



Level



Pressure



Flow



Temperature



Liquid  
Analysis



Registration



Systems  
Components



Services

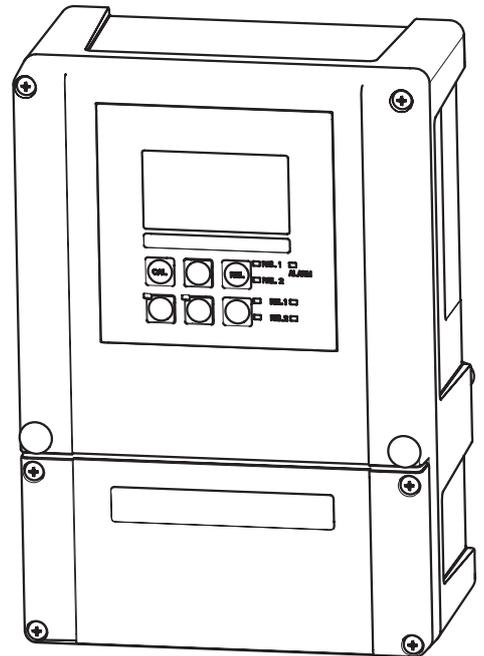
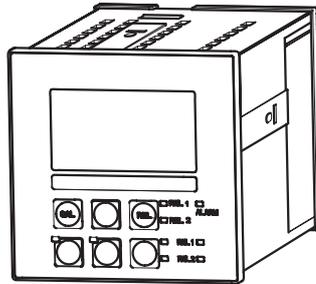


Solutions

## Operating Instructions

# HART

## Field Communication with Liquisys M CXM223/253



# Brief operating instructions

This explains how to use these Operating Instructions to commission your transmitter quickly and safely:

→ Page 4 ff. → Page 5	<b>Safety instructions</b> General safety instructions Explanation of the warning symbols You can find special instructions at the appropriate position in the chapter in question. The positions are indicated with the icons Warning  , Caution  and Note  .
→ Page 7	<b>Installation</b> The system architecture is explained here.
→ Page 8 ff.	<b>Wiring</b> Here you can find out how to connect the transmitter.
→ Page 11 → Page 12 ff. → Page 18 ff.	<b>Operation</b> The display and operating elements are described here. Here you can find out how to use Commuwin II. The commands are described here.
→ Page 24 → Page 25 ff.	<b>Maintenance</b> Here you can find the available accessories. If faults occur during operation, use the error codes to localize and eliminate the cause.
→ Page 30	<b>Technical data</b> Output, power consumption etc.
→ Page 31	<b>Index</b> You can find important terms and keywords here. Use the keyword index to find the information you need quickly and efficiently.

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# 1 Safety instructions

## 1.1 Designated use

These Operating Instructions were specially designed for use with transmitters from the Liquisys M CXM223/253 family. They contain specific information on instruments equipped with the HART interface (**H**ighway **A**ddressable **R**emote **T**ransducer).

The HART interface allows the device to be operated:

- via the handheld terminal DXR275 / DXR375
- via the operating program Commuwin II at a PC
- via FieldCare (Plant-Asset-Management-Tool) at a PC

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.

## 1.2 Installation, commissioning and operation

Please note the following items:

- Installation, 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.
- Electrical connection must only be carried out by a certified electrician.
- 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. Mark the damaged product as being defective.
- Measuring point faults may only be rectified by authorised and specially trained personnel.
- If faults can not be rectified, the products must be taken out of 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 service organisation.

## 1.3 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 prevailing standards and regulations.

Ex systems have an additional Ex documentation which is part of these Operating Instructions (see also chapter "Scope of delivery").

### **Immunity to interference**

This instrument has been tested for electromagnetic compatibility in industrial use according to applicable European standards.

Protection against interference as specified above is valid only for an instrument connected according to the instructions in these Operating Instructions.

## 1.4 Notes on safety icons and symbols

### 1.4.1 Safety icons



Warning!

This symbol alerts you to hazards. They can cause serious damage to the instrument or to persons 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.

### 1.4.2 Electrical symbols



**Direct Current (DC)**

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



**Alternating Current (AC)**

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



**Ground connecting**

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



**Protective earth terminal**

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



**Alarm relay**



**Input**



**Output**



**DC voltage source**



**Temperature sensor**

## 2 Identification

### 2.1 Instrument designation

Compare the order code on the nameplate (on the transmitter) with the product structure (see below) and your order.

You can identify the instrument version by the order code on the nameplate.

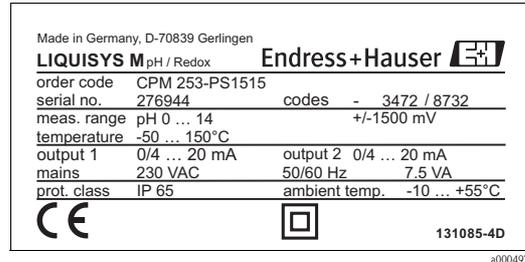


Fig. 1: Example of a nameplate

### 2.2 Scope of delivery

The scope of delivery comprises:

- 1 transmitter (type and version acc. to the nameplate)
- Installation accessories
- 1 standard Operating Instructions BA193C/07/en (CLM), BA194C/07/en (CPM), BA199C/07/en (COM), BA200C/07/en (CUM), BA214C/07/en (CCM), BA246C/07/en (COM F)
- 1 Operating Instructions Field communication with HART, BA208C/07/en
- versions with explosion protection for hazardous area zone 2 (ATEX II 3G)  
Safety instructions for use in explosion-hazardous areas, XA194C/07/a3

### 2.3 Certificates and approvals

#### Declaration of conformity

The product meets the legal requirements of the harmonized European standards.

The manufacturer confirms compliance with the standards by affixing the **CE** symbol.

#### Explosion protection for Zone 2

Version	Approval
CXM253-..6...	ATEX II 3G EEx nA[L] IIC T4
CXM253-..4... CXM223-..4... CXM223-..6...	ATEX II 3G [EEx nAL] IIC

## 3 Installation

### 3.1 System equipment

A complete system architecture comprises:

- Transmitter Liquisys M CXM223 or CXM253
- HART handheld terminal DXR275/DXR375
- HART modem Commubox FXA191
- PC with operating program FieldCare or Commuwin II
- Recorder

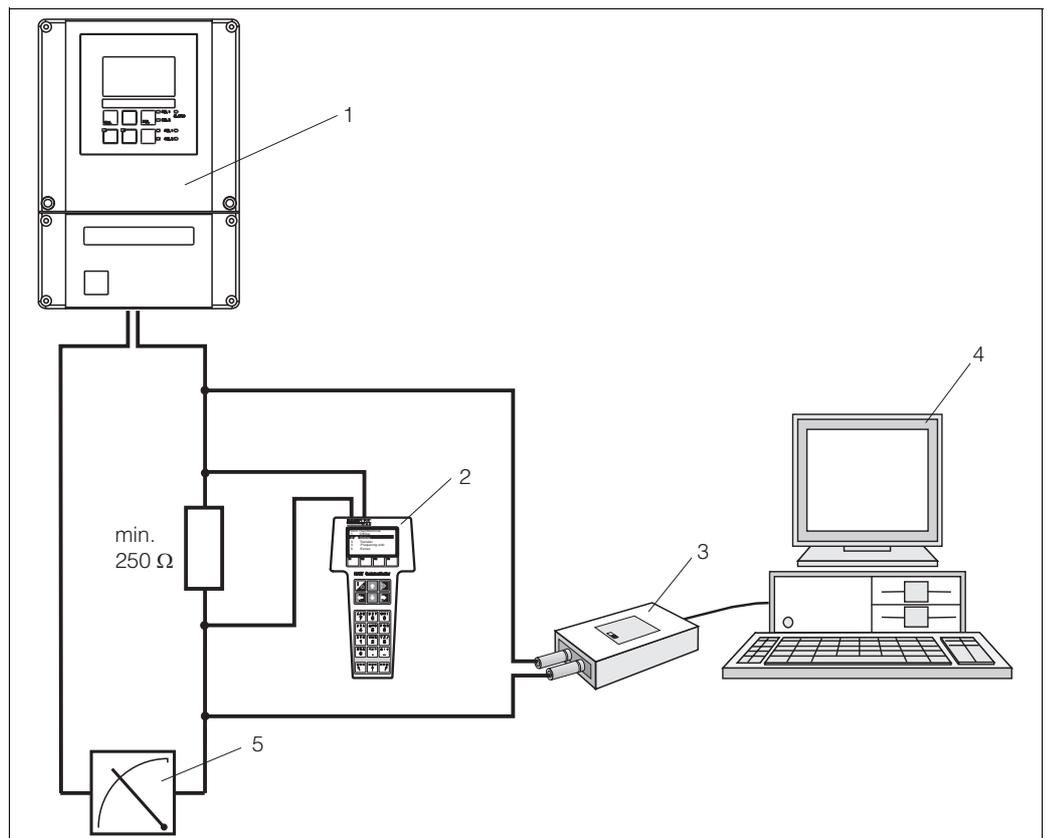


Fig. 2: System architecture Liquisys M CXM223/253 HART

- |   |                                      |   |                                  |
|---|--------------------------------------|---|----------------------------------|
| 1 | Transmitter                          | 4 | PC with FieldCare or Commuwin II |
| 2 | HART handheld terminal DXR275/DXR375 | 5 | Recorder                         |
| 3 | HART modem Commubox FXA191           |   |                                  |

### 3.2 Post-installation check

- After installation, check the transmitter for damage.
- Check whether the transmitter is protected against moisture and direct sunlight.

## 4 Wiring



Warning!

- The electrical connection must only be carried out by a certified electrician.
- Technical personnel must have read and understood the instructions in this manual and must adhere to them.
- Ensure that there is no voltage at the power cable before beginning the connection work.

### 4.1 Electrical connection

#### 4.1.1 Connection options

Users have the following connection options at their disposal:

- Connection via current output 1 (terminals 31 and 32)
- Connection via 4 ... 20 mA circuit



Note!

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

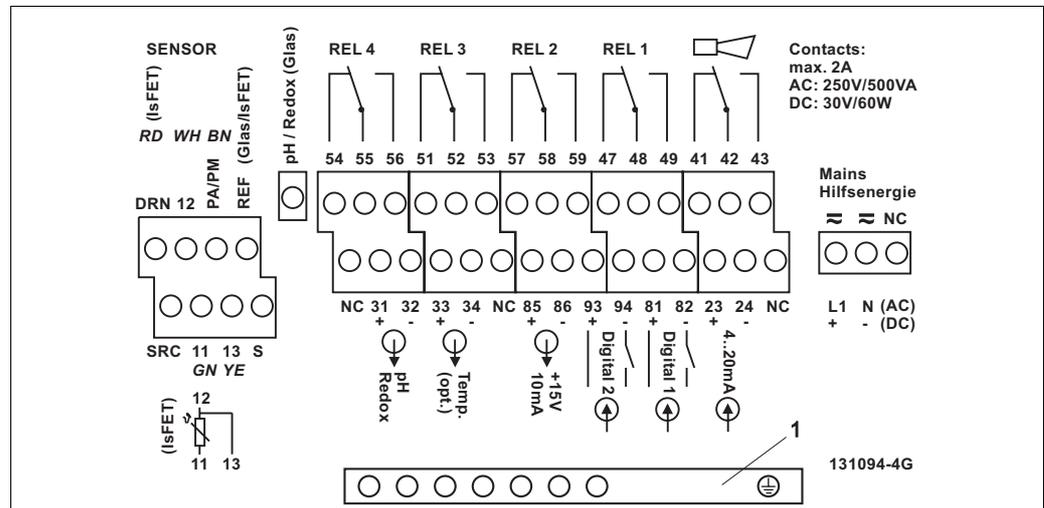


Fig. 3: Electrical connection of Liquisys M CPM253 HART

1 Grounding rail for version IS

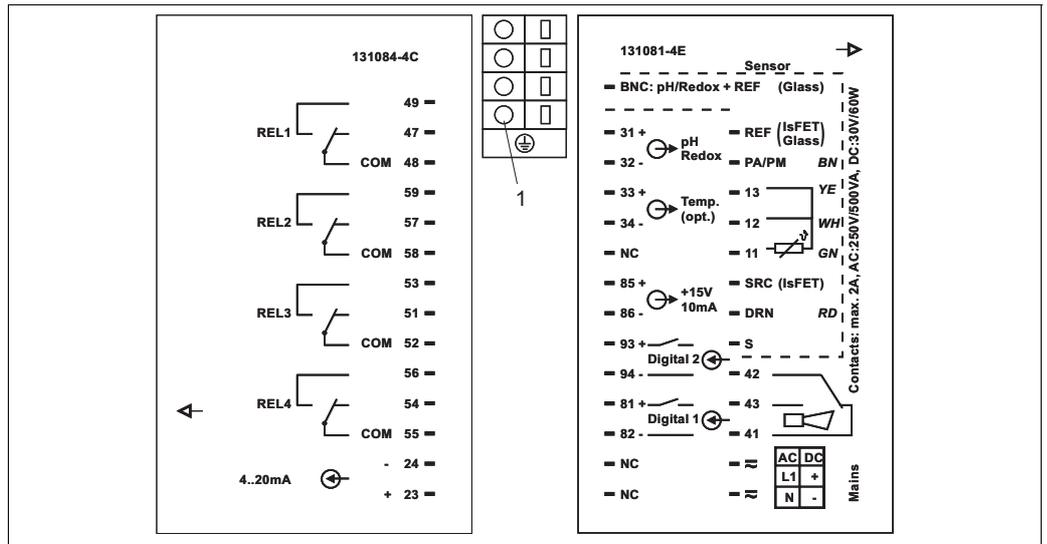


Fig. 4: Electrical connection of Liquisys M CPM223 HART

1 Grounding terminal for version IS

### 4.1.2 Connection of the HART handheld terminal DXR275/DXR375

For operation via handheld terminal you require the HART handheld terminal DXR275/DXR375. Connect the handheld terminal via current output 1 of the transmitter. For connecting, please refer also to the documentation issued by the HART Communication Foundation.

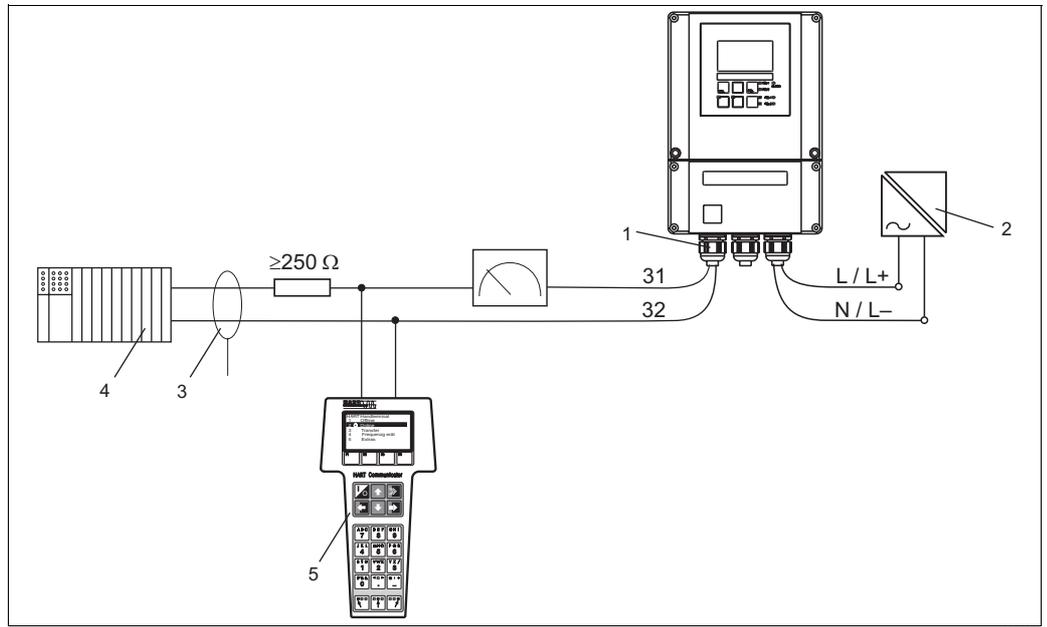


Fig. 5: Electrical connection of the HART handheld terminal

- |   |                                     |   |  |
|---|-------------------------------------|---|--|
| 1 | Current output 1 of the transmitter | 4 | Other evaluation units or PLC with passive input |
| 2 | Power supply                        | 5 | HART handheld terminal                           |
| 3 | Shield                              |   |  |

### 4.1.3 Connection of a PC with operating program

You require a HART modem Commubox FXA191 for connecting a personal computer with operating program Commuwin II. Connect FXA191 via current output 1 of the transmitter. For connecting please refer also to the documentation issued by the HART Communication Foundation.

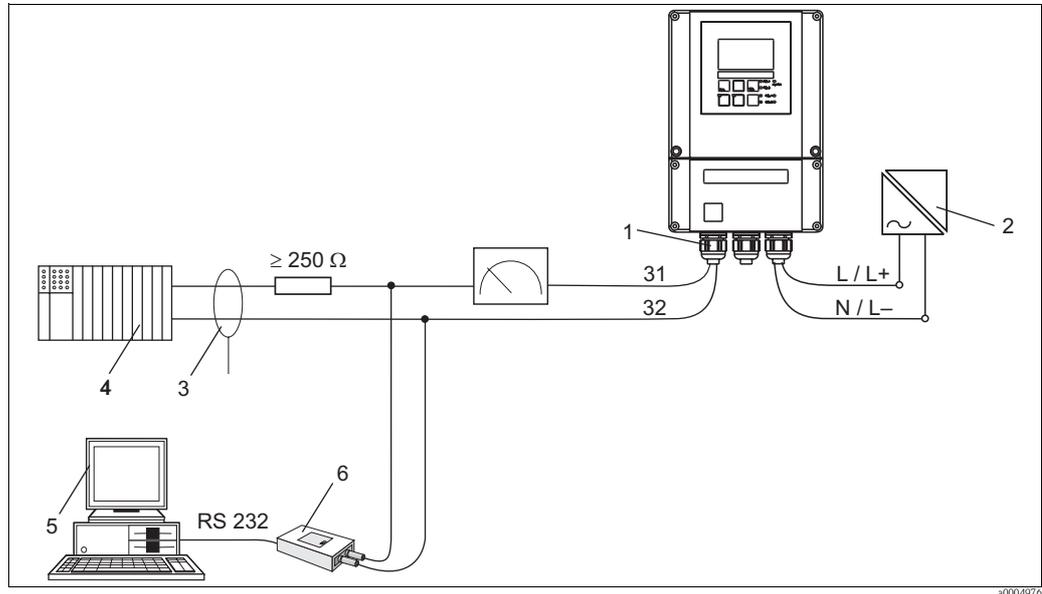


Fig. 6: Electrical connection of Commubox FXA191

- |   |                                     |   |  |
|---|-------------------------------------|---|--|
| 1 | Current output 1 of the transmitter | 4 | Other evaluation units or PLC with passive input |
| 2 | Power supply                        | 5 | PC with operating program                        |
| 3 | Shield                              | 6 | HART modem Commubox FXA191                       |



#### Note!

The Commuwin II and HART handheld terminal DXR275/DXR375 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.

## 4.2 Post-connection check

After the electrical connection, carry out the following checks:

Device condition and specifications	Notes
Are the transmitter and cables damaged on the outside?	Visual inspection

Electrical connection	Notes
Are the mounted cables strain relieved?	
Cable run without loops and cross-overs?	
Are the signal lines correctly connected in accordance with the wiring diagram?	
Are all the screw terminals tightened?	
Are all the cable entries installed, tightened and sealed?	

## 5 Operation

### 5.1 Display and operating elements

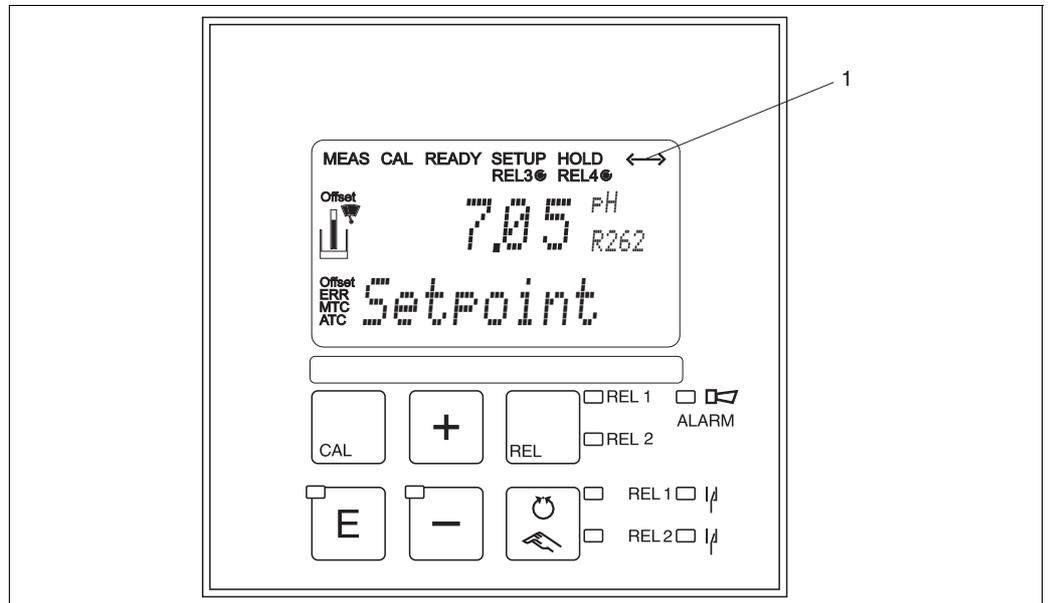


Fig. 7: Display for active communication via HART interface

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

### 5.2 Operation via HART handheld terminal DXR275/DXR375

For information on the operation refer to the "Communicator DXR275/DXR375" Operating Instructions which are supplied with the handheld terminal.

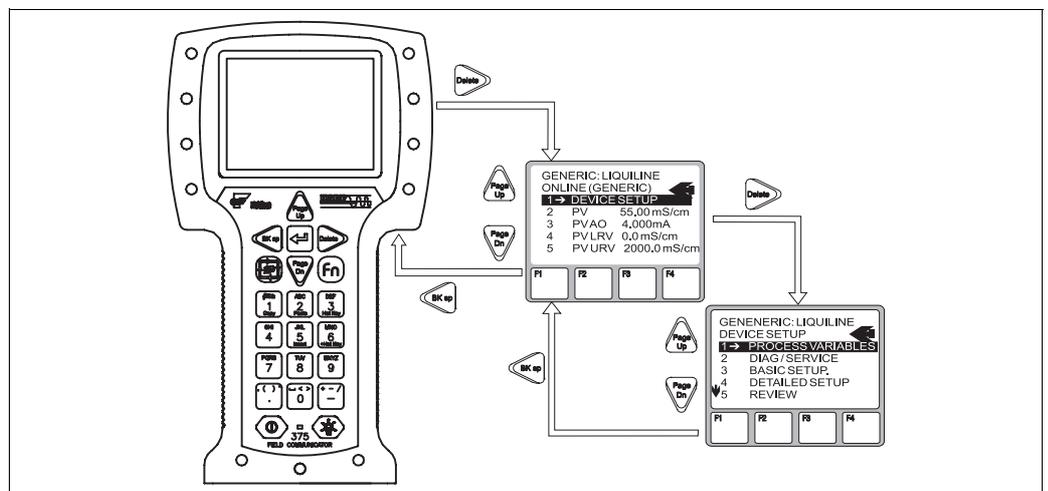


Fig. 8: Operating the HART handheld terminal DXR375

### 5.3 Operation via FieldCare

FieldCare is Endress+Hauser's FDT based Plant Asset Management Tool. It can configure all intelligent field devices in your plant and supports you in managing them. By using status information, it also provides a simple but effective means of checking their health.

- Supports Ethernet, HART, PROFIBUS, and in future FOUNDATION Fieldbus etc.
- Operates all Endress+Hauser devices
- Integrates third-party devices such as actuators, I/O systems and sensors supporting the FDT standard
- Ensures full functionality for all devices with DTMs
- Offers generic profile operation for third-party fieldbus devices that do not have a vendor DTM



Note!

You will find an installation procedure in the operating instructions "Getting started" BA027S/04/a4.

### 5.4 Operation via Commuwin II

Commuwin II is a graphic operating program with various communication protocols. The connection to Commuwin II is established via the HART modem Commubox FXA191. The parameters are configured either via the operating matrix or via the graphical user interface. In addition, measured values can be displayed and recorded with a line recorder.

The entire Liquisys M operating menu cannot be accessed via Commuwin II. The following graphic illustrates the functions available.

In addition, the field coding of the device function is displayed in the matrix position.

	H0	H1	H2	H3	H4	H5	H6	H7	H8	H9
<b>V0 SETUP 1</b>	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		
<b>V1 SETUP 2</b>	Pt 100 TEMPERATURE M	linear TEMP. COMPENS	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
<b>V2 OUTPUT</b>	Current out. 2 SELECTION	Conductive SELECTION	table CHARACT. TYPE	read EDIT TABLE	1 TOT. NUMB. OF EL	1 SELECT ELEMENT	0.00 mS/cm MEASURED VALU	4.00 mA CURRENT VALUE	OK STATUS	
<b>V3 CONTACT OUTPUT</b>	RELAY 1 SELECT RELAY	Controller RELAY FUNCTIO	OFF FUNCTION							
<b>V4 CONTACT OUTPUT</b>	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
<b>V5 CONC. TABLE</b>	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	
<b>V6 ALPHA TABLE</b>	read PROCESS TABLE	2 TOT. NUMB. OF EL	1 SELECT ELEMENT	0.00 °C TEMPERATURE V	2.10%/K ALPHA VALUE	OK STATUS				
<b>V7 CHECK</b>	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 ALA	0.50 mS/cm SETPOINT	
<b>V8 ALARM</b>	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
<b>V9 CURRENT INPUT</b>	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 FUNCT	NO RESET DEFAULT VALUES	
<b>VA USER INFORMATION</b>	----- 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 CLM223/253 via the operating program Commuwin II



## Note!

- Refer to the Operating Instructions BA124F/00/en for further information on the operation with Commuwin II.
- Make sure that the current output 1 is operated at 4 ... 20 mA. 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.

Field coding	Function group	VH position CPM2X3	VH position CLM2X3	VH position CUM2X3	VH position COM2X3	VH position CCM2X3
-	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	-	-	-	-
-	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
<b>A</b>	<b>Setup 1</b>					
A1		V0H2	V0H2	V0H2	V0H2	V0H3
A2		V0H3	V0H3	V0H3	V0H3	V0H4
A3		V0H6	V0H4	V0H4	V0H4	V0H5
A4		V0H5	V0H5	V0H5	V0H5	V0H6
A5		V0H4	V1H5	V0H6	V0H7	V0H7
A6		-	V1H6 (kond.)	-	V0H6	V0H8
A7		-	V0H6	-	-	V0H9

Field coding	Function group	VH position CPM2X3	VH position CLM2X3	VH position CUM2X3	VH position COM2X3	VH position CCM2X3
<b>B</b>	<b>Setup 2</b>					
B1		V1H0	V1H0	V1H0	V1H0	V1H0
B2		V1H1	V1H1	V1H1	V1H8	V1H1
B3		V1H2	V1H2	V1H2	V1H9	V1H2
B4		V1H8	V1H4	V1H3	-	V1H8
B5		V1H9	V1H8	V1H4	-	V1H9
B6		-	V1H9	V1H5	-	-
B7		-	V1H3	V1H8	-	-
B8		-	-	V1H9	-	-
B9		-	-	V1H6	-	-
<b>Z</b>	<b>Current input</b>					
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
<b>O</b>	<b>Current output</b>					
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

Field coding	Function group	VH position CPM2X3	VH position CLM2X3	VH position CUM2X3	VH position COM2X3	VH position CCM2X3
<b>F</b>	<b>Alarm</b>					
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		-	-	-	-	-
<b>P</b>	<b>Check</b>					
P1		V6H0	V7H0	V7H1	V7H0	V7H0
P2		V6H1	V7H1	V7H2	V7H1	P1X1: V7H1
P3		V6H2	V7H2	V7H3	V7H2	P1X2: V7H2
P4		V6H3	V7H3	V7H4	V7H3	P1X3: V7H3
P5		V7H1	V7H4	V7H5	V7H4	P1X4: V7H4
P6		V7H2	V7H5	V7H6	V7H5	P1X5: V7H5
P7		V7H3	V7H6	V7H7	V7H6	P1X6: V7H6
P8		V7H4	V7H7	V7H8	V7H7	P1X7: V7H7
P9		V7H5	V7H8	-	-	P1X8: V7H8
P10		V7H6	-	-	-	-
P11		V7H7	-	-	-	-
P12	V7H8	-	-	-	-	

Field coding	Function group	VH position CPM2X3	VH position CLM2X3	VH position CUM2X3	VH position COM2X3	VH position CCM2X3
<b>R</b>	<b>Relays</b>					
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	-	-	-	-	
<b>T</b>	<b>Alpha table</b>					
T1		-	V6H0	-	-	-
T2		-	V6H1	-	-	-
T3		-	V6H2	-	-	-
T4		-	V6H3	-	-	-
T5		-	V6H4	-	-	-
T6		-	V6H5	-	-	-

Field coding	Function group	VH position CPM2X3	VH position CLM2X3	VH position CUM2X3	VH position COM2X3	VH position CCM2X3
<b>K</b>	<b>Concentration</b>					
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	-	-	-
<b>S</b>	<b>Service</b>					
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	-	-	-	-
<b>E</b>	<b>E+H-Service</b>					
E111		VAH2	VAH2	VAH2	VAH2	VAH2
<b>I</b>	<b>Interface</b>					
I1		VAH1	VAH1	VAH1	VAH1	VAH1
I2		VAH0	VAH0	VAH0	VAH0	VAH0
<b>C</b>	<b>Calibration</b>					
C134		-	V1H6 (ind.)	-	-	-

Field coding	Function group	VH position CPM2X3	VH position CLM2X3	VH position CUM2X3	VH position COM2X3	VH position CCM2X3
V	Offset					
V1		V0H8	-	V0H8	-	-
V2		V0H9	-	V0H9	-	-

## 5.5 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 programs, require device descriptions (DD) or device type manager (DTM) 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.)

Device descriptions for universal and common practice commands are contained in HART master systems, (e.g. handheld terminal DXR275/DXR375, Emerson AMS, Simatic PDM). In this way, diverse functions can also be operated without a special device description.

### 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.

Device-specific commands always require a special device description.

The following table contains all the commands supported by Liquisys M CXM223/253.

Command No. HART command / Access type	Command data (numeric data in decimal form)	Response data (numeric data in decimal form)
<b>Universal Commands</b>		
0 Read unique device identifier Access type = Read	none	<p>The device identifier provides information on the device and manufacturer; it cannot be altered. The response consists of a 12-byte device ID:</p> <ul style="list-style-type: none"> <li>■ Byte 0: fixed value 254</li> <li>■ Byte 1: manufacturer ID: 17 = E+H</li> <li>■ 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</li> <li>■ Byte 3: number of preambles</li> <li>■ Byte 4: rev. no. universal commands</li> <li>■ Byte 5: rev. no. device-spec. commands</li> <li>■ Byte 6: software revision</li> <li>■ Byte 7: hardware revision</li> <li>■ Byte 8: additional device information</li> <li>■ Byte 9-11: device identification</li> </ul>
1 Read main measured value Access type = Read	none	<ul style="list-style-type: none"> <li>■ Byte 0: HART unit ID of the main measured value</li> <li>■ Byte 1-4: main measured value</li> </ul>
2 Read the main measured value as current in mA and percentage of the set measuring range Access type = Read	none	<ul style="list-style-type: none"> <li>■ Byte 0-3: actual current of the current output 1 (main measured value) in mA</li> <li>■ Byte 4-7: percentage of the set measuring range</li> </ul>
3 Read the main measured value as current in mA and four dynamic process variables Access type = Read	none	<p>24 bytes are sent as a response</p> <ul style="list-style-type: none"> <li>■ Byte 0-3: current of the current output 1 (main measured value) in mA</li> <li>■ Byte 4: HART unit ID of the main measured value</li> <li>■ Byte 5-8: main measured value</li> <li>■ Byte 9: HART unit ID of the temperature</li> <li>■ Byte 10-13: temperature</li> </ul>
6 Set HART short-form address Access type = Write	Byte 0: desired address (0...15) Factory setting: 0 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.	<ul style="list-style-type: none"> <li>■ Byte 0: active address</li> </ul>
11 Read unique device identifier using the tag Access type = Read	Byte 0-5: tag The tag can be set using command 18.	<p>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:</p> <ul style="list-style-type: none"> <li>■ Byte 0: fixed value 254</li> <li>■ Byte 1: manufacturer ID: 17 = E+H</li> <li>■ 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</li> <li>■ Byte 3: number of preambles</li> <li>■ Byte 4: rev. no. universal commands</li> <li>■ Byte 5: rev. no. device-spec. commands</li> <li>■ Byte 6: software revision</li> <li>■ Byte 7: hardware revision</li> <li>■ Byte 8: additional device information</li> <li>■ Byte 9-11: device identification</li> </ul>
12 Read user message Access type = Read	none	<ul style="list-style-type: none"> <li>■ Byte 0-23: current user message</li> </ul> <p>You can write the user message using command 17.</p>

Command No. HART command / Access type		Command data (numeric data in decimal form)	Response data (numeric data in decimal form)
13	Read tag, tag description and date Access type = Read	none	<ul style="list-style-type: none"> <li>■ Byte 0-5: tag</li> <li>■ Byte 6-17: tag description</li> <li>■ Byte 18-20: date</li> </ul> <p>You can write the tag, tag description and date using command 18.</p>
14	Read sensor information on the main measured value Access type = Read	none	<ul style="list-style-type: none"> <li>■ Byte 0-2: serial number of the sensor</li> <li>■ Byte 3: HART unit ID of the sensor limits and measuring range of the main measured value</li> <li>■ Byte 4-7: upper sensor limit</li> <li>■ Byte 8-11: lower sensor limit</li> <li>■ Byte 12-15: minimum distance between the limits</li> </ul>
15	Read output information of main measured value Access type = Read	none	<ul style="list-style-type: none"> <li>■ Byte 0: alarm selection ID</li> <li>■ Byte 1: ID for transfer function</li> <li>■ Byte 2: HART unit ID for the set measuring range of the main measured value</li> <li>■ Byte 3-6: end of measuring range, value for 20 mA</li> <li>■ Byte 7-10: start of measuring range, value for 4 mA</li> <li>■ Byte 11-14: not used</li> <li>■ Byte 15: ID for write protection</li> <li>■ Byte 16: ID for OEM dealer: 17 = E+H</li> </ul>
16	Read the device production number Access type = Read	none	<ul style="list-style-type: none"> <li>■ Byte 0-2: production number</li> </ul> <p>You can write the production number using command 19</p>
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	<ul style="list-style-type: none"> <li>■ Byte 0-23: current user message</li> </ul>
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: <ul style="list-style-type: none"> <li>■ Byte 0-5: tag</li> <li>■ Byte 6-17: tag description</li> <li>■ Byte 18-20: date</li> </ul> <p>The "user tag" which can be set directly at transmitter (menu field B6) is <b>not</b> identical to the tag for HART.</p>	<ul style="list-style-type: none"> <li>■ Byte 0-5: tag</li> <li>■ Byte 6-17: tag description</li> <li>■ Byte 18-20: date</li> </ul>
19	Write the device production number Access type = Write	You can save a production number in the range of 0 ... 1677715 with this parameter.	<ul style="list-style-type: none"> <li>■ Byte 0-2: production number</li> </ul>
<b>Common Practice Commands</b>			
34	Write attenuation constants for main measured value Access type = Write	<ul style="list-style-type: none"> <li>■ Byte 0-3: attenuation constants of the main measured value in seconds</li> </ul>	<ul style="list-style-type: none"> <li>■ Byte 0-3: attenuation constants in seconds</li> </ul> <p>Dummy command: You can only write 0 s.</p>
35	Write measuring range of main measured value Access type = Write	Write the desired measuring range: <ul style="list-style-type: none"> <li>■ Byte 0: HART unit ID for the main measured value</li> <li>■ Byte 1-4: end of measuring range, value for 20 mA</li> <li>■ Byte 5-8: start of measuring range, value for 4 mA</li> </ul>	<ul style="list-style-type: none"> <li>■ Byte 0: HART unit ID for the set measuring range of the main measured value</li> <li>■ Byte 1-4: end of measuring range, value for 20 mA</li> <li>■ Byte 5-8: start of measuring range, value for 4 mA</li> </ul>
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: <ul style="list-style-type: none"> <li>■ Byte 0-3: output current in mA</li> </ul> <p>Values between 2 and 22 mA can be simulated. Current simulation is <b>not</b> possible if the device is in multi-drop mode.</p>	<ul style="list-style-type: none"> <li>■ Byte 0-3: output current in mA</li> </ul>
42	Perform device reset Access type = Write	none 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: <ul style="list-style-type: none"> <li>Byte 0: HART unit ID</li> </ul> The display unit of the instrument cannot really be changed. This command exists for compatibility reasons.	Byte 0: HART unit ID
48	Read extended device status Access type = Read	none	none
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: <ul style="list-style-type: none"> <li>Byte 0: number of preambles (5...20)</li> </ul>	<ul style="list-style-type: none"> <li>Byte 0: number of preambles</li> </ul>
108	Burst mode command Write number Access type = Write	The specified command is automatically executed in burst mode <ul style="list-style-type: none"> <li>Byte 0: number of command</li> </ul>	<ul style="list-style-type: none"> <li>Byte 0: number of command</li> </ul>
109	Burst mode control Access type = Write	The burst mode can be controlled by the byte transmitted. <ul style="list-style-type: none"> <li>Byte 0: Burst control byte 0 = Off 1 = On</li> </ul>	<ul style="list-style-type: none"> <li>Byte 0: Burst control byte</li> </ul>
<b>Device Specific Commands</b>			
142	Read display format Access type = Read	Reads the number of places behind the decimal point of the Commuwin II matrix position. <ul style="list-style-type: none"> <li>Byte 0: VH position lower 4 bits: H upper 4 bits: V</li> </ul>	<ul style="list-style-type: none"> <li>Byte 0: VH position</li> <li>Byte 1: places behind the decimal point</li> </ul>
144	Read VH matrix variable Access type = Read	Reads the Commuwin II variables with this command. <ul style="list-style-type: none"> <li>Byte 0: VH position lower 4 bits: H upper 4 bits: V</li> </ul>	<ul style="list-style-type: none"> <li>Byte 0: VH position lower 4 bits: H upper 4 bits: V</li> <li>Byte 1: HART unit ID</li> <li>Byte 2 ... n: VH variable</li> </ul>
145	Write VH matrix variable Access type = Write	Writes the Commuwin II variables with this command. <ul style="list-style-type: none"> <li>Byte 0: VH position lower 4 bits: H upper 4 bits: V</li> <li>Byte 1: HART unit ID</li> <li>Byte 2 ... n: VH variable</li> </ul>	<ul style="list-style-type: none"> <li>Byte 0: VH position lower 4 bits: H upper 4 bits: V</li> <li>Byte 1: HART unit ID</li> <li>Byte 2 ... n: VH variable</li> </ul>
148	UPLOAD Access type = Read	Reads EEPROM data from instrument connected. <ul style="list-style-type: none"> <li>Byte 0 ... 3: segment number as ASCII code</li> </ul>	<ul style="list-style-type: none"> <li>Byte 0 ... 3: segment number as ASCII code</li> <li>Byte 4 ... 24: max. 21 ASCII signs</li> </ul>
149	DOWNLOAD Access type = Write	Writes data into the EEPROM of the instrument connected. <ul style="list-style-type: none"> <li>Byte 0 ... 3: segment number as ASCII code</li> <li>Byte 4 ... 24: max. 21 ASCII signs</li> </ul>	<ul style="list-style-type: none"> <li>Byte 0 ... 3: segment number as ASCII code</li> <li>Byte 4 ... 24: max. 21 ASCII signs</li> </ul>
154	Read VH matrix variable with 2 byte unit Access type = Read	Reads the Commuwin II variables with this command. <ul style="list-style-type: none"> <li>Byte 0: VH position lower 4 bits: H upper 4 bits: V</li> </ul>	<ul style="list-style-type: none"> <li>Byte 0: VH position lower 4 bits: H upper 4 bits: V</li> <li>Byte 1 ... 2: HART unit ID</li> <li>Byte 3 ... 4: VH variable</li> </ul>
155	Write VH matrix variable with 2 byte unit Access type = Write	Writes the Commuwin II variables with this command. <ul style="list-style-type: none"> <li>Byte 0: VH position lower 4 bits: H upper 4 bits: V</li> <li>Byte 1 ... 2: HART unit ID</li> <li>Byte 3 ... 4: VH variable</li> </ul>	<ul style="list-style-type: none"> <li>Byte 0: VH position lower 4 bits: H upper 4 bits: V</li> <li>Byte 1 ... 2: HART unit ID</li> <li>Byte 3 ... 4: VH variable</li> </ul>

**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	-	l/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



Warning!

- Check all connections for correctness.
- Make sure that the supply voltage is identical to the voltage written on the nameplate!

### 6.2 Setting of 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 DXR275/DXR375 or
- operating program Commuwin II or
- FieldCare

#### Setting the device address via the Liquisys M operating menu

Code	Display	Choice (factory setting = bold)	Info	User settings
I1		<b>0</b> 0 ... 15	<b>Entry of the bus address</b> 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			<b>Tag description</b> 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 Accessories

- HART handheld terminal DXR375
  - Handheld terminal for communicating with every HART-compatible device via a 4 ... 20 mA lineOrder no. DXR375
- HART modem Commubox FXA191
  - Interface modul between HART interface and serial PC interface
  - Technical Information TI237F/00/enOrder no. 016735-0000
- Commuwin II
  - Graphic PC operating program for intelligent devices
  - System Information SI003S/04/enOrder no. 556003946
- FieldCare
  - Tool für Plant-Asset-Management
  - Supports Ethernet, HART, PROFIBUS, FOUNDATION Fieldbus
  - FieldCare Lite, order no. 56004080
  - FieldCare Standard, order no. SFE551-xxxx
  - FieldCare Professional, order no. SFE552-xxxx

## 9 Troubleshooting



Note!

For further information on trouble-shooting please refer to the standard Operating Instructions.

### 9.1 Device status / error messages

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

### 9.2 Error messages Liquisys M CPM2X3

Byte	Bit	Error no.	Short error description
1	0	E001	Memory error
	1	E002	Data error in EEPROM
	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		not used
	7		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
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

### 9.3 Error messages Liquisys M CLM2X3

Byte	Bit	Error no.	Short error description
1	0	E001	Memory error
	1	E002	Data error in EEPROM
	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		not used
	2		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
4	0	E070	Alarm threshold limit contact 4 exceeded
	1	E071	Polarisation error
	2	E072	Temperature exceeds $\dot{E}\alpha$ -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

## 9.4 Error messages Liquisys M COM2X3

Byte	Bit	Error no.	Short error description
1	0	E001	Memory error
	1	E002	Data error in EEPROM
	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
4	0	E116	Download error
	1		not used
	2		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

## 9.5 Error messages Liquisys M CUM2X3

Byte	Bit	Error no.	Short error description
1	0	E001	Memory error
	1	E002	Data error in EEPROM
	2	E007	Transmitter error
	3	E008	Sensor error
	4	E010	Error temperature sensor
	5		not used
	6	E026	Wiper error
	7	E032	Error sensor slope
2	0		not used
	1		not used
	2	E044	Error stability criteria
	3	E045	Calibration aborted
	4		not used
	5		not used
	6		not used
	7		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
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		not used
	5		not used
	6		not used
	7		not used

## 9.6 Error messages Liquisys M CCM2X3

Byte	Bit	Error no.	Short error description
1	0	E001	Memory error
	1	E002	Data error in EEPROM
	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
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

## 10 Technical data

### 10.1 Output

<b>Output signal</b>	pH, redox, conductivity, turbidity, oxygen, chlorine, temperature (depending on device version)	
<b>Current output I</b>	Current range	4 ... 20 mA

### 10.2 Power supply

<b>Power supply</b>	depending on device version: 100/115/230 V AC +10/-15 %, 48 ... 62 Hz 24 V AC/DC +20/-15 %	
<b>Power consumption</b>	max. 7.5 VA	
<b>Main fuse</b>	Micro-fuse, medium-lag 250 V/3.15 A	

### 10.3 Display and user interface

<b>On-site operation</b>	via HART handheld terminal DXR375
<b>PC operation</b>	via HART modem Commubox FXA191 with operating program Commuwin II or FieldCare
<b>Device address</b>	can be set, 0 ... 15

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