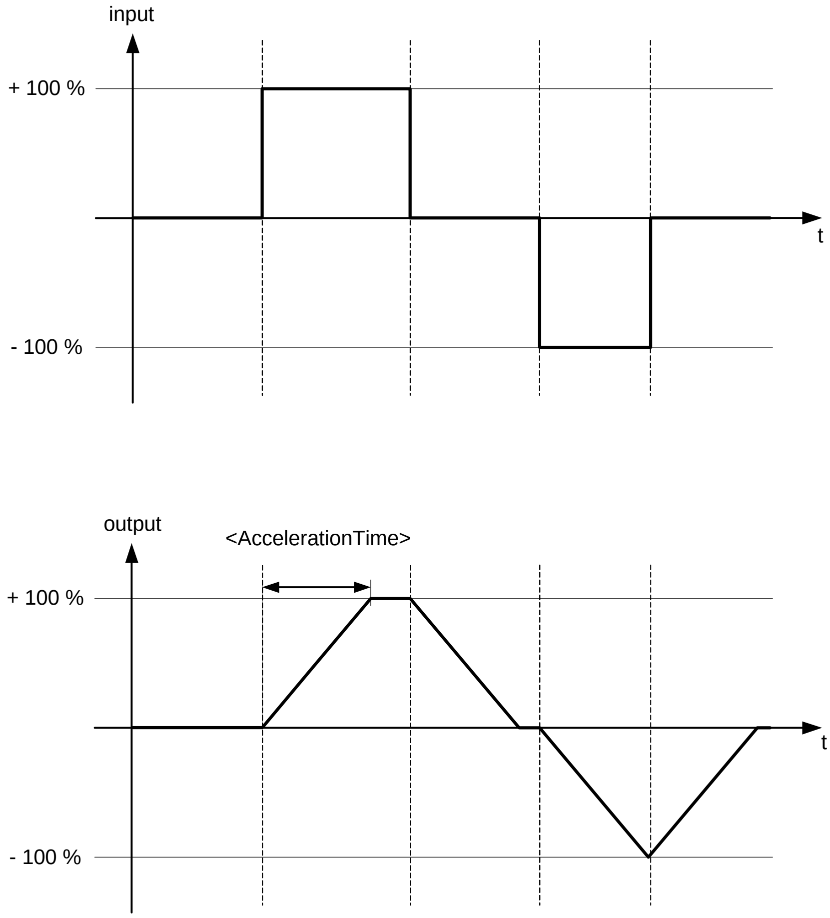


Figure 28: Ramp type 1

ValvePressureControl_DemandValueGenerator_Ramp							
Index	Subindex	Name	Data type	Access	Persis-tence	Value range	Default
0x63B1	1	AccelerationTime	UINT16	rw	Y	UINT16	0
0x63B1	2	Unit	UINT8	ro	N	UINT8	3
0x63B1	3	AccelerationTime_Prefix	INT8	rw	Y	-4…0	-3

⇨ Chapter "1.6.2 Definition of unit and prefix", page 5

<AccelerationTime>
This parameter defines the output signal's maximum rate of change. The acceleration time corresponds to the time that the signal needs for a change of 0 to 100 % as shown in the figure above.
The acceleration time can be specified in seconds with the gradation 1 s, 100 ms, 10 ms, 1 ms.

7.1.3.5.2 Ramp type 2 - two-quadrant ramp

This function limits the input signal's rate of change to an acceleration time and a deceleration time.

Activated with ramp type (0x63B0) = 2.
⇨ Chapter "7.1.3.5 Ramp", page 70

Description of the acceleration time parameter:
⇨ Chapter "7.1.3.5.1 Ramp type 1 - one-quadrant ramp", page 71

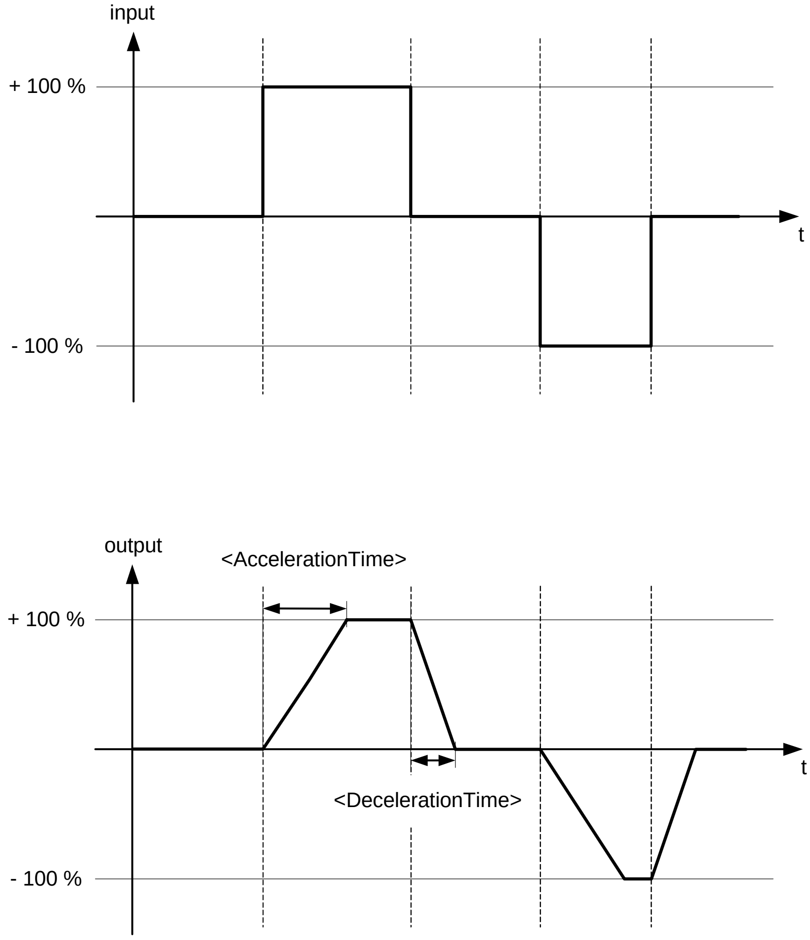


Figure 29: Ramp type 2

ValvePressureControl_DemandValueGenerator_Ramp							
Index	Subindex	Name	Data type	Access	Persis-tence	Value range	Default
0x63B4	1	DecelerationTime	UINT16	rw	Y	UINT16	0
0x63B4	2	Unit	UINT8	ro	N	UINT8	3
0x63B4	3	DecelerationTime_Prefix	INT8	rw	Y	-4…0	-3

⇨ Chapter "1.6.2 Definition of unit and prefix", page 5

<DecelerationTime>
This parameter defines the output signal's maximum rate of change. The deceleration time corresponds to the time that the signal needs for a change of 100 to 0 %.
The deceleration time can be specified in seconds with the gradation 1 s, 100 ms, 10 ms, 1 ms.

7.1.3.5.3 Ramp type 3 - four-quadrant ramp

This function limits the input signal's rate of change to an acceleration time and a deceleration time, each separated for the positive and negative sides.

Activated with ramp type (0x63B0) = 3.
⇨ Chapter "7.1.3.5 Ramp", page 70

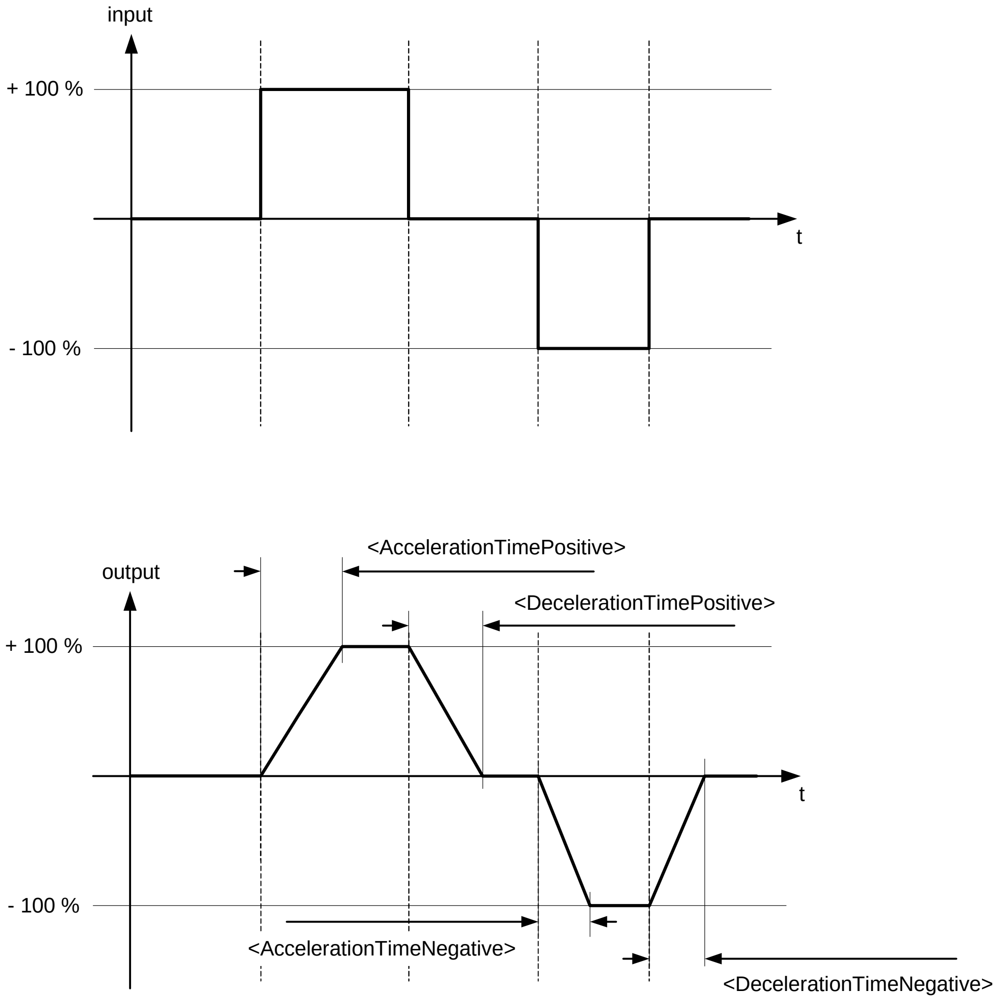


Figure 30: Ramp type 3

ValvePressureControl_DemandValueGenerator_Ramp							
Index	Subindex	Name	Data type	Access	Persis-tence	Value range	Default
0x63B2	1	AccelerationTimePositive	UINT16	rw	Y	UINT16	0
0x63B2	2	Unit	UINT8	ro	N	UINT8	3
0x63B2	3	AccelerationTimePositive_Prefix	INT8	rw	Y	-4…0	-3
0x63B3	1	AccelerationTimeNegative	UINT16	rw	Y	UINT16	0
0x63B3	2	Unit	UINT8	ro	N	UINT8	3
0x63B3	3	AccelerationTimeNegative_Prefix	INT8	rw	Y	-4…0	-3
0x63B5	1	DecelerationTimePositive	UINT16	rw	Y	UINT16	0
0x63B5	2	Unit	UINT8	ro	N	UINT8	3
0x63B5	3	DecelerationTimePositive_Prefix	INT8	rw	Y	-4…0	-3
0x63B6	1	DecelerationTimeNegative	UINT16	rw	Y	UINT16	0
0x63B6	2	Unit	UINT8	ro	N	UINT8	3
0x63B6	3	DecelerationTimeNegative_Prefix	INT8	rw	Y	-4…0	-3

⇨ Chapter "1.6.2 Definition of unit and prefix", page 5

<AccelerationTimePositive>
This parameter defines the output signal's maximum rate of change on the positive side. The acceleration time corresponds to the time that the signal needs for a change of 0 to 100 %.
The acceleration time can be specified in seconds with the gradation 1 s, 100 ms, 10 ms, 1 ms.

<DecelerationTimePositive>
This parameter defines the output signal's maximum rate of change on the positive side. The deceleration time corresponds to the time that the signal needs for a change of 100 to 0 %.
The deceleration time can be specified in seconds with the gradation 1 s, 100 ms, 10 ms, 1 ms.

<AccelerationTimeNegative>
This parameter defines the output signal's maximum rate of change on the negative side. The acceleration time corresponds to the time that the signal needs for a change of 0 to 100 %.
The acceleration time can be specified in seconds with the gradation 1 s, 100 ms, 10 ms, 1 ms.

<DecelerationTimeNegative>
This parameter defines the output signal's maximum rate of change on the negative side. The deceleration time corresponds to the time that the signal needs for a change of 100 to 0 %.
The deceleration time can be specified in seconds with the gradation 1 s, 100 ms, 10 ms, 1 ms.

7.2 Controller

7.2.1 Control modes

Control mode switching

The device can be run in the following control modes. The control mode of the device is set with the parameter <ControlMode> (0x6043).

- Control position open loop
  ⇨ Chapter "7.2.3 Control position open loop", page 80
- Control position control closed loop
  ⇨ Chapter "7.2.4 Control position closed loop", page 81
- Pressure control open loop
  ⇨ Chapter "7.2.5 Pressure control open loop", page 83
- Pressure control closed loop
  ⇨ Chapter "7.2.6 Pressure control closed loop", page 85
- p/Q control
  ⇨ Chapter "7.2.7 p/Q closed loop", page 93

Power limitation

The control modes 2, 3, 4 and 5 work parallel to the power limitation.
⇨ Figure 39, page 94

If the power limitation is active (enabled with control word bit 11), then the lowest controller output is forwarded to the pump.

Description of the power limitation function:
⇨ Chapter "7.2.8 Power limitation", page 95

Description of the control word:
⇨ Chapter "5.3.1 Object 0x6040: Control word", page 27

7.2.1.1 Object 0x6043: Control mode

With this parameter the device's control mode is indicated or switched. Depending on this setting, the device will execute the control functions that are supported by the device.

Which control modes are available for the used device is defined by the device's capability which can be indicated using the <Capability> parameter.
⇨ Chapter "4.1.14 Object 0x605F: Capability", page 21

Device							
Index	Subindex	Name	Data type	Access	Persis-tence	Value range	Default
0x6043	0	ControlMode	INT8	rw	N	1…5	<ControlModeDefault>

Values description

<ControlMode>	**Meaning**
1	Control position open loop ⇨ Chapter "7.2.3 Control position open loop", page 80
2	Control position closed loop ⇨ Chapter "7.2.4 Control position closed loop", page 81
3	Pressure control open loop ⇨ Chapter "7.2.5 Pressure control open loop", page 83
4	Pressure control closed loop ⇨ Chapter "7.2.6 Pressure control closed loop", page 85
5	p/Q closed loop ⇨ Chapter "7.2.7 p/Q closed loop", page 93
-128…0	Reserved
6…127	Reserved

Table 51: Control mode values

7.2.1.2 Object 0x4043: Control mode default

This parameter behaves the same way as the parameter <DeviceModeDefault>. It can be used to save the set control mode on the device.
⇨ Chapter "6.2.1.8 Object 0x4042: Device mode default", page 45

Device							
Index	Subindex	Name	Data type	Access	Persis-tence	Value range	Default
0x4043	0	ControlModeDefault	INT8	rw	Y	1…5	DSV

Description on how to restore the factory default values:
⇨ Chapter "9 Storing / restoring parameters", page 131

7.2.2 Monitoring

The deviation monitoring is only active if the associated controller is active. In p/Q mode the executed deviation monitoring depends on the active controller. Whether p or Q is active, is shown by the bit 8 from the status word.
⇨ Chapter "5.3.5 Object 0x6041: Status word", page 29

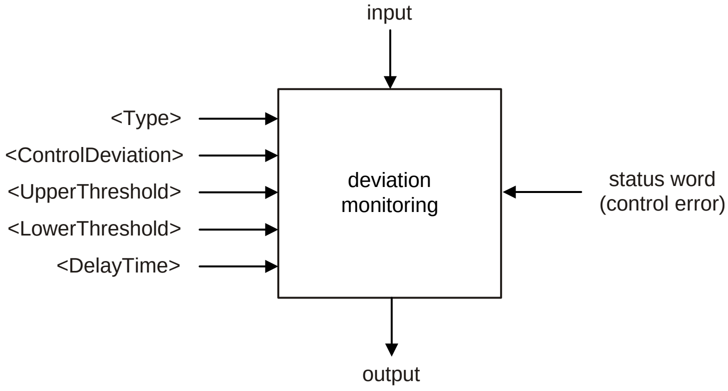


Figure 31: Deviation monitoring

The tolerance band is set by means of upper and lower thresholds (defined with parameters <UpperTreshold> and <LowerTreshold>).

If the control deviation (stored to parameter <ControlDeviation>) is outside the tolerance band for the duration of the delay time (set with parameter <DelayTime>), then the control error will be set to 1 (indicated by the status word bit 11). If the control deviation lies within the tolerance band, the value will be set immediately to 0 as shown in the following figure.

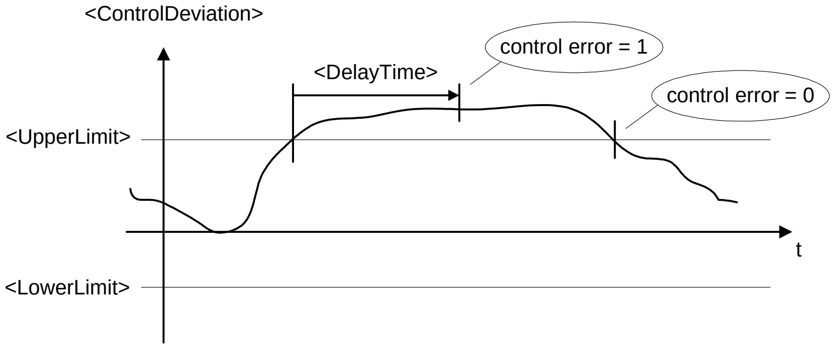


Figure 32: Monitoring the control deviation's tolerance band

Enabling control monitoring

The parameter <Type> is used to activate the standard control monitoring function or to switch off control monitoring.

Status (control error)

Whether a controller fault is pending, is indicated by the status word bit 11. If a controller fault is detected, this bit is set to 1. The bit is set to 0, if no control fault is pending or the control monitoring function is deactivated.
⇨ Chapter "5.3.5 Object 0x6041: Status word", page 29

Status word bit 11	Meaning
0	No control fault detected or control monitoring is deactivated.
1	Control fault detected.

Table 52: Control deviation indicated in status word

7.2.2.1 Stroke ring control monitoring

7.2.2.1.1 Deviation monitoring

ValvePositionControl_ControlMonitoring							
Index	Subindex	Name	Data type	Access	Persistence	Value range	Default
0x6350	1	ControlDeviation	INT16	ro	N	INT16	None
0x6350	2	Unit	UINT8	ro	N	UINT8	0
0x6350	3	Prefix	INT8	ro	N	INT8	0
0x6351	0	Type	INT8	rw	Y	0…1	0
0x6352	1	DelayTime	UINT16	rw	Y	UINT16	DSV
0x6352	2	Unit	UINT8	ro	N	UINT8	3
0x6352	3	Prefix	INT8	ro	N	INT8	-3
0x6354	1	UpperThreshold	INT16	rw	Y	INT16	DSV
0x6354	2	Unit	UINT8	ro	N	UINT8	0
0x6354	3	Prefix	INT8	ro	N	INT8	0
0x6355	1	LowerThreshold	INT16	rw	Y	INT16	DSV
0x6355	2	Unit	UINT8	ro	N	UINT8	0
0x6355	3	Prefix	INT8	ro	N	INT8	0

⇨ Chapter "1.6.2 Definition of unit and prefix", page 5

<ControlDeviation>
The value of this parameter corresponds to the difference between the position demand value (0x6310) and the position actual value (0x6301).
⇨ Chapter "7.1.2.1 Object 0x6310: Demand value", page 56
⇨ Chapter "6.3.1.1 Object 0x6301: Actual position value", page 46

<Type>
This parameter is used to select the control monitoring type or to turn off the control monitoring.

Values description

<Type>	**Meaning**
0	No control monitoring
1	Standard control monitoring (upper and lower thresholds)
2…127	Reserved
-128…-1	Reserved

Table 53: Control monitoring types

<DelayTime>
The delay time defines the minimal duration of a control deviation after which a fault will be displayed.

<UpperThreshold>
This parameter defines the upper threshold of the control deviation's tolerance band.

<LowerThreshold>
This parameter defines the upper threshold of the control deviation's tolerance band.

ⓘ The <LowerThreshold> value cannot be greater than the <UpperThreshold> value.

7.2.2.2 Pressure control monitoring

ValvePressureControl_ControlMonitoring							
Index	Subindex	Name	Data type	Access	Persistence	Value range	Default
0x63D0	1	ControlDeviation	INT16	ro	N	INT16	None
0x63D0	2	Unit	UINT8	ro	N	UINT8	0
0x63D0	3	Prefix	INT8	ro	N	INT8	0
0x63D1	0	Type	INT8	rw	Y	0…1	DSV
0x63D2	1	DelayTime	UINT16	rw	Y	UINT16	DSV
0x63D2	2	Unit	UINT8	ro	N	UINT8	3
0x63D2	3	Prefix	INT8	ro	N	INT8	-3
0x63D4	1	UpperThreshold	INT16	rw	Y	INT16	DSV
0x63D4	2	Unit	UINT8	ro	N	UINT8	0
0x63D4	3	Prefix	INT8	ro	N	INT8	0
0x63D5	1	LowerThreshold	INT16	rw	Y	INT16	DSV
0x63D5	2	Unit	UINT8	ro	N	UINT8	0
0x63D5	3	Prefix	INT8	ro	N	INT8	0

⇨ Chapter "1.6.2 Definition of unit and prefix", page 5

<ControlDeviation>
The value of this parameter corresponds to the difference between the pressure demand value (0x6390) and the pressure actual value (0x6381).
⇨ Chapter "7.1.3.1 Object 0x6390: Demand value", page 67
⇨ Chapter "6.3.2.2 Object 0x6381: Actual pressure value", page 48

<Type>
This parameter is used to select the control monitoring type or to turn off the control monitoring.

Values description

<Type>	**Meaning**
0	No control monitoring
1	Standard control monitoring (upper and lower thresholds)
2…127	Reserved
-128…-1	Reserved

Table 54: Control monitoring types

<DelayTime>
The delay time defines the minimal duration of a control deviation after which a fault will be displayed.

<UpperThreshold>
This parameter defines the upper threshold of the control deviation’s tolerance band.

<LowerThreshold>
This parameter defines the upper threshold of the control deviation’s tolerance band.

ⓘ The <LowerThreshold> value cannot be greater than the <UpperThreshold> value.

7.2.3 Control position open loop

In the position open loop mode (control mode = 1), the demand value is directly passed to the pump block as shown in figure 33.

ⓘ This control type is meant to be used only for start-up or diagnostic purposes.

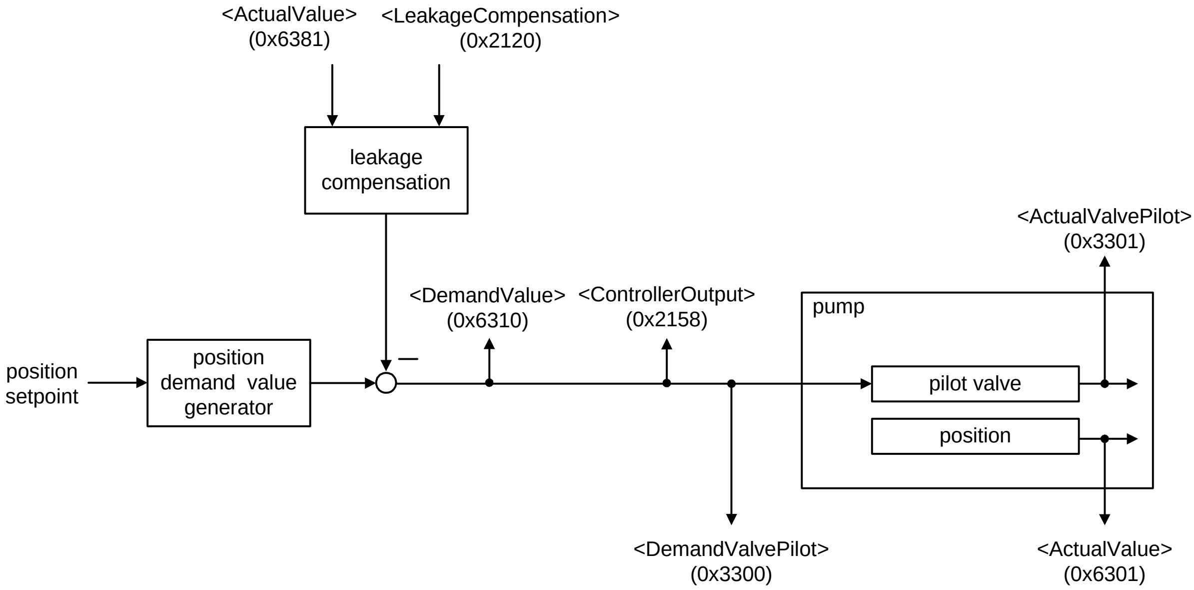


Figure 33: Control position open loop

7.2.3.1 Object 0x3300: Demand valve pilot

This parameter holds the positioning command for the valve piston.

ValvePositionControl							
Index	Subindex	Name	Data type	Access	Persis-tence	Value range	Default
0x3300	0	DemandValvePilot	INT16	ro	N	INT16	None

7.2.3.2 Object 0x3301: Actual valve pilot

This parameter indicates the actual position of the valve piston.

ValvePositionControl							
Index	Subindex	Name	Data type	Access	Persis-tence	Value range	Default
0x3301	0	ActualValvePilot	INT16	ro	N	INT16	None

7.2.4 Control position closed loop

In the position closed loop mode (control mode = 2), position is controlled.

ⓘ The parameters for the position controller are factory set and cannot be changed.

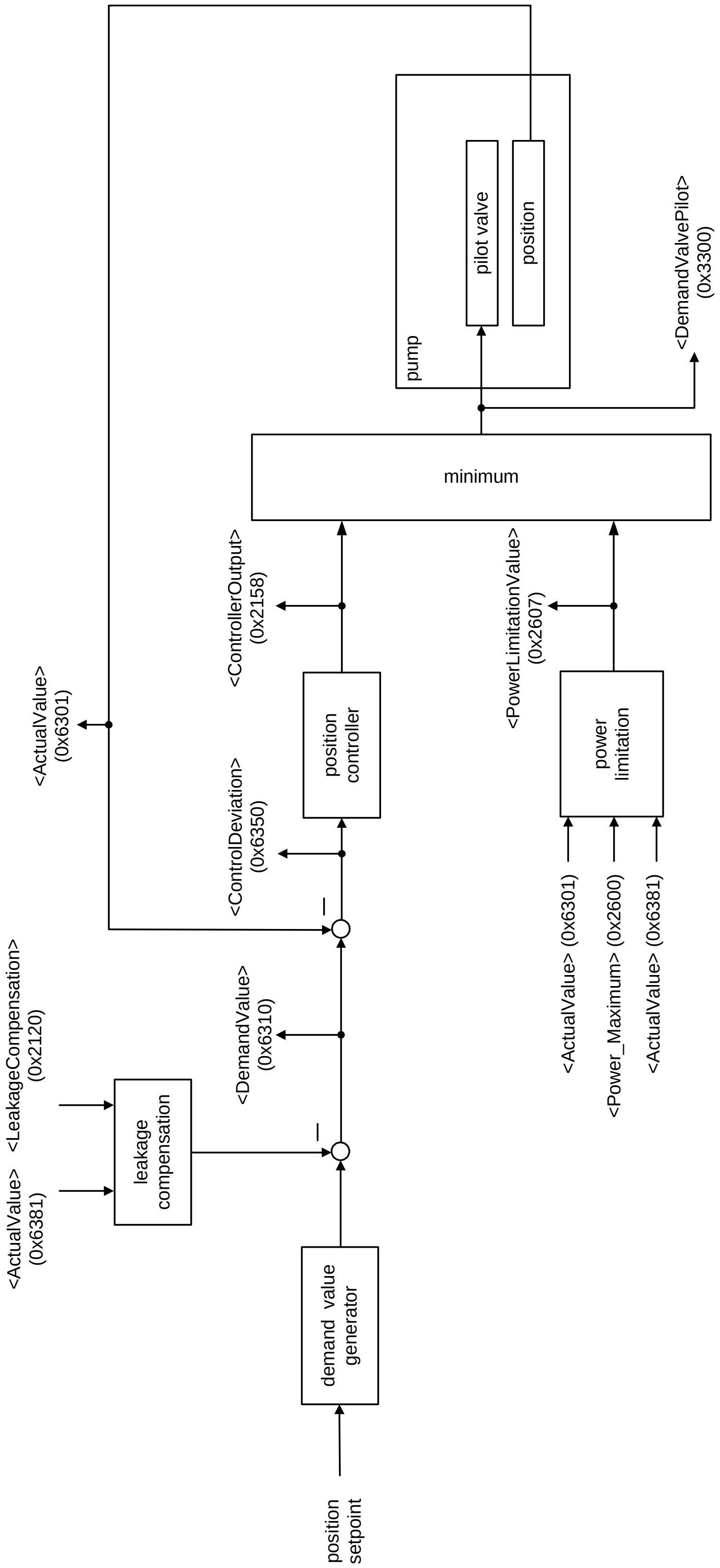


Figure 34: Control position closed loop

Setpoint source selection
Which setpoint is forwarded to the demand value generator depends on the set device mode (0x6042) and the status of the device which is controlled using the control word (<ControlWord>, 0x6040 or <LocalControl-Word>, 0x4040).
Description of the command value path and the parameters influencing this behavior:
⇨ Chapter "6.2 Command value path", page 39

Leakage compensation
The leakage compensation ensures a constant flow in case of varying pressure.
⇨ Chapter "7.2.4.1 Leakage compensation", page 82

Power limitation
Detailed information on the power limitation:
⇨ Chapter "7.2.8 Power limitation", page 95

7.2.4.1 Leakage compensation

Background
As the pressure increases, a hydraulic system will produce increasing internal leakage that will be missing from the usable volume flow that should be normally generated by the pump. The pump electronics contain a leakage-compensation to cancel out this effect.

The leakage value set with the parameter <LeakageCompensation> (0x2120) expresses how much leakage the pump has depending on the supply pressure. The unit is %eccentricity/bar.
⇨ Chapter "7.2.4.1.1 Object 0x2120: Leakage compensation", page 83

Affected values (parameters)
The leakage compensation affects the demand value to the position controller as shown in the following fig-ure.

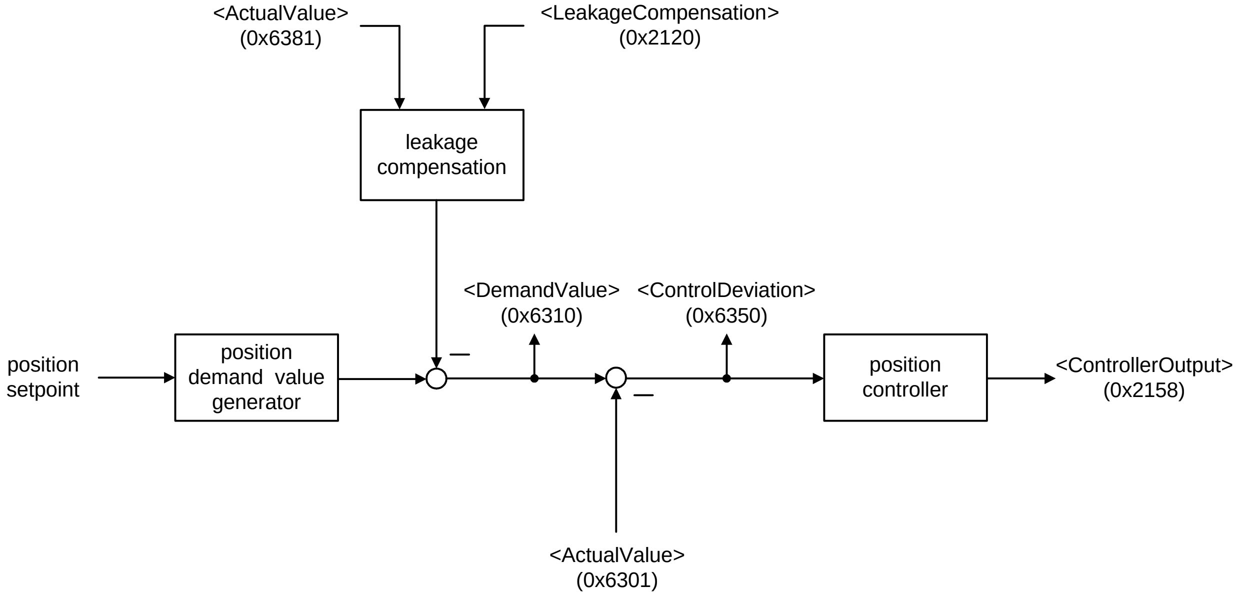


Figure 35: Leakage compensation

Enabling of the leakage compensation function
The leakage compensation function is switched on and off with the bit 10 in the control word. If bit 10 is set to true, leakage compensation is enabled.
⇨ Chapter "5.3.1 Object 0x6040: Control word", page 27

7.2.4.1.1 Object 0x2120: Leakage compensation

This parameter is used to set the leakage compensation value as described in the previous section. The unit of the leakage compensation is %eccentricity/bar.

PumpController							
Index	Subindex	Name	Data type	Access	Persis-tence	Value range	Default
0x2120	0	LeakageCompensation	FLOAT32	rw	Y	FLOAT32	DSV

7.2.5 Pressure control open loop

In the pressure open loop mode (control mode = 3), the behavior is the same as in control position closed loop. The pressure demand value is handed to the position controller. The power limitation is located parallel to the position controller and can be active.

ⓘ This control type is meant to be used only for start-up or diagnostic purposes.

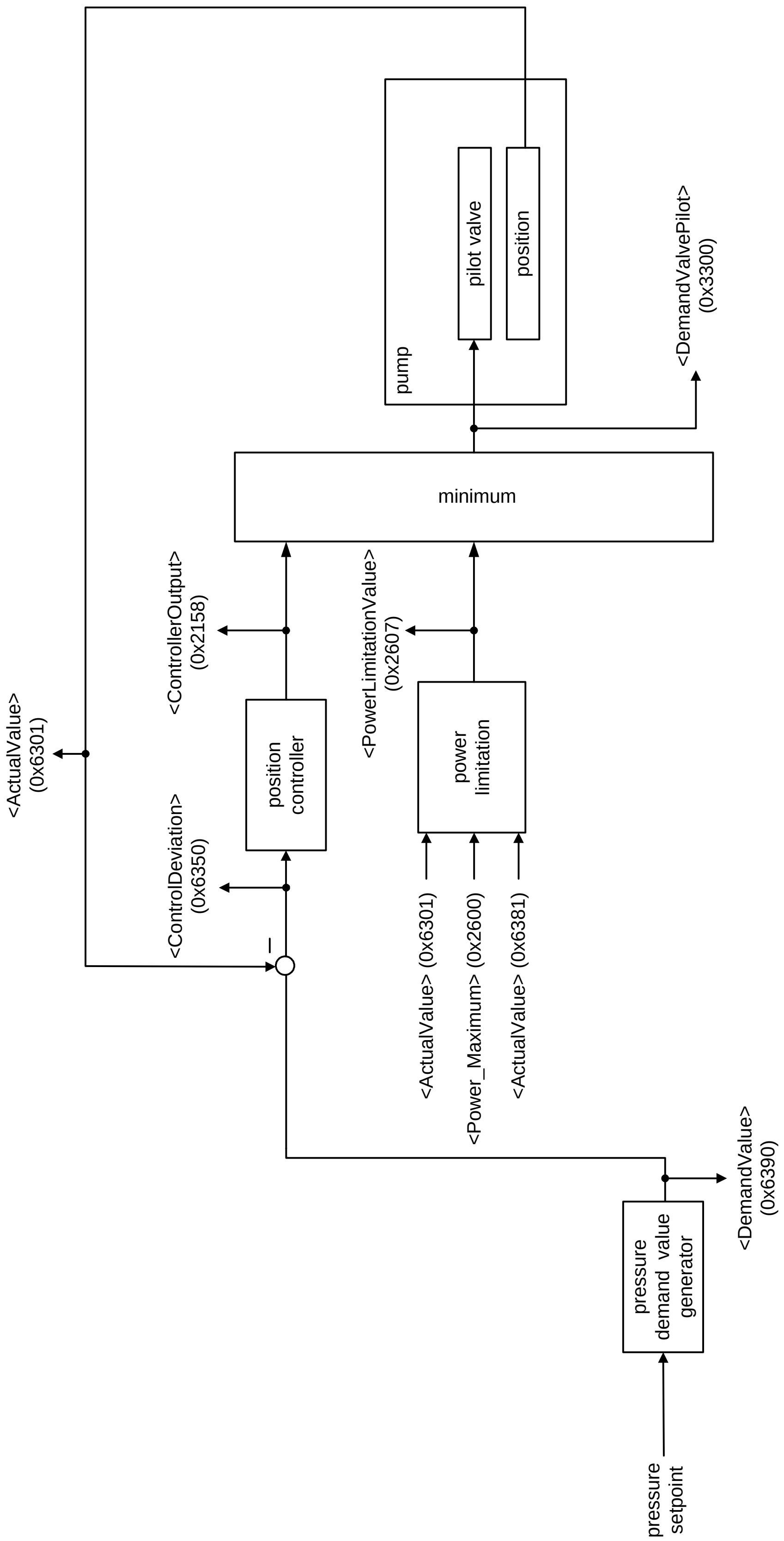


Figure 36: Pressure control open loop

Description of the power limitation function:
⇨ Chapter "7.2.8 Power limitation", page 95

7.2.6 Pressure control closed loop

In the pressure control closed loop mode (control mode = 4), the setpoint signal is converted by the demand value generator into a corresponding demand value and forwarded to the subsidiary controller.

The actual pressure value is fed back to the controller by way of the pressure sensor where the pressure signal can be chosen from the internal pressure sensor or from the 5 analog inputs (the source of the pressure signal is selected with the parameter <PressureControllerActiveTransducerInterface>.
⇨ Chapter "6.3.3.2 Object 0x230D: Pressure controller active transducer interface", page 52

The deviation between the provided pressure setpoint and the measured actual pressure is compensated by calculating a set signal and providing it to the pilot valve as a demand value.
⇨ Chapter "7.1.3 Pressure demand value generator", page 66

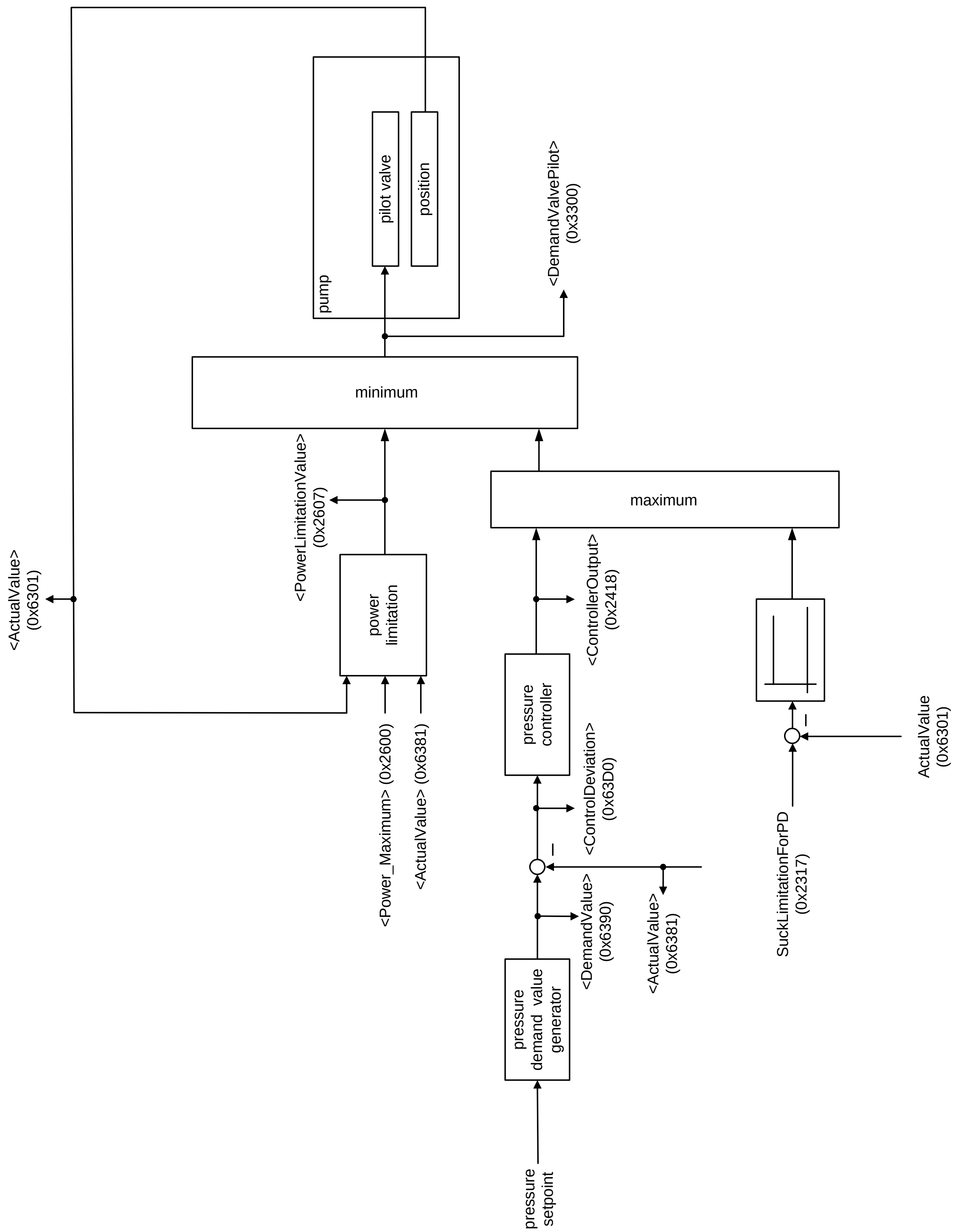


Figure 37: Pressure control closed loop

Setpoint source selection
Which setpoint is forwarded to the demand value generator depends on the set device mode (0x6042) and the status of the device which is controlled using the control word (<ControlWord>, 0x6040 or <LocalControlWord>, 0x4040).

Detailed description of the signal flow of the demand signal and the parameters influencing this behavior:
⇨ Chapter "6.2 Command value path", page 39

Suck limitation
The suck limitation function ensures a minimum flow of the pump. By means of the parameter <SuckLimitationForPD> (0x2317) the minimum position is specified in case of pressure control.
⇨ Chapter "7.2.6.2.7 Object 0x2317: Suck limitation", page 91

Power limitation
Detailed information on the power limitation:
⇨ Chapter "7.2.8 Power limitation", page 95

7.2.6.1 Controller structure

PIDT1 controller
The basic pressure controller structure corresponds to a PIDT1 controller; however, unlike a PIDT1 controller, the DT1 partition is derived not from the control deviation but from the actual pressure value.
⇨ Figure 38, page 88

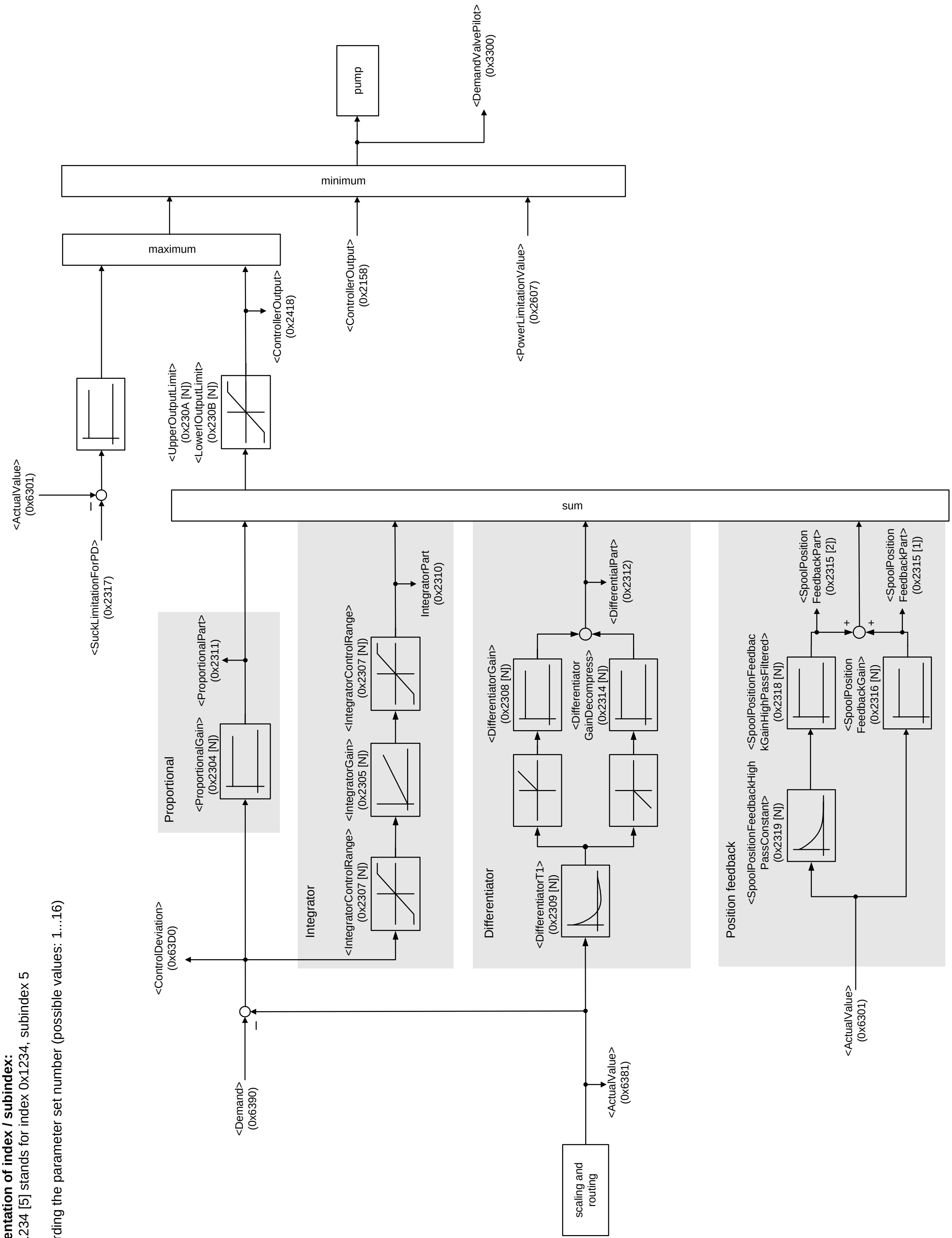
Integrator
The integration range is limited by the parameter <IntegratorControlRange> (0x2307). The integrator gain is set by the parameter <IntegratorGain> (0x2305). The output of the integrator can be accessed through the parameter <IntegratorPart> (0x2310).
⇨ Chapter "7.2.6.2.2 Objects 0x2305 / 0x2307 / 0x2310: Integrator", page 89

Differentiator
The gain of the pressure differentiator can be adjusted separately in both directions using the parameters <DifferentiatorGain> (0x2308) and <DifferentiatorGainDecompress> (0x2314).
⇨ Chapter "7.2.6.2.4 Objects 0x2308 / 0x2309 / 0x2312 / 0x2314: Differentiator", page 90

Position
The negative stroke ring position and the velocity can be limited using the parameters <SpoolPositionFeedbackGain> (0x2316), <SpoolPositionFeedbackGainHighPassFiltered> (0x2318) and <SpoolPositionFeedbackHighPassTimeConstant> (0x2319).
⇨ Chapter "7.2.6.2.6 Objects 0x2315 - 0x2316 / 0x2318 - 0x2319: Position feedback", page 91

Controller parameter sets
Sixteen predefined parameter sets with different controller settings are available. These allow a simple and fast change over to various controller settings in real-time.

The selection of the controller parameter set can be done via the CAN bus (parameter <ActiveParameterSetNumber>, 0x2350) or by using the analog parameter set switching function. This function allows to select the desired controller parameter set via one of the analog inputs.
⇨ Chapter "7.2.6.3 Object 0x2350: Active parameter set number", page 92



Representation of index / subindex:
E.g. 0x1234 [5] stands for index 0x1234, subindex 5

N: according the parameter set number (possible values: 1...16)

Figure 38: Pressure controller structure

7.2.6.2 Controller parameters

The controller parameters described in the following chapters are used to set the behavior of the pressure controller. The controller structure in figure 38 shows at which position in the structure the individual parameters act.

Controller parameter sets
Sixteen predefined parameter sets with different controller settings are available which are activated by setting the parameter <ActiveParameterSetNumber> (0x2350) or using the device’s analog inputs.
⇨ Chapter "7.2.6.3 Object 0x2350: Active parameter set number", page 92

7.2.6.2.1 Objects 0x2304 / 0x2311: Proportional gain

<ProportionalGain>
The proportional gain of the pressure controller.
Usual values: 0.5…2

ValvePressureControl							
Index	Subindex	Name	Data type	Access	Persis-tence	Value range	Default
0x2304	1…16	ProportionalGain	FLOAT32	rw	Y	0…+inf	DSV

<ProportionalPart>
The proportional portion of the pressure controller's proportional controller unit. This parameter can be used to observe the behavior of the proportional portion.

ValvePressureControl							
Index	Subindex	Name	Data type	Access	Persis-tence	Value range	Default
0x2311	0	ProportionalPart	FLOAT32	ro	N	FLOAT32	None

7.2.6.2.2 Objects 0x2305 / 0x2307 / 0x2310: Integrator

<IntegratorGain>

ValvePressureControl							
Index	Subindex	Name	Data type	Access	Persis-tence	Value range	Default
0x2305	1…16	IntegratorGain	FLOAT32	rw	Y	0…+inf	DSV

<IntegratorControlRange>
The control range of the pressure controller's integrator. If the pressure-control deviation lies within this range, then the integrator is working with the set integrator gain <IntegratorGain>.
Usual values: 0…163

ValvePressureControl							
Index	Subindex	Name	Data type	Access	Persis-tence	Value range	Default
0x2307	1…16	IntegratorControlRange	INT16	rw	Y	0…32767	DSV

<IntegratorPart>
The integral proportion of the pressure controller's integrator. This parameter can be used to observe the behavior of the integrator.

ValvePressureControl							
Index	Subindex	Name	Data type	Access	Persis-tence	Value range	Default
0x2310	0	IntegratorPart	FLOAT32	ro	N	FLOAT32	None

7.2.6.2.3 Objects 0x230A / 0x230B: Upper/lower output limit

ValvePressureControl							
Index	Subindex	Name	Data type	Access	Persis-tence	Value range	Default
0x230A	1…16	UpperOutputLimit	INT16	rw	Y	<LowerOutputLimit>… 32767	16384
0x230B	1…16	LowerOutputLimit	INT16	rw	Y	-32768… <UpperOutputLimit>	-16384

7.2.6.2.4 Objects 0x2308 / 0x2309 / 0x2312 / 0x2314: Differentiator

<DifferentiatorGain>
The pressure controller's differentiator gain that effects the positive input.
Usual values: 0.01…0.08

ValvePressureControl							
Index	Subindex	Name	Data type	Access	Persis-tence	Value range	Default
0x2308	1…16	DifferentiatorGain	FLOAT32	rw	Y	0…+inf	DSV

<DifferentiatorGainDecompress>
The pressure controller's differentiator gain decompress that effects the negative input.
Usual values: 0.01…0.08

PumpPressureControl							
Index	Subindex	Name	Data type	Access	Persis-tence	Value range	Default
0x2314	1…16	DifferentiatorGainDecompress	FLOAT32	rw	Y	0…+inf	DSV

<DifferentiatorT1>
The time constant of the pressure controller's differentiator in seconds.

ValvePressureControl							
Index	Subindex	Name	Data type	Access	Persis-tence	Value range	Default
0x2309	1…16	DifferentiatorT1	FLOAT32	rw	Y	0…+inf	DSV

<DifferentialPart>
The differentiator portion of the pressure controller's differentiator. This parameter can be used to observe the behavior of the differentiator portion.

ValvePressureControl							
Index	Subindex	Name	Data type	Access	Persis-tence	Value range	Default
0x2312	0	DifferentialPart	FLOAT32	ro	N	FLOAT32	None

7.2.6.2.5 Object 0x2418: Pressure controller output

This parameter indicates the actual pressure controller output value which is forwarded to the position controller.

ValvePressureControl							
Index	Subindex	Name	Data type	Access	Persis-tence	Value range	Default
0x2418	0	ControllerOutput	INT16	ro	N	INT16	None

7.2.6.2.6 Objects 0x2315 - 0x2316 / 0x2318 - 0x2319: Position feedback

Description on how the following parameters act:
⇨ Figure 38, page 88

<SpoolPositionFeedbackPart>

PumpPressureControl							
Index	Subindex	Name	Data type	Access	Persis-tence	Value range	Default
0x2315	1…2	SpoolPositionFeed-backPart	FLOAT32	ro	Y	FLOAT32	None

<SpoolPositionFeedbackGain>

PumpPressureControl							
Index	Subindex	Name	Data type	Access	Persis-tence	Value range	Default
0x2316	1…16	SpoolPositionFeed-backGain	FLOAT32	rw	Y	0…+inf	DSV

<SpoolPositionFeedbackGainHighPassFiltered>

PumpPressureControl							
Index	Subindex	Name	Data type	Access	Persis-tence	Value range	Default
0x2318	1…16	SpoolPositionFeed-backGainHighPassFil-tered	FLOAT32	rw	Y	0…+inf	DSV

<SpoolPositionFeedbackHighPassTimeConstant>

PumpPressureControl							
Index	Subindex	Name	Data type	Access	Persis-tence	Value range	Default
0x2319	1…16	SpoolPositionFeed-backHighPassTimeCon-stant	FLOAT32	rw	Y	0…+inf	DSV

7.2.6.2.7 Object 0x2317: Suck limitation

<SuckLimitationForPD>
This parameter limits the pressure controller output and thus ensures a minimum flow of the pump.

PumpPressureControl							
Index	Subindex	Name	Data type	Access	Persis-tence	Value range	Default
0x2317	1…16	SuckLimitationForPD	INT16	rw	Y	-32768…0	-16384

7.2.6.3 Object 0x2350: Active parameter set number

The pressure controller contains parameters to influence the control behavior. A parameter setup of the pressure controller is called pressure controller parameter set. For the pressure controller 16 parameter sets can be saved. The switching is done by the parameter <ActiveParameterSetNumber> (0x2350).

ValvePressureControl							
Index	Subindex	Name	Data type	Access	Persis-tence	Value range	Default
0x2350	0	ActiveParameterSetNumber	UINT8	rw	Y	1…16	1

The following table shows all pressure controller parameters. The <ActiveParameterSetNumber> (0x2350) sets the subindexes of the controller parameters.

Pressure controller parameter set

Index	**Parameter name**
0x2304	<ProportionalGain> ⇨ Chapter "7.2.6.2.1 Objects 0x2304 / 0x2311: Proportional gain", page 89
0x2305	<IntegratorGain> ⇨ Chapter "7.2.6.2.2 Objects 0x2305 / 0x2307 / 0x2310: Integrator", page 89
0x2307	<IntegratorControlRange> ⇨ Chapter "7.2.6.2.2 Objects 0x2305 / 0x2307 / 0x2310: Integrator", page 89
0x2308	<DifferentiatorGain> ⇨ Chapter "7.2.6.2.4 Objects 0x2308 / 0x2309 / 0x2312 / 0x2314: Differentiator", page 90
0x2309	<DifferentiatorT1> ⇨ Chapter "7.2.6.2.4 Objects 0x2308 / 0x2309 / 0x2312 / 0x2314: Differentiator", page 90
0x230A	<UpperOutputLimit> ⇨ Chapter "7.2.6.2.3 Objects 0x230A / 0x230B: Upper/lower output limit", page 90
0x230B	<LowerOutputLimit> ⇨ Chapter "7.2.6.2.3 Objects 0x230A / 0x230B: Upper/lower output limit", page 90
0x2314	<DifferentiatorGainDecompress> ⇨ Chapter "7.2.6.2.4 Objects 0x2308 / 0x2309 / 0x2312 / 0x2314: Differentiator", page 90
0x2316	<SpoolPositionFeedbackGain> ⇨ Chapter "7.2.6.2.6 Objects 0x2315 - 0x2316 / 0x2318 - 0x2319: Position feedback", page 91
0x2317	<SuckLimitationForPD> ⇨ Chapter "7.2.6.2.7 Object 0x2317: Suck limitation", page 91
0x2318	<SpoolPositionFeedbackGainHighPassFiltered> ⇨ Chapter "7.2.6.2.6 Objects 0x2315 - 0x2316 / 0x2318 - 0x2319: Position feedback", page 91
0x2319	<SpoolPositionFeedbackHighPassTimeConstant> ⇨ Chapter "7.2.6.2.6 Objects 0x2315 - 0x2316 / 0x2318 - 0x2319: Position feedback", page 91

Table 55: Pressure controller parameter set

7.2.7 p/Q closed loop

The p/Q controller (control mode = 5) is a combination of the pressure and volume-flow functions, i.e., it enables regulation of the volume flow resp. pressure.

In the p/Q closed loop, a pressure and a position are provided as a setpoint and the actual pressure (0x6381) and the position (0x6301) are measured.
⇨ Figure 39, page 94

The pressure controller output value (0x2418) is compared with the pump position controller output (0x2158). The lower of these demand values is forwarded to the position controller.

ⓘ The p/Q controller makes the transition between position controller and pressure controller automatically.

Status word bits
There are two status word bits which provide information whether the p/Q control type is active and if a control fault is detected:

- Bit 8 - Pressure controller effective
  This status word bit is set, if, and only if, the p/Q control type is active.
- Bit 11 - Control error
  The control error bit in the status word is formed from the linking of the two controller deviations for pressure and position. If this bit is set, a controller error is detected.

⇨ Chapter "5.3.5 Object 0x6041: Status word", page 29
⇨ Chapter "7.2.2 Monitoring", page 77

Description of the position and pressure controller parameters as well as the control monitoring functions:
⇨ Chapter "7.2.4 Control position closed loop", page 81
⇨ Chapter "7.2.6 Pressure control closed loop", page 85

7.2.7.1 Controller structure

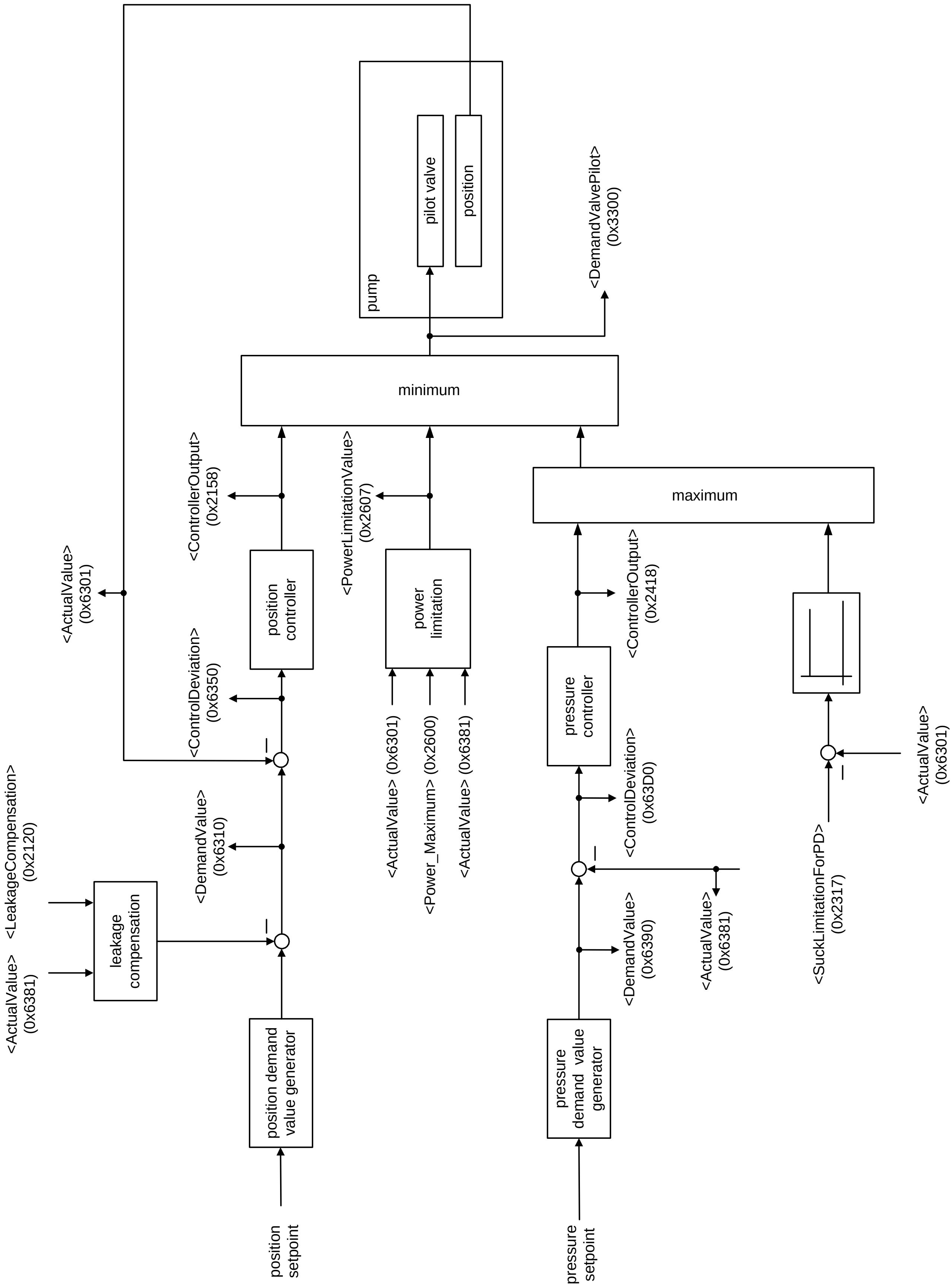


Figure 39: p/Q controller

Leakage compensation
Detailed information on the leakage compensation:
⇨ Chapter "7.2.4.1 Leakage compensation", page 82

Suck limitation
Detailed information on the suck limitation:
⇨ Chapter "7.2.6.2.7 Object 0x2317: Suck limitation", page 91

7.2.7.1.1 Object 0x2158: Controller output

ValveMainStageControl							
Index	Subindex	Name	Data type	Access	Persis-tence	Value range	Default
0x2158	0	ControllerOutput	INT16	ro	N	INT16	None

7.2.8 Power limitation

The maximum flow of the pump can be limited by means of the power limitation function. The limit value, i.e., the maximum power is written to the parameter <Power_Maximum> (0x2600). If this power limit is reached, the position demand is reduced.
⇨ Figure 34, page 81

The following figure shows the structure of the power limitation function and the parameters influencing this behavior.

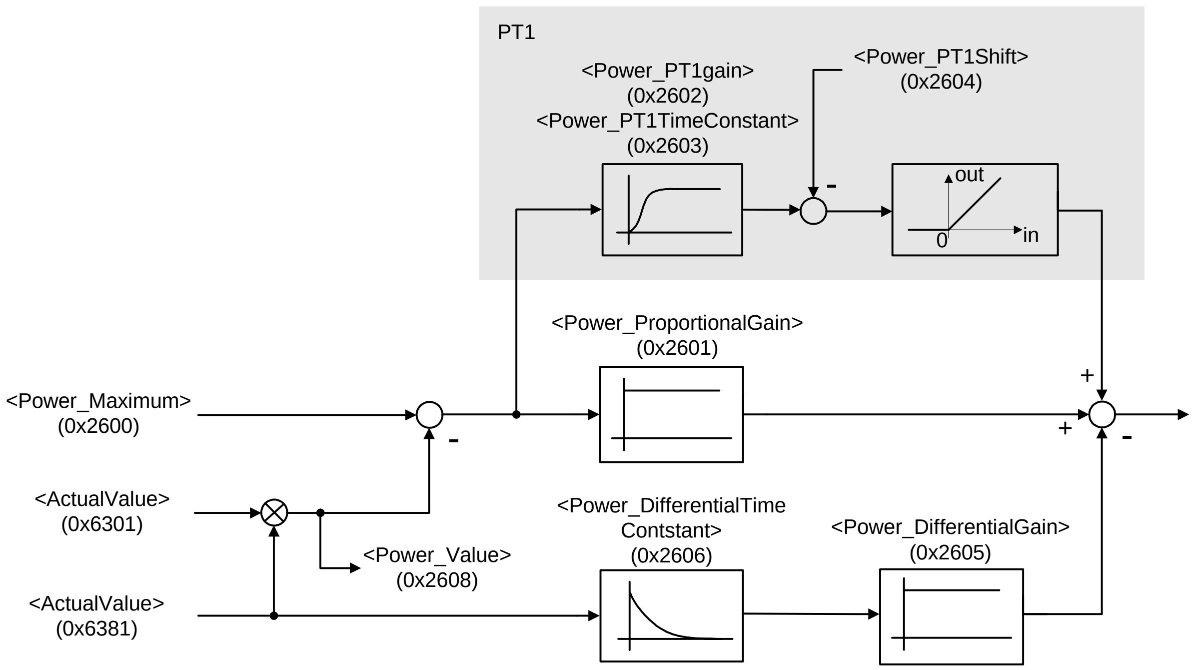


Figure 40: Power limitation structure

Enabling of the power limitation function
The power limitation function is switched on and off with the bit 11 in the control word. If bit 11 is set to true, power limitation is enabled.
⇨ Chapter "5.3.1 Object 0x6040: Control word", page 27

PT1
The additional low pass filter of the power difference allows a delayed controller takeover from position to power control. Hence, the limiting of the position is delayed by the low pass. This allows the pump to exceed the power limit for a short time period depending on the time constant of the low pass element.

7.2.8.1 Objects 0x2600 - 0x2606 / 0x2608: Power limitation

<Power_Maximum>

If this maximum power value is reached, the flow demand is reduced.

PumpController							
Index	Subindex	Name	Data type	Access	Persis-tence	Value range	Default
0x2600	0	Power_Maximum	INT16	rw	Y	0…16384	DSV

<Power_ProportionalGain>

The proportional gain of the power limitation controller.

PumpController							
Index	Subindex	Name	Data type	Access	Persis-tence	Value range	Default
0x2601	0	Power_ ProportionalGain	FLOAT32	rw	Y	0…+inf	DSV

<Power_PT1Gain>

The gain of the PT1 element.

PumpController							
Index	Subindex	Name	Data type	Access	Persis-tence	Value range	Default
0x2602	0	Power_PT1Gain	FLOAT32	rw	Y	0…+inf	DSV

<Power_PT1TimeConstant>

The time constant of the PT1 element in seconds.

PumpController							
Index	Subindex	Name	Data type	Access	Persis-tence	Value range	Default
0x2603	0	Power_ PT1TimeConstant	FLOAT32	rw	Y	0…+inf	DSV

<Power_PT1Shift>

The <Power_PT1Shift> defines the threshold above which the power deviation is passed through.

PumpController							
Index	Subindex	Name	Data type	Access	Persis-tence	Value range	Default
0x2604	0	Power_PT1Shift	INT16	rw	Y	0…32767	DSV

<Power_DifferentialGain>

The differentiator gain of the power limitation controller.

PumpController							
Index	Subindex	Name	Data type	Access	Persis-tence	Value range	Default
0x2605	0	Power_DifferentialGain	FLOAT32	rw	Y	0…+inf	DSV

<Power_DifferentialTimeConstant>
The time constant of the power limitation controller’s differentiator in seconds.

PumpController							
Index	Subindex	Name	Data type	Access	Persis-tence	Value range	Default
0x2606	0	Power_DifferentialTime Constant	FLOAT32	rw	Y	0…+inf	DSV

<Power_Value>
Actual power value.

PumpController							
Index	Subindex	Name	Data type	Access	Persis-tence	Value range	Default
0x2608	0	PowerValue	INT16	ro	N	INT16	None

7.2.9 Master/Slave operation

Scenario
Two or more pumps are feeding one hydraulic system to increase the max. flow. This could cause some undefined states in the system (e.g., pump1 = 100 % flow; pump2 = -100 % flow).

The RKP-D has the capability to manage such situations. One pump is operating as a master pump. All other pumps are working as a slave pump. The master processes all set commands: pressure, flow and power limit. The slaves only follow the position of the master. The actual value of the stroke ring and controller output is broadcasted to the slaves via local CAN.

ⓘ For a description of the hydraulic conditions refer to the Operation Manual RKP-D.

ⓘ The local CAN Network is reserved for the master/slave operation.

ⓘ In master/slave operation, there must be only one active pressure controller (master) where the remaining pumps (slaves) are purely flow controlled by the master pump.

Enabling master/slave communication
The enabling of the communication between master and slave pump and the selection whether a pump is operating as master or slave is done with the parameter <MasterSlaveSelector> (0x21A5).

Enabling the operation of a pump as a slave pump is set by the control word bit 9 (either local control word or control word via bus). If this bit is set for a pump, it operates as a slave pump, i.e., the slave pump gets the flow command from the master pump.

Description of control words:
⇨ Chapter "5.3.1 Object 0x6040: Control word", page 27
⇨ Chapter "5.3.2 Object 0x4040: Local control word", page 28

Values on master/slave side
On the master side the transmitted position is held by the parameter <ActualValue> (0x6301). On the slave side the received position command is held by the parameter <SpoolSetPointFromMaster> (0x21A4). The parameters 0x6301 and 0x21A4 both hold the master position.
⇨ Chapter "6.3.1.1 Object 0x6301: Actual position value", page 46

The pump controller output from the master is transmitted as well. This is done through the parameter <DemandValvePilot> (0x3300). The receive parameter on the slave side is <SpoolFeedForwardFromMaster> (0x21A7).

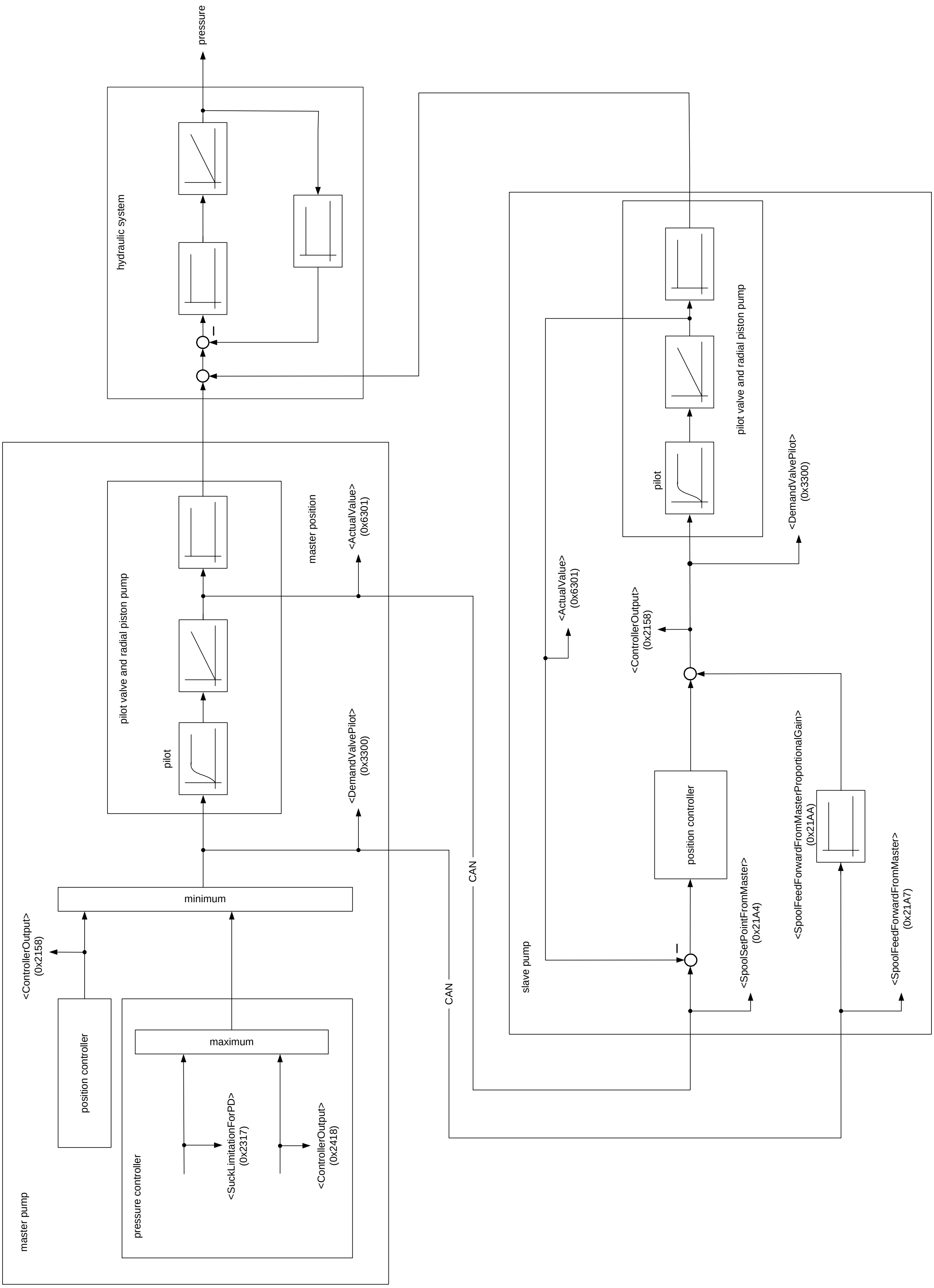


Figure 41: RKP-D control structure with slave pump

7.2.9.1 Objects 0x21A4 / 0x21A5 / 0x21A7 / 0x21AA: Master slave operation

<SpoolSetPointFromMaster>
By setting bit 9 to true in the control word, the pump is working in the slave modus. This command can be monitored by the parameter <SpoolSetPointFromMaster> in the slave pump.
On the master side the transmitted position is held by the parameter <ActualValue> (0x6301). On the slave side the received position command is held by the parameter <SpoolSetPointFromMaster> (0x21A4).

PumpController							
Index	Subindex	Name	Data type	Access	Persis-tence	Value range	Default
0x21A4	0	SpoolSetPointFromMaster	INT16	rw	N	INT16	None

Description of control words:
⇨ Chapter "5.3.1 Object 0x6040: Control word", page 27
⇨ Chapter "5.3.2 Object 0x4040: Local control word", page 28

<MasterSlaveSelector>
This parameter is used to enable the local network, i.e., the communication between the master and slave pumps and to define a pump as the master or slave pump.

- In master/slave operation, there must be only one active pressure controller (master) where the remaining pumps (slaves) are purely flow controlled by the master pump.
- A slave pump must not be configured to be slave 2 or 3, where no other pump is already configured to slave 1. The slave pumps must have different slave numbers.

PumpController							
Index	Subindex	Name	Data type	Access	Persis-tence	Value range	Default
0x21A5	0	MasterSlaveSelector	INT8	rw	Y	-1…3	DSV

Values description

Value	Function	Termination resistor
-2	Master	No
-1	Master	Yes
0	Solo	No
1	Slave 1	Yes
2	Slave 2	No
3	Slave 3	No

Table 56: Master slave selection

<SpoolFeedForwardFromMaster>
This parameter holds on the slave side the pump controller output transmitted by the master (written to the parameter <DemandValvePilot> (0x3300) on master side).

PumpController							
Index	Subindex	Name	Data type	Access	Persis-tence	Value range	Default
0x21A7	0	SpoolFeedForwardFromMaster	INT16	rw	N	INT16	None

<SpoolFeedForwardFromMasterProportionalGain>

Proportional gain for the pump controller output transmitted by the master (on slave side held by the parameter <SpoolFeedForwardFromMaster>, 0x21A7).

PumpController							
Index	Subindex	Name	Data type	Access	Persistence	Value range	Default
0x21AA	0	SpoolFeedForwardFromMaster-ProportionalGain	FLOAT32	rw	Y	FLOAT32	DSV

7.2.10 Local holding pressure switchover

When running a RKP-D in the device mode "setpoint via bus", setpoint data is typically transferred from the machine's controller to the pump with a fixed cycle time. The ideal time for the switchover from position control to hold pressure control lays in between the cycle period and may vary from shot to shot. Caused by the tiny, but unavoidable jitter, the repeatability of the injection process decreases, which may impact the product quality.

To counteract this phenomenon, the "local holding pressure switchover" function has been incorporated into the RKP-D. This function manages the transition from the velocity control phase to holding pressure phase in almost real time, without getting the machine controller involved. This way the transmission delay between the device and the machine controller has no influence.

ⓘ This function is only needed for injection machines and fieldbus operated RKP-D pumps.

Operation

ⓘ Local holding pressure switchover can only be activated if the RKP-D is in device state 'ACTIVE' and in control mode p/Q only.

Once this function has been activated (by setting bit 13 of the control word), the RKP-D starts monitoring the pressure actual value until the hold pressure trigger level (parameter <HoldPressureTrigger>, 0x2107) is reached (see the following figure).

At this moment the RKP-D activates the internal pressure setpoints (<PressureSetpoint>, 0x2108 and <SpoolPositionSetpoint>, 0x2109) and sends an acknowledgement of the performed holding pressure switchover by setting immediately bit 14 of the status word.

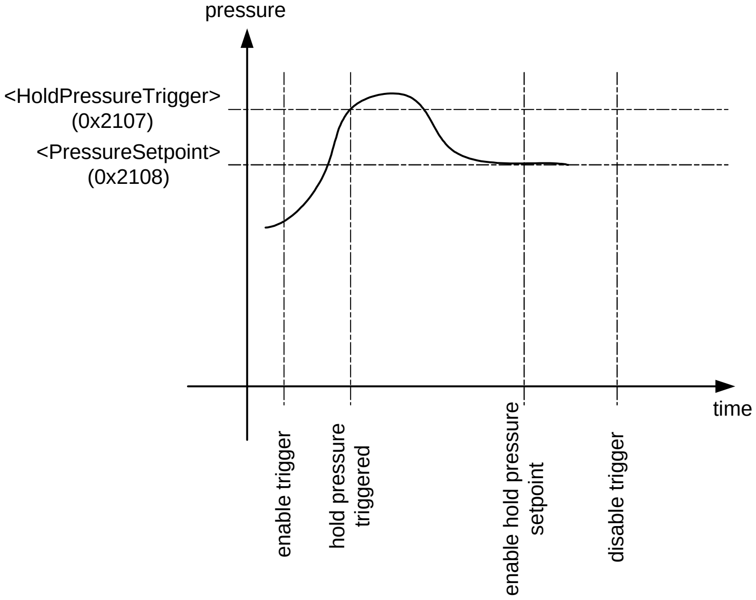


Figure 42: Hold pressure setpoint behavior

<ControlWord> bit 13	Meaning
0	Disable trigger
1	Enable trigger

Table 57: Control word bit 13 values

ⓘ In case the holding pressure trigger level is not reached, the superior controller sends a trigger signal after a certain time.

Control word and status word bits

Local holding pressure switchover can be deactivated by resetting bit 13 of the control word, which results in a reset of bit 14 of the status word on the pump side.

Furthermore the holding pressure switchover can be forced externally by setting the bit 14 in the control word at anytime. The completion of this action will also be acknowledged by setting of bit 14 in the status word. Bit 14 of the status word is set, whenever it is switched over to local holding pressure setpoints internally.

The following table shows the relations between the control word bits 13 and 14 and the status word bit 14.

<ControlWord>		<StatusWord>	
Bit 14	**Bit 13**	**Bit 14**	**Remark**
0	0	0	Holding pressure setpoints remain inactive.
0	1	0/1	Pump continues monitoring trigger level. When reaching the trigger level, local holding pressure set-points will be activated.
1	X	1	Local holding pressure setpoints activated, regardless of trigger level.

Table 58: Control word and status word bits for local holding pressure switchover

Control word bits

Bit	<ControlWord>
0…12	⇨ Chapter "5.3.1 Object 0x6040: Control word", page 27
13	Activate holding pressure switchover
14	Force holding pressure switchover

Table 59: Control word bits

Status word bits

Bit	<StatusWord>
0…12	⇨ Chapter "5.3.5 Object 0x6041: Status word", page 29
14	Holding pressure setpoints active

Table 60: Status word bits

Status machine of the hold pressure switchover

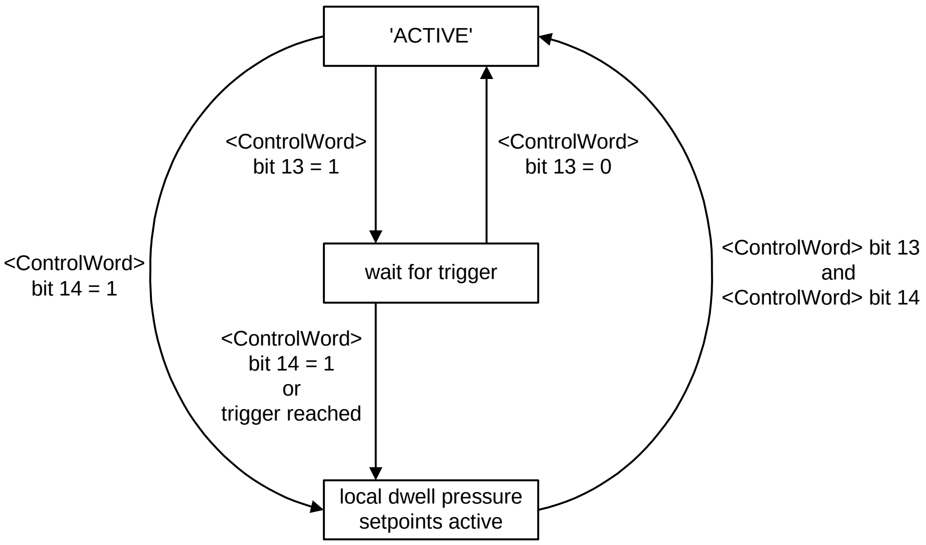


Figure 43: Status machine of the hold pressure enable

7.2.10.1 Objects 0x2107 - 0x2109: Local holding pressure switchover

<HoldPressureTrigger>
This parameter sets the holding pressure trigger level at which the internal holding pressure setpoints (parameters <PressureSetpoint> and <SpoolPositionSepoint> are activated by the RKP-D when the local holding pressure switchover is activated (see Figure 42).

HoldPressureControl							
Index	Subindex	Name	Data type	Access	Persistence	Value range	Default
0x2107	1	HoldPressureTrigger	INT16	rw	Y	INT16	16384

<PressureSetpoint>
The pressure setpoint is activated by the RKP-D when the holding pressure trigger level (<HoldPressureTrigger>, 0x2107) is reached (see Figure 42). This pressure is held until a new pressure setpoint is transmitted or the trigger is disabled.

HoldPressureControl							
Index	Subindex	Name	Data type	Access	Persistence	Value range	Default
0x2108	1	PressureSetpoint	INT16	rw	Y	INT16	DSV

<SpoolPositionSetpoint>
The position setpoint is activated by the RKP-D when the holding pressure trigger level (<HoldPressureTrigger>, 0x2107) is reached (see figure 42). This position is held until a new pressure setpoint is transmitted or the trigger is disabled.

HoldPressureControl							
Index	Subindex	Name	Data type	Access	Persistence	Value range	Default
0x2109	1	SpoolPositionSetpoint	INT16	rw	Y	INT16	16384

7.2.11 Flushing mode

This function is included in digital pumps with internal pressure supply. The flushing mode prevents overheating of the pump. If all relevant demand values (p, Q, or both) are below 1 %, the pump might overheat because there is not enough flow to cool the pump. Therefore the pump goes into flushing mode after the time stored in the parameter 0x21A1 (<FlushingTime>) has elapsed.
The flushing time represented by the parameter 0x21A1 is stored in seconds. Typically the value is 180. Hence, if the relevant demand values are below 1 % for the duration of 3 minutes, the pump will go into flushing mode.

PumpController							
Index	Subindex	Name	Data type	Access	Persistence	Value range	Default
0x21A1	0	FlushingTime	UINT16	ro	Y	0…300	180

7.3 Analog parameter set switching

This feature allows to choose pressure controller parameter settings through an analog input. The influenced parameters build a parameter set. This chapter describes how the parameter sets can be chosen via an analog input.

A parameter set consists of the following parameters:

- The saved control word (0x2141)
- The parameter selecting the hybrid mode (0x2148)
- The parameter addressing a pressure controller parameter set (0x2142)

The analog parameter set switching is done over an interface. The interface is assigned to an analog input. Depending on the analog input signal level a parameter set is activated. The selection of the interface is done by the parameter <SourceTransducer> (0x2143). The value of the parameter <ActiveParameterSet> (0x2146) corresponds to a certain input range of the interface (see Table 61).

Description of the interface assignment:
⇨ Chapter "6.3.3 Interface assignment", page 48

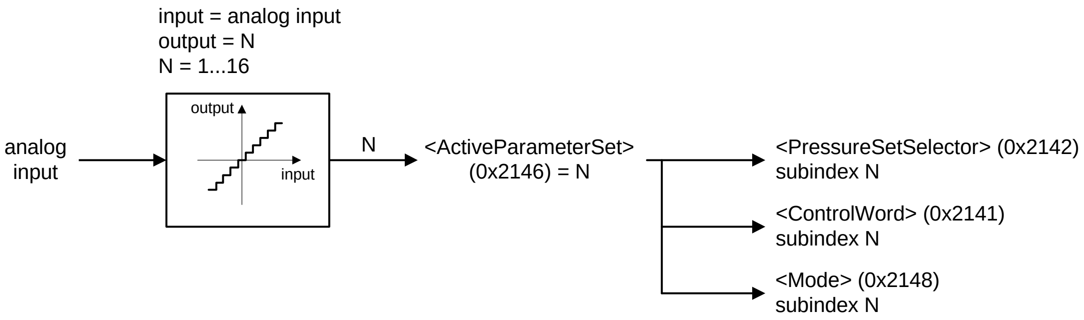


Figure 44: Assignment of analog input value to active parameter set

The analog input is quantized according Table 61. The resulting value from 1…16 is assigned to <ActiveParameterSet> (0x2146). The <ActiveParameterSet> sets the subindex of three parameters. The <PressureSetSelector> (0x2142) defines which controller parameters will be active.

Description of <PressureSetSelector> (0x2142):
⇨ Chapter "7.2.6.3 Object 0x2350: Active parameter set number", page 92

The following table shows the relation between the currently active control parameter set (indicated by parameter 0x2146) and the interface input range.
Description of analog input types:
⇨ Chapter "6.1.1 Analog inputs 0 and 1", page 34
⇨ Chapter "6.1.2 Analog inputs 2, 3 and 4", page 36

Value of <ActiveParameterSet> (0x2146)	**Analog input type 1, 3 (±100 % corresponds to ±10 V or ±10 mA)**		**Analog input type 2, 4, 7, 10 (0…100 % corresponds to 0…10 V or 0…10 mA)**		**Analog input type 5, 8 (0…100 % corresponds to 4…20 mA)**	
	Low limit	**High limit**	**Low limit**	**High limit**	**Low limit**	**High limit**
1	-10	-6,8	0	1,6	4	6,56
2	-6,2	-5,8	1,9	2,1	7,04	7,36
3	-5,2	-4,8	2,4	2,6	7,84	8,16
4	-4,2	-3,8	2,9	3,1	8,64	8,96
5	-3,2	-2,8	3,4	3,6	9,44	9,76
6	-2,2	-1,8	3,9	4,1	10,24	10,56
7	-1,2	-0,8	4,4	4,6	11,04	11,36
8	-0,2	0,2	4,9	5,4	11,84	12,16

Table 61: Relation between value of <ActiveParameterSet> and interface input range (part 1 of 2)

Value of <ActiveParameterSet> (0x2146)	Analog input type 1, 3 (±100 % corresponds to ±10 V or ±10 mA)		Analog input type 2, 4, 7, 10 (0…100 % corresponds to 0…10 V or 0…10 mA)		Analog input type 5, 8 (0…100 % corresponds to 4…20 mA)	
	Low limit	**High limit**	**Low limit**	**High limit**	**Low limit**	**High limit**
9	0,8	1,2	5,4	5,6	12,64	12,96
10	1,8	2,2	5,9	6,1	13,44	13,76
11	2,8	3,2	6,4	6,6	14,24	14,56
12	3,8	4,2	6,9	7,1	15,04	15,36
13	4,8	5,2	7,4	7,6	15,84	16,16
14	5,8	6,2	7,9	8,1	16,64	16,96
15	6,8	7,2	8,4	8,6	17,44	17,76
16	7,8	10	8,9	10	18,24	20

Table 61: Relation between value of <ActiveParameterSet> and interface input range (part 2 of 2)

The <PressureSetSelector> (0x2142) assigns an active parameter set to the desired pressure controller parameter set. This means, each subindex of 0x2142 holds a value of 1…16 which is written into the parameter <ActiveParameterSetNumber> (0x2350).

List of possible controller parameters:
⇨ Table 55, page 92

Description of active parameter set:
⇨ Chapter "7.3 Analog parameter set switching", page 105

Description of <PressureSetSelector> (0x2142):
⇨ Chapter "7.3.1 Objects 0x2141 - 0x2146 / 0x2148: Active parameter set", page 107

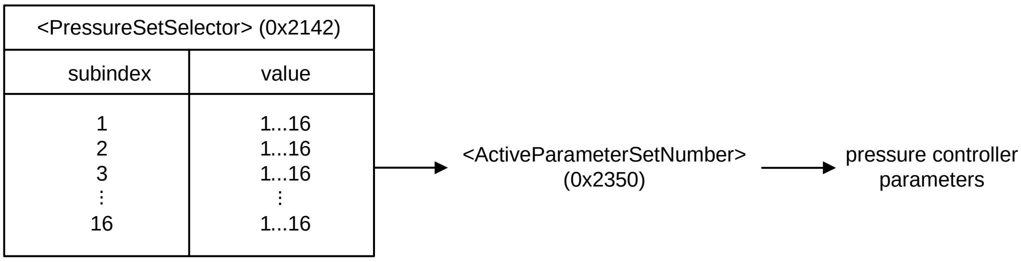


Figure 45: Assignment of <PressureSetSelector> subindex to active parameter set number

7.3.1 Objects 0x2141 - 0x2146 / 0x2148: Active parameter set

<SourceTransducer>
Selection of the interface that is assigned to an analog input.
Interface definition:
⇨ Chapter "6.3.3.1 Interface definition", page 49

AnalogParameterSetSwitching							
Index	Subindex	Name	Data type	Access	Persistence	Value range	Default
0x2143	0	SourceTransducer	UINT8	rw	Y	1…4	DSV

<Enable>
Activates the analog parameter set switching function.

AnalogParameterSetSwitching							
Index	Subindex	Name	Data type	Access	Persistence	Value range	Default
0x2145	0	Enable	UINT8	rw	Y	0…1	DSV

<ActiveParameterSet>
Indicates the currently active control parameter set.

AnalogParameterSetSwitching							
Index	Subindex	Name	Data type	Access	Persistence	Value range	Default
0x2146	0	ActiveParameterSet	UINT8	ro	N	0…16	DSV

<ControlWord>

AnalogParameterSetSwitching							
Index	Subindex	Name	Data type	Access	Persistence	Value range	Default
0x2141	1…16	ControlWord	UINT16	rw	Y	1…65535	DSV

The parameter sets allow to save a control word. At activation of a set, the saved control word is applied to the local control word (<LocalControlWord>, 0x4040).

The subindex of the control word points to the corresponding control parameter set.

Example:
Subindex 2 of 0x2141 holds the value 7 (dec).

This means, the device is set to the device status 'ACTIVE' if the control parameter set 2 is activated by a corresponding signal applied at the selected analog input.

Description of the device states:
⇨ Chapter "5.2.1 Device states", page 25

<PressureSetSelector>
This parameter holds a pressure controller parameter set number. At activation of a set, the saved number is applied to the active parameter set number (<ActiveParameterSetNumber>, 0x2350).

AnalogParameterSetSwitching							
Index	Subindex	Name	Data type	Access	Persistence	Value range	Default
0x2142	1	PressureSetSelector	UINT8	rw	Y	1…16	1
0x2142	2	PressureSetSelector	UINT8	rw	Y	1…16	2
…							
0x2142	16	PressureSetSelector	UINT8	rw	Y	1…16	16

<Mode>

This parameter is used to activate/deactivate the hybrid mode. Each pressure parameter set has a hybrid mode. Writing the value 1 to one of the parameter's subindexes means hybrid mode is active for the corresponding parameter set. 0 means hybrid mode is deactivated for the selected parameter set.

Description hybrid mode correction:
⇨ Chapter "7.1.2.7 Hybrid mode correction", page 65

AnalogParameterSetSwitching							
Index	Subindex	Name	Data type	Access	Persistence	Value range	Default
0x2148	1…16	Mode	UINT8	rw	Y	0…16	DSV

8 Diagnostics

If the RKP-D recognizes a malfunction, a self-diagnosis is performed. The fault reaction is dependent on the identified malfunction and the fault reaction parameter setting (0x2830).
If an error occurs and a fault reaction is activated, an emergency object is sent out. The emergency object contains information about the occurred error. The error register holds information about the last occurred error.

The predefined error field (0x1003) further allows a more detailed analysis on the occurred failures, where errors are recorded chronologically.

The diagnostics chapter describes the diagnostic capabilities of the RKP-D. Various faults are detected. A list of all detected faults is shown in Table 63. There is the possibility to assign a fault reaction. The different fault reactions are listed in Table 64. The occurred faults are recorded in chronological order.

8.1 Error information

8.1.1 Object 0x1001: Error register

The error register displays the error status of the device in bit-coded form. Bit 0 is set as soon as an error occurs on the device.
The exact cause of the error can be determined by means of the <PreDefinedErrorField> object (0x1003).
The error code of the error occurred last is stored to subindex 1 of the <PreDefinedErrorField> object. The number of actual errors recorded is written to subindex 0 of the <PreDefinedErrorField>.

ErrorRegister							
Index	Subindex	Name	Data type	Access	Persistence	Value range	Default
0x1001	0	ErrorRegister	UINT8	ro	N	UINT8	0x00

The error register specifies the error type according to the following table, where a 1 indicates the specific error type:

Bit	**Description**
0	Generic error This bit is set every time an error occurs on the device
1	Current error
2	Voltage error
3	Temperature error
4	Communication error
5	Device profile
6	Reserved
7	Reserved

Table 62: Bit coding of error register value

8.1.2 Object 0x1003: Predefined error field

Every time an error occurred, which triggered a fault reaction, an error code is stored to the <StandardError-Field> object. The <StandardErrorField> contains a list of up to 16 entries. This error code provides information about the cause of the error.

Table 63 lists the possible errors with the corresponding error code.

Subindex 0 in the <StandardErrorField> object holds information about the number of actual errors recorded. Every new error is stored at subindex 1, the older ones move down the list. Thus, a chronological order of errors is produced. If the maximum number of entries (16) is reached, the error code stored to subindex 16 is deleted.

Writing the value 0 to the subindex 0 deletes the entire error code list.

PreDefinedErrorField							
Index	Subindex	Name	Data type	Access	Persistence	Value range	Default
0x1003	0	NumberOfErrors	UINT32	rw	N	UINT32	0
0x1003	1…16	StandardErrorField	UINT32	ro	N	UINT32	DSV

The structure of each <StandardErrorField> entry is as follows:

<table>
<tr><td>Byte</td><td>3</td><td>2</td><td>1</td><td>0</td></tr>
<tr><td rowspan="2">Contents</td><td colspan="2">Additional information</td><td colspan="2" rowspan="2">Error code</td></tr>
<tr><td>Reserved</td><td>Fault code</td></tr>
</table>

Error code list: ⇨ Table 65, page 118
Fault code list: ⇨ Table 63, page 112

Example:
The parameter 0x1003 holds the value 0x305530 (corresponds to 3167536 dec).

The coding of the value is as follows:

<table>
<tr><td>Byte</td><td>3</td><td>2</td><td>1</td><td>0</td></tr>
<tr><td>Contents</td><td>00</td><td>30</td><td>55</td><td>30</td></tr>
<tr><td></td><td>Reserved</td><td>Fault code</td><td colspan="2">Error code</td></tr>
</table>

Result:

Error code 0x5530: EEPROM error (⇨ Table 65, page 118)
Fault code 0x30: Internal nonvolatile memory (⇨ Table 63, page 112)

8.1.3 Objects 0x2832/0x2833: Fault reaction description / Fault history number

While the error code is stored to the predefined error field (0x1003), the fault description parameter returns a text message which describes the occurred fault. The description corresponds to that entry of the predefined error field to which the parameter <FaultHistoryNumber> (0x2833) is set.

To read a specific fault description, first the <FaultHistoryNumber> has to be set to the entry of the predefined error field and then the fault description can be read by means of the <FaultReactionDescription> parameter.

Example reading the fault description:

1. To read the latest entry stored in the predefined error field, write the value 0 to the parameter <FaultHistoryNumber> (0x2833).
2. Read the fault description by means of the <FaultReactionDescription> parameter (0x2832).

<FaultReactionDescription>

FaultReaction							
Index	Subindex	Name	Data type	Access	Persistence	Value range	Default
0x2832	0	FaultReactionDescription	STRING	ro	N	64 char	DSV

<FaultHistoryNumber>

FaultReaction							
Index	Subindex	Name	Data type	Access	Persistence	Value range	Default
0x2833	0	FaultHistoryNumber	UINT8	rw	N	0...7	0

8.1.4 Objects 0x2822/0x2823 Error Handler: Address / Time

These parameters store information, which could assist to debug software malfunctions. The user may be asked to pass these values to our service personnel in order to identify software malfunctions.

ErrorHandler							
Index	Subindex	Name	Data type	Access	Persistence	Value range	Default
0x2822	1…5	Address	UINT32	ro	N	UINT32	0
0x2823	1…5	Time	UINT32	ro	N	UINT32	0

8.2 Fault reaction

8.2.1 Fault reaction settings

The fault reaction <Type> parameter (0x2830) is used to assign a specific fault reaction to an error. Each subindex (1…118) of the parameter stands for a specific fault. The value assigned to the subindex describes the reaction to take place if the fault occurs.

FaultReaction							
Index	Subindex	Name	Data type	Access	Persistence	Value range	Default
0x2830	1…118	Type	INT8	rw	Y	INT8	DSV

Subindex
The subindex of the Type parameter defines for which fault the reaction is set. Each subindex has its according error as shown in the following table.
For example, writing the value 2 to the subindex 6, the device will send an emergency message and switch to the device status 'FAULT' if the fault "Power supply voltage too high" occurs on the device.

The following table lists the Type parameters for each fault reaction event and the fault code.

Fault code 0x2830	**Subindex (hex)**	**Fault description**	**Value range**	**Default**
1	02	Error microprocessor core	127	127
2	03	Error digital signal processor	127	127
3	04	Error DSP program download	127	127
4	05	Error DSP realtime data transmission	0…3	2
5	06	Power supply voltage too low	0…3	2
6	07	Power supply voltage too high	0…3	2
7	08	Internal supply voltage too low	127	127
8	09	Internal supply voltage too high	127	127
9	0A	Internal reference voltage too low	127	127
10	0B	Internal reference voltage too high	127	127
11	0C	Internal current too low	127	127
12	0D	Internal current too high	127	127
13	0E	Electronics temperature too low (< -20 °C)	0…3	2
14	0F	Electronics temperature too high (> 85 °C)	0…3	1
15	10	Electronics temperature exceeded (> 105 °C)	0…3	2
16	11	Current sensor circuit failure	127	127
17	12	Pilot/single stage LVDT cable break	127	127
18	13	Pilot/single stage LVDT position out of range	127	127
19	14	Pilot/single stage LVDT circuit failure	127	127
20	15	Main stage LVDT cable break	127	127
21	16	Main stage LVDT position out of range	127	127
22	17	Main stage LVDT circuit failure	127	127
23	18	Internal pressure transducer cable break	127	127
24	19	Internal pressure transducer circuit failure	127	127
25	1A	Internal pressure transducer pressure peak	0…3	0
26	1B	Analog input 0 supply cable break/short circuit	0…3	0
27	1C	Analog input 1 supply cable break/short circuit	0…3	0
28	1D	Analog input 2 supply cable break/short circuit	0…3	0
29	1E	Analog input 3 supply cable break/short circuit	0…3	0

Table 63: Type subindex values (part 1 of 3)

Fault code 0x2830	Subindex (hex)	Fault description	Value range	Default
30	1F	Analog input 4 supply cable break/short circuit	0…3	0
31	20	Analog input 0 current too low (4…20 mA)/ADC overflow (voltage)	0…3	0
32	21	Analog input 1 current too low (4…20 mA)/ADC overflow (voltage)	0…3	0
33	22	Analog input 2 current too low (4…20 mA)/ADC overflow (voltage)	0…3	0
34	23	Analog input 3 current too low (4…20 mA)/ADC overflow (voltage)	0…3	0
35	24	Analog input 4 current too low (4…20 mA)/ADC overflow (voltage)	0…3	0
36	25	Analog input 0 circuit failure	0…3	0
37	26	Analog input 1 circuit failure	0…3	0
38	27	Analog input 2 circuit failure	0…3	0
39	28	Analog input 3 circuit failure	0…3	0
40	29	Analog input 4 circuit failure	0…3	0
41	2A	Encoder channel a cable break	0…3	0
42	2B	Encoder channel b cable break	0…3	0
43	2C	Encoder channel z cable break	0…3	0
44	2D	SSI error	0…3	0
45	2E	Power driver	127	127
46	2F	Internal random access memory	127	127
47	30	Internal program memory	127	127
48	31	Internal nonvolatile memory	127	127
49	32	Out of memory error	0…3	2
50	33	Software coding	0…3	2
51	34	Software reset (watchdog)	0…3	2
52	35	Interrupt time exceeded	0…3	2
53	36	Task time exceeded	0…3	2
54	37	Parameter initialization error	0…3	2
55	38	Node identifier data memory corrupted	0…3	2
56	39	User data memory corrupted	0…3	2
57	3A	Restore data memory corrupted	127	127
58	3B	Factory data memory corrupted	127	127
59	3C	Calibration data memory corrupted	127	127
60	3D	Diagnosis data memory corrupted	0…3	0
61	3E	Position control monitoring	0…3	0
62	3F	Velocity control monitoring	0…3	0
63	40	Force control monitoring	0…3	0
64	41	Flow control monitoring	0…3	0
65	42	Pressure control monitoring	0…3	0
66	43	Current control monitoring	0…3	0
67	44	Spool position control monitoring	0…3	2
68	45	Trajectory generator processing error	0…3	0
69	46	Eventhandler exception	0…3	0
70	47	Local CAN general fault	0…3	0
71	48	Local CAN overrun	0…3	0
72	49	Local CAN in error passive mode	0…3	0
73	4A	Local CAN recovered from bus-off	0…3	0
74	4B	Local CAN RPDO1 time out	0…3	0
75	4C	Local CAN RPDO2 time out	0…3	0
76	4D	Local CAN RPDO3 time out	0…3	0

Table 63: Type subindex values (part 2 of 3)

Fault code 0x2830	Subindex (hex)	Fault description	Value range	Default
77	4E	Local CAN RPDO4 time out	0…3	0
78	4F	Local CAN RPDO1 data	0…3	0
79	50	Local CAN RPDO2 data	0…3	0
80	51	Local CAN RPDO3 data	0…3	0
81	52	Local CAN RPDO4 data	0…3	0
82	53	Local CAN TPDO1 time out	0…3	0
83	54	Local CAN TPDO2 time out	0…3	0
84	55	Local CAN TPDO3 time out	0…3	0
85	56	Local CAN TPDO4 time out	0…3	0
86	57	Local CAN TPDO1 data	0…3	0
87	58	Local CAN TPDO2 data	0…3	0
88	59	Local CAN TPDO3 data	0…3	0
89	5A	Local CAN TPDO4 data	0…3	0
90	5B	CAN general fault	0…3	0
91	5C	CAN overrun	0…3	0
92	5D	CAN in error passive mode	0…3	0
93	5E	CAN recovered from bus-off	0…3	0
94	5F	CAN RPDO1 time out	0…3	0
95	60	CAN RPDO2 time out	0…3	0
96	61	CAN RPDO3 time out	0…3	0
97	62	CAN RPDO4 time out	0…3	0
98	63	CAN RPDO1 data	0…3	0
99	64	CAN RPDO2 data	0…3	0
100	65	CAN RPDO3 data	0…3	0
101	66	CAN RPDO4 data	0…3	0
102	67	CAN TPDO1 time out	0…3	0
103	68	CAN TPDO2 time out	0…3	0
104	69	CAN TPDO3 time out	0…3	0
105	6A	CAN TPDO4 time out	0…3	0
106	6B	CAN TPDO1 data	0…3	0
107	6C	CAN TPDO2 data	0…3	0
108	6D	CAN TPDO3 data	0…3	0
109	6E	CAN TPDO4 data	0…3	0
110	6F	CAN life guard error or heartbeat error	0…3	0
111	70	CAN SYNC producer time out	0…3	0
112	71	CAN SYNC consumer time out	0…3	0
113	72	EtherCAT communication fault	0…3	0
114	73	EtherCAT RPDO time out	0…3	0
115	74	EtherCAT RPDO data	0…3	0
116	75	EtherCAT TPDO time out	0…3	0
117	76	EtherCAT TPDO data	0…3	0
118	77	PROFIBUS general fault	0…3	0

Table 63: Type subindex values (part 3 of 3)

The fault reaction type for each fault event can be configured between options 0 to 3, if not predefined to option 127 (non removable error). In case option 127 is predefined, the fault reaction type cannot be changed to another fault reaction.

Values description

Fault reaction type (dec)	Fault reaction if error occurs
0	No fault reaction, error is ignored. Independent whether a malfunction for the monitored fault is detected, the device does not react on this event. The device continuous to operate. Special care must be taken, as the malfunction may have an impact to the device functions.
1	Send emergency message. If a malfunction for the monitored fault is detected, an emergency message will be sent onto the bus. The device continuous to operate. Special care must be taken, as the malfunction may have an impact to the device functions.
2	Enter 'FAULT' state. If a malfunction for the monitored fault is detected, the device enters the 'FAULT' state and an emergency message will be sent onto the bus. The power stage of the device is switched off, while all device functions are still alive. The device must be re-enabled in order to return into normal operation.
3	Enter 'FAULT_HOLD' state. If a malfunction for the monitored fault is detected, the device enters the 'FAULT_HOLD' state and an emergency message will be sent onto the bus. The hold set point of the device is controlled. The device must be re-enabled in order to return into normal operation.
4…126	Reserved
127	Stop operation (switch to device status 'NOT_READY'). If a malfunction for the monitored fault is detected, the device enters the 'NOT_READY' state and an emergency message will be sent onto the bus. The power stage of the device is switched off, while almost all device functions are stopped. The device must be serviced.

Table 64: Fault reaction settings

ⓘ The device always sends an emergency message for fault reaction types greater than 0.

The following figure shows which fault reaction takes place depending on the value assigned to the subindex of 0x2830.

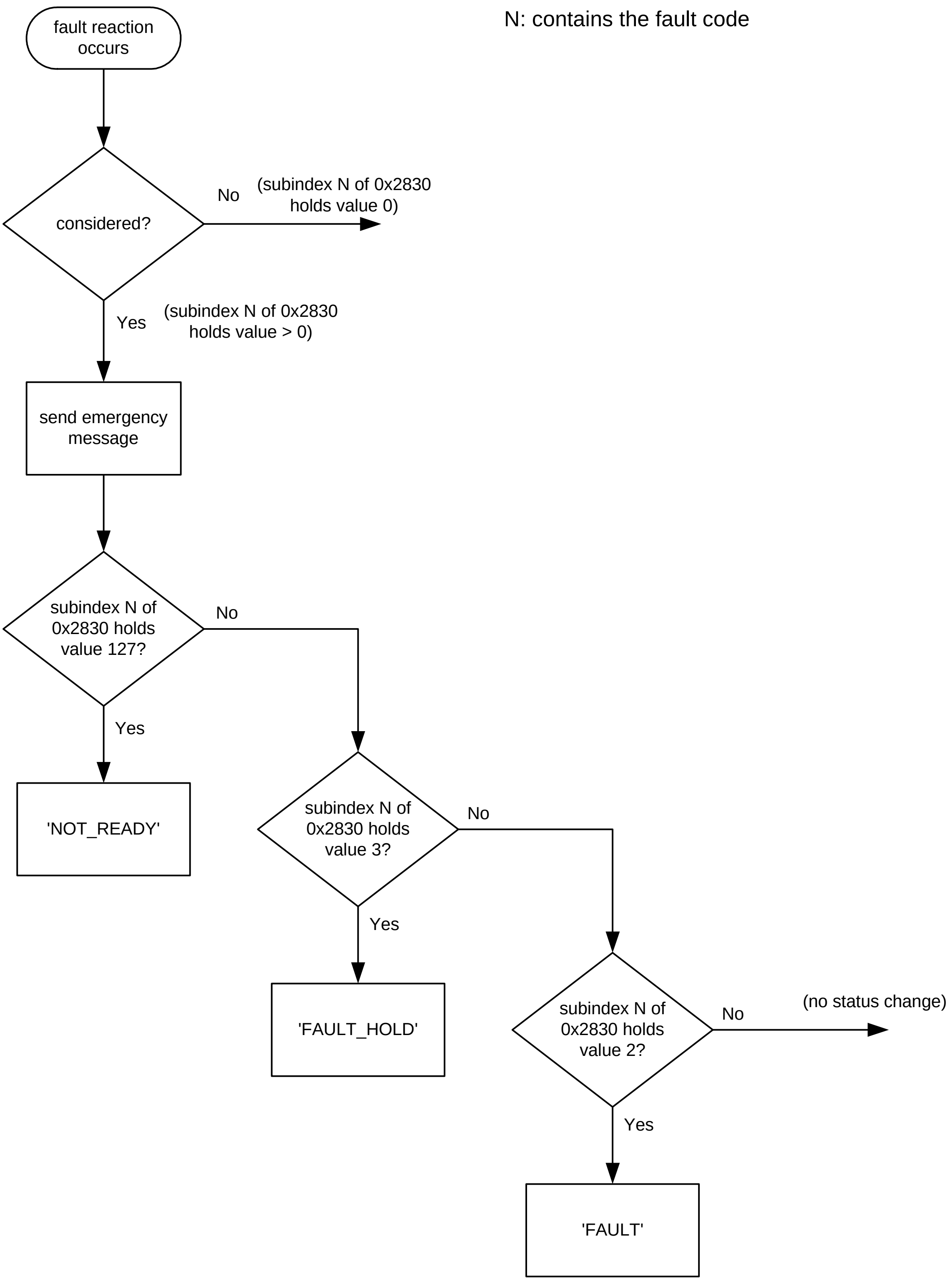


Figure 46: Fault reaction behavior

8.2.2 Emergency message

Every time a configured error occurs on the device (i.e., when the device goes into the FAULT condition), the device sends an emergency message with error register, error code and time of occurrence.

The emergency message will also be sent in case all errors disappeared. In this case the emergency message will hold the fault code for no fault.

The parameter <CobIdEmergencyMessage> (0x1014) holds the COB ID of the telegram:

CobIdEmergencyMessage							
Index	Subindex	Name	Data type	Access	Persistence	Value range	Default
0x1014	0	CobIdEmergencyMessage	UINT32	rw	Y	1…2047	255

Coding of the emergency message:

<table>
<tr><td>Byte</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td></tr>
<tr><td rowspan="2">Contents</td><td colspan="2" rowspan="2">Emergency error code</td><td rowspan="2">Error register</td><td colspan="5">Moog-specific error code</td></tr>
<tr><td>Fault code</td><td colspan="4">Power on time</td></tr>
</table>

Byte 0, 1: Emergency message error code
Byte 2: Error register object value
⇨ Chapter "8.1.1 Object 0x1001: Error register", page 109
Byte 3: Fault code
⇨ Table 63, page 112
Byte 4…7: Power on time [min]

ⓘ The first three bytes are defined by the DSP 408.

Example
If the error "Power supply voltage too low" occurs, the following data is available:

Error code: 0x3412
Fault code: 5
Time: 1000 min
Error register: 4

The coding of the emergency message is as follows:

<table>
<tr><td>Byte</td><td colspan="2">0</td><td colspan="2">1</td><td colspan="2">2</td><td colspan="2">3</td><td colspan="2">4</td><td colspan="2">5</td><td colspan="2">6</td><td colspan="2">7</td></tr>
<tr><td rowspan="2">Contents</td><td colspan="4" rowspan="2">Emergency error code</td><td colspan="2" rowspan="2">Error register</td><td colspan="10">Moog-specific error code</td></tr>
<tr><td colspan="2">Fault code</td><td colspan="8">Power on time</td></tr>
<tr><td>hex</td><td>1</td><td>2</td><td>3</td><td>4</td><td>0</td><td>4</td><td>0</td><td>5</td><td>E</td><td>8</td><td>0</td><td>3</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
</table>

Byte 0: Least Significant Byte
Byte 7: Most Significant Byte

Emergency message error code

Bytes 0 and 1 of the emergency message contains detailed information about the detected error. This code is transmitted within the emergency telegram and will be also stored in the <ErrorRegister> (object 0x1001).
⇨ Chapter "8.1.1 Object 0x1001: Error register", page 109

The device supports the following error codes. The fault codes assigned to the corresponding error code is shown in the last column.

Error code [hex]	Meaning	Fault code
1000	Generic Error	
2000	Current	
2100	Current, device input side	
2110	Input current too high	
2200	Current inside the device	
2211	Internal current #1	16
2212	Internal current #2	
2300	Current, device output side	
3000	Voltage	
3100	Mains voltage	
3110	Input voltage out of range	
3200	Voltage inside the device	
3210	Internal voltage too high	8, 10
3220	Internal voltage too low	7, 9
3300	Output voltage	
3400	Internal voltage	
3410	Power supply voltage	
3411	Power supply voltage too high	6
3412	Power supply voltage too low	5
3420	Control voltage	
3421	Control voltage too high	
3422	Control voltage too low	
4000	Temperature	
4100	Ambient temperature	
4110	Ambient temperature too high	
4120	Ambient temperature too low	
4200	Device temperature	
4210	Temperature of electronic components	
4211	Temperature of electronic components too high	14, 15
4212	Temperature of electronic components too low	13
4220	Temperature of hydraulic components	
4221	Temperature of hydraulic components too high	
4222	Temperature of hydraulic components too low	
5000	Device hardware	
5100	Hardware power supply	
5110	Internal power supply error	
5200	Device control	
5210	Measurement circuits	
5211	Pressure	24
5212	Internal LVDT	17, 18, 19
5213	Analog input 0	36
5214	Analog input 1	37
5215	Analog input 2	38
5216	Analog input 3	39
5217	Analog input 4	40
5218	External LVDT	22
5220	Microprocessor core	1, 2, 3, 4

Table 65: Error codes (part 1 of 4)

Error code [hex]	Meaning	Fault code
5230	Sensors	
5231	Pressure	23, 25
5232	Encoder/SSI/Local CAN	41, 42, 43, 44
5233	Analog input 0	26, 31
5234	Analog input 1	27, 32
5235	Analog input 2	28, 33
5236	Analog input 3	29, 34
5237	Analog input 4	30, 35
5238	External LVDT	20, 21
5300	Local input device	
5400	Power electronics	
5410	Driver	45
5500	Data memory	
5510	RAM	46
5520	EPROM	47
5530	EEPROM	48
6000	Device software	
6010	Software reset (watchdog)	51
6100	Internal software	
6101	Error handler	50
6102	Interrupt time exceeded	52
6103	Task time exceeded	53
6104	Out of memory	49
6200	User software	
6201	Event handler	69
6300	Data set	
6310	Parameter loss	
6311	Node identifier data	55
6312	User data	56
6313	Restore data	57
6314	Factory data	58
6315	Calibration data	59
6316	Diagnosis data	60
6320	Parameter error	54
7000	Additional modules	
7300	Sensor	
7310	Pressure sensor	
8000	Monitoring	
8300	Closed loop control monitoring	
8301	Position control monitoring	67
8302	Pressure control monitoring	65
8303	Position control	61
8304	Velocity control	62
8305	Force control	63
8306	Flow control	64
8307	Current control	66
8308	Trajectory generation	68

Table 65: Error codes (part 2 of 4)

Error code [hex]	Meaning	Fault code
8100	CAN communication	90, 91
8101	Local CAN communication	70
8110	CAN overrun (objects lost)	
8111	Local CAN overrun (objects lost)	71
8120	CAN in error passive mode	92
8121	Local CAN in error passive mode	72
8130	Life guard error or heartbeat error	110
8140	CAN recovered from bus off	93
8141	Local CAN recovered from bus off	73
8150	CAN transmit COB ID collision	
8151	Local CAN transmit COB ID collision	
8200	Protocol Error	
8210	PDO not processed due to length error	
8220	PDO length exceeded	
8231	RPDO1 time out	94
8232	RPDO2 time out	95
8233	PDO3 time out	96
8234	RPDO4 time out	97
8235	TPDO1 time out	102
8236	TPDO2 time out	103
8237	TPDO3 time out	104
8238	TPDO4 time out	105
8239	SYNC producer time out	111
823A	SYNC consumer time out	112
8241	RPDO1 data	98
8242	RPDO2 data	99
8243	RPDO3 data	100
8244	RPDO4 data	101
8245	TPDO1 data	106
8246	TPDO2 data	107
8247	TPDO3 data	108
8248	TPDO4 data	109
8251	Local RPDO1 time out	74
8252	Local RPDO2 time out	75
8253	Local RPDO3 time out	76
8254	Local RPDO4 time out	77
8255	Local TPDO1 time out	82
8256	Local TPDO2 time out	83
8257	Local TPDO3 time out	84
8258	Local TPDO4 time out	85
8261	Local RPDO1 data	78
8262	Local RPDO2 data	79
8263	Local RPDO3 data	80

Table 65: Error codes (part 3 of 4)

Error code [hex]	Meaning	Fault code
8264	Local RPDO4 data	81
8265	Local TPDO1 data	86
8266	Local TPDO2 data	87
8267	Local TPDO3 data	88
8268	Local TPDO4 data	89

Table 65: Error codes (part 4 of 4)

8.2.3 Object 0x2831: Fault reaction status

The bit coded fault reaction status indicates which errors are currently reported for the device. Each bit of the fault status array (built with the subindexes 1…4) stands for a specific error.
⇨ Table 66, page 122

FaultReaction							
Index	Subindex	Name	Data type	Access	Persistence	Value range	Default
0x2831	1…4	Status	UINT32	ro	N	UINT32	DSV

Example:
Subindex 1 of 0x2813 holds the value 0x7000000 (hex). The binary coding is as follows:

<table>
<tr><th colspan="16">MSB</th><th colspan="16">LSB</th></tr>
<tr><td>31</td><td>30</td><td>29</td><td>28</td><td colspan="28">27…0</td></tr>
<tr><td>0</td><td>1</td><td>1</td><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
</table>

This means, the errors "Analog input 2 supply cable break/short circuit" (bit 28), "Analog input 3 supply cable break/short circuit" (bit 29) and "Analog input 4 supply cable break/short circuit" (bit 30) have occurred as listed in the following table.

The following table shows the bits of the subindexes 1…4 and the assigned errors.

Subindex of 0x2831	Bit	Fault code (hex)	Fault description
1	0	00	No fault
	1	01	Error microprocessor core
	2	02	Error digital signal processor
	3	03	Error DSP program download
	4	04	Error DSP realtime data transmission
	5	05	Power supply voltage too low
	6	06	Power supply voltage too high
	7	07	Internal supply voltage too low
	8	08	Internal supply voltage too high
	9	09	Internal reference voltage too low
	10	0A	Internal reference voltage too high
	11	0B	Internal current too low
	12	0C	Internal current too high
	13	0D	Electronics temperature too low (< -20 °C)
	14	0E	Electronics temperature too high (> 85 °C)
	15	0F	Electronics temperature exceeded (> 105 °C)
	16	10	Current sensor circuit failure
	17	11	Pilot/single stage LVDT cable break
	18	12	Pilot/single stage LVDT position out of range
	19	13	Pilot/single stage LVDT circuit failure
	20	14	Main stage LVDT cable break
	21	15	Main stage LVDT position out of range
	22	16	Main stage LVDT circuit failure
	23	17	Internal pressure transducer cable break
	24	18	Internal pressure transducer circuit failure
	25	19	Internal pressure transducer pressure peak
	26	1A	Analog input 0 supply cable break/short circuit
	27	1B	Analog input 1 supply cable break/short circuit
	28	1C	Analog input 2 supply cable break/short circuit
	29	1D	Analog input 3 supply cable break/short circuit
	30	1E	Analog input 4 supply cable break/short circuit
	31	1F	Analog input 0 current too low (4…20 mA)/ADC overflow (voltage)

Table 66: Fault reaction status bits (part 1 of 4)

Subindex of 0x2831	Bit	Fault code (hex)	Fault description
2	0	20	Analog input 1 current too low (4…20 mA)/ADC overflow (voltage)
	1	21	Analog input 2 current too low (4…20 mA)/ADC overflow (voltage)
	2	22	Analog input 3 current too low (4…20 mA)/ADC overflow (voltage)
	3	23	Analog input 4 current too low (4…20 mA)/ADC overflow (voltage)
	4	24	Analog input 0 circuit failure
	5	25	Analog input 1 circuit failure
	6	26	Analog input 2 circuit failure
	7	27	Analog input 3 circuit failure
	8	28	Analog input 4 circuit failure
	9	29	Encoder channel a cable break
	10	2A	Encoder channel b cable break
	11	2B	Encoder channel z cable break
	12	2C	SSI error
	13	2D	Power driver
	14	2E	Internal random access memory
	15	2F	Internal program memory
	16	30	Internal nonvolatile memory
	17	31	Out of memory error
	18	32	Software coding
	19	33	Software reset (watchdog)
	20	34	Interrupt time exceeded
	21	35	Task time exceeded
	22	36	Parameter initialization error
	23	37	Node identifier data memory corrupted
	24	38	User data memory corrupted
	25	39	Restore data memory corrupted
	26	3A	Factory data memory corrupted
	27	3B	Calibration data memory corrupted
	28	3C	Diagnosis data memory corrupted
	29	3D	Position control monitoring
	30	3E	Velocity control monitoring
	31	3F	Force control monitoring

Table 66: Fault reaction status bits (part 2 of 4)

Subindex of 0x2831	Bit	Fault code (hex)	Fault description
3	0	40	Flow control monitoring
	1	41	Pressure control monitoring
	2	42	Current control monitoring
	3	43	Spool position control monitoring
	4	44	Trajectory generator processing error
	5	45	Eventhandler exception
	6	46	Local CAN general fault
	7	47	Local CAN overrun
	8	48	Local CAN in error passive mode
	9	49	Local CAN recovered from bus-off
	10	4A	Local CAN RPDO1 time out
	11	4B	Local CAN RPDO2 time out
	12	4C	Local CAN RPDO3 time out
	13	4D	Local CAN RPDO4 time out
	14	4E	Local CAN RPDO1 data
	15	4F	Local CAN RPDO2 data
	16	50	Local CAN RPDO3 data
	17	51	Local CAN RPDO4 data
	18	52	Local CAN TPDO1 time out
	19	53	Local CAN TPDO2 time out
	20	54	Local CAN TPDO3 time out
	21	55	Local CAN TPDO4 time out
	22	56	Local CAN TPDO1 data
	23	57	Local CAN TPDO2 data
	24	58	Local CAN TPDO3 data
	25	59	Local CAN TPDO4 data
	26	5A	CAN general fault
	27	5B	CAN overrun
	28	5C	CAN in error passive mode
	29	5D	CAN recovered from bus-off
	30	5E	CAN RPDO1 time out
	31	5F	CAN RPDO2 time out

Table 66: Fault reaction status bits (part 3 of 4)

Subindex of 0x2831	Bit	Fault code (hex)	Fault description
4	0	60	CAN RPDO3 time out
	1	61	CAN RPDO4 time out
	2	62	CAN RPDO1 data
	3	63	CAN RPDO2 data
	4	64	CAN RPDO3 data
	5	65	CAN RPDO4 data
	6	66	CAN TPDO1 time out
	7	67	CAN TPDO2 time out
	8	68	CAN TPDO3 time out
	9	69	CAN TPDO4 time out
	10	6A	CAN TPDO1 data
	11	6B	CAN TPDO2 data
	12	6C	CAN TPDO3 data
	13	6D	CAN TPDO4 data
	14	6E	CAN life guard error or heartbeat error
	15	6F	CAN SYNC producer time out
	16	70	CAN SYNC consumer time out
	17	71	EtherCAT communication fault
	18	72	EtherCAT RPDO time out
	19	73	EtherCAT RPDO data
	20	74	EtherCAT TPDO time out
	21	75	EtherCAT TPDO data
	22…31		Reserved

Table 66: Fault reaction status bits (part 4 of 4)

8.2.4 Fault acknowledgement

Depending on the set fault reaction, the device sends out an emergency message and changes into a fault state.
Description of the emergency message:
⇨ Chapter "8.2.2 Emergency message", page 117
Fault reaction settings:
⇨ Chapter "8.2.1 Fault reaction settings", page 112

In order to get out of the fault state the fault must be acknowledged. This is achieved by sending the <ControlWord> (0x6040) or <LocalControlWord> (0x4040) to the device with the fault reset bit set (bit 3 of the control word). Another possibility is to toggle the enable signal. (The enable signal should stay low for at least a hundred ms.)
⇨ Chapter "5.3.1 Object 0x6040: Control word", page 27
⇨ Chapter "5.3.2 Object 0x4040: Local control word", page 28

ⓘ If the fault is not fixed or other faults are still present, the device will fall back into the 'FAULT' state.

8.2.5 Monitoring features

8.2.5.1 Object 0x2803: CPU supply voltage

This parameter holds the value of the CPU supply voltage. A fault reaction is thrown if the parameter is outside it's nominal range.
Nominal range: 3.1 V ≤ CpuSupplyVoltage ≤ 3.5 V

The following fault reactions are thrown:

Parameter value	**Fault Code (hex)**	**Fault reaction**
CpuSupplyVoltage < 3.1 V	07	Internal supply voltage too low
CpuSuppyVoltage > 3.5 V	08	Internal supply voltage too high

Table 67: Fault reactions for CPU supply voltage failure

Hardware_DiagnosticData							
Index	Subindex	Name	Data type	Access	Persistence	Value range	Default
0x2803	0	CpuSupplyVoltage	UINT16	ro	N	UINT16	None

ⓘ The power supply voltage should be in the range of 18…32 V to ensure proper operation.

8.2.5.2 Object 0x2804: Power supply voltage

This parameter holds the value of the power supply voltage. A fault reaction is thrown if the parameter is outside it's nominal range.
Nominal range: 17 V ≤ PowerSupplyVoltage ≤ 32.5 V

The following fault reactions are thrown:

Parameter value	**Fault Code (hex)**	**Fault reaction**
PowerSupplyVoltage < 17 V	05	Power supply voltage too low
PowerSuppyVoltage > 32.5 V	06	Power supply voltage too high

Table 68: Fault reactions for power supply voltage failure

Hardware_DiagnosticData							
Index	Subindex	Name	Data type	Access	Persistence	Value range	Default
0x2804	0	PowerSupplyVoltage	UINT16	ro	N	UINT16	None

8.2.5.3 Object 0x2805: PCB temperature

This parameter holds the value of the temperature on the board. A fault reaction is thrown if the parameter value falls below or exceeds the following temperature values:

- PCB temperature < -20 °C
- PCB temperature > 85 °C
- PCB temperature > 105 °C

The following fault reactions are thrown:

Parameter value	**Fault Code (hex)**	**Fault reaction**
PCB temperature < -20 °C	0D	Electronics temperature too low
PCB temperature > 85 °C	0E	Electronics temperature too high
PCB temperature > 105 °C	0F	Electronics temperature exceeded

Table 69: Fault reactions for PCB temperature failure

Hardware_DiagnosticData							
Index	Subindex	Name	Data type	Access	Persistence	Value range	Default
0x2805	0	PcbTemperature	INT16	ro	N	INT16	None

ⓘ The PCB temperature should not exceed the range of -20…85 °C to ensure proper operation. The electronics temperature has a big impact on the electronics lifetime. For a long life, the device should be operated at lower temperatures.

8.2.5.4 Object 0x280D: Operating time

Subindex 1 of the parameter 0x280D counts the time the device is switched on. The value is provided in minutes.
Subindex 2 holds the time (in minutes) the device is in the device status 'HOLD', 'FAULT_HOLD' or 'ACTIVE'.
⇨ Chapter "5.2.1 Device states", page 25

Hardware_DiagnosticData							
Index	Subindex	Name	Data type	Access	Persistence	Value range	Default
0x280D	1…2	OperatingTime	UINT32	ro	N	UINT32	None

8.3 Cable break monitoring

The cable break monitoring feature is a property of the analog inputs. All according fault reactions for the inputs in case of a cable break can be assigned to specific fault codes (see Table 71). The following cable connections are monitored:

- **Internal LVDT**
  In case of a cable break, the fault reaction NOT_READY is executed.
  Description of fault reaction settings:
  ⇨ Table 64, page 115

WARNING **The device must be serviced by our service technicians. The device may behave unpredictable.**

- **External LVDT**
  Monitoring is only active in case of device state greater 'INIT'. In case of a cable break, the fault reaction NOT_READY is executed.
  Description of the device states:
  ⇨ Chapter "5.2 State machine", page 24

WARNING **The device must be serviced by our service technicians. The device may behave unpredictable.**

- **Analog input 0, 1**
  Only the sensor wires are monitored (not the supply wires). The monitoring is active if the 4…20 mA type is selected (set with parameter <InputType>; 0x3200 for analog input 0, 0x3208 for analog input 1). If the current falls below 3 mA, a cable break is detected.
  ⇨ Chapter "6.1.1 Analog inputs 0 and 1", page 34
- **Analog input 2, 3, 4**
  The sensor supply wires and the sensor wires are monitored.
  - Sensor supply wire monitoring
    The supply current is being monitored. Currents < 3 mA are interpreted as cable break. The short circuit of the supply is also recognized. The fault reaction is the same. Each sensor has its own fault reaction. A short circuit on one of the sensors leads to a fault reaction of all sensors.
  - Sensor wire monitoring
    Cable break monitoring can be activated separately for each of the three external analog inputs 2, 3, 4.

Analog input type	Monitoring description
5, 8 (4…20 mA)	A fault reaction is thrown by input currents below 3 mA.
2, 10 (0…10 V)	The monitoring feature can be used by setting the according monitoring currents (see Table 71). The sensor needs to be able to sink a current of at least 0,1 mA. A fault reaction is thrown by an input voltage above 11 V. Due to the monitoring current, this occurs also in case of a cable break.
4, 7 (0…10 mA)	Only sensor supply wire monitored.

Table 70: Monitoring description for analog input types

Description of analog inputs:
⇨ Chapter "6.1.2 Analog inputs 2, 3 and 4", page 36

The following table shows to which fault codes the according fault reactions for the inputs can be assigned and which parameters are used to activate the monitoring feature.

Description of the fault codes:
⇨ Figure 63, page 112

Input	Fault code	<MonitoringCurrent> parameter
Analog input 0	31	No
Analog input 1	32	No
Analog input 2	28, 33	0x3217
Analog input 3	29, 34	0x3228
Analog input 4	30, 35	0x3227

Table 71: Cable break monitoring (assignment input to fault code)

Analog inputs - <MonitoringCurrent>
Each <MonitoringCurrent> parameter enables/disables the cable break detection for the according analog input. A value of 1 enables the monitoring current. A value of 0 disables the monitoring current.

AnalogInput							
Index	Subindex	Name	Data type	Access	Persis-tence	Value range	Default
0x3217	0	MonitoringCurrent	UINT8	rw	Y	0, 1	DSV
0x3228	0	MonitoringCurrent	UINT8	rw	Y	0…1	DSV
0x3227	0	MonitoringCurrent	UINT8	rw	Y	0…1	DSV

For your notes.

9 Storing / restoring parameters

Parameters are stored and restored in accordance with the procedure described in the DS 301.

9.1 Storing parameters

The electronics of our radial piston pump provide a non-volatile memory which allows to store parameters. Also restoring is possible, where all factory settings can be recalled.

The actual values of all parameters declared as non-volatile can be stored in a non-volatile memory on the device. Storing is proceeded when the signature "save" is written to the correspond subindex of the object 0x1010 in the Object Dictionary.

Volatile parameters have either a constant value (which can not be modified) or an associated default value parameter. These default parameters are savable in order to provide a choosable bootup status.

The following table describes the behavior of the savable and volatile parameters when performing a save, bootup or restore operation.

	Savable parameters	**Volatile parameters**	
		with associated default parameters	**without associated default parameters**
At save	Value saved	Value of default parameter saved	Nothing saved
At bootup	Saved value loaded	Saved value of the default parameter loaded	Factory default value loaded
At restore	Factory settings loaded	Factory settings loaded to default parameter and volatile parameter	Factory default value loaded

Table 72: Behavior of savable and volatile parameters

There is the possibility to store all non-volatile parameters or only a specific parameter group which lies within a certain object index range.

The write access to any parameter will not affect its default value.

The following table shows the different parameter groups and where they are found in the index range as defined in the DS 301 (the parameter used to store the corresponding parameter group is shown in the last column):

Parameter group	**Index range**	**Store command**
Communication	0x1000…0x1FFF	<SaveCommunicationParameters> (0x1010, subindex 2)
Application	0x6000…0x9FFF	<SaveApplicationParameters> (0x1010, subindex 3)
Manufacturer-defined	0x2000…0x5FFF	<SaveApplicationParameters> (0x1010, subindex 4)

Table 73: Parameter groups (store command)

The signature, which has to be written to the corresponding subindex of 0x1010, is as follows:

Signature	MSB			LSB
ASCII	e	v	a	s
hex	65	76	61	73

9.1.1 Object 0x1010: Store parameters

StoreParameters							
Index	Subindex	Name	Data type	Access	Persistence	Value range	Default
0x1010	1	SaveAllParameters	UINT32	rw	N	UINT32	1
0x1010	2	SaveCommunicationParameters	UINT32	rw	N	UINT32	1
0x1010	3	SaveApplicationParameters	UINT32	rw	N	UINT32	1
0x1010	4	SaveManufacturerDefinedParameters	UINT32	rw	N	UINT32	1

<SaveAllParameters>
Saves all parameters in the device's non-volatile memory by writing the signature 0x65766173 ("save").

<SaveCommunicationParameters>
Saves all communication parameters (index range 0x1000…0x1FFF) in the device's non-volatile memory by writing the signature 0x65766173 ("save").

<SaveApplicationParameters>
Saves all application parameters (index range 0x6000…0x9FFF) in the device's non-volatile memory by writing the signature 0x65766173 ("save").

<SaveManufacturerDefinedParameters>
Saves all manufacturer-defined parameters (index range 0x2000…0x5FFF) in the device's non-volatile memory by writing the signature 0x65766173 ("save").

9.2 Restoring default parameters

In order to activate the default values, the application needs to be reset. The restore command sets the default values to factory defaults. The default settings (factory settings) of parameters can be restored, when the signature "load" is written to the corresponding subindex of the object 0x1011 in the object dictionary.

Writing to subindex 01 causes restoring of all parameters in the object dictionary. For the parameter groups the following applies:

Parameter group	**Index range**	**Restore command**
Communication	0x1000…0x1FFF	<RestoreCommunicationDefaultParameters> (0x1011, subindex 2)
Application	0x6000…0x9FFF	<RestoreApplicationDefaultParameters> (0x1011, subindex 3)
Manufacturer-defined	0x2000…0x5FFF	<RestoreManufacturerDefinedDefaultParameters> (0x1011, subindex 4)

Table 74: Parameter groups (restore command)

The write access to any parameter will not affect its default value.

The format of the signature written to the corresponding subindex of 0x1010 is as follows:

Signature	MSB			LSB
ASCII	d	a	o	l
hex	64	61	6F	6C

The factory settings that are restored will be only set valid after a reset in the following manner:

- Reset Application is necessary to restore all parameters (needed if restore options at subindex 01, 03 and 04 are executed).
- Reset Communication is necessary to restore all communication parameters (needed if restore options at subindex 02 was executed).

In order to finalize the restoration of the factory settings the device must be reset by means of the NMT services Reset Communication or Reset Application.

The interruption of the power supply will not lead to a restore of parameters.

9.2.1 Object 0x1011: Restore default parameters

RestoreDefaultParameters							
Index	Subindex	Name	Data type	Access	Persistence	Value range	Default
0x1011	1	RestoreAllDefaultParameters	UINT32	rw	N	UINT32	1
0x1011	2	RestoreCommunicationDefaultParameters	UINT32	rw	N	UINT32	1
0x1011	3	RestoreApplicationDefaultParameters	UINT32	rw	N	UINT32	1
0x1011	4	RestoreManufacturerDefinedDefaultParameters	UINT32	rw	N	UINT32	1

<RestoreAllDefaultParameters>
Restores the factory settings for all parameters in the device by writing the signature 0x64616F6C ("load").
See note below.

<RestoreCommunicationCommunicationParameters>
Restores all communication parameters (index range 0x1000…0x1FFF) in the device by writing the signature 0x64616F6C ("load").
See note below.

<RestoreApplicationDefaultParameters>
Restores all application parameters (index range 0x6000…0x9FFF) in the device by writing the signature 0x64616F6C ("load").
See note below.

<RestoreManufacturerDefinedDefaultParameters>
Restores all manufacturer-defined parameters (index range 0x2000…0x5FFF) in the device by writing the signature 0x64616F6C ("load").

ⓘ In order to finalize the restoration of the factory settings, after any of the above described parameters was written, a reset of the device needs to be performed by means of the NMT services Reset Communication or Reset Application.

10 Object dictionary

ⓘ On request, we provide an EDS file (Electronic Data Sheet). The EDS file is a representation of the object dictionary. If the master controller has the ability to read EDS files, the object dictionary can be loaded into the master controller.

Index	Subindex	PDO mapping	Short name	Specification	1. line: Block name 2. line: Parameter name	Data type	Access	Persistence	Value range	Default
0x0002	0	Y	dums08	DS301	DataType INTEGER8	INT8	rw	N	INT8	0
0x0003	0	Y	dums16	DS301	DataType INTEGER16	INT16	rw	N	INT16	0
0x0004	0	Y	dums32	DS301	DataType INTEGER32	INT32	rw	N	INT32	0
0x0005	0	Y	dumu08	DS301	DataType UNSIGNED8	UINT8	rw	N	UINT8	0
0x0006	0	Y	dumu16	DS301	DataType UNSIGNED16	UINT16	rw	N	UINT16	0
0x0007	0	Y	dumu32	DS301	DataType UNSIGNED32	UINT32	rw	N	UINT32	0
0x1000	0	N	devtyp	DS301	- DeviceType	UINT32	ro	N	UINT32	408
0x1001	0	Y	errreg	DS301	- ErrorRegister	UINT8	ro	N	UINT8	0
0x1002	0	Y	manstsreg	DS301	- ManufacturerStatusRegister	UINT32	ro	N	UINT32	0
0x1003	0	N	preerrnum	DS301	PreDefinedErrorField NumberOfErrors	UINT32	rw	N	UINT32	0
0x1003	1	N	preerrfld[0]	DS301	PreDefinedErrorField StandardErrorField	UINT32	ro	N	UINT32	DSV
0x1003	…									
0x1003	16	N	preerrfld[15]	DS301	PreDefinedErrorField StandardErrorField	UINT32	ro	N	UINT32	DSV
0x1005	0	N	sncmsgcob	DS301	- CobIdSyncMessage	UINT32	rw	Y	1…1073743871	128

Table 75: Object dictionary (part 1 of 31)

Index	Subindex	PDO mapping	Short name	Specification	1. line: Block name 2. line: Parameter name	Data type	Access	Persistence	Value range	Default
0x1006	0	N	comcycper	DS301	- CommunicationCyclePeriod	UINT32	rw	Y	UINT32	0
0x1007	0	N	sncwinlen	DS301	- SynchronousWindowLength	UINT32	rw	Y	UINT32	0
0x1008	0	N	mandevnam	DS301	Device ManufacturerDeviceName	STRING	ro	N	64 char	DSV
0x1009	0	N	manhdwver	DS301	Device ManufacturerHardwareVersion	STRING	ro	N	64 char	DSV
0x100A	0	N	mansfwver	DS301	Device ManufacturerSoftwareVersion	STRING	ro	N	64 char	DSV
0x100B	0	N	nodide	DS301	- NodeId	UINT32	ro	N	UINT32	127
0x100C	0	N	grdtim	DS301	- GuardTime	UINT16	rw	Y	UINT16	0
0x100D	0	N	liftimfct	DS301	- LifeTimeFactor	UINT8	rw	Y	UINT8	0
0x1010	1	N	stopar[0]	DS301	StoreParameters SaveAllParameters	UINT32	rw	N	UINT32	1
0x1010	2	N	stopar[1]	DS301	StoreParameters SaveCommunicationParameters	UINT32	rw	N	UINT32	1
0x1010	3	N	stopar[2]	DS301	StoreParameters SaveApplicationParameters	UINT32	rw	N	UINT32	1
0x1010	4	N	stopar[3]	DS301	StoreParameters SaveManufacturerDefinedParameters	UINT32	rw	N	UINT32	1
0x1011	1	N	rstpar[0]	DS301	RestoreDefaultParameters RestoreAllDefaultParameters	UINT32	rw	N	UINT32	1
0x1011	2	N	rstpar[1]	DS301	RestoreDefaultParameters RestoreCommunicationDefaultParameters	UINT32	rw	N	UINT32	1
0x1011	3	N	rstpar[2]	DS301	RestoreDefaultParameters RestoreApplicationDefaultParameters	UINT32	rw	N	UINT32	1
0x1011	4	N	rstpar[3]	DS301	RestoreDefaultParameters RestoreManufacturerDefinedDefaultParameters	UINT32	rw	N	UINT32	1

Table 75: Object dictionary (part 2 of 31)

Index	Subindex	PDO mapping	Short name	Specification	1. line: Block name 2. line: Parameter name	Data type	Access	Persistence	Value range	Default
0x1012	0	N	tspmsgcob	DS301	- CobIdTimeStampMessage	UINT32	rw	Y	1…2047	256
0x1013	0	Y	hghrsltsp	DS301	- HighResolutionTimeStamp	UINT32	rw	Y	UINT32	0
0x1014	0	N	emgmsgcob	DS301	- CobIdEmergencyMessage	UINT32	rw	Y	1…2047	255
0x1015	0	N	emgmsginh	DS301	- InhibitTimeEmergencyMessage	UINT16	rw	Y	UINT16	0
0x1017	0	N	proharbea	DS301	- ProducerHeartbeatTime	UINT16	rw	Y	UINT16	0
0x1018	1	N	ideobj[0]	DS301	IdentityObject VendorId	UINT32	ro	N	UINT32	40
0x1018	2	N	ideobj[1]	DS301	IdentityObject ProductCode	UINT32	ro	N	UINT32	DSV
0x1018	3	N	ideobj[2]	DS301	IdentityObject RevisionNumber	UINT32	ro	N	UINT32	DSV
0x1018	4	N	ideobj[3]	DS301	IdentityObject SerialNumber	UINT32	ro	N	UINT32	DSV
0x1200	1	N	sdoclncob	DS301	ServerSdoParameter CobIdClientServer	UINT32	ro	N	UINT32	1663
0x1200	2	N	sdosrvcob	DS301	ServerSdoParameter CobIdServerClient	UINT32	ro	N	UINT32	1535
0x1400	1	N	pdrcob[0]	DS301	ReceivePdoCommunicationParameter 1stReceivePdo_CobIdUsedByPdo	UINT32	rw	Y	1…2147485695	639
0x1400	2	N	pdrtrn[0]	DS301	ReceivePdoCommunicationParameter 1stReceivePdo_TransmissionType	UINT8	rw	Y	UINT8	255
0x1400	5	N	pdrtim[0]	DS301	ReceivePdoCommunicationParameter 1stReceivePdo_EventTimer	UINT16	rw	Y	UINT16	0
0x1401	1	N	pdrcob[1]	DS301	ReceivePdoCommunicationParameter 2ndReceivePdo_CobIdUsedByPdo	UINT32	rw	Y	1…2147485695	895
0x1401	2	N	pdrtrn[1]	DS301	ReceivePdoCommunicationParameter 2ndReceivePdo_TransmissionType	UINT8	rw	Y	UINT8	255

Table 75: Object dictionary (part 3 of 31)

Index	Subindex	PDO mapping	Short name	Specification	1. line: Block name 2. line: Parameter name	Data type	Access	Persistence	Value range	Default
0x1401	5	N	pdrtim[1]	DS301	ReceivePdoCommunicationParameter 2ndReceivePdo_EventTimer	UINT16	rw	Y	UINT16	0
0x1402	1	N	pdrcob[2]	DS301	ReceivePdoCommunicationParameter 3rdReceivePdo_CobIdUsedByPdo	UINT32	rw	Y	1…2147485695	1151
0x1402	2	N	pdrtrn[2]	DS301	ReceivePdoCommunicationParameter 3rdReceivePdo_TransmissionType	UINT8	rw	Y	UINT8	255
0x1402	5	N	pdrtim[2]	DS301	ReceivePdoCommunicationParameter 3rdReceivePdo_EventTimer	UINT16	rw	Y	UINT16	0
0x1403	1	N	pdrcob[3]	DS301	ReceivePdoCommunicationParameter 4thReceivePdo_CobIdUsedByPdo	UINT32	rw	Y	1…2147485695	1407
0x1403	2	N	pdrtrn[3]	DS301	ReceivePdoCommunicationParameter 4thReceivePdo_TransmissionType	UINT8	rw	Y	UINT8	255
0x1403	5	N	pdrtim[3]	DS301	ReceivePdoCommunicationParameter 4thReceivePdo_EventTimer	UINT16	rw	Y	UINT16	0
0x1600	0	N	pdrmapnum[0]	DS301	ReceivePdoMappingParameter 1stReceivePdoMapping_NumberOfMappedApplicationObjectsInPdo	UINT8	rw	Y	0…8	1
0x1600	1	N	pdrmap[0]	DS301	ReceivePdoMappingParameter PdoMappingForTheNthApplicationObjectToBeMapped	UINT32	rw	Y	UINT32	1614807056
0x1600	…									
0x1600	8	N	pdrmap[7]	DS301	ReceivePdoMappingParameter PdoMappingForTheNthApplicationObjectToBeMapped	UINT32	rw	Y	UINT32	0
0x1601	0	N	pdrmapnum[1]	DS301	ReceivePdoMappingParameter 2ndReceivePdoMapping_NumberOfMappedApplicationObjectsInPdo	UINT8	rw	Y	0…8	2
0x1601	1	N	pdrmap[8]	DS301	ReceivePdoMappingParameter PdoMappingForTheNthApplicationObjectToBeMapped	UINT32	rw	Y	UINT32	1614807056
0x1601	…									
0x1601	8	N	pdrmap[15]	DS301	ReceivePdoMappingParameter PdoMappingForTheNthApplicationObjectToBeMapped	UINT32	rw	Y	UINT32	0
0x1602	0	N	pdrmapnum[2]	DS301	ReceivePdoMappingParameter 3rdReceivePdoMapping_NumberOfMappedApplicationObjectsInPdo	UINT8	rw	Y	0…8	2
0x1602	1	N	pdrmap[16]	DS301	ReceivePdoMappingParameter PdoMappingForTheNthApplicationObjectToBeMapped	UINT32	rw	Y	UINT32	1614807056

Table 75: Object dictionary (part 4 of 31)

Index	Subindex	PDO mapping	Short name	Specification	1. line: Block name 2. line: Parameter name	Data type	Access	Persistence	Value range	Default
0x1602	…									
0x1602	8	N	pdrmap[23]	DS301	ReceivePdoMappingParameter PdoMappingForTheNthApplicationObjectToBeMapped	UINT32	rw	Y	UINT32	0
0x1603	0	N	pdrmapnum[3]	DS301	ReceivePdoMappingParameter 4thReceivePdoMapping_NumberOfMappedApplicationObjectsInPdo	UINT8	rw	Y	0…8	3
0x1603	1	N	pdrmap[24]	DS301	ReceivePdoMappingParameter PdoMappingForTheNthApplicationObjectToBeMapped	UINT32	rw	Y	UINT32	1614807056
0x1603	…									
0x1603	8	N	pdrmap[31]	DS301	ReceivePdoMappingParameter PdoMappingForTheNthApplicationObjectToBeMapped	UINT32	rw	Y	UINT32	0
0x1800	1	N	pdtcob[0]	DS301	TransmitPdoCommunicationParameter 1stTransmitPdo_CobIdUsedByPdo	UINT32	rw	Y	1…2147485695	511
0x1800	2	N	pdttrn[0]	DS301	TransmitPdoCommunicationParameter 1stTransmitPdo_TransmissionType	UINT8	rw	Y	UINT8	255
0x1800	3	N	pdtinh[0]	DS301	TransmitPdoCommunicationParameter 1stTransmitPdo_InhibitTime	UINT16	rw	Y	UINT16	0
0x1800	5	N	pdttim[0]	DS301	TransmitPdoCommunicationParameter 1stTransmitPdo_EventTimer	UINT16	rw	Y	UINT16	0
0x1801	1	N	pdtcob[1]	DS301	TransmitPdoCommunicationParameter 2ndTransmitPdo_CobIdUsedByPdo	UINT32	rw	Y	1…2147485695	767
0x1801	2	N	pdttrn[1]	DS301	TransmitPdoCommunicationParameter 2ndTransmitPdo_TransmissionType	UINT8	rw	Y	UINT8	255
0x1801	3	N	pdtinh[1]	DS301	TransmitPdoCommunicationParameter 2ndTransmitPdo_InhibitTime	UINT16	rw	Y	UINT16	0
0x1801	5	N	pdttim[1]	DS301	TransmitPdoCommunicationParameter 2ndTransmitPdo_EventTimer	UINT16	rw	Y	UINT16	0
0x1802	1	N	pdtcob[2]	DS301	TransmitPdoCommunicationParameter 3rdTransmitPdo_CobIdUsedByPdo	UINT32	rw	Y	1…2147485695	1023
0x1802	2	N	pdttrn[2]	DS301	TransmitPdoCommunicationParameter 3rdTransmitPdo_TransmissionType	UINT8	rw	Y	UINT8	255
0x1802	3	N	pdtinh[2]	DS301	TransmitPdoCommunicationParameter 3rdTransmitPdo_InhibitTime	UINT16	rw	Y	UINT16	0

Table 75: Object dictionary (part 5 of 31)

Index	Subindex	PDO mapping	Short name	Specification	1. line: Block name 2. line: Parameter name	Data type	Access	Persistence	Value range	Default
0x1802	5	N	pdttim[2]	DS301	TransmitPdoCommunicationParameter 3rdTransmitPdo_EventTimer	UINT16	rw	Y	UINT16	0
0x1803	1	N	pdtcob[3]	DS301	TransmitPdoCommunicationParameter 4thTransmitPdo_CobIdUsedByPdo	UINT32	rw	Y	1…2147485695	1279
0x1803	2	N	pdttrn[3]	DS301	TransmitPdoCommunicationParameter 4thTransmitPdo_TransmissionType	UINT8	rw	Y	UINT8	255
0x1803	3	N	pdtinh[3]	DS301	TransmitPdoCommunicationParameter 4thTransmitPdo_InhibitTime	UINT16	rw	Y	UINT16	0
0x1803	5	N	pdttim[3]	DS301	TransmitPdoCommunicationParameter 4thTransmitPdo_EventTimer	UINT16	rw	Y	UINT16	0
0x1A00	0	N	pdtmapnum[0]	DS301	TransmitPdoMappingParameter 1stTransmitPdoMapping_NumberOfMappedApplicationObjectsInPdo	UINT8	rw	Y	0…8	1
0x1A00	1	N	pdtmap[0]	DS301	TransmitPdoMappingParameter PdoMappingForTheNthApplicationObjectToBeMapped	UINT32	rw	Y	UINT32	1614872592
0x1A00	…									
0x1A00	8	N	pdtmap[7]	DS301	TransmitPdoMappingParameter PdoMappingForTheNthApplicationObjectToBeMapped	UINT32	rw	Y	UINT32	0
0x1A01	0	N	pdtmapnum[1]	DS301	TransmitPdoMappingParameter 2ndTransmitPdoMapping_NumberOfMappedApplicationObjectsInPdo	UINT8	rw	Y	0…8	2
0x1A01	1	N	pdtmap[8]	DS301	TransmitPdoMappingParameter PdoMappingForTheNthApplicationObjectToBeMapped	UINT32	rw	Y	UINT32	1614872592
0x1A01	…									
0x1A01	8	N	pdtmap[15]	DS301	TransmitPdoMappingParameter PdoMappingForTheNthApplicationObjectToBeMapped	UINT32	rw	Y	UINT32	0
0x1A02	0	N	pdtmapnum[2]	DS301	TransmitPdoMappingParameter 3rdTransmitPdoMapping_NumberOfMappedApplicationObjectsInPdo	UINT8	rw	Y	0…8	2
0x1A02	1	N	pdtmap[16]	DS301	TransmitPdoMappingParameter PdoMappingForTheNthApplicationObjectToBeMapped	UINT32	rw	Y	UINT32	1614872592
0x1A02	…									
0x1A02	8	N	pdtmap[23]	DS301	TransmitPdoMappingParameter PdoMappingForTheNthApplicationObjectToBeMapped	UINT32	rw	Y	UINT32	0

Table 75: Object dictionary (part 6 of 31)

Index	Subindex	PDO mapping	Short name	Specification	1. line: Block name 2. line: Parameter name	Data type	Access	Persistence	Value range	Default
0x1A03	0	N	pdtmapnum[2]	DS301	TransmitPdoMappingParameter 4thTransmitPdoMapping_NumberOfMappedApplicationObjectsInPdo	UINT8	rw	Y	0…8	3
0x1A03	1	N	pdtmap[24]	DS301	TransmitPdoMappingParameter PdoMappingForTheNthApplicationObjectToBeMapped	UINT32	rw	Y	UINT32	1614872592
0x1A03	…									
0x1A03	8	N	pdtmap[31]	DS301	TransmitPdoMappingParameter PdoMappingForTheNthApplicationObjectToBeMapped	UINT32	rw	Y	UINT32	0
0x200F	0	N	pwrdly	DIV	System PowerOnDelay	UINT8	rw	Y	0…10	0
0x2107	0	Y	hldtrg	DIV	HoldPressureControl HoldPressureTrigger	INT16	rw	Y	INT16	16384
0x2108	0	Y	hldprsset	DIV	HoldPressureControl PressureSetpoint	INT16	rw	Y	INT16	DSV
0x2109	0	Y	hldsplset	DIV	HoldPressureControl SpoolPositionSetpoint	INT16	rw	Y	INT16	16384
0x2120	0	N	prslekfct	DIV	PumpController LeakageCompensation	FLOAT32	rw	Y	FLOAT32	DSV
0x2141	1	N	parctlwrd[0]	DIV	AnalogParameterSetSwitching ControlWord	UINT16	rw	Y	1…65535	DSV
0x2141	…									
0x2141	16	N	parctlwrd[15]	DIV	AnalogParameterSetSwitching ControlWord	UINT16	rw	Y	1…65535	DSV
0x2142	1	N	parprssetnum[0]	DIV	AnalogParameterSetSwitching PressureSetSelector	UINT8	rw	Y	1…16	1
0x2142	…									
0x2142	16	N	parprssetnum[15]	DIV	AnalogParameterSetSwitching PressureSetSelector	UINT8	rw	Y	1…16	16
0x2143	0	N	parsetitf	DIV	AnalogParameterSetSwitching SourceTransducer	UINT8	rw	Y	1…4	DSV
0x2145	0	N	parsetena	DIV	AnalogParameterSetSwitching Enable	UINT8	rw	Y	0…1	DSV

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Index	Subindex	PDO mapping	Short name	Specification	1. line: Block name 2. line: Parameter name	Data type	Access	Persistence	Value range	Default
0x2146	0	N	parsetnum	DIV	AnalogParameterSetSwitching ActiveParameterSet	UINT8	ro	N	0…16	DSV
0x2147	0	N	parhybflw	DIV	AnalogParameterSetSwitching HybridFlow	INT16	rw	Y	INT16	DSV
0x2148	1	N	parsetmod[0]	DIV	AnalogParameterSetSwitching Mode	UINT8	rw	Y	0…16	DSV
0x2148	…									
0x2148	16	N	parsetmod[15]	DIV	AnalogParameterSetSwitching Mode	UINT8	rw	Y	0…16	DSV
0x2158	0	Y	stgposout	DIV	ValveMainStageControl ControllerOutput	INT16	ro	N	INT16	None
0x21A1	0	N	pmpflstim	DIV	PumpController FlushingTime	UINT16	ro	N	0…300	180
0x21A4	0	Y	splsetmst	DIV	PumpController SpoolSetPointFromMaster	INT16	rw	N	INT16	None
0x21A5	0	N	pmpmstslv	DIV	PumpController MasterSlaveSelector	INT8	rw	Y	-1…3	DSV
0x21A7	0	Y	splfwdmst	DIV	PumpController SpoolFeedForwardFromMaster	INT16	rw	N	INT16	None
0x21AA	0	Y	splfwdmstpgn	DIV	PumpController SpoolFeedForwardFromMasterProportionalGain	FLOAT32	rw	Y	FLOAT32	DSV
0x2304	1	Y	cmpprspgn[0]	DIV	ValvePressureControl ProportionalGain	FLOAT32	rw	Y	0…+inf	DSV
0x2304	…									
0x2304	16	Y	cmpprspgn[15]	DIV	ValvePressureControl ProportionalGain	FLOAT32	rw	Y	0…+inf	DSV
0x2305	1	Y	cmpprsign[0]	DIV	ValvePressureControl IntegratorGain	FLOAT32	rw	Y	0…+inf	DSV
0x2305	…									
0x2305	16	Y	cmpprsign[15]	DIV	ValvePressureControl IntegratorGain	FLOAT32	rw	Y	0…+inf	DSV

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Index	Subindex	PDO mapping	Short name	Specification	1. line: Block name 2. line: Parameter name	Data type	Access	Persistence	Value range	Default
0x2307	1	Y	cmpprsicr[0]	DIV	ValvePressureControl IntegratorControlRange	INT16	rw	Y	0…32767	DSV
0x2307	…									
0x2307	16	Y	cmpprsicr[15]	DIV	ValvePressureControl IntegratorControlRange	INT16	rw	Y	0…32767	DSV
0x2308	1	Y	cmpprsdgn[0]	DIV	ValvePressureControl DifferentiatorGain	FLOAT32	rw	Y	0…+inf	DSV
0x2308	…									
0x2308	16	Y	cmpprsdgn[15]	DIV	ValvePressureControl DifferentiatorGain	FLOAT32	rw	Y	0…+inf	DSV
0x2309	1	Y	cmpprsdtm[0]	DIV	ValvePressureControl DifferentiatorT1	FLOAT32	rw	Y	0…+inf	DSV
0x2309	…									
0x2309	16	Y	cmpprsdtm[15]	DIV	ValvePressureControl DifferentiatorT1	FLOAT32	rw	Y	0…+inf	DSV
0x230A	1	Y	cmpprsupp[0]	DIV	ValvePressureControl UpperOutputLimit	INT16	rw	Y	<LowerOutput-Limit>…32767	16384
0x230A	…									
0x230A	16	Y	cmpprsupp[15]	DIV	ValvePressureControl UpperOutputLimit	INT16	rw	Y	<LowerOutput-Limit>…32767	16384
0x230B	1	Y	cmpprslow[0]	DIV	ValvePressureControl LowerOutputLimit	INT16	rw	Y	-32768…<UpperOutput-Limit>	-16384
0x230B	…									
0x230B	16	Y	cmpprslow[15]	DIV	ValvePressureControl LowerOutputLimit	INT16	rw	Y	-32768…<UpperOutput-Limit>	-16384
0x230D	1	N	cmpprsitf[0]	DIV	ValvePressureControl PressureControllerActiveTransducerInterface	INT8	rw	Y	1…4	DSV
0x230D	…									
0x230D	16	N	cmpprsitf[15]	DIV	ValvePressureControl PressureControllerActiveTransducerInterface	INT8	rw	Y	1…4	DSV

Table 75: Object dictionary (part 9 of 31)

Index	Subindex	PDO mapping	Short name	Specification	1. line: Block name 2. line: Parameter name	Data type	Access	Persistence	Value range	Default
0x2310	0	Y	cmpprsint	DIV	ValvePressureControl IntegratorPart	FLOAT32	ro	N	FLOAT32	None
0x2311	0	Y	cmpprspro	DIV	ValvePressureControl ProportionalPart	FLOAT32	ro	N	FLOAT32	None
0x2312	0	Y	cmpprsdt1	DIV	ValvePressureControl DifferantialPart	FLOAT32	ro	N	FLOAT32	None
0x2314	1	Y	cmpprsdgndwn[0]	DIV	PumpPressureControl DifferentiatorGainDecompress	FLOAT32	rw	Y	0…+inf	DSV
0x2314	…									
0x2314	16	Y	cmpprsdgndwn[15]	DIV	PumpPressureControl DifferentiatorGainDecompress	FLOAT32	rw	Y	0…+inf	DSV
0x2315	1	Y	cmpprsspl[0]	DIV	PumpPressureControl SpoolPositionFeedbackPart	FLOAT32	ro	N	FLOAT32	None
0x2315	2	Y	cmpprsspl[1]	DIV	PumpPressureControl SpoolPositionFeedbackPart	FLOAT32	ro	N	FLOAT32	None
0x2316	1	Y	cmpprssgn[0]	DIV	PumpPressureControl SpoolPositionFeedbackGain	FLOAT32	rw	Y	0…+inf	DSV
0x2316	…									
0x2316	16	Y	cmpprssgn[15]	DIV	PumpPressureControl SpoolPositionFeedbackGain	FLOAT32	rw	Y	0…+inf	DSV
0x2317	1	Y	cmpprslim[0]	DIV	PumpPressureControl SuckLimitationForPD	INT16	rw	Y	-32768…0	-16384
0x2317	…									
0x2317	16	Y	cmpprslim[15]	DIV	PumpPressureControl SuckLimitationForPD	INT16	rw	Y	-32768…0	-16384
0x2318	1	Y	cmpprshpssgn[0]	DIV	PumpPressureControl SpoolPositionFeedbackGainHighPassFiltered	FLOAT32	rw	Y	0…+inf	DSV
0x2318	…									
0x2318	16	Y	cmpprshpssgn[15]	DIV	PumpPressureControl SpoolPositionFeedbackGainHighPassFiltered	FLOAT32	rw	Y	0…+inf	DSV
0x2319	1	Y	cmpprshpsdtm[0]	DIV	PumpPressureControl SpoolPositionFeedbackHighPassTimeConstant	FLOAT32	rw	Y	0…+inf	DSV

Table 75: Object dictionary (part 10 of 31)

Index	Subindex	PDO mapping	Short name	Specification	1. line: Block name 2. line: Parameter name	Data type	Access	Persistence	Value range	Default
0x2319	…									
0x2319	16	Y	cmpprshpsdtm[15]	DIV	PumpPressureControl SpoolPositionFeedbackHighPassTimeConstant	FLOAT32	rw	Y	0…+inf	DSV
0x2350	0	Y	prssetnum	DIV	ValvePressureControl ActiveParameterSetNumber	UINT8	rw	Y	1…16	1
0x23F2	0	N	cmpprsflt	DIV	ValvePressureControl ActualPressureFilterCutoffFrequency	FLOAT32	rw	Y	0…5000	0
0x23F3	0	N	prsfltord	DIV	ValvePressureControl ActualPressureFilterOrder	UINT8	rw	Y	1…3	1
0x2418	0	Y	cmpprsout	DIV	ValvePressureControl ControllerOutput	INT16	ro	N	INT16	None
0x2420	0	N	faisaftyp	DIV	ValveFailSafeWindowMonitoring Typ	INT8	ro	N	0…1	DSV
0x2421	0	N	faisafupp	DIV	ValveFailSafeWindowMonitoring UpperLimit	INT16	ro	N	<LowerLimit>… 32767	16384
0x2422	0	N	faisaflow	DIV	ValveFailSafeWindowMonitoring LowerLimit	INT16	ro	N	-32768… <UpperLimit>	-16384
0x2600	0	N	pmppwrmax	DIV	PumpController Power_Maximum	INT16	rw	Y	0…16384	DSV
0x2601	0	N	pmppwrpgn	DIV	PumpController Power_ProportionalGain	FLOAT32	rw	Y	0…+inf	DSV
0x2602	0	N	pmppwrpt1	DIV	PumpController Power_PT1Gain	FLOAT32	rw	Y	0…+inf	DSV
0x2603	0	N	pmppwrptm	DIV	PumpController Power_PT1TimeConstant	FLOAT32	rw	Y	0…+inf	DSV
0x2604	0	N	pmppwrpts	DIV	PumpController Power_PT1Shift	INT16	rw	Y	0…32767	DSV
0x2605	0	N	pmppwrdgn	DIV	PumpController Power_DifferentialGain	FLOAT32	rw	Y	0…+inf	DSV
0x2606	0	N	pmppwrdtm	DIV	PumpController Power_DifferentialTimeConstant	FLOAT32	rw	Y	0…+inf	DSV

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Index	Subindex	PDO mapping	Short name	Specification	1. line: Block name 2. line: Parameter name	Data type	Access	Persistence	Value range	Default
0x2608	0	Y	pwrval	DIV	PumpController PowerValue	INT16	ro	N	INT16	None
0x2803	0	Y	cpusup	DIV	Hardware_DiagnosticData CpuSupplyVoltage	UINT16	ro	N	UINT16	None
0x2804	0	Y	pwrsup	DIV	Hardware_DiagnosticData PowerSupplyVoltage	UINT16	ro	N	UINT16	None
0x2805	0	Y	pcbtmp	DIV	Hardware_DiagnosticData PcbTemperature	INT16	ro	N	INT16	None
0x280D	1	N	oprtim[0]	DIV	Hardware_DiagnosticData OperatingTime	UINT32	ro	N	UINT32	None
0x280D	2	N	oprtim[1]	DIV	Hardware_DiagnosticData OperatingTime	UINT32	ro	N	UINT32	None
0x2822	1	N	errval[0]	DIV	ErrorHandler Address	UINT32	ro	N	UINT32	0
0x2822	…									
0x2822	5	N	errval[15]	DIV	ErrorHandler Address	UINT32	ro	N	UINT32	0
0x2823	1	N	errtim[0]	DIV	ErrorHandler Time	UINT32	ro	N	UINT32	0
0x2823	…									
0x2823	5	N	errtim[15]	DIV	ErrorHandler Time	UINT32	ro	N	UINT32	0
0x2830	1	N	faurea[0]	DIV	FaultReaction Type	INT8	rw	Y	INT8	DSV
0x2830	…									
0x2830	118	N	faurea[15]	DIV	FaultReaction Type	INT8	rw	Y	INT8	DSV
0x2831	1	N	fausts[0]	DIV	FaultReaction Status	UINT32	ro	N	UINT32	DSV
0x2831	…									
0x2831	4	N	fausts[15]	DIV	FaultReaction Status	UINT32	ro	N	UINT32	DSV

Table 75: Object dictionary (part 12 of 31)

Index	Subindex	PDO mapping	Short name	Specification	1. line: Block name 2. line: Parameter name	Data type	Access	Persistence	Value range	Default
0x2832	0	N	faudsc	DIV	FaultReaction FaultReactionDescription	STRING	ro	N	64 char	DSV
0x2833	0	N	fauhis	DIV	FaultReaction FaultHistoryNumber	UINT8	rw	N	0…7	0
0x3010	1	N	pdttrnman[0]	DIV	Can 1stTransmitPdoManufacturerTransmissionType	UINT8	rw	Y	UINT8	DSV
0x3010	2	N	pdttrnman[1]	DIV	Can 2ndTransmitPdoManufacturerTransmissionType	UINT8	rw	Y	UINT8	DSV
0x3010	3	N	pdttrnman[2]	DIV	Can 3rdTransmitPdoManufacturerTransmissionType	UINT8	rw	Y	UINT8	DSV
0x3010	4	N	pdttrnman[3]	DIV	Can 4thTransmitPdoManufacturerTransmissionType	UINT8	rw	Y	UINT8	DSV
0x3011	0	N	pdttrg	DIV	Can TransmitPdoTrigger	UINT8	rw	N	0…4	0
0x3012	1	Y	pdrctr[0]	DIV	Can 1stReceivePdoCounter	UINT32	rw	N	UINT32	0
0x3012	2	Y	pdrctr[1]	DIV	Can 2ndReceivePdoCounter	UINT32	rw	N	UINT32	0
0x3012	3	Y	pdrctr[2]	DIV	Can 3rdReceivePdoCounter	UINT32	rw	N	UINT32	0
0x3012	4	Y	pdrctr[3]	DIV	Can 4thReceivePdoCounter	UINT32	rw	N	UINT32	0
0x3013	0	N	snctim	DIV	Can SyncTimer	UINT16	rw	Y	UINT16	DSV
0x3180	0	N	dlgctl	DIV	DataLogger Control	UINT8	wo	N	0…1	None
0x3181	0	N	dlgsts	DIV	DataLogger Status	UINT8	ro	N	0…3	0
0x3182	0	N	dlgdiv	DIV	DataLogger Divider	UINT16	rw	N	1…65535	1
0x3183	0	N	dlgsmp	DIV	DataLogger NumberOfSamples	INT32	ro	N	-2147483648… 2048	0

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Index	Subindex	PDO mapping	Short name	Specification	1. line: Block name 2. line: Parameter name	Data type	Access	Persistence	Value range	Default
0x3184	1	N	dlgena[0]	DIV	DataLogger EnableChannel	UINT8	rw	N	UINT8	0
0x3184	2	N	dlgena[1]	DIV	DataLogger EnableChannel	UINT8	rw	N	UINT8	0
0x3184	3	N	dlgena[2]	DIV	DataLogger EnableChannel	UINT8	rw	N	UINT8	0
0x3184	4	N	dlgena[3]	DIV	DataLogger EnableChannel	UINT8	rw	N	UINT8	0
0x3185	1	N	dlgpar[0]	DIV	DataLogger ChannelParameter	UINT32	ro	N	UINT32	0x63100110
0x3185	2	N	dlgpar[1]	DIV	DataLogger ChannelParameter	UINT32	ro	N	UINT32	0x63010110
0x3185	3	N	dlgpar[2]	DIV	DataLogger ChannelParameter	UINT32	ro	N	UINT32	0x63900110
0x3185	4	N	dlgpar[3]	DIV	DataLogger ChannelParameter	UINT32	ro	N	UINT32	0x63810110
0x3186	0	N	dlgmem	DIV	DataLogger Memory	DOMAIN	ro	N	2048 bytes	0
0x3187	0	N	dlgofs	DIV	DataLogger SampleStartOffset	UINT32	ro	N	UINT32	0
0x3188	0	N	trgtyp	DIV	DataLogger TriggerType	UINT8	rw	N	0…2	1
0x3189	0	N	trgpar	DIV	DataLogger TriggerParameter	UINT32	rw	N	UINT32	1661993232
0x318A	0	N	trgcpl	DIV	DataLogger TriggerCoupling	UINT8	rw	N	0…2	1
0x318B	0	N	trgslp	DIV	DataLogger TriggerSlope	UINT8	rw	N	1…3	1
0x318C	0	N	trglvl	DIV	DataLogger TriggerLevelOrBitmask	INT32	rw	N	INT32	0
0x318D	0	N	trgpos	DIV	DataLogger TriggerPosition	INT32	rw	N	INT32	0

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Index	Subindex	PDO mapping	Short name	Specification	1. line: Block name 2. line: Parameter name	Data type	Access	Persistence	Value range	Default
0x318E	0	N	trgtim	DIV	DataLogger TriggerTimeStamp	UINT32	ro	N	UINT32	0
0x3200	0	N	an0typ	DIV	AnalogInput0 InputType	INT8	rw	Y	INT8	1
0x3204	0	Y	an0val	DIV	AnalogInput0 ActualValue	INT16	ro	N	INT16	None
0x3208	0	N	an1typ	DIV	AnalogInput1 InputType	INT8	rw	Y	INT8	1
0x320C	0	Y	an1val	DIV	AnalogInput1 ActualValue	INT16	ro	N	INT16	None
0x3210	0	N	an2typ	DIV	AnalogInput2 InputType	INT8	rw	Y	INT8	2
0x3214	0	Y	an2val	DIV	AnalogInput2 ActualValue	INT16	ro	N	INT16	None
0x3217	0	N	an2mon	DIV	AnalogInput2 MonitoringCurrent	UINT8	rw	Y	0…1	DSV
0x3218	0	N	an3typ	DIV	AnalogInput3 InputType	INT8	rw	Y	INT8	2
0x321C	0	Y	an3val	DIV	AnalogInput3 ActualValue	INT16	ro	N	INT16	None
0x3220	0	N	an4typ	DIV	AnalogInput4 InputType	INT8	rw	Y	INT8	2
0x3224	0	Y	an4val	DIV	AnalogInput4 ActualValue	INT16	ro	N	INT16	None
0x3227	0	N	an4mon	DIV	AnalogInput4 MonitoringCurrent	UINT8	rw	Y	0…1	DSV
0x3228	0	N	an3mon	DIV	AnalogInput3 MonitoringCurrent	UINT8	rw	Y	0…1	DSV
0x3235	0	Y	extlvdval	DIV	ExternalLVDT ActualValue	INT16	ro	N	INT16	None
0x3237	1	N	extlvdref[0]	DIV	ExternalLVDT CustomerScalingFactorNumerator	INT16	rw	N	INT16	16384

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Index	Subindex	PDO mapping	Short name	Specification	1. line: Block name 2. line: Parameter name	Data type	Access	Persistence	Value range	Default
0x3237	2	N	extlvdref[1]	DIV	ExternalLVDT CustomerScalingFactorDenominator	INT16	rw	N	INT16	16384
0x3237	3	N	extlvdref[2]	DIV	ExternalLVDT CustomerScalingOffset	INT16	rw	N	INT16	0
0x3244	1	N	da0ref[0]	DIV	AnalogOutput0 Scaling	INT16	rw	Y	INT16	16384
0x3244	2	N	da0ref[1]	DIV	AnalogOutput0 Scaling	INT16	rw	Y	INT16	16384
0x3244	3	N	da0ref[2]	DIV	AnalogOutput0 Scaling	INT16	rw	Y	INT16	0
0x3264	0	N	vlvtrdpar	DIV	Valve_ActualValueConditioning TransducerPort	UINT32	rw	N	UINT32	DSV
0x3265	1	N	da1ref[0]	DIV	AnalogOutput1 Scaling	INT16	rw	Y	INT16	16384
0x3265	2	N	da1ref[1]	DIV	AnalogOutput1 Scaling	INT16	rw	Y	INT16	16384
0x3265	3	N	da1ref[2]	DIV	AnalogOutput1 Scaling	INT16	rw	Y	INT16	0
0x3270	0	N	vlvtrdstc	DIV	Valve_ActualValueConditioning ValveTransducerStructure	DOMAIN	rw	Y	100 bytes	DSV
0x3300	0	Y	spldemplt	DIV	ValvePositionControl DemandValvePilot	INT16	ro	N	INT16	None
0x3301	0	Y	splvalplt	DIV	ValvePositionControl ActualValvePilot	INT16	ro	N	INT16	None
0x3310	0	N	prspar	DIV	ValvePressureControl SetpointParameter	UINT32	ro	N	UINT32	0x320C0010
0x3320	0	N	splpar	DIV	ValvePositionControl SetpointParameter	UINT32	ro	N	UINT32	0x32040010
0x3404	0	Y	prstrd	DIV	PressureTransducer Value	INT16	ro	N	INT16	None
0x403F	0	N	ctllocdef	DIV	Device LocalControlWordDefault	UINT16	rw	Y	UINT16	0x0507

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Index	Subindex	PDO mapping	Short name	Specification	1. line: Block name 2. line: Parameter name	Data type	Access	Persistence	Value range	Default
0x4040	0	Y	ctlloc	DIV	Device LocalControlWord	UINT16	rw	N	UINT16	<LocalControlWord-Default>
0x4042	0	N	devmoddef	DIV	Device DeviceModeDefault	INT8	rw	Y	1…2	2
0x4043	0	N	ctlmoddef	DIV	Device ControlModeDefault	INT8	rw	Y	1…9	DSV
0x5400	1	N	locpdrcob[0]	DIV	LocalCAN 1stReceivePdo_CobIdUsedByPdo	UINT32	rw	Y	1…2147485695	639
0x5400	2	N	locpdrtrn[0]	DIV	LocalCAN 1stReceivePdo_TransmissionType	UINT8	rw	Y	UINT8	255
0x5400	5	N	locpdrtim[0]	DIV	LocalCAN 1stReceivePdo_EventTimer	UINT16	rw	Y	UINT16	0
0x5401	1	N	locpdrcob[1]	DIV	LocalCAN 2ndReceivePdo_CobIdUsedByPdo	UINT32	rw	Y	1…2147485695	895
0x5401	2	N	locpdrtrn[1]	DIV	LocalCAN 2ndReceivePdo_TransmissionType	UINT8	rw	Y	UINT8	255
0x5401	5	N	locpdrtim[1]	DIV	LocalCAN 2ndReceivePdo_EventTimer	UINT16	rw	Y	UINT16	0
0x5402	1	N	locpdrcob[2]	DIV	LocalCAN 3rdReceivePdo_CobIdUsedByPdo	UINT32	rw	Y	1…2147485695	1151
0x5402	2	N	locpdrtrn[2]	DIV	LocalCAN 3rdReceivePdo_TransmissionType	UINT8	rw	Y	UINT8	255
0x5402	5	N	locpdrtim[2]	DIV	LocalCAN 3rdReceivePdo_EventTimer	UINT16	rw	Y	UINT16	0
0x5403	1	N	locpdrcob[3]	DIV	LocalCAN 4thReceivePdo_CobIdUsedByPdo	UINT32	rw	Y	1…2147485695	1407
0x5403	2	N	locpdrtrn[3]	DIV	LocalCAN 4thReceivePdo_TransmissionType	UINT8	rw	Y	UINT8	255
0x5403	5	N	locpdrtim[3]	DIV	LocalCAN 4thReceivePdo_EventTimer	UINT16	rw	Y	UINT16	0
0x5600	0	N	locpdrmapnum[0]	DIV	LocalCAN 1stReceivePdoMapping_NumberOfMappedApplicationObjectsInPdo	UINT8	rw	Y	0…8	DSV

Table 75: Object dictionary (part 17 of 31)

Index	Subindex	PDO mapping	Short name	Specification	1. line: Block name 2. line: Parameter name	Data type	Access	Persistence	Value range	Default
0x5600	1	N	locpdrmap[0]	DIV	LocalCAN ReceivePdoMappingParameter__PdoMappingForTheNthApplication-ObjectToBeMapped	UINT32	rw	Y	UINT32	DSV
0x5600	…									
0x5600	8	N	locpdrmap[7]	DIV	LocalCAN ReceivePdoMappingParameter__PdoMappingForTheNthApplication-ObjectToBeMapped	UINT32	rw	Y	UINT32	DSV
0x5601	0	N	locpdrmapnum[1]	DIV	LocalCAN 2ndReceivePdoMapping_NumberOfMappedApplicationObjectsInPdo	UINT8	rw	Y	0…8	DSV
0x5601	1	N	locpdrmap[8]	DIV	LocalCAN ReceivePdoMappingParameter__PdoMappingForTheNthApplication-ObjectToBeMapped	UINT32	rw	Y	UINT32	DSV
0x5601	…									
0x5601	8	N	locpdrmap[15]	DIV	LocalCAN ReceivePdoMappingParameter__PdoMappingForTheNthApplication-ObjectToBeMapped	UINT32	rw	Y	UINT32	DSV
0x5602	0	N	locpdrmapnum[2]	DIV	LocalCAN 3rdReceivePdoMapping_NumberOfMappedApplicationObjectsInPdo	UINT8	rw	Y	0…8	DSV
0x5602	1	N	locpdrmap[16]	DIV	LocalCAN ReceivePdoMappingParameter__PdoMappingForTheNthApplication-ObjectToBeMapped	UINT32	rw	Y	UINT32	DSV
0x5602	…									
0x5602	8	N	locpdrmap[23]	DIV	LocalCAN ReceivePdoMappingParameter__PdoMappingForTheNthApplication-ObjectToBeMapped	UINT32	rw	Y	UINT32	DSV
0x5603	0	N	locpdrmapnum[3]	DIV	LocalCAN 4thReceivePdoMapping_NumberOfMappedApplicationObjectsInPdo	UINT8	rw	Y	0…8	DSV
0x5603	1	N	locpdrmap[24]	DIV	LocalCAN ReceivePdoMappingParameter__PdoMappingForTheNthApplication-ObjectToBeMapped	UINT32	rw	Y	UINT32	DSV
0x5603	…									

Table 75: Object dictionary (part 18 of 31)

Index	Subindex	PDO mapping	Short name	Specification	1. line: Block name 2. line: Parameter name	Data type	Access	Persistence	Value range	Default
0x5603	8	N	locpdrmap[31]	DIV	LocalCAN ReceivePdoMappingParameter__PdoMappingForTheNthApplication-ObjectToBeMapped	UINT32	rw	Y	UINT32	DSV
0x5800	1	N	locpdtcob[0]	DIV	LocalCAN 1stTransmitPdo_CobIdUsedByPdo	UINT32	rw	Y	1…2147485695	511
0x5800	2	N	locpdttrn[0]	DIV	LocalCAN 1stTransmitPdo_TransmissionType	UINT8	rw	Y	UINT8	255
0x5800	3	N	locpdtinh[0]	DIV	LocalCAN 1stTransmitPdo_InhibitTime	UINT16	rw	Y	UINT16	0
0x5800	5	N	locpdttim[0]	DIV	LocalCAN 1stTransmitPdo_EventTimer	UINT16	rw	Y	UINT16	0
0x5801	1	N	locpdtcob[1]	DIV	LocalCAN 2ndTransmitPdo_CobIdUsedByPdo	UINT32	rw	Y	1…2147485695	767
0x5801	2	N	locpdttrn[1]	DIV	LocalCAN 2ndTransmitPdo_TransmissionType	UINT8	rw	Y	UINT8	255
0x5801	3	N	locpdtinh[1]	DIV	LocalCAN 2ndTransmitPdo_InhibitTime	UINT16	rw	Y	UINT16	0
0x5801	5	N	locpdttim[1]	DIV	LocalCAN 2ndTransmitPdo_EventTimer	UINT16	rw	Y	UINT16	0
0x5802	1	N	locpdtcob[2]	DIV	LocalCAN 3rdTransmitPdo_CobIdUsedByPdo	UINT32	rw	Y	1…2147485695	1023
0x5802	2	N	locpdttrn[2]	DIV	LocalCAN 3rdTransmitPdo_TransmissionType	UINT8	rw	Y	UINT8	255
0x5802	3	N	locpdtinh[2]	DIV	LocalCAN 3rdTransmitPdo_InhibitTime	UINT16	rw	Y	UINT16	0
0x5802	5	N	locpdttim[2]	DIV	LocalCAN 3rdTransmitPdo_EventTimer	UINT16	rw	Y	UINT16	0
0x5803	1	N	locpdtcob[3]	DIV	LocalCAN 4thTransmitPdo_CobIdUsedByPdo	UINT32	rw	Y	1…2147485695	1279
0x5803	2	N	locpdttrn[3]	DIV	LocalCAN 4thTransmitPdo_TransmissionType	UINT8	rw	Y	UINT8	255
0x5803	3	N	locpdtinh[3]	DIV	LocalCAN 4thTransmitPdo_InhibitTime	UINT16	rw	Y	UINT16	0

Table 75: Object dictionary (part 19 of 31)

Index	Subindex	PDO mapping	Short name	Specification	1. line: Block name 2. line: Parameter name	Data type	Access	Persistence	Value range	Default
0x5803	5	N	locpdttim[3]	DIV	LocalCAN 4thTransmitPdo_EventTimer	UINT16	rw	Y	UINT16	0
0x5A00	0	N	locpdtmapnum[0]	DIV	LocalCAN 1stTransmitPdoMapping_NumberOfMappedApplicationObjectsInPdo	UINT8	rw	Y	0…8	DSV
0x5A00	1	N	locpdtmap[0]	DIV	LocalCAN TransmitPdoMappingParameter_PdoMappingForTheNthApplicationObject-ToBeMapped	UINT32	rw	Y	UINT32	DSV
0x5A00	…									
0x5A00	8	N	locpdtmap[7]	DIV	LocalCAN TransmitPdoMappingParameter_PdoMappingForTheNthApplicationObject-ToBeMapped	UINT32	rw	Y	UINT32	DSV
0x5A01	0	N	locpdtmapnum[1]	DIV	LocalCAN 2ndTransmitPdoMapping_NumberOfMappedApplicationObjectsInPdo	UINT8	rw	Y	0…8	DSV
0x5A01	1	N	locpdtmap[8]	DIV	LocalCAN TransmitPdoMappingParameter_PdoMappingForTheNthApplicationObject-ToBeMapped	UINT32	rw	Y	UINT32	DSV
0x5A01	…									
0x5A01	8	N	locpdtmap[15]	DIV	LocalCAN TransmitPdoMappingParameter_PdoMappingForTheNthApplicationObject-ToBeMapped	UINT32	rw	Y	UINT32	DSV
0x5A02	0	N	locpdtmapnum[2]	DIV	LocalCAN 3rdTransmitPdoMapping_NumberOfMappedApplicationObjectsInPdo	UINT8	rw	Y	0…8	DSV
0x5A02	1	N	locpdtmap[16]	DIV	LocalCAN TransmitPdoMappingParameter_PdoMappingForTheNthApplicationObject-ToBeMapped	UINT32	rw	Y	UINT32	DSV
0x5A02	…									
0x5A02	8	N	locpdtmap[23]	DIV	LocalCAN TransmitPdoMappingParameter_PdoMappingForTheNthApplicationObject-ToBeMapped	UINT32	rw	Y	UINT32	DSV
0x5A03	0	N	locpdtmapnum[3]	DIV	LocalCAN 4thTransmitPdoMapping_NumberOfMappedApplicationObjectsInPdo	UINT8	rw	Y	0…8	DSV

Table 75: Object dictionary (part 20 of 31)

Index	Subindex	PDO mapping	Short name	Specification	1. line: Block name 2. line: Parameter name	Data type	Access	Persistence	Value range	Default
0x5A03	1	N	locpdtmap[24]	DIV	LocalCAN TransmitPdoMappingParameter_PdoMappingForTheNthApplicationObject-ToBeMapped	UINT32	rw	Y	UINT32	DSV
0x5A03	…									
0x5A03	8	N	locpdtmap[31]	DIV	LocalCAN TransmitPdoMappingParameter_PdoMappingForTheNthApplicationObject-ToBeMapped	UINT32	rw	Y	UINT32	DSV
0x5A08	1	N	locpdttrnman[0]	DIV	Local_Can 1stLocalCANTransmitPdoManufacturerTransmissionType	UINT8	rw	Y	UINT8	DSV
0x5A08	2	N	locpdttrnman[1]	DIV	Local_Can 2ndLocalCANTransmitPdoManufacturerTransmissionType	UINT8	rw	Y	UINT8	DSV
0x5A08	3	N	locpdttrnman[2]	DIV	Local_Can 3rdLocalCANTransmitPdoManufacturerTransmissionType	UINT8	rw	Y	UINT8	DSV
0x5A08	4	N	locpdttrnman[3]	DIV	Local_Can 4thLocalCANTransmitPdoManufacturerTransmissionType	UINT8	rw	Y	UINT8	DSV
0x5B00	0	N	locmodide	DIV	Local_Can ModuleIdentifier	UINT8	rw	Y	1…127	127
0x5B01	0	N	locbdr	DIV	Local_Can Bitrate	UINT32	rw	Y	0…1000000	500000
0x5B02	0	Y	locsrn	DIV	Local_Can StartRemoteNode	UINT8	rw	N	UINT8	0
0x5B10	0	N	locrempar	DIV	LocalCAN RemoteParameter	UINT32	rw	N	UINT32	0
0x5B11	0	N	locremadr	DIV	LocalCAN RemoteParameterAdress	UINT32	rw	N	UINT32	0
0x5B12	0	N	locremnod	DIV	LocalCAN RemoteNodeId	UINT8	rw	N	1…127	1
0x5B13	0	N	locremtrn	DIV	LocalCAN RemoteTransmission	INT8	rw	N	-1…2	0
0x6040	0	Y	ctlwrd	DS408	Device ControlWord	UINT16	rw	N	UINT16	DSV
0x6041	0	Y	stswrd	DS408	Device StatusWord	UINT16	ro	N	UINT16	None

Table 75: Object dictionary (part 21 of 31)

Index	Subindex	PDO mapping	Short name	Specification	1. line: Block name 2. line: Parameter name	Data type	Access	Persistence	Value range	Default
0x6042	0	Y	devmod	DS408	Device DeviceMode	INT8	rw	N	1…4	<DeviceMode-Default>
0x6043	0	Y	ctlmod	DS408	Device ControlMode	INT8	rw	N	-1…9	<ControlMode-Default>
0x604F	0	Y	locmod	DS408	Device Local	INT8	rw	Y	-128…1	1
0x6050	0	N	devver	DS408	Device DeviceVersion	STRING	ro	N	64 char	DSV
0x6051	0	Y	devcodnum	DS408	Device CodeNo	UINT16	rw	Y	UINT16	DSV
0x6052	0	N	sernum	DS408	Device SerialNo	STRING	ro	N	64 char	DSV
0x6053	0	N	devdsc	DS408	Device Description	STRING	rw	Y	64 char	DSV
0x6054	0	N	devmdldsc	DS408	Device ModelDescription	STRING	ro	N	64 char	DSV
0x6055	0	N	devmdlurl	DS408	Device ModelURL	STRING	ro	N	64 char	www.moog.com
0x6056	0	Y	devprmcod	DS408	Device ParameterSetCode	UINT8	rw	Y	0…254	0
0x6057	0	N	devvennam	DS408	Device VendorName	STRING	ro	N	64 char	MOOG GmbH, Hanns-Klemm-Strasse 28, D-71034 Boeblingen, Germany
0x605F	0	Y	devcap	DS408	Device Capability	UINT32	ro	N	16777216… 1057001472	0x3F009000
0x6100	0	N	vlvtrdmax	DS408	Valve_ActualValueConditioning MaxInterfaceNo	UINT8	ro	N	UINT8	4
0x6101	0	N	vlvtrditf	DS408	Valve_ActualValueConditioning InterfaceNo	UINT8	rw	N	1…4	DSV
0x6102	0	N	vlvtrdtyp	DS408	Valve_ActualValueConditioning Type	INT8	rw	N	INT8	DSV

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Index	**Subindex**	**PDO mapping**	**Short name**	**Specification**	**1. line: Block name 2. line: Parameter name**	**Data type**	**Access**	**Persistence**	**Value range**	**Default**
0x6103	0	N	vlvtrdsgn	DS408	Valve_ActualValueConditioning Sign	INT8	rw	N	-1…1	1
0x6104	1	Y	vlvtrdval	DS408	Valve_ActualValueConditioning ActualValue	INT16	ro	N	INT16	None
0x6110	1	Y	trditfval[0]	DS408	Valve_ActualValueConditioning ActualValue1	INT16	ro	N	INT16	None
0x6111	1	Y	trditfval[1]	DS408	Valve_ActualValueConditioning ActualValue2	INT16	ro	N	INT16	None
0x6112	1	Y	trditfval[2]	DS408	Valve_ActualValueConditioning ActualValue3	INT16	ro	N	INT16	None
0x6113	1	Y	trditfval[3]	DS408	Valve_ActualValueConditioning ActualValue3	INT16	ro	N	INT16	None
0x6120	1	N	trdprsmin	DS408	Valve_ActualValueConditioning MinimumPressure	INT16	rw	N	INT16	0
0x6121	1	N	trdprsmax	DS408	Valve_ActualValueConditioning MaximumPressure	INT16	rw	N	INT16	16384
0x6122	1	N	trdprsare	DS408	Valve_ActualValueConditioning Area	INT16	rw	N	INT16	0
0x6123	1	N	trdprsofs	DS408	Valve_ActualValueConditioning PressureOffset	INT16	rw	N	INT16	0
0x6124	1	N	trdprssigmin	DS408	Valve_ActualValueConditioning MinimumTransducerSignal	INT16	rw	N	INT16	0
0x6125	1	N	trdprssigmax	DS408	Valve_ActualValueConditioning MaximumTransducerSignal	INT16	rw	N	INT16	16384
0x6300	1	Y	splset	DS408	ValvePositionControl Setpoint	INT16	rw	N	INT16	0
0x6300	2	N	spluni	DS408	ValvePositionControl Unit	UINT8	ro	N	UINT8	0
0x6300	3	N	splprf	DS408	ValvePositionControl Prefix	INT8	ro	N	INT8	0
0x6301	1	Y	splval	DS408	ValvePositionControl ActualValue	INT16	ro	N	INT16	None

Table 75: Object dictionary (part 23 of 31)

Index	Subindex	PDO mapping	Short name	Specification	1. line: Block name 2. line: Parameter name	Data type	Access	Persistence	Value range	Default
0x6301	1	Y	splval	DS408	ValvePositionControl ActualValue	INT16	ro	N	INT16	None
0x6301	2	N	spluni	DS408	ValvePositionControl Unit	UINT8	ro	N	UINT8	0
0x6301	3	N	splprf	DS408	ValvePositionControl Prefix	INT8	ro	N	INT8	0
0x6310	1	Y	spldem	DS408	ValvePositionControl_DemandValueGenerator DemandValue	INT16	ro	N	INT16	None
0x6310	2	N	spluni	DS408	ValvePositionControl Unit	UINT8	ro	N	UINT8	0
0x6310	3	N	splprf	DS408	ValvePositionControl Prefix	INT8	ro	N	INT8	0
0x6311	1	Y	splref	DS408	ValvePositionControl_DemandValueGenerator ReferenceValue	INT16	ro	N	INT16	16384
0x6311	2	N	spluni	DS408	ValvePositionControl Unit	UINT8	ro	N	UINT8	0
0x6311	3	N	splprf	DS408	ValvePositionControl Prefix	INT8	ro	N	INT8	0
0x6314	1	Y	splsethld	DS408	ValvePositionControl_DemandValueGenerator HoldSetPoint	INT16	rw	Y	INT16	0
0x6314	2	N	spluni	DS408	ValvePositionControl Unit	UINT8	ro	N	UINT8	0
0x6314	3	N	splprf	DS408	ValvePositionControl Prefix	INT8	ro	N	INT8	0
0x6320	1	Y	spllimupp	DS408	ValvePositionControl_DemandValueGenerator_Limit UpperLimit	INT16	rw	Y	<LowerLimit>… 32767	16384
0x6320	2	N	spluni	DS408	ValvePositionControl Unit	UINT8	ro	N	UINT8	0
0x6320	3	N	splprf	DS408	ValvePositionControl Prefix	INT8	ro	N	INT8	0
0x6321	1	Y	spllimlow	DS408	ValvePositionControl_DemandValueGenerator_Limit LowerLimit	INT16	rw	Y	-32768… <UpperLimit>	-16384

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Index	Subindex	PDO mapping	Short name	Specification	1. line: Block name 2. line: Parameter name	Data type	Access	Persistence	Value range	Default
0x6321	2	N	spluni	DS408	ValvePositionControl Unit	UINT8	ro	N	UINT8	0
0x6321	3	N	splprf	DS408	ValvePositionControl Prefix	INT8	ro	N	INT8	0
0x6322	0	Y	spldemfct	DS408	ValvePositionControl_DemandValueGenerator_Scaling Factor	UINT32	rw	Y	UINT32	0x00010001
0x6323	1	Y	spldemofs	DS408	ValvePositionControl_DemandValueGenerator_Scaling Offset	INT16	rw	Y	INT16	0
0x6323	2	N	spluni	DS408	ValvePositionControl Unit	UINT8	ro	N	UINT8	0
0x6323	3	N	splprf	DS408	ValvePositionControl Prefix	INT8	ro	N	INT8	0
0x6324	1	Y	splzrocor	DS408	ValvePositionControl_DemandValueGenerator_ZeroCorrection Offset	INT16	rw	Y	INT16	0
0x6324	2	N	spluni	DS408	ValvePositionControl Unit	UINT8	ro	N	UINT8	0
0x6324	3	N	splprf	DS408	ValvePositionControl Prefix	INT8	ro	N	INT8	0
0x6330	0	Y	splrmptyp	DS408	ValvePositionControl_DemandValueGenerator_Ramp Type	INT8	rw	Y	0…3	0
0x6331	1	Y	splrmpacl	DS408	ValvePositionControl_DemandValueGenerator_Ramp AccelerationTime	UINT16	rw	Y	UINT16	0
0x6331	2	N	timuni	DS408	- Unit	UINT8	ro	N	UINT8	3
0x6331	3	Y	splrmpaclprf	DS408	ValvePositionControl_DemandValueGenerator_Ramp AccelerationTime_Prefix	INT8	rw	Y	-4…0	-3
0x6332	1	Y	splrmpaclpos	DS408	ValvePositionControl_DemandValueGenerator_Ramp AccelerationTimePositive	UINT16	rw	Y	UINT16	0
0x6332	2	N	timuni	DS408	- Unit	UINT8	ro	N	UINT8	3
0x6332	3	Y	splrmpaclposprf	DS408	ValvePositionControl_DemandValueGenerator_Ramp AccelerationTimePositive_Prefix	INT8	rw	Y	-4…0	-3

Table 75: Object dictionary (part 25 of 31)

Index	Subindex	PDO mapping	Short name	Specification	1. line: Block name 2. line: Parameter name	Data type	Access	Persistence	Value range	Default
0x6333	1	Y	splrmpaclneg	DS408	ValvePositionControl_DemandValueGenerator_Ramp AccelerationTimeNegative	UINT16	rw	Y	UINT16	0
0x6333	2	N	timuni	DS408	- Unit	UINT8	ro	N	UINT8	3
0x6333	3	Y	splrmpaclnegprf	DS408	ValvePositionControl_DemandValueGenerator_Ramp AccelerationTimeNegative_Prefix	INT8	rw	Y	-4…0	-3
0x6334	1	Y	splrmpdcl	DS408	ValvePositionControl_DemandValueGenerator_Ramp DecelerationTime	UINT16	rw	Y	UINT16	0
0x6334	2	N	timuni	DS408	- Unit	UINT8	ro	N	UINT8	3
0x6334	3	Y	splrmpdclprf	DS408	ValvePositionControl_DemandValueGenerator_Ramp DecelerationTime_Prefix	INT8	rw	Y	-4…0	-3
0x6335	1	Y	splrmpdclpos	DS408	ValvePositionControl_DemandValueGenerator_Ramp DecelerationTimePositive	UINT16	rw	Y	UINT16	0
0x6335	2	N	timuni	DS408	- Unit	UINT8	ro	N	UINT8	3
0x6335	3	Y	splrmpdclposprf	DS408	ValvePositionControl_DemandValueGenerator_Ramp DecelerationTimePositive_Prefix	INT8	rw	Y	-4…0	-3
0x6336	1	Y	splrmpdclneg	DS408	ValvePositionControl_DemandValueGenerator_Ramp DecelerationTimeNegative	UINT16	rw	Y	UINT16	0
0x6336	2	N	timuni	DS408	- Unit	UINT8	ro	N	UINT8	3
0x6336	3	Y	splrmpdclnegprf	DS408	ValvePositionControl_DemandValueGenerator_Ramp DecelerationTimeNegative_Prefix	INT8	rw	Y	-4…0	-3
0x6350	1	Y	splctldvn	DS408	ValvePositionControl ControlDeviation	INT16	ro	N	INT16	None
0x6350	2	N	spluni	DS408	ValvePositionControl Unit	UINT8	ro	N	UINT8	0
0x6350	3	N	splprf	DS408	ValvePositionControl Prefix	INT8	ro	N	INT8	0
0x6351	0	Y	splmontyp	DS408	ValvePositionControl_ControlMonitoring Type	INT8	rw	Y	0…1	0

Table 75: Object dictionary (part 26 of 31)

Index	Subindex	PDO mapping	Short name	Specification	1. line: Block name 2. line: Parameter name	Data type	Access	Persistence	Value range	Default
0x6352	1	Y	splmontim	DS408	ValvePositionControl_ControlMonitoring DelayTime	UINT16	rw	Y	UINT16	DSV
0x6352	2	N	timuni	DS408	- Unit	UINT8	ro	N	UINT8	3
0x6352	3	N	timprf	DS408	- Prefix	INT8	ro	N	INT8	-3
0x6354	1	Y	splmonupp	DS408	ValvePositionControl_ControlMonitoring UpperThreshold	INT16	rw	Y	INT16	DSV
0x6354	2	N	spluni	DS408	ValvePositionControl Unit	UINT8	ro	N	UINT8	0
0x6354	3	N	splprf	DS408	ValvePositionControl Prefix	INT8	ro	N	INT8	0
0x6355	1	Y	splmonlow	DS408	ValvePositionControl_ControlMonitoring LowerThreshold	INT16	rw	Y	INT16	DSV
0x6355	2	N	spluni	DS408	ValvePositionControl Unit	UINT8	ro	N	UINT8	0
0x6355	3	N	splprf	DS408	ValvePositionControl Prefix	INT8	ro	N	INT8	0
0x6380	1	Y	prsset	DS408	ValvePressureControl Setpoint	INT16	rw	N	INT16	0
0x6380	2	N	prsuni	DS408	ValvePressureControl Unit	UINT8	ro	N	UINT8	0
0x6380	3	N	prsprf	DS408	ValvePressureControl Prefix	INT8	ro	N	INT8	0
0x6381	1	Y	prsval	DS408	ValvePressureControl ActualValue	INT16	ro	N	INT16	None
0x6381	2	N	prsuni	DS408	ValvePressureControl Unit	UINT8	ro	N	UINT8	0
0x6381	3	N	prsprf	DS408	ValvePressureControl Prefix	INT8	ro	N	INT8	0
0x6390	1	Y	prsdem	DS408	ValvePressureControl_DemandValueGenerator Demand	INT16	ro	N	INT16	None

Table 75: Object dictionary (part 27 of 31)

Index	Subindex	PDO mapping	Short name	Specification	1. line: Block name 2. line: Parameter name	Data type	Access	Persistence	Value range	Default
0x6390	2	N	prsuni	DS408	ValvePressureControl Unit	UINT8	ro	N	UINT8	0
0x6390	3	N	prsprf	DS408	ValvePressureControl Prefix	INT8	ro	N	INT8	0
0x6391	1	Y	prsref	DS408	ValvePressureControl_DemandValueGenerator ReferenceValue	INT16	rw	N	0…32767	DSV
0x6391	2	N	prsrefuni	DS408	ValvePressureControl_DemandValueGenerator_Reference Unit	UINT8	ro	N	UINT8	78
0x6391	3	N	prsprf	DS408	ValvePressureControl Prefix	INT8	ro	N	INT8	0
0x6394	1	Y	prssethld	DS408	ValvePressureControl_DemandValueGenerator HoldSetPoint	INT16	rw	Y	INT16	0
0x6394	2	N	prsuni	DS408	ValvePressureControl Unit	UINT8	ro	N	UINT8	0
0x6394	3	N	prsprf	DS408	ValvePressureControl Prefix	INT8	ro	N	INT8	0
0x63A0	1	Y	prslimupp	DS408	ValvePressureControl_DemandValueGenerator_Limit UpperLimit	INT16	rw	Y	<LowerLimit>… 32767	16384
0x63A0	2	N	prsuni	DS408	ValvePressureControl Unit	UINT8	ro	N	UINT8	0
0x63A0	3	N	prsprf	DS408	ValvePressureControl Prefix	INT8	ro	N	INT8	0
0x63A1	1	Y	prslimlow	DS408	ValvePressureControl_DemandValueGenerator_Limit LowerLimit	INT16	rw	Y	-32768… <UpperLimit>	-16384
0x63A1	2	N	prsuni	DS408	ValvePressureControl Unit	UINT8	ro	N	UINT8	0
0x63A1	3	N	prsprf	DS408	ValvePressureControl Prefix	INT8	ro	N	INT8	0
0x63A2	0	Y	prsdemfct	DS408	ValvePressureControl_DemandValueGenerator_Scaling Factor	UINT32	rw	Y	UINT32	0x00010001
0x63A3	1	Y	prsdemofs	DS408	ValvePressureControl_DemandValueGenerator_Scaling Offset	INT16	rw	Y	INT16	0

Table 75: Object dictionary (part 28 of 31)

Index	Subindex	PDO mapping	Short name	Specification	1. line: Block name 2. line: Parameter name	Data type	Access	Persistence	Value range	Default
0x63A3	2	N	prsuni	DS408	ValvePressureControl Unit	UINT8	ro	N	UINT8	0
0x63A3	3	N	prsprf	DS408	ValvePressureControl Prefix	INT8	ro	N	INT8	0
0x63B0	0	Y	prsrmptyp	DS408	ValvePressureControl_DemandValueGenerator_Ramp Type	INT8	rw	Y	0…3	0
0x63B1	1	Y	prsrmpacl	DS408	ValvePressureControl_DemandValueGenerator_Ramp AccelerationTime	UINT16	rw	Y	UINT16	0
0x63B1	2	N	timuni	DS408	- Unit	UINT8	ro	N	UINT8	3
0x63B1	3	Y	prsrmpaclprf	DS408	ValvePressureControl_DemandValueGenerator_Ramp AccelerationTime_Prefix	INT8	rw	Y	-4…0	-3
0x63B2	1	Y	prsrmpaclpos	DS408	ValvePressureControl_DemandValueGenerator_Ramp AccelerationTimePositive	UINT16	rw	Y	UINT16	0
0x63B2	2	N	timuni	DS408	- Unit	UINT8	ro	N	UINT8	3
0x63B2	3	Y	prsrmpaclposprf	DS408	ValvePressureControl_DemandValueGenerator_Ramp AccelerationTimePositive_Prefix	INT8	rw	Y	-4…0	-3
0x63B3	1	Y	prsrmpaclneg	DS408	ValvePressureControl_DemandValueGenerator_Ramp AccelerationTimeNegative	UINT16	rw	Y	UINT16	0
0x63B3	2	N	timuni	DS408	- Unit	UINT8	ro	N	UINT8	3
0x63B3	3	Y	prsrmpaclnegprf	DS408	ValvePressureControl_DemandValueGenerator_Ramp AccelerationTimeNegative_Prefix	INT8	rw	Y	-4…0	-3
0x63B4	1	Y	prsrmpdcl	DS408	ValvePressureControl_DemandValueGenerator_Ramp DecelerationTime	UINT16	rw	Y	UINT16	0
0x63B4	2	N	timuni	DS408	- Unit	UINT8	ro	N	UINT8	3
0x63B4	3	Y	prsrmpdclprf	DS408	ValvePressureControl_DemandValueGenerator_Ramp DecelerationTime_Prefix	INT8	rw	Y	-4…0	-3
0x63B5	1	Y	prsrmpdclpos	DS408	ValvePressureControl_DemandValueGenerator_Ramp DecelerationTimePositive	UINT16	rw	Y	UINT16	0

Table 75: Object dictionary (part 29 of 31)

Index	Subindex	PDO mapping	Short name	Specification	1. line: Block name 2. line: Parameter name	Data type	Access	Persistence	Value range	Default
0x63B5	2	N	timuni	DS408	- Unit	UINT8	ro	N	UINT8	3
0x63B5	3	Y	prsrmpdclposprf	DS408	ValvePressureControl_DemandValueGenerator_Ramp DecelerationTimePositive_Prefix	INT8	rw	Y	-4…0	-3
0x63B6	1	Y	prsrmpdclneg	DS408	ValvePressureControl_DemandValueGenerator_Ramp DecelerationTimeNegative	UINT16	rw	Y	UINT16	0
0x63B6	2	N	timuni	DS408	- Unit	UINT8	ro	N	UINT8	3
0x63B6	3	Y	prsrmpdclnegprf	DS408	ValvePressureControl_DemandValueGenerator_Ramp DecelerationTimeNegative_Prefix	INT8	rw	Y	-4…0	-3
0x63D0	1	Y	prsctldvn	DS408	ValvePressureControl ControlDeviation	INT16	ro	N	INT16	None
0x63D0	2	N	prsuni	DS408	ValvePressureControl Unit	UINT8	ro	N	UINT8	0
0x63D0	3	N	prsprf	DS408	ValvePressureControl Prefix	INT8	ro	N	INT8	0
0x63D1	0	Y	prsmontyp	DS408	ValvePressureControl_ControlMonitoring Type	INT8	rw	Y	0…1	DSV
0x63D2	1	Y	prsmontim	DS408	ValvePressureControl_ControlMonitoring DelayTime	UINT16	rw	Y	UINT16	DSV
0x63D2	2	N	timuni	DS408	- Unit	UINT8	ro	N	UINT8	3
0x63D2	3	N	timprf	DS408	- Prefix	INT8	ro	N	INT8	-3
0x63D4	1	Y	prsmonupp	DS408	ValvePressureControl_ControlMonitoring UpperThreshold	INT16	rw	Y	INT16	DSV

Table 75: Object dictionary (part 30 of 31)

Index	Subindex	PDO mapping	Short name	Specification	1. line: Block name 2. line: Parameter name	Data type	Access	Persistence	Value range	Default
0x63D4	2	N	prsuni	DS408	ValvePressureControl Unit	UINT8	ro	N	UINT8	0
0x63D4	3	N	prsprf	DS408	ValvePressureControl Prefix	INT8	ro	N	INT8	0
0x63D5	1	Y	prsmonlow	DS408	ValvePressureControl_ControlMonitoring LowerThreshold	INT16	rw	Y	INT16	DSV
0x63D5	2	N	prsuni	DS408	ValvePressureControl Unit	UINT8	ro	N	UINT8	0
0x63D5	3	N	prsprf	DS408	ValvePressureControl Prefix	INT8	ro	N	INT8	0

Table 75: Object dictionary (part 31 of 31)

For your notes.

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moog.com/industrial/globallocator

Argentina	+54	11 4326 5916	info.argentina@moog.com
Australia	+61	3 9561 6044	info.australia@moog.com
Austria	+43	664 144 65 80	info.austria@moog.com
Brazil	+55	11 5523 8011	info.brazil@moog.com
China	+86	21 2893 1600	info.china@moog.com
Finland	+358	9 2517 2730	info.finland@moog.com
France	+33	1 4560 7000	info.france@moog.com
Germany	+49	7031 622 0	info.germany@moog.com
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India	+91	80 4120 8799	info.india@moog.com
Ireland	+353	21 451 9000	info.ireland@moog.com
Italy	+39	0332 421 111	info.italy@moog.com
Japan	+81	463 55 3615	info.japan@moog.com
Korea	+82	31 764 6711	info.korea@moog.com
Luxembourg	+352	40 46 401	info.luxembourg@moog.com
Netherlands	+31	252 462 000	info.netherlands@moog.com
Norway	+47	64 94 19 48	info.norway@moog.com
Russia	+7	31713 1811	info.russia@moog.com
Singapore	+65	6773 6238	info.singapore@moog.com
South Africa	+27	12 653 6768	info.southafrica@moog.com
Spain	+34	902 133 240	info.spain@moog.com
Sweden	+46	31 680 060	info.sweden@moog.com
Switzerland	+41	71 394 5010	info.switzerland@moog.com
United Kingdom	+44	1684 296600	info.unitedkingdom@moog.com
USA	+1	716 652 2000	info.usa@moog.com

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