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Supplementary document

Liquiline Control CDC90

Fieldbus communication interface

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1 Note

1.1 About this manual

This supplementary document must only be used in conjunction with a field device Liquiline Control CDC90 current output, Modbus TCP, Profibus, Ethernet IP and Profinet.
This supplementary document is an integral part of the Operating Instruction and extends it with additional information for use with current output, Modbus TCP, Profibus, Ethernet IP and Profinet.
Additional information is contained in the Liquiline Control CDC90 user manual.
This document is aimed at individuals who are integrating the device into a current output Modbus TCP, Profibus, Ethernet IP and Profinet network. It is assumed that the reader has fundamental knowledge of current output, Modbus TCP, Profibus, Ethernet IP and Profinet technology.

1.2 Abbreviations

n.a. Not applicable
NaN Not a Number (IEEE-754, 7Fh A0h 00h 00h)
ENP Electronic name plate
AI Analog Input (PA Profile function block)
DI Discrete Input (PA Profile function block)
AO Analog Output (PA Profile function block)
DO Discrete Output (PA Profile function block)

2 Installation and wiring

Installation and wiring is described in the operating instructions of Liquiline Control CDC90.

3 Commissioning

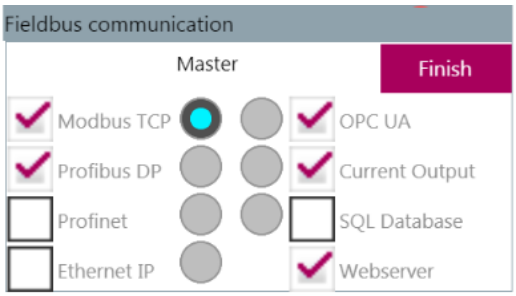
3.1 Note

The device starts when the supply voltage is applied. This process can take up to two minutes depending on the device's configuration. Fieldbus communication with the device is not possible during the start-up process.
When the fieldbus interface is ready for operation, it is signaled by the (blinking green) PWR LED on all connected Ethernet switch ports. This occurs, at the very latest, 30 seconds after the measuring screen has been displayed.

Several fieldbus communications can run simultaneously, but only one is used to send commands to the Liquiline control CDC90.

To activate which fieldbus communication interface is used to send commands and acts as master, navigate to:

Menu/Setup/System settings/Communication/Fieldbus communication



1. Pic. Multiple fieldbus protocols possible, Modbus TCP as master for command interface

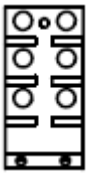
The other fieldbus protocols have only reading rights.

3.2 Reaction delay

The reaction delay is different depending on the direction of the data flow.

3.3 Digital fieldbus to Device

The physical interface to the customer's central control system (PLS or DCS) is the Ethernet switch mounted on the CDC90. The connection on CDC90 side is done via an Ethernet cable with a M12 connector, the other cable end depends on PLS/DCS interface port. It can be RJ45 or M12. Received data is sent without delay to the internal component demanding this data. The internal components have a fixed sampling rate of 3 Hz.



RJ45	Standard cable		Industrial normed cable	M12
2	OR	TxD-	OR	3
1	OR/WH	TxD+	YE	1
6	GN	RxD-	BU	4
3	GN/WH	RxD+	WH	2

2. Pic. Ethernet switch and Cable connector configuration

3.4 Device to digital fieldbus

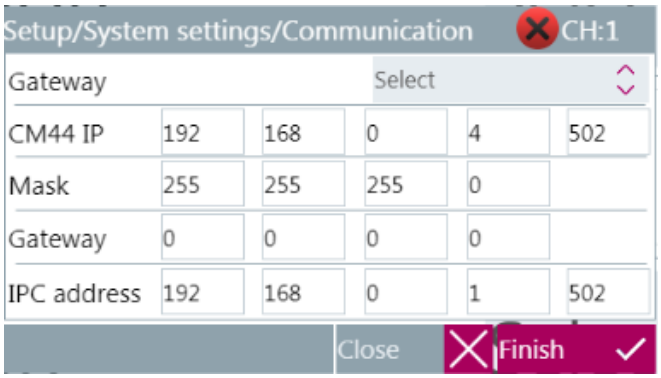
The reaction delay is defined as the time span between the moment a process value assumes a new value and this value is replied to the fieldbus client.

$T_{Reaction\ delay} = T_{1Sensor\ response\ time} + T_{Sensor\ sampling\ time} + T_{Modbus\ response\ time}$

3.5 TCP IP Connectivity

Via the TCP port 502 and a standard IP address 192.168.0.1, you can support up to 3 parallel TCP connections with the device simultaneously. The first master sending a command has the priority.

To change the IP address, navigate to Menu/System setting/Communication/Transmitter connection and change the **IPC IP address**. The IP address (ADDR1 . ADDR2 . ADDR3 . ADDR4) of the transmitter will change automatically to ADDR4 + 3. The IP transmitter address can be changed later. In this case, it is important to adjust the address manually in the transmitter CM44 too.

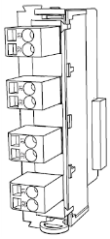


3. Pic. IP address configuration visualization

Changing the transmitter Modbus IO configuration will lead to information loss and software instability. It is recommended to leave any IO configuration (AI, AO, DI and DO of CM44), these connectivities are responsible for the transfer of data between the transmitter and the CDC90 controller such as measurement values, calibration values and pump canister status.

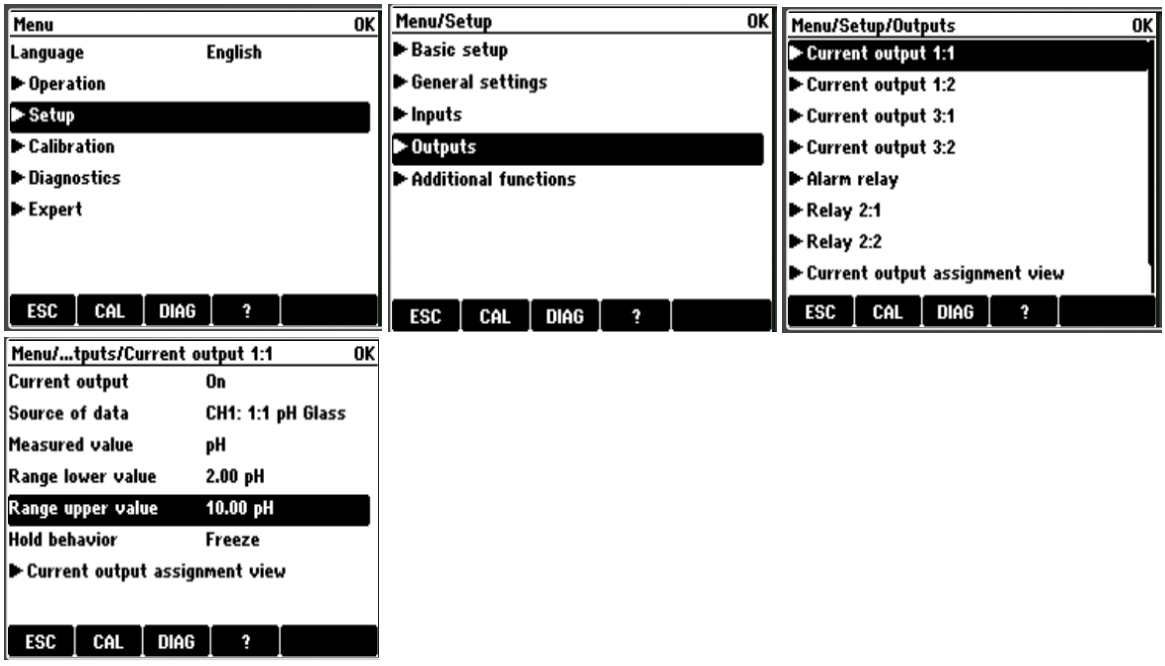
3.6 Analog communication interface

The analog communication is done via the analog input and output reserved in the transmitter. For the transmission of measurement values the 4 AO module is required.



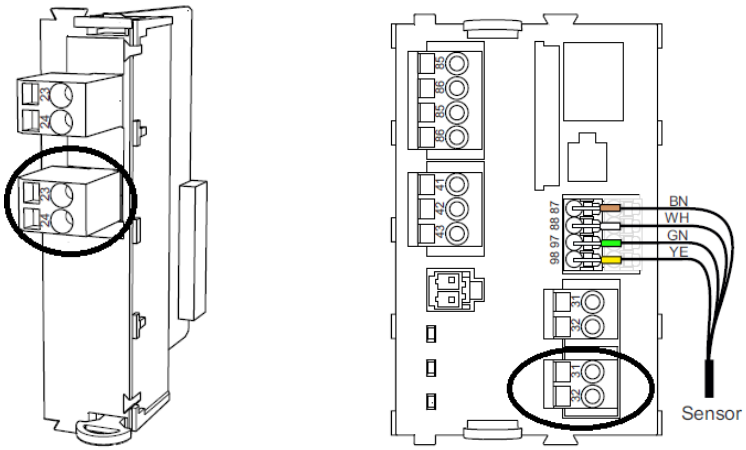
4. Pic. Current output module reserved for measurement values

The configuration of the measurement output interface can be done on transmitter webserver. The default transmitter IP address is 192.168.0.4. Start your browser and enter the transmitter IP address. If a password is required enter as user **admin** and password **admin**. Navigate to Setup/Output and select the outputs 7.1 to 7.4 and follow the displayed configuration requirements.



5. Pic. Example of current output configuration on pH meas. value

To send commands to CDC90, use the second analog input port on the AI module of the transmitter reserved therefore. For status responses from CDC90 the second analog output port of the base module can be used.



Input Output

6. Pic. Analog input port to send commands to CDC90 (left) and analog output port to get status response from CDC90 (right)

4 General procedure

The CDC90 has a fieldbus communication interface. This offers the possibility to start and stop programs, to change the operating mode configuration and to monitor the system such as measurement values, actor state, transmitter and sensors information.

The procedure which can be used to control the system via PLS respectively DCS has for example the following steps:

1. Stop a measurement loop
2. Start a cleaning program (for example **program 1: Cleaning**)
3. Start a verification program (for example verification of buffer 7 and buffer 4: **program 5: 2 Pt verification** or a verification at one point using buffer 4 or buffer 7: program 4: **Valid. Buffer 4** or program 3**: Valid. Buffer 7**)
4. The PLS resp. DCS will compare the calibration data (for example for pH glass sensor: slope, zero point, mV meas. values) with the predefined limit values and decides if an adjustment should be done or not: Per default CDC90 compares the calibration result (Offset, zero point, operating point, slope delta zero point, delta operating point and delta slope) and gives an alarm if the limit value is exceeded. If one of these alarms is detected the system will stop and wait for a command. **The advantage is that the alarm is displayed before adjusting the sensor and not after**.
5. For an **adjustment on site** with the CDC90 control, start the program (for example **program 7: 2 Pt adjustment**). For an adjustment in laboratory set the **operating mode on 5 permanently (maintenance assembly mode) to permit the change of the sensor and run the sensor adjustment in the laboratory.**
6. **Park the sensor** if necessary (if the next measurement loop must not start the next few days) by starting the **program 6: Regeneration** for example. If the sensor is getting old (very long response time after cleaning, for example) regeneration can help to extend the sensor's life.
7. Send the **sensor to measurement position** by starting the **program 9: Meas** if the next measurement must be started**.**

To achieve such a procedure the customer control system should set constantly the parameter "**Enable DCS/PLS**" to 1. This determines that the control system is taking the control of the Liquiline control CDC90 system. If an alarm appears during the verification procedure it is recommended to start a new cleaning procedure via PLS and restart the verification.

The CDC90 stores only successful validation resp. calibration data to the sensors. This procedure is done to avoid warnings or alarms after the sensor adjustment in the process. A verification resp. calibration or sensor adjustment is strongly depending on the calibration result ranges. To define the calibration result ranges, navigate to MENU/SETUP/Settings/Next.

Code example to run a program from a PLS/DCS system

```
General_ProgramNr: BYTE; //Selected program number: Input 1
DCSOperatingMode: BYTE; //Operating mode: Input 2
General_Start: BYTE; //Program start/stop: Input 3
General_Prg_Release_PRG_ERROR: BYTE; //Command when a program error occurred: Input 4
FieldOrDCSContrl: BYTE; // Enable DCS/PLS control: Input 5
SelectChannelNr: BYTE; //Channel selection: Input 6
Program1ReadyForStart: BYTE; //Program ready to run: Output 17
Program1Abort: BYTE; //Program abort: Output 18
OperatingMode: BYTE; //Operating mode: Output 13
ControlStatus: USINT; //0= No program started, 1= Program started
CASE ControlStatus OF
0://Start a program
        IF OperatingMode <> 4 AND OperatingMode <> 5 THEN //(Service mode or Assembly maintenance); The command won't
be accept from the system
                IF Program1ReadyForStart THEN
                        SelectChannelNr:= 1; //For channel 1
                        FieldOrDCSContrl:= 1;
                        DCSOperatingMode:= 3; //PLS DCS mode
                        General_ProgramNr:= xxx; //xxx [1..10] is the program number which should start
                        General_Start:= 1; //Start the program xxx
                END_IF
                IF Program1ReadyForStart = FALSE THEN
                        ControlStatus:= 1;
                END_IF
        END_IF
1://Observe the running program
        General_Start:= 2;//Leave the system to stop program at the last step
        IF Program1Abort THEN//Check for error during the running time
                General_Prg_Release_PRG_ERROR:= .... //What do you want to do:1= Restart last program step; 2= Start next
program step; 3= Stop / Abort program;4= Restart program
                //For a calibration or adjustement program, please set it to 4 (restart program or 3 Stop
        END_IF
        IF Program1ReadyForStart AND ... (other conditions depending of your plant) THEN
                ControlStatus:= 0;
        END_IF
END_CASE
```

5 0/4...20 mA and digital IO command definition

5.1 Current input control

The control of Liquiline Control CDC90 with current (0/4..20 mA) is done by the current input and output interface of the CM44 module installed the transmitter.

Please use the current output 2 on the Base E (CPU of CM44) to read each response of the automation system and use the reserved current input 2 (additional AI module installed pin 23+ 24-) to send the commands from the PLS respectively DCS to control the automation system. Please read the CM44 manual for more information about the current input and output module.

The commands accepted from the Liquiline Control CDC90 are current in mA with a tolerance of **+/-0.2 mA**. The CDC90 starts to analyze each current which stays stable for more than **4 seconds**. The response of each command is sent as current from Liquiline Control CDC90. The following table shows all available commands and responses to control the Liquiline Control CDC90.

System states or warnings such as canister empty, no sensor communication, glass break or calibration error are all summarized in a single error response signal: 22mA. When all commands and procedures are working without error, the response of the CDC90 controller is different to 22 mA. **To get more system states use the external digital output explained in the next chapter**.

In addition the current output module with four outputs is reserved to transfer the measurement values such as pH and temperature. The configuration of these outputs via CM44 webserver or extern display is done as mentioned in chapter 3.6 of this document. Further information on the settings can be found in the CM44 manual. This gives a flexibility to transfer any signals that are important for the customer control system.

The number of outputs for measurement signals is limited to four. The output interface can be configured individually via Webserver. Please read the CM44x manual for more information.

Customer control system Command[mA] +/-0.2mA	Command explanation	CDC90 Answer [mA]	Answer explanation
PLS 0..20mA PLS Config.	**Configuration**		
0	Stop the CDC90 control from PLS, this stops automatically a running program.	0	System stopped
1	Customer control system takes control of CDC90 through current input, no command from field device is accepted	1	PLS control set
2	Select channel resp. meas. point 1 for the configuration; after the answer, this current can be switched to another channel	2	Channel 1 for configuration selected
3	Select channel resp. meas. point 2 for the configuration; after the answer, this current can be switched to another channel	3	Channel 2 for configuration selected
4	Set operating mode to automatic	4	System set to automatic mode
PLS 4..20mA PLS Config.	**Configuration**		
4	Stop the CDC90 control from PLS, this stops automatically a running program. Operating mode is set to Manual mode	4	System stopped
5	Customer control system takes control of CDC90 through current input, no command from field device is accepted	5	PLS control set
6	Select channel resp. meas. point 1 for the configuration; after the answer, this current can be switched to another channel	6	Channel 1 for configuration selected
7	Select channel resp. meas. point 2 for the configuration; after the answer, this current can be switched to another channel	7	Channel 2 for configuration selected

8	Set operating mode to automatic	8	System set to automatic mode
Program execution			
	No program running	4	No program running
11	Run program 1	11	Program 1 is running
12	Run program 2	12	Program 2 is running
13	Run program 3	13	Program 3 is running
14	Run program 4	14	Program 4 is running
15	Run program 5	15	Program 5 is running
16	Run program 6	16	Program 6 is running
17	Run program 7	17	Program 7 is running
18	Run program 8	18	Program 8 is running
19	Run program 9	19	Program 9 is running
20	Run program 10	20	Program 10 is running
		22	Alarm occurred
21	Idle	NONE	The current running program will stop automatically at the end
Command in case of error	**Error handling**		

9	**Restart whole program**
10	**Jump to next program step**

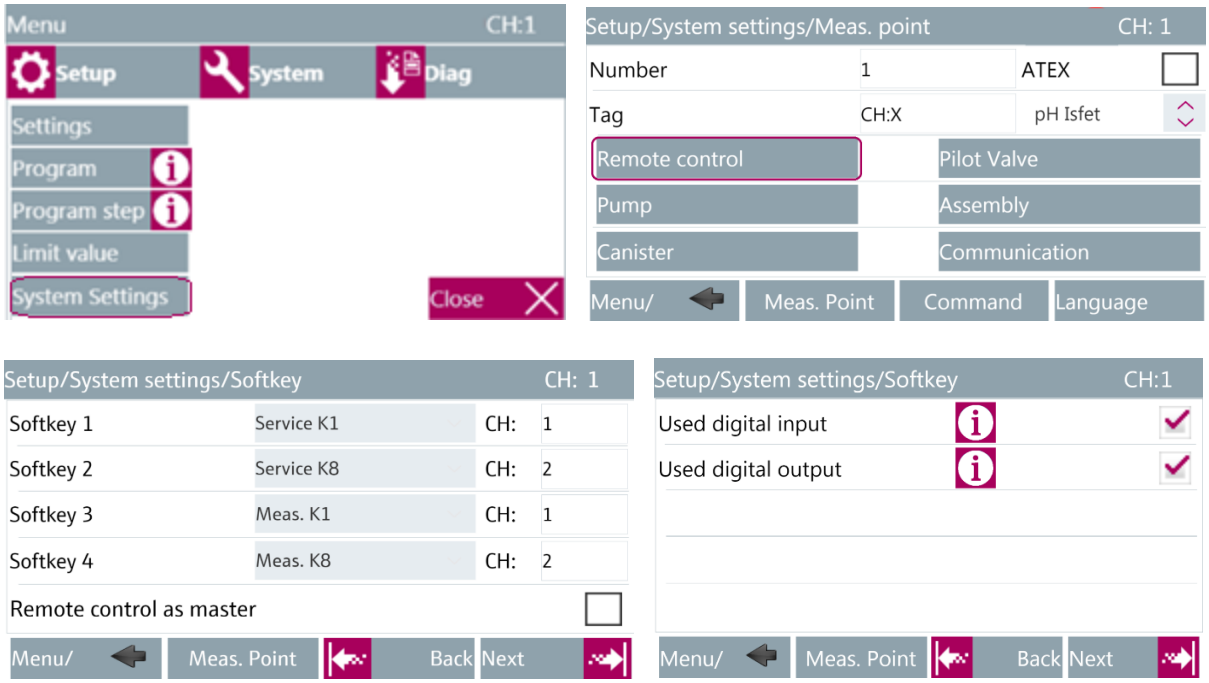
For a multi-channel Liquiline Control CDC90, please use the current 6 mA resp. 2 mA (switch to measurement point 1) and 7 mA resp. 3 mA (switch to measurement point 2) to send commands to control the respective measurement point.

5.2 Digital input control

The CDC90 is equipped with an external remote IO. This can be used to send commands to the CDC90 and receive states related to hardware and programs. To use the digital input and output a setting should be done. Navigate to:

Menu/Setup/System settings/Remote control/Next/Next

Select the checkbox „Used digital input“ to send commands via digital input. Select the checkbox „Used digital output“ to receive system states via digital output.

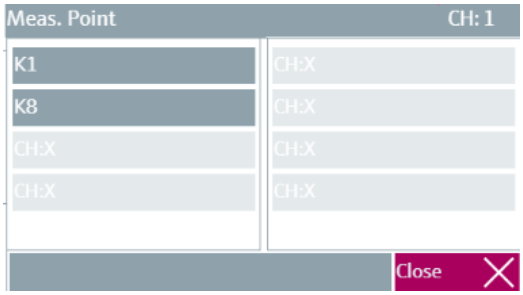


7. Pic. Softkeys resp. digital in and output configuration screens

After selecting the checkbox, the softkeys (1, 2, 3 and 4 from left to right) and the programs assigned to the softkeys are linked to the external digital inputs 13,14,15 and 16. Set the program which should be triggered by pressing the Softkey 1 or by switching on the digital input 13, set the program which should be triggered by pressing the Softkey 2 or by switching on the

digital input 14, set the program which should be triggered by pressing the Softkey 3 or by switching on the digital input 15 and set the program which should be triggered by pressing the Softkey 4 or by switching on the digital input 16. By setting the program you can also set which channel should be selected for executing the program. This feature is suitable for users who do not want to use the touch screen to switch the channel before pressing a Softkey.

For a multi-channel system, the program settings for the softkey should be done for each channel. Press the symbol CH: 1 on top of the screen Setup/System settings/Softkey and select the next channel.



The following table shows the system states sent via digital outputs (13 to 16) of the remote IO.

Digital output	Status	Description
13	Blinking (0 and 24 V)	1. Operating mode of channel 1 is on Service 2. Operating mode of channel 1 is on Maintenance assembly 3. The assembly position of channel 1 is not defined, level switches are defective or the assembly is stuck
13	24 V	Assembly on channel 1 is in measurement position
13	0 V	Assembly on channel 1 is in service position
14	Blinking (0 and 24 V)	1. Operating mode of channel 2 is on Service 2. Operating mode of channel 2 is on Maintenance assembly 3. The assembly position of channel 2 is not defined, level switches are defective or the assembly is stuck
14	24 V	Assembly on channel 2 is in measurement position
14	0 V	Assembly on channel 2 is in service position

15	24 V	A program is running (on channel 1 or 2)
15	0 V	No program is running (on channel 1 and 2)
16	24 V	System failure, warning or assembly on maintenance
16	0 V	No alarm

5.3 Example of procedural configuration with current output

Start **program 9** on measurement point 1 from PLS respectively DCS with current output **0...20 mA**.

Id		Current values [mA] Hold 4 seconds	Description
1	Command	1 mA	Take control of the Liquiline CDC90 from customer control system
	Answer	1 mA	Answer that the command was received and registered
2	Command	2 mA	Switch all commands to control measurement point 1
	Answer	2 mA	Answer that the command was received and registered
3	Command	19 mA	Start program 9
	Answer	19 mA	Answer that the program 9 is running
4	Command	21 mA	The program will stop automatically at the end and **wait for next the command**
	Answer	19 mA	

Start **program 9** on measurement point 2 from PLS respectively DCS with current out **4...20 mA**.

Id		Current values [mA] Hold 4 seconds	Description
1	Command	5 mA	Take control of the Liquiline CDC90 from customer control system
	Answer	5 mA	Answer that the command was received and registered

2	Command	7 mA	Switch all commands to control measurement point 2
	Answer	7 mA	Answer that the command was received and registered
3	Command	19 mA	Start program 9
	Answer	19 mA	Answer that the program 9 is running
4	Command	21 mA	The program will stop automatically at the end and **wait for next the command**
	Answer	19 mA	

Send 21 mA after starting a program to ensure that the program will stop automatically at the end. If this current information is not sent, the program will be repeated continuously and can be stopped manually by sending another current command such as 0 mA, 3 mA or another program trigger.

If an error occurs, the Liquiline Control CDC90 will send a response signal 22 mA. The field device diagnosis interface contains all details about the displayed error.

6 Profibus DP server

The data transfer to a PLS or DCS is done via a gateway (Modbus TCP/ Profibus DP). To connect the customer control system to CDC90, the customer control system must be connected to the gateway first. **For special project, we use different controller which allows a direct connection without gateway**.

8. Pic. Gateway connection with CDC90 Ethernet switch

Please read the installation manual of the gateway enclosed to the Liquiline Control CDC90.

6.1 Setting the device address

For a 1-channel system one gateway is included in the delivery, for a 2-channel system two gateways are included in the delivery.

The default gateway IP address for both gateways is 192.168.0.5. The gateway address is set on the software side and all dip switches are not used. This IP address is for the communication to CDC90 and must not be changed, otherwise the CDC90 will not recognize the gateway.

In a 2-channel system the IP address of the second gateway must be changed to 192.168.0.6 using the dip switches of the Gateway: push the 6th and 7th switch from the left downwards. Do not change the dipswitches of the first gateway. It is also possible to leave the dipswitches in their position and set the IP address with the IP Config software from Anybus.

The default Profibus address for communication to the DCS/PLS is 77. This address needs to be configured according to the network of the customer. To change the address, please read the manual of the gateway.

9. Pic. IP address configuration two channel (CH1: 192.168.0.5 and CH2: 192.168.0.6)

6.2 Configuration of the process data for PROFIBUS

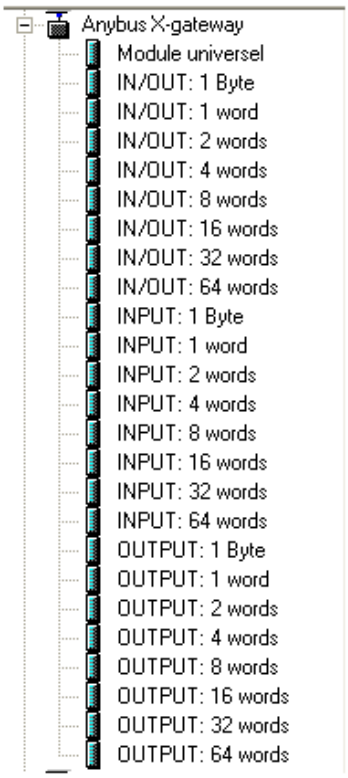
6.2.1 GSD file

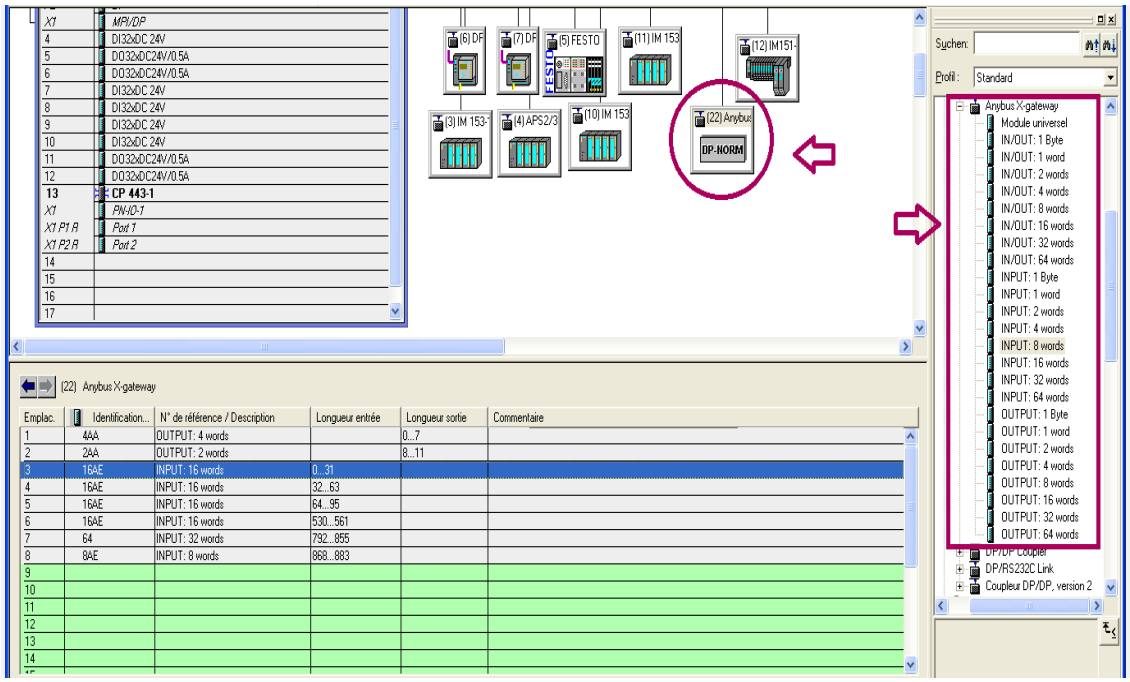
The electronic data sheet (GSD) file can be obtained from the following source:

https://www.endress.com/en/Field-instruments-overview/liquid-analysis-product-overview/pH-sensor-automatic-cleaning-calibration-cdc90

Upload the GSD file "HMSB1831" to the PLS resp. DCS system. Insert data output module (2 words and 4 words) and data input module (8 words, 32 words and 64 words).

For a multichannel system please set the Profibus address of the second gateway as described in the gateway user manual. The default Profibus address of both modules is 77.





1. Pic. Representation of the data container of the gateway on Siemens TIA portal and Simatic

The input and output data modules are mapped on the following chapters.

6.3 Output data modules

The output data modules are used as command parameter, to configure and start programs of the CDC90.

Real and **DWORD** parameters must be swapped on Siemens and Schneider control systems. We consider that a float value is built with the following format bytes AB CD, the swap function results in CD AB. Please note that these two systems are the ones validated from our system integration.

Take control of Liquiline Control CDC90 from PLS resp. DCS means: Permanently set the parameter for PLS control “Enable DCS/PLS” to 1 (see the following description). Only then it is possible to write parameters to the CDC90. During that time, it is not possible to set or configure any parameter from the field device. If this parameter is set back to zero, the CDC90 will stop the running program at its last step. The field device is then free to be configured. The PLS resp. DCS cannot write parameters or control the CDC90 anymore.

Write/Read Parameters	OPC UA Parameter name	Data type	Digital Data	Byte	Address/Slot	Bytes	Unit
Selected program number Range: 1-10	General_ProgramNr	BYTE	WORD	2	1	1, 2	NONE
Operating mode 0 = Manual mode, 1 = Automatic mode, 2 = Stop, 3 = PLS DCS mode, 4 = Service mode, 5 = Assembly maintenance	DCSOperatingMode	BYTE	WORD	2	2	3, 4	NONE
Program start/stop 1= Start selected program 0= Stop program 2= Stop automatically after starting (without closing the connection to PLS)	General_Start	BYTE	WORD	2	3	5, 6	NONE
Command when a program error occurred 1= Restart last program step 2= Start next program step 3= Stop / Abort program 4= Restart program	General_Prg_Release_PRG_ERROR	BYTE	WORD	2	4	7, 8	NONE
Enable DCS/PLS control	FieldOrDCSContrl	BOOL	WORD	2	5	9, 10	NONE
Channel selection 1 or 2	SelectChannelNr	USINT	WORD	2	6	11, 12	NONE

6.4 Data input modules

The data container of this block includes states, alarms, warnings, measurement values, calibration data and device information.

6.4.1 Media control unit alarm parameters

Read Parameters	OPC UA Parameter name	Data type	Digital Data	Byte	Profibus address	Bytes	Unit
Canister 2 nearly empty	CanisterLevel2_1Warning	BOOL	WORD	2	1	1, 2	NONE
Pump 2 active	Pump2On	BOOL	WORD	2	2	3, 4	NONE
Canister 3 nearly empty	CanisterLevel3_1Warning	BOOL	WORD	2	3	5, 6	NONE
Pump 3 active	Pump3On	BOOL	WORD	2	4	7, 8	NONE
Canister 1 nearly empty	CanisterLevel1_1Warning	BOOL	WORD	2	5	9, 10	NONE
Pump 1 active	Pump1On	BOOL	WORD	2	6	11, 12	NONE
Air pressure measured	PressureSwitchAirIn	BOOL	WORD	2	7	13, 14	NONE
Communication error between controller and pilot valve block	CommErrorPilotValveBufferProvider	BOOL	WORD	2	8	15, 16	NONE
Communication error between controller and remote IO	CommErrorRemoteIOBufferProvider	BOOL	WORD	2	9	17, 18	NONE

Canister 2 empty	FeedbackFillLevel2_1_Empty	BOOL	WORD	2	10	19, 20	NONE
Canister 3 empty	FeedbackFillLevel3_1_Empty	BOOL	WORD	2	11	21, 22	NONE
Canister 1 empty	FeedbackFillLevel1_1_Empty	BOOL	WORD	2	12	23, 24	NONE

6.4.2 Program feedback parameters

Read Parameters	OPC UA Parameter name	Data type	Digital Data	Byte	Profibus address	Bytes	Unit
Operating mode 0 = Manual mode, 1 = Automatic mode, 2 = Stop, 3 = PLS DCS mode, 4 = Service mode, 5 = Assembly maintenance	OperatingMode	BYTE	WORD	2	13	25, 26	NONE
Selected program Range: 1-10	SelectedProgramm	BYTE	WORD	2	14	27, 28	NONE
Time left till program step end	CurrentStepTime	INT	WORD	2	15	29, 30	Seconds
Current program step number	Program1CurrentStep	INT	WORD	2	16	31, 32	NONE

Program ready to run	Program1ReadyForStart	BOOL	WORD	2	17	33, 34	NONE
Program abort	Program1Abort	BOOL	WORD	2	18	35, 36	NONE
Program ended	Program1Ended	BOOL	WORD	2	19	37, 38	NONE
Error code during the execution of the program	ErrorNumber	UINT	WORD	2	20	39, 40	NONE

6.4.3 Assembly signals

Read Parameters	OPC UA Parameter name	Data type	Digital Data	Byte	Profibus address	Bytes	Unit
Assembly in service position	AssemblyServicepOsition	BOOL	WORD	2	21	41, 42	NONE
Assembly in meas. Position	AssemblyMeaspOsition	BOOL	WORD	2	22	43, 44	NONE
Provide air pressure	ProvidedPressure	BOOL	WORD	2	23	45, 46	NONE

6.4.4 Transmitter measurement values

Read Parameters	OPC UA Parameter name	Data type	Digital Data	Byte	Profibus address	Bytes	Unit
Alarm transmitter CM42	CM42_ALM_CODE	INT	WORD	2	24	47, 48	NONE

pH value	pHValue	REAL	2xWORD	4	25	49, 50, 51, 52	pH
State pH value Bad = value, Good = 0	pH_State	BYTE	WORD	2	27	53, 54	NONE
mV value	mV_Value	REAL	2xWORD	4	28	55, 56, 57, 58	mV
State mV value Bad = value, Good = 0	mV_State	BYTE	WORD	2	30	59, 60	NONE
Impedance value	GlassImp	REAL	2xWORD	4	31	61, 62, 63, 64	Mega Ohm
State impedance value Bad = value, Good = 0	GlassImp_State	BYTE	WORD	2	33	65, 66	NONE
Temperature value	MeasTemperature	REAL	2xWORD	4	34	67, 68, 69, 70	℃
State temperature value Bad = value, Good = 0	Temperature_State	BYTE	WORD	2	36	71, 72	NONE
Alarm critic Liquiline	Transmitter_Sum_Alm	BOOL	WORD	2	37	73, 74	NONE
Alarm transmitter CM44	Transmitter_Sum_Warn	BOOL	WORD	2	38	75, 76	NONE
Alarm Impedance	Transmitter_GlasAlarm	BOOL	WORD	2	39	77, 78	NONE
Alarm glass	Transmitter_Glasbruch	BOOL	WORD	2	40	79, 80	NONE

6.4.5 Sensor calibration and sensor information

Read Parameters	OPC UA Parameter name	Data type	Digital Data	Byte	Profibus address	Bytes	Unit
Alarm zero point	ZeroPointOutOfRange	BOOL	WORD	2	41	81, 82	NONE
Alarm slope	SlopeOutOfrange	BOOL	WORD	2	42	83, 84	NONE
Alarm delta zero point	DeltaZeroPointOutOfRange	BOOL	WORD	2	43	85, 86	NONE
Alarm delta slope	DeltaSlopeOutOfRange	BOOL	WORD	2	44	87, 88	NONE
pH unstable during calibration	Transmitter_pH_Instabil	BOOL	WORD	2	45	89, 90	NONE
Remote communication error	Transmitter_Remote_Cal_ Abort	BOOL	WORD	2	46	91, 92	NONE
Zero point	ZeroPoint	REAL	2xWORD	4	47	93, 94, 95, 96	pH
Slope	Slope	REAL	2xWORD	4	49	97, 98, 99, 100	pH/mV
Delta Zero point	DeltaZeroPoint	REAL	2xWORD	4	51	101, 102, 103, 104	pH

Delta Slope	DeltaSlope	REAL	2xWORD	4	53	105, 106, 107, 108	pH/mV
Max. meas. Temperature	MaxTemp	REAL	2xWORD	4	55	109, 110, 111, 112s	℃
Operating time sensor	OpHours	REAL	2xWORD	4	57	113, 114, 115, 116	Hours
Number of sensor adjustment	NumCalibration	INT	WORD	2	59	117, 118	NONE
Adjustment type 0 = calibration, 1 = adjustment	ADJ_CAL	BYTE	WORD	2	60	119, 120	NONE
Adjustment date	Adjustement_Date	DATE	DWORD	4	61	121, 122, 123, 124	SINCE 01.01.1970, 00:00; YYYY-MM-DD HH:MM:SS
Adjusted zero point	Adjustement_ZeroPoint	REAL	2xWORD	4	63	125, 126, 127, 128	pH
Adjusted slope	Adjustement_Slope	REAL	2xWORD	4	65	129, 130, 131, 132	pH/mV

pH Meas. Value in buffer 7	Adjustement_pH1	REAL	2xWORD	4	67	133, 134, 135, 136	pH
mV Meas. Value in buffer 7	Adjustement_mV1	REAL	2xWORD	4	69	137, 138, 139, 140	mV
Meas. temperature Value in buffer 7	Adjustement_Temperatur1	REAL	2xWORD	4	71	141, 142, 143, 144	°C
SCS meas. Value 1	Adjustement_SCS1	REAL	2xWORD	4	73	145, 146, 147, 148	Mega Ohm
Response time till stability 1	Adjustement_ResponseTime1	INT	WORD	2	75	149, 150	Seconds
mV value 1 after 30 s	Adjustement_mV_T30_1	REAL	2xWORD	4	76	151, 152 153, 154	Seconds
pH Meas. Value in buffer 4	Adjustement_pH2	REAL	2xWORD	4	78	155, 156, 157, 158	pH
mV Meas. Value in buffer 4	Adjustement_mV2	REAL	2xWORD	4	80	159, 160, 161, 162	mV

Meas. temperature Value in buffer 4	Adjustement_Temperatur2	REAL	2xWORD	4	82	163, 164, 165, 166	°C
SCS meas. Value 2	Adjustement_SCS2	REAL	2xWORD	4	84	167, 168, 169, 170	Mega Ohm
Response time till stability 2	Adjustement_ResponseTime2	INT	WORD	2	86	171, 172	Seconds
mV value 2 after 30 s	Adjustement_mV_T30_2	REAL	2xWORD	4	87	173, 174, 175, 176	Seconds
Operating point	OperatingPoint	REAL	2xWORD	4	89	177, 178, 179, 180	mV
Delta operating point	DeltaOperatingPoint	REAL	2xWORD	4	91	181, 182, 183, 184	mV
Adjusted operating point	Adjustement_OperatingPoint	REAL	2xWORD	4	93	185, 186, 187, 188	mV
Reference impedance 1	Adjustement_RefImpedance1	REAL	2xWORD	4	95	189, 190, 191, 192	MOhm

Reference impedance 2	Adjustement_RefImpedance2	REAL	2xWORD	4	97	193, 194, 195, 196	MOhm
pH Offset	pHOffsetValue	REAL	2xWORD	4	99	197, 198, 199, 200	pH
Offset pH out of limit	pHOffsetOutOfRange	BOOL	WORD	2	101	201, 202	NONE
Operation point out of limit	OperationPointOutOfRange	BOOL	WORD	2	102	203, 204	NONE
Delta Operation point out of limit	DeltaOperationPointOutOfRange	BOOL	WORD	2	103	205, 206	NONE
Temperature offset out of limit	TempOffsetOutOfRange	BOOL	WORD	2	104	207, 208	NONE

6.4.6 Data mapping of the second channel resp. second measurement point

The second measurement point is controlled via a second gateway. The data mapping is the same as described in the chapters above.

For a multichannel system please set the Profibus address of the second gateway as described on the gateway user manual. The default address of both modules is 77.

6.5 Example of procedural configuration with Profibus DP

Run **program 9** on **channel 1** from Profibus DP interface and leave the system to stop it automatically when the program is at the end.

Please pay attention to the settings of the stop/start parameter. The first value is 1 to start a program and 2 to leave the CDC90 to stop it automatically when the program is at the end. This function is integrated to avoid a restart of a program if the customer control system has a delay time.

Write the cyclic addresses as follows:

OPC UA Parameter name	Parameter descriptions	Profibus interface	Address/Slot	Parameter values
General_ProgramNr	**Selected program identification number** 1..10	Out	1	9
DCSOperatingMode	**Operating mode** 0 = Manual mode, 1 = Automatic mode, 2 = Stop, 3 = PLS/DCS control mode, 4 = Service mode 5 = Maintenance mode	Out	2	0
General_Start	**Start/ Stop program**: 1 = Start program 0 = Stop program 2 = CDC90 control stops program at the end	Out	3	1 then 2 when the program is running
General_Prg_Release_PRG_ERROR	**Release error command** 1= Repeat the last program step 2= Start the next program step 3= Abort program and stop all 4= Restart program	Out	4	
FieldOrDCSContrl	**PLS/DCS Control** 0 = Field device free control	Out	5	1

	1 = PLS/DCS control			
SelectChannelNr	**Selected channel resp. meas. Point**	Out	6	1

Run **program 9** on **channel 2** from Profibus DP interface and leave the system to stop it automatically when the program is at the end.

Please pay attention to the settings of the stop/start parameter. The first value is 1 to start a program and 2 to leave the CDC90 to stop it automatically when the program is at the end. This function is integrated to avoid a restart of a program if the customer control system has a delay time.

Write the cyclic addresses as follows:

OPC UA Parameter name	Parameter descriptions	**Profibus interface**	**Address/Slot**	**Parameter values**
General_ProgramNr	**Selected program identification number** 1..10	Out	1	9
DCSOperatingMode	**Operating mode** 0 = Manual mode, 1 = Automatic mode, 2 = Stop, 3 = PLS/DCS control mode, 4 = Service mode 5 = Maintenance mode	Out	2	0

General_Start	**Start/ Stop program**: 1 = Start program 0 = Stop program 2 = CDC90 control stops program at the end	Out	3	1 then 2 when the program is running
General_Prg_Release_PRG_ERROR	**Release error command** 1= Repeat the last program step 2= Start the next program step 3= Abort program and stop all 4= Restart program	Out	4	
FieldOrDCSContrl	**PLS/DCS Control** 0 = Field device free control 1 = PLS/DCS control	Out	5	1
SelectChannelNr	**Selected channel resp. meas. Point**	Out	6	2

A program started from PLS won't stop automatically. It must be stopped from the PLS as soon as the state parameter "Program ended" on input 19 is true. To let the system stop the procedure automatically set the parameter "Program start/stop" to 2 when the procedure has started.

7 Modbus TCP Server

7.1 Functional principle

7.1.1 General

Modbus communication (unicast) uses a simple request-response mechanism.
There are three different scenarios:
If the device (server) receives a valid telegram with a valid request and can reply to it, it replies with a response telegram containing the function code of the request. If the device (server) receives an invalid telegram (e.g. CRC error), it does not reply. The application (client) must carry out an error diagnosis once a specified time (time-out) has elapsed. If the device (server) receives a valid telegram with an invalid request, it replies with a Modbus exception. The application (client) must carry out an error diagnosis.
As with RTU, the data is transmitted in binary format. Address and checksum used in RTU mode are dispensed with. The Modbus ADU is embedded in the TCP/IP telegram Modbus TCP/IP ADU.

MBAP header			**Modbus PDU**		
Transaction number	Protocol attribute	Number of bytes to follow	Address	Function	Data
2 Byte	2 Bytes	2 Bytes	1 Byte	1 Byte	N Bytes
= 0x0000		= N + 2		= 0	

Field	**Length**	**Info**	**Client**	**Server**
Transaction number	2 Byte	Identifies the transaction	Set by the client	Copied from the request into the reply
Protocol attribute	2 Byte		Set by the client	Copied from the request into the reply
Number of bytes to follow	2 Byte	Number of bytes to follow	Set by the client	Set by the server
Address	1 Byte	Identifies a slave that is connected to a serial bus located downstream.	Set by the client	Copied from the request into the reply

		Note The devices in the Liquiline product family do not use the unit identifier. This should always be set to 0.		

7.2 Liquiline Control CDC90 integration via Modbus TCP

The direct connection of CDC90 with customer control system PLS or DCS via Modbus TCP is possible.

7.3 Command holding register data

The holding registers are used to configure and start programs of the CDC90.

Block	Setting	Remark
Type	Holding	
Function codes	03, 16	For Schneider PLS/DCS Write Data; %IW; %MW

Real and **DWORD** parameters must be swapped on Siemens and Schneider control systems. We consider that a float value is built with the following format bytes AB CD, the swap function results in CD BA. Please note that these two systems are the ones validated from our system integration.

Schneider control systems must use the WRITE_DATA function with the code %IW.

Take control of Liquiline Control CDC90 from PLS resp. DCS means: Permanently set the parameter for PLS control “Enable DCS/PLS” to 1 (see the following description). Only then it is possible to write parameters to the CDC90. During that time, it is not possible to set or configure any parameter from the field device. If this parameter is set back to zero, the CDC90 will stop the running program at its last step. The field device is then free to be configured. The PLS resp. DCS cannot write parameters or control the CDC90 anymore.

7.3.1 Program control parameters

Write/Read Parameters	OPC UA Parameter name	Data type	Digital Data	Byte	Modbus TCP Register	Modbus TCP Register	Unit
					Channel 1	Channel 2	
Selected program number Range: 1-10	General_ProgramNr	BYTE	WORD	2	0	200	NONE
Operating mode 0 = Manual mode, 1 = Automatic mode, 2 = Stop, 3 = PLS DCS mode, 4 = Service mode, 5 = Assembly maintenance	DCSOperatingMode	BYTE	WORD	2	1	201	NONE
Program start/stop 1= Start selected program 0= Stop program 2= Stop automatically after starting (without closing the connection to PLS)	General_Start	BYTE	WORD	2	2	202	NONE

Command when a program error occurred 1= Restart last program step 2= Start next program step 3= Stop / Abort program 4= Restart program	General_Prg_Release_PRG_ERROR	BYTE	WORD	2	3	203	NONE
Enable DCS/PLS control	FieldOrDCSContrl	BOOL	WORD	2	4	204	NONE
Channel selection [1..2]	SelectChannelNr	USINT	WORD	2	5	205	NONE

7.3.2 Limit parameters

To set the limit parameters the PLS resp. DCS must set the operating mode on value 3 and the **"Enable DCS/PLS"** control parameter (PLS/DCS mode see chapter above). The parameter combination is as follows:

Parameter	Value
Selected program number	
Operating mode	**3**
Program start/stop	
Command when a program error occurred	
Enable DCS/PLS control	**1**
Channel selection [1..2]	**1**

Write/Read Parameters	OPC UA Parameter name	Data type	Digital Data	Byte	Modbus TCP Register	Modbus TCP Register	Unit
					Channel 1	Channel	
Limit max. offset pH	MaxpHOffset	REAL	2xWORD	4	6	206	pH
Limit max. slope	MaxResultSlope	REAL	2xWORD	4	8	208	pH/mV
Limit min. slope	MinResultSlope	REAL	2xWORD	4	10	210	pH/mV
Limit delta slope	MaxResultDeltaSlope	REAL	2xWORD	4	12	212	pH/mV
Limit max. zero point	MaxResultZeroPt	REAL	2xWORD	4	14	214	pH
Limit min. zero point	MinResultZeroPt	REAL	2xWORD	4	16	216	pH
Limit delta zero point	MaxResultDeltaZeroPt	REAL	2xWORD	4	18	218	pH
Limit max. operation point	MaxResultOperationPt	REAL	2xWORD	4	20	220	pH
Limit min. operation point	MinResultOperationPt	REAL	2xWORD	4	22	222	pH
Limit delta operation point	MaxResultDeltaOperation Pt	REAL	2xWORD	4	24	224	pH
Limit max. offset temperature	MaxTempOffset	REAL	2xWORD	4	26	226	Delta Kelvin
Control limit assembly	TranslationControlSwitch	BOOL	WORD	2	28	228	NONE

Limit number of assembly movements (Warning)	WarnLimitNumOfTranslation	UINT	WORD	2	29	229	NONE
Limit number of assembly movements (Alarm)	AlarmLimitNumOfTranslation	UINT	WORD	2	30	230	NONE
Control limit pump	LimitSwitchCtrl	BOOL	WORD	2	31	231	NONE
Limit max. volume pump (warning)	WarnLimVolPump1	REAL	2xWORD	4	32	232	Liter
Limit max. volume pump (alarm)	AlarmLimVolPump1	REAL	2xWORD	4	34	234	Liter
Limit operating time pump (warning)	WarnOptimePump	REAL	2xWORD	4	36	236	Days
Limit operating time pump (alarm)	AlarmOptimePump	REAL	2xWORD	4	38	238	Days
Control limit canisters	CanLimitSwitchCtrl	BOOL	WORD	2	40	240	NONE
Limit remaining volume canister 1	WarningRestVolumnCan1	REAL	2xWORD	4	41	241	Liter
Limit remaining volume canister 2	WarningRestVolumnCan2	REAL	2xWORD	4	43	243	Liter
Limit remaining volume canister 3	WarningRestVolumnCan3	REAL	2xWORD	4	45	245	Liter
Limit operating time canister 1	OperatingTImeCan1	REAL	2xWORD	4	47	247	Days
Limit operating time canister 2	OperatingTImeCan2	REAL	2xWORD	4	49	249	Days
Limit operating time canister 3	OperatingTImeCan3	REAL	2xWORD	4	51	251	Days

Date time of the system	SetSystemTime	UDINT	DWORD	4	53	253	SINCE 01.01.1970, 00:00; YYYY-MM-DD HH:MM:SS
Control limit of sensor	SensorLimitControlSwitch	BOOL	WORD	2	55	255	NONE
Limit operating time sensor (alarm)	SensorAlarmOpTime	REAL	2xWORD	4	56	256	Days
Limit operating time sensor (warning)	SensorWarningOpTime	REAL	2xWORD	4	58	258	Days
Limit number calibration (warning)	SensorWarningCalibNumber	REAL	2xWORD	4	60	260	Days
Limit number calibration (alarm)	SensorAlarmCalibNumber	REAL	2xWORD	4	62	262	NONE

7.4 Input register data

The data container of this block includes states, alarms, warnings, measurement values, calibration data and device information.

Block	Setting	Remark
Type	Input	

Function condes	04	For Schneider PLS/DCS Write Data; %MW

7.4.1 Media control unit alarm parameters

Read Parameters	OPC UA Parameter name	Data type	Digital Data	Byte	Modbus TCP Register	Modbus TCP Register	Unit
					Channel 1	Channel 2	
Canister 2 nearly empty	CanisterLevel2_1Warning	BOOL	WORD	2	0	200	NONE
Pump 2 active	Pump2On	BOOL	WORD	2	1	201	NONE
Canister 3 nearly empty	CanisterLevel3_1Warning	BOOL	WORD	2	2	202	NONE
Pump 3 active	Pump3On	BOOL	WORD	2	3	203	NONE
Canister 1 nearly empty	CanisterLevel1_1Warning	BOOL	WORD	2	4	204	NONE
Pump 1 active	Pump1On	BOOL	WORD	2	5	205	NONE
Air pressure measured	PressureSwitchAirIn	BOOL	WORD	2	6	206	NONE

Communication error between controller and pilot valve block	CommErrorPilotValveBufferProvider	BOOL	WORD	2	7	207	NONE
Communication error between controller and remote IO	CommErrorRemoteIOBufferProvider	BOOL	WORD	2	8	208	NONE
Canister 2 empty	FeedbackFillLevel2_1_Empty	BOOL	WORD	2	9	209	NONE
Canister 3 empty	FeedbackFillLevel3_1_Empty	BOOL	WORD	2	10	210	NONE
Canister 1 empty	FeedbackFillLevel1_1_Empty	BOOL	WORD	2	11	211	NONE

7.4.2 Program feedback parameters

Read Parameters	OPC UA Parameter name	Data type	Digital Data	Byte	Modbus TCP Register	Modbus TCP Register	Unit
					Channel 1	Channel 2	
Operating mode 0 = Manual mode, 1 = Automatic mode, 2 = Stop, 3 = PLS DCS mode, 4 = Service mode, 5 = Assembly maintenance	OperatingMode	BYTE	WORD	2	12	212	NONE

Selected program Range: 1-10	SelectedProgramm	BYTE	WORD	2	13	213	NONE
Time left till program step end	CurrentStepTime	INT	WORD	2	14	214	Seconds
Current program step number	Program1CurrentStep	INT	WORD	2	15	215	NONE
Program ready to run	Program1ReadyForStart	BOOL	WORD	2	16	216	NONE
Program abort	Program1Abort	BOOL	WORD	2	17	217	NONE
Program ended	Program1Ended	BOOL	WORD	2	18	218	NONE
Error code during the execution of the program	ErrorNumber	UINT	WORD	2	19	219	NONE

7.4.3 Assembly signals

Read Parameters	OPC UA Parameter name	Data type	Digital Data	Byte	Modbus TCP Register	Modbus TCP Register	Unit
					Channel 1	Channel 2	
Assembly in service position	AssemblyServicepOsition	BOOL	WORD	2	20	220	NONE
Assembly in meas. Position	AssemblyMeaspOsition	BOOL	WORD	2	21	221	NONE
Provide air pressure	ProvidedPressure	BOOL	WORD	2	22	222	NONE

7.4.4 Transmitter measurement values

Read Parameters	OPC UA Parameter name	Data type	Digital Data	Byte	Modbus TCP Register	Modbus TCP Register	Unit
					Channel 1	Channel 2	
Alarm transmitter CM42	CM42_ALM_CODE	INT	WORD	2	23	223	NONE
pH value	pHValue	REAL	2xWORD	4	24	224	pH
State pH value Bad = value, Good = 0	pH_State	BYTE	WORD	2	26	226	NONE
mV value	mV_Value	REAL	2xWORD	4	27	227	mV
State mV value Bad = value, Good = 0	mV_State	BYTE	WORD	2	29	229	NONE
Impedance value	GlassImp	REAL	2xWORD	4	30	230	Mega Ohm
State impedance value Bad = value, Good = 0	GlassImp_State	BYTE	WORD	2	32	232	NONE
Temperature value	MeasTemperature	REAL	2xWORD	4	33	233	℃
State temperature value Bad = value, Good = 0	Temperature_State	BYTE	WORD	2	35	235	NONE
Alarm critic transmitter	Transmitter_Sum_Alm	BOOL	WORD	2	36	236	NONE

Warning critic transmitter	Transmitter_Sum_Warn	BOOL	WORD	2	37	237	NONE
Alarm Impedance	Transmitter_GlasAlarm	BOOL	WORD	2	38	238	NONE
Alarm glass	Transmitter_Glasbruch	BOOL	WORD	2	39	239	NONE

7.4.5 Sensor calibration and sensor information

Read Parameters	OPC UA Parameter name	Data type	Digital Data	Byte	Modbus TCP Register	Modbus TCP Register	Unit
Alarm zero point	ZeroPointOutOfRange	BOOL	WORD	2	40	240	NONE
Alarm slope	SlopeOutOfrange	BOOL	WORD	2	41	241	NONE
Alarm delta zero point	DeltaZeroPointOutOfRange	BOOL	WORD	2	42	242	NONE
Alarm delta slope	DeltaSlopeOutOfRange	BOOL	WORD	2	43	243	NONE
pH unstable during calibration	Transmitter_pH_Instabil	BOOL	WORD	2	44	244	NONE
Remote communication error	Transmitter_Remote_Cal_Abort	BOOL	WORD	2	45	245	NONE
Offset pH out of limit	pHOffsetOutOfRange	BOOL	WORD	2	46	246	

Operation point out of limit	OperationPointOutOfRange	BOOL	WORD	2	47	247	
Temperature offset out of limit	TempOffsetOutOfRange	BOOL	WORD	2	48	248	
Zero point	ZeroPoint	REAL	2xWORD	4	49	249	pH
Slope	Slope	REAL	2xWORD	4	51	251	pH/mV
Delta Zero point	DeltaZeroPoint	REAL	2xWORD	4	53	253	pH
Delta Slope	DeltaSlope	REAL	2xWORD	4	55	255	pH/mV
Max. meas. Temperature	MaxTemp	REAL	2xWORD	4	57	257	℃
Operating time sensor	OpHours	REAL	2xWORD	4	59	259	Hours
Operating time sensor > 80 ℃	OpHours80	REAL	2xWORD	4	61	261	Hours
Operating time sensor > 100 ℃	OpHours100	REAL	2xWORD	4	63	263	Hours
Operating time sensor > 300 mV	OpHours300mV	REAL	2xWORD	4	65	265	Hours
Operating time sensor < 300mV	OpHoursMin300mV	REAL	2xWORD	4	67	267	Hours
Number of sensor adjustment	NumCalibration	INT	WORD	2	69	269	NONE

Adjustment type 0 = calibration, 1 = adjustment	ADJ_CAL	BYTE	WORD	2	70	270	NONE
Adjustment date	Adjustement_Date	DATE	DWORD	4	71	271	SINCE 01.01.1970, 00:00; YYYY-MM-DD HH:MM:SS
Adjusted Zero point	Adjustement_ZeroPoint	REAL	2xWORD	4	73	273	pH
Adjusted Slope	Adjustement_Slope	REAL	2xWORD	4	75	275	pH/mV
pH Meas. Value in buffer 7	Adjustement_pH1	REAL	2xWORD	4	77	277	pH
mV Meas. Value in buffer 7	Adjustement_mV1	REAL	2xWORD	4	79	279	mV
Meas. temperature Value in buffer 7	Adjustement_Temperatur1	REAL	2xWORD	4	81	281	℃
SCS meas. Value 1	Adjustement_SCS1	REAL	2xWORD	4	83	283	Mega Ohm
Response time till stability 1	Adjustement_ResponseTime 1	INT	WORD	2	85	285	Seconds
mV value 1 after 30 s	Adjustement_mV_T30_1	REAL	2xWORD	4	86	286	Seconds
pH Meas. Value in buffer 4	Adjustement_pH2	REAL	2xWORD	4	88	288	pH

mV Meas. Value in buffer 4	Adjustement_mV2	REAL	2xWORD	4	90	290	mV
Meas. temperature Value in buffer 4	Adjustement_Temperatur2	REAL	2xWORD	4	92	292	℃
SCS meas. Value 2	Adjustement_SCS2	REAL	2xWORD	4	94	294	Mega Ohm
Response time till stability 2	Adjustement_ResponseTime 2	INT	WORD	2	96	296	Seconds
mV value 2 after 30 s	Adjustement_mV_T30_2	REAL	2xWORD	4	97	297	Seconds
Operating point	OperatingPoint	REAL	2xWORD	4	158	358	mV
Delta operating point	DeltaOperatingPoint	REAL	2xWORD	4	160	360	mV
Adjusted operating point	Adjustement_OperatingPoint	REAL	2xWORD	4	162	362	mV
Reference impedance 1	Adjustement_RefImpedance 1	REAL	2xWORD	4	164	364	MOhm
Reference impedance 2	Adjustement_RefImpedance 2	REAL	2xWORD	4	166	366	MOhm
pH Offset	pHOffsetValue	REAL	2xWORD	4	168	368	pH
Offset pH out of limit	pHOffsetOutOfRange	BOOL	WORD	2	170	370	NONE

Operation point out of limit	OperationPointOutOfRange	BOOL	WORD	2	171	371	NONE
Delta Operation point out of limit	DeltaOperationPointOutOfRange	BOOL	WORD	2	172	372	NONE
Temperature offset out of limit	TempOffsetOutOfRange	BOOL	WORD	2	173	373	NONE

7.4.6 Media control unit and program parameters

Read Parameters	OPC UA Parameter name	Data type	Digital Data	Modbus TCP Register	Modbus TCP Register	Unit
Program step number	Program1CurrentStep	UINT	WORD	99	299	NONE
Operating time canister 1	OperatingTImeCan1	UINT	WORD	100	300	Days
Operating time canister 2	OperatingTImeCan2	UINT	WORD	101	301	Days
Operating time canister 3	OperatingTImeCan3	UINT	WORD	102	302	Days
Remaining volume canister 1	RestVolumCanister1	REAL	2xWORD	103	303	Liter
Remaining volume canister 2	RestVolumCanister2	REAL	2xWORD	105	305	Liter
Remaining volume canister 3	RestVolumCanister3	REAL	2xWORD	107	307	Liter

Changing time canister 1	Canister1changingDate	UDINT	DWORD	109	309	SINCE 01.01.1970, 00:00; YYYY-MM-DD HH:MM:SS
Changing time canister 2	Canister2changingDate	UDINT	DWORD	111	311	SINCE 01.01.1970, 00:00; YYYY-MM-DD HH:MM:SS
Changing time canister 3	Canister3changingDate	UDINT	DWORD	113	313	SINCE 01.01.1970, 00:00; YYYY-MM-DD HH:MM:SS
Number of movement of the assembly	NumberOfAssemblyTranslation	UDINT	DWORD	115	315	NONE
Operating time pump 1	OpTimePump1	REAL	2xWORD	117	317	Days
Operating time pump 2	OpTimePump2	REAL	2xWORD	119	319	Days
Operating time pump 3	OpTimePump3	REAL	2xWORD	121	321	Days
System date time	SetSystemTime	UDINT	DWORD	123	323	SINCE 01.01.1970, 00:00; YYYY-MM-DD HH:MM:SS

7.5 Example of procedural configuration with Modbus TCP Master

Run **program 9** on **channel 1** from Modbus TCP interface and leave the system to stop it automatically when the program is at the end.

Please pay attention to the settings of the stop/start parameter. The first value is 1 to start a program and 2 to leave the CDC90 to stop it automatically when the program is at the end. This function is integrated to avoid a restart of a program if the customer control system has a delay time.

Write the cyclic registers as follows:

OPC UA Parameter name	Parameter descriptions	Data to write: Code FC: 16	Parameter values
General_ProgramNr	**Selected program identification number** 1..10	0	9
DCSOperatingMode	**Operating mode** 0 = Manual mode, 1 = Automatic mode, 2 = Stop, 3 = PLS/DCS control mode, 4 = Service mode 5 = Maintenance mode	1	0

General_Start	**Start/ Stop program**: 1 = Start program 0 = Stop program 2 = CDC90 control stop program at the end	2	1 then 2 when the program started
General_Prg_Release_PRG_ERROR	**Release error command** 1= Repeat the last program step 2= Start the next program step 3= Abort program and stop all 4= Restart program	3	
FieldOrDCSContrl	**PLS/DCS Control** 0 = Field device free control 1 = PLS/DCS control	4	1
SelectChannelNr	**Selected channel resp. meas. Point**	5	1

Run **program 7** on **channel 2** from Modbus TCP interface and leave the system to stop it automatically when the program is at the end.

Please pay attention to the settings of the stop/start parameter. The first value is 1 to start a program and 2 to leave the CDC90 to stop it automatically when the program is at the end. This function is integrated to avoid a restart of a program if the customer control system has a delay time.

Write the cyclic registers as follows:

OPC UA Parameter name	Parameter descriptions	Data to write: Code FC: 16	Parameter values
General_ProgramNr	**Selected program identification number** 1..10	0	7
DCSOperatingMode	**Operating mode** 0 = Manual mode, 1 = Automatic mode, 2 = Stop, 3 = PLS/DCS control mode, 4 = Service mode 5 = Maintenance mode	1	0
General_Start	**Start/ Stop program**: 1 = Start program 0 = Stop program 2 = CDC90 control stop program at the end	2	1 then 2 when the program started
General_Prg_Release_PRG_ERROR	**Release error command** 1= Repeat the last program step 2= Start the next program step 3= Abort program and stop all 4= Restart program	3	

FieldOrDCSContrl	**PLS/DCS Control** 0 = Field device free control 1 = PLS/DCS control	4	1
SelectChannelNr	**Selected channel resp. meas. Point**	5	2

8 Ethernet IP data connection

The direct connection of CDC90 with customer control system PLS or DCS via Ethernet IP is possible.

8.1 Network settings

The network settings can be made via local operation or via the Web server IP-address xxx.xxx.xxx.xxx:8080/cdc90.htm (the default page is 192.168.0.1:8080/CDC90.htm).

8.2 Integration into a control system

8.2.1 EDS file

The electronic data sheet (EDS) file can be obtained from the following source:

https://www.endress.com/en/Field-instruments-overview/liquid-analysis-product-overview/pH-sensor-automatic-cleaning-calibration-cdc90

8.3 Input data

Take control of Liquiline Control CDC90 from PLS resp. DCS means: Permanently set the parameter for PLS control “Enable DCS/PLS” to 1 (see the following description). Only then it is possible to write parameters to the CDC90. During that time, it is not possible to set or configure any parameter from the field device. If this parameter is set back to zero, the CDC90 will stop the running program at its last step. The field device is then free to be configured. The PLS resp. DCS cannot write parameters or control the CDC90 anymore.

8.3.1 Program control parameters

Write/Read Parameters	OPC UA Parameter name	Data type	Digital Data	Byte size	Input data	Bytes	Bytes	Unit
						Channel 1	Channel 2	
Selected program number Range: 1-10	General_ProgramNr	USINT	BYTE	2	1	1	7	NONE
Operating mode 0 = Manual mode, 1 = Automatic mode, 2 = Stop, 3 = PLS DCS mode, 4 = Service mode, 5 = Assembly maintenance	DCSOperatingMode	USINT	BYTE	2	2	2	8	NONE
Program start/stop 1= Start selected program 0= Stop program 2= Stop automatically after starting (without closing the connection to PLS)	General_Start	USINT	BYTE	2	3	3	9	NONE
Command when a program error occurred 1= Restart last program step 2= Start next program step	General_Prg_Release_PRG_ERROR	USINT	BYTE	2	4	4	10	NONE

3= Stop / Abort program 4= Restart program								
Enable DCS/PLS control	FieldOrDCSContrl	BOOL	BYTE	2	5	5	11	NONE
Channel selection [1..2]	SelectChannelNr	USINT	BYTE	2	6	6	12	NONE

8.4 Output data

The data container of this block includes states, alarms, warnings, measurement values, calibration data and device information.

8.4.1 Media control unit alarm parameters

Read Parameters		OPC UA Parameter name	Data type	Digital Data	Byte size	Output	Bytes	Bytes	Unit
							Channel 1	Channel 2	
Pump canister and assembly states		PumpCanisterAssemblyState	WORD	WORD	2	1	1, 2	175, 176	NONE
CanisterLevel2_1Warning	BIT 0								
Pump2On	BIT 1								

CanisterLevel3_1Warning	BIT 2
Pump3On	BIT 3
CanisterLevel1_1Warning	BIT 4
Pump1On	BIT 5
PressureSwitchAirIn	BIT 6
CommErrorPilotValveBufferProvider	BIT 7
CommErrorRemoteIOBufferProvider	BIT 8
FeedbackFillLevel2_1_Empty	BIT 9
FeedbackFillLevel3_1_Empty	BIT 10
FeedbackFillLevel1_1_Empty	BIT 11
AssemblyServicepOsition	BIT 12
AssemblyMeaspOsition	BIT 13
ProvidedPressure	BIT 14

8.4.2 Program feedback parameters

Read Parameters	OPC UA Parameter name	Data type	Digital Data	Byte size	Output	Bytes	Unit

						Channel 1	Channel 2	
Operating mode 0 = Manual mode, 1 = Automatic mode, 2 = Stop, 3 = PLS DCS mode, 4 = Service mode, 5 = Assembly maintenance	OperatingMode	USINT	BYTE	2	2	3	177	NONE
Selected program Range: 1-10	SelectedProgramm	USINT	BYTE	2	3	4	178	NONE
Time left till program step end	CurrentStepTime	INT	WORD	2	4	5, 6	179, 180	Seconds
Current program step number	Program1CurrentStep	INT	WORD	2	5	7, 8	181, 182	NONE
Program ready to run	Program1ReadyForStart	BOOL	BYTE	2	6	9	183	NONE
Program abort	Program1Abort	BOOL	BYTE	2	7	10	184	NONE
Program ended	Program1Ended	BOOL	BYTE	2	8	11	185	NONE
Error code during the execution of the program	ErrorNumber	UINT	WORD	2	9	12, 13	186, 187	NONE

8.4.3 Transmitter measurement values

Read Parameters	OPC UA Parameter name	Data type	Digital Data	Byte size	Output	Bytes	Bytes	Unit
						Channel 1	Channel 2	
Alarm transmitter CM42	CM42_ALM_CODE	INT	WORD	2	10	14, 15	188, 189	NONE
pH value	pHValue	REAL	2xWORD	4	11	16, 17, 18, 19	190, 191, 192, 193	pH
State pH value Bad = value, Good = 0	pH_State	USINT	BYTE	2	12	20	194	NONE
mV value	mV_Value	REAL	2xWORD	4	13	21, 22, 23, 24	195, 196, 197, 198	mV
State mV value Bad = value, Good = 0	mV_State	USINT	BYTE	2	14	25	199	NONE
Impedance value	GlassImp	REAL	2xWORD	4	15	26, 27, 28, 29	200, 201, 202, 203	Mega Ohm
State impedance value Bad = value, Good = 0	GlassImp_State	USINT	BYTE	2	16	30	204	NONE
Temperature value	MeasTemperature	REAL	2xWORD	4	17	31, 32, 33, 34	205, 206, 207, 208	℃

State temperature value Bad = value, Good = 0	Temperature_State	USINT	BYTE	2	18	35	209	NONE

8.4.4 Sensor calibration and sensor information

Read Parameters		OPC UA Parameter name	Data type	Digital Data	Byte size	Output	Bytes		Unit
							Channel 1	Channel 2	
Process parameter monitoring		ProcessParameter OutOfRange	WORD	WORD	2	19	36, 37	210, 211	NONE
Transmitter_Sum_Alm	BIT 0								
Transmitter_Sum_Warn	BIT 1								
Transmitter_GlasAlarm	BIT 2								
Transmitter_Glasbruch	BIT 3								
ZeroPointOutOfRange	BIT 4								
SlopeOutOfrange	BIT 5								
DeltaZeroPointOutOfRange	BIT 6								
DeltaSlopeOutOfRange	BIT 7								
Transmitter_pH_Instabil	BIT 8								

Transmitter_Remote_Cal_Abort BIT 9								
pHOffsetOutOfRange BIT 10								
OperationPointOutOfRange BIT 11								
TempOffsetOutOfRange BIT 12								
pHOffsetOutOfRange BIT 13								
OperationPointOutOfRange BIT 14								
DeltaOperationPointOutOfRange BIT 15								
Zero point	ZeroPoint	REAL	2xWORD	4	20	38, 39, 40, 41	212, 213, 214, 215	pH
Slope	Slope	REAL	2xWORD	4	21	42, 43, 44, 45	216, 217, 218, 219	pH/mV
Delta Zero point	DeltaZeroPoint	REAL	2xWORD	4	22	46, 47, 48, 49	220, 221, 222, 223	pH
Delta Slope	DeltaSlope	REAL	2xWORD	4	23	50, 51, 52, 53	224, 225, 226, 227	pH/mV

Max. meas. Temperature	MaxTemp	REAL	2xWORD	4	24	54, 55, 56, 57	228, 229, 230, 231	℃
Operating time sensor	OpHours	REAL	2xWORD	4	25	58, 59, 60, 61	232, 233, 234, 235	Hours
Number of sensor adjustment	NumCalibration	INT	WORD	2	26	62, 63	236, 237	NONE
Adjustment type 0 = calibration, 1 = adjustment	ADJ_CAL	USINT	BYTE		27	64	238	NONE
Adjustment date	Adjustement_Date	DATE	2xWORD	8	28	65, 66, 67, 68	239, 240, 241, 242	SINCE 01.01.1970, 00:00; YYYY-MM-DD HH:MM:SS
Zero point	Adjustement_Zero Point	REAL	2xWORD	4	29	69, 70, 71, 72	243, 244, 245, 246	pH
Slope	Adjustement_Slope	REAL	2xWORD	4	30	73, 74, 75, 76	247, 248, 249, 250	pH/mV
pH Meas. Value in buffer 7	Adjustement_pH1	REAL	2xWORD	4	31	77, 78, 79, 80	251, 252, 253, 254	pH
mV Meas. Value in buffer 7	Adjustement_mV1	REAL	2xWORD	4	32	81, 82,	255, 256,	mV

						83, 84	257, 258	
Meas. temperature Value in buffer 7	Adjustement_Temperatur1	REAL	2xWORD	4	33	85, 86, 87, 88	259, 260, 261, 262	℃
SCS meas. Value 1	Adjustement_SCS1	REAL	2xWORD	4	34	89, 90, 91, 92	263, 264, 265, 266	Mega Ohm
Response time till stability 1	Adjustement_ResponseTime1	INT	WORD	2	35	93, 94	267, 268	Seconds
mV value 1 after 30 s	Adjustement_mV_T30_1	REAL	2xWORD	4	36	95, 96, 97, 98	269, 270, 271, 272	Seconds
pH Meas. Value in buffer 4	Adjustement_pH2	REAL	2xWORD	4	37	99, 100, 101, 102	273, 274, 275, 276	pH
mV Meas. Value in buffer 4	Adjustement_mV2	REAL	2xWORD	4	38	103, 104, 105, 106	277, 278, 279, 280	mV
Meas. temperature Value in buffer 4	Adjustement_Temperatur2	REAL	2xWORD	4	39	107, 108, 109, 110	281, 282, 283, 284	℃
SCS meas. Value 2	Adjustement_SCS2	REAL	2xWORD	4	40	111, 112, 113, 114	285, 286, 287, 288	Mega Ohm

Response time till stability 2	Adjustement_ResponseTime2	INT	WORD	2	41	115, 116	289, 290	Seconds
mV value 2 after 30 s	Adjustement_mV_T30_2	REAL	2xWORD	4	42	117, 118, 119, 120	291, 292, 293, 294	Seconds
Operating point	OperatingPoint	REAL	2xWORD	4	43	121, 122, 123, 124	295, 296, 297, 298	mV
Delta operating point	DeltaOperatingPoint	REAL	2xWORD	4	44	125, 126, 127, 128	299, 300, 301, 302	mV
Adjusted operating point	Adjustement_OperatingPoint	REAL	2xWORD	4	45	129, 130, 131, 132	303, 304, 305, 306	mV
pH Offset	pHOffsetValue	REAL	2xWORD	4	46	133, 134, 135, 136	307, 308, 309, 310	pH

8.4.5 Media control unit and program parameters

Read Parameters	OPC UA Parameter name	Data type	Digital Data	Byte size	Output	Bytes		Unit
						Channel 1	Channel 2	

Operating time canister 1	OperatingTImeCan1	UINT	WORD	4	47	137, 138	311, 312	Days
Operating time canister 2	OperatingTImeCan2	UINT	WORD	4	48	139, 140	313, 314	Days
Operating time canister 3	OperatingTImeCan3	UINT	WORD	4	49	141, 142	315, 316	Days
Remaining volume canister 1	RestVolumCanister1	REAL	2xWORD	4	50	143, 144, 145, 146	317, 318, 319, 320	Liter
Remaining volume canister 2	RestVolumCanister2	REAL	2xWORD	4	51	147, 148, 149, 150	321, 322, 323, 324	Liter
Remaining volume canister 3	RestVolumCanister3	REAL	2xWORD	4	52	151, 152, 153, 154	325, 326, 327, 328	Liter
Number of movement of the assembly	NumberOfAssemblyTranslation	UDINT	DWORD	4	53	155, 156, 157, 158	329, 330, 331, 332	NONE
Operating time pump 1	OpTimePump1	REAL	2xWORD	4	54	159, 160, 161, 162	333, 334, 335, 336	Days
Operating time pump 2	OpTimePump2	REAL	2xWORD	4	55	163, 164, 165, 166	337, 338, 339, 340	Days
Operating time pump 3	OpTimePump3	REAL	2xWORD	4	56	167, 168, 169, 170	341, 342, 343, 344	Days

System date time	SetSystemTime	UDINT	DWORD	4	57	171, 172, 173, 174	NOT DEFINED	SINCE 01.01. 1970, 00:00; YYYY-MM-DD HH:MM:SS

8.5 Example of procedural configuration with Ethernet IP

Run **program 9** on **channel 1** from Ethernet IP interface and leave the system to stop it automatically when the program is at the end.

Please pay attention to the settings of the stop/start parameter. The first value is 1 to start a program and 2 to leave the CDC90 to stop it automatically when the program is at the end. This function is integrated to avoid a restart of a program if the customer control system has a delay time.

Write the cyclic registers as follows:

OPC UA Parameter name	Parameter descriptions	Input	Parameter values
General_ProgramNr	**Selected program identification number** 1..10	0	9

DCSOperatingMode	**Operating mode** 0 = Manual mode, 1 = Automatic mode, 2 = Stop, 3 = PLS/DCS control mode, 4 = Service mode 5 = Maintenance mode	1	0
General_Start	**Star/ Stop program**: 1 = Start program 0 = Stop program 2 = CDC90 control stop program at the end	2	1 then 2 when the program started
General_Prg_Release_PRG_ERROR	**Release error command** 1= Repeat the last program step 2= Start the next program step 3= Abort program and stop all 4= Restart program	3	
FieldOrDCSContrl	**PLS/DCS Control** 0 = Field device free control 1 = PLS/DCS control	4	1
SelectChannelNr	**Selected channel resp. meas. Point**	5	1

Run **program 10** on **channel 2** from Ethernet IP interface and leave the system to stop it automatically when the program is at the end.

Please pay attention to the settings of the stop/start parameter. The first value is 1 to start a program and 2 to leave the CDC90 to stop it automatically when the program is at the end. This function is integrated to avoid a restart of a program if the customer control system has a delay time.

Write the cyclic registers as follows:

OPC UA Parameter name	Parameter descriptions	Input	Parameter values
General_ProgramNr	**Selected program identification number** 1..10	0	10
DCSOperatingMode	**Operating mode** 0 = Manual mode, 1 = Automatic mode, 2 = Stop, 3 = PLS/DCS control mode, 4 = Service mode 5 = Maintenance mode	1	0
General_Start	**Star/ Stop program**: 1 = Start program 0 = Stop program 2 = CDC90 control stop program at the end	2	1 then 2 when the program started

General_Prg_Release_PRG_ERROR	**Release error command** 1= Repeat the last program step 2= Start the next program step 3= Abort program and stop all 4= Restart program	3	
FieldOrDCSContrl	**PLS/DCS Control** 0 = Field device free control 1 = PLS/DCS control	4	1
SelectChannelNr	**Selected channel resp. meas. Point**	5	2

9 Profinet data connection

The direct connection of CDC90 with customer control system PLS or DCS via Profinet IRT is possible.

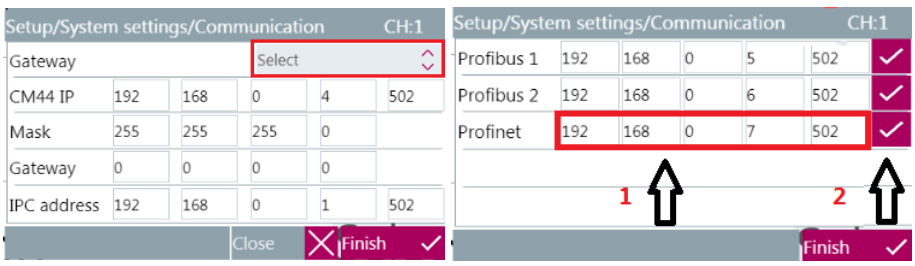
The data transfer to a PLS or DCS for a standard CDC90 is done via a gateway (Modbus TCP/ Profinet IRT). **For special project, we use different controller which allows a direct connection without gateway**. To connect the customer control system to CDC90, the customer control system must be connected to the gateway first. For a one channel and two channel systems only one gateway is necessary and included in the order.

10. Pic. Gateway connection with CDC90 Ethernet switch

Please read the installation manual of the gateway enclosed in the Liquiline Control CDC90.

9.1 Setting the device address

The default Modbus TCP address is 192.168.0.7. To change the device address, please read the manual of the gateway and set the IP address node on CDC90 corresponding to your new gateway IP address. To set the IP address node navigate to: Menu/Setup/System settings/Communication/Transmitter connection/Gateway.



11. Pic. Setting visualization Profinet IRT IP address

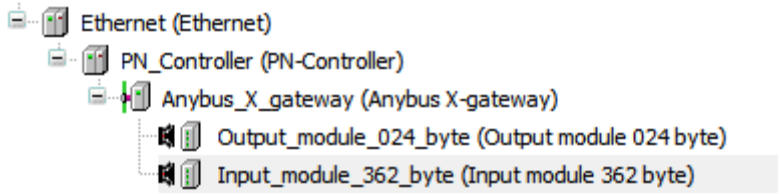
The default gateway IP address for the gateway is 192.168.0.7. The gateway address is set on the software side and all dip switches are not used. This IP address is for the communication to CDC90 and must not be changed, otherwise the CDC90 will not recognize the gateway.

The Profinet IP address must be set according to the manual of the gateway.

12. Pic. None DHCP IP address configuration (CH1: 192.168.0.7)

9.2 Configuration of the process data for PROFINET IRT

Upload the GSDML file "GSDML-V2.3-HMS-ANYBUS_X_GATEWAY_PROFINET_IO-20151023" to the PLS resp. DCS system. Insert data output module (24 Bytes) and data input module (362 Bytes).



13. Pic. Representation of the data container of the gateway on Wago (Codesys)

9.3 Integration into a control system

9.3.1 GSDML file

The electronic data sheet (GSDML) file can be obtained from the following source:

https://www.endress.com/en/Field-instruments-overview/liquid-analysis-product-overview/pH-sensor-automatic-cleaning-calibration-cdc90

9.4 Input data

Take control of Liquiline Control CDC90 from PLS resp. DCS means: Permanently set the parameter for PLS control “Enable DCS/PLS” to 1 (see the following description). Only then it is possible to write parameters to the CDC90. During that time, it is not possible to set or configure any parameter from the field device. If this parameter is set back to zero, the CDC90 will stop the running program at its last step. The field device is then free to be configured. The PLS resp. DCS cannot write parameters or control the CDC90 anymore.

9.4.1 Program control parameters

Write/Read Parameters	OPC UA Parameter name	Data type	Digital Data	Byte size	Input data	Bytes Channel 1	Bytes Channel 2	Unit
Selected program number Range: 1-10	General_ProgramNr	USINT	WORD	2	1	1, 2	13, 14	NONE
Operating mode 0 = Manual mode, 1 = Automatic mode, 2 = Stop, 3 = PLS DCS mode, 4 = Service mode, 5 = Assembly maintenance	DCSOperatingMode	USINT	WORD	2	2	3, 4	15, 16	NONE
Program start/stop 1= Start selected program 0= Stop program 2= Stop automatically after starting (without closing the connection to PLS)	General_Start	USINT	WORD	2	3	5, 6	17, 18	NONE

Command when a program error occurred 1= Restart last program step 2= Start next program step 3= Stop / Abort program 4= Restart program	General_Prg_Release_PRG_ERROR	USINT	WORD	2	4	7, 8	19, 20	NONE
Enable DCS/PLS control	FieldOrDCSContrl	BOOL	WORD	2	5	9, 10	21, 22	NONE
Channel selection [1..2]	SelectChannelNr	USINT	WORD	2	6	11, 12	23, 24	NONE

9.5 Output data

The data container of this block includes states, alarms, warnings, measurement values, calibration data and device information.

9.5.1 Media control unit alarm parameters

Read Parameters	OPC UA Parameter name	Data type	Digital Data	Byte size	Output	Bytes	Bytes	Unit
						Channel 1	Channel 2	
Pump canister and assembly states	PumpCanisterAssemblyState	WORD	WORD	2	1	1, 2	181, 182	NONE
CanisterLevel2_1Warning BIT 0								

Pump2On	BIT 1
CanisterLevel3_1Warning	BIT 2
Pump3On	BIT 3
CanisterLevel1_1Warning	BIT 4
Pump1On	BIT 5
PressureSwitchAirIn	BIT 6
CommErrorPilotValveBufferProvider	BIT 7
CommErrorRemoteIOBufferProvider	BIT 8
FeedbackFillLevel2_1_Empty	BIT 9
FeedbackFillLevel3_1_Empty	BIT 10
FeedbackFillLevel1_1_Empty	BIT 11
AssemblyServicepOsition	BIT 12
AssemblyMeaspOsition	BIT 13
ProvidedPressure	BIT 14

9.5.2 Program feedback parameters

Read Parameters	OPC UA Parameter name	Data type	Digital Data	Byte size	Output	Bytes		Unit
						Channel 1	Channel 2	
Operating mode 0 = Manual mode, 1 = Automatic mode, 2 = Stop, 3 = PLS DCS mode, 4 = Service mode, 5 = Assembly maintenance	OperatingMode	USINT	WORD	2	2	3, 4	183, 184	NONE
Selected program Range: 1-10	SelectedProgramm	USINT	WORD	2	3	5, 6	185, 186	NONE
Time left till program step end	CurrentStepTime	INT	WORD	2	4	7, 8	187, 188	Seconds
Current program step number	Program1CurrentStep	INT	WORD	2	5	9, 10	189, 190	NONE
Program ready to run	Program1ReadyForStart	BOOL	WORD	2	6	11, 12	191, 192	NONE
Program abort	Program1Abort	BOOL	WORD	2	7	13, 14	193, 194	NONE
Program ended	Program1Ended	BOOL	WORD	2	8	15, 16	195, 196	NONE
Error code during the execution of the program	ErrorNumber	UINT	WORD	2	9	17, 18	197, 198	NONE

9.5.3 Transmitter measurement values

Read Parameters	OPC UA Parameter name	Data type	Digital Data	Byte size	Output	Bytes	Bytes	Unit
						Channel 1	Channel 2	
Alarm transmitter CM42	CM42_ALM_CODE	INT	WORD	2	10	19, 20	199, 200	NONE
pH value	pHValue	REAL	2xWORD	4	11	21, 22, 23, 24	201, 202, 203, 204	pH
State pH value Bad = value, Good = 0	pH_State	USINT	WORD	2	12	25, 26	205, 206	NONE
mV value	mV_Value	REAL	2xWORD	4	13	27, 28, 29, 30	207, 208, 209, 210	mV
State mV value Bad = value, Good = 0	mV_State	USINT	WORD	2	14	31, 32	211, 212	NONE
Impedance value	GlassImp	REAL	2xWORD	4	15	33, 34, 35, 36	213, 214, 215, 216	Mega Ohm
State impedance value Bad = value, Good = 0	GlassImp_State	USINT	WORD	2	16	37, 38	217, 218	NONE
Temperature value	MeasTemperature	REAL	2xWORD	4	17	39, 40, 41, 42	219, 220, 221, 222	℃

State temperature value Bad = value, Good = 0	Temperature_State	USINT	WORD	2	18	43, 44	223, 224	NONE

9.5.4 Sensor calibration and sensor information

Read Parameters		OPC UA Parameter name	Data type	Digital Data	Byte size	Output	Bytes		Unit
							Channel 1	Channel 2	
Process parameter monitoring		ProcessParameter OutOfRange	WORD	WORD	2	19	45, 46	225, 226	NONE
Transmitter_Sum_Alm	BIT 0								
Transmitter_Sum_Warn	BIT 1								
Transmitter_GlasAlarm	BIT 2								
Transmitter_Glasbruch	BIT 3								
ZeroPointOutOfRange	BIT 4								
SlopeOutOfrange	BIT 5								
DeltaZeroPointOutOfRange	BIT 6								
DeltaSlopeOutOfRange	BIT 7								
Transmitter_pH_Instabil	BIT 8								

Transmitter_Remote_Cal_Abort BIT 9								
pHOffsetOutOfRange BIT 10								
OperationPointOutOfRange BIT 11								
TempOffsetOutOfRange BIT 12								
pHOffsetOutOfRange BIT 13								
OperationPointOutOfRange BIT 14								
DeltaOperationPointOutOfRange BIT 15								
Zero point	ZeroPoint	REAL	2xWORD	4	20	47, 48, 49, 50	227, 228, 229, 230	pH
Slope	Slope	REAL	2xWORD	4	21	51, 52, 53, 54	231, 232, 233, 234	pH/mV
Delta Zero point	DeltaZeroPoint	REAL	2xWORD	4	22	55, 56, 57, 58	235, 236, 237, 238	pH
Delta Slope	DeltaSlope	REAL	2xWORD	4	23	59, 60, 61, 62	239, 240, 241, 242	pH/mV
Max. meas. Temperature	MaxTemp	REAL	2xWORD	4	24	63, 64,	243, 244,	℃

						65, 66	245, 246	
Operating time sensor	OpHours	REAL	2xWORD	4	25	67, 68, 69, 70	247, 248, 249, 250	Hours
Number of sensor adjustment	NumCalibration	INT	WORD	2	26	71, 72	251, 252	NONE
Adjustment type 0 = calibration, 1 = adjustment	ADJ_CAL	USINT	WORD	2	27	73, 74	253, 254	NONE
Adjustment date	Adjustement_Date	DATE	2xWORD	4	28	75, 76, 77, 78	255, 256, 257, 258	SINCE 01.01.1970, 00:00; YYYY-MM-DD HH:MM:SS
Zero point	Adjustement_Zero Point	REAL	2xWORD	4	29	79, 80, 81, 82	259, 260, 261, 262	pH
Slope	Adjustement_Slop e	REAL	2xWORD	4	30	83, 84, 85, 86	263, 264, 265, 266	pH/mV
pH Meas. Value in buffer 7	Adjustement_pH1	REAL	2xWORD	4	31	87, 88, 89, 90	267, 268, 269, 270	pH
mV Meas. Value in buffer 7	Adjustement_mV1	REAL	2xWORD	4	32	91, 92, 93, 94	271, 272, 273, 274	mV

Meas. temperature Value in buffer 7	Adjustement_Temperatur1	REAL	2xWORD	4	33	95, 96, 97, 98	275, 276, 277, 278	℃
SCS meas. Value 1	Adjustement_SCS1	REAL	2xWORD	4	34	99, 100, 101, 102	279, 280, 281, 282	Mega Ohm
Response time till stability 1	Adjustement_ResponseTime1	INT	WORD	2	35	103, 104	283, 284	Seconds
mV value 1 after 30 s	Adjustement_mV_T30_1	REAL	2xWORD	4	36	105, 106, 107, 108	285, 286, 287, 288	Seconds
pH Meas. Value in buffer 4	Adjustement_pH2	REAL	2xWORD	4	37	109, 110, 111, 112	289, 290, 291, 292	pH
mV Meas. Value in buffer 4	Adjustement_mV2	REAL	2xWORD	4	38	113, 114, 115, 116	293, 294, 295, 296	mV
Meas. temperature Value in buffer 4	Adjustement_Temperatur2	REAL	2xWORD	4	39	117, 118, 119, 120	297, 298, 299, 300	℃
SCS meas. Value 2	Adjustement_SCS2	REAL	2xWORD	4	40	121, 122, 123, 124	301, 302, 303, 304	Mega Ohm
Response time till stability 2	Adjustement_ResponseTime2	INT	WORD	2	41	125, 126	305, 306	Seconds

mV value 2 after 30 s	Adjustement_mV_T30_2	REAL	2xWORD	4	42	127, 128, 129, 130	307, 308, 309, 310	Seconds
Operating point	OperatingPoint	REAL	2xWORD	4	43	131, 132, 133, 134	311, 312, 313, 314	mV
Delta operating point	DeltaOperatingPoint	REAL	2xWORD	4	44	135, 136, 137, 138	315, 316, 317, 318	mV
pH Offset	pHOffsetValue	REAL	2xWORD	4	46	139, 140, 141, 142	319, 320, 321, 322	pH

9.5.5 Media control unit and program parameters

Read Parameters	OPC UA Parameter name	Data type	Digital Data	Byte size	Output	Bytes		Unit
						Channel 1	Channel 2	
Operating time canister 1	OperatingTImeCan1	UINT	WORD	2	47	143, 144	323, 324	Days
Operating time canister 2	OperatingTImeCan2	UINT	WORD	2	48	145, 146	325, 326	Days
Operating time canister 3	OperatingTImeCan3	UINT	WORD	2	49	147, 148	327, 328,	Days

Remaining volume canister 1	RestVolumCanister1	REAL	2xWORD	4	50	149, 150, 151, 152	329, 330, 331, 332	Liter
Remaining volume canister 2	RestVolumCanister2	REAL	2xWORD	4	51	153, 154, 155, 156	333, 334, 335, 336	Liter
Remaining volume canister 3	RestVolumCanister3	REAL	2xWORD	4	52	157, 158, 159, 160	337, 338, 339, 340	Liter
Number of movement of the assembly	NumberOfAssemblyTranslation	UDINT	DWORD	4	53	161, 162, 163, 164	341, 342, 343, 344	NONE
Operating time pump 1	OpTimePump1	REAL	2xWORD	4	54	165, 166, 167, 168	345, 346, 347, 348	Days
Operating time pump 2	OpTimePump2	REAL	2xWORD	4	55	169, 170, 171, 172	349, 350, 351, 352	Days
Operating time pump 3	OpTimePump3	REAL	2xWORD	4	56	173, 174, 175, 176	353, 354, 355, 356	Days

System date time	SetSystemTime	UDINT	DWORD	4	57	177, 178, 179, 180	NOT DEFINED	SINCE 01.01. 1970, 00:00; YYYY-MM-DD HH:MM:SS

9.6 Example of procedural configuration with Profinet IRT

Run **program 9** on **channel 1** from Profinet IRT interface and leave the system to stop it automatically when the program is at the end.

Please pay attention to the settings of the stop/start parameter. The first value is 1 to start a program and 2 to leave the CDC90 to stop it automatically when the program is at the end. This function is integrated to avoid a restart of a program if the customer control system has a delay time.

Write the cyclic registers as follows:

OPC UA Parameter name	Parameter descriptions	Input	Parameter values
General_ProgramNr	**Selected program identification number** 1..10	0	9
DCSOperatingMode	**Operating mode** 0 = Manual mode, 1 = Automatic mode, 2 = Stop, 3 = PLS/DCS control mode, 4 = Service mode 5 = Maintenance mode	1	0
General_Start	**Star/ Stop program**: 1 = Start program 0 = Stop program 2 = CDC90 control stop program at the end	2	1 then 2 when the program started

General_Prg_Release_PRG_ERROR	**Release error command** 1= Repeat the last program step 2= Start the next program step 3= Abort program and stop all 4= Restart program	3	
FieldOrDCSContrl	**PLS/DCS Control** 0 = Field device free control 1 = PLS/DCS control	4	1
SelectChannelNr	**Selected channel resp. meas. Point**	5	1

Run **program 9** on **channel 2** from Profinet IRT interface and leave the system to stop it automatically when the program is at the end.

Please pay attention to the settings of the stop/start parameter. The first value is 1 to start a program and 2 to leave the CDC90 to stop it automatically when the program is at the end. This function is integrated to avoid a restart of a program if the customer control system has a delay time.

Write the cyclic registers as follows:

OPC UA Parameter name	Parameter descriptions	Input	Parameter values
General_ProgramNr	**Selected program identification number** 1..10	0	9

DCSOperatingMode	**Operating mode** 0 = Manual mode, 1 = Automatic mode, 2 = Stop, 3 = PLS/DCS control mode, 4 = Service mode 5 = Maintenance mode	1	0
General_Start	**Star/ Stop program**: 1 = Start program 0 = Stop program 2 = CDC90 control stop program at the end	2	1 then 2 when the program started
General_Prg_Release_PRG_ERROR	**Release error command** 1= Repeat the last program step 2= Start the next program step 3= Abort program and stop all 4= Restart program	3	
FieldOrDCSContrl	**PLS/DCS Control** 0 = Field device free control 1 = PLS/DCS control	4	1
SelectChannelNr	**Selected channel resp. meas. Point**	5	2

10 OPC UA Connection and data

The standard IP address of the CDC90 controller is 192.168.0.1. The OPC UA connection is done by choosing the server **OPC.tcp://192.168.0.1:4840/CODESYS_OPC_UA_Server**. The data structure transfer is defined as follows:

Take control of Liquiline Control CDC90 from PLS resp. DCS means: Permanently set the parameter for PLS control "Enable DCS/PLS" to 1 (see the following description). Only then it is possible to write parameters to the CDC90. During that time, it is not possible to set or configure any parameter from the field device. If this parameter is set back to zero, the CDC90 will stop the running program at its last step. The field device is then free to be configured. The PLS resp. DCS cannot write parameters or control the CDC90 anymore.

10.1 Read/Write data

10.1.1 Program control parameters

Write/Read Parameters	OPC UA Parameter name	Data type	Unit
Selected program number Range: 1-10	General_ProgramNr	BYTE	NONE
Operating mode 0 = Manual mode, 1 = Automatic mode, 2 = Stop, 3 = PLS DCS mode, 4 = Service mode, 5 = Assembly maintenance	DCSOperatingMode	BYTE	NONE
Program start/stop 1= Start selected program 0= Stop program 2= Stop automatically after starting (without closing the connection to PLS)	General_Start	BYTE	NONE
Command when a program error occurred 1= Restart last program step 2= Start next program step 3= Stop / Abort program 4= Restart program	General_Prg_Release_PRG_ERROR	BYTE	NONE

Enable DCS/PLS control	FieldOrDCSContrl	BOOL	NONE
Channel selection [1..2]	SelectChannelNr	USINT	NONE

10.1.2 Limit parameters

To set the limit parameters the PLS resp. DCS must set the operating mode on value 3 and the **"Enable DCS/PLS"** control parameter (PLS/DCS mode see chapter above). The parameter combination is as follows:

Parameter	**Value**
Selected program number	
Operating mode	**3**
Program start/stop	
Command when a program error occurred	
Enable DCS/PLS control	**1**
Channel selection [1..2]	**1**

Write/Read Parameters	**OPC UA Parameter name**	**Data type**	**Unit**
Limit max. offset pH	MaxpHOffset	REAL	pH
Limit max. slope	MaxResultSlope	REAL	pH/mV
Limit min. slope	MinResultSlope	REAL	pH/mV
Limit delta slope	MaxResultDeltaSlope	REAL	pH/mV
Limit max. zero point	MaxResultZeroPt	REAL	pH
Limit min. zero point	MinResultZeroPt	REAL	pH
Limit delta zero point	MaxResultDeltaZeroPt	REAL	pH
Limit max. operation point	MaxResultOperationPt	REAL	pH

Limit min. operation point	MinResultOperationPt	REAL	pH
Limit delta operation point	MaxResultDeltaOperationPt	REAL	pH
Limit max. offset temperature	MaxTempOffset	REAL	Delta Kelvin
Control limit assembly	TranslationControlSwitch	BOOL	NONE
Limit number of assembly movements (Warning)	WarnLimitNumOfTranslation	UINT	NONE
Limit number of assembly movements (Alarm)	AlarmLimitNumOfTranslation	UINT	NONE
Control limit pump	LimitSwitchCtrl	BOOL	NONE
Limit max. volume pump (warning)	WarnLimVolPump1	REAL	Liter
Limit max. volume pump (alarm)	AlarmLimVolPump1	REAL	Liter
Limit operating time pump (warning)	WarnOptimePump	REAL	Days
Limit operating time pump (alarm)	AlarmOptimePump	REAL	Days
Control limit canisters	CanLimitSwitchCtrl	BOOL	NONE
Limit remaining volume canister 1	WarningRestVolumnCan1	REAL	Liter
Limit remaining volume canister 2	WarningRestVolumnCan2	REAL	Liter
Limit remaining volume canister 3	WarningRestVolumnCan3	REAL	Liter
Limit operating time canister 1	OperatingTImeCan1	REAL	Days
Limit operating time canister 2	OperatingTImeCan2	REAL	Days
Limit operating time canister 3	OperatingTImeCan3	REAL	Days
Date time of the system	SetSystemTime	UDINT	SINCE 01.01.1970, 00:00; YYYY-MM-DD HH:MM:SS
Control limit of sensor	SensorLimitControlSwitch	BOOL	NONE
Limit operating time sensor (alarm)	SensorAlarmOpTime	REAL	Days
Limit operating time sensor (warning)	SensorWarningOpTime	REAL	Days

Limit number calibration (warning)	SensorWarningCalibNumber	REAL	Days
Limit number calibration (alarm)	SensorAlarmCalibNumber	REAL	NONE

10.2 Read only data

The data container of this block includes states, alarms, warnings, measurement values, calibration data and device information.

10.2.1 Media control unit alarm parameters

Read Parameters	OPC UA Parameter name	Data type	Unit
Canister 2 nearly empty	CanisterLevel2_1Warning	BOOL	NONE
Pump 2 active	Pump2On	BOOL	NONE
Canister 3 nearly empty	CanisterLevel3_1Warning	BOOL	NONE
Pump 3 active	Pump3On	BOOL	NONE
Canister 1 nearly empty	CanisterLevel1_1Warning	BOOL	NONE
Pump 1 active	Pump1On	BOOL	NONE
Air pressure measured	PressureSwitchAirIn	BOOL	NONE
Communication error between controller and pilot valve block	CommErrorPilotValveBufferProvider	BOOL	NONE
Communication error between controller and remote IO	CommErrorRemoteIOBufferProvider	BOOL	NONE
Canister 2 empty	FeedbackFillLevel2_1_Empty	BOOL	NONE
Canister 3 empty	FeedbackFillLevel3_1_Empty	BOOL	NONE
Canister 1 empty	FeedbackFillLevel1_1_Empty	BOOL	NONE

10.2.2 Program feedback parameters

Read Parameters	OPC UA Parameter name	Data type	Unit
Operating mode 0 = Manual mode, 1 = Automatic mode, 2 = Stop, 3 = PLS DCS mode, 4 = Service mode, 5 = Assembly maintenance	OperatingMode	BYTE	NONE
Selected program Range: 1-10	SelectedProgramm	BYTE	NONE
Time left till program step end	CurrentStepTime	INT	Seconds
Current program step number	Program1CurrentStep	INT	NONE
Program ready to run	Program1ReadyForStart	BOOL	NONE
Program abort	Program1Abort	BOOL	NONE
Program ended	Program1Ended	BOOL	NONE
Error code during the execution of the program	ErrorNumber	UINT	NONE

10.2.3 Assembly signals

Read Parameters	OPC UA Parameter name	Data type	Unit
Assembly in service position	AssemblyServicepOsition	BOOL	NONE
Assembly in meas. Position	AssemblyMeaspOsition	BOOL	NONE
Provide air pressure	ProvidedPressure	BOOL	NONE

10.2.4 Transmitter measurement values

Read Parameters	OPC UA Parameter name	Data type	Unit

Alarm transmitter CM42	CM42_ALM_CODE	INT	NONE
pH value	pHValue	REAL	pH
State pH value Bad = value, Good = 0	pH_State	BYTE	NONE
mV value	mV_Value	REAL	mV
State mV value Bad = value, Good = 0	mV_State	BYTE	NONE
Impedance value	GlassImp	REAL	Mega Ohm
State impedance value Bad = value, Good = 0	GlassImp_State	BYTE	NONE
Temperature value	MeasTemperature	REAL	℃
State temperature value Bad = value, Good = 0	Temperature_State	BYTE	NONE
Alarm critic Liquiline	Transmitter_Sum_Alm	BOOL	NONE
Alarm transmitter CM44	Transmitter_Sum_Warn	BOOL	NONE
Alarm Impedance	Transmitter_GlasAlarm	BOOL	NONE
Alarm glass	Transmitter_Glasbruch	BOOL	NONE
Alarm zero point	ZeroPointOutOfRange	BOOL	NONE
Alarm slope	SlopeOutOfrange	BOOL	NONE
Alarm delta zero point	DeltaZeroPointOutOfRange	BOOL	NONE
Alarm delta slope	DeltaSlopeOutOfRange	BOOL	NONE

10.2.5 Sensor calibration and sensor information

Read Parameters	OPC UA Parameter name	Data type	Unit
pH unstable during calibration	Transmitter_pH_Instabil	BOOL	NONE

Remote communication error	Transmitter_Remote_Cal_ Abort	BOOL	NONE
Offset pH out of limit	pHOffsetOutOfRange	BOOL	
Operation point out of limit	OperationPointOutOfRange	BOOL	
Temperature offset out of limit	TempOffsetOutOfRange	BOOL	
Zero point	ZeroPoint	REAL	pH
Slope	Slope	REAL	pH/mV
Delta Zero point	DeltaZeroPoint	REAL	pH
Delta Slope	DeltaSlope	REAL	pH/mV
Max. meas. Temperature	MaxTemp	REAL	°C
Operating time sensor	OpHours	REAL	Hours
Operating time sensor > 80 °C	OpHours80	REAL	Hours
Operating time sensor > 100 °C	OpHours100	REAL	Hours
Operating time sensor > 300 mV	OpHours300mV	REAL	Hours
Operating time sensor < 300mV	OpHoursMin300mV	REAL	Hours
Number of sensor adjustment	NumCalibration	INT	NONE
Adjustment type 0 = calibration, 1 = adjustment	ADJ_CAL	BYTE	NONE
Adjustment date	Adjustement_Date	DATE	SINCE 01.01.1970 , 00:00; YYYY-MM-DD HH:MM:SS
Zero point	Adjustement_ZeroPoint	REAL	pH
Slope	Adjustement_Slope	REAL	pH/mV
pH Meas. Value in buffer 4	Adjustement_pH1	REAL	pH
mV Meas. Value in buffer 4	Adjustement_mV1	REAL	mV
Meas. temperature Value in buffer 4	Adjustement_Temperatur1	REAL	°C

SCS meas. Value	Adjustement_SCS1	REAL	Mega Ohm
Response time till stability	Adjustement_ResponseTime1	INT	Seconds
mV value after 30 s	Adjustement_mV_T30_1	REAL	Seconds
pH Meas. Value in buffer 7	Adjustement_pH2	REAL	pH
mV Meas. Value in buffer 7	Adjustement_mV2	REAL	mV
Meas. temperature Value in buffer 7	Adjustement_Temperatur2	REAL	℃
SCS meas. Value	Adjustement_SCS2	REAL	Mega Ohm
Response time till stability	Adjustement_ResponseTime2	INT	Seconds
mV value after 30 s	Adjustement_mV_T30_2	REAL	Seconds

10.2.6 Media control unit and program parameters

Read Parameters	OPC UA Parameter name	Data type	Unit
Program step number	Program1CurrentStep	UINT	NONE
Operating time canister 1	OperatingTImeCan1	UINT	Days
Operating time canister 2	OperatingTImeCan2	UINT	Days
Operating time canister 3	OperatingTImeCan3	UINT	Days
Remaining volume canister 1	RestVolumCanister1	REAL	Liter
Remaining volume canister 2	RestVolumCanister2	REAL	Liter
Remaining volume canister 3	RestVolumCanister3	REAL	Liter

Changing time canister 1	Canister1changingDate	UDINT	SINCE 01.01.1970, 00:00; YYYY-MM-DD HH:MM:SS
Changing time canister 2	Canister2changingDate	UDINT	SINCE 01.01.1970, 00:00; YYYY-MM-DD HH:MM:SS
Changing time canister 3	Canister3changingDate	UDINT	SINCE 01.01.1970, 00:00; YYYY-MM-DD HH:MM:SS
Number of movement of the assembly	NumberOfAssemblyTranslation	UDINT	NONE
Operating time pump 1	OpTimePump1	UINT	Days
Operating time pump 2	OpTimePump2	UINT	Days
Operating time pump 3	OpTimePump3	UINT	Days
System date time	SetSystemTime	UDINT	SINCE 01.01.1970, 00:00; YYYY-MM-DD HH:MM:SS

10.2.7 Data mapping of the second channel resp. second measurement point

The list of data above is an array of data [1..8]. The data of the first measurement point is the data with the array index 1 and the data of the second measurement point has the array index 2.

10.3 Example of procedural configuration with OPC UA

Run **program 9** on **channel 1** from OPC UA interface and leave the system to stop it automatically when the program is at the end.

Please pay attention to the settings of the stop/start parameter. The first value is 1 to start a program and 2 to leave the CDC90 to stop it automatically when the program is at the end. This function is integrated to avoid a restart of a program if the customer control system has a delay time.

Write the cyclic registers as followed:

OPC UA Parameter name	Parameter descriptions	Parameter values
General_ProgramNr	**Selected program identification number**	9

	1..10	
DCSOperatingMode	**Operating mode** 0 = Manual mode, 1 = Automatic mode, 2 = Stop, 3 = PLS/DCS control mode, 4 = Service mode 5 = Maintenance mode	0
General_Start	**Star/ Stop program**: 1 = Start program 0 = Stop program 2 = CDC90 control stop program at the end	1 then 2 when the program started
General_Prg_Release_PRG_ERROR	**Release error command** 1= Repeat the last program step 2= Start the next program step 3= Abort program and stop all 4= Restart program	
FieldOrDCSContrl	**PLS/DCS Control** 0 = Field device free control 1 = PLS/DCS control	1
SelectChannelNr	**Selected channel**	1

Run **program 5** on **channel 2** from OPC UA interface and leave the system to stop it automatically when the program is at the end.

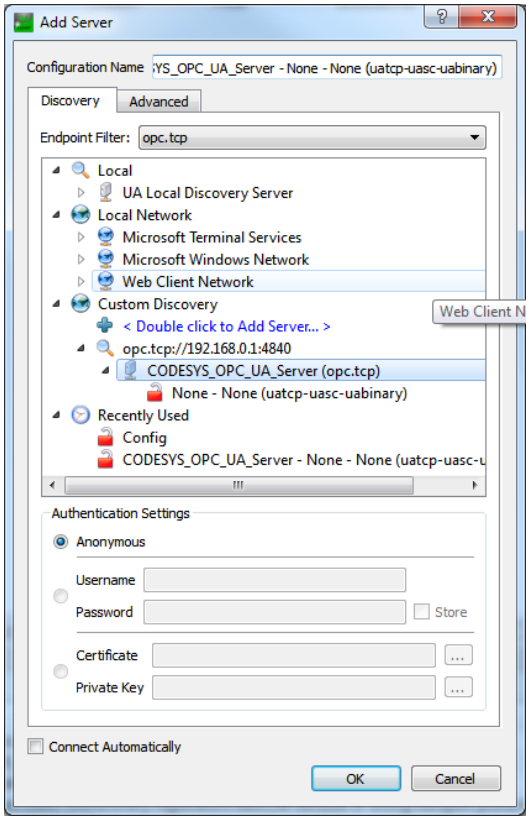
Please pay attention to the settings of the stop/start parameter. The first value is 1 to start a program and 2 to leave the CDC90 to stop it automatically when the program is at the end. This function is integrated to avoid a restart of a program if the customer control system has a delay time.

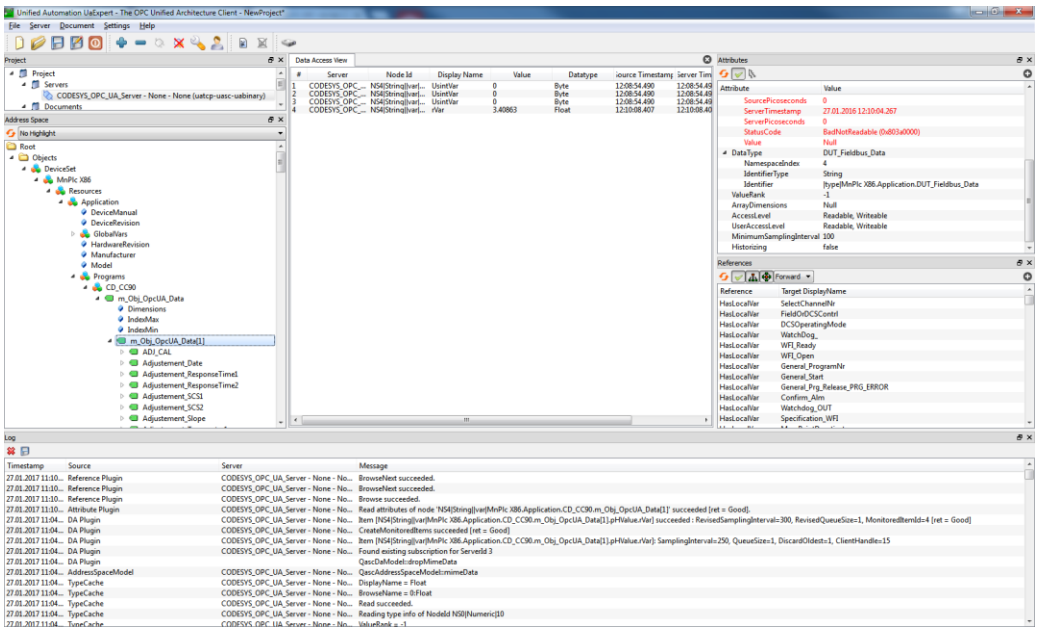
Write the cyclic registers as followed:

OPC UA Parameter name	Parameter descriptions	Parameter values
General_ProgramNr	**Selected program identification number** 1..10	5
DCSOperatingMode	**Operating mode** 0 = Manual mode, 1 = Automatic mode, 2 = Stop, 3 = PLS/DCS control mode, 4 = Service mode 5 = Maintenance mode	0
General_Start	**Star/ Stop program**: 1 = Start program 0 = Stop program 2 = CDC90 control stop program at the end	1 then 2 when the program started
General_Prg_Release_PRG_ERROR	**Release error command** 1= Repeat the last program step 2= Start the next program step 3= Abort program and stop all 4= Restart program	

FieldOrDCSContrl	**PLS/DCS Control** 0 = Field device free control 1 = PLS/DCS control	1
SelectChannelNr	**Selected channel**	2

Example with automation UaExpress:





11 Default possible program

11.1 Cleaning and flush programs

11.1.1 Cleaning and flush program with sensor staying in service position

Cleaning program: Sensor stays in service position

Steps	Time till next step	Remark
Service position	5	
Water	60	
Air	5	
Cleaner	4	Must be adapted to installation
Wait	120	
Water	60	
End	3	The sensor stays in service position

Cleaning program with back pressure: Sensor stays in service position

Steps	Time till next step	Remark
Water	5	
H2O + Service Pos.	60	
Air	5	
Cleaner	4	Must be adapted to installation
Wait	120	

Water	60	
End	3	The sensor stays in service position

Flush program: Sensor stays in service position

Steps	Time till next step	Remark
Service position	5	
Water	40	
Wait	2	
Water	60	Must be adapted to application properties
Air	5	
Water	10	
End	3	The sensor stays in service position

Flush program with back pressure: Sensor stays in service position

Steps	Time till next step	Remark
Water	5	
H2O + Service Pos.	60	
Water	40	
Wait	2	
Water	60	Must be adapted to application properties

Air	5	
Water	10	
End	3	The sensor stays in service position

11.1.2 Cleaning and flush program with sensor back to measurement position

Cleaning program: Sensor back in meas. position

Steps	Time till next step	Remark
Service position	5	
Water	60	
Air	5	
Cleaner	4	Must be adapted to installation
Wait	120	
Water	30	
Wait	3	
Measure position	5	
End	3	The sensor back goes back to meas. position

Cleaning program with back pressure: Sensor back to meas. position

Steps	Time till next step	Remark
Water	5	

H2O + Service Pos.	60	
Air	5	
Cleaner	4	Must be adapted to installation
Wait	120	
Water	60	
H2O + Meas. Pos.	5	
End	3	The sensor goes back to meas. position

Flush program: Sensor back to meas. position

Steps	Time till next step	Remark
Service Pos.	5	
Water	60	
Air	5	
Water	10	
Meas. Pos.	5	
End	3	The sensor goes back to meas. position

Flush program with back pressure: Sensor back to meas. position

Steps	Time till next step	Remark

Water	5	
H2O + Service Pos.	5	
Water	40	
Wait	2	
Water	60	Must be adapted to application properties
Air	5	
Water	10	
H2O + Meas. Pos.	5	
End	3	The sensor stays in service position

11.1.3 Flush or cleaning programs for application with short and fixed meas. interval

Flush program: Sensor stays in service position

Steps	Time till next step	Remark
Measure position	5	
Wait	600	Adjust the time depending on the meas. cycle
Service position	5	
Water	40	
Wait	2	
Water	60	
Air	5	

Water	10	
End	3	The sensor stays in service position

Flush program with back pressure: Sensor stays in service position

Steps	Time till next step	Remark
Water	10	
H2O + Meas. Pos.	5	
Wait	600	Adjust the time depending on the meas. cycle
Water	10	
H2O + Service p.	5	
Water	40	
Wait	2	
Water	60	
Air	5	
Water	10	
End	3	The sensor stays in service position

Cleaning program: Sensor stays in service position

Steps	Time till next step	Remark

Measure position	5	
Wait	600	Adjust the time depending on the meas. cycle
Service position	5	
Water	60	
Air	5	
Cleaner	4	Must be adapted to installation
Wait	120	
Water	30	
Wait	3	
End	3	The sensor stays in service position

Cleaning program with back pressure: Sensor stays in service. Position

Steps	Time till next step	Remark
Water	10	
H2O + Meas. Pos.	5	
Wait	600	Adjust the time depending on the meas. cycle
Water	5	

H2O + Service Pos.	60	
Air	5	
Cleaner	4	Must be adapted to installation
Wait	120	
Water	60	
End	3	The sensor stays in service position

11.1.4 Flush and cleaning programs for application with long and fixed interval

See chapter 11.1.1 (Program with assembly staying in a defined position)

11.2 Programs pH glass and pH Isfet calibration

11.2.1 Validation buffer 1 program with sensor staying in service position

Validation buffer 1 program with back pressure: Sensor stays in service position

Steps	Time till next step	Remark
Water	30	
H2O + Service Pos.	60	
Init. calibration	0	
Start 1 Pt. cal pH	0	
Cleaner	4	
Wait	120	
Air	5	
Cleaning end	0	
Buffer pH 7	4	
Wait	300	
Buffer 1 end	0	
Meas. E+H 7.00 PH	0	
cal calculation	0	
Init. calibration	0	
Water	60	
End	3	

Validation buffer 1: Sensor stays in service position

Steps	Time till next step	Remark
Service position	5	
Water	30	
Init. calibration	0	
Start 1 Pt. cal pH	0	
Cleaner	4	
Wait	120	
Air	5	
Cleaning end	0	
Buffer pH 7	4	
Wait	300	
Buffer 1 end	0	
Meas. E+H 7.00 PH	0	
cal calculation	0	
Init. calibration	0	
Water	30	
End	3	

11.2.2 Validation buffer 1 program with sensor back to measurement position

Validation buffer 1 program: Sensor back in meas. position

Steps	Time till next step	Remark
Service position	5	

Water	30
Init. calibration	0
Start 1 Pt. cal pH	0
Cleaner	4
Wait	120
Air	5
Cleaning end	0
Buffer pH 7	4
Wait	300
Buffer 1 end	0
Meas. E+H 7.00 PH	0
cal calculation	0
Init. calibration	0
Water	30
Wait	3
Measure position	5
End	3

Validation buffer 1 program with back pressure: Sensor back in meas. position

Steps	Time till next step	Remark
Water	30	

H2O + Service Pos.	60
Init. calibration	0
Start 1 Pt. cal pH	0
Cleaner	4
Wait	120
Air	5
Cleaning end	0
Buffer pH 7	4
Wait	300
Buffer 1 end	0
Meas. E+H 7.00 PH	0
cal calculation	0
Init. calibration	0
Water	60
H20 + Meas. Pos.	5
End	3

11.2.3 Validation buffer 2 program with sensor staying in service position

Validation buffer 2 program with back pressure: Sensor stays in service position

Steps	Time till next step	Remark
Water	30	
H2O + Service Pos.	60	

Init. calibration	0
Start 1 Pt. cal pH	0
Cleaner	4
Wait	120
Air	5
Cleaning end	0
Buffer pH 4	3
Wait	300
Buffer 1 end	0
Meas. E+H 4.00 PH	0
cal calculation	0
Init. calibration	0
Water	60
End	3

Validation buffer 2: Sensor stays in service position

Steps	Time till next step	Remark
Service position	5	
Init. calibration	0	
Start 1 Pt. cal pH	0	
Cleaner	4	
Wait	120	

Air	5
Cleaning end	0
Buffer pH 4	3
Wait	300
Buffer 1 end	0
Meas. E+H 4.00 PH	0
cal calculation	0
Init. calibration	0
Water	60
End	3

11.2.4 Validation buffer 2 program with sensor back to measurement position

Validation buffer 2 program: Sensor back in meas. position

Steps	Time till next step	Remark
Service position	5	
Water	3	
Init. calibration	0	
Start 1 Pt. cal pH	0	
Cleaner	4	
Wait	120	
Air	5	
Cleaning end	0	

Buffer pH 4	3
Wait	300
Buffer 2 end	0
Meas. E+H 4.00 PH	0
cal calculation	0
Init. calibration	0
Water	30
Wait	3
Measure position	5
End	3

Validation buffer 2 program with back pressure: Sensor back in meas. position		
Steps	Time till next step	Remark
Water	30	
H2O + Service Pos.	60	
Init. calibration	0	
Start 1 Pt. cal pH	0	
Cleaner	4	
Wait	120	
Air	5	
Cleaning end	0	

Buffer pH 4	3
Wait	300
Buffer 1 end	0
Meas. E+H 4.00 PH	0
cal calculation	0
Init. calibration	0
Water	60
H20 + Meas. Pos.	5
End	3

11.2.5 2 Pt verification program with sensor staying in service position

2 Pt verification program with back pressure: Sensor stays in service position

Steps	Time till next step	Remark
Water	3	
H2O + Service Pos.	30	
fInit. calibration	0	
Start 2 Pt. cal pH	0	
Cleaner	4	
Wait	120	
Water	60	
Air	5	
Cleaning end	0	

Buffer pH 7	4
Wait	300
Buffer 1 end	0
Meas. E+H 7.00 PH	0
Water	60
Air	5
End	3
Cleaning end	0
Buffer pH 4	4
Wait	300
Buffer 2 end	0
Meas. E+H 4.00 PH	0
cal calculation	0
Init. calibration	0
Water	60
End	3

2 Pt verification program: Sensor stays in service position

Steps	Time till next step	Remark
Service position	5	
Water	3	

Init. calibration	0
Start 2 Pt. cal pH	0
Cleaner	4
Wait	120
Water	60
Air	5
Cleaning end	0
Buffer pH 7	4
Wait	300
Buffer 1 end	0
Meas. E+H 7.00 PH	0
Water	60
Air	5
End	3
Cleaning end	0
Buffer pH 4	4
Wait	300
Buffer 2 end	0
Meas. E+H 4.00 PH	0
cal calculation	0
Init. calibration	0

Water	60
End	3

11.2.6 2 Pt verification program with sensor back to measurement position

2 Pt verification program with back pressure: Sensor back to meas. position

Steps	Time till next step	Remark
Water	3	
H2O + Service Pos.	30	
Init. calibration	0	
Start 2 Pt. cal pH	0	
Cleaner	4	
Wait	120	
Water	60	
Air	5	
Cleaning end	0	
Buffer pH 7	4	
Wait	300	
Buffer 1 end	0	
Meas. E+H 7.00 PH	0	
Water	60	
Air	5	
End	3	

Cleaning end	0
Buffer pH 4	4
Wait	300
Buffer 2 end	0
Meas. E+H 4.00 PH	0
cal calculation	0
Init. calibration	0
Water	60
H2O + Meas. Pos.	5
End	3

2 Pt verification program: Sensor back to meas. position

Steps	Time till next step	Remark
Service position	5	
Water	3	
Init. calibration	0	
Start 2 Pt. cal pH	0	
Cleaner	4	
Wait	120	
Water	60	
Air	5	
Cleaning end	0	

Buffer pH 7	4
Wait	300
Buffer 1 end	0
Meas. E+H 7.00 PH	0
Water	60
Air	5
End	3
Cleaning end	0
Buffer pH 4	4
Wait	300
Buffer 2 end	0
Meas. E+H 4.00 PH	0
cal calculation	0
Init. calibration	0
Water	30
Wait	3
Measure position	5
End	3

11.2.7 2 Pt adjustment program with sensor staying in service position

2 Pt adjustment program with back pressure: Sensor stays in service position

Steps	Time till next step	Remark
Water	3	
H2O + Service Pos.	30	
Init. calibration	0	
Start 2 Pt. cal pH	0	
Cleaner	4	
Wait	120	
Water	60	
Air	5	
Cleaning end	0	
Buffer pH 7	4	
Wait	300	
Buffer 1 end	0	
Meas. E+H 7.00 PH	0	
Water	60	
Air	5	
End	3	
Cleaning end	0	
Buffer pH 4	4	
Wait	300	

Buffer 2 end	0
Meas. E+H 4.00 PH	0
cal calculation	0
Adjust sensor	0
Close calib.	0
Water	60
End	3

2 Pt adjustment program: Sensor stays in service position

Steps	Time till next step	Remark
Service position	5	
Water	60	
Init. calibration	0	
Start 2 Pt. cal pH	0	
Cleaner	4	
Wait	120	
Water	60	
Air	5	
Cleaning end	0	
Buffer pH 7	4	
Wait	300	
Buffer 1 end	0	

Meas. E+H 7.00 PH	0
Water	60
Air	5
End	3
Cleaning end	0
Buffer pH 4	4
Wait	300
Buffer 2 end	0
Meas. E+H 4.00 PH	0
cal calculation	0
Adjust sensor	0
Close calib.	0
Water	60
End	3

11.2.8 2 Pt adjustment program with sensor back to measurement position

2 Pt adjustment program with back pressure: Sensor back to meas. position

Steps	Time till next step	Remark
Water	3	
H2O + Service Pos.	30	
Init. calibration	0	

Start 2 Pt. cal pH	0
Cleaner	4
Wait	120
Water	60
Air	5
Cleaning end	0
Buffer pH 7	4
Wait	300
Buffer 1 end	0
Meas. E+H 7.00 PH	0
Water	60
Air	5
End	3
Cleaning end	0
Buffer pH 4	4
Wait	300
Buffer 2 end	0
Meas. E+H 4.00 PH	0
cal calculation	0
Adjust sensor	0
Close calib.	0

Water	60
H2O + Meas. Pos.	5
End	3

2 Pt adjustment program: Sensor back to meas. position		
Steps	Time till next step	Remark
Service position	5	
Init. calibration	0	
Start 2 Pt. cal pH	0	
Cleaner	4	
Wait	120	
Water	60	
Air	5	
Cleaning end	0	
Buffer pH 7	4	
Wait	300	
Buffer 1 end	0	
Meas. E+H 7.00 PH	0	
Water	60	
Air	5	
End	3	
Cleaning end	0	
Buffer pH 4	4	

Wait	300
Buffer 2 end	0
Meas. E+H 4.00 PH	0
cal calculation	0
Adjust sensor	0
Close calib.	0
Water	30
Wait	3
Measure position	5
End	3

11.3 Parking and regeneration pH glass and pH Isfet

Regeneration program

Steps	Time till next step	Remark
Service position	5	
Cleaning	-	Time depending on cleaning program: Program 1
Buffer pH 7	4	
End	3	

Regeneration program with back pressure

Steps	Time till next step	Remark
Water	5	
H2O + Service Pos.	5	
Cleaning	-	Time depending on cleaning program: Program 1
Buffer pH 7	4	
End	3	

11.4 Programs pH ORP calibration

220 mV Validation with back pressure: Sensor stays in service. position

Steps	Time till next step	Remark
Water	5	
H2O + Service Pos.	60	
Init. calibration	0	
Start 1 Pt. cal ORP	0	
Cleaner	4	
Wait	120	
Air	5	
Cleaning end	0	

Pump 2 Buffer 1	4
Wait	300
Buffer 1 end	0
Meas. E+H 220 mV	0
cal calculation	0
Init. calibration	0
Water	60
End	3

220 mV Validation with back pressure: Sensor stays in meas. position

Steps	Time till next step	Remark
Water	5	
H2O + Service Pos.	60	
Init. calibration	0	
Start 1 Pt. cal ORP	0	
Cleaner	4	
Wait	120	
Air	5	
Cleaning end	0	
Pump 2 Buffer 1	4	
Wait	300	

Buffer 1 end	0
Meas. E+H 220 mV	0
cal calculation	0
Init. calibration	0
Water	60
H2O + Meas. Pos.	5
End	3

220 mV Validation: Sensor stays in service. position

Steps	Time till next step	Remark
Service position	5	
Water	60	
Init. calibration	0	
Start 1 Pt. cal ORP	0	
Cleaner	4	
Wait	120	
Air	5	
Cleaning end	0	
Pump 2 Buffer 1	4	
Wait	300	
Buffer 1 end	0	
Meas. E+H 220 mV	0	

cal calculation	0
Init. calibration	0
Water	60
End	3

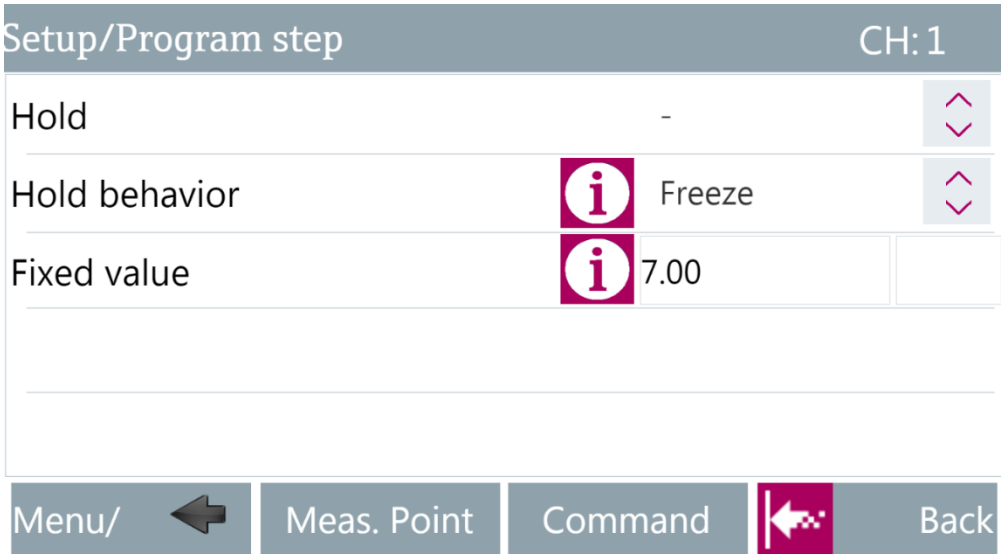
220 mV Validation: Sensor stays in meas. position

Steps	Time till next step	Remark
Service position	5	
Water	60	
Init. calibration	0	
Start 1 Pt. cal ORP	0	
Cleaner	4	
Wait	120	
Air	5	
Cleaning end	0	
Pump 2 Buffer 1	4	
Wait	300	
Buffer 1 end	0	
Meas. E+H 220 mV	0	
cal calculation	0	
Init. calibration	0	
Water	60	

Wait	3
Measure position	5
End	3

11.5 Program with Hold function

Every program step can contain the hold functionality. The setting is done on the program step setting visualization. Navigate to Menu/Setup/Program step (NEXT/NEXT). Two default sequences HOLD ON and HOLD OFF are already saved in the system and can be used as steps at any position in the program.



14. Pic. Hold configuration view

Cleaning program with back pressure: Sensor stays in service.

Position

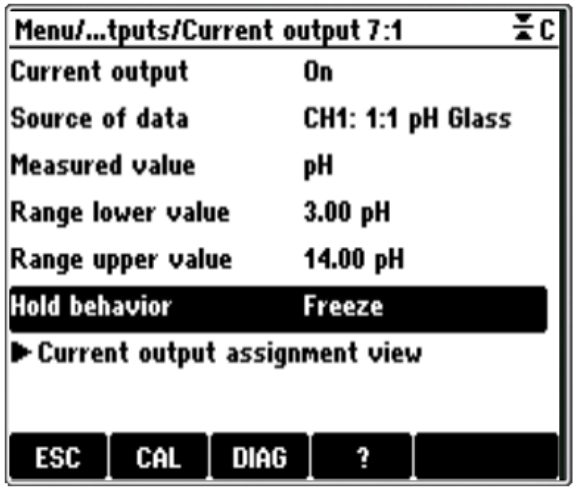
Steps	Time till next step	Remark
Hold ON		
Water	5	
H2O + Service Pos.	60	
Air	5	

Cleaner	4	Must be adapted to installation
Wait	120	
Water	60	
End	3	The sensor stays in service position

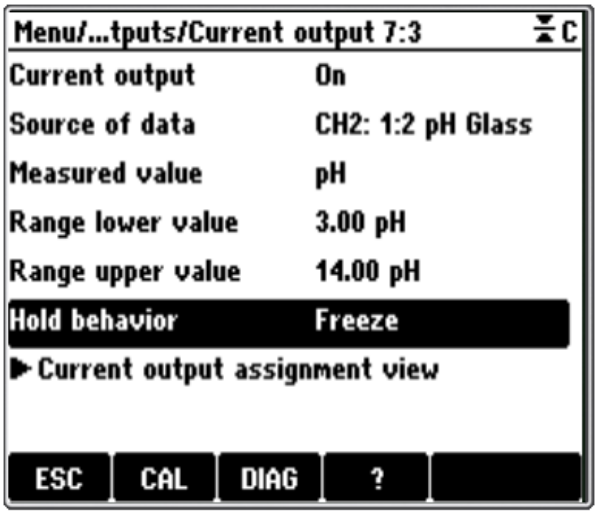
Cleaning program: Sensor back in meas. position

Steps	Time till next step	Remark
Hold ON	2	
Service position	5	
Water	60	
Air	5	
Cleaner	4	Must be adapted to installation
Wait	120	
Water	30	
Wait	3	
Measure position	5	
Hold OFF	2	
End	3	The sensor back goes back to meas. position

The Hold parameters “Hold behavior” and “Hold fixed value” of the HOLD step are defined only for digital Fieldbus communication. For analog communication please set the Hold behavior on CM44 (follow the pictures below). The steps HOLD ON and HOLD OFF must also be inserted in the program for analog communication.



(First Sensor) current output setting



(Second Sensor) current output setting