Endress+Hauser
People for Process Automation

Liquiline Compact CM82 – Revision 3

HART Field Device Specification

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Author:

Mark Fuchs
Endress+Hauser
Gesellschaft für Mess- und Regeltechnik mbH+Co. KG
Dieselstr. 24
70839 Gerlingen
Germany

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1. Introduction

1.1. Scope

The Endress+Hauser analysis transmitter, model Liquiline Compact complies with HART protocol revision 7. This document specifies all the device specific features and documents HART protocol implementation details. The functionality of this field device is described sufficiently to allow its proper application in a process and its complete support in HART capable host applications.

1.2. Purpose

This specification is designed to complement the operating instructions by providing a complete, unambiguous description of this field device from a HART communication perspective.

1.3. Who should use this document?

The specification is designed to be a technical reference for HART capable host application developers, system integrators and knowledgeable end users. It also provides functional specifications (e.g., commands, enumerations and performance requirements) used during field device development, maintenance and testing. This document assumes the reader is familiar with HART protocol requirements and terminology.

1.4. Abbreviations and definitions

FSK: Frequency shift keying
FCG: FieldComm Group
n. A.: Not applicable
NaN: Not a number
ENP: Electronic nameplate

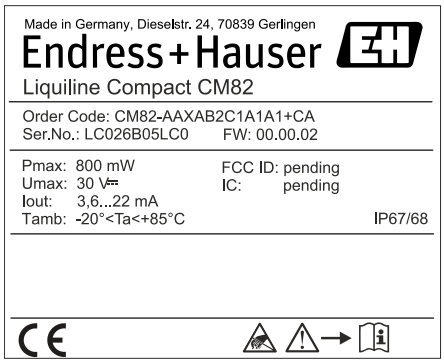
1.5. References

HCF_SPEC-12: HART Smart Communications Protocol Specification. Available from the FCG.
Liquiline Operating Instructions available from www.endress.com/cm82

2. Device identification

Manufacturer name:	Endress+Hauser
Model name:	Liquiline Compact
Manufacturer ID code:	17 (11_h)
Device type code:	163 ($A3_h$)
Expanded device type code:	4515 ($11A3_h$)
HART protocol revision:	7.6
Device revision:	3
Number of device variables:	20
Physical layers supported:	FSK
Physical device category:	Transmitter

The nameplate is located on the housing and indicates model name, order code, and serial number of the device.



An example nameplate

Liquiline Compact CM82

3. Product overview

Liquiline Compact is a robust 2 wire loop powered transmitter for measurement of a variety of analysis values in all process applications.
Different sensors can be connected for different use cases. For more information please refer to the Operating Instructions.

4. Product interfaces

4.1. Process interface

4.1.1. Sensor input channels

Depending on Liquiline version and use case different sensors can be connected to the bayonet connector. Please refer to the Operating Instructions.

4.2. Host interface

Current output cables are blue (+) and white (-). Liquiline is powered by current output. Voltage range is 14.0 V - 30 V DC.

4.2.1. Analog output

Certain device variables described in chapter 5 can be assigned to analog output, depending on the connected sensor. The output is scaled according to the configured range of the instrument. Analog output corresponds to the HART primary variable.
Linear overrange is possible from 3.8 mA to 20.5 mA. Device malfunction can be indicated by error current if selected. Current values are shown in the table below:

Downwards linear over-range:	3.8 mA
Upwards linear over-range:	20.5 mA
Device malfunction indication (high):	22.5 mA
Device malfunction indication (low):	3.6 mA
Minimum current:	3.6 mA
Maximum current:	23.0 mA
Multidrop current draw:	4.0 mA (during power-up: ≤3.6 mA)
Lift-off Voltage:	14.0 V

4.3. Local interfaces, jumpers and switches

4.3.1. Local controls and displays

Liquiline Compact has no controls. Two LEDs (red and green) are used to signal its status. For detailed information refer to the Operating Instructions.

4.3.2. Internal jumpers and switches

There are no controls inside the housing.

5. Device variables

5.1. Remarks

Liquiline Compact is a multiparameter transmitter. Different sensors for different measurement parameters can be connected. Depending on connected sensor type some device variables are valid and some are not:

Sensor	Valid device variables
pH glass	0, 1, 3, 8
pH ISFET	0, 1, 2, 8
ORP	5, 6, 8
pH + ORP	0, 1, 3, 4, 5, 6, 7, 8
Conductivity	9,10, 11, 12
Oxygen ampereometrical	13, 14, 15, 16, 17, 19
Oxygen optical	13, 14, 15, 16, 18, 19

Some device variables may become invalid because of operating mode.

Invalid device variables will return:

Device variable classification:	None	0 (0_h)
Device family:	Not used	250 (FA_h)
Device variable unit:	Not used	250 (FA_h)
Device variable lower limit:	NaN	
Device variable upper limit:	NaN	

5.2. Device variable 0 (00_h) - pH

This value returns the damped temperature compensated pH value.

Device variable classification:	Analytical	81 (51_h)
Device family:	Not used	250 (FA_h)
Device variable unit:	pH	59 ($3B_h$)
Device variable lower limit:	-2 pH	
Device variable upper limit:	16 pH	

5.3. Device variable 1 (01_h) - pH raw value

This device variable returns the pH raw value.

Device variable classification:	EMF/Voltage	83 (53_h)
Device family:	Not used	250 (FA_h)
Device variable unit:	mV, V	36, 58 (24_h, $3A_h$)
Device variable lower limit:	-2000 mV	
Device variable upper limit:	2000 mV	

5.4. Device variable 2 (02_h) – ISFET leakage current

This device variable returns the leakage current if an ISFET sensor is connected.
Attention: Hosts not resolving device variable classification will display cmH20(4°C) as unit instead of nA.

Device variable classification:	Current	84 (54_h)
Device family:	Not used	250 (FA_h)
Device variable units:	nA, mA	170, 39 (AA_h, 27_h)
Device variable lower limit:	-3276.8 nA	
Device variable upper limit:	3276.7 nA	

5.5. Device variable 3 (03_h) - pH glass impedance

This device variable returns the impedance of the glass membrane.
Attention: Hosts not resolving device variable classification will display cmH20(4°C) as unit instead of MΩ.

Device variable classification:	Resistance	85 (55_h)
Device family:	Not used	250 (FA_h)
Device variable unit:	MΩ, kΩ, Ω	170, 163, 37 (AA_h, $A3_h$, 25_h)
Device variable lower limit:	0 MΩ	
Device variable upper limit:	200000 MΩ	

5.6. Device variable 4 (04_h) - pH reference impedance

This device variable returns the impedance of the reference.
Attention: Hosts not resolving device variable classification will display cmH20(4°C) as unit instead of MΩ.

Device variable classification:	Resistance	85 (55_h)
Device family:	Not used	250 (FA_h)
Device variable unit:	Ω, kΩ, MΩ,	37, 163, 170 (25_h, $A3_h$, AA_h)
Device variable lower limit:	0 Ω	
Device variable upper limit:	2000000 Ω	

5.7. Device variable 5 (05_h) - ORP mV

This value returns the ORP mV value.

Device variable classification:	EMF/Voltage	83 (53_h)
Device family:	Not used	250 (FA_h)
Device variable unit:	mV, V	36, 58 (24_h, $3A_h$)
Device variable lower limit:	-2000 mV	
Device variable upper limit:	2000 mV	

5.8. Device variable 6 (06_h) - ORP %

This value returns the ORP % value.

Device variable classification:	Analytical	81 (51_h)
Device family:	Not used	250 (FA_h)
Device variable unit:	%	57 (39_h)
Device variable lower limit:	-3000 %	
Device variable upper limit:	3000 %	

5.9. Device variable 7 (07_h) - rH

This value returns the rH value calculated from a pH and mV value.

Device variable classification:	None	0 (0_h)
Device family:	Not used	250 (FA_h)
Device variable unit:	rH	247 ($F7_h$)
Device variable lower limit:	0 rH	
Device variable upper limit:	70 rH	

5.10. Device variable 8 (08_h) - Temperature (pH/ORP)

This device variable returns the process temperature when a pH or ORP sensor is used.

Device variable classification:	Temperature	64 (40_h)
Device family:	Not used	250 (FA_h)
Device variable units:	℃, ℉, K	32, 33, 35 (20_h, 21_h, 23_h)
Device variable lower limit:	-50 ℃	
Device variable upper limit:	150 ℃	

5.11. Device variable 9 (09_h) - Conductivity

This device variable returns the temperature compensated conductivity.

Device variable classification:	Conductance	87 (57_h)
Device family:	Not used	250 (FA_h)
Device variable units:	mS/cm, µS/cm	66, 67 (42_h, 43_h)
Device variable lower limit:	0 mS/cm	
Device variable upper limit:	2000 mS/cm	

5.12. Device variable 10 ($0A_h$) - Resistivity

This device variable returns the temperature compensated resistivity.

Device variable classification:	None	0 (0_h)
Device family:	Not used	250 (FA_h)
Device variable unit:	MΩcm, Ωm	242,243 ($F2_h$, $F3_h$)
Device variable lower limit:	0 MΩcm	
Device variable upper limit:	200 MΩcm	

5.13. Device variable 11 ($0B_h$) - Uncompensated conductivity

This device variable returns the uncompensated conductivity.

Device variable classification:	Conductance	87 (57_h)
Device family:	Not used	250 (FA_h)
Device variable units:	mS/cm, µS/cm	66, 67 (42_h, 43_h)
Device variable lower limit:	0 mS/cm	
Device variable upper limit:	2000 mS/cm	

5.14. Device variable 12 ($0C_h$) - Temperature (conductivity)

This device variable returns the process temperature when a conductivity sensor is used.

Device variable classification:	Temperature	64 (40_h)
Device family:	Not used	250 (FA_h)
Device variable units:	°C, °F, K	32, 33, 35 (20_h, 21_h, 23_h)
Device variable lower limit:	-50 °C	
Device variable upper limit:	250 °C	

5.15. Device variable 13 ($0D_h$) - Partial pressure

This device variable returns the partial pressure.

Device variable classification:	Pressure	65 (41_h)
Device family:	Not used	250 (FA_h)
Device variable units:	hPa, Pa	174, 11 (AE_h, $0B_h$)
Device variable lower limit:	0 hPa	
Device variable upper limit:	2500 hPa	

5.16. Device variable 14 ($0E_h$) - Oxygen saturation

This device variable returns the saturation.

Device variable classification:	Analytical	81 (51_h)
Device family:	Not used	250 (FA_h)
Device variable unit:	%	57 (39_h)
Device variable lower limit:	-0.02 %	
Device variable upper limit:	200 %	

5.17. Device variable 15 ($0F_h$) - Concentration liquid (oxygen)

This device variable returns the oxygen concentration of liquids.
Attention: Hosts not resolving device variable classification will display cmH20(4°C) as unit instead of mg/l.

mg/l mode:

Device variable classification:	Mass per volume	73 (49_h)
Device family:	Not used	250 (FA_h)
Device variable units:	mg/l, kg/m3,	170, 92 (AA_h, $5C_h$)
	g/ml, g/l, µg/l	95, 97, 146 ($5F_h$, 61_h, 92_h)
Device variable lower limit:	-0.02 mg/l	
Device variable upper limit:	120 mg/l	

ppm mode:

Device variable classification:	Concentration	90 ($5A_h$)
Device family:	Not used	250 (FA_h)
Device variable units:	ppm, ppb	139, 169 ($8B_h$, $A9_h$)
Device variable lower limit:	-0.02 ppm	
Device variable upper limit:	120 ppm	

5.18. Device variable 16 (10_h) - Concentration gaseous (oxygen)

This value returns the oxygen concentration of gasses.

%Vol mode:

Device variable classification:	Volume per volume	88 (58_h)
Device family:	Not used	250 (FA_h)
Device variable units:	%Vol	149 (95_h)
Device variable lower limit:	-0.02 %Vol	
Device variable upper limit:	200 %Vol	

ppm mode:

Device variable classification:	Concentration	90 ($5A_h$)
Device family:	Not used	250 (FA_h)
Device variable units:	ppm	139 ($8B_h$)
Device variable lower limit:	-200 ppm	
Device variable upper limit:	2000000 ppm	

5.19. Device variable 17 (11_h) - Oxygen electrode current

This device variable returns raw current measured by amperometric electrode.
Attention: Hosts not resolving device variable classification will display cmH2O(4°C) as unit instead of nA.

Device variable classification:	Current	84 (54_h)
Device family:	Not used	250 (FA_h)
Device variable units:	nA, mA	170, 39 (AA_h, 27_h)
Device variable lower limit:	0 nA	
Device variable upper limit:	12000 nA	

5.20. Device variable 18 (12_h) - Raw value µs

This value returns the raw τ value measured by optical sensor.
Attention: Hosts not resolving device variable classification will display cmH2O(4°C) as unit instead of ms and mH2O(4°C) instead of µs.

Device variable classification:	Time	70 (46_h)
Device family:	Not used	250 (FA_h)
Device variable unit:	µs, ms, s	171, 170, 51 (AB_h, AA_h, 33_h)
Device variable lower limit:	0 µs	
Device variable upper limit:	100 µs	

5.21. Device variable 19 (13_h) - Temperature (oxygen)

This device variable returns the process temperature when an oxygen sensor is used.

Device variable classification:	Temperature	64 (40_h)
Device family:	Not used	250 (FA_h)
Device variable units:	°C, °F, K	32, 33, 35 (20_h, 21_h, 23_h)
Device variable lower limit:	-10 °C	
Device variable upper limit:	140 °C	

5.22. Device variable status

Bit 0:	Not used	
Bit 1:	Not used	
Bit 2:	Not used	
Bit 3:	Not used	
Bit 5+4:	Limit status	00: Not limited 01: Low limited 10: High limited 11: Constant
Bit 7+6:	Process data status	00: Bad 01: Poor accuracy 10: Manual / fixed 11: Good

5.23. Manufacturer specific unit codes

Code	$Code_h$	Unit
242	$F2_h$	MΩcm
243	$F3_h$	Ωm
247	$F7_h$	rH

5.24. Standardized device variables

These device variables are present in every HART 7 device.
Standardized device variables cannot be mapped to PV, SV, TV or QV using command 51.

5.24.1. Battery life

This device variable will always return NaN, as Liquiline is not battery powered.

Device variable number:	243 ($F3_h$)	
Device variable classification:	None	0 (0_h)
Device family:	Not used	250 (FA_h)
Device variable unit:	Not used	250 (FA_h)
Device variable lower limit:	NaN	
Device variable upper limit:	NaN	

5.24.2. Percent range

This device variable returns the PV percentage corresponding to its user set limits. The value will always follow the PV even if the limits are exceeded, or the device is in an error state.

Device variable number:	244 ($F4_h$)	
Device variable classification:	Analytical	81 (51_h)
Device family:	Not used	250 (FA_h)
Device variable unit:	%	57 (39_h)
Device variable lower limit:	-1000 %	
Device variable upper limit:	1000 %	

5.24.3. Loop current

This device variable returns the loop current on current output even if the device is in an error or simulation state.

Device variable number:	245 ($F5_h$)	
Device variable classification:	Current	84 (54_h)
Device family:	Not used	250 (FA_h)
Device variable unit:	mA	39 (27_h)
Device variable lower limit:	0 mA	
Device variable upper limit:	23 mA	

5.24.4. Primary variable

This device variable returns the primary variable (PV).

Device variable number:	246 ($F6_h$)	
Device variable classification:	Depends on PV settings	
Device family:	Not used	250 (FA_h)
Device variable unit:	Depends on PV settings	
Device variable lower limit:	Depends on PV settings	
Device variable upper limit:	Depends on PV settings	

5.24.5. Secondary variable

This device variable returns the secondary variable (SV).

Device variable number:	247 ($F7_h$)	
Device variable classification:	Depends on SV settings	
Device family:	Not used	250 (FA_h)
Device variable unit:	Depends on SV settings	
Device variable lower limit:	Depends on SV settings	
Device variable upper limit:	Depends on SV settings	

5.24.6. Tertiary variable

This device variable returns the tertiary variable (TV).

Device variable number:	248 ($F8_h$)	
Device variable classification:	Depends on TV settings	
Device family:	Not used	250 (FA_h)
Device variable unit:	Depends on TV settings	
Device variable lower limit:	Depends on TV settings	
Device variable upper limit:	Depends on TV settings	

5.24.7. Quaternary variable

This device variable returns the quaternary variable (QV).

Device variable number:	249 ($F9_h$)	
Device variable classification:	Depends on QV settings	
Device family:	Not used	250 (FA_h)
Device variable unit:	Depends on QV settings	
Device variable lower limit:	Depends on QV settings	
Device variable upper limit:	Depends on QV settings	

6. Dynamic variables

All 4 dynamic variables (primary variable PV, secondary variable SV, tertiary variable TV and quaternary variable QV) are implemented in Liquiline devices.

6.1. Fixed dynamic variables

There are no fixed dynamic variables.

6.2. Dynamic variables with configurable mapping

All dynamic variables can be mapped to any valid device variable, see chapter 5.1.
Changing the mapping of the PV will change the current output source, too.

The default mapping depends on the connected sensor.

pH glass sensor:
PV returns device variable 0 - pH
SV returns device variable 8 - Temperature (pH/ORP)
TV returns device variable 1 - pH raw value
QV returns device variable 3 - pH glass impedance

pH ISFET sensor:
PV returns device variable 0 - pH
SV returns device variable 8 - Temperature (pH/ORP)
TV returns device variable 1 - pH raw value
QV returns device variable 2 - ISFET leakage current

ORP sensor:
PV returns device variable 5 - ORP mV
SV returns device variable 8 - Temperature (pH/ORP)
TV returns device variable 6 - ORP %
QV returns device variable 5 - ORP mV

pH + ORP sensor:
PV returns device variable 7 - rH
SV returns device variable 8 - Temperature (pH/ORP)
TV returns device variable 0 - pH
QV returns device variable 5 - ORP mV

Oxygen sensor:
PV returns device variable 13 - Partial pressure
SV returns device variable 19 - Temperature (oxygen)
TV returns device variable 15 - Concentration liquid (oxygen)
QV returns device variable 14 - Oxygen saturation

Conductivity sensor:
PV returns device variable 9 - Conductivity
SV returns device variable 12 - Temperature (conductivity)
TV returns device variable 10 - Resistivity
QV returns device variable 11 - Uncompensated conductivity

7. Status information

7.1. Device status

Bit 0 (01_h, "Primary variable out of limits") is set whenever diagnostic message 460 or 461 is set.
Bit 1 (02_h, "Non-primary variable out of limits") is not used.
Bit 2 (04_h, "Loop current saturated") is set whenever diagnostic message 460 or 461 is set.
Bit 3 (08_h, "Loop current fixed") is set when simulation or multidrop mode or hold is active.
Bit 4 (10_h, "More status available") is set whenever a diagnostic message change is detected. This bit can be reset by user interaction.
Bit 5 (20_h, “Cold start") is set after device reset. It is reset after the first HART communication request.
Bit 6 (40_h, “Configuration changed") is set whenever a HART command has changed a persistent parameter. This bit stays set until it is reset by user interaction.
Bit 7 (80_h, "Device malfunction") is set when the present highest priority diagnostic code is classified as F.

7.2. Extended device status

Bit 0 (01_h, "Maintenance required") is set when the present highest priority diagnostic code is classified as M.
Bit 1 (02_h, "Device variable alert") is not used.
Bit 2 (04_h, "Critical power failure") is not used.
Bit 3 (08_h, "Failure") is set when the present highest priority diagnostic code is classified as F.
Bit 4 (10_h, "Out of specification") is set when the present highest priority diagnostic code is classified as S.
Bit 5 (20_h, "Function check") is set when the present highest priority diagnostic code is classified as C.
Bit 6 (40_h) is not used.
Bit 7 (80_h) is not used.

7.3. Standardized status 0

Bit 0 (01_h, "Device variable simulation active") is not used.
Bit 1 (02_h, "Non-volatile memory defect") is not used.
Bit 2 (04_h, "Volatile memory defect") is not used.
Bit 3 (08_h, "Watchdog reset executed") is not used.
Bit 4 (10_h, "Power supply conditions out of range”) is not used.
Bit 5 (20_h, "Environmental conditions out of range”) is set if there is a diagnostic code present marked in column ENV in chapter 7.7.
Bit 6 (40_h, "Electronic defect”) is set if there is a diagnostic code present marked in column DEF in chapter 7.7.
Bit 7 (80_h, "Device configuration locked”) is set if the device is locked using command 71.

7.4. Standardized status 1

Bit 0 (01_h, "Status simulation active") is set when status simulation is set via command 526.
Bit 1 (02_h, "Discrete variable simulation active") is not used.
Bit 2 (04_h, "Event notification overflow") is not used.
Bit 3 (08_h) is not used.
Bit 4 (10_h) is not used.
Bit 5 (20_h) is not used.
Bit 6 (40_h) is not used.
Bit 7 (80_h) is not used.

7.5. Standardized status 2

Standardized status 2 is not used.

7.6. Standardized status 3

Standardized status 3 is not used.

7.7. Additional device status - command 48

Column “C48/Byte/Bit”: Bit and byte numbers for use with command 48
Column “CS”: Bit numbers for use with condensed status commands 148, 149, 523, 524, 526, 527
Column “Conf”: Status category is user configurable
Column “Cat”: Default status category
Column “Code”: CM82 diagnostics code number (refer to operating instructions)
Column “pH/Cond/DO”: Diagnostics code can occur depending on connected sensor
Column “DEF”: Standardized status 0 bit 6 is set (“Electronic defect “)
Column “ENV”: Standardized status 0 bit 5 is set (“Environmental conditions out of range “)
Column “LCS”: Device status bit 2 is set (“Loop current saturated “)
Column “PVOL”: Device status bit 0 is set (“PV out of limits“)
Bits not mentioned in table are not used and set to 0.

C48	Byte	Bit	CS	Conf	Cat	Code	Description	pH	Cond	DO	DEF	ENV	LCS	PVOL
0	0	0	8		F	2	Sensor unknown	X	X	X				
1	0	1	9		F	4	Sensor defective	X	X	X	X			
2	0	2	10		F	5	Sensor data invalid	X	X	X				
3	0	3	11		F	10	Sensor scanning	X	X	X				
4	0	4	12		F	12	Writing data failed	X	X	X				
5	0	5	13		F	13	Sensor type wrong	X	X	X				
6	0	6	14		F	18	Sensor not ready	X	X	X				
7	0	7	15	X	F	22	Temperature sensor	X	X	X	X			
8	1	0	16		F	61	Sensor electronic	X	X	X	X			
9	1	1	17		F	62	Sensor connection	X	X	X	X			
10	1	2	18		F	100	Sensor communication	X	X	X	X			
11	1	3	19		F	106	Sensor TAG	X	X	X				
12	1	4	20		C	107	Calibration active	X	X	X				
13	1	5	21	X	M	108	SIP, CIP, autoclaving	X	X	X		X		
14	1	6	22		M	109	Sterilization cap			X				
15	1	7	23	X	F	118	Sensor glass break.	X			X			
16	2	0	24		M	119	Sensor check							
17	2	1	25	X	F	120	Sensor reference	X			X			
18	2	2	26		M	121	Sensor reference							
19	2	3	27	X	F	122	Sensor glass	X						
20	2	4	28	X	M	123	Sensor glass	X						
21	2	5	29	X	F	124	Sensor glass	X						
22	2	6	30	X	M	125	Sensor glass	X						
23	2	7	31		M	126	Sensor check	X						
24	3	0	32		M	127	Sensor check	X						
25	3	1	33	X	F	128	Sensor leakage	X		X				
26	3	2	34	X	M	129	Sensor leakage	X		X				
27	3	3	35	X	F	130	Sensor supply	X	X	X				
28	3	4	36		M	131	Sensor calibration			X				
29	3	5	37		M	132	Sensor calibration			X				
30	3	6	38		F	133	Sensor signal			X				
31	3	7	39		M	134	Sensor signal			X				

C48	Byte	Bit	CS	Conf	Cat	Code	Description	pH	Cond	DO	DEF	ENV	LCS	PVOL
32	4	0	40		S	136	Sensor temp. high					X		
33	4	1	41		S	141	Polarization		X					
34	4	2	42		S	142	Sensor signal		X			X		
35	4	3	43		M	154	Sensor data invalid		X					
36	4	4	44		F	160	Sensor data invalid							
37	4	5	45	X	N	164	Sensor data invalid		X					
38	4	6	46		S	168	Polarization		X					
39	4	7	47		M	178	Operating time							
40	5	0	48		M	179	Operating time	X						
41	5	1	49		M	180	Operating time	X						
42	5	2	50		M	183	Operating time			X				
43	5	3	51		M	184	Operating time			X				
44	5	4	52		M	185	Operating time			X				
45	5	5	53		M	186	Operating time			X				
46	5	6	54		M	187	Operating time		X					
47	5	7	55		M	189	Operating time			X				
112	14	0	120		M	191	Operating time			X				
113	14	1	121		M	192	Operating time			X				
114	14	2	122		M	193	Operating time	X	X	X				
115	14	3	123		M	194	Operating time	X	X					
116	14	4	124		M	195	Operating time		X	X				
117	14	5	125		M	197	Operating time		X					
118	14	6	126		M	198	Operating time		X					
119	14	7	127		M	199	Operating time	X	X	X				
120	15	0	128		F	202	Selftest active			X				
121	15	1	129		C	215	Simulation active	X	X	X				
122	15	2	130		C	216	Hold active	X	X	X				
124	15	4	132		F	243	Firmware failure	X	X	X				
125	15	5	133		M	373	Electronic temp. high					X		
126	15	6	134		M	408	Calibration aborted	X	X	X				
127	15	7	135		S	460	Output below limit	X	X	X		X	X	X
128	16	0	136		S	461	Output above limit	X	X	X		X	X	X
129	16	1	137		M	500	Sensor calibration	X	X	X				
130	16	2	138		M	501	Sensor calibration	X	X	X				
131	16	3	139		M	505	Sensor calibration	X		X				
132	16	4	140		M	507	Sensor calibration	X		X				
133	16	5	141		M	509	Sensor calibration	X		X				
134	16	6	142		M	511	Sensor calibration	X		X				
135	16	7	143		M	513	Zero Warning							
136	17	0	144		M	515	Sensor calibration	X						
137	17	1	145		M	517	Sensor calibration	X						
138	17	2	146		M	518	Sensor calibration	X		X				
139	17	3	147		M	520	Sensor calibration	X		X				
140	17	4	148		M	522	Sensor calibration	X						

C48	Byte	Bit	CS	Conf	Cat	Code	Description	pH	Cond	DO	DEF	ENV	LCS	PVOL
141	17	5	149		M	532	License error	X	X	X				
142	17	6	150		M	534	Electrolyte warning							
143	17	7	151		M	535	Sensor check			X				
144	18	0	152		S	550	Process temperature		X			X		
145	18	1	153		S	551	Process temperature		X			X		
146	18	2	154		S	552	Conductivity low		X					
147	18	3	155		S	553	Conductivity high		X					
148	18	4	156		S	554	Concentration low		X			X		
149	18	5	157		S	555	Concentration high		X			X		
150	18	6	158	X	F	722	Sensor reference							
151	18	7	159	X	M	723	Sensor reference							
152	19	0	160	X	F	724	Sensor reference	X						
153	19	1	161	X	M	725	Sensor reference	X						
154	19	2	162		F	740	Sensor defective		X		X			
155	19	3	163	X	S	832	Temp. range exceeded	X	X	X		X		
156	19	4	164	X	S	841	Operating range	X	X	X		X		
157	19	5	165	X	S	842	Process value	X						
158	19	6	166	X	S	843	Process value	X						
159	19	7	167		F	904	Process check alarm	X	X	X				
160	20	0	168		S	910	Limit switch							
161	20	1	169	X	M	914	USP/ EP alarm		X			X		
162	20	2	170	X	M	915	USP / EP warning		X					
163	20	3	171		S	942	Process value	X						
164	20	4	172		S	943	Process value	X						
165	20	5	173		F	384	Firmware failure	X	X	X				
166	20	6	174		C	411	Up-/Download active, please wait	X	X	X				
167	20	7	175		M	987	Calibration required			X				
168	21	0	176		M	734	Calibration quality			X				
169	21	1	177		M	111	Operating time cap			X				
170	21	2	178	X	M	102	Calibration timer							
171	21	3	179	X	M	104	Calibration validity	X	X	X				
172	21	4	180	X	M	105	Calibration validity	X	X	X				
173	21	5	181		F	284	Firmware update	X	X	X				
174	21	6	182		F	285	Update failure	X	X	X				
175	21	7	183	X	S	146	Sensor temperature		X	X		X		
176	22	0	184		F	770	Sensor deactivated	X						

8. Universal commands

It is not suggested to use HART at command level directly.
Endress+Hauser provides device descriptions (DD) and device type managers (DTM) for a variety of control systems.

8.1. Read unique identifier - 0 (00_h)

This command reads fundamental information about the connected device.

Request data bytes

Byte	Format	Description
None		

Response data bytes

Byte	Format	Description
0	Unsigned-8	254
1-2	Enum	Expanded device type
3	Unsigned-8	Minimum request preambles
4	Unsigned-8	Universal command revision
5	Unsigned-8	Device revision
6	Unsigned-8	Software revision
7	Unsigned-8	Hardware revision / Physical signaling code
8	Bits	Flags
9-11	Unsigned-24	Device ID
12	Unsigned-8	Minimum response preambles
13	Unsigned-8	Maximum number of device variables
14-15	Unsigned-16	Configuration change counter
16	Bits	Extended field device status
17-18	Enum	Manufacturer identification code
19-20	Enum	Private label distributor code
21	Enum	Device profile

Command specific response codes

Code	Class	Description
0	Success	No command specific errors

8.2. Read primary variable - 1 (01_h)

This command reads the primary variable (PV). The primary variable is given by the source of the current output. The PV is one of the device variables described in chapter 5. Supported units can be found in chapter 5.

Request data bytes

Byte	Format	Description
None		

Response data bytes

Byte	Format	Description
0	Enum	Primary variable unit
1-4	Float	Primary variable

Command specific response codes

Code	Class	Description
0	Success	No command specific errors

8.3. Read loop current and percent of range - 2 (02_h)

This command reads the loop current and the percent of range of the current output.

Request data bytes

Byte	Format	Description
None		

Response data bytes

Byte	Format	Description
0-3	Float	Loop current [mA]
4-7	Float	Percent of range [%]

Command specific response codes

Code	Class	Description
0	Success	No command specific errors

8.4. Read dynamic variables and loop current - 3 (03_h)

This command reads the loop current and up to four predefined dynamic variables. Every dynamic variable corresponds to one device variable (see chapter 6.2). Supported units can be found in chapter 5.

Request data bytes

Byte	Format	Description
None		

Response data bytes

Byte	Format	Description
0-3	Float	Loop current [mA]
4	Enum	Primary variable unit
5-8	Float	Primary variable
9	Enum	Secondary variable unit
10-13	Float	Secondary variable
14	Enum	Tertiary variable unit
15-18	Float	Tertiary variable
19	Enum	Quaternary variable unit
20-23	Float	Quaternary variable

Command specific response codes

Code	Class	Description
0	Success	No command specific errors

8.5. Write polling address - 6 (06_h)

This command writes the polling address and the loop current mode.

Request data bytes

Byte	Format	Description
0	Unsigned-8	Polling address
1	Enum	Loop current mode (optional)

Response data bytes

Byte	Format	Description
0	Unsigned-8	Polling address
1	Enum	Loop current mode

Command specific response codes

Code	Class	Description
0	Success	No command specific errors
2	Error	Invalid address
5	Error	Too few data bytes received
12	Error	Invalid mode
16	Error	Access restricted
32	Error	Busy

Loop current mode

Disabled: 0
Enabled: 1

8.6. Read loop configuration - 7 (07_h)

This command reads the loop current mode and the polling address.

Request data bytes

Byte	Format	Description
None		

Response data bytes

Byte	Format	Description
0	Unsigned-8	Polling address
1	Enum	Loop current mode

Command specific response codes

Code	Class	Description
0	Success	No command specific errors

8.7. Read dynamic variable classification - 8 (08_h)

This command reads the classification associated with the dynamic variables. Reading the classification is necessary to select the correct unit code table. Supported units and classification codes can be found in chapter 5.

Request data bytes

Byte	Format	Description
None		

Response data bytes

Byte	Format	Description
0	Unsigned-8	Primary variable classification
1	Unsigned-8	Secondary variable classification
2	Unsigned-8	Tertiary variable classification
3	Unsigned-8	Quaternary variable classification

Command specific response codes

Code	Class	Description
0	Success	No command specific errors

8.8. Read device variables with status - 9 (09_h)

This command reads up to eight device variables with their status.

Request data bytes

Byte	Format	Description
0	Unsigned-8	Slot 0: Device variable code
1	Unsigned-8	Slot 1: Device variable code (optional)
2	Unsigned-8	Slot 2: Device variable code (optional)
3	Unsigned-8	Slot 3: Device variable code (optional)
4	Unsigned-8	Slot 4: Device variable code (optional)
5	Unsigned-8	Slot 5: Device variable code (optional)
6	Unsigned-8	Slot 6: Device variable code (optional)
7	Unsigned-8	Slot 7: Device variable code (optional)

Response data bytes

Byte	Format	Description
0	Bits	Extended device status
1	Unsigned-8	Slot 0: Device variable code
2	Enum	Slot 0: Device variable classification
3	Enum	Slot 0: Device variable unit
4-7	Float	Slot 0: Device variable value
8	Bits	Slot 0: Device variable status
9	Unsigned-8	Slot 1: Device variable code
10	Enum	Slot 1: Device variable classification
11	Enum	Slot 1: Device variable unit
12-15	Float	Slot 1: Device variable value
16	Bits	Slot 1: Device variable status
17	Unsigned-8	Slot 2: Device variable code
18	Enum	Slot 2: Device variable classification
19	Enum	Slot 2: Device variable unit
20-23	Float	Slot 2: Device variable value
24	Bits	Slot 2: Device variable status
25	Unsigned-8	Slot 3: Device variable code
26	Enum	Slot 3: Device variable classification
27	Enum	Slot 3: Device variable unit
28-31	Float	Slot 3: Device variable value
32	Bits	Slot 3: Device variable status
33	Unsigned-8	Slot 4: Device variable code
34	Enum	Slot 4: Device variable classification
35	Enum	Slot 4: Device variable unit
36-39	Float	Slot 4: Device variable value
40	Bits	Slot 4: Device variable status
41	Unsigned-8	Slot 5: Device variable code
42	Enum	Slot 5: Device variable classification
43	Enum	Slot 5: Device variable unit
44-47	Float	Slot 5: Device variable value
48	Bits	Slot 5: Device variable status
49	Unsigned-8	Slot 6: Device variable code
50	Enum	Slot 6: Device variable classification
51	Enum	Slot 6: Device variable unit
52-55	Float	Slot 6: Device variable value
56	Bits	Slot 6: Device variable status

57	Unsigned-8	Slot 7: Device variable code
58	Enum	Slot 7: Device variable classification
59	Enum	Slot 7: Device variable unit
60-63	Float	Slot 7: Device variable value
64	Bits	Slot 7: Device variable status
65-68(*)	Time	Data time stamp

(*) Timestamp is always present, even if less than 8 device variables were requested. Its position is always at the end of the frame. Timestamp is in format 1/32 ms since midnight (Unsigned-32).

Command specific response codes

Code	Class	Description
0	Success	No command specific errors
2	Error	Invalid selection
5	Error	Too few data bytes received

8.9. Read unique identifier associated with tag - 11 ($0B_h$)

This command reads fundamental information about the connected device.
The device will not respond to this command unless the short tag matches.

Request data bytes

Byte	Format	Description
0-5	Packed ASCII	Tag

Response data bytes

Byte	Format	Description
0	Unsigned-8	254
1-2	Enum	Expanded device type
3	Unsigned-8	Minimum request preambles
4	Unsigned-8	Universal command revision
5	Unsigned-8	Device revision
6	Unsigned-8	Software revision
7	Unsigned-8	Hardware revision / Physical signaling code
8	Bits	Flags
9-11	Unsigned-24	Device ID
12	Unsigned-8	Minimum response preambles
13	Unsigned-8	Maximum number of device variables
14-15	Unsigned-16	Configuration change counter
16	Bits	Extended field device status
17-18	Enum	Manufacturer identification code
19-20	Enum	Private label distributor code
21	Enum	Device profile

Command specific response codes

Code	Class	Description
0	Success	No command specific errors

8.10. Read message - 12 ($0C_h$)

This command reads the message.

Request data bytes

Byte	Format	Description
None		

Response data bytes

Byte	Format	Description
0-23	Packed ASCII	Message

Command specific response codes

Code	Class	Description
0	Success	No command specific errors

8.11. Read tag, descriptor and date - 13 ($0D_h$)

This command reads the short tag, descriptor and the date.
The short HART tag is completely separated from the long tag (see command 20).

Request data bytes

Byte	Format	Description
None		

Response data bytes

Byte	Format	Description
0-5	Packed ASCII	Short tag
6-17	Packed ASCII	Descriptor
18-20	Unsigned-24	Date

Command specific response codes

Code	Class	Description
0	Success	No command specific errors

8.12. Read primary variable transducer information - 14 ($0E_h$)

This command reads the serial number, limits and the minimum span for the primary variable transducer. The serial number is always 0.

Request data bytes

Byte	Format	Description
None		

Response data bytes

Byte	Format	Description
0-2	Unsigned-24	Transducer serial number
3	Enum	Transducer limits and span unit
4-7	Float	Upper transducer limit
8-11	Float	Lower transducer limit
12-15	Float	Minimum transducer span

Command specific response codes

Code	Class	Description
0	Success	No command specific errors

8.13. Read device information - 15 ($0F_h$)

This command reads additional information of the device.

Request data bytes

Byte	Format	Description
None		

Response data bytes

Byte	Format	Description
0	Enum	PV alarm selection code
1	Enum	PV transfer function code
2	Enum	PV range value unit
3-6	Float	PV upper range value
7-10	Float	PV lower range value
11-14	Float	PV damping value [s]
15	Enum	Write protect code
16	Unsigned-8	Reserved
17	Enum	PV analog channel flags

Command specific response codes

Code	Class	Description
0	Success	No command specific errors

8.14. Read final assembly number - 16 (10_h)

This command reads the final assembly number of the device.

Request data bytes

Byte	Format	Description
None		

Response data bytes

Byte	Format	Description
0-2	Unsigned-24	Final assembly number

Command specific response codes

Code	Class	Description
0	Success	No command specific errors

8.15. Write message - 17 (11_h)

This command writes the message.

Request data bytes

Byte	Format	Description
0-23	Packed ASCII	Message

Response data bytes

Byte	Format	Description
0-23	Packed ASCII	Message

Command specific response codes

Code	Class	Description
0	Success	No command specific errors
5	Error	Too few data bytes received
16	Error	Access restricted
32	Error	Busy

8.16. Write tag, descriptor and date - 18 (12_h)

This command writes the short tag, descriptor and the date.
The short HART tag is completely separated from the long tag.

Request data bytes

Byte	Format	Description
0-5	Packed ASCII	Short tag
6-17	Packed ASCII	Descriptor
18-20	Unsigned-24	Date

Response data bytes

Byte	Format	Description
0-5	Packed ASCII	Short tag
6-17	Packed ASCII	Descriptor
18-20	Unsigned-24	Date

Command specific response codes

Code	Class	Description
0	Success	No command specific errors
5	Error	Too few data bytes received
16	Error	Access restricted
32	Error	Busy

8.17. Write final assembly number - 19 (13_h)

This command writes the final assembly number.

Request data bytes

Byte	Format	Description
0-2	Unsigned-24	Final assembly number

Response data bytes

Byte	Format	Description
0-2	Unsigned-24	Final assembly number

Command specific response codes

Code	Class	Description
0	Success	No command specific errors
5	Error	Too few data bytes received
16	Error	Access restricted
32	Error	Busy

8.18. Read long tag - 20 (14_h)

This command reads the long tag.

Request data bytes

Byte	Format	Description
None		

Response data bytes

Byte	Format	Description
0-31	Latin-1	Long tag

Command specific response codes

Code	Class	Description
0	Success	No command specific errors

8.19. Read unique identifier associated with long tag - 21 (15_h)

This command reads fundamental information about the connected device.
The device will not respond to this command unless the long tag matches.

Request data bytes

Byte	Format	Description
0-31	Latin-1	Tag

Response data bytes

Byte	Format	Description
0	Unsigned-8	254
1-2	Enum	Expanded device type
3	Unsigned-8	Minimum request preambles
4	Unsigned-8	Universal command revision
5	Unsigned-8	Device revision
6	Unsigned-8	Software revision
7	Unsigned-8	Hardware revision / Physical signaling code
8	Bits	Flags
9-11	Unsigned-24	Device ID
12	Unsigned-8	Minimum response preambles
13	Unsigned-8	Maximum number of device variables
14-15	Unsigned-16	Configuration change counter
16	Bits	Extended field device status
17-18	Enum	Manufacturer identification code
19-20	Enum	Private label distributor code
21	Enum	Device profile

Command specific response codes

Code	Class	Description
0	Success	No command specific errors

8.20. Write long tag - 22 (16_h)

This command writes the long tag.

Request data bytes

Byte	Format	Description
0-31	Latin-1	Long tag

Response data bytes

Byte	Format	Description
0-31	Latin-1	Long tag

Command specific response codes

Code	Class	Description
0	Success	No command specific errors
5	Error	Too few data bytes received
16	Error	Access restricted
32	Error	Busy

8.21. Reset configuration changed flag - 38 (26_h)

This command will reset one of the configuration changed flags, depending on the sending master.
If the configuration change counter value is sent, the device will check it versus the current counter value.
If both are matching, the configuration changed flag will be reset.

Request data bytes

Byte	Format	Description
0-1	Unsigned-16	Configuration change counter (optional)

Response data bytes

Byte	Format	Description
0-1	Unsigned-16	Configuration change counter

Command specific response codes

Code	Class	Description
0	Success	No command specific errors
9	Error	Configuration change counter mismatch
16	Error	Access restricted
32	Error	Busy

8.22. Read additional status - 48 (30_h)

This command returns device status information not included in the response code or device status byte.
A description of single bits meanings can be found in chapter 7.7.
If data is included when sending command 48 this data is checked versus the current device status. If all data matches the “more status available” flag is reset.

Request data bytes

Byte	Format	Description
0-5	Bits	See chapter 7.7 (optional)
6	Bits	Extended device status (optional)
7	Bits	Device operating mode (optional)
8	Bits	Standardized status 0 (optional)
9	Bits	Standardized status 1 (optional)
10	Bits	Analog channel saturated (optional)
11	Bits	Standardized status 2 (optional)
12	Bits	Standardized status 3 (optional)
13	Bits	Analog channel fixed (optional)
14-24	Bits	See chapter 7.7 (optional)

Response data bytes

Byte	Format	Description
0-5	Bits	See chapter 7.7
6	Bits	Extended device status
7	Bits	Device operating mode
8	Bits	Standardized status 0
9	Bits	Standardized status 1
10	Bits	Analog channel saturated
11	Bits	Standardized status 2
12	Bits	Standardized status 3
13	Bits	Analog channel fixed
14-24	Bits	See chapter 7.7

Command specific response codes

Code	Class	Description
0	Success	No command specific errors

9. Common practice commands

It is not suggested to use HART at command level directly.
Endress+Hauser provides device descriptions (DD) and device type managers (DTM) for a variety of control systems.

9.1. Read device variable - 33 (21_h)

This command reads up to 4 device variables.

Request data bytes

Byte	Format	Description
0	Unsigned-8	Slot 0: Device variable code
1	Unsigned-8	Slot 1: Device variable code (optional)
2	Unsigned-8	Slot 2: Device variable code (optional)
3	Unsigned-8	Slot 3: Device variable code (optional)

Response data bytes

Byte	Format	Description
0	Unsigned-8	Slot 0: Device variable code
1	Enum	Slot 0: Device variable unit
2-5	Float	Slot 0: Device variable value
6	Unsigned-8	Slot 1: Device variable code
7	Enum	Slot 1: Device variable unit
8-11	Float	Slot 1: Device variable value
12	Unsigned-8	Slot 2: Device variable code
13	Enum	Slot 2: Device variable unit
14-17	Float	Slot 2: Device variable value
18	Unsigned-8	Slot 3: Device variable code
19	Enum	Slot 3: Device variable unit
20-23	Float	Slot 3: Device variable value

Command specific response codes

Code	Class	Description
0	Success	No command specific errors
2	Error	Invalid selection
5	Error	Too few data bytes received

9.2. Write primary variable damping value - 34 (22_h)

This command writes the primary variable damping value.

Request data bytes

Byte	Format	Description
0-3	Float	Primary variable damping value [s]

Response data bytes

Byte	Format	Description
0-3	Float	Primary variable damping value [s]

Command specific response codes

Code	Class	Description
0	Success	No command specific errors
5	Error	Too few data bytes received
8	Warning	Set to nearest possible value
16	Error	Access restricted
32	Error	Busy

9.3. Write primary variable range values - 35 (23_h)

This command defines the relationship between the loop current and the primary variable.

Request data bytes

Byte	Format	Description
0	Enum	Range value unit
1-4	Float	Upper range value (value at 20 mA)
5-8	Float	Lower range value (value at 4 mA)

Response data bytes

Byte	Format	Description
0	Enum	Range value unit
1-4	Float	Upper range value (value at 20 mA)
5-8	Float	Lower range value (value at 4 mA)

Command specific response codes

Code	Class	Description
0	Success	No command specific errors
5	Error	Too few data bytes received
9	Error	Lower range value too high
10	Error	Lower range value too low
11	Error	Upper range value too high
12	Error	Upper range value too low
13	Error	Upper and lower range value out of limits
14	Warning	Span too small
16	Error	Access restricted
18	Error	Invalid units code
29	Error	Invalid span
32	Error	Busy

9.4. Set primary variable upper range value - 36 (24_h)

As soon as this command is received, the present primary variable value is copied into the upper range value.
The upper range can be set below the lower range.

Request data bytes

Byte	Format	Description
None		

Response data bytes

Byte	Format	Description
None		

Command specific response codes

Code	Class	Description
0	Success	No command specific errors
9	Error	Applied process too high
10	Error	Applied process too low
16	Error	Access restricted
32	Error	Busy

9.5. Set primary variable lower range value - 37 (25_h)

As soon as this command is received, the present primary variable value is copied into the lower range value.
At the same time, the upper range will be shifted to keep the span constant.
The lower range can be set above the upper range.

Request data bytes

Byte	Format	Description
None		

Response data bytes

Byte	Format	Description
None		

Command specific response codes

Code	Class	Description
0	Success	No command specific errors
9	Error	Applied process too high
10	Error	Applied process too low
16	Error	Access restricted
32	Error	Busy

9.6. Set simulation current - 40 (28_h)

This command sets a certain fixed current on the current output (current simulation).
To disable simulation mode a value of 0.0 can be set.
Simulation values in the range from 3.6 to 23.0 mA are valid.

Request data bytes

Byte	Format	Description
0-3	Float	Fixed current value [mA]

Response data bytes

Byte	Format	Description
0-3	Float	Fixed current value [mA]

Command specific response codes

Code	Class	Description
0	Success	No command specific errors
3	Error	Passed parameter too large
4	Error	Passed parameter too small
5	Error	Too few data bytes received
11	Error	Loop current not active (multidrop mode)
16	Error	Access restricted
32	Error	Busy

9.7. Perform self-test - 41 (29_h)

This command answers the request, only. It is implemented for compatibility reasons.

Request data bytes

Byte	Format	Description
None		

Response data bytes

Byte	Format	Description
None		

Command specific response codes

Code	Class	Description
0	Success	No command specific errors

9.8. Reset device - 42 ($2A_h$)

This command triggers a reset. Liquiline will need about 45 seconds to initialize and to be back online.

Request data bytes

Byte	Format	Description
None		

Response data bytes

Byte	Format	Description
None		

Command specific response codes

Code	Class	Description
0	Success	No command specific errors
16	Error	Access restricted

9.9. Write primary variable unit - 44 ($2C_h$)

This command selects the unit of the primary variable and its ranges.
Possible units depending on different operating modes are listed in chapter 5.

Request data bytes

Byte	Format	Description
0	Enum	Primary variable unit

Response data bytes

Byte	Format	Description
0	Enum	Primary variable unit

Command specific response codes

Code	Class	Description
0	Success	No command specific errors
2	Error	Invalid selection
5	Error	Too few data bytes received
16	Error	Access restricted
32	Error	Busy

9.10. Trim loop current zero - 45 ($2D_h$)

Command 45 and 46 can do a recalibration of the current output loop.
These commands will not overwrite the factory current output calibration but do a second user calibration.
To restore the original values command 45 with value 0.0 mA can be sent.

Command 45 recalibrates the lower range of the current output.

Before sending command 45 command 40 with a value of 4 mA has to be sent.
The value to be sent with command 45 must be measured with an external ampere meter.

Request data bytes

Byte	Format	Description
0-3	Float	Externally measured loop current [mA]

Response data bytes

Byte	Format	Description
0-3	Float	Loop current [mA]

Command specific response codes

Code	Class	Description
0	Success	No command specific errors
3	Error	Passed parameter too large
4	Error	Passed parameter too small
5	Error	Too few data bytes received
9	Error	Incorrect loop current mode or value
11	Error	Loop current not active (multidrop mode)
16	Error	Access restricted
32	Error	Busy

9.11. Trim loop current gain - 46 ($2E_h$)

Command 45 and 46 can do a recalibration of the current output loop.
These commands will not overwrite the factory current output calibration but do a second user calibration.
To restore the original values command 45 with value 0.0 mA can be sent.

Command 46 recalibrates the upper range of the current output.

Before sending command 46 command 40 with a value of 20 mA has to be sent.
The value to be sent with command 46 must be measured with an external ampere meter.

Request data bytes

Byte	Format	Description
0-3	Float	Externally measured loop current [mA]

Response data bytes

Byte	Format	Description
0-3	Float	Loop current [mA]

Command specific response codes

Code	Class	Description
0	Success	No command specific errors
3	Error	Passed parameter too large
4	Error	Passed parameter too small
5	Error	Too few data bytes received
9	Error	Incorrect loop current mode or value
11	Error	Loop current not active (multidrop mode)
16	Error	Access restricted
32	Error	Busy

9.12. Read dynamic variable assignments - 50 (32_h)

This command returns the mapping between device and dynamic variables (see chapter 6.2).

Request data bytes

Byte	Format	Description
None		

Response data bytes

Byte	Format	Description
0	Unsigned-8	Device variable assigned to primary variable
1	Unsigned-8	Device variable assigned to secondary variable
2	Unsigned-8	Device variable assigned to tertiary variable
3	Unsigned-8	Device variable assigned to quaternary variable

Command specific response codes

Code	Class	Description
0	Success	No command specific errors

9.13. Write dynamic variable assignments - 51 (33_h)

This command sets the mapping between device and dynamic variables (see chapter 6.2).

Request data bytes

Byte	Format	Description
0	Unsigned-8	Device variable to assign to primary variable
1	Unsigned-8	Device variable to assign to secondary variable
2	Unsigned-8	Device variable to assign to tertiary variable
3	Unsigned-8	Device variable to assign to quaternary variable

Response data bytes

Byte	Format	Description
0	Unsigned-8	Device variable assigned to primary variable
1	Unsigned-8	Device variable assigned to secondary variable
2	Unsigned-8	Device variable assigned to tertiary variable
3	Unsigned-8	Device variable assigned to quaternary variable

Command specific response codes

Code	Class	Description
0	Success	No command specific errors
2	Error	Invalid selection
5	Error	Too few data bytes received
16	Error	Access restricted
32	Error	Busy

9.14. Write device variable unit - 53 (35_h)

This command selects the unit of a certain device variable and its ranges.
Possible units depending on different sensors are listed in chapter 5.

Request data bytes

Byte	Format	Description
0	Unsigned-8	Device variable code
1	Enum	Device variable unit

Response data bytes

Byte	Format	Description
0	Unsigned-8	Device variable code
1	Enum	Device variable unit

Command specific response codes

Code	Class	Description
0	Success	No command specific errors
5	Error	Too few data bytes received
11	Error	Invalid device variable code
12	Error	Invalid unit code
16	Error	Access restricted
32	Error	Busy

9.15. Read device variable information - 54 (36_h)

This command reads more information about a device variable.
Device variable transducer serial number and family classification are not supported and will return 0.

Request data bytes

Byte	Format	Description
0	Unsigned-8	Device variable code

Response data bytes

Byte	Format	Description
0	Unsigned-8	Device variable code
1-3	Unsigned-24	Transducer serial number
4	Enum	Transducer limits and span unit
5-8	Float	Upper transducer limit
9-12	Float	Lower transducer limit
13-16	Float	Damping value [s]
17-20	Float	Minimum span
21	Enum	Device variable classification
22	Enum	Device variable family
23-26	Time	Acquisition period
27	Bits	Device variable properties

Command specific response codes

Code	Class	Description
0	Success	No command specific errors
5	Error	Too few data bytes received
11	Error	Invalid device variable code

9.16. Write number of response preambles - 59 ($3B_h$)

This command sets the number of response preambles.

Request data bytes

Byte	Format	Description
0	Unsigned-8	Number of response preambles

Response data bytes

Byte	Format	Description
0	Unsigned-8	Number of response preambles

Command specific response codes

Code	Class	Description
0	Success	No command specific errors
3	Error	Passed parameter too large
4	Error	Passed parameter too small
5	Error	Too few data bytes received
16	Error	Access restricted
32	Error	Busy

9.17. Lock device - 71 (47_h)

This command locks the device to one HART master.
If a permanent lock was set and the device loses power, the lock will be set again as soon as the first HART frame is detected.
“Lock all” prevents any master from writing. Then any master can reset the lock, though.

Request data bytes

Byte	Format	Description
0	Enum	Lock code

Response data bytes

Byte	Format	Description
0	Enum	Lock code

Command specific response codes

Code	Class	Description
0	Success	No command specific errors
5	Error	Too few data bytes received
10	Error	Invalid lock code
16	Error	Access restricted
32	Error	Busy

Lock code

Unlock: 0
Lock temporary: 1
Lock permanent: 2
Lock all: 3

9.18. Squawk - 72 (48_h)

On reception of this command Liquiline will flash its LED two times green and two times red alternatingly.
If no data byte is sent with the command the LED is reset to normal operation after 10 seconds.
This command can be used to identify a certain device in large installations.

Request data bytes

Byte	Format	Description
0	Enum	Squawk code (optional)

Response data bytes

Byte	Format	Description
0	Enum	Squawk code

Command specific response codes

Code	Class	Description
0	Success	No command specific errors

Squawk code

Off: 0
On: 1
10 seconds: 2

9.19. Read lock device state - 76 ($4C_h$)

This command reads the current state of the device lock.

Request data bytes

Byte	Format	Description
None		

Response data bytes

Byte	Format	Description
0	Bits	Lock state

Command specific response codes

Code	Class	Description
0	Success	No command specific errors

Lock state

Locked:	1
Permanent:	2
Locked by primary master:	4
All locked:	8

9.20. Read communication statistics - 95 ($5F_h$)

This command reads the current communication statistics. The counters roll over to 0 if they reach their maximum. This will happen about once a day, assuming one communication per second.

Request data bytes

Byte	Format	Description
None		

Response data bytes

Byte	Format	Description
0-1	Unsigned-16	Number of HART requests received
2-3	Unsigned-16	Number of HART responses sent
4-5	Unsigned-16	Always 0

Command specific response codes

Code	Class	Description
0	Success	No command specific errors

9.21. Write primary variable alarm code - 100 (64_h)

This command will set the current output behavior if device is in state “Alarm”.
Alarm is not necessarily condensed status “F”. Please refer to the operating instructions.

Request data bytes

Byte	Format	Description
0	Enum	PV alarm selection code

Response data bytes

Byte	Format	Description
0	Enum	PV alarm selection code

Command specific response codes

Code	Class	Description
0	Success	No command specific errors
2	Error	Invalid selection
5	Error	Too few data bytes received
16	Error	Access restricted
32	Error	Busy

Alarm selection code
High (fixed 22.5 mA): 0
Low (fixed 3.6 mA): 1

9.22. Read device location - 516 (0204_h)

This command reads the location of Liquiline. Content can be set by user using command 517.

Request data bytes

Byte	Format	Description
None		

Response data bytes

Byte	Format	Description
0-3	Float	Latitude [°]. N = +, S = -
4-7	Float	Longitude [°] E = +, W = -
8	Enum	Location method/quality
9-12	Float	Altitude [m]

Command specific response codes

Code	Class	Description
0	Success	No command specific errors

9.23. Write device location - 517 (0205_h)

This command writes the device location.

Request data bytes

Byte	Format	Description
0-3	Float	Latitude [°]. N = +, S = -
4-7	Float	Longitude [°] E = +, W = -
8	Enum	Location method/quality
9-12	Float	Altitude [m]

Response data bytes

Byte	Format	Description
0-3	Float	Latitude [°]. N = +, S = -
4-7	Float	Longitude [°] E = +, W = -
8	Enum	Location method/quality
9-12	Float	Altitude [m]

Command specific response codes

Code	Class	Description
0	Success	No command specific errors
2	Error	Invalid location method
3	Error	Latitude or longitude to large
4	Error	Latitude or longitude to small
5	Error	Too few data bytes received
16	Error	Access restricted
32	Error	Busy

Location method

No fix:	0
GPS or SPS fix:	1
Differential GPS fix:	2
PPS fix:	3
RTK fixed solution:	4
RTK float solution:	5
Estimated dead reckoning:	6
Manual input mode:	7
Simulation mode:	8

9.24. Read location description - 518 (0206_h)

This command reads the location description.

Request data bytes

Byte	Format	Description
None		

Response data bytes

Byte	Format	Description
0-31	Latin-1	Location description

Command specific response codes

Code	Class	Description
0	Success	No command specific errors

9.25. Write location description - 519 (0207_h)

This command writes the location description.

Request data bytes

Byte	Format	Description
0-31	Latin-1	Location description

Response data bytes

Byte	Format	Description
0-31	Latin-1	Location description

Command specific response codes

Code	Class	Description
0	Success	No command specific errors
5	Error	Too few data bytes received
16	Error	Access restricted
32	Error	Busy

9.26. Read process unit tag - 520 (0208_h)

This command reads the process unit tag.

Request data bytes

Byte	Format	Description
None		

Response data bytes

Byte	Format	Description
0-31	Latin-1	Process unit tag

Command specific response codes

Code	Class	Description
0	Success	No command specific errors

9.27. Write process unit tag - 521 (0209_h)

This command writes the process unit tag.

Request data bytes

Byte	Format	Description
0-31	Latin-1	Process unit tag

Response data bytes

Byte	Format	Description
0-31	Latin-1	Process unit tag

Command specific response codes

Code	Class	Description
0	Success	No command specific errors
5	Error	Too few data bytes received
16	Error	Access restricted
32	Error	Busy

9.28. Read condensed status mapping array - 523 ($020B_h$)

This command reads the status mapping array or a part of it.
The status mapping array determines the devices behavior depending on the highest priority diagnostic message.
The default mapping can be found in chapter 7.7.
No more than 84 status maps can be read at once.

Request data bytes

Byte	Format	Description
0	Unsigned-8	Starting status map index (see chapter 7.7)
1	Unsigned-8	Number of entries to read

Response data bytes

Byte	Format	Description
0	Unsigned-8	Actual starting status map index
1	Unsigned-8	Number of entries actually returned
2 (bits 0-3)	Enum	First status map code
2 (bits 4-7)	Enum	Second status map code
3 (bits 0-3)	Enum	Third status map code
...	Enum	Remaining status map codes

Command specific response codes

Code	Class	Description
0	Success	No command specific errors
5	Error	Too few data bytes received
8	Warning	Set to nearest possible value

9.29. Write condensed status mapping array - 524 ($020C_h$)

This command writes the status mapping array or a part of it.
The status mapping array determines the devices behavior depending on the highest priority diagnostic message.
The default mapping can be found in chapter 7.7.
Only maps marked as “Config” (chapter 7.7) can be changed.
At least 2 status maps must be written.

Request data bytes

Byte	Format	Description
0	Unsigned-8	Starting status map index (see chapter 7.7)
1	Unsigned-8	Number of entries to write
2 (bits 0-3)	Enum	First status map code
2 (bits 4-7)	Enum	Second status map code
3 (bits 0-3)	Enum	Third status map code
…	Enum	Remaining status map codes

Response data bytes

Byte	Format	Description
0	Unsigned-8	Actual starting status map index
1	Unsigned-8	Number of entries actually returned
2 (bits 0-3)	Enum	First status map code
2 (bits 4-7)	Enum	Second status map code
3 (bits 0-3)	Enum	Third status map code
…	Enum	Remaining status map codes

Command specific response codes

Code	Class	Description
0	Success	No command specific errors
2	Error	Invalid selection
5	Error	Too few data bytes received
8	Warning	Set to nearest possible value
9	Error	Starting status map index must be even
16	Error	Access restricted
32	Error	Busy

Condensed status mapping code

N:	0
M:	1
F:	3
S:	4
C:	5

9.30. Reset condensed status map - 525 ($020D_h$)

This command restores the condensed status map factory settings.

Request data bytes

Byte	Format	Description
None		

Response data bytes

Byte	Format	Description
None		

Command specific response codes

Code	Class	Description
0	Success	No command specific errors
16	Error	Access restricted
32	Error	Busy

9.31. Write status simulation - 526 ($020E_h$)

This command enables or disables status simulation.

Request data bytes

Byte	Format	Description
0	Enum	Status simulation mode

Response data bytes

Byte	Format	Description
0	Enum	Status simulation mode

Command specific response codes

Code	Class	Description
0	Success	No command specific errors
2	Error	Invalid selection
5	Error	Too few data bytes received
16	Error	Access restricted
32	Error	Busy

Status simulation mode

Disabled: 0
Enabled: 1

9.32. Simulate status bit - 527 ($020F_h$)

This command sets or resets a specific status bit (see chapter 7.7) while simulation mode is enabled.
The following bits cannot be simulated:
4, 56, 59, 60, 61, 64, 65, 66, 67, 68, 69, 70, 71, 80

Request data bytes

Byte	Format	Description
0	Unsigned-8	Index of bit to be simulated
1	Enum	Simulated value code

Response data bytes

Byte	Format	Description
0	Unsigned-8	Index of bit to be simulated
1	Enum	Simulated value code

Command specific response codes

Code	Class	Description
0	Success	No command specific errors
2	Error	Invalid selection
5	Error	Too few data bytes received
16	Error	Access restricted
32	Error	Busy

Simulated value
Reset: 0
Set: 1

10. Device specific commands

It is not suggested to use HART at command level directly.
Endress+Hauser provides device descriptions (DD) and device type managers (DTM) for a variety of control systems.

10.1. Device specific command - 128 (80_h)

This command is for Endress+Hauser internal use, only.

10.2. Device specific command - 129 (81_h)

This command is for Endress+Hauser internal use, only.

10.3. Device specific command - 140 ($8C_h$)

This command is for Endress+Hauser internal use, only.

10.4. Read extended condensed status mapping array - 148 (94_h)

This command reads the extended status mapping array or a part of it.
The status mapping array determines the devices behavior depending on the highest priority diagnostic message.
The default mapping can be found in chapter 7.7.
No more than 84 status maps can be read at once.
Compared with command 523 this command returns information about the present error current setting for each status, additionally.

Request data bytes

Byte	Format	Description
0	Unsigned-8	Starting status map index (see chapter 7.7)
1	Unsigned-8	Number of entries to read

Response data bytes

Byte	Format	Description
0	Unsigned-8	Actual starting status map index
1	Unsigned-8	Number of entries actually returned
2 (bits 0-3)	Bits	First status map code
2 (bits 4-7)	Bits	Second status map code
3 (bits 0-3)	Bits	Third status map code
...	Bits	Remaining status map codes

Command specific response codes

Code	Class	Description
0	Success	No command specific errors
5	Error	Too few data bytes received
8	Warning	Set to nearest possible value

10.5. Write extended condensed status mapping array - 149 (95_h)

This command writes the extended status mapping array or a part of it.
The status mapping array determines the devices behavior depending on the highest priority diagnostic message.
The default mapping can be found in chapter 7.7.
Only maps marked as “Config” (chapter 7.7) can be changed.
At least 2 status maps must be written.

Compared to command 524 this command can set the current output behavior, too. The current output behavior does not necessarily depend on the condensed status, i.e. status “F” may not set error current.
The original enum “Condensed status mapping code” is extended by an additional bit (“Error current”). If this bit is set error current is set as soon as the according status bit is set.

Request data bytes

Byte	Format	Description
0	Unsigned-8	Starting status map index (see chapter 7.7)
1	Unsigned-8	Number of entries to write
2 (bits 0-3)	Bits	First status map code
2 (bits 4-7)	Bits	Second status map code
3 (bits 0-3)	Bits	Third status map code
…	Bits	Remaining status map codes

Response data bytes

Byte	Format	Description
0	Unsigned-8	Actual starting status map index
1	Unsigned-8	Number of entries actually returned
2 (bits 0-3)	Bits	First status map code
2 (bits 4-7)	Bits	Second status map code
3 (bits 0-3)	Bits	Third status map code
…	Bits	Remaining status map codes

Command specific response codes

Code	Class	Description
0	Success	No command specific errors
2	Error	Invalid selection
5	Error	Too few data bytes received
8	Warning	Set to nearest possible value
9	Error	Starting status map index must be even
16	Error	Access restricted
32	Error	Busy

Extended condensed status mapping code

N (enum):	0
M (enum):	1
F (enum):	3
S (enum):	4
C (enum):	5
Error current (bit):	8

10.6. Set diagnostic code behavior - 150 (96_h)

This command is for Endress+Hauser internal use, only.

This command sets the status code for a certain diagnostic message (e.g. “F100”).

Request data bytes

Byte	Format	Description
0-1	Unsigned-16	Diagnostic code
2	Unsigned-8	Not used, must be 0
3	Bits	Enhanced device status code to set

Response data bytes

Byte	Format	Description
0-1	Unsigned-16	Diagnostic code
2	Unsigned-8	Not used, returns 0
3	Bits	Enhanced device status code

Command specific response codes

Code	Class	Description
0	Success	No command specific errors
2	Error	Invalid selection
5	Error	Too few data bytes received
16	Error	Access restricted
32	Error	Busy

Enhanced device status

N (enum): 0
M (enum): 1
F (enum): 3
S (enum): 4
C (enum): 5

10.7. Read diagnostic code behavior - 151 (97_h)

This command is for Endress+Hauser internal use, only.

This command reads the status code for a certain diagnostic message (e.g. “F100”).

Request data bytes

Byte	Format	Description
0-1	Unsigned-16	Diagnostic code

Response data bytes

Byte	Format	Description
0-1	Unsigned-16	Diagnostic code
2	Unsigned-8	Reserved (=0)
3	Unsigned-8	Enhanced device status code

Command specific response codes

Code	Class	Description
0	Success	No command specific errors
2	Error	Invalid selection
5	Error	Too few data bytes received

10.8. Device specific command - 153 (99_h)

This command is for Endress+Hauser internal use, only.

10.9. Device specific command - 154 ($9A_h$)

This command is for Endress+Hauser internal use, only.

10.10. Device specific command - 155 ($9B_h$)

This command is for Endress+Hauser internal use, only.

10.11. Device specific command - 156 ($9C_h$)

This command is for Endress+Hauser internal use, only.

10.12. Device specific command - 158 ($9E_h$)

This command is for Endress+Hauser internal use, only.

10.13. Device specific command - 160 ($A0_h$)

This command is for Endress+Hauser internal use, only.

10.14. Device specific command - 161 ($A1_h$)

This command is for Endress+Hauser internal use, only.

10.15. Device specific command - 166 ($A6_h$)

This command is for Endress+Hauser internal use, only.

10.16. Read extended communication statistics - 170 (AA_h)

This command reads the current extended communication statistics of Liquiline. The counters roll over to 0 if they reach their maximum.

Request data bytes

Byte	Format	Description
None		

Response data bytes

Byte	Format	Description
0-3	Unsigned-32	Number of HART requests received
4-7	Unsigned-32	Number of HART responses sent
8-11	Unsigned-32	Number of parity errors
12-15	Unsigned-32	Number of framing errors
16-19	Unsigned-32	Number of overrun errors
20-23	Unsigned-32	Number of overflow errors
24-27	Unsigned-32	Number of checksum errors
28-31	Unsigned-32	Number of busies

Command specific response codes

Code	Class	Description
0	Success	No command specific errors

10.17. Device specific command - 211 ($D3_h$)

This command is for Endress+Hauser internal use, only.

10.18. Device specific command - 212 ($D4_h$)

This command is for Endress+Hauser internal use, only.

10.19. Device specific command - 213 ($D5_h$)

This command is for Endress+Hauser internal use, only.

10.20. Device specific command - 214 ($D6_h$)

This command is for Endress+Hauser internal use, only.

10.21. Device specific command - 215 ($D7_h$)

This command is for Endress+Hauser internal use, only.

10.22. Device specific command - 216 ($D8_h$)

This command is for Endress+Hauser internal use, only.

10.23. Reset device - 217 ($D9_h$)

This command executes a device restart (same as command 42) or restart with parameter resetting to factory defaults.

Request data bytes

Byte	Format	Description
0	Unsigned-8	Reset code

Response data bytes

Byte	Format	Description
0	Unsigned-8	Reset code

Command specific response codes

Code	Class	Description
0	Success	No command specific errors
2	Error	Invalid selection
5	Error	Too few data bytes received
16	Error	Access restricted
32	Error	Busy

Reset code

No reset: 0
Restart: 1
Reset parameters to factory default: 2

10.24. Read software version - 226 ($E2_h$)

This command reads the software version.

Request data bytes

Byte	Format	Description
0	Unsigned-8	Module index (always 0)

Response data bytes

Byte	Format	Description
0	Unsigned-8	Module index
1-16	Latin-1	Software version string

Command specific response codes

Code	Class	Description
0	Success	No command specific errors
2	Error	Invalid selection
5	Error	Too few data bytes received

10.25. Read serial number - 227 ($E3_h$)

This command reads the serial number.

Request data bytes

Byte	Format	Description
0	Unsigned-8	Module index (always 0)

Response data bytes

Byte	Format	Description
0	Unsigned-8	Module index
1-16	Latin-1	Serial number string

Command specific response codes

Code	Class	Description
0	Success	No command specific errors
2	Error	Invalid selection
5	Error	Too few data bytes received

10.26. Read extended order code - 228 ($E4_h$)

This command reads the extended order code.
As Liquiline does not support the extended order code the normal order code is returned.

Request data bytes

Byte	Format	Description
0	Unsigned-8	Index (always 0)

Response data bytes

Byte	Format	Description
0	Unsigned-8	Index
1-20	Latin-1	Order code string

Command specific response codes

Code	Class	Description
0	Success	No command specific errors
2	Error	Invalid selection
5	Error	Too few data bytes received

10.27. Check device status - 231 ($E7_h$)

This command is for Endress+Hauser internal use, only.

This command enables the active barrier RN221N getting status information from Liquiline.

Request data bytes

Byte	Format	Description
0	Unsigned-8	Module index

Response data bytes

Byte	Format	Description
0	Unsigned-8	Module index
1	Unsigned-8	Device status
2-3	Unsigned-16	Number of the highest priority diagnostics

Command specific response codes

Code	Class	Description
0	Success	No command specific errors
2	Error	Invalid selection
5	Error	Too few data bytes received

Device status

OK:	0
F:	1
C:	2
M:	4
S:	8

10.28. Device specific command - 232 ($E8_h$)

This command is for Endress+Hauser internal use, only.

10.29. Read order code - 233 ($E9_h$)

This command reads the order code.

Request data bytes

Byte	Format	Description
0	Unsigned-8	Module index (always 0)

Response data bytes

Byte	Format	Description
0	Unsigned-8	Module index
1-20	Latin-1	Order code string

Command specific response codes

Code	Class	Description
0	Success	No command specific errors
2	Error	Invalid selection
5	Error	Too few data bytes received

10.30. Read ENP version - 234 (EA_h)

This command is for Endress+Hauser internal use, only.

Request data bytes

Byte	Format	Description
0	Unsigned-8	Module index (always 0)

Response data bytes

Byte	Format	Description
0	Unsigned-8	Module index
1-16	Latin-1	ENP version string

Command specific response codes

Code	Class	Description
0	Success	No command specific errors
2	Error	Invalid selection
5	Error	Too few data bytes received

10.31. Read startup behavior - 236 (EC_h)

This command reads the startup behavior of Liquiline.

Request data bytes

Byte	Format	Description
None		

Response data bytes

Byte	Format	Description
0-3	Float	Minimal startup voltage [V]
4-7	Float	Startup current [mA]
8-9	Unsigned-16	Time until HART communication possible [s]
10-13	Float	Minimal operating voltage [V]
14-17	Float	Multidrop current [mA]
18-19	Unsigned-16	Time until measurement values are present [s]

Command specific response codes

Code	Class	Description
0	Success	No command specific errors

Minimal startup voltage: 14.0 V
Minimal operating voltage: 14.0 V
Startup current: 3.6 mA
Multidrop current: 4.0 mA
Time till HART communication: 15 s
Time till measurement values: 45 s

11. Tables

All necessary information can be found in the previous chapters.

12. Performance

12.1. Sampling rates

All sensors sample: ≥1 per second
All device variables digital value calculation: ≥1 per second
All analog outputs update: ≥1 per second

12.2. Power-up

On power-up, the transmitter initializes itself, which takes up to 45 seconds. During this period, the device will not respond to HART commands.
Fixed current and simulation mode are cancelled by power loss.

12.3. Reset

Command 42 ("Device Reset") causes the device to reset. The resulting restart is identical to the normal power up sequence.

12.4. Self-test

Liquiline does not support a self-test.

12.5. Command response times

Minimum:	0 ms
Typical:	8 ms
Maximum:	200 ms

12.6. Busy and delayed response

The Liquiline will respond with "busy" status whenever the requested action occupies the CPU for more than 200 ms.
Delayed response mechanism is not used.

12.7. Long messages

The largest data field can be 240 bytes.

12.8. Nonvolatile memory

The devices configuration parameters are saved into a flash memory. New data is written to this memory by a special flash handler. Data will not be saved immediately on execution of a write command, but with a short delay. Data consistency is ensured even if there is a power loss when writing.

12.9. Operating modes

Fixed current mode is implemented, using command 40. This mode is cleared by power loss or reset.

12.10. Write protection

Liquiline does not support write protection.

Write protection is not supported.

12.11. Burst mode

Liquiline does not support burst mode.

12.12. Catch device variable

Liquiline does not support device variable catching.

13. Annex A: Capability checklist

Manufacturer, model and revision:	Endress+Hauser Liquiline Compact rev. 3
Device type:	Transmitter
HART revision:	7.6
Device description available:	Yes
Number and type of sensors:	1 Memosens sensor, pH, ORP, Conductivity or Oxygen
Number and type of actuators:	0
Number and type of host side signals:	1x 4 - 20 mA analog
Number of device variables:	20
Number of dynamic variables:	4
Mappable dynamic variables:	Yes / 4
Number of common practice commands:	32
Number of device specific commands:	31
Bits of additional device status:	113
Alternative operating modes:	No
Burst mode:	No
Write protection:	No
Condensed status:	Yes

14. Annex B: Default configuration

Please refer to the operating instructions.

15. Annex C: Revision history

Rev. 1, 21-Jun-2017:	Initial revision
Rev. 2, 27-Jul-2017:	Fixed device variable units and classifications
Rev. 3, 24-Oct-2017:	Fixed device variables and diagnostic bits
Rev. 4, 22-Jan-2018:	Fixed device variables, diagnostic bits and response codes
Rev. 5, 11-Apr-2018:	Fixed response codes
Rev. 6, 07-May-2020	Device revision 3, Fixed diagnostic bits, minor improvements

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