

Documentation

inclusive Operation Manual and Datasheet

Designation : **Dosing Quantity Tester DP4**
(Dosiermengenprüfer DP4)

Order - Nr. : 011-2020-XXXX-Y



Revision	Modification

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1 Safety

The Dosing Quantity Tester DP4 will be installed as a sub-component in a machine.

- The supplier of the machine has to prove the safety of the machine.
- The supplier of the machine has to do the risk analyses. He has to create the documentation, which corresponds to current directives, laws, regulations and standards. Also, this documentation has to contain all safety instructions and necessary information of the machine. This documentation the supplier has to hand over to the buyer and user of the machine.

This operating manual has to be read before installation and commissioning, as well as before operating, maintaining and repairing the machine. This operating manual must be kept by the owner until decommissioning.

The Dosing Quantity Tester DP4 has to be checked for suitability and approved before using in the machine.

The Dosing Quantity Tester DP4 has to be used as intended only.

The sensor of the DP4 may be used for permitted liquids and pressures only.

In case of disregarding of this operating manual the DP4-sensor and the system can be damaged or even injure people.

The manufacturer assumes no liability and no guarantee for the consequences of tampering the Dosing Quantity Tester DP4 or misuse.

Assembly, installation, commissioning, programming, configuration, operation and maintenance of the Dosing Quantity Tester DP4 has to be done by trained and authorized personnel only.

The sensor, controller and cable of the Dosing Quantity Tester DP4 has to be protected from damage.

2 Intended Use

The Dosing Quantity Tester DP4 is a test device for determining flow rates of liquids.

Before use, check if technical conditions are being met. If not, it can lead to damage and / or personal injury.

Modification or manipulation of the Dosing Quantity Tester DP4 (sensor and controller) are prohibited and lead to the loss of any liability and warranty of the manufacturer.

3 Functions

The Dosing Quantity Tester DP4 determines the flow rate in defined time intervals. The value is determined in μl .

The values can be displayed directly via any current browser. If the DP4 is integrated into a machine, the values are transmitted via the Profinet interface.

Parameters for evaluating of measured values can be entered and saved directly in the controller via the browser. Alternatively, parameters can be loaded into the controller via the PLC. If no parameters are to be loaded into the controller, measured values are transmitted via the Profinet interface only. In this case an evaluation has to be carried out by the PLC.

3.1 Operating Modes

3.1.1 Web Interface

During commissioning it is helpful to operate the Dosing Quantity Tester DP4 via its software. For this purpose, the DP4 is accessible directly by any browser via a web interface. Parameters are entered and saved via the browser. Actual values and the evaluation are displayed in the browser. The browser page must be refreshed manually on a regular basis.

Operation without the presence of a controller (PLC) is not guaranteed.

3.1.2 Profinet Operation

In regular operation, signals are transmitted to a PLC via the Profinet interface. Full functionality is guaranteed in this operation.

3.2 Communication

The Dosing Quantity Tester DP4 has two equivalent Profinet interfaces. The following protocols are available for communication via these interfaces:

- HTML Web Interface
- Profinet DP

Port 1 is for communication with the PLC. Another DP4 controller can be connected to port 2, which means that several DP4 controllers can be connected.

3.3 Function of the Sensor

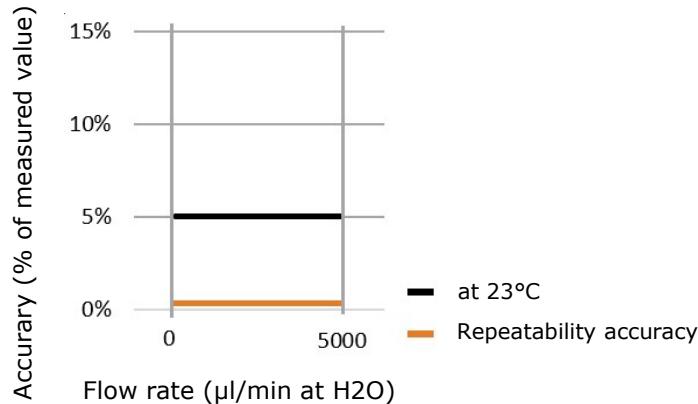
The DP4 sensor records measured values and sends them to the DP4 controller.

3.3.1 Parameter

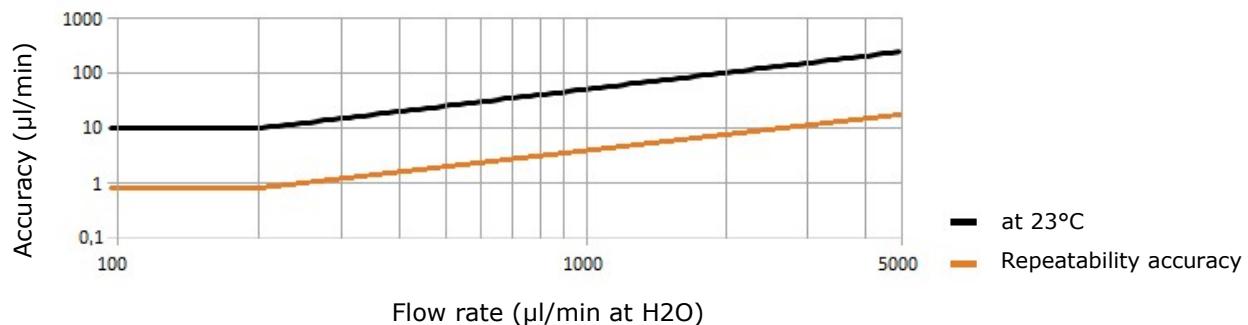
Parameter	Sensor	Units
Min. flow rate	5	µl/min
Max. flow rate	5.500	µl/min
Accuracy	5,0 0,2	% of measured value % of max. flow rate
Repeatability accuracy	0,5 0,02	% of measured value % of max. flow rate
Temperature coefficient	0,1 0,004	% of measured value / °C % of max. flow rate / °C
Max. offset at vertical position	1,5	% of max. flow rate

3.3.2 Specifications

relative accuracy (reference: H₂O)



Absolute accuracy (reference: H₂O)



3.3.3 Operating Environment

Parameter	Sensor	Units
Perm. environment temperature	+10 bis +45	°C
Perm. max. system pressure	15	bar
Burst pressure	30	bar

3.3.4 Material Specifications

Parameter	Sensor
Material of internal sensor	Borosilicate glass
Material of thread	PEEK
Material of connector	PEEK
Material of sealing	NBR (alternatively: PTFE, FEP, FEP-coating)

Note:

Mechanical shocks and use of not suitable tools put stress on the thin-walled inner glass and can cause it to break.

Always check for leaks, if new connections are made.

3.4 Function of the Controller

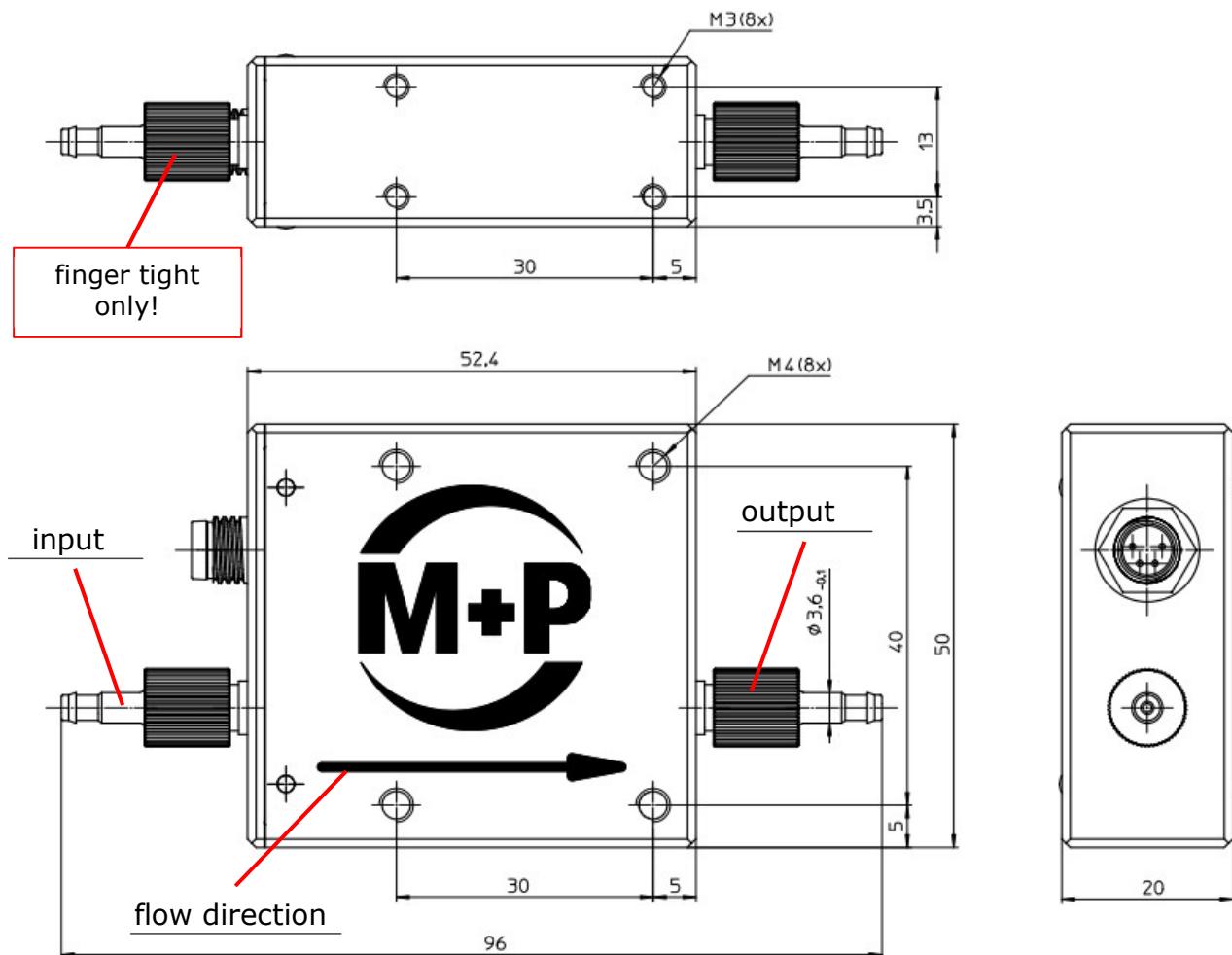
The controller processes measurement data from the DP4 sensor and is used for communication. This can be done via the web interface or the Profinet interface. It is not necessary to install software on the computer.

4 Assembly

Before installing and removing the sensor and controller, ensure that the system is without pressure and electric energy.

4.1 DP4 - Sensor

4.1.1 Dimensions



4.1.2 Mechanical Assembly

- Assembly sensor in a suitable position with 2 screws
 - Lay the cable to the controller neatly and securely
- Assembly hoses on the connectors
 - hoses with an inner diameter of 2.5 mm are recommended
 - Secure hoses against slipping (depending on application, hose material and pressure)
- Screw connectors into the sensor threads
 - Tight finger tight only! and check for leakages
 - Do not forget the O-ring, avoid twisting the hose, pay attention to the direction of flow
- Horizontal installation recommended

4.1.3 Electrical Connection

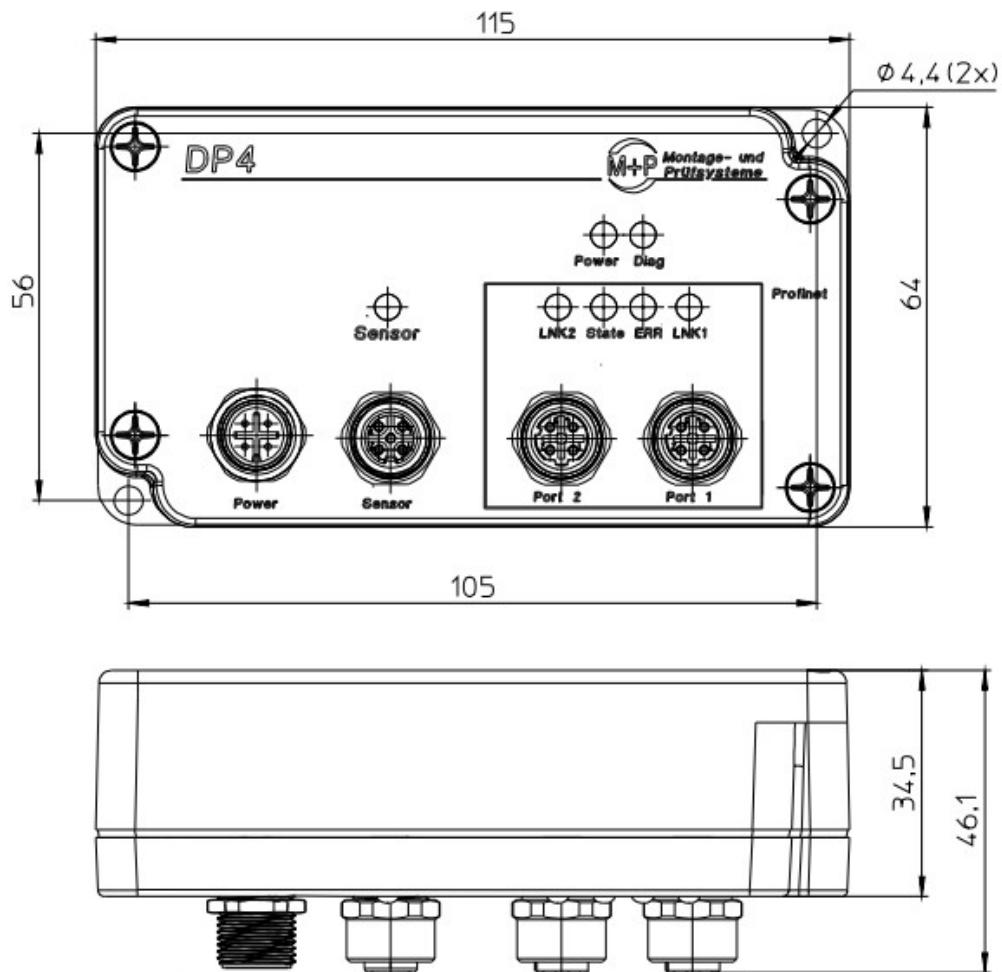


Pin Sensor	Connection	Function	Pin Controller
1	SDA	Data	1
2	GND	Sensor power supply - (0V / ground)	2
3	VDD	Sensor power supply +	3
4	SCL	Bus Clock	4
M8 A-coded			M12 A-coded

- max. length of cable: 30cm

4.2 DP4 - Controller

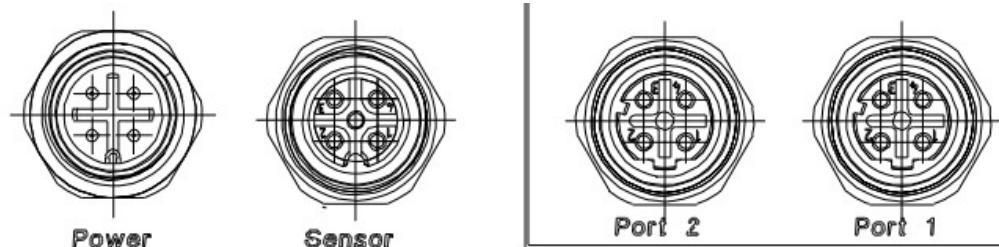
4.2.1 Dimensions



4.2.2 Mechanical Assembly

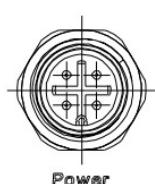
Assemble the controller in a suitable position with 2 screws so that the cable to the sensor can be laid neatly and safely.

4.2.3 Electrical Connection



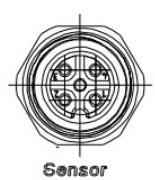
Socket - description	Function
Power	Power supply 24V / 100mA
Sensor	Interface sensor - controller
Port 1 / Port 2	Interface Profinet (and web interface)

X1 Power (M12 A-coded)



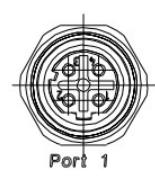
Pin	Connection	Function
1	+24V	Power supply +24V
2	+24V	Power supply +24V
3	GND	Power supply 0V / ground
4	GND	Power supply 0V / ground

X4 Sensor (M12 A-coded)



Pin	Connection	Function
1	SDA	Data
2	GND	Sensor Power supply - (0V / ground)
3	VDD	Power supply +
4	SCL	Bus Clock

Port 1 und Port 2 (Profinet M12 D-coded)



Pin	Connection	Function
1	TD+	Transmission Data +
2	RD+	Receive Data +
3	TD-	Transmission Data -
4	RD-	Receive Data -

5 LED Display Elements

The following table shows the meaning of the individual LED signals of the controller.

LED description	Function
Power (green):	ON: Operation voltage available OFF: Operation voltage not available
Diag (green)	System OK: Flashing slowly
Sensor LED (red/green)	Off: No sensor detected Red: Electric current too high (>100 mA) sensor interface Green: Sensor present Flickers – measurement active
Profinet State (green)	Off: Bus not started Flash 10 Hz: Error Flash 2 Hz: Bus started, wait for connection / Configuration mode On: Connected
Profinet Error (red)	Off: No error Flash: PROFINET - light test On: Error
LINKACT 1/2 (green)	Lights up, if gateway on port 1/2 is on a working network and flickers, if there is network data traffic

6 Determination of Measured Values

The DP4 determines the flow rate in a specified time interval. The flow rate results from the flow speed and the length of the time interval. The sum of all intervals is the total flow rate amount. The measured value is in μl .

The length of the time interval can be configured from 1 ms to 70 ms. The measured value can be corrected by using a linear correction factor.

6.1 Measure and Evaluate

The measurement will be done as follows:

1. Command „Start“
2. End measurement
3. Read measurement value in μl
4. Optional: Command „Reset“, reset of measured values and status flags.

To end the measurement following methods can be used:

- End with command „Stop“
- End after expiry of the measuring time (measuring time parameter > 0)
- End after detection of a decrease in flow rate (auto stop parameter)

At the end of measurement, an evaluation with alarm and warning thresholds will be done and the result is reported via the status flags.

6.2 Determination of Measured Values in Detail

The following parameters are used to determine the exact measured value:

- Raw value of the interval, simple integer value from the DP4 sensor (-27500 ... 27500)
- Offset value, average value of the last 8 raw values in the state "Stop"
- 0-value threshold, configuration parameters
- Sensor coefficients, given by the DP4 sensor
- Interval time, time between the endpoints of two measurements
- Correction factor, configuration parameters for linear measured value correction

The calculation process is as follows:

1. Read raw value and interval time
2. Optional correction of the raw value with offset value, thereby eliminating the 0-offset of the DP4 sensor
3. Optional measured value = 0 if lower than 0 value threshold // not applicable if threshold value = 0
4. Link with sensor coefficients and interval time => interval flow rate => Result: internal flow rate
5. Save raw flow rate values for this interval

6. Adding up the interval flow rates
7. When the measurement is completed, the correction factor is applied
8. Evaluation of the measurement result and setting of the status flags

During the measurement, the individual interval values (raw value) are stored in the controller RAM. A maximum of 500 values can be saved. If more value will be generated, the oldest values will be overwritten.

6.1 Configuration and Parameterization

The configuration / parameterization of the DP4 can be done via the PLC or a web browser.

See chapters:

- 7.2 Web Interface Parameter
- 8.2 PLC control signals - data from the PLC to the DP4 controller
- 8.3 DP4 status signals - data DP4 sensor to the PLC

7 Operation via Web Interface

The DP4 controller contains an integrated web server and enables the flow sensor to be operated.

For commissioning the dosing process, it is recommendable to operate the DP4 via the web interface. Once the correct parameters have been found and the process is stable, the DP4 should be operated via the Profinet interface.

The page is called up by entering the IP address of the DP4 in the web browser.

Note: The factory-set IP address is: 192.168.1.100.

Note: The websites need Java-Script to run correctly

The following functions are available via the web browser:

- Measurement
- Parameterization
- Data evaluation
- System information

Note: Only the last 500 measured values of the measurement can be graphically displayed and exported in the web browser (web interface data evaluation / data analysis). If the measuring interval (ADC bits) is too short, the display of the measured values is incomplete. Measured values in the buffer are overwritten.

7.1 Web Interface Measurement

The page "Measurement" shows status information and result data of the DP4. A manual measurement can be done by using the buttons in the section "Commands".

Note: Manual measurement is only possible if the PLC does not have control. See parameter: "ConfigActive" (is set in PLC)

- „Actions disabled“ manual measurement is disabled (PLC has control)
- „Actions enabled“ manual measurement is enabled

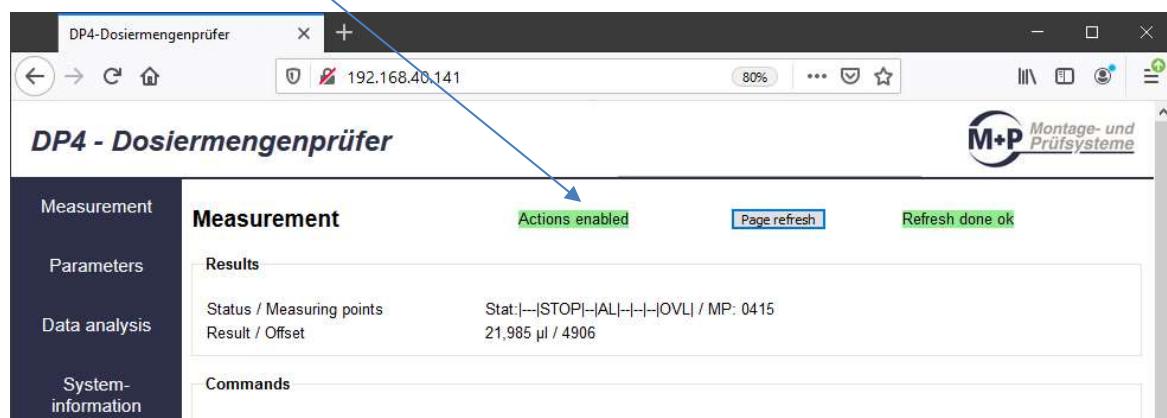


Figure: DP4 Dosing Quantity Tester - "Measurement" in web browser

The web interface shows various status information under "Results"

Abb.	Description
RUN	Measurement is active
STOP	Measurement is ended
OK	Measurement result is ok
AL	Alarm too little

Abb.	Description
WL	Warning too little
WU	Warning too much
AU	Alarm too much
OVL	Exceeding measurement range

Operation via the integrated web browser / manual measurement

Several control buttons are available under "Commands" for measurement:

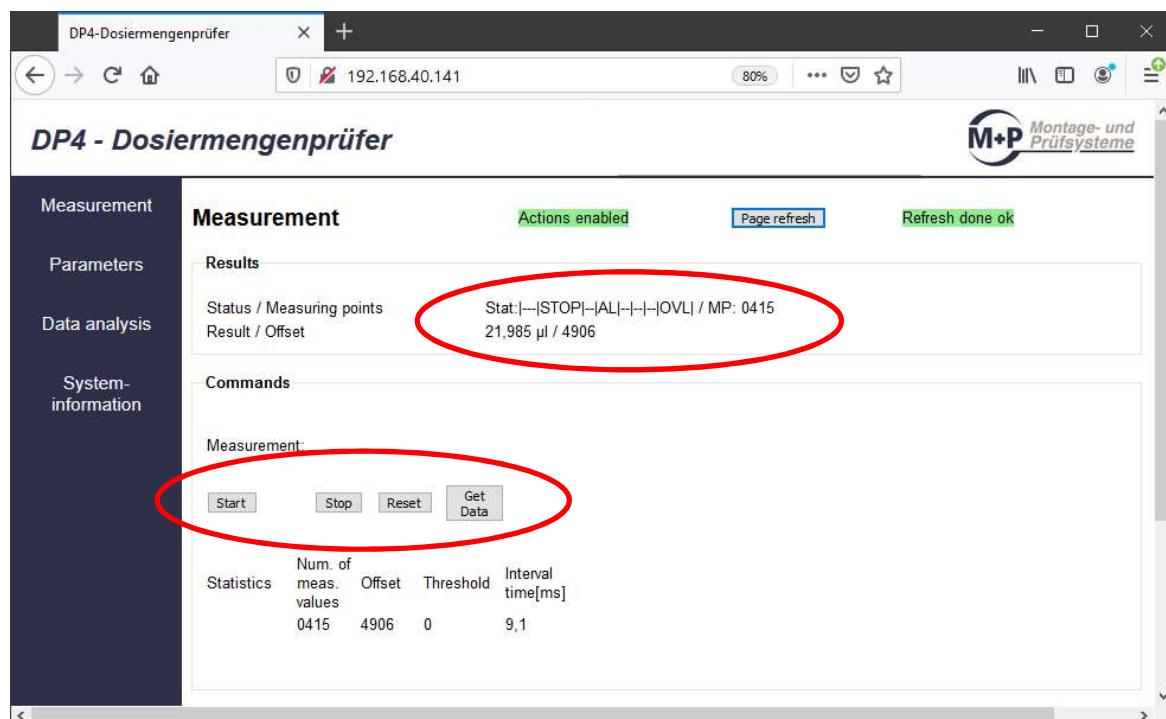


Figure: DP4 Dosing Quantity Tester - "Measurement" in web browser

Control buttons for manual measurement

Button	Function	
„Start“	Start measurement	possible at „Action enabled“ only
„Stop“	Stop measurement	possible at „Action enabled“ only
„Reset“	Reset measurement / sequence	possible at „Action enabled“ only
„Get Data“	Get data	
„Display Data“	Display data / update display	

7.2 Web Interface Parameters

The page "Parameters" can be used to parameterize the DP4. The parameters of the current parameterization are displayed in the upper section. The current configuration can be saved as a TXT-file on the local computer using the button "Save Config".

Note to the parameter overview:

- 8.2 PLC control signals - data from the PLC to the DP4 controller
- 8.3 DP4 status signals - data DP4 sensor to the PLC

A configuration can be loaded and enabled from the computer by using the buttons "Load Config" and "Activate Config".

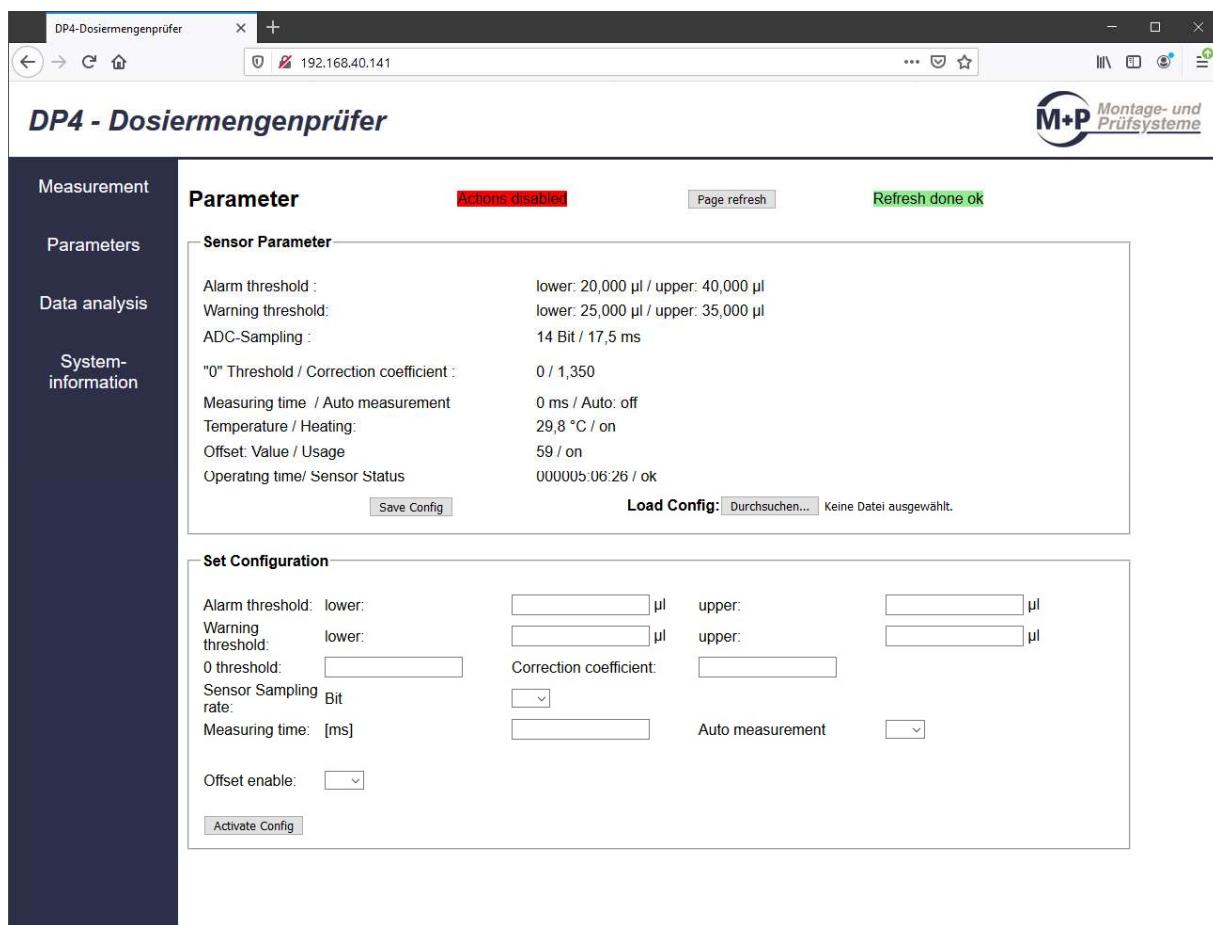


Figure: DP4 Dosing Quantity Tester - "Parameters" in web browser

7.3 Web Interface Data Evaluation

The page "Data analysis" can be used to display the measured values. The measured values of the last measurement can be called up and displayed by the DP4 using the buttons "Get Data" and "Display Data".

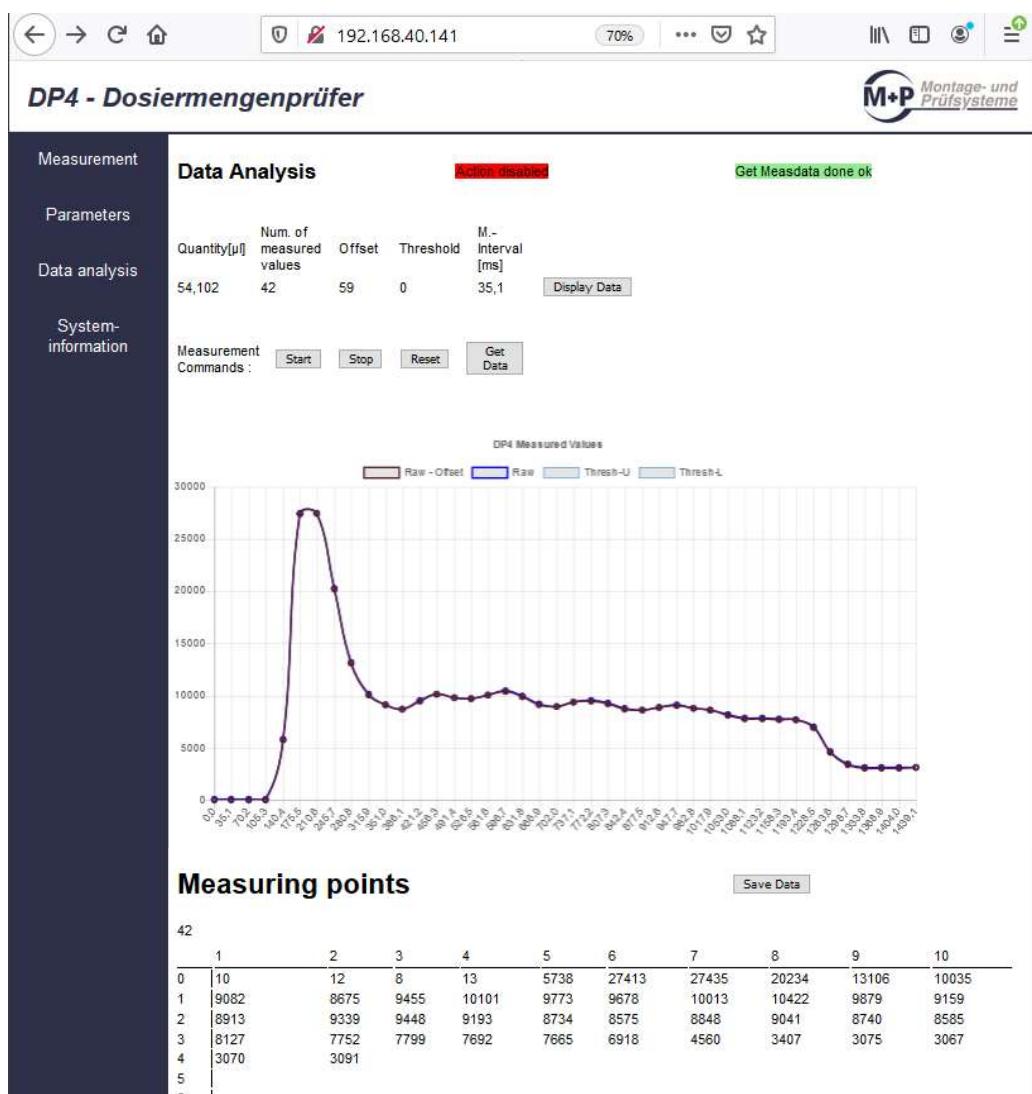


Figure: DP4 Dosing Quantity Tester - "Data analysis" in web browser - measurement curve

Function	Description
Start	Start measurement
Stop	Stop measurement
Reset	Reset measurement
Get Data	Get data from DP4 controller
Display Data	Display measured data
Save Data	Save displayed measurement data (CSV-file)

Note: Manual measurement is only possible if the PLC does not have control.

7.3.1 Data Export as CSV-File (Save Data)

Measurement data DP4

Volume: ;40,464

Points: ;64

Offset: ;84

ZeroThresh.: ;0

Interval: ;35,1

1;2

2;-2

3;6

4;1

5;1

6;2

7;-2

8;8

9;4

10;0

11;7

12;3

13;4

14;0

15;1

16;8

17;5

18;25

19;2124

20;6691

21;5529

22;5883

23;5369

24;4552

25;4230

26;4417

27;4557

...

Figure: Data export as CSV-file

7.4 Web Interface System Information

Device and status information is displayed on the page "System Information":

- Firmware version
- Script version
- PN-module and IP-address
- Sensor
- Sensor status
- Amount of measurements (since last reset)
- Operating time (since last turn on)

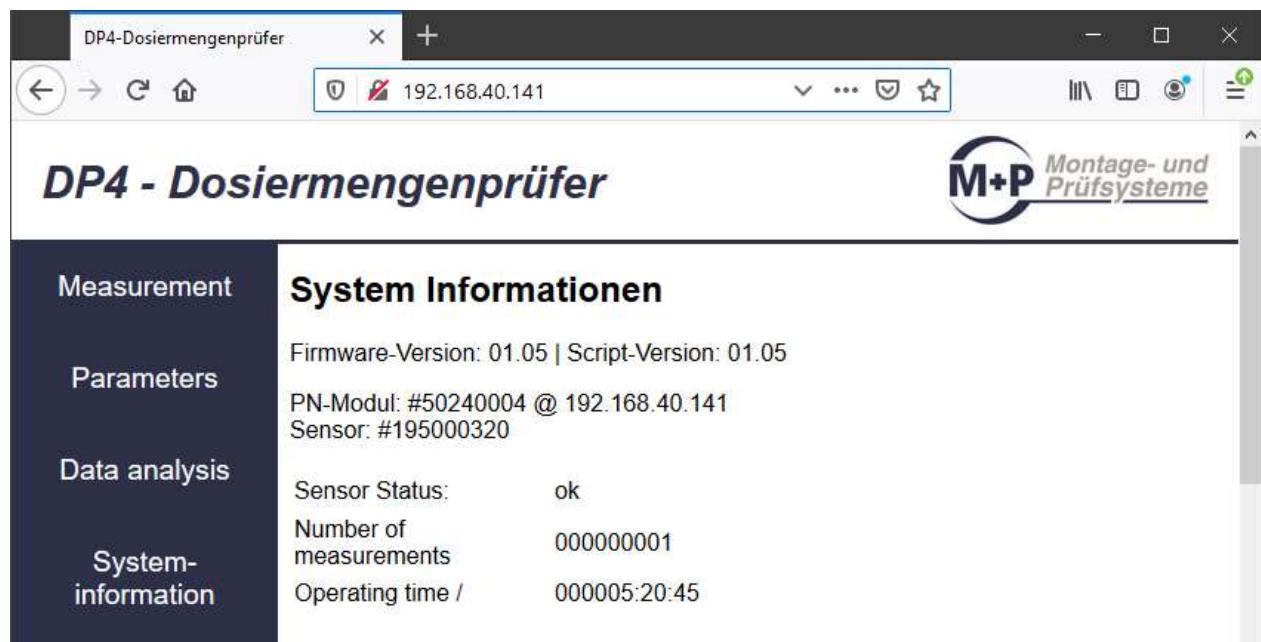


Figure: DP4 Dosing Quantity Tester - "System Information" in web browser

8 Operation via Profinet Interface

8.1 Functional Description of Profinet Interface

This communication is via one of the two Profinet ports.

The control and status signals must be written or read synchronously. Use the blocks for consistent reading / writing of data (DPRD_DAT und DPWR_DAT).

Note: In the TIA-PORTAL library „DP4_LIB_Vxx.xx“ the control and status signals are declared as templates (PLC data types „typDP4_CONTROL“ and „typDP4_STATUS“).

The structure of the data types is listed in the appendix „typDP4_CONTROL“ and „typDP4_STATUS“.

8.2 PLC control signals - data from the PLC to the DP4 controller

28 bytes are transferred from the DP4 controller to the DP4 sensor (data types in S7 format).

The measurement process is started with the command "Start". "Stop" ended and "Reset" cancelled. The control signals also contain configuration parameters and enable signals for configuration and operation via the web browser.

Byte	Bit	Data type	Name	Description
0	0	Bool	Start	Command: Start
0	1	Bool	Stop	Command: Stop
0	2	Bool	Reset	Command: Reset
0	3	Bool		Reserve
0	4	Bool		Reserve
0	5	Bool		Reserve
0	6	Bool		Reserve
0	7	Bool		Reserve
1	0	Bool	HeatingOn	not in use (Sensor heating keep on after measurement)
1	1	Bool	UseOffsetOn	Config: The zero-point offset determined in the measurement pause is used
1	2	Bool	AutoStopOn	Config: The measurement is stopped after the end of dosing is detected
1	3	Bool		Reserve
1	4	Bool		Reserve
1	5	Bool		Reserve

1	6	Bool	WebConfigEnable	1: Release configuration and manual measurement via web browser
1	7	Bool	ConfigActive	0: Ignore config values 1: Accept config values
2-5	-	Real	UpperLimit	Config: Upper limit ok [μl]
6-9	-	Real	UpperLimitWarn	Config: Upper limit warning [μl]
10-13	-	Real	LowerLimitWarn	Config: Lower limit warning [μl]
14-17	-	Real	LowerLimit	Config: Lower limit ok [μl]
18-21	-	Real	CorrCoeff	Config: Correction factor (linear correction)
22-23	-	UINT	MeasTime	Config: Measurement time (ms) automatic end after measurement time [ms], if > 0
24-25	-	UINT	ZeroThreshold	Config: „0“ threshold for evaluating of raw data of the sensor
26	-	USINT	ADC-Bits	Config: Sensor resolution in Bit (9-16) (indirect setting of the measurement interval time) ⇒ see table ADC-Bits
27	-	Byte		<i>Fill byte, not in use</i>

ADC-Bits:

The parameter "ADC bits" indirectly determines the setting of the measurement interval time and is dependent on the DP4 sensor. The parameter also has an influence on the presentation of the values in the web browser, since only the last 500 measured values can be displayed.

DP4 sensor - typical values for the parameter "ADC bits":

ADC-Bits	Measurement interval [ms]	max. record of measurement [s] (max. 500 values) for display in the web browser
9	1,0	0,5
10	1,6	0,8
11	2,6	1,3
12	4,8	2,4
13	9,1	4,5
14	17,8	9,0
15	35,0	17,0
16	70,0	35,0

Example: The configuration ADC bits = 13 (measuring interval approx. 9.1 ms) enables measured value recording of approx. 4.5 seconds.

Note: Only the last 500 measured values of the measurement can be graphically displayed and exported in the web browser (web interface data evaluation / data analysis). If the measuring interval is too short, the display of the measured values is incomplete. Increase the value in the parameter "ADC bits" in order to fully display the measured values of the measurement.

The flow rate ("quantity") is calculated for the entire measuring process and is independent of the display time (buffering) of the last 500 measured values.

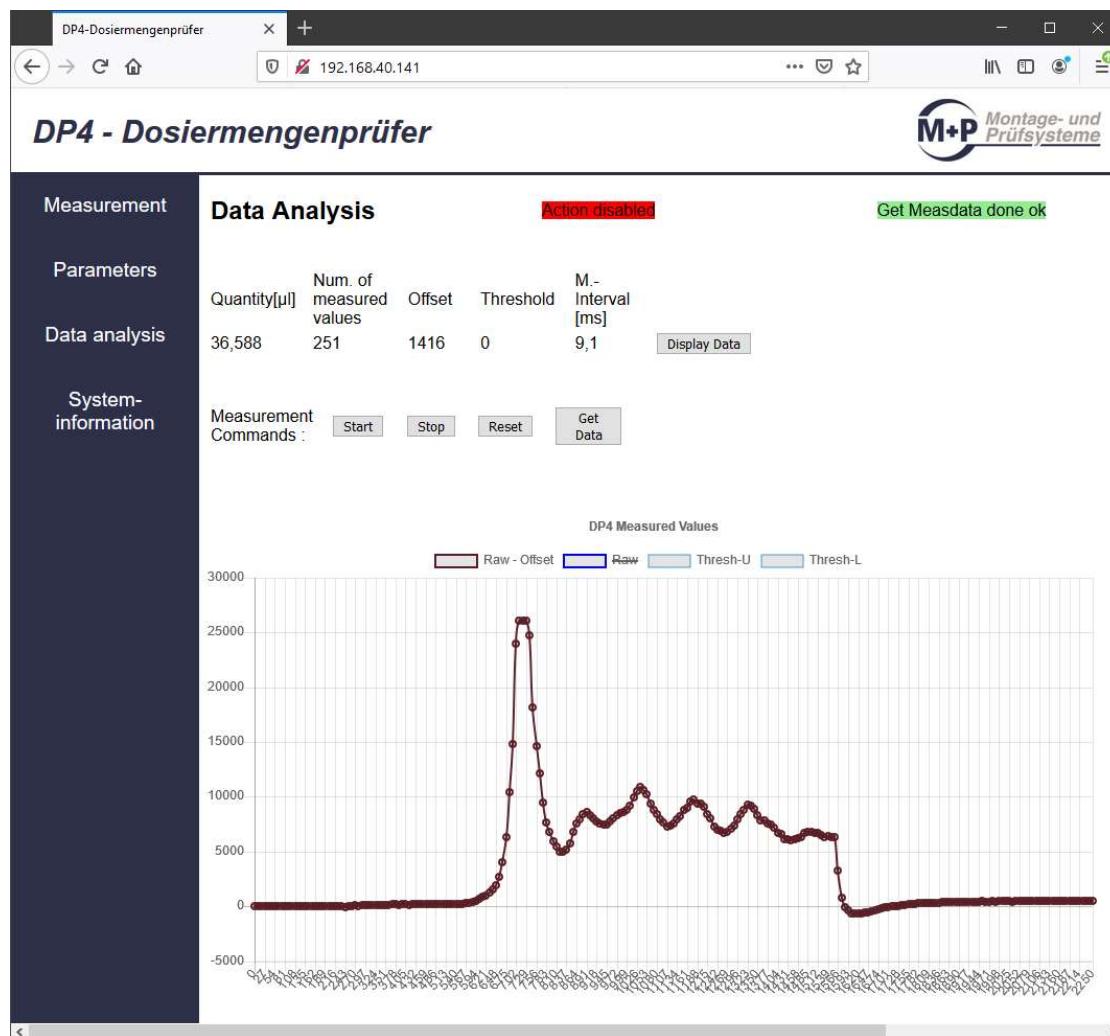


Figure: DP4 Dosing Quantity Tester - "Data analysis" in web browser

The control signal "Start" (command "Start") must remain set until the "Run = TRUE" status signal is reported.

The control signal "Stop" (command "Stop") must remain set until the "Stop = TRUE" status signal is reported.

The control signal "Reset" (command "Reset") has to remain set until the status signals (Run, Stop, IO, Nok +, Warn +, Warn-, Nok-, Overflow) have been reset (= FALSE) and DosingQuantity = 0.0 was set.

8.3 DP4 status signals - data DP4 sensor to the PLC

40 bytes are transferred from the Dosing Quantity Tester DP4 to the PLC (data types in S7 format).

The meaning of the status signals is listed in the following table:

Byte	Bit	Data type	Name	Description
0	0	Bool	Run	Measurement active
0	1	Bool	Stop	Measurement ended
0	2	Bool	Ok	OK (UpperLimit >= result <= LowerLimit)
0	3	Bool	Nok+	NOK: too much (result > UpperLimit)
0	4	Bool	Warn+	Warning: Upper limit passed
0	5	Bool	Warn-	Warning: Lower limit passed
0	6	Bool	Nok-	NOK: too little (result < UpperLimit)
0	7	Bool	Overflow	Overflow measurement range
1	0	Bool	Heating	not in use (Sensor heating keep on after measurement)
1	1	Bool	UseOffset	1: the 0-point offset determined in the measurement pauses is in use
1	2	Bool	AutoStop	1: the measurement is stopped after the end of dosing has been detected
1	3	Bool	Sensor	1: Measuring sensor detected on the device, works properly
1	4	Bool		Reserve
1	5	Bool		Reserve
1	6	Bool		Reserve
1	7	Bool		Reserve
2-5	-	Real	DosingQuantity	Dosing quantity [μl]
6-9	-	Real	UpperLimit	Upper limit ok [μl]
10-13	-	Real	UpperLimitWarn	Upper limit warning [μl]
14-17	-	Real	LowerLimitWarn	Lower limit warning [μl]
18-21	-	Real	LowerLimit	Lower limit ok [μl]
22-25	-	Real	SensorOffset	Sensor offset (actual value)

26-29	-	Real	Temp	Temperature [°C] (actual value)
30-33	-	Real	CorrCoeff	Correction coefficient
34-35	-	UINT	MeasTime	Measurement time [ms]
36-37	-	UINT	ZeroThreshold	„0“ threshold
38	-	USINT	ADC-Bits	Sensor resolution in bit (9-16)
39	-	Byte		<i>Fill byte, not in use</i>

Note:

In the event of a measuring range overflow (Overflow = TRUE), the flow rate is too high.

Countermeasures:

- reduce flow speed
- increase measurement interval (parameter ADC-Bits)

If the dosing quantity is different, check the correction factor "CorrCoeff" (linear correction).

9 PLC Hardware Configuration / Hardware Catalogue

The device description data of the Dosing Quantity Tester DP4 has to be added to the hardware catalogue of your programming environment. Here explained on basis of TIA Portal.

9.1 Installation of the Device Description Data: DP4

To install the device description data of the DP4, use the menu item "Device Description Files (GSD)" in the TIA Portal menu "Extras".

Install supplied device description file:

e.g. „GSDML-V2.33-MP_GMBH-DP4-SENSOR-20200226.XML“.

Note: For further information, use the help information system of the TIA PORTAL (search term "Install GSD file").

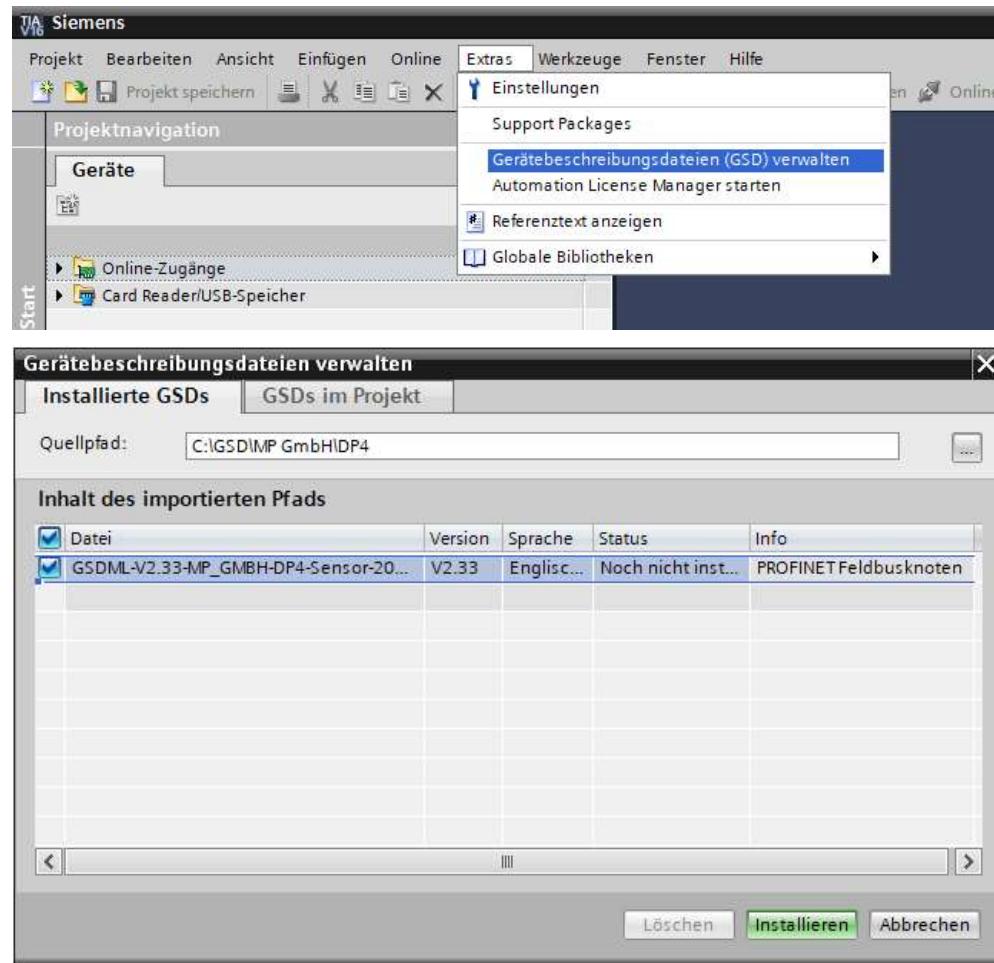


Figure: TIA Portal: Manage device description files (GSD)

After installation, the component "DP4" is displayed in the "additional field devices / PROFINET IO / sensors / MP GmbH" folder in the hardware catalogue.

In the folder DP4 head module "DP4-PROFINET 2Port" and sensor module "DP4 Flow Sensor" are displayed.

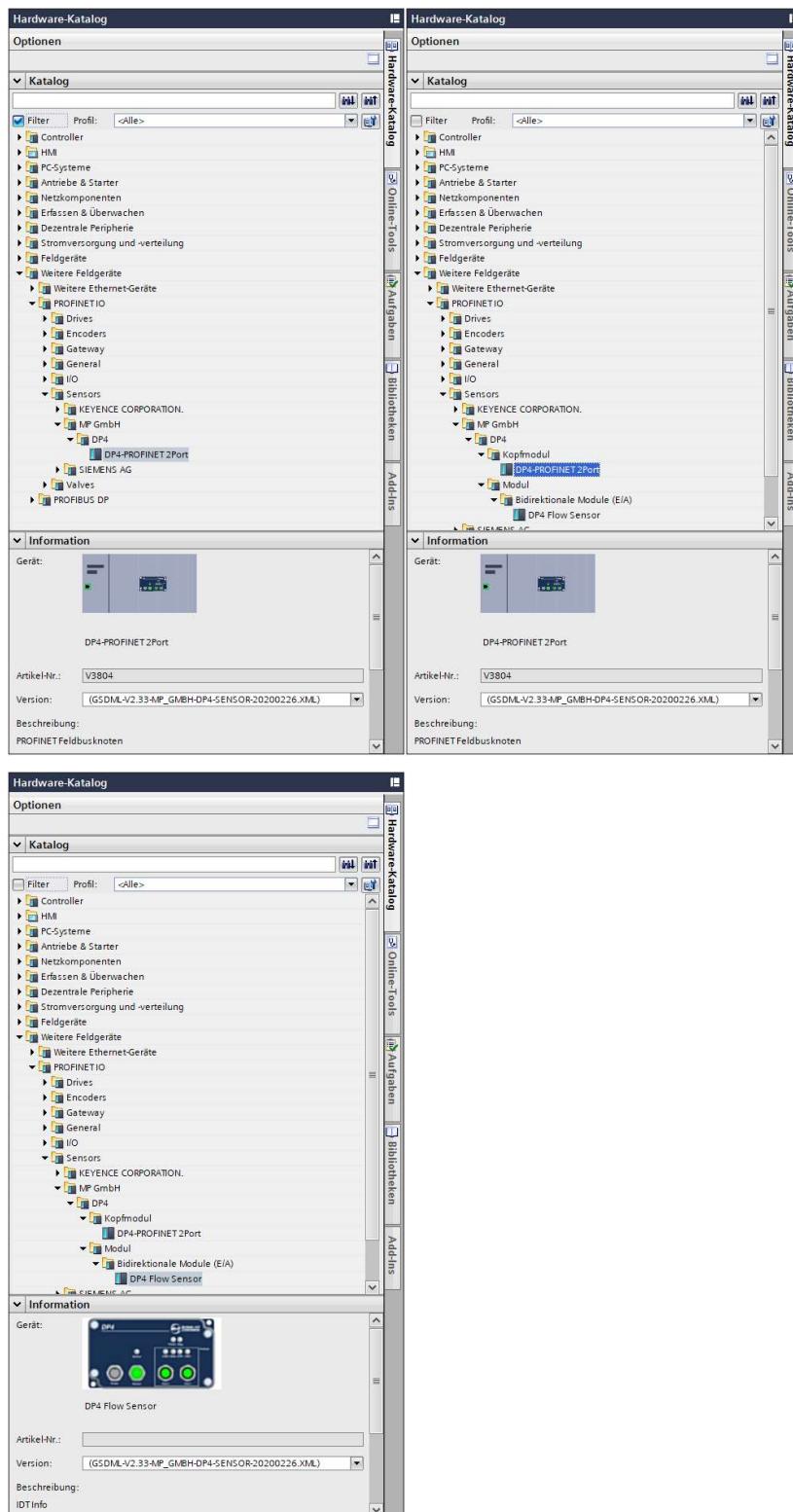


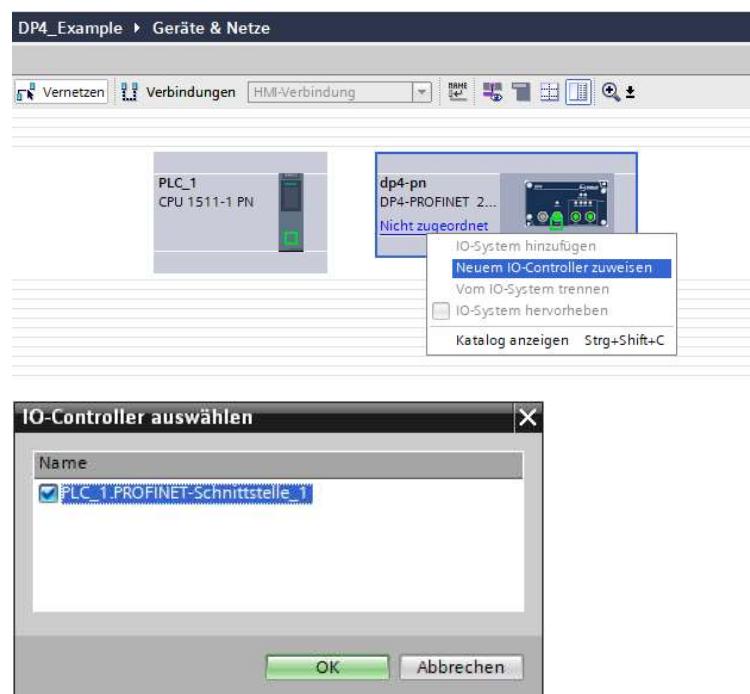
Figure: TIA Portal: Hardware catalogue

Note: Display view varies depending on the filter setting.

9.2 Adding a DP4 Component to your TIA-Portal Project

The following steps are required to add the Dosing Quantity Tester DP4:

- Open or create a new TIA project with a PLC with PROFINET connection (e.g. "CPU 1511-1 PN")
- Open the "Topology view" or "Network view" via the "Devices & Networks" project navigator
- Open the folder in the hardware catalogue "Other field devices / PROFINET IO / Sensors / MP GmbH / DP4"
- Add the device "DP4-PROFINET 2Port" to your "topology view" or "network view"
- Select the device "DP4-PROFINET 2Port" in the "Topology view" or "Network view" and switch to the page "Device view"
- Configure slot 1 by selecting the entry "DP4 Flow Sensor" in the hardware catalogue and dragging it to slot 1 with a double-click or drag & drop.
- Configure the PROFINET interface ("Network interface with subnet", "Settings for IP protocol" and "PROFINET device name")
- Connect the PROFINET interface of the DP4 with the configured PLC ("network interface with subnet")
- A PROFINET connection between the PLC and the DP4 is now displayed in the network view.



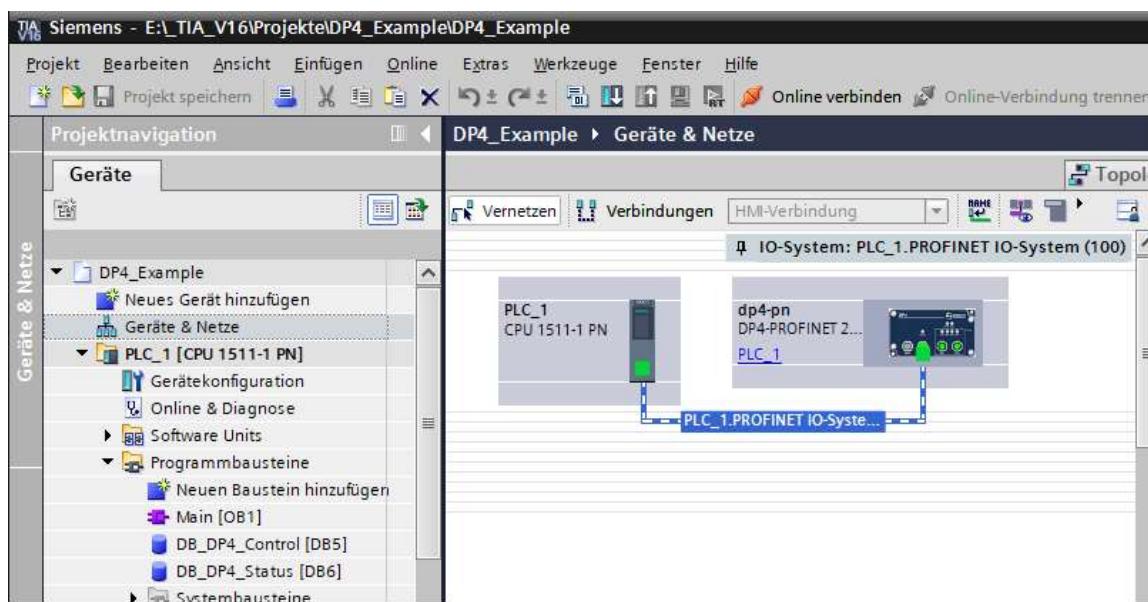


Figure: TIA Portal: Devices and Networks / Network View - Networking

Switch to the device view:

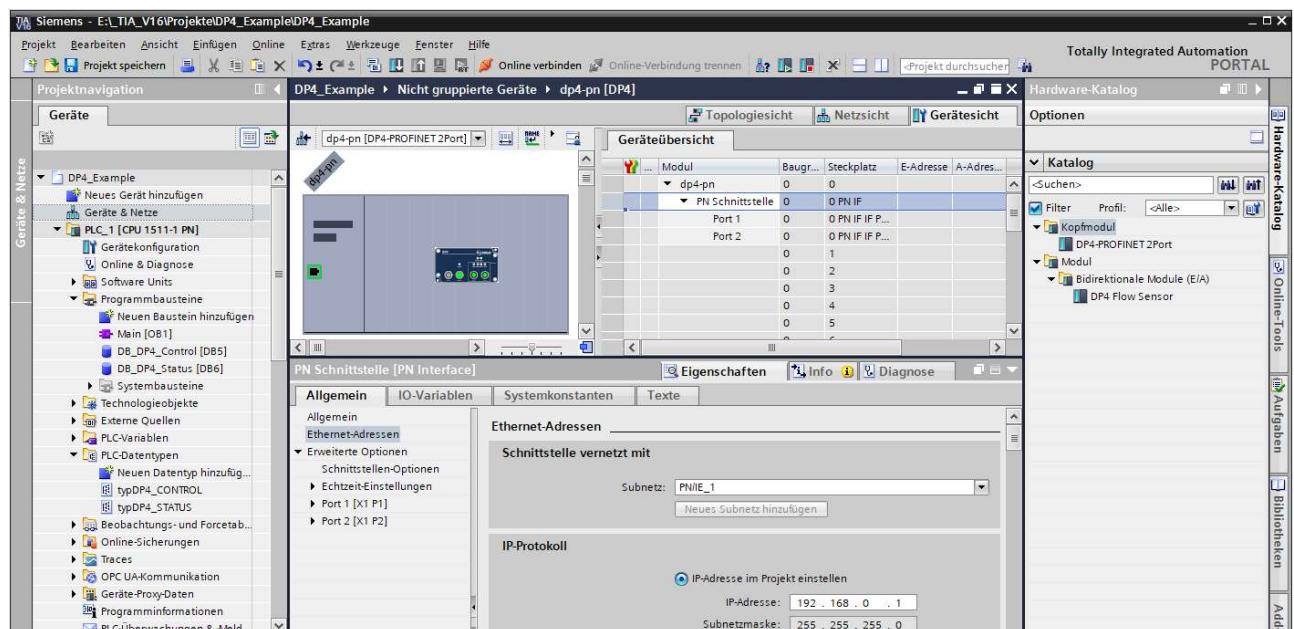


Figure: TIA Portal: Devices and networks / “dp4-pn” device / device view

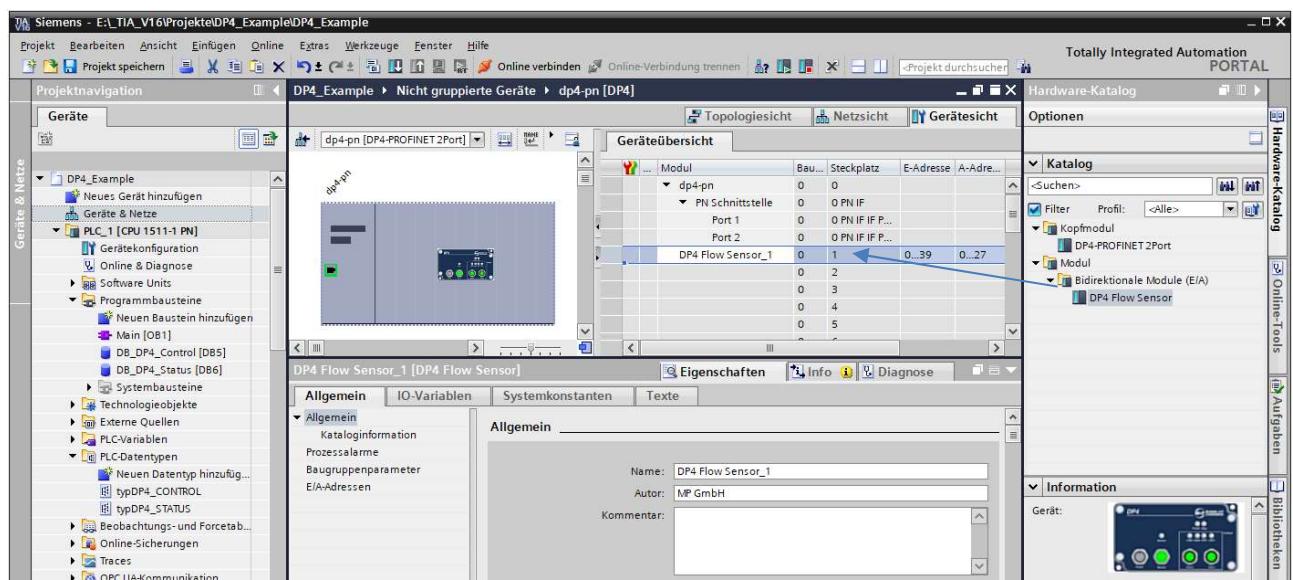


Figure: TIA Portal: "dp4-pn" device view - module "DP4 Flow Sensor_1"

10 Programming / Sample Program

The DP4 can be controlled by using of control and status signals.

A function block (FB) is available for controlling and evaluating the signals of the DP4. The function block "FB_DP4" can be integrated into your project via the global library (TIA-PORTAL V16) "DP4_LIB_V01.00".

The library contains templates for data types (type declaration) and program blocks (function block and data blocks).

10.1 Global Library „DP4_LIB_V01.00“

Add the global library "DP4_LIB_V01.00" to your programming environment "TIA Portal".

Integration of global library e.g. "DP4_LIB_V01.00"

File: „DP4_LIB_V01.00.zal16“ (data type „compressed library ...“)

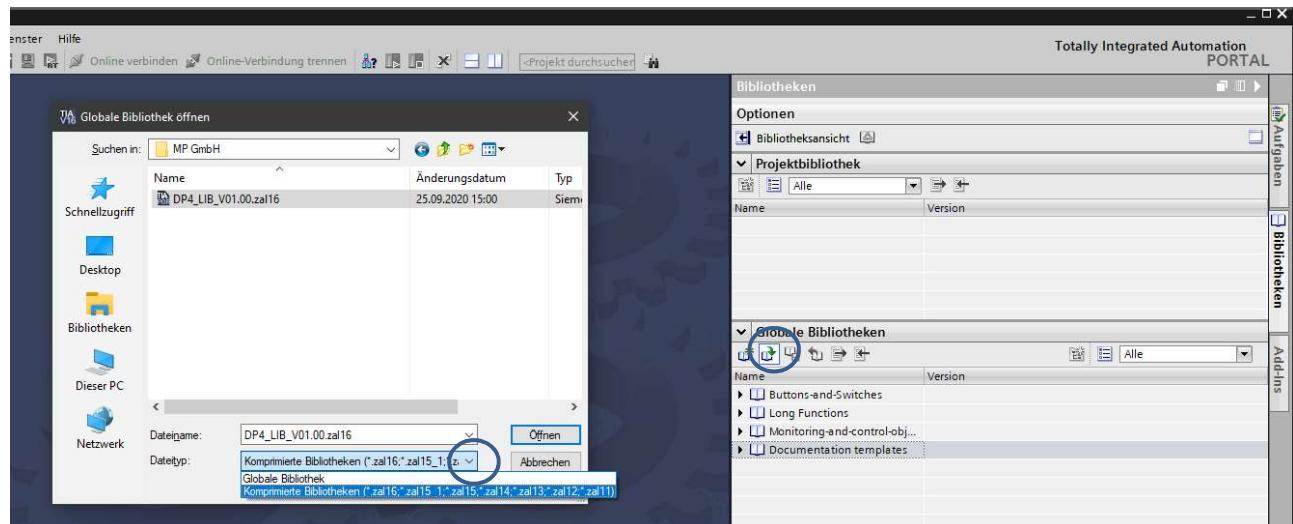


Figure: TIA-Portal: Open global library

Master copies are now displayed in the global library.

Copy the master copies from the global library into your project.

The folder "DP4" in the library contains templates for programming by using control and status signals.

The folder "DP4_FB" in the library contains templates for programming by using "FB_DP4".

Copy the PLC data types ("typDP4*") from the global library into your project folder "PLC data types".

Copy the program blocks ("DB_DP4*" and, if necessary "FB_DP4") from the global library into your project folder "Program blocks".

The data blocks "DB_DP4_Parameter" and "DB_DP4_Result" are contained in the template and are used to parameterize or save the result data of the function block instance.

Note: For further information, use the help information system of the TIA-Portal (search term "use global library").

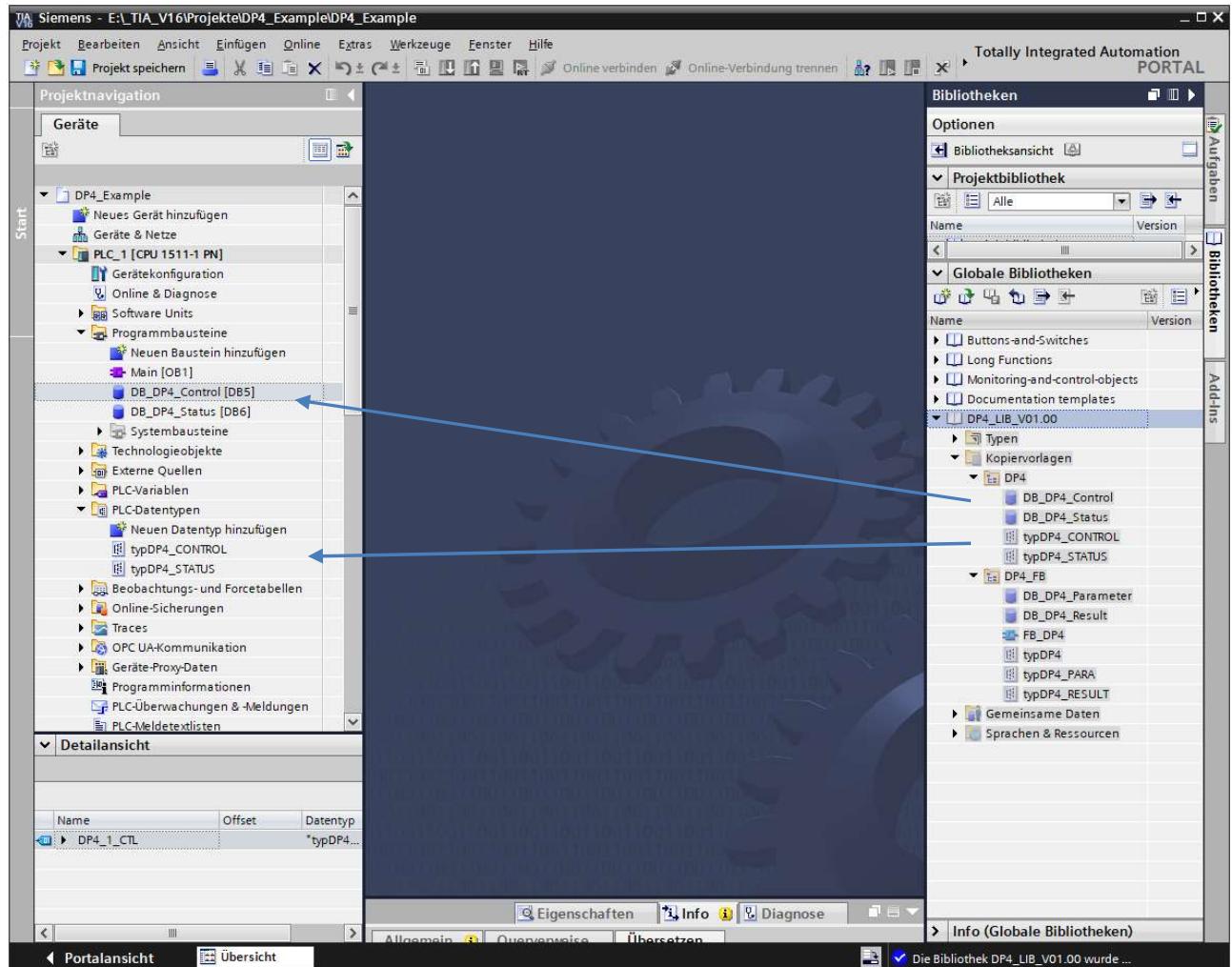


Figure: TIA Portal: Global library - DP4 master copies ("DP4" and "DP4_Fb")

10.2 Programming via Control and Status Signals

Project and configure the field device in your project „DP4-PROFINET 2Port“ (see: „9. PLC Hardware Configuration / Hardware Catalogue“).

Add data blocks to your project for the control signals (e.g. "DB_DP4_Control") and the status signals (e.g. "DB_DP4_Status").

Use blocks for consistent reading / writing of data (DPRD_DAT and DPWR_DAT) in the cyclic user program.

The input parameter "LADDR" has to be assigned to the system constant of the "DP4-Flow Sensor" e.g. "dp4-pn~DP4_Flow_Sensor_1" type: "Hw_Submodule"

The system constant is formed by naming the modules slot 0 and slot 1 in the device view.

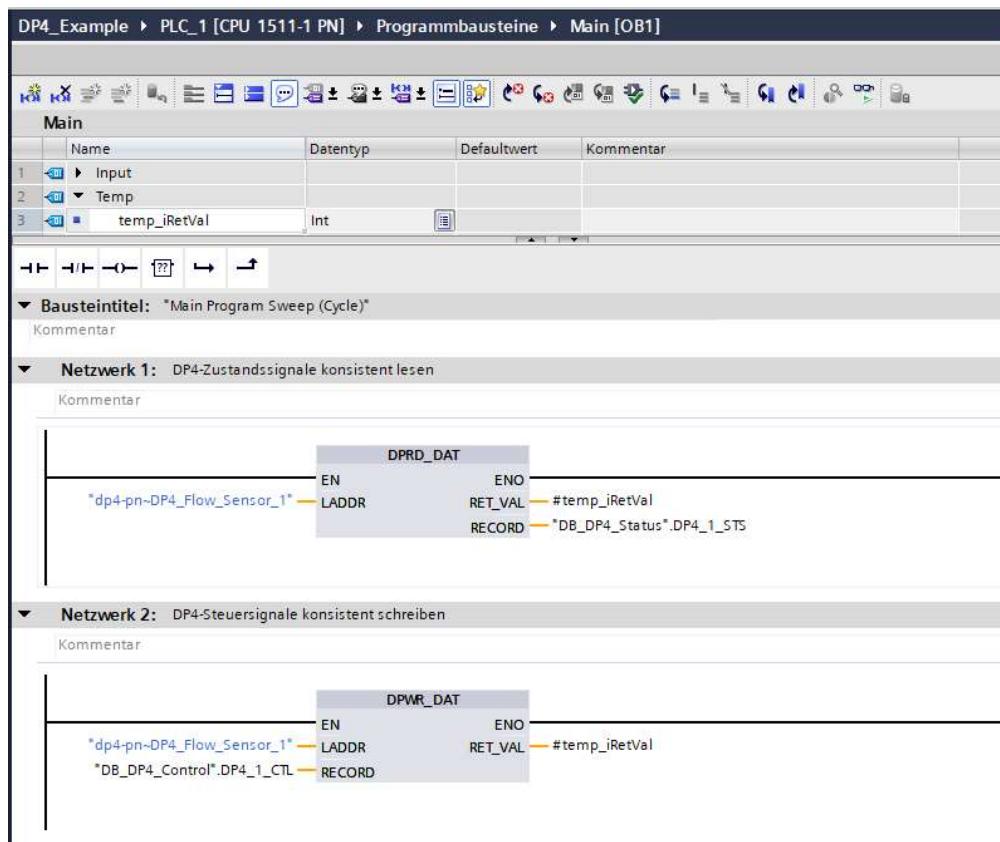


Figure: Read & write DP4 status signals consistently

The configuration parameters can be set by using the data block control signals (e.g. "DB_DP4_Control"). The control signals "Start", "Stop" and "Reset" can be set and reset directly in the data block by using the function "control operand" (context menu).

The status signals can be monitored in the data block status signals (e.g. "DB_DP4_Status").

DB_DP4_Control					DB_DP4_Status				
Name	Datentyp	Startwert	Beobachtungswert	Kommentar	Name	Datentyp	Startwert	Beobachtungswert	Kommentar
1 □ Static					1 □ Static				
2 □ DP4_1_CTL	*typDP4_CON...			DP4 Control Data	2 □ DP4_1_STS	*typDP4_STATUS*			
3 □ Start	Bool	false	FALSE	Kommando: Start	3 □ Run	Bool	false	FALSE	Messung aktiv
4 □ Stop	Bool	false	FALSE	Kommando: Stop	4 □ Stop	Bool	false	TRUE	Messung beendet
5 □ Reset	Bool	false	FALSE	Kommando: Reset	5 □ Ok	Bool	false	TRUE	IO
6 □ Reserve1	Bool	false	FALSE		6 □ Nok+	Bool	false	FALSE	NIO: zu viel
7 □ Reserve2	Bool	false	FALSE		7 □ Warn+	Bool	false	FALSE	Wärmegrenze oben ueberschritten
8 □ Reserve3	Bool	false	FALSE		8 □ Warn-	Bool	false	FALSE	Wärmegrenze unten unterschritten
9 □ Reserve4	Bool	false	FALSE		9 □ Nok-	Bool	false	FALSE	NIO: zu wenig
10 □ Reserve5	Bool	false	FALSE		10 □ Overflow	Bool	false	FALSE	Messbereich Ueberlauf
11 □ HeatingOn	Bool	false	TRUE	nicht verwendet (Sensorheizung)	11 □ Heating	Bool	false	TRUE	nicht verwendet: Sensorenheizung bleibt nach der 1-durch den Messpausen ermittelte 0-Pkt-Offset
12 □ UseOffsetOn	Bool	false	TRUE	Konfig: Der in den Messpausen ermittelte 0-Pkt-Offset	12 □ UseOffset	Bool	false	TRUE	1-die Messung wird nach Erkennen des Dosier-Sensors am Gerät erkannt, arbeitet fehlerfrei
13 □ AutoStopOn	Bool	false	FALSE	Konfig: Die Messung wird nach Erkennen des Dosier-Sensors am Gerät gestoppt	13 □ AutoStop	Bool	false	FALSE	
14 □ Reserve6	Bool	false	FALSE		14 □ Sensor	Bool	false	TRUE	
15 □ Reserve7	Bool	false	FALSE		15 □ Reserve1	Bool	false	FALSE	
16 □ Reserve8	Bool	false	FALSE		16 □ Reserve2	Bool	false	FALSE	
17 □ WebConfigEnable	Bool	false	FALSE	Konfiguration ueber Webseite zu ermöglichen	17 □ Reserve4	Bool	false	FALSE	
18 □ ConfigActive	Bool	TRUE	TRUE	Konfigurationsparameter von Prozess	18 □ Reserve5	Bool	false	FALSE	
19 □ UpperLimit	Real	30.0	25.0	Konfig: Obergrenze [µl]	19 □ DosingQuantity	Real	0.0	19.21199	Dosiermenge [µl]
20 □ UpperLimitWarn	Real	25.0	23.0	Konfig: Obergrenze Wärzung [µl]	20 □ UpperLimit	Real	0.0	25.0	Rückmeldung: Obergrenze [µl]
21 □ LowerLimitWarn	Real	25.0	17.0	Konfig: Untergrenze Wärzung [µl]	21 □ UpperLimitWarn	Real	0.0	23.0	Rückmeldung: Obergrenze Wärzung [µl]
22 □ LowerLimit	Real	20.0	15.0	Konfig: Untergrenze [µl]	22 □ LowerLimitWarn	Real	0.0	17.0	Rückmeldung: Untergrenze Wärzung [µl]
23 □ CorrCoeff	Real	1.0	1.0	Konfig: Linearer Korrekturfaktor	23 □ LowerLimit	Real	0.0	15.0	Rückmeldung: Untergrenze [µl]
24 □ MeasTime	UInt	0	0	Konfig: automatisch Ende nach Messzeit	24 □ SensorOffset	Real	0.0	237.0	Sensor Offset
25 □ ZeroThreshold	UInt	0	0	Konfig: Null-Schwelle zur Bewertung	25 □ Temp	Real	0.0	25.8	Temperatur [°C]
26 □ ADC-Bits	UInt	16	14	Konfig: Sensor-Auflösung in Bits (9-16)	26 □ CorrCoeff	Real	0.0	1.0	Rückmeldung: Linearer Korrekturfaktor
27 □ Reserve9	Byte	16#0	16#00		27 □ MeasTime	UInt	0	0	Rückmeldung: Null-Schwelle
					28 □ ZeroThreshold	UInt	0	0	Rückmeldung: Sensor-Auflösung in Bit (9-16)
					29 □ ADC-Bits	UInt	0	14	
					30 □ Reserve6	Byte	16#0	16#55	

Figure: Control signals "DB_DP4_Control", status signals "DB_DP4_Status"

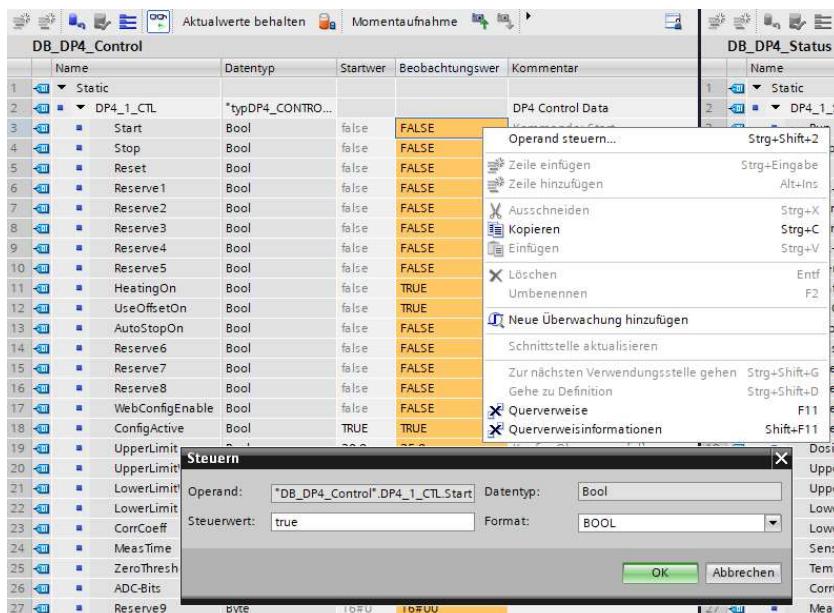


Figure: Control signals - controlling operand

10.3 Parameterization - function block "FB_DP4"

The function block "FB_DP4" can parameterize, control and evaluate a dosing process (measure and evaluate the dosing quantity).

The dosing process is started with the signal e.g. "FB_DP4_DB".DP.Dosing.START = TRUE (control dosing valve: fill / load). The dosing valve is emptied if the parameter e.g. "FB_DP4_DB".DP.RELEASE_DOSING = TRUE (release for the dosing process - control of the dosing valve drain).

Reset the start signal "FB_DP4_DB".DP.Dosing.START = FALSE if the status "Run" is reported.

Insert the FB call "FB_DP4" into your program and assign the FB instance its own data block (e.g. "FB_DP4_DB").

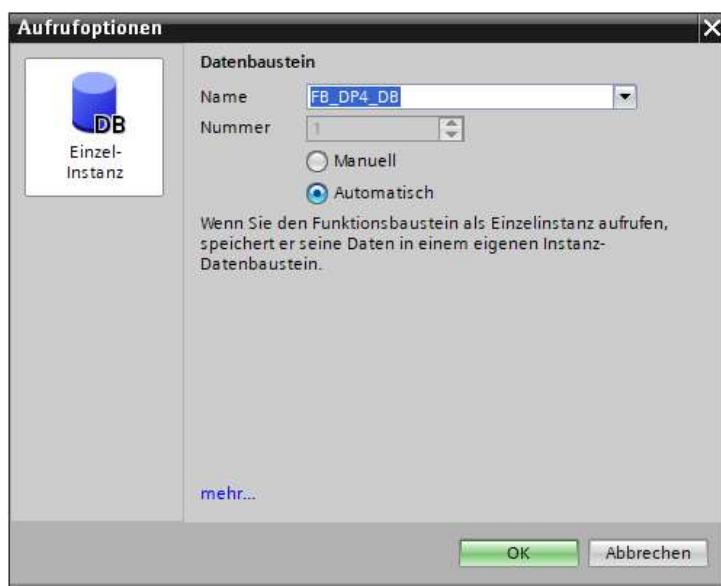


Figure: Parameterization of the FB instance

The input parameter "LADDR" has to be assigned to the system constant of the "DP4-Flow Sensor" e.g. "dp4-pn~DP4_Flow_Sensor_1" type: "Hw_Submodule"

The system constant is formed by naming the modules slot 0 and slot 1 in the device view.

Assign the input parameter "inPARA" (data type "typDP4_PARA") to the parameterization data of the DP4 (use e.g. the "DB_DP4_Parameter" from the master copy of the global library).

Assign the output parameter "outRESULT" (data type "typDP4_RESULT") to the storage location of the result data of the DP4 instance - use e.g. the data block "DB_DP4_Result" from the master copy of the global library. Note that each DP4 instance must use a separate memory area!

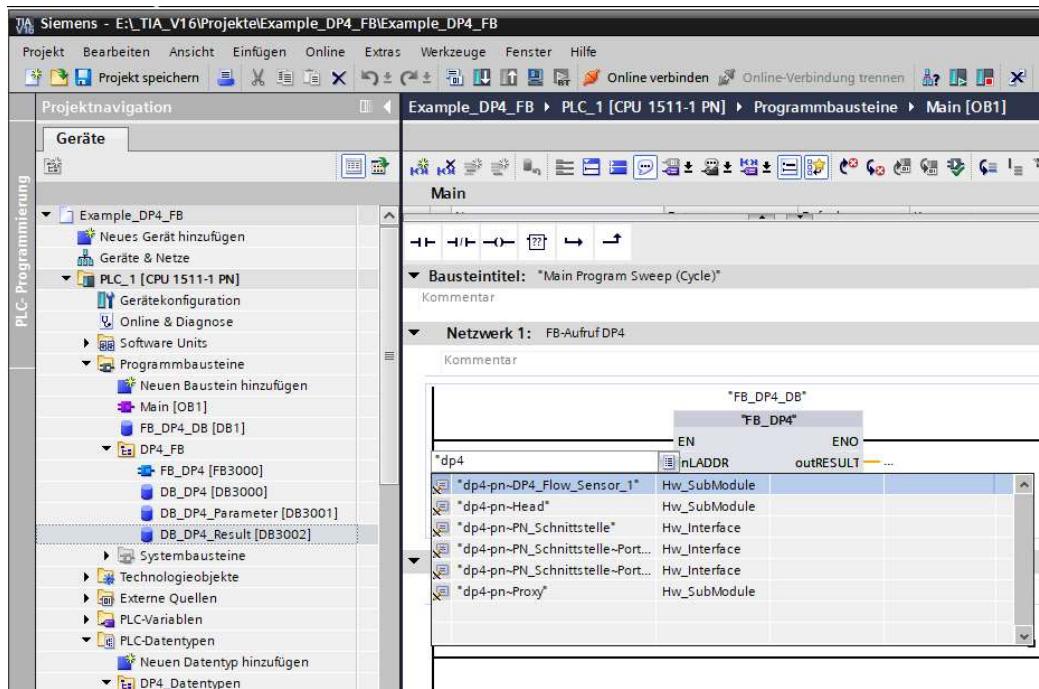


Figure: Program blocks / Main [OB1] / Network

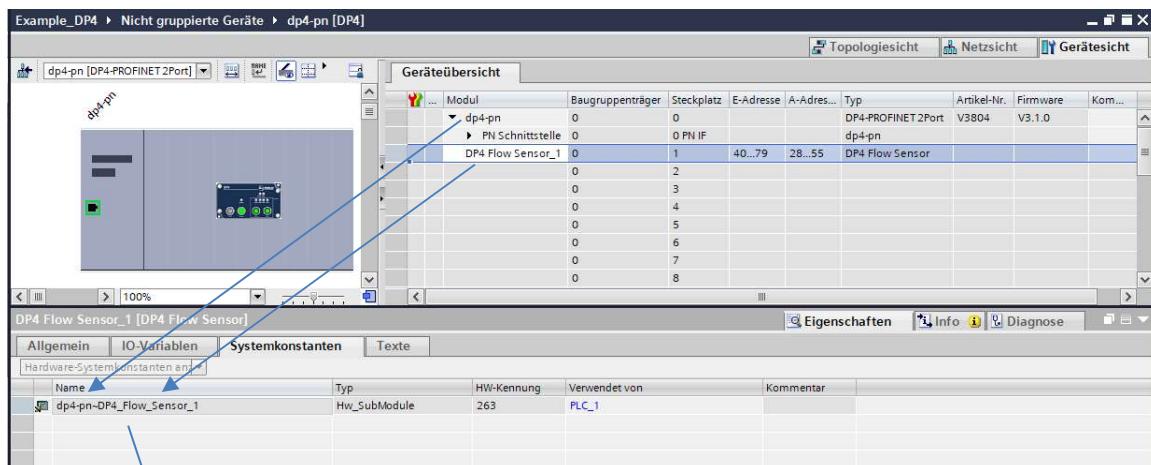


Figure: "dp4-pn" device view / "DP4 Flow Sensor_1"

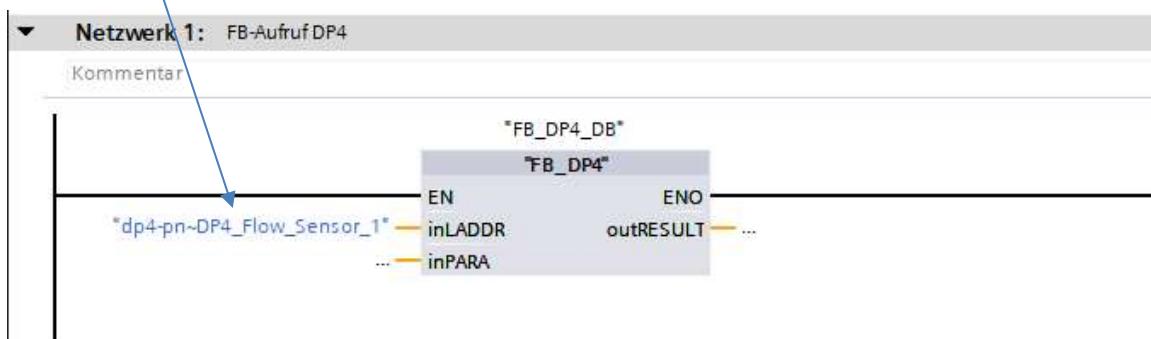


Figure: FB parameters: "inLADDR"

in LADDR "dp4-pn~DP4_Flow_Sensor_1"

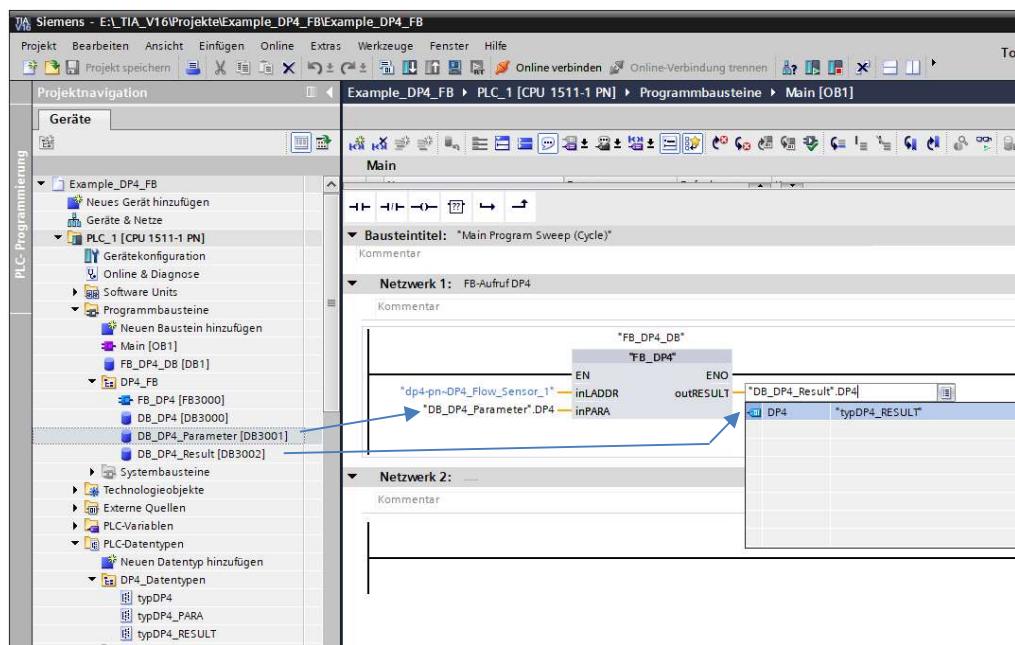
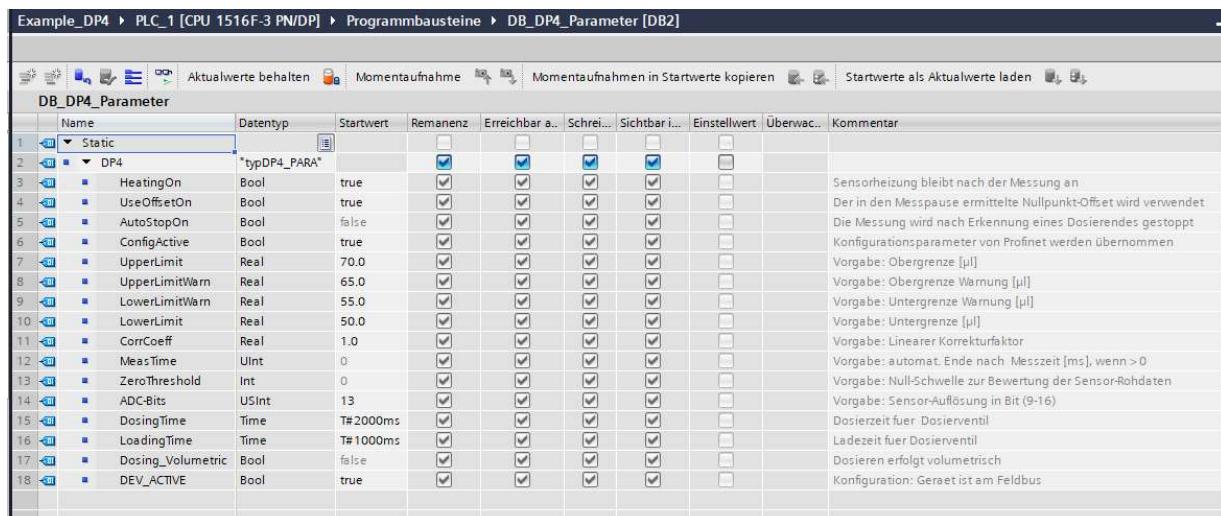


Figure: FB parameters: „inPARA“, „outRESULT“

10.3.1 Input parameters - data type "typDP4_PARA"

The "FB_Dp4" is parameterized by using the data structure assigned to the "inPARA" input parameter (e.g. "DB_DP4_Parameter".DP4).



Name	Datentyp	Startwert	Remanenz	Erreichbar a...	Schreib...	Sichtbar i...	Einstellwert	Überwac...	Kommentar
1	Static								
2	DP4	"typDP4_PARA"							
3	HeatingOn	Bool	true	✓	✓	✓	✓	✓	Sensorheizung bleibt nach der Messung an
4	UseOffsetOn	Bool	true	✓	✓	✓	✓	✓	Der in den Messpausen ermittelte Nullpunkt-Offset wird verwendet
5	AutoStopOn	Bool	false	✓	✓	✓	✓	✓	Die Messung wird nach Erkennung eines Dosierendes gestoppt
6	ConfigActive	Bool	true	✓	✓	✓	✓	✓	Konfigurationsparameter von Profinet werden übernommen
7	UpperLimit	Real	70.0	✓	✓	✓	✓	✓	Vorgabe: Obergrenze [µl]
8	UpperLimitWarn	Real	65.0	✓	✓	✓	✓	✓	Vorgabe: Obergrenze Warming [µl]
9	LowerLimitWarn	Real	55.0	✓	✓	✓	✓	✓	Vorgabe: Untergrenze Warming [µl]
10	LowerLimit	Real	50.0	✓	✓	✓	✓	✓	Vorgabe: Untergrenze [µl]
11	CorrCoeff	Real	1.0	✓	✓	✓	✓	✓	Vorgabe: Linearer Korrekturfaktor
12	MeasTime	UInt	0	✓	✓	✓	✓	✓	Vorgabe: autom. Ende nach Messzeit [ms], wenn > 0
13	ZeroThreshold	Int	0	✓	✓	✓	✓	✓	Vorgabe: Null-Schwelle zur Bewertung der Sensor-Rohdaten
14	ADC_Bits	USint	13	✓	✓	✓	✓	✓	Vorgabe: Sensor-Auflösung in Bit (9-16)
15	DosingTime	Time	T#2000ms	✓	✓	✓	✓	✓	Dosierzeit für Dosierventil
16	LoadingTime	Time	T#1000ms	✓	✓	✓	✓	✓	Ladezeit für Dosierventil
17	Dosing_Volumetric	Bool	false	✓	✓	✓	✓	✓	Dosieren erfolgt volumetrisch
18	DEV_ACTIVE	Bool	true	✓	✓	✓	✓	✓	Konfiguration: Gerät ist am Feldbus

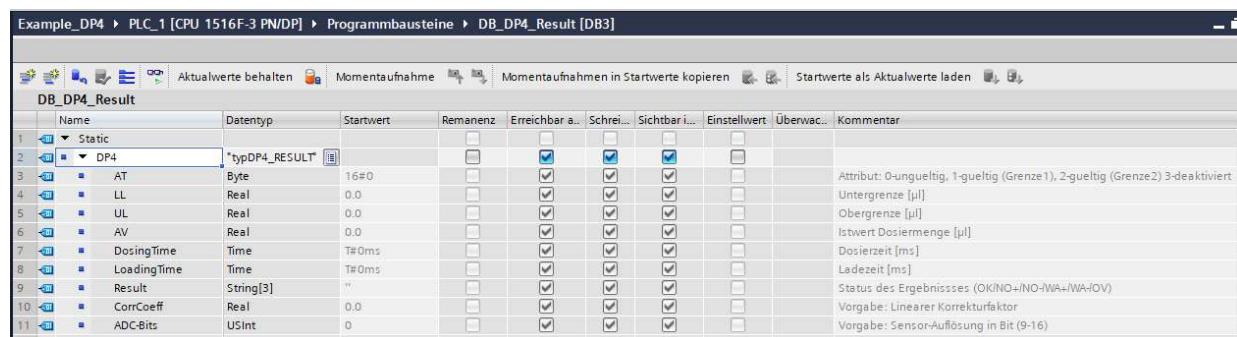
Figure: Data block "DB_DP4_Parameter"

Data type: „typDP4_PARA“

HeatingOn	Not in use (Sensor heating keep on after measurement)
UseOffsetOn	The 0-point offset determined in the measurement pauses is in use
AutoStopOn	The measurement is stopped after the end of dosing is detected
ConfigActive	Configuration parameter used from Profinet (manual measurement is off)
UpperLimit	Definition: Upper limit [μl]
UpperLimitWarn	Definition: Upper limit warning [μl]
LowerLimitWarn	Definition: Lower limit warning [μl]
LowerLimit	Definition: Lower limit [μl]
CorrCoeff	Definition: Linear correction factor
MeasTime	Definition: automatic end after measurement time [ms], if > 0
ZeroThreshold	Definition: „0“ threshold for evaluating of raw data of the sensor
ADC-Bits	Definition: Sensor resolution in Bit (9-16)
DosingTime	Dosing time for dosing valve
LoadingTime	Loading time for dosing valve
Dosing_Volumetric	Dosing is volumetric
DEV_ACTIVE	Configuration: Device is on Profibus

10.3.2 Output parameter - data type "typDP4_RESULT"

Status and results can be evaluated by the user program via the data structure assigned at the FB parameter outRESULT (e.g. "DB_DP4_Result" .DP4).



The screenshot shows the SIMATIC Manager interface with the following details:

- Project Path:** Example_DP4 > PLC_1 [CPU 1516F-3 PN/DP] > Programmbausteine > DB_DP4_Result [DB3]
- Toolbar:** Includes icons for file operations, clipboard, and search.
- Menu Bar:** Actualwerte behalten, Momentaufnahme, Startwerte als Aktualwerte laden.
- Table:** Shows the structure of the DB_DP4_Result data block with 11 entries. The first entry is expanded to show its internal structure.
- Table Headers:** Name, Datentyp, Startwert, Remanenz, Erreichbar a..., Schreib..., Sichtbar i..., Einstellwert, Überwach., Kommentar.
- Table Data:**

Name	Datentyp	Startwert	Remanenz	Erreichbar a...	Schreib...	Sichtbar i...	Einstellwert	Überwach.	Kommentar
1 Static									
2 DP4	*typDP4_RESULT*			<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>			
3 AT	Byte	16#0		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>			Attribut: 0-ungültig, 1-gültig (Grenze1), 2-gültig (Grenze2) 3-deaktiviert.
4 LL	Real	0.0		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>			Untergrenze [μl]
5 UL	Real	0.0		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>			Obergrenze [μl]
6 AV	Real	0.0		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>			Istwert Dosiermenge [μl]
7 DosingTime	Time	T#0ms		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>			Dosierzeit [ms]
8 LoadingTime	Time	T#0ms		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>			Ladezeit [ms]
9 Result	String[3]	" "		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>			Status des Ergebnisses (OK/NO+/NO-/WA+/WA-/OV)
10 CorrCoeff	Real	0.0		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>			Vorgabe: Linearer Korrekturfaktor
11 ADC-Bits	USInt	0		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>			Vorgabe: Sensor-Auflösung in Bit (9-16)

Figure: Data block "DB_DP4_Result"

AT	Attribute: 0-invalid, 1-valid (limit1), 2-valid (limit2), 3 deactivated
LL	lower limit [μ l]
UL	upper limit [μ l]
AV	actual value / dosing quantity [μ l]
DosingTime	Dosing time [ms]
LoadingTime	Loading time [ms]
Result	Status of results (OK/NO+/NO-/WA+/WA-/OV)
CorrCoeff	Definition: Linear correction factor
ADC-Bits	Definition: Sensor resolution in Bit (9-16)

Table: Data type „typDP4_RESULT“

The status of the result is entered in the field "Result" (Data type STRING[3]). The value of "Result" can have the following values:

'OK'	OK
'NO+'	NOK / value > upper limit
'NO-'	NOK / value < lower limit
'WA+'	OK value > upper limit warning
'WA-'	OK value < lower limit warning
'OV'	Overload – Exceeding the measured value occurred
" "	No valid result – e.g. after Reset

Table: Data field "Result" - values

10.3.3 Instance Data Block

The instance data in the data block enable the control and evaluation of the DP4 (fieldbus interface). The "Fieldbus: Status signals" are output by the field "STATUS". The field "CMD" contains the "Fieldbus: control signals".

Data type: "typDP4"

STATUS	Struct	Field bus: Status signals
	Run	Measurement active
	Stop	Measurement ended
	Ok	OK
	Nok+	NOK: too much
	Warn+	Upper warning limit passed
	Warn-	Lower warning limit passed
	Nok-	NOK: too little
	Overflow	Overflow measurement range
	Heating	1 - Sensor heating switched off after measurement
	UseOffset	1 - The 0-point offset determined in the measurement pauses is in use
	AutoStop	1 - The measurement is stopped after the end of dosing is detected
	Sensor	1 - Sensor on device detected, works properly
	Reserve1	Reserve
	Reserve2	Reserve
	Reserve4	Reserve
	Reserve5	Reserve
	DosingQuantity	Dosing quantity [μl]
	UpperLimit	Feedback: Upper limit [μl]
	UpperLimitWarn	Feedback: Upper limit warning [μl]
	LowerLimitWarn	Feedback: Lower limit warning [μl]
	LowerLimit	Feedback: Lower limit [μl]
	SensorOffset	Sensor Offset
	Temp	Temperature [$^{\circ}\text{C}$]
	CorrCoeff	Feedback: Linear correction factor
	MeasTime	Feedback: Measurement time [ms]
	ZeroThreshold	Feedback: 0-threshold
	ADC-Bits	Feedback: Sensor resolution in Bit (9-16)

	Reserve6	Reserve
CMD	Struct	Field bus: Control signals
	Start	Start measurement
	Stop	Stop measurement
	Reset	Reset measurement
	Reserve1	Reserve
	Reserve2	Reserve
	Reserve3	Reserve
	Reserve4	Reserve
	Reserve5	Reserve
	HeatingOn	Sensor heating keep on after measurement
	UseOffsetOn	The 0-point offset determined in the measurement pauses is in use
	AutoStopOn	The measurement stops automatically after the end of dosing is detected
	Reserve6	Reserve
	Reserve7	Reserve
	Reserve8	Reserve
	WebConfigEnable	Allow configuration and manual measurement via web browser
	ConfigActive	Take over configuration parameters from Profinet
	UpperLimit	Definition: Upper limit [μl]
	UpperLimitWarn	Definition: Upper limit warning [μl]
	LowerLimitWarn	Definition: Lower limit warning [μl]
	LowerLimit	Definition: Lower limit [μl]
	CorrCoeff	Definition: Linear correction factor
	MeasTime	Definition: automatic end after measurement time [ms], if > 0
	ZeroThreshold	Definition: „0“-threshold for evaluating of raw data of the sensor
	ADC-Bits	Definition: Sensor resolution in Bit (9-16)
K	Struct	Internal step chain
DosingValve	Struct	Dosing valve
Loading	Struct	Loading process (fill dosing valve)
Dosing	Struct	Dosing process
RESET	BOOL	Reset

flmRESET	BOOL	Notice of edges
WEIT	BOOL	Switching conditions
IS_ERROR	BOOL	Device not ready, error
IS_RESET	BOOL	Device in status reset
Dosing_Volumetric	BOOL	Volumetric dosing chosen
Save_PD	BOOL	Save process data
PERM_IO	BOOL	Evaluation not active, permanent OK-results
DEV_ACTIVE	BOOL	Configuration: Device is on Profibus
RELEASE_DOSING	BOOL	release dosing

Table: Data type "typDP4"

11 Appendix

11.1 Data Type „typDP4_CONTROL“

	Name	Datentyp	Defaultwert	Kommentar
1	Start	Bool	false	Kommando: Start
2	Stop	Bool	false	Kommando: Stop
3	Reset	Bool	false	Kommando: Reset
4	Reserve1	Bool	false	
5	Reserve2	Bool	false	
6	Reserve3	Bool	false	
7	Reserve4	Bool	false	
8	Reserve5	Bool	false	
9	HeatingOn	Bool	false	nicht verwendet (Sensorheizung bleibt nach der Messung an)
10	UseOffsetOn	Bool	false	Konfig: Der in den Messpause ermittelte Nullpunkt-Offset wird verwendet
11	AutoStopOn	Bool	false	Konfig: Die Messung wird nach Erkennung eines Dosierendes gestoppt
12	Reserve6	Bool	false	
13	Reserve7	Bool	false	
14	Reserve8	Bool	false	
15	WebConfigEnable	Bool	false	Konfiguration ueber Webseite zulassen
16	ConfigActive	Bool	false	Konfigurationsparameter von Profinet werden übernommen
17	UpperLimit	Real	0.0	Konfig: Obergrenze [μ l]
18	UpperLimitWarn	Real	0.0	Konfig: Obergrenze Warnung [μ l]
19	LowerLimitWarn	Real	0.0	Konfig: Untergrenze Warnung [μ l]
20	LowerLimit	Real	0.0	Konfig: Untergrenze [μ l]
21	CorrCoeff	Real	0.0	Konfig: Linearer Korrekturfaktor
22	MeasTime	UInt	0	Konfig: automat. Ende nach Messzeit [ms], wenn > 0
23	ZeroThreshold	UInt	0	Konfig: Null-Schwelle zur Bewertung der Sensor-Rohdaten
24	ADC-Bits	USInt	0	Konfig: Sensor-Auflösung in Bit (9-16)
25	Reserve9	Byte	16#0	

Figure: Data type "typDP4_CONTROL"

11.2 Data Type „typDP4_STATUS“

typDP4_STATUS				
	Name	Datentyp	Defaultwert	Kommentar
1	Run	Bool	false	Messung aktiv
2	Stop	Bool	false	Messung beendet
3	Ok	Bool	false	IO
4	Nok+	Bool	false	NIO: zu viel
5	Warn+	Bool	false	Warngrenze oben ueberschritten
6	Warn-	Bool	false	Warngrenze unten unterschritten
7	Nok-	Bool	false	NIO: zu wenig
8	Overflow	Bool	false	Messbereich Ueberlauf
9	Heating	Bool	false	nicht verwendet (Sensorheizung bleibt nach der Messung an)
10	UseOffset	Bool	false	1-der in den Messpausen ermittelte 0-Pkt.-Offset wird verwendet
11	AutoStop	Bool	false	1-die Messung wird nach Erkennen des Dosierendes gestoppt
12	Sensor	Bool	false	1-Messsensor am Geraet erkannt, arbeitet fehlerfrei
13	Reserve1	Bool	false	
14	Reserve2	Bool	false	
15	Reserve4	Bool	false	
16	Reserve5	Bool	false	
17	DosingQuantity	Real	0.0	Dosiermenge [μ l]
18	UpperLimit	Real	0.0	Rueckmeldung: Obergrenze [μ l]
19	UpperLimitWarn	Real	0.0	Rueckmeldung: Obergrenze Warnung [μ l]
20	LowerLimitWarn	Real	0.0	Rueckmeldung: Untergrenze Warnung [μ l]
21	LowerLimit	Real	0.0	Rueckmeldung: Untergrenze [μ l]
22	SensorOffset	Real	0.0	Sensor Offset
23	Temp	Real	0.0	Temperatur [$^{\circ}$ C]
24	CorrCoeff	Real	0.0	Rueckmeldung: Linearer Korrekturfaktor
25	MeasTime	UInt	0	Rueckmeldung: Messzeit [ms]
26	ZeroThreshold	UInt	0	Rueckmeldung: Null-Schwelle
27	ADC-Bits	USInt	0	Rueckmeldung: Sensor-Auflösung in Bit (9-16)
28	Reserve6	Byte	16#0	

Figure: Data type "typDP4_STATUS"

12 Warranty

MP GmbH grants a warranty of 12 months of this product from the date of delivery, to the original buyer only.

The installation and use of the Dosing Quantity Tester DP4 have to be according to the specifications published by MP GmbH.

If the Dosing Quantity Tester DP4 is defective, MP GmbH will repair and / or replace this product at its own discretion free of charge for the buyer, provided that:

- MP GmbH will be informed in writing form about the defect within 14 days after delivery.
- it is determined that the defect is because of faulty construction, material or workmanship by MP GmbH.

The defective product will be returned to the MP GmbH factory at the buyer's expense.

This warranty does not apply if the Dosing Quantity Tester DP4 is not installed and used according to the specifications recommended by MP GmbH and not used in intended and proper use.

MP GmbH is only liable for defects of this product that arise under operating conditions, specified in the data sheet and if using the product properly. MP GmbH rejects any warranties if the product is operated or stored out of stated specifications or if the product is used out of intended use.

MP GmbH accepts no liability for application or use of the Dosing Quantity Tester DP4 in a circuit, system, product or machine. MP GmbH rejects any liability, without limitation and including consequential or incidental damage.

All operating parameters have to be validated by customer's technical experts for each customer's applications. Recommended parameters can vary depending on the application.

MP GmbH reserves the right to change the product specifications and / or the information in this document without further notice and to improve the reliability, functions and design of this product.

13 Manufacturer Information

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11. December 2020

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14 EC Declaration of Conformity

According to the Machinery Directive 2006/42/EC, Appendix II, Letter A.

We, the

MP GmbH
Montage- und Prüfsysteme
Zeppelinstr. 31
D - 15370 Fredersdorf / nearby Berlin
Germany

declare in sole responsibility for the product

Model

Dosing Quantity Tester DP4
(Dosiermengenprüfsystem DP4)

Type designation

Dosing Quantity Tester /
Dosiermengenprüfsystem

Serial number

011-2020-XXXX-Y

Year of construction

2020

conformity with following EU directives:

- 2006/42/EC Machinery Directive
- 2014/30/EU EMC - Directive

The documents are created according to Annex VII Part A.

Name: Wolf

First name: Christian

Position: Managing Director

Fredersdorf, 11. December 2020

Place and Date



Signature