

HART

Field Communication with Liquisys M CXM 223 / 253

Operating Instructions

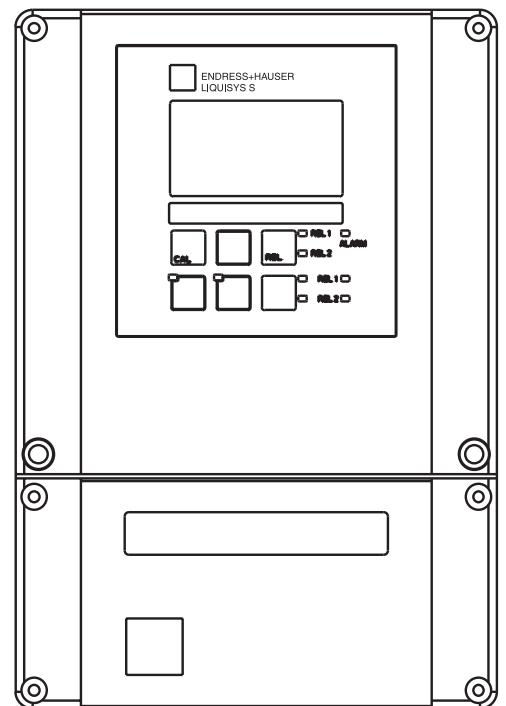
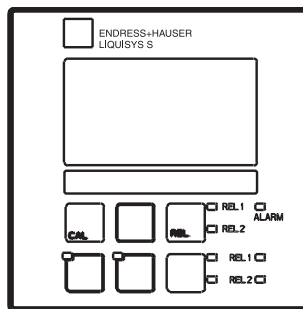


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1 Safety instructions

1.1 Notes on safety conventions and icons

General safety instructions



Warning!

This symbol alerts you to hazards which could cause serious injuries as well as damage to the instrument if ignored.



Caution!

This symbol alerts you to possible faults which could arise from incorrect operation. They could cause damage to the instrument if ignored.



Note!

This symbol indicates important items of information.

Electrical symbols



DC voltage

A terminal at which DC voltage is applied or through which DC flows.



AC voltage

A terminal at which (sine-form) AC voltage is applied or through which AC flows.



Ground connection

A grounded terminal, which, from the user's point of view, is already grounded using a ground system.



Protective earth terminal

A terminal which must be grounded before other connections may be set up.



Equipotential connection

A connection which must be connected to the grounding system of the equipment. This can be, for example, a potential matching line of a star-shaped grounding system, depending on national or company practice.



Double insulation

The equipment is protected with double insulation.



Alarm relay



Input



Output

1.2 Designated use

These Operating Instructions were specially designed for use with transmitters from the Liquisys M CXM 223 / 253 family. They contain specific information on instruments equipped with the HART® interface (**H**ighway **A**dressable **R**emote **T**ransducer). The HART® interface allows the device to be operated via the handheld terminal DXR 275 or, using the operating programme Commuwin II, at a PC by means of a HART® modem, e.g. Commubox FXA 191.

Any other use than the one described here compromises the safety of persons and the entire measuring system and is therefore not permitted.

The manufacturer is not liable for damage caused by improper or non-designated use.

1.3 Installation, Commissioning, Operation

Please note the following items:

- Installation, electrical connection, commissioning, operation and maintenance of the measuring system must only be carried out by trained technical personnel. The technical personnel must be authorised for the specified activities by the system operator.
- Technical personnel must have read and understood these Operating Instructions and must adhere to them.
- Before commissioning the entire measuring point, check all the connections for correctness. Ensure that electrical cables and hose connections are not damaged.
- Do not operate damaged products and secure them against unintentional commissioning.
- Measuring point faults may only be rectified by authorised and specially trained personnel.
- If faults can not be rectified, the products must be moved from service and secured against unintentional commissioning.
- Repairs not described in these Operating Instructions may only be carried out at the manufacturer's or by the Endress+Hauser service organisation.

1.4 Operational safety

The transmitter has been designed and tested according to the state of the art and left the factory in perfect functioning order.

Relevant regulations and European standards have been met.

As the user, you are responsible for complying with the following safety conditions:

- Installation instructions
- Local standards and regulations

2 Identification

2.1 Device designation

2.1.1 Nameplate

		ENDRESS+HAUSER		Made in Germany	
		LIQUISYS M pH / Redox		D-70839 Gerlingen	
order code	CPM 253-PS1515				
serial no.	276944	codes	-	3472 / 8732	
meas. range pH	0 ... 14	+/-1500 mV			
temperature	-50 ... 150°C				
output 1	0/4 ... 20 mA	output 2	0/4 ... 20 mA		
mains	230 VAC		50/60 Hz	7.5 VA	
prot. class	IP 65	ambient temp.	-10 ... +55°C		
				131085-4D	

Fig. 1: Example of a nameplate of the Liquisys M CXM 223 / 253 transmitter with HART® communication.

Identify your device using the product structure in the standard Operating Instructions for the device, (s. chap. 2.2).

2.2 Scope of delivery

Check the scope of delivery using your order and the delivery documents for:

- Completeness
- Instrument type and version acc. to the nameplate, (s. chap. 2.1.1)
- Accessories, (s. chap. 9)
- Standard Operating Instructions BA 193C/07/en (CLM), BA 194C/07/en (CPM), BA 199C/07/en (COM), BA 200C/07/en (CUM), BA 214C/07/en (CCM), BA 246C/07/en (COM F)
- HART® Operating Instructions BA 208C/07/en

2.3 Certificates and approvals

Declaration of conformity

The transmitter complies with the legal demands of the harmonized European standards. Endress+Hauser certifies the compliance with the standards by using the **CE** mark.

3 Installation

3.1 System architecture

The complete system consists of the following components:

- Transmitter Liquisys M CXM 223 / 253 (1)
- HART® handheld terminal DXR 275 (2)
- HART® modem Commubox FXA 191 (3)
- PC with operating programme Commuwin II (4)
- Recorder (5)

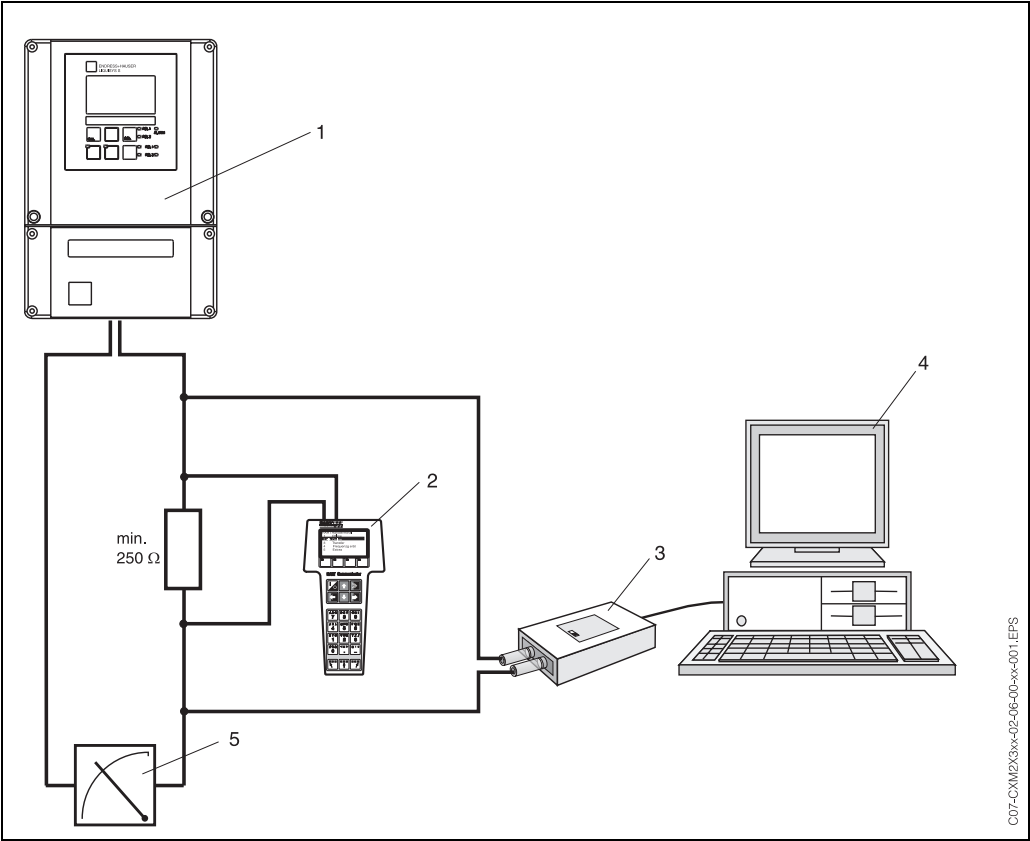


Fig. 2: System architecture Liquisys M CXM 223 / 253 HART®

3.2 Post-installation check

After installing the transmitter, carry out the following checks:

Instrument status and specifications	Note
Is the transmitter damaged?	Visual inspection
Installation	Note
Are the measuring point number and the labelling correct?	Visual inspection
Process environment/conditions	Note
Is the transmitter protected against rainfall and direct sunlight?	For outdoor installation, the weather protection cover CYY 101 is required, (see Accessories).

4 Electrical connection

4.1 Quick connection guide

4.1.1 Wiring diagram

Users have the following connection options at their disposal:

- Direct connection to the transmitter by means of current output 1 (terminals 31 / 32)
- Connection by means of the 4...20 mA circuit.



Note!

- The measuring circuit's minimum load in current output 1 must be at least 250 Ω.

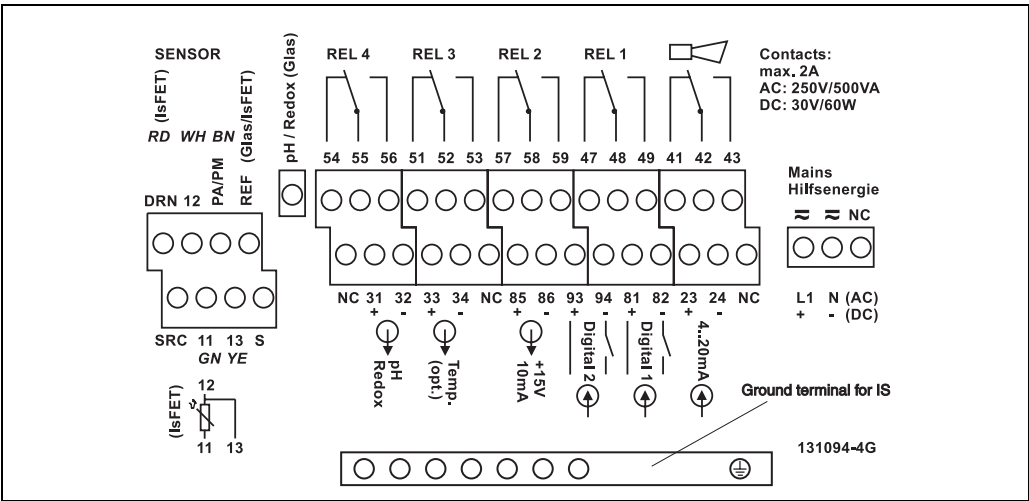


Fig. 3: Electrical connection of Liquisys M CPM 253 HART®

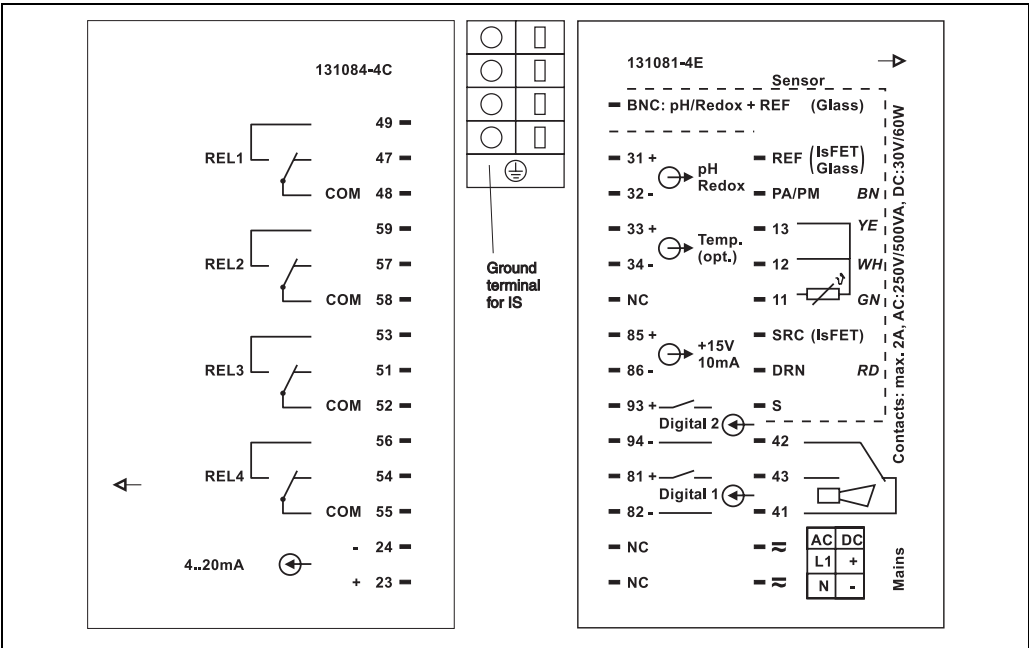


Fig. 4: Electrical connection of Liquisys M CPM 223 HART®

4.2 Connecting the HART® handheld terminal DXR 275

You require the HART® handheld terminal DXR 275 for operation using a handheld terminal. The HART® handheld terminal DXR 275 is connected via the current output 1 of the transmitter.

For connecting, please refer also to the documentation issued by the HART® Communication Foundation, and in particular the booklet HCF LIT 20: “HART®, A Technical Overview”.

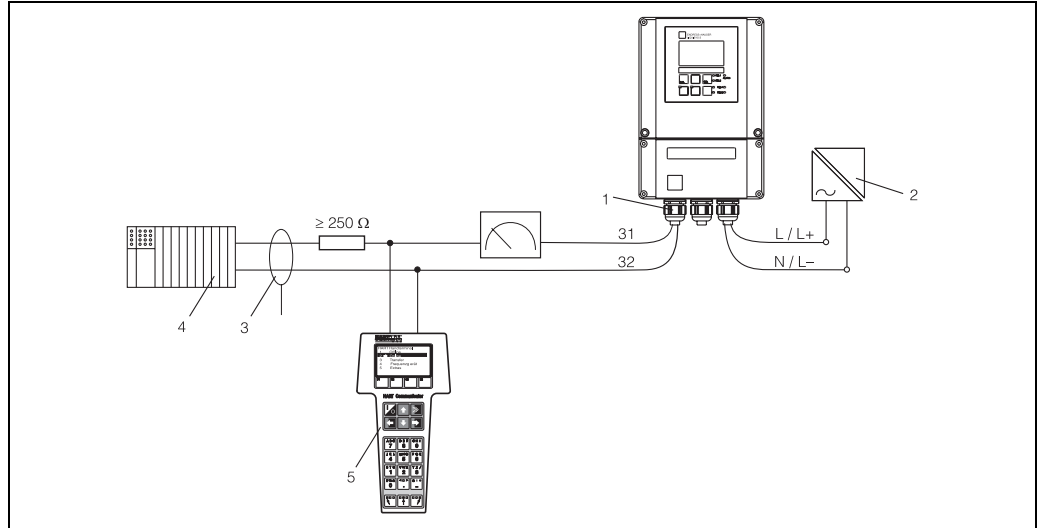


Fig. 5: Electrical connection of the HART® handheld terminal DXR 275
1= current output 1 of the transmitter, 2 = power supply, 3 = screening, 4 = other switching units or PLC with passive input, 5 = HART® handheld terminal DXR 275

4.3 Connecting a PC with operating programme

You require a HART® modem Commubox FXA 191 for connecting a personal computer with operating programme Commuwin II. The HART® modem Commubox FXA 191 is connected via the current output 1 of the transmitter.

For connecting please refer also to the documentation issued by the HART® Communication Foundation, and in particular the booklet HCF LIT 20: “HART®, A Technical Overview”.

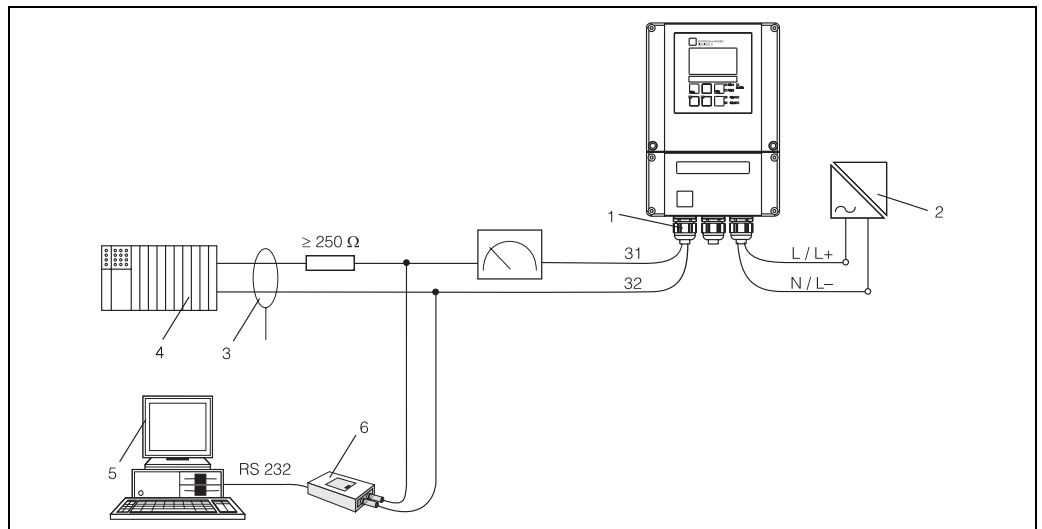


Fig. 6: Electrical connection of the Commubox FXA 191
1 = current output 1 of the transmitter, 2 = power supply, 3 = screening, 4 = other switching units or PLC with passive input, 5 = PC with operating software, 6 = HART® modem Commubox FXA 191



Note!

- The Commuwin II and HART® handheld terminal DXR 275 can only be operated simultaneously if:
 - one device is set as the primary master and the other as the secondary master
 - neither master is constantly communicating.

4.4 Post-connection check

After wiring up the electrical connection of the measuring instrument, carry out the following checks:

Instrument status and specifications	Note
Is the measuring instrument or the cable damaged externally?	Visual inspection
Electrical connection	Note
Does the supply voltage match the specifications on the nameplate?	100 / 115 / 230 V AC 24 V AC / DC
Do the cables used fulfil the required specifications?	Use genuine E+H cables for sensor connection, see Accessories chapter in the standard Operating Instructions
Are the mounted cables strain-relieved?	
Is the cable type route completely isolated?	Along the whole cable length, run the power supply and signal line cables separately to avoid any mutual influence. Cable channels are best.
No loops and cross-overs in the cable run?	
Are the power supply and signal cable correctly connected according to the wiring diagram?	
Are all the screw terminals tightened?	
For connection with potential matching (PML): Is the PML connected to the measuring medium?	 Note! During calibration, insert the PML into the buffer solution.
Are all the cable entries installed, tightened and sealed? Cable run with "water sag"?	"Water sag": cable circuit hanging down so that water can drip off.
Are all the housing covers installed and tightened?	Check seals for damage.

5 Operation

5.1 Display and operating elements

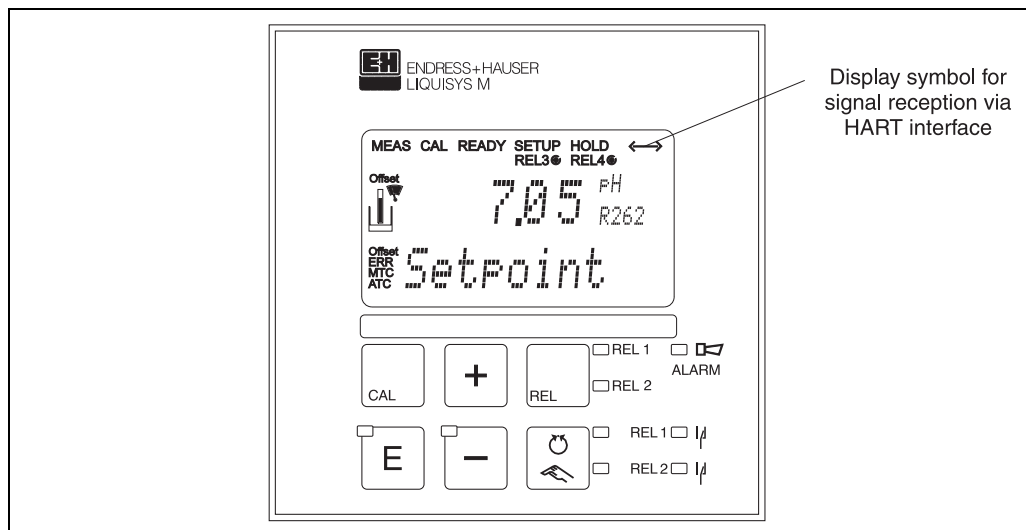


Fig. 7: User interface Liquisys M CXM 223 / 253

1 = Display for active communication via HART® interface

Please refer to the standard Operating Instructions for an explanation of the key assignment and the other icons.

5.2 Operation via the HART® handheld terminal DXR 275

The HART® handheld terminal DXR 275 is operated by means of push buttons with which the instrument functions on a special HART® function matrix are selected. Please refer to the "Communicator DXR 275" Operating Instructions which are supplied with the handheld terminal for information on the operation of the HART® handheld terminal DXR 275.

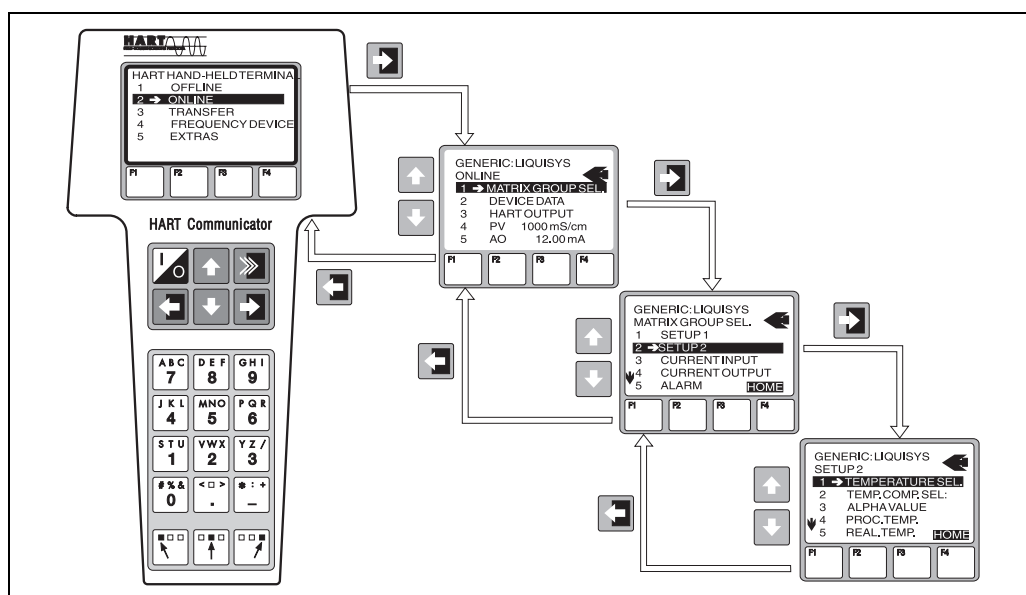


Fig. 8: Operating the HART® handheld terminal DXR 275

5.3 Operation via Commuwin II

Commuwin II is a graphic operating programme with various communication protocols. Connection to Commuwin II is by means of the HART® modem Commubox FXA 191. The parameters are configured either by means of the keypad or by means of the graphic interface. In addition, measured values can be displayed and recorded with a line recorder.

Commuwin II supports the configuration of the transmitter in on-line mode only. The entire Liquisys M operating menu cannot be accessed via Commuwin II. The following diagrams illustrate the functions available.

The matrix positions are determined by "V0...A" to indicate the vertical position and by "H0...9" to indicate the horizontal position.

	H0	H1	H2	H3	H4	H5	H6	H7	H8	H9
V₀ SETUP 1	0.00 mS/cm MEASURED VALU	0.0 °C TEMPERATURE	Conductive OPERATING MODE	ppm CONC. UNIT	XX.xx DECIMALS	mS/cm MEASURED UNIT	1 SIGNAL DAMPING	0.000 mS/cm RAW VALUE		
V₁ SETUP 2	Pt 100 TEMPERATURE M	linear TEMP. COMPENSA	2.10%/K ALPHA VALUE	25.0 °C REFERENCE TEM		1.000 1/cm CELL CONSTANT	0.00 Ohm CABLE RESISTAN		0.0 °C REAL TEMP.	0.0 °C TEMP. CORRECTI
V₂ OUTPUT	Current out. 2 SELECTION	Conductive SELECTION	table CHARACT. TYPE	read EDIT TABLE	1 TOT. NUMB. OF ELE	1 SELECT ELEMENT	0.00 mS/cm MEASURED VALU	4.00 mA CURRENT VALUE	OK STATUS	
V₃ CONTACT OUTPUT	RELAY 1 SELECT RELAY	Controller RELAY FUNCTIO	OFF FUNCTION							
V₄ CONTACT OUTPUT	0.00 mS/cm SETPOINT	1.00 KP	0.0 min TIME TN	0.0 min TIME TV	invers DIRECTION	Pulse length OPERATING MOD	10.0 s PULSE PERIOD		0.3 s START PULSE WID	1% BASE LOAD
V₅ CONC. TABLE	1 SELECT SUBSTA	1 PROCESS TABLE	read TABLE	4 TOT. NUMB. OF EL	1 SELECT ELEMENT	0.099 mS/cm CONDUCTIVITY	0.05 ppm CONCENTRATION	25.00 °C TEMPERATURE V	OK STATUS	
V₆ ALPHA TABLE	read PROCESS TABLE	2 TOT. NUMB. OF EL	1 SELECT ELEMENT	0.00 °C TEMPERATURE V	2.10%/K ALPHA VALUE	OK STATUS				
V₇ CHECK	OFF POL. DETECTION	OFF ALARM THRESHO	0 min ERROR DELAY	0.00 mS/cm LOW ALARM THRE	20.00 mS/cm HIGH ALARM THR	OFF PROC. MONITORIN	60 min MAX. TIME LO ALA	120 min MAX. TIME HIGH AL	0.50 mS/cm SETPOINT	
V₈ ALARM	0 DIAGNOSTIC COD	steady CONTACT TYPE	s TIME UNIT	0 s ALARM DELAY	1 FAULT	NO ALARM STATUS	YES RELAY ASSIGNME	JA FAULT CURRENT A		22 SECURITY LOCKI
V₉ CURRENT INPUT	External input CONTROL STOP	0 s SWITCH OFF DEL	0 s SWITCH ON DELA	50% SWITCH OFF VALU	low STOP DIRECTION	linear PID INFLUENCE	50% K INFLUENCE=1	YES CLEANING FUNCTI	NO RESET DEFAULT VALUES	
V_A USER INFORMATION	----- SET TAG NUMBER	0 INSTRUMENT ADD	230 SOFTWARE VERS	----- SERIAL NUMBER		Setup+Calib. HOLD FUNCTION	10 HOLD CONT. TIME	YES WITH S VERSION		

Fig. 9: Operation of Liquisys M CLM 223 / 253 via the operating programme Commuwin II



Note!

- Refer to the Operating Instructions BA 124F/00/de for further information on the operation with Commuwin II.
- Make sure that the current output 1 is operated at 4 ... 20 mA during parameter setting. There is no presetting due to transmitter operation without HART® communication (HART® only as upload-download support).
- Remote calibration via the HART® interface is not possible.
- All operating fields are accessible via off-line parameter setting, if access code "Yes" is selected in matrix position V9H2 and V9H3. If there is no compatibility with the actual device status (e.g. no access code for Plus package), error code E003 is displayed after finishing the download.

Table of matrix positions

Field coding	Function group	VH position CPM 2X3	VH position CLM 2X3	VH position CUM 2X3	VH position COM 2x3	VH position CCM 2x3
-	Measured value display	V0H0	V0H0	V0H0	V0H0	V0H0
-	Measured value display with temperature in °C	V0H1	V0H1	V0H1	V0H1	V0H1
-	Measured value display in mV	V1H7	-	-	V1H7	V1H7
-	Measured value display uncomp.	-	V0H7	-	-	-
-	Measured value display in FNU	-	-	V0H7	-	-
-	Measured value display in nA	-	-	-	V0H8	-
-	Error display	V8H0	V8H0	V8H0	V8H0	V8H0
-	Editing mode	V8H9	V8H9	V8H9	V8H9	V8H9
A	Setup 1					
A1		V0H2	V0H2	V0H2	V0H2	V0H3
A2		-	V0H3	V0H3	V0H3	V0H4
A3		V0H3	V0H4	V0H4	V0H4	V0H5
A4		V0H6	V0H5	V0H5	V0H5	V0H6
A5		V0H5	V1H5	V0H6	V0H7	V0H7
A6		V0H4	V1H6 (kond.)	-	V0H6	V0H8
A7		-	V0H6	-	-	V0H9
B	Setup 2					
B1		V1H0	V1H0	V1H0	V1H0	V1H0
B2		V1H1	V1H1	V1H1	V1H8	V1H1
B3		V1H2	V1H2	V1H2	V1H9	V1H2
B4		-	V1H4	V1H3	-	-
B5		V1H9	V1H8	V1H4	-	V1H9
B6		-	V1H9	V1H5	-	-
B7		-	V1H3	V1H8	-	-
B8		-	-	V1H9	-	-
B9		-	-	V1H6	-	-

Field coding	Function group	VH position CPM 2X3	VH position CLM 2X3	VH position CUM 2X3	VH position COM 2x3	VH position CCM 2x3
Z	Current input					
Z1		V5H0	V9H0	V6H0	V5H0	V5H0
Z2		V5H1	V9H1	V6H1	V5H1	V5H1
Z3		V5H2	V9H2	V6H2	V5H2	V5H2
Z4		V5H3	V9H3	V6H3	V5H3	V5H3
Z5		V5H4	V9H4	V6H4	V5H4	V5H4
Z6		V5H5	V9H5	V6H5	V5H5	V5H5
Z7		V5H6	V9H6	V6H6	V5H6	V5H6
O	Current output					
O1		V2H0	V2H0	V2H0	V2H0	V2H0
O2		V2H1	V2H1	V2H1	V2H1	V2H1
O3		V2H2	V2H2	V2H2	V2H2	V2H2
O3x1		V2H3	V2H3	V2H3	V2H3	V2H3
O3x2		V2H4	V2H4	V2H4	V2H4	V2H4
O3x3		V2H5	V2H5	V2H5	V2H5	V2H5
O334		V2H6	V2H6	V2H6	V2H6	V2H6
O335		V2H7	V2H7	V2H7	V2H7	V2H7
O336		V2H8	V2H8	V2H8	V2H8	V2H8
F	Alarm					
F1		V8H1	V8H1	V8H1	V8H1	V8H1
F2		V8H2	V8H2	V8H2	V8H2	V8H2
F3		V8H3	V8H3	V8H3	V8H3	V8H3
F4		-	-	-	-	-
F5		V8H4	V8H4	V8H4	V8H4	V8H4
F6		V8H6	V8H6	V8H6	V8H6	V8H6
F7		V8H7	V8H7	V8H7	V8H7	V8H7
F8		V8H8	V8H8	V8H8	V8H8	V8H8
F9		-	-	-	-	-

Field coding	Function group	VH position CPM 2X3	VH position CLM 2X3	VH position CUM 2X3	VH position COM 2x3	VH position CCM 2x3
P	Check					
P1		V6H0	V7H0	V7H1	V7H0	V7H0
P2		V6H1	V7H1	V7H2	V7H1	V7H1
P3		V6H2	V7H2	V7H3	V7H2	V7H2
P4		V7H0	V7H3	V7H4	V7H3	V7H3
P5		V7H1	V7H4	V7H5	V7H4	V7H4
P6		V7H2	V7H5	V7H6	V7H5	V7H5
P7		V7H3	V7H6	V7H7	V7H6	V7H6
P8		V7H4	V7H7	V7H8	V7H7	V7H7
P9		V7H5	V7H8	-	-	V7H8
P10		V7H6	-	-	-	-
P11		V7H7	-	-	-	-
P12		V7H8	-	-	-	-
R	Relays					
R1		V3H0	V3H0	V3H0	V3H0	V3H0
R2		V3H1	V3H1	V3H1	V3H1	V3H1
R2x1		V3H2	V3H2	V3H2	V3H2	V3H2
R2x2		V4H0	V4H0	V4H0	V4H0	V4H0
R2x3		V4H1	V4H1	V4H1	V4H1	V4H1
R2x4		V4H2	V4H2	V4H2	V4H2	V4H2
R2x5		V4H3	V4H3	V4H3	V4H3	V4H3
R2x6		V4H4	V4H4	V4H4	V4H4	V4H4
R2x7		V4H5	V4H5	V4H5	V4H5	V4H5
R2x8		V4H6	V4H6	V4H6	V4H6	V4H6
R2x9		V4H7	V4H7	V4H7	V4H7	V4H7
R2x10		V4H8	V4H8	V4H8	V4H8	V4H8
R2x11		V4H9	V4H9	V4H9	V4H9	V4H9
R2x12		V5H9	-	-	-	-

Field coding	Function group	VH position CPM 2X3	VH position CLM 2X3	VH position CUM 2X3	VH position COM 2x3	VH position CCM 2x3
T	Alpha Table	-		-	-	-
T1		-	V6H0	-	-	-
T2		-	V6H1	-	-	-
T3		-	V6H2	-	-	-
T4		-	V6H3	-	-	-
T5		-	V6H4	-	-	-
T6		-	V6H5	-	-	-
K	Concentration	-			-	-
K1		-	V5H0	V5H0	-	-
K2		-	V5H1	V5H1	-	-
K3		-	V5H2	V5H2	-	-
K4		-	V5H3	V5H3	-	-
K5		-	V5H4	V5H4	-	-
K6		-	V5H5	V5H5	-	-
K7		-	V5H6	V5H6	-	-
K8		-	V5H7	V5H7	-	-
K9		-	V5H8	-	-	-
S	Service					
S1		-	-	-		-
S2		V9H0	VAH5	V9H0	V9H0	V9H0
S3		-	-	-	-	-
S4		V9H1	VAH6	V9H1	V9H1	V9H1
S5		V9H2	VAH7	V9H2	V9H2	V9H2
S6		V9H3	V9H7	V9H3	V9H3	V9H3
S7		-	-	-	-	-
S8		VAH3	VAH3	VAH3	VAH3	VAH3
S9		V9H4	V9H8	V9H4	V9H4	V9H4
S10		-	-	-	-	-
S11		-	-	-	-	-
S12		H0H7	-	-	-	-

Field coding	Function group	VH position CPM 2X3	VH position CLM 2X3	VH position CUM 2X3	VH position COM 2x3	VH position CCM 2x3
E	E+H Service					
E111		VAH2	VAH2	VAH2	VAH2	VAH2
I	Interface					
I1		VAH1	VAH1	VAH1	VAH1	VAH1
I2		VAH0	VAH0	VAH0	VAH0	VAH0
C	Calibration					
C134		-	V1H6 (ind.)	-	-	-
V	Offset		-		-	-
V1		V0H8	-	V0H8	-	-
V2		V0H9	-	V0H9	-	-

5.4 HART® commands

The HART® protocol allows the transfer of measuring and device data between the HART® master and the field device. The HART® master, such as the handheld terminal or the PC-based operating programmes (Commuwin II), require device description (DD) files. They are used to access all the information in a HART® device. Such information is transferred solely via "commands".

There are three different command classes:

Universal commands:

All HART® devices support and use universal commands. The following functionalities are linked to them:

- Recognising HART® devices
- Reading off digital measured values (pH value, conductivity, temperature etc.)

Common practice commands:

Common practice commands offer functions which are supported and can be executed by many field devices.

Device-specific commands:

These commands allow access to device-specific functions which are not HART® standard. Such commands access individual field device information, for example.

Device descriptions for universal and common practice commands are contained in HART® master systems, (e.g. handheld terminal DXR 275, Emerson AMS, Simatic PDM). In this way, diverse functions can also be operated without a special device description. Device-specific commands always require a special device description.

The following table contains all the commands supported by Liquisys M CXM 223 / 253.

Command No. HART® command / Access type		Command data (numeric data in decimal form)	Response data (numeric data in decimal form)
Universal commands			
0	Read unique device identifier Access type = Read	none	The device identifier provides information on the device and manufacturer; it cannot be altered. The response consists of a 12 -byte device ID: – Byte 0: fixed value 254 – Byte 1: manufacturer ID: 17 = E+H – Byte 2: device type ID: 145 = CPM 2X3, 146 = CLM 2X3 inductive 147 = CLM 2X3 conductive 148 = COM 2X3 149 = CUM 2X3 150 = CCM 2X3 – Byte 3: number of preambles – Byte 4: rev. no. universal commands – Byte 5: rev. no. device-spec. commands – Byte 6: software revision – Byte 7: hardware revision – Byte8: additional device information – Byte 9-11: device identification
1	Read main measured value Access type = Read	none	– Byte 0: HART® unit ID of the main measured value – Byte 1-4: main measured value
2	Read the main measured value as current in mA and percentage of the set measuring range Access type = Read	none	– Byte 0-3: current current of the current output 1 (main measured value) in mA – Byte 4-7: percentage of the set measuring range
3	Read the main measured value as current in mA and four dynamic process variables Access type = Read	none	24 bytes are sent as a response: – Byte 0-3: current of the current output 1 (= main measured value) in mA – Byte 4: HART® unit ID of the main measured value – Byte 5-8: main measured value – Byte 9: HART® unit ID of the temperature – Byte 10-13: temperature
6	Set HART® short-form address Access type = Write	Byte 0: desired address (0...15) <i>Factory setting</i> 0  Note! With an address >0 (multi-drop mode), the current output 1 of the main measured value is fixed at 4 mA. Any current simulation is terminated.	– Byte 0: active address

Command No. HART® command / Access type		Command data (numeric data in decimal form)	Response data (numeric data in decimal form)
11	Read unique device identifier using the tag Access type = Read	Byte 0-5: tag  Note! The tag can be set using command 18.	The device identifier provides information on the device and manufacturer; it cannot be altered. The response consists of a 12 -byte device ID if the given tag agrees with the one saved in the device: – Byte 0: fixed value 254 – Byte 1: manufacturer ID: 17 = E+H – Byte 2: device type ID: 145 = CPM 2X3, 146 = CLM 2X3 inductive 147 = CLM 2X3 conductive 148 = COM 2X3 149 = CUM 2X3 150 = CCM 2X3 – Byte 3: number of preambles – Byte 4: rev. no. universal commands – Byte 5: rev. no. device-spec. commands – Byte 6: software revision – Byte 7: hardware revision – Byte 8: additional device information – Byte 9-11: device identification
12	Read user message Access type = Read	none	– Byte 0-23: current user message  Note! You can write the user message using command 17.
13	Read tag, tag description and date Access type = Read	none	– Byte 0-5: tag – Byte 6-17: tag description – Byte 18-20: date  Note! You can write the tag, tag description and date using command 18.
14	Read sensor information on the main measured value Access type = Read	none	– Byte 0-2: serial number of the sensor – Byte 3: HART®unit ID of the sensor limits and measuring range of the main measured value – Byte 4-7: upper sensor limit – Byte 8-11: lower sensor limit – Byte 12-15: minimum distance between the limits
15	Read output information of main measured value Access type = Read	none	– Byte 0: alarm selection ID – Byte 1: ID for transfer function – Byte 2: HART®unit ID for the set measuring range of the main measured value – Byte 3-6: end of measuring range, value for 20 mA – Byte 7-10: start of measuring range, value for 4 mA – Byte 11-14: not used – Byte 15: ID for write protection – Byte 16: ID for OEM dealer: 17 = E+H
16	Read the device production number Access type = Read	none	– Byte 0-2: production number  Note! You can write the production number using command 19.

Command No. HART® command / Access type		Command data (numeric data in decimal form)	Response data (numeric data in decimal form)
17	Write user message Access type = Write	You can save any 32-character long text in the device with this parameter: Byte 0-23: desired user message	– Byte 0-23: current user message
18	Write tag, tag description and date Access type = Write	You can save an 8-character tag, a 16-character tag description and a date with this parameter: – Byte 0-5: tag – Byte 6-17: tag description – Byte 18-20: date  Note! The "user tag" which can be set directly at transmitter (menu field B6) is not identical to the tag for HART®.	– Byte 0-5: tag – Byte 6-17: tag description – Byte 18-20: date
19	Write the device production number Access type = Write	You can save a production number in the range of 0 ... 1677715 with this parameter.	– Byte 0-2: production number
Common practice commands			
34	Write attenuation constants for main measured value Access type = Write	– Byte 0-3: attenuation constants of the main measured value in seconds	– Byte 0-3: attenuation constants in seconds  Note! Dummy command: You can only write 0 s.
35	Write measuring range of main measured value Access type = Write	Write the desired measuring range: – Byte 0: HART unit ID for the main measured value – Byte 1-4: end of measuring range, value for 20 mA – Byte 5-8: start of measuring range, value for 4 mA	– Byte 0: HART® unit ID for the set measuring range of the main measured value – Byte 1-4: end of measuring range, value for 20 mA – Byte 5-8: start of measuring range, value for 4 mA  Note! Manufacturer-specific units for HART® see table → page 23
38	Device status reset "configuration changed" Access type = Write	none	none
40	Simulate output current of main measured value Access type = Write	Simulation of the desired output current of the main measured value. An entry value of 0 exits the simulation mode: Byte 0-3: output current in mA  Note! Values between 2 and 22 mA can be simulated. Current simulation is not possible if the device is in multi-drop mode.	– Byte 0-3: output current in mA
42	Perform device reset Access type = Write	none  Note! Communication is not possible during the device initialisation which is necessary after a reset, (approx. 15 s).	none

Command No. HART® command / Access type		Command data (numeric data in decimal form)	Response data (numeric data in decimal form)
44	Write unit of the main measured value Access type = Write	Specify the unit of main measured value. Only units which are suitable for the process variable are accepted by the device: Byte 0: HART® unit ID  Note! • The display unit of the instrument cannot really be changed. This command only exists for compatibility reasons.	– Byte 0: HART® unit ID  Note! Manufacturer-specific units for HART® see table → page 23
48	Read extended device status Access type = Read	none	Coding: see table → page 26
59	Specify number of preambles in message responses Access type = Write	This parameter specifies the number of preambles which are inserted in the message responses: Byte 0: number of preambles (5...20)	– Byte 0: number of preambles
108	Burst mode command Write number Access type = Write	The specified command is automatically executed in burst mode. Byte 0: number of command	– Byte 0: number of command
109	Burst mode control Access type = Write	The burst mode can be controlled by the byte transmitted. Byte 0: Burst control byte 0 = Off 1 = On	– Byte 0: Burst control byte
Device-specific commands			
142	Read display format Access type = Read	Reads the number of places behind the decimal point of the Commuwin II matrix position. Byte 0: VH position lower 4 bits: H upper 4 bits: V	– Byte 0: VH position – Byte 1: Places behind the decimal point
144	Read VH matrix variable Access type = Read	Reads the Commuwin II variables with this command. – Byte 0: VH position lower 4 bits: H upper 4 bits: V	– Byte 0: VH position lower 4 bits: H upper 4 bits: V – Byte 1: HART® unit ID – Byte 2 ... n: VH variable
145	Write VH matrix variable Access type = Write	Writes the Commuwin II variables with this command. – Byte 0: VH position lower 4 bits: H upper 4 bits: V – Byte 1: HART® unit ID – Byte 2 ... n: VH variable	– Byte 0: VH position lower 4 bits: H upper 4 bits: V – Byte 1: HART® unit ID – Byte 2 ... n: VH variable
148	UPLOAD Access type = Read	Reads EEPROM data from instrument connected. Byte 0 ... 3: Segment number as ASCII code	– Byte 0 ... 3: Segment number as ASCII code – Byte 4 ... 24: max. 21 ASCII signs

Command No. HART® command / Access type		Command data (numeric data in decimal form)	Response data (numeric data in decimal form)
149	DOWNLOAD Access code = Write	Writes data into the EEPROM of the instrument connected. – Byte 0 ... 3: Segment number as ASCII code – Byte 4 ... 24: max. 21 ASCII signs	– Byte 0 ... 3: Segment number as ASCII code – Byte 4 ... 24: max. 21 ASCII signs
154	Read VH matrix variable with 2 byte unit Access code = Read	Reads the Commuwin II variables with this command. Byte 0: VH position lower 4 bits: H upper 4 bits: V	– Byte 0: VH position lower 4 bits: H upper 4 bits: V – Byte 1 ... 2: HART® unit ID – Byte 3 ... 4: VH variable
155	Write VH matrix variable with 2 byte unit Access code = Write	Writes the Commuwin II variables with this command. – Byte 0: VH-Position lower 4 bits: H upper 4 bits: V – Byte 1 ... 2: HART® unit ID – Byte 3 ... 4: VH variable	– Byte 0: VH position lower 4 bits: H upper 4 bits: V – Byte 1 ... 2: HART® unit ID – Byte 3 ... 4: VH variable

Manufacturer-specific units for HART®

Decimal	Hexa-decimal	Unit CPM	Unit CLM	Unit CUM	Unit COM	Unit CCM
212	D4	-	-	-	-	µA
213	D5	-	-	-	ppb	ppb
240	F0	mV/pH	S/m	-	mg/l	mV/pH
241	F1	µA	kΩ•cm	-	hPa	-
242	F2	-	MΩ•cm	-	%	-
243	F3	-	1/cm	-	nA	nA
244	F4	-	-	NTU	-	-
245	F5	-	mg/l	mg/l	-	-
246	F6	-	S/cm	FNU	-	-
247	F7	-	µS/cm	ppm	-	-
248	F8	-	ms/cm	hPa	-	-
249	F9	-	kΩ•m	%	-	-

6 Commissioning

6.1 Function check



- Caution!
- Before power-up, check all the connections again for correctness.
 - Make sure that the sensors and, if necessary, the temperature sensor are in the medium or in a buffer solution, as otherwise no plausible measured value can be displayed.
 - Make sure also that the post-connection check has been carried out, (s. chap. 4.2).



Warning!
Before power-up, make sure there is no danger to the measuring point. Uncontrolled actuated pumps, valves or similar could lead to damage to instruments.

6.2 Setting the device address

All HART® devices have the device address 0 on leaving the factory. This address can be changed to connect up several devices for HART® communication to the network, (multi-drop operation).

- The device address can be set via
- local operation or
 - handheld terminal DXR 275 or
 - operating programme Commuwin II.

Setting the device address via the Liquisys M operating menu

CODE	Display	CHOICE (default = bold)	INFO	User settings
I1		0 0...15	Entry of the bus address Each address may only be given once in a network. If a device address ≠ 0 is selected, the current output is automatically set to 4 mA and the device is set to multi-drop operation.	
I2		-	Tag description Here display only; cannot be edited.	

7 Maintenance



Note!

Please refer to the standard Operating Instructions for information on maintenance of the measuring point.

8 Troubleshooting



Note!

Please refer to the standard Operating Instructions for information on troubleshooting requiring user input.

8.1 Device status / error messages

You can read the extended device status or current error messages via command 48. The command delivers bit-encoded information.

8.1.1 Error messages Liquisys M CPM 2X3

Byte	Bit	Error no.	Short error description
1	0	E001	Memory error
	1	E002	Data error in the EPROM
	2	E007	Transmitter error
	3	E008	SCS glass error
	4	E010	Error temperature sensor
	5	E030	Error SCS reference electrode
	6	E032	Error electrode slope
	7	E033	Error zeropoint
2	0	E034	Error Offset range redox
	1	E041	Error calibration parameter
	2	E042	Error distance calibration value buffer 2 to zeropoint
	3	E043	Error distance calibration value buffer 1 to buffer 2
	4	E044	Error stability criteria
	5	E045	Calibration aborted
	6	E046	not used
	7	E047	not used
3	0	E055	Measuring range main parameter undershot
	1	E057	Measuring range main parameter exceeded
	2	E059	Measuring range temperature undershot
	3	E061	Measuring range temperature exceeded
	4	E063	Current output range 1 undershot
	5	E064	Current output range 1 exceeded
	6	E065	Current output range 2 undershot
	7	E066	Current output range 2 exceeded

Byte	Bit	Error no.	Short error description
4	0	E067	Alarm threshold limit contact 1 exceeded
	1	E068	Alarm threshold limit contact 2 exceeded
	2	E069	Alarm threshold limit contact 3 exceeded
	3	E070	Alarm threshold limit contact 4 exceeded
	4	E080	Current output range 1 too small
	5	E081	Current output range 2 too small
	6	E100	Current simulation active
	7	E101	Service function active

8.1.2 Error messages Liquisys M CLM 2X3

Byte	Bit	Error no.	Short error description
1	0	E001	Memory error
	1	E002	Data error in the EPROM
	2	E007	Transmitter error
	3	E008	Sensor error
	4	E010	Error temperature sensor
	5	E025	Airset value exceeded
	6	E036	Cell constant exceeded
	7	E037	Cell constant undershot
2	0	E045	Calibration aborted
	1	E046	not used
	2	E047	not used
	3	E049	Installation factor exceeded
	4	E050	Installation factor undershot
	5	E055	Measuring range main parameter undershot
	6	E057	Measuring range main parameter exceeded
	7	E059	Measuring range temperature undershot
3	0	E061	Measuring range temperature exceeded
	1	E063	Current output range 1 undershot
	2	E064	Current output range 1 exceeded
	3	E065	Current output range 2 undershot
	4	E066	Current output range 2 exceeded
	5	E067	Alarm threshold limit contact 1 exceeded
	6	E068	Alarm threshold limit contact 2 exceeded
	7	E069	Alarm threshold limit contact 3 exceeded

Byte	Bit	Error no.	Short error description
4	0	E070	Alarm threshold limit contact 4 exceeded
	1	E071	Polarisation error
	2	E072	Temperature exceeds α -value range
	3	E078	Temperature exceeds concentration table
	4	E079	Conductivity exceeds concentration table
	5	E080	Current output range 1 too small
	6	E081	Current output range 2 too small
	7	E100	Current simulation active

8.1.3 Error messages Liquisys M COM 2X3

Byte	Bit	Error no.	Short error description
1	0	E001	Memory error
	1	E002	Data error in the EPROM
	2	E007	Transmitter error
	3	E032	Error sensor slope
	4	E044	Error signal stability
	5	E057	Measuring range main parameter exceeded
	6	E058	Measuring range temperature undershot
	7	E059	Measuring range temperature exceeded
2	0	E063	Current output range 1 undershot
	1	E064	Current output range 1 exceeded
	2	E065	Current output range 2 undershot
	3	E066	Current output range 2 exceeded
	4	E067	Alarm threshold limit contact 1 exceeded
	5	E068	Alarm threshold limit contact 2 exceeded
	6	E069	Alarm threshold limit contact 3 exceeded
	7	E070	Alarm threshold limit contact 4 exceeded
3	0	E080	Current output range 1 too small
	1	E081	Current output range 2 too small
	2	E082	Air pressure range undershot
	3	E083	Air pressure range exceeded
	4	E100	Current simulation active
	5	E101	Service function active
	6	E102	Manual mode active
	7	E106	Download active

Byte	Bit	Error no.	Short error description
4	0	E116	Download error
	1	E----	not used
	2	E----	not used
	3	E018	Diaphragm error
	4	E020	Sensor signal range undershot
	5	E022	Sensor signal range exceeded
	6	E003	Invalid configuration
	7	E004	Incompatible hardware or software

8.1.4 Error messages Liquisys M CUM 2X3

Byte	Bit	Error no.	Short error description
1	0	E001	Memory error
	1	E002	Data error in the EPROM
	2	E007	Transmitter error
	3	E008	Sensor error
	4	E010	Error temperature sensor
	5	E025	not used
	6	E026	Wiper error
	7	E032	Error sensor slope
2	0	E036	not used
	1	E037	not used
	2	E044	Error stability criteria
	3	E045	Calibration aborted
	4	E046	Limits current output 1 exchanged
	5	E047	Limits current output 2 exchanged
	6	E049	not used
	7	E050	not used
3	0	E055	Measuring range main parameter undershot
	1	E057	Measuring range main parameter exceeded
	2	E059	Measuring range temperature undershot
	3	E061	Measuring range temperature exceeded
	4	E063	Current output range 1 undershot
	5	E064	Current output range 1 exceeded
	6	E065	Current output range 2 undershot
	7	E066	Current output range 2 exceeded

Byte	Bit	Error no.	Short error description
4	0	E067	Alarm threshold limit contact 1 exceeded
	1	E068	Alarm threshold limit contact 2 exceeded
	2	E069	Alarm threshold limit contact 3 exceeded
	3	E070	Alarm threshold limit contact 4 exceeded
	4	E071	not used
	5	E077	not used
	6	E078	not used
	7	E079	Measured value exceeds concentration table

8.1.5 Error messages Liquisys M CCM 2X3

Byte	Bit	Error no.	Short error description
1	0	E001	Memory error
	1	E002	Data error in the EPROM
	2	E007	Transmitter error
	3	E032	Error sensor slope pH
	4	E038	Error sensor slope Cl
	5	E033	Error zeropoint
	6	E034	Error offset range redox
	7	E035	Error offset range sensor 963
2	0	E042	Error distance calibration value buffer 2 to zeropoint
	1	E043	Error distance calibration value buffer 1 to buffer 2
	2	E044	Error stability criteria
	3	E045	Calibration aborted
	4	E046	Limits current output 1 exchanged
	5	E047	Limits current output 2 exchanged
	6	E055	Measuring range main parameter (Cl) undershot
	7	E057	Measuring range main parameter (Cl) exceeded
3	0	E056	Measuring range second parameter (pH) undershot
	1	E058	Measuring range second parameter (pH) exceeded
	2	E059	Measuring range temperature undershot
	3	E061	Measuring range temperature exceeded
	4	E063	Current output range 1 undershot
	5	E064	Current output range 1 exceeded
	6	E065	Current output range 2 undershot
	7	E066	Current output range 2 exceeded

Byte	Bit	Fehler-Nr.	Kurzbeschreibung des Fehlers
4	0	E067	Alarm threshold limit contact 1 exceeded
	1	E068	Alarm threshold limit contact 2 exceeded
	2	E069	Alarm threshold limit contact 3 exceeded
	3	E070	Alarm threshold limit contact 4 exceeded
	4	E080	Current output range 1 too small
	5	E081	Current output range 2 too small
	6	E100	Current simulation active
	7	E101	Service function active

9 Accessories

DXR 275

HART® handheld terminal DXR 275

Handheld terminal for communicating with every HART®-compatible device via a 4...20 mA line.

Order No.: DXR 275

Commubox FXA 191

HART® modem Commubox FXA 191

Interface module between HART® interface and series PC interface

Technical Information TI 237F/00/en

Order No.: 016735-1000

Commuwin II

Operating programme Commuwin II

Graphic PC operating programme for intelligent devices.

System Information SI 003F/04/en

Order No.: 51503952

10 Technical data

10.1 Output

Output signal	pH, redox, conductivity, temperature (depending on device version)	
Current output 1	Current range	4 ... 20 mA
	Load	250 ... 500 Ω
	Power supply with passive current output	24 V DC

10.2 Electrical connection

Electrical connection data	Power supply	100 / 115 / 230 V AC 24 V AC/DC
	Frequency	48 ... 62 Hz
	Power consumption	max. 7.5 VA

10.3 Human interface

Operating elements	On-site operation	Via HART® handheld terminal DXR 275
	PC operation	Via HART® modem Commubox FXA 191 with operating programme Commuwin II
	Device address	Can be set, 0 ... 15

10.4 Documentation

Commuwin II	System Information SI 003F/04/en	Order No.: 51503952
	Operating Instructions BA 124F/00/a2	Order No.: 52000549
	Technical Information TI 237F/00/en	Order No.: 016735-1000

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