Supplementary Operating Instructions

Solenoid Metering Pump gamma/ X

Modules, Options, Accessories

EN

The instructions contained herein apply only in conjunction with the "Operating Instructions for Solenoid Metering Pump gamma /X, GMXa"

Please carefully read these operating instructions before use. · Do not discard.
The operator shall be liable for any damage caused by installation or operating errors.
The latest version of the operating instructions are available on our homepage.

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1 Supplementary Operating Instructions for Bluetooth Control

1.1 Description of Bluetooth Functionality

The metering pump gamma/ X with Bluetooth functionality can largely be wirelessly controlled and monitored via a Bluetooth-enabled Android Smart device using the "gamma/ X" app. A log file containing pump-related events can also be displayed and e-mailed. The app can also be used to save and then restore the pump configuration. The pump configuration can also be e-mailed.

Certain information must be stated in certain countries:

Country	Information
USA:	Contains FCC ID: T7VPAN10
Canada:	Contains IC: 216Q-PAN10 Contiens IC: 216Q-PAN10

1.2 Safety

CAUTION!
Danger from hackers
The user must guarantee the IT security of his smart device (smartphone, tablet, ...) to ensure that the metering pump cannot be controlled by hackers.

CAUTION!
Change the temporary *„password“* in the pump menu under *„Settings ➔ Service ➔ Password“*.

CAUTION!
Only download the "gamma /X" app from the Google Play Store - not from other sources.

CAUTION!
Do not modify the device.

In particular do not increase the size of the aerial.

Qualification of personnel

Personnel must:

- Be familiar with Android smart devices.
- Have read and understood the pump operating instructions and these operating instructions as well.

Licences for Bluetooth metering pumps

The Bluetooth metering pump can be operated licence-free in the following countries:

Belgium, Denmark, Germany, Estonia, Finland, France, Greece, Great Britain, Ireland, Italy, Canada, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Austria, Poland, Portugal, Sweden, Switzerland, Slovakia, Slovenia, Spain, Czech Republic, Hungary, USA and Cyprus.

CAUTION!

For all other countries:

Check whether the operation of Bluetooth metering pumps is permitted in the country in question.
Please get in touch with the ProMinent head office.

Emissions

WARNING!

The Bluetooth metering pump is not designed for applications in which interference from or by the metering pump can lead to fatal injury or serious personal injury.

WARNING!

The Bluetooth metering pump can cause interference to or even destroy radio and television frequencies.

It is essential that this is avoided.

– For a remedy, refer to the "Troubleshooting" chapter.

)

Start up the device in accordance with the following start-up regulations:

This device complies with Part 15 of the FCC Regulations. The following 2 conditions must be fulfilled for operation: (1) This device should not cause any hazardous interference, and (2) this device should tolerate all interference, including interference that can cause undesirable operation.

1.3 Prerequisites

Prerequisites for operation:

- Metering pump gamma/ X with Bluetooth functionality (identity code characteristic "Remote stop/Remote control" = "B, with Bluetooth")
- The metering pump gamma/ X has been fully electrically and hydraulically installed
- Bluetooth-enabled Android smart device - see *Tab. 1 „These Android smart devices support the "gamma/ X" app (dated 01.09. 2015):“ on page 6*
- Only for handling log files and downloading the app: the smart device has to have access to the internet.
- The "gamma/ X" app can be downloaded free of charge from the Google Play Store:

Fig. 1: QR code for "gamma/ X" download app

CAUTION!
Only download the "gamma /X" app from the Google Play Store - not from other sources.

Tab. 1: These Android smart devices support the "gamma/ X" app (dated 01.09. 2015):

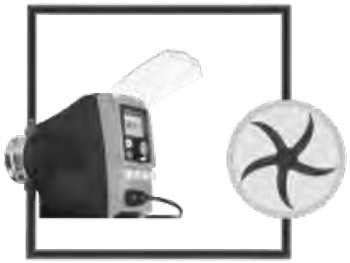
Manufacturer	Model	Android operating system
HTC	One M8	5.0.1
Sony	Xperia Z3 Compact	5.0.2
Motorola	Moto G (2nd generation)	5.0.2
Huawei	Ascend P7	4.4.2
LG	Nexus 5	5.1.1
Samsung	Galaxy S4	4.4.2
Samsung	Galaxy Tab 4	4.4.2

If you have another Android smart device or Android operating system, you can still try to see if the app works correctly with it. However ProMinent has not tested this.

1.4 App Test Operation with Pump Simulation

It is possible to check how the app works even without a metering pump. Use the *„GMXa simulation“* pump simulation to do so.

1. Enable Bluetooth functionality on the smart device - see operating instructions for the smart device.
2. Press *„gamma/ X“* on the app.
   ⇨ The *„Connect to device“* window appears after a few seconds with the *„GMXa simulation“* "device".
3. Press *„GMXa simulation“*.
   ⇨ A *„Simulation ➔ Password“* appears.
4. Enter any 4 digits and press *[Enter]*.
   ⇨ Now you can gain an impression of how certain setting options on the app look and work.



An animation shows whether the simulated pump is currently "pumping" or not.

Fig. 2: Animation

1.5 Establishing a Bluetooth Connection

To establish a Bluetooth connection between the metering pump and the smart device:

1 - Enable Bluetooth functionality on both devices

2 - Initiate a search for Bluetooth devices nearby on the smart device

3 - Couple the smart device to a pump that has been found

4 - Connect the smart device to a pump that has been found

1.5.1 Enable Bluetooth functionality on both devices

1. *The „System“ menu only appears if [Start/Stop] has stopped the metering pump.*

   Enable Bluetooth functionality on the metering pump:

   „Settings ➔ System ➔ Bluetooth enabled“

   ⇨ The blue Bluetooth LED flashes and the Bluetooth symbol appears on the display.

2. Enable the Bluetooth function on the smart device - see operating instructions for your smart device.

1.5.2 Initiating a Search for Bluetooth Devices on the Smart Device

If a search is made for the metering pump for the first time:

Stand next to the metering pump in question and trigger a search for Bluetooth devices on the smart device *„Settings ➔ Bluetooth“*.

⇨ A metering pump gamma/ X with the Bluetooth name *„ProMinent GMXa (GMXa XYZ)“* appears under *„Available“*. "XYZ" are place holders for the last digits of the serial number of the metering pump.

In all other cases

Stand next to the metering pump in question and trigger a search for Bluetooth devices on the smart device, in the gamma/ X, using *„Refresh list“*.

⇨ A metering pump with the name *„GMXa XYZ“* appears under *„Connect to device“*. "XYZ" are place holders for the last digits of the serial number of the metering pump.

1.5.3 Couple the smart device to a pump that has been found

The coupling is permanent after coupling. This is the case except when the pump has been coupled to a further 6 Bluetooth devices; then the smart device coupled first disappears from the list of coupled devices.

1. Press "gamma/ X" on the app.
   ⇨ The app now creates a *„Connect to device“* list in which only metering pumps gamma/ X are displayed with Bluetooth functionality.

   A metering pump gamma /X has a Bluetooth name like "GMXa XYZ".

   If „Reachable“ does not appear in the list of metering pumps found, hold the smart device closer to the pump and update the list by pressing „Refresh list“.

   The „GMXa simulation“ pump simulator, which can be used to try out the app without a metering pump, always appears - see chapter "App Test Mode With Pump Simulation".

2. Press *„GMXa XYZ“*.
   ⇨ A window, such as *„Bluetooth pairing request“* with a multi-digit figure appears on the display of the smart device: the smart device security key.

   „Bluetooth pairing“ with a multi-digit figure appears on the display of the metering pump: the smart device security key.

3. Only if the two security keys match, press *„Couple“* or *„Pair“* on the display of the smart device.

   Cancel and repeat the process if the two security keys do not match.

1.5.4 Connecting the Smart Device to a pump that has been found

If a dosing pump has not yet been coupled to a smart device to which it has to be connected, it first has to be "coupled" to it - see ↳ Chapter 1.5 „Establishing a Bluetooth Connection“ on page 7.

1. Press "gamma/ X" on the app to connect the smart device to a pump that has been found.
   ⇨ The *„Connect to device“* window appears with the Bluetooth devices found.
   „Reachable“ should appear under *„GMXa XYZ“*.

   If „Reachable“ does not appear in the list of metering pumps found, hold the smart device closer to the pump and update the list by pressing „Refresh list“.

2. Press *„GMXa XYZ“*.
   ⇨ A prompt for a *„Password“* appears.
3. The temporary metering pump *„Password“* consists of the last 4 digits of its serial number.
   Enter the *„Password“*.
   ⇨ The metering pump can now be controlled by Bluetooth.

CAUTION!
Change the temporary *„password“* in the pump menu under *„Settings ➔ Service ➔ Password“*.

1.5.5 Disconnecting the Smart Device from the Metering Pump

1. Leave the app menu for the metering pump.
   ⇨ A *„Disconnect from device“* window appears.
2. Press *„Yes“*.

1.6 Setting and Operating

CAUTION!
If a hook ✓ is visible in place of an angle ❭ to the right of a menu point on the app, then you trigger a function, such as *„Tap here to prime“*, when it is pressed.

The individual setting options on the app function similar to the corresponding setting options on the metering pump gamma/ X.

Exceptions:

There is an additional menu: *„Show log“*.

You can view the pump's log file with *„Show log“*. The log file contains messages about events and faults on the pump.

Use *„Send log via email“* to e-mail the log file, for example to the ProMinent Service.

Starting metering pump

First use *[Start/Stop]* to cancel manual stop on the metering pump.

A slide switch is visible in the header of the app.

It can be used to start ("1") or stop ("0") the pump.

1.7 Further Information / Functions

1.7.1 Bluetooth LED Signal Code

LED	Meaning
lit	The Bluetooth function on the metering pump is switched to *„active“* and the metering pump has a connection to a smart device.
flashes slowly	The Bluetooth function on the metering pump is switched to *„active“* but the metering pump does not have a connection to a smart device.
flashes quickly for 5 s	The user uses the app to try to find the Bluetooth metering pump that the user wishes to control amongst several Bluetooth metering pumps - see *Chapter 1.7.2 „Finding a Metering Pump Amongst Several Metering Pumps“ on page 10*.
off	■ The Bluetooth function on the metering pump is switched to *„inactive“*. ■ The metering pump is disconnected from the mains/power supply.

1.7.2 Finding a Metering Pump Amongst Several Metering Pumps

The "gamma/ X" app can help users to find a specific metering pump amongst several metering pumps:

Valid coupling

A coupling must have been made in the past and still be applicable to be able to use the identification function.

Option 1:

1. Switch to the metering pump menu in the app and press the image of the metering pump beside the slide switch.

   ⇨ The blue Bluetooth LED on the metering pump searched for flashes for 5 seconds.

Option 2:

2. Press the small image in the *„connect to device“* menu in the app

   ⇨ The blue Bluetooth LED on the metering pump searched for flashes for 5 seconds.

1.7.3 Managing the *„Connect to Device“* List

The „Connect to device“ list on the app can be updated by pressing „Refresh list“.

Additional information on the device	Meaning
„Known device“	The device has already been coupled with the smart device.
„Reachable“	The device is within reach of the smart device.
„Out of range“	The device is outside of the reach of the smart device.

Delete device

If you wish to delete a device from the „Connect to device“ list, then you also have to delete the device from the Bluetooth menu in the smart device setting app.

Otherwise the coupling is maintained.

1. To delete a device from the *„Connect to device“* list, swipe along the line containing the device name.
   ⇨ *„Delete“* appears.
2. Press *„Delete“*.
   ⇨ The line with the device name disappears.

1.7.4 Saving and Restoring the Pump Configuration

Saving the pump configuration

1. Use *[Start/Stop]* to stop the metering pump.
2. Connect the smart device to the metering pump.
3. Under *„Expert Settings* ➔ *Backup “* press the **„ + “** button.
   ⇨ The app will ask whether you are sure you want to create a backup.
4. Answer *„yes“* when prompted.
   ⇨ A progress bar will appear.
5. Once the process is complete, assign a name to the backup.

The name must contain only upper and lower case characters and spaces.

⇨ The pump configuration is saved on the smart device as a backup file

Restoring the pump configuration

CAUTION!
Warning of data loss
Do not close the app during restoring.

Do not interrupt the Bluetooth connection, for example by moving the smart device out of the range of the pump.

A pump configuration that has been previously saved, can be restored if need be.

(The pump configuration is dependent on the identity code.)

1. Use *[Start/Stop]* to stop the metering pump.
2. Connect the smart device to the metering pump.
3. Press the relevant backup file under *„Expert settings ➔ Restore pump configuration“*.
   ⇨ A progress bar appears and the pump configuration is saved on the metering pump.

Deleting the backup file from the smart device

1. Open the menu item *„Restore pump configuration“* in the gamma/ X app..
2. Swipe sidewards on a backup file.
   ⇨ A button appears.
3. Delete the backup file by pressing the button.

1.7.5 Bluetooth Address

The metering pump's Bluetooth address can be found:

- ... in the app under *„Device info ➔ BT address“*
- ... in the metering pump under *„Information ➔ BT device address“*

1.8 Troubleshooting

Fault description	Cause	Remedy
The metering pump does not start although I have pressed the slide switch in the app.	The metering pump has been stopped using *[Start/Stop]* or a fault is pending.	Use *[START/STOP]* to start the metering pump. Rectify the fault.
The metering pump and other devices are interfering with each other.*	The WiFi signal from the smart device is interfering with the connection.	Switch off WiFi on the smart device.
	Interference with other devices is causing a problem.	Change the orientation of the metering pump until the problems disappear. Change the installation site of the metering pump until the problems disappear. Connect the metering pump and the devices experiencing interference to different power circuits. Call in a high-frequency engineer.
	Other devices are interfering with the Bluetooth connection to the metering pump.	Increase the gap between the devices and the metering pump.

* Confirm or cancel this by switch the Bluetooth metering pump on and off.

1.9 Extract EC / EU Declaration of Conformity gamma/ X with Bluetooth

In accordance with DIRECTIVE 2006/42/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL, Appendix I, BASIC HEALTH AND SAFETY REQUIREMENTS, section 1.7.4.2. C.

We,

- ProMinent GmbH
- Im Schuhmachergewann 5 - 11
- D - 69123 Heidelberg, Germany,

hereby declare that the product specified in the following, complies with the relevant basic health and safety requirements of the EC Directive, on the basis of its functional concept and design and in the version distributed by us.

Any modification to the product not approved by us will invalidate this declaration.

Tab. 2: Extract from the EC / EU Declaration of Conformity

Designation of the product:	Metering pump, gamma/ X product range	
Product type:	GMXa _ _ _ _ _ _ _ _ _ _ _ _U _ _ _ Y _ B Y = 0, 3, 4, 5	
Serial number:	see nameplate on the device	
Relevant EC directives:	Machinery Directive (2006/42/EC) Compliance with the protection targets of the Low Voltage Directive according to Appendix I, No. 1.5.1 of the Machinery Directive RoHS- Directive (2011/65/EU) R&TTE Directive (1999/5/EC)	
	up to 19.04.2016 EMC - Directive (2004/108/EC)	from 20.04.2016 EMC Directive (2014/30/EU)
Harmonised standards applied, in particular:	EN ISO 12100:2010 EN 809:1998 + A1:2009 + AC:2010 EN 61010-1:2010 EN 61000-6-3:2007 + A1:2011 EN 61000-6-2:2005 EN 300 328 V1.8.1:2012 EN 50581:2012	
Date:	21.03.2016	

You will find the EC Declaration of Conformity to download on our homepage.

2 Supplementary Operating Instructions CANopen

2.1 About this pump

Solenoid metering pumps gamma/ X with CAN connector differ from standard pumps as they can be connected to a CANopen bus system. A CAN pump gamma/ X can be connected to a CANopen bus or used on its own.

Example:

- Measurement-value dependent metering of sodium-calcium hypochlorite into a swimming pool water circuit, where in the operating mode *„CANopen“*, the pump is controlled from a controller.

A gamma/ X in the "CANopen" version (Identity code feature "Control type" = C or D) is designed for incorporation in a CANopen system.

2.2 Control Elements

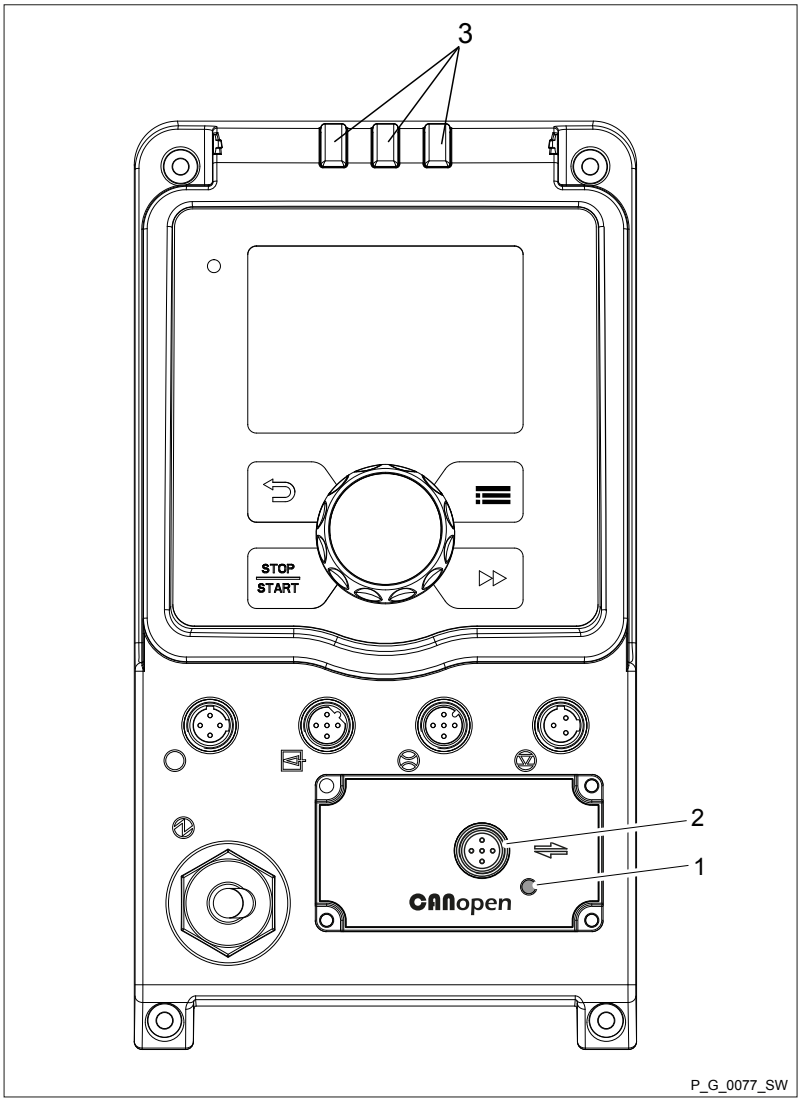


Fig. 3: Control Elements

1 Status LED CAN bus
2 Socket "CAN bus"
3 Device LEDs

2.3 Installation, electrical

CAUTION!

Pump can be damaged

If the CAN cable is not correctly screwed in, the IP65 protection rating is not achieved.

– Manually screw in the CAN cable glands until they reach the stop.

CAUTION!

Pump can be damaged

The panel connector at the housing can break off.

– Never connect a T-coupler directly to the housing.

Connect the CAN cable with the CANopen bus connector as shown below (For more - see the documentation for your CANopen installation).

Insert the mains plug in the power socket - the metering pump starts to pump as necessary.

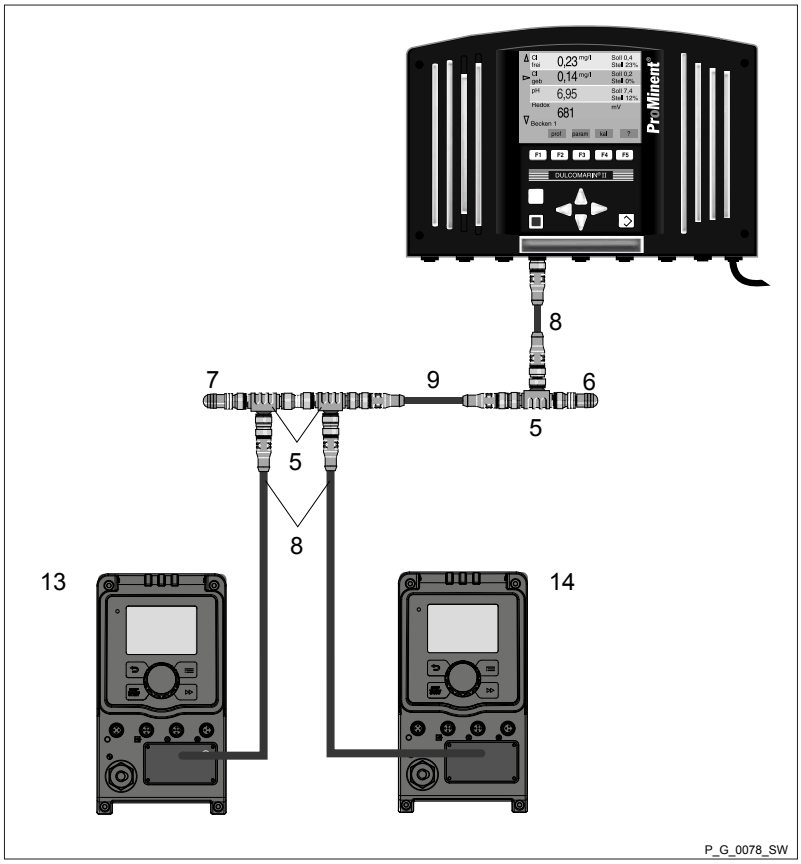


Fig. 4: CAN connector for metering pumps (example with Dulcomarin II as control)

5 T-coupler, M 12, 5-pole CAN
6 Termination resistance M12 coupling
7 Termination resistance M12 plug
8 CAN connecting cable CAN connecting cable
9 CAN connecting cable
13 CAN pump gamma/ X e.g. for acid
14 CAN pump gamma/ X e.g. for alkali

CANopen-Bus connector

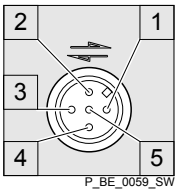


Fig. 5: Pump pin assignments (male)

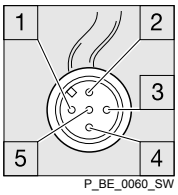


Fig. 6: CAN cable assignments (female)

The "CANopen bus connection" takes place via a five-pin plug.

1 Shielding
2 CAN V+ (supply voltage – not connected)
3 CAN GND (reference potential)
4 CAN H (bus line - dominant high)
5 CAN L (bus line - dominant low)

2.4 Emergency mode

You can guard against the possibility of the CANopen bus control failing in the following way:

1. Program an auxiliary frequency into the pump that fits optimally with a stroke length of 30 ... 100 % into your process in emergency operation.
2. As soon as emergency operation is required, run the pump using the "external control" socket on the auxiliary frequency - see "Operating Instructions for Solenoid Metering Pump gamma/ X GMXa" - "Installation, electrical".

2.5 Troubleshooting

The CANopen status LED indicates the status of the CAN connection.

The display for operating and fault status is carried out using 3 other LEDs - see "Operating Instructions for Solenoid Metering Pump gamma/ X GMXa“.

Tab. 3: Flash code CANopen status LED, top

Colour	Flash code	Cause	Remedy
green	illuminated	Bus status OPERATIONAL	- (Pump normal operation)
green	flashing *	Bus status PRE-OPERATIONAL	wait briefly or start the pump over the bus
green	Single flashing **	Bus status STARTUP	wait briefly of set the pump for active bus operation - see "Set-up" chapter
green	off	Error (BUSOFF, Error,…)	CAN bus test
green	flickering	Bus status INIT	wait briefly

Ignore the flash codes for approx. 2 minutes after connecting the metering pump.

For "Error messages about CANopen-telegram", see the end of the appendix.

2.6 Accessories

Accessories	Order no.
T-coupler M12 5-pin CAN	1022155
Termination resistance M12 coupling	1022154
Termination resistance M12 plug	1022592
Connecting cable - CAN, M 12, 5-pole, 1 m	1022139
Connecting cable - CAN, M 12, 5-pole, 2 m	1022140
Connecting cable - CAN, M 12, 5-pole, 5 m	1022141
Connecting cable - CAN, sold by the metre	1022160
Coupling, M12, 5-pole Screw connector	1022157
Plug CAN M12, 5-pole Screw connector	1022156

2.7 Appendix

2.7.1 Object list metering pump gamma/ X, GMXa

2.7.1.1 Communication profile area 0x1000-0x1FFF

Index	S	Name	Type	Description			
1000h	1	p_ident.d_profile	U32	Device type (10.2.1 in 450)	0001 01C2h	RO	M
1001h	1	Error register	U8	9.6.3 in 301		RO	M
1010h	1	Save all parameters	U32			RW	O
	2	Save comm.. parame-ters					
	3	Save process.. parameters					
1011h	1	Load(restoredefault) parameters	U32			RW	O

Index	S	Name	Type	Description			
	2	Load comm.. parame-ters					
	3	Load process.. parameters					
1017h	1	p_ident.w_heart_beat _time	U16	50-2000	800	RO	O
1018h	0	Identification					M
		p_ident.b_entries	U8		4	RO	
	1	p_ident.d_vendor_ID	U32		0xE1	RO	
	2	p_ident.d_product_co de	U32		0x0E020 115	RO	
	3	p_ident.d_rev number	U32		1	RO	
	4	assemblyID	U32	Unit serial number		RW	

Tab. 4: Transmit-PDOs MAPPING-Parameter

Index	S	Name	Type	Description	Mapping
1A00h	0	**TPDO1**			
	1	DP_state	U16	Status metering pump (base)	0x2A10**00**10
	2	DP_output_man (actual)	U16	Pump frequency (actual) in %	0x2A01**00**10
	3	DP_stroke_len	U8	Stroke length	0x2A040**0**08
1A01h	0	**TPDO2**			
	1	DP_level	U8	Liquid level metering container	0x2A050**0**08

Tab. 5: Receive-PDOs MAPPING-Parameter

Index	S	Name	Type	Description	Mapping
1600h	0	**RPDO1**			
	1	DP_output_cont	U16	Pump frequency (setpoint) in %	0x2A00**00**10
1601h	0	**RPDO2**			
	1	DP_batch_time_stamp	U16	Batch time stamp	0x2A02**00**10
	2	DP_batch_value	U16	Factor (setpoint)	0x2A03**00**10

2.7.1.2 Manufacturer specific profile area 0x2000-0x5FFF

Index	S	Name	Type	Description	Objects	Attr
2A00h	0	DP_output_cont (set-point)	U16	Frequency in % (0=100.0%)	RPDO1	wr
2A01h	0	DP_output_actual	U16	Frequency in % (0=100.0%)	TPDO1	ro
2A02h	0	DP_batch_time_stamp	U16	Time stamp last received com-mand	RPDO2	wo
2A03h	0	DP_batch_value	U16	Batch factor	RPDO2	wo
2A04h	0	DP_stroke_len	U8	Stroke length	TPDO1	rO
2A05h	0	DP_level	U8	Liquid level metering container	TPDO2	rO
2A10h	0	DP_state	U16	0=out of ctrl, 1=mem, 2=cal, 3=pos/neg 4=prime, 5=warning, 6=errors, 7=stops, 8-11=mode, 12=aux;13=flow; 14=pause, 15=hand/bus	TPDO1	ro
2A11h	0	DP_Control	U8	1= batch-mem, 2=setp. pos/neg, 3=calibrated, 4=flowctrl active, 6=reset	SDO	rw
2A12h	0	DP_Mode	U8	0=stop,1=manual, 2=batch,	SDO	wo
2A20h	0	DP_stroke_max	U16	max. stroke rate (strokes/min)	SDO	ro
2A21h	0	DP_metering volume	Float	in 1/stroke (at 100% stroke)	SDO	wr
2A22h	0	DP_measuring_unit	U8	0=litre, 1=gallon	SDO	wr
2A30h	0	DP_volume	U32	in ml since last reset	SDO	ro
2A31h	0	DP_stroke_cnt	U16	strokes since last reset	SDO	ro
2A33h	0	DP_rem_stroke	U16	Remaining stroke no. (in batch mode)	SDO	ro
2A35h	0	`PCO_HighestSubIndex`	U8			ro
	1	FlowControl	U8	Bit	SDO	wo
	2	BatchMem	U8	Bit	SDO	wo
	3	ClearCount	U8	Bit	SDO	wo
3FBBh	0	`PCO_HighestSubIndex`	U8			
	1		U32	Identity code		RO

Index	S	Name	Type	Description	Objects	Attr
	2		U32			RO
	3		U32			RO
	4		U32			RO
	5		U32			RO
	6		U32			RO
	7		U32			RO
	8		U32			RO
3FBCh	0	PCO_HighestSubIndex	U8			
	1		String	Serial number		RO
	2		String			RO
	3		String			RO
	4		String			RO
	5		String			RO
	6		String			RO
	7		String			RO
	8		String			RO
3FBDh	0	PCO_HighestSubIndex	U8			
	1		String	Hardware Version		RO
	2		String			RO
	3		String			RO
3FBEh	0	PCO_HighestSubIndex	U8			
	1		String	Software Version		RO
	2		String			RO
	3		String			RO

Tab. 6: 0x5100 – 0x5500

Index	S	Name	Type	Description Max	Objects	Attr
5100h	1	Einschalt-zähler	U32	Switch-on counter	SDO	RO
5101h	1	Fehlerflags	U32	Pump error flags	SDO	RO
5102h	1	Warnflags	U32	Pump warn-ings	SDO	RO
5105h	1	Total calibra-tion volume	U32	Total stroke counter	SDO	RO

Index	S	Name	Type	Description Max	Objects	Attr
5106h	1	Dosiermen-genzähler	Float	Metering volume counter	SDO	RO
5107h	1	Calibration strokes:	U32	Calibration strokes	SDO	RO
5108h	1	Rest-Dosier-menge	Float	Remaining metering quantity	SDO	RO
5109h	1	Ist-Hublänge	Float	Current stroke length	SDO	RO
510Ah	1	Soll-Hublaenge	Float	Setpoint stroke length	SDO	RW
510Bh	1	Soll-Hubfre-quenz	U16	Setpoint stroke rate	SDO	RW
510Ch	1	Ist-Hubfre-quenz	U16	Current stroke rate	SDO	RO
510Dh	1	Dosiervo-lumen pro Auslösung	Float	Metering vol-umes per release	SDO	RW
510Eh	1	Ist-Dosierleis-tung	Float	Current metering capacity	SDO	RO
510Fh	1	Dosierzeit für Batch	U16	Metering time for batch in sec	SDO	RW
5110h	1	maximale Dosierleis-tung	Float	Maximum capacity	SDO	RO
5112h	1	Soll-Dosier-leistung	Float	Setpoint metering capacity	SDO	RW
5113h	1	Auxiliarfre-quenz	U16	Auxiliary fre-quency	SDO	RW
5114h	1	Auxiliar-Dos-ierleistung	Float	Auxiliary capacity	SDO	RW
5115h	1	Dosierart	U32	Metering type (0-optimum, 1-fast,2-sinus mode,3-cont. 4-DFMa)	SDO	RW
5117h	1	Soll-Betrieb-sart	U32	Setpoint operating mode (0-stop,1-manual,..)	SDO	RW
5118h	1	Ist-Betrieb-sart	U32	Current oper-ating mode	SDO	RO

Index	S	Name	Type	Description Max	Objects	Attr
5119h	1	Soll-Unterbetriebsart	U32	Setpoint operating submode (0-0..20mA, 1-4..20mA,4 linear curve,..)	SDO	RW
511Ah	1	Ist-Unterbetriebsart	U32	Current operating submode	SDO	RO
511Bh	1	Betriebsmodus (Automatik On/Off)	U32	Operating mode (automatic on(1)/ off(0))	SDO	RW
511Ch	1	Konzentrationsgesteuerter Betrieb an/aus	U32	Concentration-controlled operation on(1)/ off(0)	SDO	RW
511Eh	1	Dauer des Ansaugens	U16	Priming duration in sec	SDO	RW
511Fh	1	Batch-Faktor	U32	Batch factor (1-99999)	SDO	RW
5122h	1	Kontakt-Faktor	Float	Contact factor (0.01-99.99)	SDO	RW
5147h	1	Maximale Hubfrequenz	U16	Maximum stroke rate	SDO	RO
5148h	1	Gesamtbetriebsdauer	U32	Operating period in sec	SDO	RO
5152h	1	Dosiermenge pro Vollhub	Float	Metering quantity per full stroke in ml (stroke length100%)	SDO	RO
5153h	1	Löschbarer Hubzähler	U32	Deletable stroke counter	SDO	RW
5154h	1	Löschbarer Mengenzähler	Float	Deletable volume counter	SDO	RW

Tab. 7: Strings

Index	S	Name	Type	Description	Objects	Attr
5D00h	0	PCO_HighestSubIndex	U8			RO
	1	Name1	String	Pump name		RO
	2	Name2	String			RO

Index	S	Name	Type	Description	Objects	Attr
	3	Name3	String			RO
	4	Name4	String			RO
	5	Name5	String			RO
	6	Name6	String			RO
	7	Name7	String			RO
	8	Name8	String			RO
5D01h	0	PCO_HighestSubIndex	U8			RO
	1	Location1	String	Pump installation location		RO
	2	Location 2	String			RO
	3	Location 3	String			RO
	4	Location 4	String			RO
	5	Location 5	String			RO
	6	Location 6	String			RO
	7	Location 7	String			RO
	8	Location 8	String			RO
5042h	1	Identification_LED	U16	0- off	SDO	rw
				>0 Set identification time (LED yellow +red flash for duration)		
				1 equivalent to approx. 10 ms		
5FEE	0	CANopenStackRevision	UINT32	ProMinent CANopen-Stack-Revision		RO

2.7.1.3 Device specific area 0x51000-0x5FFF

Tab. 8: HMI area 0x5100 – 0x5FFF

Index	S	Name	Type	Description	Objects	Attr
5111h	1	sw_version_ctrl	U32	Software version of control		RO
5112h	1	hw_version_ctrl	U32	Hardware version of control		ro
5113h	1	sw_version_fu	U32	Software version of FC		RO

Index	S	Name	Type	Description	Objects	Attr
5114h	1	hw_version_fc	U32	Hardware version of FC		RO
5115h	1	sw_version_pfc	U32	Software version of PFCU		RO
5116h	1	hw_version_pfc	U32	Hardware version of PFC		RO
5118h	1	serial_number	U32	Serial number of SxCn		RO

Index	S	Name	Type	Description	Objects	Attr
5120h	1	Nominal frequency	U16	Setpoint frequency	PDO	Rw
5121h	1	Actual frequency	U16	Setpoint frequency	PDO	RO
5122h	1	Nominal mode	U8	Setpoint operating mode:	PDO	Rw
5123h	1	Actual mode	U8	Actual operating mode	PDO	RO
5124h	1	Analogue mode	U8	Analogue mode:	PDO	Rw

Index	S	Name	Type	Description	Objects	Attr
5125h	1	Analogue curve	U8	Curve type for analogue		ro
5126h	1	Curve-IP1	U16	Current at curve point 1		rW
5127h	1	Curve-FP1	U16	Stroke rate at curve point 1		rW
5128h	1	Curve-IP2	U16	Current at curve point 2		rW
5129h	1	Curve-FP2	U16	Stroke rate at curve point 2		rW
512Ah	1	Auxiliary	U16	Auxiliary frequency		ro
512Bh	1	Metering mode	U8	Metering mode (metering profile)		Rw

Index	S	Name	Type	Description	Objects	Attr
512Ch	1	Batch memory	U8	Saving function for batch metering:	PDO	ro
512Dh	1	Batch factor	U16	Batch_factor	PDO	ro
512Eh	1	Contact memory	U8	Saving function for contact metering:	PDO	ro
512Fh	1	Contact factor	U16	Contact factor	PDO	ro
5130h	1	Pressure control	U8	Pressure gauge		Rw

Index	S	Name	Type	Description	Objects	Attr
5131h	1	Calibration counter	U8	Calibration stroke counter	PDO	Rw
5132h	1	Calibration value	U16	Calibration value (total quantity)	PDO	Rw

Index	S	Name	Type	Description	Objects	Attr
5133h	1	Viscosity	U8	Viscosity level		ro
5134h	1	Stroke length	U16	Stroke length	PDO	ro
5135h	1	Stroke counter	U32	Stroke counter	PDO	rO
5136h	1	Quantity counter	U32	Volume counter	PDO	rO
5137h	1	Clear counters	U8	Clear counter		WO
5138h	1	Strokes left	U32	Remaining strokes	PDO	RO

Index	S	Name	Type	Description	Objects	Attr
5139h	1	Quantity left	U32	Remaining quantity	PDO	RO
513Ah	1	User code	U16	User password	PDO	WO
513Bh	1	Language index	U8	Language index		RW
513Ch	1	Analogue external	U16	Analogue value at external input	PDO	RO
513Dh	1	Quantity per stroke	U16	Metering quantity per stroke at 100% stroke length	PDO	RO
513Eh	1	NomFreq_Litreper-Hour	U16	Requested metering frequency in litres/ hour	PDO	RO

Index	S	Name	Type	Description	Objects	Attr
513Fh	1	Metering control	U8	Metering monitoring		RW
5140h	1	Metering-Control-Pulses	U16	Defective strokes for metering monitoring		RW
5141h	1	Dosing-Control-by-Aux	U8	Metering monitoring in aux mode		RW
5142h	1	Metering-Control-Errorsignal	U8	Metering monitoring error signalling		RW
5143h	1	Access level	U8	Access protection level (0-none, 1-menu blocked, 2-continuous display and menu blocked)		RW
5144h	1	Unit	U8	Pump unit (0-litre, 1-gallon)		RW

Index	S	Name	Type	Description	Objects	Attr
5145h	1	Diaphragm	U8	Diaphragm error signalling		RW
5146h	1	AnalogueCurveError	U8	Error signalling for analogue curve		RW

Index	S	Name	Type	Description	Objects	Attr
5147h	1	Relay1-Type	U16	Relay-Type (0-warning,1-error, 2-warn.+error, 3-warn. +error+stop, 4-stop, 5-clock)		RW
5148h	1	Relay2-Type	U16	Relay-Type (0-warning,1-error, 2-warn.+error, 3-warn. +error+stop, 4-stop, 5-clock)		RW
5149h	1	Relay1-Polarity	U16	Relay polarity (0-attracting(NO), 1-falling off (NC))		RW
514Ah	1	Relay2-Polarity	U16	Relay polarity (0-attracting(NO), 1-falling off (NC))		RW
514Bh	1	Analogue-Out-Range	U16	Analogue output range (0: 0-20mA,1: 4-20mA)		RW
514Ch	1	Analogue-Out-Function	U16	Analogue-Function (0:strokes/min, 1: current metering capacity, 2: Capacity at 20mA)		RW
514Dh	1	Analog-Out-Capacity	U16	Adjustable capacity at 20mA		RW

Index	S	Name	Type	Description	Objects	Attr
514Eh	1	NomFreqStrokesperHour	U16	Nominal metering capacity in strokes/hour		RW
514Fh	1	CalibReset	U16	Calibration reset		RW
5150h	1	BatchQuantity	U32	Set metering quantity		RW
5151h	1	DeviceName	U16	Device name		ro
5152h	1	DeviceLocation	U16	Device installation location		ro
5153h	1	Betriebsdruck	U16	Pressure stages (0: 4 bar, 1: 7 bar; 2: 10 bar, 4: 12 bar)		RW

Index	S	Name	Type	Description	Objects	Attr
5D00h	0	PCO_HighestSubIndex	U8			RO
	1	Name1	String	Pump name		RO
	2	Name2	String			RO
	3	Name3	String			RO
	4	Name4	String			RO
	5	Name5	String			RO
	6	Name6	String			RO
	7	Name7	String			RO
	8	Name8	String			RO
5D01h	0	PCO_HighestSubIndex	U8			RO
	1	Location1	String	Pump installation location		RO
	2	Location 2	String			RO
	3	Location 3	String			RO
	4	Location 4	String			RO
	5	Location 5	String			RO
	6	Location 6	String			RO
	7	Location 7	String			RO
	8	Location 8	String			RO
5042h	1	Identification_LED	U16	0 - off > 0 - Set identification time (LED yellow + red flash for duration) 1 - equivalent to approx. 10 ms	SDO	RW
5FEE	0	CANopenStackRevision	UINT32	ProMinent CANopen-Stack-Revision		RO

2.7.1.4 Device profile area 0x6000-0x9FFF

Index	Sub	Name	Type	Description	Categ.*	Attr
6000h	00h	HighestSubIndex	U32	Failure codes	MANDA	RO
	01h	Hardware failure codes 1	U32		MANDA	RO
	02h	Hardware failure codes 2	U32		MANDA	RO
	03h	Software failure codes 1	U32	Bit#0: Software-Fault	MANDA	RO

Index	Sub	Name	Type	Description	Categ.*	Attr
				Bit#1: SoftwareR-eset		
				Bit#2: Parameter problem		
				Bit#3: Memory resource problem		
				Bit#4: Application failure		
				Bit#5: Failure in control software		
				Bit#6: Failure of operation system software		
				Bit#7: Failure in communication soft-ware		
				Bit#8 to 31 Reserved		
	04h	Software failure codes 2	U32		MANDA	RO
	05h	Mechanics failure codes 1	U32		MANDA	RO
	06h	Mechanics failure codes 2	U32		MANDA	RO
	07h	Electrics failure codes 1	U32		MANDA	RO
	08h	Electrics failure codes 2	U32		MANDA	RO
	0Dh	Operation failure codes 1	U32		MANDA	RO
	0Eh	Operation failure codes 2	U32		MANDA	RO
	0Fh	Operation failure codes 3	U32		MANDA	RO
	10h	Auxiliary device failure codes 1	U32		MANDA	RO
	11h	Auxiliary device failure codes 2	U32		MANDA	RO
	12h	Auxiliary device failure codes 3	U32		MANDA	RO

Index	Sub	Name	Type	Description	Categ.*	Attr
6001h	00h	`HighestSubIndex`	U32	Warning codes	MANDA	RO
	01h	Hardware warning codes 1	U32		MANDA	RO

Index	Sub	Name	Type	Description	Categ.*	Attr
	02h	Hardware warning codes 2	U32		MANDA	RO
	03h	Software warning codes 1	U32	Bit#0: Software-Warning	MANDA	RO
				Bit#1: SoftwareR-eset		
				Bit#2: Parameter problem		
				Bit#3: Memory resource problem		
				Bit#4: Application failure		
				Bit#5: Warning in control software		
				Bit#6: Warning of operation system software		
				Bit#7: Warning in communication software		
				Bit#8 to 31 Reserved		
	04h	Software warning codes 2	U32		MANDA	RO
	05h	Mechanics warning codes 1	U32		MANDA	RO
	06h	Mechanics warning codes 2	U32		MANDA	RO
	07h	Electrics warning codes 1	U32		MANDA	RO
	08h	Electrics warning codes 2	U32		MANDA	RO
	0Dh	Operation warning codes 1	U32		MANDA	RO
	0Eh	Operation warning codes 2	U32		MANDA	RO
	0Fh	Operation warning codes 3	U32		MANDA	RO
	10h	Auxiliary device warning codes 1	U32		MANDA	RO
	11h	Auxiliary device warning codes 2	U32		MANDA	RO
	12h	Auxiliary device warning codes 3	U32		MANDA	RO

*Tab. 9: **

MANDA	mandatory
OPTION	optional
CONDIT	Conditional mandatory

Index	Sub	Name	Type	Description	Categ.*	Attr
6002h	00h	`HighestSubIndex`	U32	Alarm codes	MANDA	RO
	01h	Hardware alarm codes 1	U32		MANDA	RO
	02h	Hardware alarm codes 2	U32		MANDA	RO
	03h	Software alarm codes 1	U32	Bit#0: Software-Fault	MANDA	RO
				Bit#1: SoftwareR-eset		
				Bit#2: Parameter problem		
				Bit#3: Memory resource problem		
				Bit#4: Application failure		
				Bit#5: Failure in control software		
				Bit#6: Failure of operation system software		
				Bit#7: Failure in communication soft-ware		
				Bit#8 to 31 Reserved		
	04h	Software alarm codes 2	U32		MANDA	RO
	05h	Mechanics alarm codes 1	U32		MANDA	RO
	06h	Mechanics alarm codes 2	U32		MANDA	RO
	07h07	Electrics alarm codes 1	U32		MANDA	RO
	08h	Electrics alarm codes 2	U32		MANDA	RO
	0Dh	Operation alarm codes 1	U32		MANDA	RO
	0Eh	Operation alarm codes 2	U32		MANDA	RO
	0Fh	Operation alarm codes 3	U32		MANDA	RO

Index	Sub	Name	Type	Description	Categ.*	Attr
	10h	Auxiliary device alarm codes 1	U32		MANDA	RO
	11h	Auxiliary device alarm codes 2	U32		MANDA	RO
	12h	Auxiliary device alarm codes 3	U32		MANDA	RO

Index	Sub	Name	Type	Description	Categ.*	Attr
6003h	00h	HighestSubIndex	U32	Specific physical units	MANDA	RO
	01h	Physical unit pressure	U32	Standard: bar 0x004E0000, gal (AE)	MANDA	RW
6005h	00h	HighestSubIndex		GenericPump control	MANDA	
	01h	Generic pump commands	U8	Bit#0: Pump operation: off=0 / on=1	MANDA	RW
				Bit#1: ResetFault: No reset=0 / Reset of fault=1		
				Bit#2: RemoteAccessReq: No remote=0; Remote access=1		
				Bit#3 to 7 Reserved		
6007h	00h	HighestSubIndex		Identification	MANDA	RO
	01h	ManufacturerID	String		MANDA	RO
	02h	DeviceType	String		MANDA	RO
	03h	ProfileRevision	String		MANDA	RO

Index	Sub	Name	Type	Description	Categ.*	Attr
6026h	00h	HighestSubIndex		Error notification control	MANDA	CO
	02h	Name	String		MANDA	RW
	03h	Class	String		MANDA	RW
	07h	NotificationCode	U16		OPTION	RW
6027h	00h	HighestSubIndex		Error notification status	MANDA	
	01h	Status	U8		MANDA	RO

*Tab. 10: **

MANDA	mandatory
OPTION	optional
CONDIT	Conditional mandatory

2.7.1.5 Alarm action area for measurement devices (404)

Index	Sub	Name	Type	Description	Categ.	Attr
6509h	1	AI1_action=1 warn,=3 err	U8	Level min error		RW
6519h	1	AI2_action =0 inactive	U8	Level min warning		RW
6529h	1	AI3_action	U8	Batch error		RW
6539h	1	AI4_action	U8	Cal warning		RW
6549h	1	AI5_action	U8	Sys error		RW
6559h	1	AI6_action	U8	Not bus		RW
6569h	1	AI7_action	U8	add2		RW
6579h	1	AI8_action	U8	add3		RW
6600	1	AI_state0_7	U8	0=no error, 1=error (DLT/ Sigma/DF3)		RW

2.7.2 EMERGENCY

Tab. 11: Emergency Object Data:

Byte	0	1	2	3	4	5	6	7
Content*	Emergency Error Code*		Error register*	Manufacturer specific Error Field*				

*Tab. 12: **

Content (1 Byte):	80h+Node-Id
Emergency Error Code (2 Byte):	0x1000 (0x10xx = Generic Error) 0x0000 (0x00xx = No Error)
Error Register (1001h-content) (1 Byte):	0x81 (Bit #0=Generic Error,Bit #7= Manufacturer specific)
Manufacturer specific Error Field (5 Byte):	Byte #3: Component no. (channel) Byte #4: Error type Byte #5: Error class Byte #6: free Byte #7: free

Emergency ErrorCode (2 Byte):	0xFF01 (0xFFxx = Device specific, 0x01 = Sigma b)

Tab. 13: Manufacturer specific Error Field (5 Byte):

Byte #3:	Component no. (channel)
Byte #4:	Error type
Byte #5:	Error class
Byte #6:	free
Byte #7:	free

Tab. 14: Component no. (channel):

0	-
1	GMXa

Tab. 15: Error type (1-99):

- see error table

Tab. 16: Error class:

Bit0	Emergency active
Bit1	Error (1) / warning (0)
Bit2	Action: 1 active (horn on) – 0 inactive (horn off)

Tab. 17: Error table

Fault	**EMCY**						
	Emergency ErrorCode	**Error Register**	**Manufacturer specific Error Field**				
			Component no.	**Error type**	**Error class**	**-**	**-**
Level warning	0xFF01	0x81	0x01	0x01	0x01	0x00	0x00
Metering monitoring warning	0xFF01	0x81	0x01	0x03	0x01	0x00	0x00
Diaphragm warning	0xFF01	0x81	0x01	0x04	0x01	0x00	0x00
Stroke length warning	0xFF01	0x81	0x01	0x05	0x01	0x00	0x00
Overload warning	0xFF01	0x81	0x01	0x06	0x01	0x00	0x00
Temperature warning	0x4201	0x09	0x01	0x07	0x01	0x00	0x00
Level error	0xFF01	0x81	0x01	0x21	0x02	0x00	0x00
Storage tank overflow	0xFF01	0x81	0x01	0x22	0x02	0x00	0x00
Control signal < 4mA	0xFF01	0x81	0x01	0x23	0x02	0x00	0x00
Control signal > 20mA	0xFF01	0x81	0x01	0x24	0x02	0x00	0x00
Defective stroke metering	0xFF01	0x81	0x01	0x25	0x02	0x00	0x00
Diaphragm rupture	0xFF01	0x81	0x01	0x26	0x02	0x00	0x00

Fault	EMCY						
	Emergency ErrorCode	Error Register	Manufacturer specific Error Field				
			Component no.	Error type	Error class	-	-
Stroke length adjusted	0xFF01	0x81	0x01	0x27	0x02	0x00	0x00
System error	0xFF01	0x81	0x01	0x2A	0x02	0x00	0x00
Module communication	0x8101	0x11	0x01	0x2C	0x02	0x00	0x00
Module missing	0x8101	0x11	0x01	0x2D	0x02	0x00	0x00

Tab. 18: Emergency ErrorCodes from stack

	Emergency ErrorCode	
#define ERRCODE_COMM_ERROR	0x8100	communication error
#define ERRCODE_CAN_OVERRUN	0x8110	CAN overrun
#define ERRCODE_CAN_PASSIVE	0x8120	CAN in error passive
#define ERRCODE_HB_ERROR	0x8130	HB or life guard
#define ERRCODE_CAN_RECOVER_BOFF	0x8140	CAN recoverd from bus-off
#define ERRCODE_BAD_PDOPARA	0x8210	PDO not processed due the length
#define ERRCODE_BAD_PDOLEN	0x8220	PDO length exceeded

2.7.3 Object explanations

DeviceState [Index 0x2A10, Subindex 0x00]

The "DeviceState" object contains actual operating conditions and the pump's existing errors. 'DeviceState' can only be read.

Tab. 19: DeviceState BitValues

Bit positions	Meaning
15 (MSB)	Manual / bus operation
14	Pause
13	-
12	Auxiliary
11	Operating mode: 1. continuous
10	Operating mode: 2. batch operation
9	Operating mode: 3. external contact
8	Operating mode: 4. analogue input
7	Stop

Bit positions	Meaning
6	Internal error
5	Warning (e.g. container filling level)
4	Suction active
3	Lowerer (only in ProMinent systems)
2	Calibration invalid
1	Memory metering
0 (LSB)	No remote operation possible

DeviceControl [Index 0x2A11, Subindex 0x00]

The object 'DeviceControl' is used to specify the operating mode more precisely.

Tab. 20: DeviceControl BitValues

Bit positions	Meaning
7 (MSB)	Must be set to 0
6	Reset
5	Must be set to 0
4	-
3	Calibration completed
2	Must be set to 0
1	Batch memory active
0 (LSB)	Must be set to 0

If Bit 6 (RESET) is set to ‘1’, the pump is stopped (DeviceMode = 0x00), existing errors are deleted and the batch memory is set to 0.

DeviceMode [Index 0x2A12, Subindex 0x00]

The object 'DeviceMode' is used to configure CANopen operating mode of the pump.

Tab. 21: DeviceMode BitValues

Bit positions	Meaning
7 (MSB)	Must be set to 0
6	Must be set to 0
5	Must be set to 0
4	Must be set to 0
3	Must be set to 0
2	Must be set to 0
1	Continuous operation [0], batch operation [1]
0 (LSB)	Stop [0] / Start [1]

Tab. 22

		Value of 'DeviceMode'
a)	Stop	0x00
b)	Continuous operation	0x01
c)	Batch operation	0x02

2.7.4 Changing the CANopen node address (node ID)

The CANopen node address can be changed as follows:

Change via the object list using Standard SDO traffic.

The object list index 3F40h, subindex 1 can be used to read the currently configured node address or to configure a new node address.

The permitted range for the node address is 1..127. The standard node address is 119.

The data type of this entry is UNSIGNED SHORT.

1. To change the node address, the new address is written to the Index 3F40h, subindex 1.

Tab. 23: CAN message for writing the new node address 55:

ID	DLC	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
600h + Node ID	8	CMD = 2Bh	40h	3Fh	01h	37h	00h	X	X
			Index 3F40h		Sindex 1	Node ID 0037h			

2. The writing of the signature "save" to index 1010h, subindex 05 causes the saving of the new node address to the non-volatile memory.

Tab. 24: CAN message for saving the new node address 250kBit/s:

ID	DLC	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
600h + Node ID	8	CMD = 23h	10h	10Fh	05h	73h	61h	76h	65h
			Index 1010h		Sindex 5		“save”		

3. When the device is next started, the changed baud rate becomes effective. A restart of the device is also possible via the NMT command "ResetNode".

2.7.5 Transfer rate (baud rate)

As supplied, the device is set to the baud rate 125 kBit/s. This is the ProMinent default baud rate.

2.7.6 Calibration, explanations

The pump is precalibrated. The metering volumes can be recalibrated if required.

2.7.7 Firmware update

The firmware cannot be updated via the CAN-Bus.

2.7.8 Data storage

Configuration data (e.g. the determined calibration data) are saved in a power fail-safe memory.

2.7.9 Received directives / standards

Fulfilled CAN standards and specifications

In respect of the hardware, the device complies with the harmonised CAN specification 2.0 (ISO99-1, ISO99-2). This includes the CAN protocol (ISO 11898-1) and details on the physical layer in compliance with ISO 11898-2 (high speed CAN up to 1 Mbit/sec) and ISO 11898-3 (low speed CAN up to 125 kBit/sec).

The unit complies with the CAN-Open specification CIA-DS401 that forms the basis of the European standard EN50325-4 and

also complies with the controller device profile CiA-404.

3 Supplementary Operating Instructions PROFIBUS®

3.1 Prerequisites

Personnel must be familiar with the contents of the "Operating Instructions for Solenoid Metering Pump gamma /X, GMXa"!

The pump must have the identity code feature "Control types": "R" PROFIBUS®DP interface M 12". The menu item *„Fieldbus“* is then available in the operating menu. (When *„Fieldbus* ➔ *active“* is set, *„Settings* ➔ *PROFIBUS“* also appears in the operating menu.)

3.2 Adjusting the pump

3.2.1 General

The pump with PROFIBUS® functionality is adjusted in the same way as the standard pump, with the addition of the bus functionality.

In the event of a pause longer than 60 s, the adjustment process is cancelled.

Using the connected PROFIBUS® module, the PROFIBUS® pump represents a device with slave functionality in conformity with DP-V1. This means that the payload is transferred both cyclically and acyclically.

3.2.2 Activating / deactivating PROFIBUS®

In order for the pump to be controlled using the PROFIBUS®, *„Fieldbus“* must be set to *„Active“* in the operating menu.

1. To access the *„Menu“*: press *[Menu]*.
   ⇨ The cursor immediately points to *„Information“*.
2. To switch from *„Information“* to *„Fieldbus“*: turn the *[Clickwheel]* and press.
3. To switch the *„Fieldbus“* to *„Inactive / active“*: turn the *[Clickwheel]* and press.
4. To switch from *„Inactive“* to *„Active“*, turn the *[Clickwheel]* and press.
   ⇨ The pump saves the *„Active“* setting.
   The *„Settings* ➔ *PROFIBUS“* menu also appears.
   The pump is in "stop" mode. To start controlling it, press the *[Stop/Start]* key. Give the Start command using the BUS.

While the PROFIBUS® is *„Active“*, all external inputs such as level monitoring, metering monitoring and external control (pause, contact input, analogue input) will function. They lead to the expected reactions as in the case of the pump without PROFIBUS® functionality - see pump operating instructions. The pump sends corresponding information over the PROFIBUS® to the master (PCL, PC etc.).

The gamma/ X, GMXa is set to *„Automatic“* metering type at the factory.

Even if the fieldbus is set to inactive, the master is able to read-access the pump data defined in its GSD file.

If the PROFIBUS® is set to *„Inactive“*, the settings for the operating mode previously selected are reloaded.

If the pump is switched to another operating mode, it stops and can only be restarted using the *[Stop/Start]* key.

3.2.3 Setting the slave address

3.2.3.1 using the *„Bus address“*

If the master in the PROFIBUS® segment assigns the slave addresses, manual setting of the slave address is cancelled.

The address is set to "120" for the gamma/ X GMXa.

1. To access the *„Menu“*: press the *[Menu]* key
   ⇨ The cursor immediately points to *„Information“*.
2. To switch from *„Settings“* to *„Fieldbus“*: turn the *[Clickwheel]* and press.
   ⇨ The cursor immediately points to *„Operating mode“*.
3. To switch from *„Operating mode“* to *„PROFIBUS“*: turn the *[Clickwheel]* and press.
   ⇨ The menu *„Bus address“* appears.

The PROFIBUS® address must always be entered as 3 digits (addresses from "002" to "125"):

1. 1. Option: Turn the *[Clickwheel]* until the desired value is reached and then press the *[Clickwheel]* .
2. 2. Option: Press the *[Priming]* key to change to digit-by-digit setting. Set the number using the *[Clickwheel]* and save using the *[Priming]* key. The cursor moves to the next number, and so on .

3.2.3.2 About *„Pump type“*

In this case you only need to make a setting if you want to use the gamma/ L data profile instead of gamma/ X.

1. In accordance with chap. jump to *„Pump type“* .
2. Select, for example, *„GALa“* as the pump type.
   ⇨ The pump loads the data profile for the gamma/ L, GALa pump.

3.3 Special features in PROFIBUS® mode

3.3.1 General

In PROFIBUS® mode, the pump cannot be manually set or programmed! To do this, set the PROFIBUS® to „Inactive“ .

- Using the *[Clickwheel]* it is possible to switch between the continuous displays at any time as in the other operating modes. This has no effect on the operating of the pump.
- When PROFIBUS® mode is selected, the settings from the last operating mode without PROFIBUS® are applied. **Settings made using PROFIBUS® are, however, not saved!** These only apply as long as the pump is linked to the PROFIBUS® . Only the *„stroke counter“* (total number of strokes) and the *„volume counter“* (total number of litres) continue to be counted and saved.
- If the pump is set to PROFIBUS® mode, it stops. It can be controlled again by pressing the *[Stop/Start]* key. Give the Start command using the BUS.

3.3.2 Display

In running PROFIBUS® mode there are further identifiers in the operating indicator.

The current identifier can be found in the "Controls" chapter in the "Solenoid metering pump gamma/ X, GMXa Operating Instructions".

PROFIBUS Stop PROFIBUS®: The pump has been stopped using the PROFIBUS®. The master has sent the pump a corresponding telegram.

⇌ Connection error: If the pump loses its connection with the PROFIBUS® (as soon as, for example, the BUS cable is removed or the bus master becomes inoperative), the ϟ fault symbol and the ⇌ symbol appear.

Fault module: If the pump loses its connection with the BUS module (as soon as, for example, the BUS module is removed or if communication is interrupted for other reasons between the BUS module and the pump), the error symbol and the symbol appear.

3.3.3 LEDs on the PROFIBUS® module

LED 1 (left) - module operating status

Signal	Cause
Off	The module has no supply voltage or connection.
Green	The module and the master are exchanging information.
Green flashing	The module has been initialised.
Red flashing	Error in pump parametrisation
Red flashing, double	Error in PROFIBUS configuration

LED 2 (right) - module status

Signal	Cause
Off	The module has not been initialised.
Green	The module has been initialised.
Green flashing	The module has been initialised and there are diagnostic messages.
Red	Serious exception error

3.3.4 Use metering monitor

In order to use the metering monitor in PROFIBUS® mode, the "Metering monitor" socket must be used. The pump then sends *„Available“* for the "Flow" status bit. The metering monitor can be switched on and off using the PROFIBUS® using the *„Metering monitor“* and *„FlowControl“* parameters.

If the metering monitor is set to *„Active“*, in the event of a problem it only gives a warning with gamma/ L, GALa - the gamma/ X, GMXa can give a warning as a problem or a fault.

3.4 Installation

Bus installation

All devices that are members of the bus system, must be connected in a line. There are up to 32 possible positions (master, slaves, repeaters).

At both the beginning and end of the cable, the bus must be terminated with a terminating resistance.

Plugs and cable

For the PROFIBUS® cable, use a shielded, twisted-pair cable in conformity with EN 50170 (cable type A).

Use of screening which is earthed at one end prevents low-frequency ground loops. Shielding earthed at one end has no effect in combating HF magnetic pick-up. Shielding earthed at both ends as well as twisted conductors work to counter magnetic HF pick-up, but have no effect against electrical HF pick-up.

For PROFIBUS®, it is recommended that a bilateral, low-inductance (i.e. large area and low-impedance) connection is established with the protective earth.

The overall length of the bus cabling without repeaters varies according to the desired data transmission rate:

Tab. 25: Data transmission rate and length of the bus cabling

Data transmission rate	Max. length of bus cabling
kBit/s	m
12000	100
6000	100
3000	100
1500	200
500	400
187.5	1000
93.75	1200
19.2	1200
9.6	1200

The PROFIBUS® module has two M12 industry sockets for connecting with the PROFIBUS®cable. The pin configuration complies with the PROFIBUS® standard - see below - which means that commercially available bus plugs may be used. Please note that cable connections made with these plugs are generally only contact and moisture proof to IP 20!

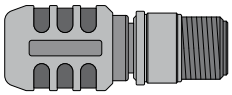
Note for achieving IP 65 protection

Installation to IP 65 contact and moisture proofing level is possible, since the M12 industry socket of the PROFIBUS® module allows it. Accordingly, the PROFIBUS® cable must be provided with IP 65 class M12 industrial connectors.

CAUTION!

- Protection level IP 65 applies only to a plug/ socket combination that has been screwed together!
- In ambient conditions requiring contact and moisture proofing up to IP 65, cables with moulded M12 industry plugs must be used.
- Protection level IP 65 applies only to an unwired pump (with PROFIBUS®module), if IP 65-capable covers are placed over the M12 industry sockets! The cover included in the delivery does not guarantee chemical resistance.

Terminating resistance



P_DE_0079_SW

If the pump is the last bus device connected to the PROFIBUS® cable, it must be connected completely as a termination using the PROFIBUS®terminating resistance, pluggable (order no. 1036622) see EN 50170. The PROFIBUS® terminating resistance has IP 65 class contact and moisture protection.

3.5 Operation

3.5.1 General

Using the connected PROFIBUS® module, the PROFIBUS® pump represents a device with slave functionality in conformity with DP-V1. This means that the payload is transferred both cyclically and acyclically.

3.5.2 GSD file

The GSD file must be used for configuring the master. It describes all of the features of the pump in PROFIBUS® mode (keywords, diagnosis, modules, slots). The GSD file can be downloaded from the PROFIBUS® website and from the ProMinent website. The file-name is clearly indicated: `GMXA0F4E.GSD` .

3.5.3 Data objects gamma/ X, GMXa

Tab. 26: Status and control

Module/slot	Index	Name	Module name	Diag. number	Identi-fication (hex)	Type	Data-flow *	Description		
								bit	Name	Function
1	1	State	**Status**	1	40.83	u32	R	0	Service	There are service requests
								1	Mes-sages	There are reports

Module/slot	Index	Name	Module name	Diag. number	Identification (hex)	Type	Dataflow *	Description		
								bit	Name	Function
								2	Mode	00 – stop 03 – contact
								3		01 – manual 04 – analogue
								4		02 – batch
								5	Fault	There are faults - see "Fault"
								6	Warnings	There are warnings - see "Warnings"
								7	Hand stop	Pump has been stopped manually
								8	Stop	Pump has stopped
								9	Priming	Pump is in priming mode (higher-level function)
								10	Auxiliary	Pump is in auxiliary mode (higher-level function)
								11	Pause	Pump has been switched to *„Pause“* status (higher-level function)
								12	Module	Fieldbus active
								13	Flow	Metering monitor is activated
								14	Batch-Mem.	Batch memory is activated
								15	Calibrated	Pump is calibrated
								16	-	-
								17	-	-
								18	-	-
								19	Diaphragm rupture	Diaphragm rupture indicator is installed
								20	Concentration	Concentration calculation is activated

Module/slot	Index	Name	Module name	Diag. number	Identification (hex)	Type	Dataflow *	Description		
								bit	Name	Function
								21	-	-
								22	Cavitation	Priming occurred during cavitation
								23	Airlock	Air in dosing-head
								24	Over-pressure	Excessive back pressure
								25	Under-pressure	Low back pressure
								26	Bleed valve	Pump vented
								27	-	-
								28	-	-
								29	-	-
								30	-	-
								31	-	-
2	1	Start / Stop	Control	2	80.81	u8	S	Complies with *[Start/Stop]* key; If Start / Stop = 0, then the pump is stopped		
	2	Reset		3		u8		If the Reset value is switched from 1 to 0, the internal pump memory is erased (e.g. in the event of a batch metering) and - as far as possible - the existing faults deleted		

* R = read, W = write

Tab. 27: Mode, flow rate, max. flow rate, batch, contact, concentration, metering monitor

Module/slot	Index	Name	Module name	Diag. number	Identification (hex)	Type	Dataflow *	Description		
3	1	Mode	Mode	4.5	C0,80, 80	u8	R, W	Value	Name	Description
								0.16	Stop	Pump is ready but not metering.
								1	Manual	Pump is metering continuously with the set volumes

Module/slot	Index	Name	Module name	Diag. number	Identification (hex)	Type	Dataflow *	Description		
								2	Batch	When triggered, the pump is metering the volumes set in the batch code
								3	Contact	Pump meters volumes in the predefined time
								4	Analogue	Pump is metering in accordance with the analogue signal and the analogue mode set at the pump.
								17	Manual (concentr.)	Manual in concentration mode
								18	Batch (concentr.)	Batch in concentration mode
								19	Contact (concentr.)	Contact in concentration mode
								20	Analogue (concentr.)	Analogue in concentration mode
4	1	nominal flow rate	**Flow rate**	6	C0,83,83	f32	S	Metering capacity setpoint in litres / hour		
	2	Actual flow rate		7		f32	R	Metering capacity actual value		
5	1	max. flow rate	**Max. flow rate**	8	40.83	f32	R	Maximum metering capacity in litres / hour		
6	1	Batch volume	**Batch**	9	C0,83,88	f32	S	Batch metering volumes		
	2	Batch time		10		u16		Time in which the batch should be metered		
	3	Batch start		11		u8		If the value changes from 1 to 0, a batch metering is activated in batch mode. (Batches may also be activated via contact input.)		

Module/slot	Index	Name	Module name	Diag. number	Identification (hex)	Type	Dataflow *	Description
	4	Batch memory		12		u8		If "Batch Memory" is activated and a new batch is activated during a batch metering already in progress, the remaining metering volumes are increased by that of the new batch. If the "Batch Memory" is not activated, the remaining volume is deleted and the new batch started.
	5	Remaining volume		13		f32	R	The remaining volumes to be metered in batch mode
7	1	Contact volume	**Contact**	14	80.84	f32	S	Volumes that are metered per contact
	2	Contact memory		14		u8		- see "Batch Memory"
8	1	Concentration rate	**Concentration**	15	C0,83, 83	f32	S	Concentration setting setpoint (only in *„Concentration“* operating mode)
	2	Actual concentration		16		f32	R	Concentration setting actual value (only in *„Concentration“* operating mode)
9	1	Metering monitor	**Metering Monitor**	17	80.80	u8	S	If metering monitoring is installed, it can be activated by yourself (1). Deactivate is 0.

* R = read, W = write

Tab. 28: Error / Warning

Module/slot	Index	Name	Module name	Diag. number	Identification (hex)	Type	Dataflow *	Description		
10	1	Error	**Error / Warning**	18	40.85	u32	R	**Bit**	**Name**	**Function**
								0	Minimum	Metering medium level is too low
								1	Batch	Too many metering strokes: > 100 000
								2	Analog < 4mA	Analogue current is less than 4 mA
								3	Analog > 23mA	Analogue current is greater than 23 mA

Module/slot	Index	Name	Module name	Diag. number	Identification (hex)	Type	Dataflow *	Description		
								4	Dosing monitor	Fault metering monitoring
								5	Diaphragm rupture	Dosing head diaphragm broken
								6	Airlock	Air in dosing-head
								7	Overpressure	Overpressure (feed chemical)
								8	-	
								9	Cavitation	
								10	Low pressure	Pressure too low (feed chemical)
								11	Change stroke length	The stroke length has been adjusted in locked state
								12	Bleed valve	Automatic ventilation is not possible
								13	Bus fault	Bus fault reported by module
								14	System fault	System components defect - see display
								15	Module fault	Fault in module handling
								16	-	
								17	-	
								18	-	
								19	-	
								20	-	
								21	-	
								22	-	
								23	-	
								24	-	
								25	-	
								26	-	
								27	-	
								28	-	

Module/slot	Index	Name	Module name	Diag. number	Identification (hex)	Type	Dataflow *	Description		
								29	-	
								30	-	
								31	-	
	2	Warnings		19		u16		**Bit**	**Name**	**Function**
								0	Minimum	Metering liquid is low
								1	Calibration	-
								2	Dosing monitor	Metering monitoring warning
								3	Diaphragm rupture	Defective diaphragm in the dosing head
								4	Airlock	Air in dosing-head
								5	-	
								6	Cavitation	
								7	Overpressure	Overpressure in hydraulics
								8	Low pressure	Pressure too low in hydraulics
								9	-	
								10	-	
								11	-	
								12	-	
								13	-	
								14	-	
								15	-	

* R = read, W = write

Tab. 29: Strokes / quantity and individual data

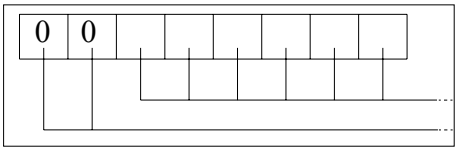
Module/ slot	Index	Name	Module name	Diag. number	Identification (hex)	Type	Dataflow *	Description
11	1	Reset stroke counter	**Strokes /quantity**	20	C0,81, C5	u8	S	If the value changes from 1 to 0, the *„Stroke counter“* (total number of strokes) is reset
	2	Reset quantity counter		21		u8		If the value changes from 1 to 0, the *„Volume counter“* (total number of litres) is reset
	3	Stroke counter		22		u32	R	Count the number of strokes - since the last reset (*„Stroke counter“*)
	4	Quantity counter		23		f32		Count the metering volumes in litres - since the last reset (*„Volume counter“*)
	5	Litres per stroke		24		f32		Litres per stroke
acyclical only / 12	1	Identity code		25		s32		Pump identity code
	2	Serial number		26		s16		Pump serial number
	3	Name		27		s32		Pump name (freely editable)
	4	Installation location		28		s32		Installation site (freely editable)

* R = read, W = write

Diagnostics frame

In conformity with PROFIBUS® standard, the device makes the *[Get_Sl_Diag]* service available. The diagnostics data comprise standard diagnostics information (6-Bytes according to PROFIBUS® standard) and any possible diagnostics data specific to the device. A maximum of 63 bytes can be inserted for the device-specific diagnostics data. The first 4 bytes in the PROFIBUS® standard are specified from this:

❯



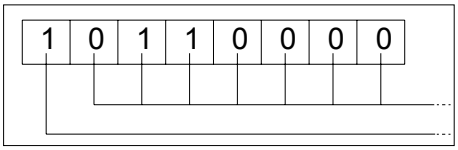
Encode the byte `sign_len` as follows:

❯

Length of the DU status including the header byte: 04..63

Flags ‘device-related diagnostics’: 00 constant

❯



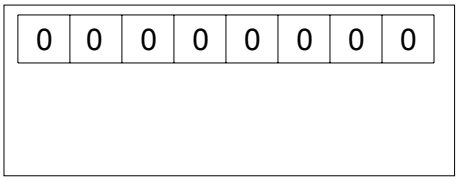
Encode the byte `status_type` as follows:

❯

Status type: 48 (manufacturer specific)

Flags ‘Status’: 1 constant

❯

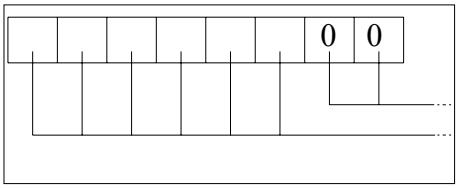


Encode the byte `slot_number` as follows:

)

Slot number: 0 (because only slot 0 is being used)

)



Encode the byte `specifier` as follows:

)

Status specification: 00 constant

Reserved

)

59 bytes subsequently remain freely available (user_data):

Tab. 30: User_Data

Order Number	Name	Explanation
1	Status	- see "data objects GMXa" table
11	Start/Stop	Complies with Start/Stop switch; If Start/Stop = 0, then the pump is stopped
12	Reset	Delete internal pump memory and pending faults by changing "1" to "0"
21	Setpoint operating mode	- see "data objects GMXa" table
22	Actual operating mode	- see "data objects GMXa" table
31	Setpoint metering capacity	Setpoint metering capacity in [L/h]
32	Actual metering capacity	Actual value metering capacity in [L/h]
41	Max. metering capacity	Maximum metering capacity in [L/h]
51	Volumes per contact "batch mode"	Volumes to be delivered in contact in batch mode
52	Metering time batch mode	Time in which the batch volumes are to be delivered
53	Batch start	Start batch metering by changing "1" to "0"
54	Batch memory	For "1", the volumes to be delivered are added up for each additional batch contact; for "0", the remaining volumes are deleted and a new batch process is started
55	Remaining volumes batch mode	Remaining volumes to be metered in batch mode
61	Volumes per contact "contact mode"	Volumes to be delivered in contact in contact mode

Order Number	Name	Explanation
62	Contact memory	For "1", the volumes to be delivered are added up for each additional batch contact; for "0", the remaining volumes are deleted and a new contact process is started (analogous to "batch memory")
71	Setpoint final concentration	Desired final concentration in concentration mode
72	Actual value final concentration	current final concentration in concentration mode
81	Dosing monitor	Activate/deactivate metering monitoring:
		0 – deactivated
		1 – activated / warning
		3 – activated / fault
91	Fault	- see "data objects GMXa" table
92	Warnings	- see "data objects GMXa" table
101	Reset stroke counter	Reset stroke counter by changing "1" to "0"
102	Reset metering quantity counter	Reset metering volume counter by changing "1" to "0"
103	Deletable stroke counter	Number of strokes since the last reset
104	Deletable metering quantity counter	Totalled metering volumes since the last reset
105	Litres per stroke	Litres per stroke
111	Identity code	Pump identity code
112	Serial number	Pump serial number
113	Pump name	Pump name, freely determinable
114	Installation site	Installation site, freely determinable

3.5.4 Data objects gamma/ L, GALa

So that the pump can participate in the cyclic data transfer, the initial parameters must be transferred from the master. To do this only standard parametrisation is necessary; there are no application-specific parameters.

Please note: Data are stored in the "Big-Endian" format! This means that the byte with the highest value bits is initially stored at the memory location with the lowest address:

Example using "number of strokes"- see "data from pump"

The pump stroke rate is stored as Integer32 type at the offset addresses +17 to +20. Bytes are stored in this sequence:

Name	Type	Off.	Byte	Bits
Number of strokes	Integer32	17	0	24 ... 31
		18	1	16 ... 23
		19	2	8 … 15
		20	3	0 … 7

Communication takes place in cyclic data traffic.

The cyclic data frame comprises:

Tab. 31: Data on the pump

Start byte	Length	Data type	Name	Explanation
1	1	Byte	StartStop	1=on, 0=deactivation of pump function
2	1	Byte	FlowControl	1=on-, 0=deactivation of metering monitoring (option)
3	1	Byte	StartBatch	A batch is started in "Batch" operating mode when 0 is changed to 1
4	1	Byte	BatchMemory	1=on, 0=deactivation of saving function for batches and external metering
5	1	Byte	Reset	Delete faults and basic setting by changing 0 to 1
6	1	Byte	ClearCount	Delete internal stroke and volume counter by ≠ 0
7	1	Unsigned8	SetpointOperation	Operating mode 0=continuous; 1=Batch; 2=External contact; 3=Analogue

Start byte	Length	Data type	Name	Explanation
8	2	Unsigned16	SetpointFactor	Batch size in batch metering operating mode transmission ratio *100 in "external contact" operating mode (range 0...32767)
10	2	Unsigned16	SetpointMetfreq	Metering frequency in "continual" operating mode max. metering frequency in "batch" and "ext. contact" operating modes (range 0 ... Max-Freq. (dependent on pump))

Tab. 32: Pump data

Start byte	Length	Data type	Name	Explanation
1	2	Unsigned16	Status	- see "Status" table
3	1	Unsigned8	ActualOperation	Operating mode 0=continuous; 1=Batch; 2=External contact; 3=Analogue
4	2	Unsigned16	ActualFactor	Batch size in "batch metering" operating mode Transmission ratio *100 in "external contact" operating mode
6	2	Unsigned16	ActualMetFreq	Metering frequency in "continual" operating mode max. metering rate in "batch" and "ext. Contact" operating modes
8	2	Unsigned16	ActualFreq	Actual frequency. The number of strokes actually metered by the pump. In "batch" and ext. contact, the Dosfreq. is displayed
10	1	Unsigned8	Stroke length	Adjusted stroke length in % from end stop

Start byte	Length	Data type	Name	Explanation
11	2	Unsigned16	Remaining strokes	The number of strokes still to be performed in batch metering in progress
13	1	Unsigned8	Fault	Flags for fault sources - see "Fault" table
14	1	Unsigned8	Warning	Flags for warning sources - see "Warning" table
15	2	Integer16	MaxFreq	Maximum frequency in strokes/min that can be metered
17	4	Integer32	Number of strokes	Number of strokes performed since the last reset
21	4	Floating	LpH	Metering volume in litres (gallons) per stroke
25	4	Floating	Quantity	Metered volume in litres (gallons) since the last reset

Tab. 33: Status

Item	Name	Status "0"	Status "1"
2^0	Operating mode	continuous	Charge=1; Contact=2; Analogue=3
2^1	Operating mode	-	-
2^2	Fault	No fault	No fault present
2^3	Warning	No warning	Warning present
2^4	Priming	No priming	Priming
2^5	Auxiliary frequency	Aux. Freq. off	Pump metering with aux. Freq.
2^6	Pause	No pause	Pause externally connected
2^7	Stop	Pump is running	Pump stopped
2^8	Option FlowControl	Not present	Present
2^9	FlowControl	Metering monitoring deactivated	Metering monitoring activated
2^{10}	-	-	-
2^{11}	Dividing factor	1:1	1:100
2^{12}	BatchMemory	Deactivated	Activated
2^{13}	Measuring unit	Litres	Gallons

Item	Name	Status "0"	Status "1"
2^{14}	Calibration	Pump not calibrated	Pump calibrated
2^{15}	Operation	Manual mode	BUS mode

Tab. 34: Fault

Item	Fault
2^0	Minimum (storage empty)
2^1	Fault analogue current
2^2	-
2^3	-
2^4	Diaphragm rupture (option)
2^5	Metering monitoring (option)
2^6	Overflow stroke storage
2^7	System fault

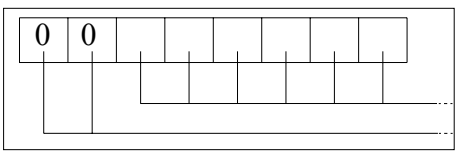
Tab. 35: Warning

Item	Warning
2^0	Minimum (storage empty)
2^1	Stroke length adjustment beyond tolerance
2^2	Diaphragm rupture (option)
2^3	-
2^4	-
2^5	-
2^6	-
2^7	-

Diagnostics frame

In conformity with PROFIBUS® standard, the device makes the *[Get_Sl_Diag]* service available. The diagnostics data comprise standard diagnostics information (6-Bytes according to PROFIBUS® standard) and any possible diagnostics data specific to the device. A maximum of 63 bytes can be inserted for the device-specific diagnostics data. The first 4 bytes in the PROFIBUS® standard are specified from this:

❯



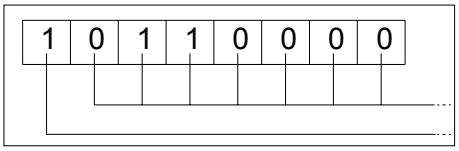
Encode the byte `sign_len` as follows:

❯

Length of the DU status including the header byte: 04..63

Flags ‘device-related diagnostics’: 00 constant

❯



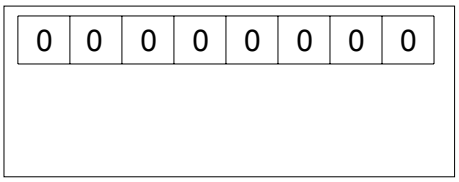
Encode the byte `status_type` as follows:

)

Status type: 48 (manufacturer specific)

Flags ‘Status’: 1 constant

)

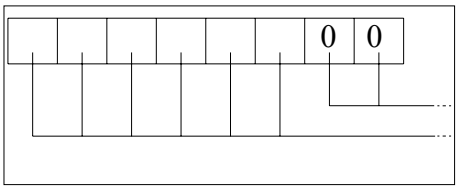


Encode the byte `slot_number` as follows:

)

Slot number: 0 (because only slot 0 is being used)

)



Encode the byte `specifier` as follows:

)

Status specification: 00 constant

Reserved

)

59 bytes subsequently remain freely available (user_data):

user_data

Errors are indicated using the user_data fields.

The user_data fields are each combined in blocks of 3 bytes and are interpreted as follows:

1 - Service

2 - Error type

3 - Type of data access (read/write)

Thus up to 19 errors can be signalled.

Encoding user_data

Tab. 36: 1 service

Index	Name	Explanation
0x01	Status	- see "Status" table
0x02	StartStop	1=on, 0=deactivation of pump function
0x03	FlowControl	1=on-, 0=deactivation of metering monitoring (option)
0x04	StartBatch	A batch is started in "Batch" operating mode when 0 is changed to 1
0x05	BatchMemory	Saving function for batch and external metering
0x06	Reset	Delete faults and basic setting by changing 0 to 1
0x07	ClearCount	Delete internal stroke and volume counter by ≠ 0

Index	Name	Explanation
0x08	SetpointOperation	Operating mode 0=Continuous; 1= Batch; 2=External contact; 3=Analogue
0x09	ActualOperation	Operating mode 0=continuous; 1= Batch; 2=External contact; 3=Analogue
0x0A	SetpointFactor	Batch size in batch metering operating mode transmission ratio *100 in "external contact" operating mode
0x0B	ActualFactor	Batch size in batch metering operating mode transmission ratio *100 in "external contact" operating mode
0x0C	SetpointMetfrequency	Max metering frequency in "continuous" operating mode max. metering frequency in "batch" operating mode and "ext. Contact" operating modes
0x0D	ActualMetfrequency	Max metering frequency in "continuous" operating mode max. metering frequency in "batch" operating mode and "ext. Contact" operating modes
0x0E	Actualfrequency	Actual frequency. The number of strokes actually metered by the pump. In "batch" and "ext. contact" the metering frequency is displayed
0x0F	Stroke length	Adjusted stroke length in % from end stop
0x10	Remaining strokes	The number of strokes still to be performed in batch metering in progress
0x11	Fault	Fault sources flags - see below
0x12	Warning	Warning sources flags - see below
0x13	MaxFrequency	Maximum frequency in strokes / min that can be metered
0x14	Number of strokes	Number of strokes performed since the last reset
0x15	LpH	Number of strokes performed since the last reset
0x16	Quantity	Metered volume in litres (gallons) since the last reset

Value	Meaning	
0x30	OK	-
0x31	Transfer OK	Date outside of permitted range
0x32	Transfer OK	Date protected
0x33	Transfer OK	Date rejected, due to device in manual and not in remote operation
0x34	Transfer OK	Date rejected, due to uninstalled option
0x35	Transfer OK	Service not defined
0x36	Transfer OK	Value cannot be read or changed in current device context
0x37	Transfer OK	No further updating
0x55	Transfer OK	Fuse / UART error
0x56	Error in timeout	-

Tab. 37: Data access types

Value	Meaning
0xD3	Write access
0xE5	Read access

4 Supplementary Operating Instructions for PROFINET

4.1 Prerequisites

Personnel must be familiar with the contents of the "Operating Instructions for Solenoid Metering Pump gamma /X, GMXa"!

The pump must have the identity code feature "Control type": "E" - "PROFINET 10". The menu item *„Fieldbus“* is then available in the operating menu. (When *„Fieldbus* ➔ *active“* is set, *„Settings* ➔ *PROFINET“* also appears in the operating menu.)

4.2 Adjusting the pump

4.2.1 General

The pump with PROFINET functionality is adjusted in the same way as the standard pump, with the addition of the bus functionality.

The adjustment process is cancelled in the event of a pause longer than 60 s.

4.2.2 Activating / deactivating PROFINET

In order for the pump to be controlled using the PROFINET, *„Fieldbus“* must be set to *„Active“* in the operating menu.

1. To access the *„Menu“*: press *[Menu]*.
   ⇨ The cursor immediately points to *„Information“*.
2. To switch from *„Information“* to *„Fieldbus“*: turn the *[Clickwheel]* and press.
3. To switch the *„Fieldbus“* to *„Inactive / active“*: turn the *[Clickwheel]* and press.
4. To switch from *„Inactive“* to *„Active“*, turn the *[Clickwheel]* and press.
   ⇨ The pump saves the *„Active“* setting.
   The *„Settings* ➔ *PROFINET“* menu also appears.
   The pump is in "Stop" mode. To start controlling it, press *[Stop/Start]*. Use the BUS to give the Start command.

While the PROFINET is *„Active“*, all external inputs such as level monitoring, metering monitoring and external control (pause, contact input, analogue input) will function. They result in the expected reactions, as with the pump without PROFINET functionality - see pump operating instructions. The pump sends corresponding information via the PROFINET to the master (PLC Programmable Logic Controller, PC etc.).

The gamma/ X, GMXa is factory-set to *„Automatic“* metering.

Even if the fieldbus is set to inactive, the master is able to read-access the pump data defined in its GSDML file.

If the PROFINET is set to *„Inactive“*, the settings for the operating mode previously selected are reloaded.

If the pump is switched to another operating mode, it stops and can only be restarted using *[Stop/Start]*.

4.2.3 Configuring PROFINET

Fieldbus mode must be enabled to be able to configure and control the pump via the PROFINET. The PROFINET is always enabled but it does not accept external commands if fieldbus mode has not been enabled.

Prerequisite:

The PROFINET is actively switched - see *Chapter 4.2 „Adjusting the pump“ on page 61*.

1. To access the *„Menu“*: press *[Menu]*
2. Use the *[arrow keys]* to select the menu item *„Settings“* and confirm with *[OK]*
   ⇨ The *„Operating mode“* menu appears.
3. Use the *[arrow keys]* to select the menu item *„PROFINET“* and confirm with *[OK]*
4. In the *„PROFINET“* menu, you can set the following for the pump:
   - *„IP address“*
     – ... einstellen.
   - *„Subnet address“*
     – ... Adresse einstellen.
   - *„Gateway address“*
     – ... Adresse einstellen.
   - *„DNS address“*
     – ... Adresse einstellen.
   - switch dhcp on or off
     – ... ein- oder ausschalten.
   - *„read off the pump name.“*
     – ... ablesen.

Origin of the designations
The different names and/or addresses represent user-specific information and are the responsibility of the system operator.

4.3 Special Features in Active PROFINET Mode

4.3.1 General

In PROFINET mode, the pump cannot be manually set or programmed! To do this, set the PROFINET® to „Inactive“ .

- Using the *[Clickwheel]* it is possible to switch between the continuous displays at any time as in the other operating modes. This has no effect on the operation of the pump.
- The settings from the last operating mode without PROFINET are carried over when switching to PROFINET mode. **By contrast, the settings made via PROFINET are not saved!** They only apply as long as the pump is linked to the PROFINET. Only the *„stroke counter“* (total number of strokes) and the *„volume counter“* (total number of litres) continue to be counted and saved.
- The pump stops if it is set to PROFINET mode. It can be controlled again by pressing *[Stop/Start]*. Use the BUS to give the Start command.

4.3.2 Displays

When PROFINET mode is running there are further identifiers in the operating indicator.

The current identifier can be found in the "Controls" chapter in the "Solenoid metering pump gamma/ X, GMXa Operating Instructions".

Stop PROFINET: The pump has been stopped using PROFINET. The master has sent the pump a corresponding telegram.

Connection error: If the pump loses its connection to the PROFINET (as soon as, for example, the BUS cable was removed, the bus master has switched to “Stop” status or the bus master has become inoperative), then the error symbol and the symbol appear.

Fault module: If the pump loses its connection with the BUS module (as soon as, for example, the BUS module is removed or if communication is interrupted for other reasons between the BUS module and the pump), the error symbol and the symbol appear.

4.3.3 LEDs on the PROFINET module

LED 1 (left) - module operating status

Signal	Cause
Off	The module has no supply voltage or connection.
Green	The module and the master are exchanging information.
Green flashing	The module has been initialised.

LED 2 (right) - module status

Signal	Cause
Off	The module has not been initialised.
Green	The module has been initialised / normal mode
Green flashing, single flash	The module has been initialised and there are diagnostic messages.
Green flashing, 1 Hz	DCP flash
Red	Serious exception error
Red, single flash	Configuration error
Red, double flash	IP address error
Red, triple flash	Station name error
Red, quadruple flash	Internal error

4.3.4 Use metering monitor

The "Metering monitor" socket must be used to use the metering monitor in PROFINET mode. The pump then sends *„Available“* for the "Flow" status bit. The metering monitor can be switched on and off using the PROFINET using the *„Metering monitor“* and/or *„FlowControl“* parameters.

If the metering monitor is set to *„Active“*, it issues either a warning or an error with gamma/ X.

4.4 Installation

Bus installation

CAUTION!
Degree of protection IP 65
– IP 65 degree of protection only applies if the appropriate assembly accessories (cable openings etc.) have been fitted correctly.

The connection to the existing LAN infrastructure is provided by a suitable LAN cable, e.g. twisted pair cable (CAT5 or higher) to comply with IP 65 with a screwed M12x1 plug, 4-pin, D-coded to IEC 61076-2-101. Complies with IEEE 802.3.

Tab. 38: Connectors

Module label	Meaning
OUT	Port 1
IN	Port 2

Mains extension:

- Copper-based twisted pair cable (TP) maximum 100 metres.

4.5 Operation

4.5.1 General

Using the connected PROFINET module, the pump in the PROFINET represents a device with slave functionality. In this context, user data is cyclically transmitted.

4.5.2 GSDML File

The GSDML file must be used to configure the master. The GSDML file describes all the features of the pump in PROFINET mode (keywords, diagnostics, modules, sub-modules). The GSDML file can be downloaded from the PROFINET website and from the ProMinent website. The file name is clearly indicated:

`GSDML-V2.32-Prominent-GMXa-20170721.xml`.

4.5.3 Description of the data objects gamma/ X, GMXa

Tab. 39: Status and control

Module/ slot	Index	Name	Module name	Type	Dataflow *	Description		
						bit	Name	Function
1	1	State	**Status**	UINT32	L	0	Service	There are service requests
						1	Mes-sages	There are reports
						2	Mode	00 – stop 03 – contact
						3		01 – manual 04 – analogue
						4		02 – batch
						5	Error	There are errors - see "Errors"
						6	Warn-ings	There are warnings - see "Warnings"
						7	Hand stop	Pump has been stopped manually
						8	Stop	Pump has stopped
						9	Priming key	Pump is in priming mode (higher-level function)
						10	Auxiliary	Pump is in auxiliary mode (higher-level function)
						11	Pause	Pump has been switched to *„Pause“* status (higher-level function)

Module/ slot	Index	Name	Module name	Type	Dataflow *	Description		
						bit	Name	Function
						12	Module	Fieldbus active
						13	Flow	Metering monitor is activated
						14	Batch-Mem.	Batch memory is activated
						15	Cali-brated	Pump is calibrated
						16	-	-
						17	-	-
						18	-	-
						19	Dia-phragm rupture	Diaphragm rupture indicator is installed
						20	Concen-tration	Concentration calculation is activated
						21	-	-
						22	Cavita-tion	Priming occurred during cavitation
						23	Airlock	Air in the dosing head
						24	Over-pressure	Excessive back pressure
						25	Under-pressure	Low back pressure
						26	Bleeding	Pump vented
						27	-	-
						28	-	-
						29	-	-
						30	-	-
						31	-	-
2	1	Start / Stop	**Control**	UINT8	S	Corresponds to *[Start/Stop]* key; if Start / Stop = 0, then the pump is stopped		
	2	Reset		UINT8		If the Reset value is switched from 1 to 0, the internal pump memory is erased (e.g. with batch metering) and - as far as possible - existing errors are deleted		

* R = read, W = write

Tab. 40: Mode, Flow rate, Max. flow rate, Batch, Contact, Concentration, Metering monitor

Module/ slot	Index	Name	Module name	Type	Dataflow *	Description		
3	1	Mode	**Mode**	UINT8	R, W	**Value**	**Name**	**Description**
						0.16	Stop	Pump is ready but not metering.
						1	Manual	Pump is metering continuously with the set volume
						2	Batch	When triggered, the pump is metering the volume set in the batch code
						3	Contact	Pump meters volume in the pre-defined time
						4	Ana-logue oper-ating mode	Pump is metering in accordance with the analogue signal and the analogue mode set at the pump.
						17	Manual (con-centr.)	Manual in concen-tration mode
						18	Batch (con-centr.)	Batch in concentra-tion mode
						19	Contact (con-centr.)	Contact in concen-tration mode
						20	Ana-logue (con-centr.)	Analogue in con-centration mode
4	1	nominal flow rate	**Flow rate**	FLOAT32	S	Metering capacity setpoint in litres / hour		
	2	Actual flow rate		FLOAT32	L	Metering capacity actual value		
5	1	max. flow rate	**Max. flow rate**	FLOAT32	L	Maximum metering capacity in litres / hour		
6	1	Batch volume	**Batch**	FLOAT32	S	Batch metering volume		
	2	Batch time		UINT16		Time in which the batch should be metered		
	3	Batch start		UINT8		If the value changes from 1 to 0, batch metering is activated in batch mode. (Batches may also be activated via the contact input.)		

Module/ slot	Index	Name	Module name	Type	Dataflow *	Description
	4	Batch memory		UINT8		If "Batch Memory" is activated and a new batch is activated during a batch metering already in progress, the remaining metering volume is increased by that of the new batch. If the "Batch Memory" is not activated, the remaining volume is deleted and the new batch started.
	5	Remaining volume		FLOAT32	L	The remaining volume to be metered in batch mode
7	1	Contact volume	**Contact**	FLOAT32	S	Volume metered per contact
	2	Contact memory		UINT8		- see "Batch Memory"
8	1	Concentration rate	**Concentration**	FLOAT32	S	Concentration setting setpoint (only in *„Concentration“* operating mode)
	2	Actual concentration		FLOAT32	L	Actual value of concentration setting (only in *„Concentration“* operating mode)
9	1	Metering monitor	**Metering Monitor**	UINT8	S	When a metering monitor is installed, you can enable it yourself: 0 = inactive 1 - warning 3 - error

* R = read, W = write

Tab. 41: Error / Warning

Module/ slot	Index	Name	Module name	Type	Dataflow *	Description		
10	1	Error	**Error / Warning**	UINT32	L	**Bit**	**Name**	**Function**
						0	Minimum	Metering medium level is too low
						1	Batch	Too many metering strokes: > 100 000
						2	Analogue < 4mA	Analogue current is less than 4 mA
						3	Analogue > 23mA	Analogue current is greater than 23 mA
						4	Metering monitor	Fault metering monitoring
						5	Diaphragm rupture	Dosing head diaphragm broken
						6	Airlock	Air in the dosing head

Module/ slot	Index	Name	Module name	Type	Dataflow *	Description		
						7	Overpres-sure	Overpressure (feed chemical)
						8	-	
						9	Cavitation	
						10	Low pres-sure	Pressure too low (feed chemical)
						11	Change stroke length	The stroke length has been adjusted in locked state
						12	Bleeding	Automatic bleeding is not possible
						13	Bus error	Bus error reported by the module
						14	System error	System compo-nent faulty - see display
						15	Module error	Fault in module handling
						16	-	
						17	-	
						18	-	
						19	-	
						20	-	
						21	-	
						22	-	
						23	-	
						24	-	
						25	-	
						26	-	
						27	-	
						28	-	
						29	-	
						30	-	
						31	-	
	2	Warn-ings		UINT16		**Bit**	**Name**	**Function**
						0	Minimum	Metering liquid is low
						1	Calibra-tion	-
						2	Metering monitor	Metering monitor warning

Module/ slot	Index	Name	Module name	Type	Dataflow *	Description		
						3	Dia-phragm rupture	Faulty diaphragm in the dosing head
						4	Airlock	Air in the dosing head
						5	-	
						6	Cavitation	
						7	Overpres-sure	Overpressure in the hydraulics
						8	Low pres-sure	Pressure too low in the hydraulics
						9	-	
						10	-	
						11	-	
						12	-	
						13	-	
						14	-	
						15	-	

* R = read, W = write

Tab. 42: Strokes / quantity and individual data

Module/ slot	Index	Name	Module name	Type	Dataflow *	Description
11	1	Reset stroke counter	**Strokes/ quantity**	UINT8	S	If the value changes from 1 to 0, the *„Stroke counter“* (total number of strokes) is reset
	2	Reset quantity counter		UINT8		If the value changes from 1 to 0, the *„Volume counter“* (total number of litres) is reset
	3	Stroke counter		UINT32	L	Count the number of strokes - since the last reset (*„Stroke counter“*)
	4	Quantity counter		FLOAT32		Counts the metering volume in litres - since the last reset (*„Volume counter“*)
	5	Litres per stroke		FLOAT32		Litres per stroke

* R = read, W = write

4.5.4 Diagnostic messages and types of data access

The diagnostic messages are shown in plain text in the PLC.

Error type	Diagnostic messages
12755	Limit error when writing
12773	Limit error when reading
13011	Protected value
13029	Protected value
13267	Device not in remote mode
13285	Device not in remote mode
13523	Option not installed
13541	Option not installed
13779	Service not defined
13797	Service not defined
14035	Value cannot be changed
14053	Value cannot be changed

Tab. 43: Data access types

Value	Meaning
0xD3	Write access
0xE5	Read access

4.5.5 PLC error and behaviour of the pump

PLC error	Behaviour of the pump
IOPS = bad	Stopped
Disconnected connection	Stopped
Mains power on	Stopped

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