HART-Protocol

D184B108U12

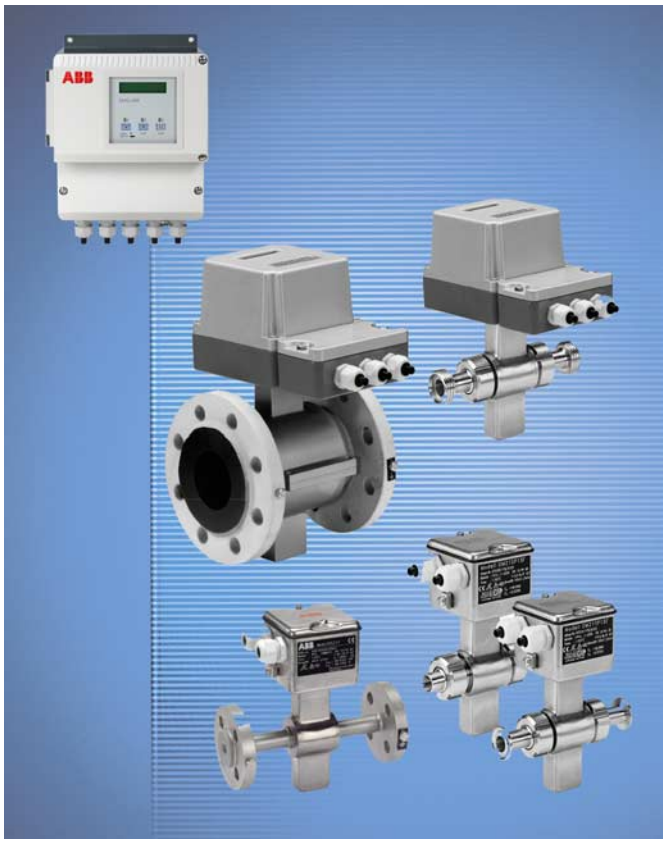
Field^IT

Electromagnetic Flowmeter FXM2000

(COPA-XM/MAG-XM)

Industrial^IT enabled

Valid Software Version from X.31



HART® FIELD COMMUNICATIONS PROTOCOL

PROFIBUS

ABB

Product Designation
FXM2000 (COPA-XM/MAG-XM)

HART-Protocol

Part No. D184B108U12

Issue date: 02.03
Revision: 00

Manufacturer:

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HART-Protocol		
Prepared by Name: **Holger Seebode** Date: **15.6.1998**	Instrument: **COPA/MAG-XM, 50XM2000** Software: **HART-Software** Identification: **D699B138 X.3-**	Revision: **1** Name: **Holger Seebode** Date: **5.10.1998**
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1 Revision Overview

Revision Nr.	Revision Soft	Date	New Pages	Changed Pages	Name
0	X.30	25.05.1998	generated	-	HS
1	X.30	5.10.1998	-	6-4	HS

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2 Introduction

The present overview shows all available HART-Commands. Included are the Universal and Common Practice as well as special commands like Slot- and miscellaneous commands.

3 Universal Commands

3.1 HART-Command 0 : Read Transmitter Unique Identifier			Revision
Request Data Bytes	none		
Response Data Bytes	#0	Device Type Code for Expansion	= 254
	#1	Manufacturer Identification Code	= 18 = ABB
	#2	Manufacturer Device Type	= 7 = XM2000
	#3	Number of Request Preambles	= 8
	#4	Revision Level of Universal Command	= 5
	#5	Revision Level of Transmitter Document	= 0
	#6	Software Revision Level	= 3
	#7	Hardware Revision Level	= 0
	#8	Flags, none defined at this time	= 0
	#9	Device Identification Number, 24 Bit, MSB	= 0
	#10	Device Identification Number, 24 Bit	= MSB Instr. no.
	#11	Device Identification Number, 24 Bit, LSB	= LSB Instr. no.
Response Codes	0	No Command Specific Error	
	5	Incorrect Byte Count	

3.2 HART-Command 1 : Read Primary Variable			Revision
Request Data Bytes	none		
Response Data Bytes	#0	Primary Variable Unit Code (Table 2)	
	#1..#4	Primary Variable, IEEE 754	
Response Codes	0	No Command Specific Error	
	5	Incorrect Byte Count	
Comment		Primary Variable => Flow	

3.3 HART-Command 2 : Read Current and Percent of Range			Revision
Request Data Bytes	none		
Response Data Bytes	#0..#3	Analog Output Current mA, IEEE 754	
	#4..#7	Percent of Range, IEEE 754	
Response Codes	0	No Command Specific Error	
	5	Incorrect Byte Count	

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3.4 HART-Command 3 : Read all dynamic Variables and Current			Revision
Request Data Bytes	none		
Response Data Bytes	#0..#3	Analog Output Current mA, IEEE 754	
	#4	Primary Variable Unit Code (Table 2)	
	#5..#8	Primary Variable, IEEE 754	
	#9	Secondary Variable Unit Code (Table 2)	
	#10..#13	Secondary Variable, IEEE 754	
	#14	Tertiary Variable Unit Code (Table 2)	
	#15..#18	Tertiary Variable, IEEE 754	
	#19	4th Variable Unit Code (Table 2)	
	#20..#23	4th Variable, IEEE 754	
Response Codes	0	No Command Specific Error	
	5	Incorrect Byte Count	
Comment		Primary Variable = Flow, Unit siehe unsigned char-Slot 3	
		Secondary Variable = Totalizer >V, Unit siehe unsigned char-Slot 4	
		Tertiary Variable = Totalizer <R, Unit siehe unsigned char-Slot 4	
		Fourth Variable = Flow, Unit siehe unsigned char-Slot 3	

3.5 HART-Command 6 : Write Polling Address			Revision
Request Data Bytes	#0	Polling Address of Device	
Response Data Bytes	#0	Polling Address of Device	
Response Codes	0	No Command Specific Error	
	2	Invalid Selection	
	5	Incorrect Byte Count	

3.6 HART-Command 11 : Read Unique Identifier Associated With Tag				Revision
Request Data Bytes	#0..#5	Tag, Packed ASCII		
Response Data Bytes	#0	Device Type Code for Expansion	= 254	
	#1	Manufacturer Identification Code	= 18 = ABB	
	#2	Manufacturer Device Type	= 7 = XM2000	
	#3	Number of Request Preambles	= 8	
	#4	Revision Level of Universal Command	= 5	
	#5	Revision Level of Transmitter Document	= 0	
	#6	Software Revision Level	= 3	
	#7	Hardware Revision Level	= 0	

	#8	Flags, none defined at this time	= 0
	#9	Device Identification Number, 24 Bit, MSB	= 0
	#10	Device Identification Number, 24 Bit	= MSB Device number
	#11	Device Identification Number, 24 Bit, LSB	= LSB Device number
Response Codes	0	No Command Specific Error	
	5	Incorrect Byte Count	

3.7 HART-Command 12 : Read Message			Revision
Request Data Bytes	none		
Response Data Bytes	#0..#23	Message, Packed ASCII	
Response Codes	0	No Command Specific Error	
	5	Incorrect Byte Count	

3.8 HART-Command 13 : Read Tag, Descriptor, Date			Revision
Request Data Bytes	none		
Response Data Bytes	#0..#5	Tag, Packed-ASCII	
	#6..#17	Descriptor, Packed-ASCII	
	#18..#20	Date: Day, Month, Year	
Response Codes	0	No Command Specific Error	
	5	Incorrect Byte Count	

3.9 HART-Command 14 : Read Primary Variable Sensor Information				Revision
Request Data Bytes	none			
Response Data Bytes	#0..#2	Sensor Serial Number MSB, 24-bit unsigned integer		
	#3	Sensor Limits/Min Span Units, Table II Unit Codes		
	#4..#7	Upper Sensor Limit, IEEE754		
	#8..#11	Lower Sensor Limit, IEEE754		
	#12..#15	Minimum Span, IEEE754		
Response Codes	0	No Command Specific Error		
	5	Incorrect Byte Count		
Comment		Sensor Serial Number	= 0	
		Upper Sensor Limit	= QmaxDN	
		Lower Sensor Limit	= 0	
		Minimum Span	= 0.02 oder 0.05 * QmaxDN, (see unsigned char-Slot 28: Range <0.05RangeDN)	

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	Project Number:	

3.10 HART-Command 15 : Read Primary Variable Output Information			Revision
Request Data Bytes	none		
Response Data Bytes	#0	Alarm Select Code, Table VI	
	#1	Primary Variable Transfer Function Code, Table III	
	#2	Primary Variable Range Values Units Code, Table II	
	#3..#6	Primary Variable Upper Range Value, IEEE754	
	#7..#10	Primary Variable Lower Range Value, IEEE754, always Zero	
	#11..#14	Primary Variable Damping Value, IEEE754, Units of Seconds	
	#15	Write Protect Code, Table VII	
	#16	Private Label Distributor Code, Table VIII	
Response Codes	0	No Command Specific Error	
	5	Incorrect Byte Count	
Comment		Alarm Selection Code = 0 = High, 1 = Low PV Transfer Function Code = 0 = Linear PV Upper Range Value = Qmax PV Lower Range Value = 0 PV Damping Value = Damping Write Protect Code = 251 = Not Implemented Private Label Distributor = 18 =ABB	

3.11 HART-Command 16 : Read Final Assembly Number			Revision
Request Data Bytes	none		
Response Data Bytes	#0..#2	Final Assembly Number	
Response Codes	0	No Command Specific Error	
	5	Incorrect Byte Count	

3.12 HART-Command 17 : Write Message			Revision
Request Data Bytes	#0..#23	Message, Packed-ASCII	
Response Data Bytes	#0..#23	Message, Packed-ASCII	
Response Codes	0	No Command Specific Error	
	5	Incorrect Byte Count	

3.13 HART-Command 18 : Write Tag, Descriptor, Date		Revision
Request Data Bytes	#0..#5 Tag, Packed-ASCII #6..#17 Descriptor, Packed-ASCII #18..#20 Date: Day, Month, Year	
Response Data Bytes	#0..#5 Tag, Packed-ASCII #6..#17 Descriptor, Packed-ASCII #18..#20 Date: Day, Month, Year	
Response Codes	0 No Command Specific Error 5 Incorrect Byte Count	

3.14 HART-Command 19 : Write Final Assembly Number		Revision
Request Data Bytes	#0..#2 Final Assembly Number	
Response Data Bytes	#0..#2 Final Assembly Number	
Response Codes	0 No Command Specific Error 5 Incorrect Byte Count	

4 Commom Practice Commands

4.1 HART-Command 33 : Read Transmitter Variables		Revision
Request Data Bytes	#0 Transmitter Variable assigned to Slot #0 #1 Transmitter Variable assigned to Slot #1 #2 Transmitter Variable assigned to Slot #2 #3 Transmitter Variable assigned to Slot #3	
Response Data Bytes	#0 Transmitter Variable assigned to Slot #0 #1 Slot #0 Unit Code #2..#5 Slot #0 Variable, IEEE 754 #6 Transmitter Variable assigned to Slot #1 #7 Slot #1 Unit Code #8..#11 Slot #1 Variable, IEEE 754 #12 Transmitter Variable assigned to Slot #2 #13 Slot #2 Unit Code #14..#17 Slot #2 Variable, IEEE 754 #18 Transmitter Variable assigned to Slot #3 #19 Slot #3 Unit Code #20..#23 Slot #3 Variable, IEEE 754	
Response Codes	0 No Command Specific Error 2 Invalid Selection 5 Incorrect Byte Count	
Comment	Transmitter Variables: 0 = Flow 1 = Totalizer >V 2 = Totalizer <R	

4.2 HART-Command 34 : Write Primary Variable Damping Value		Revision
Request Data Bytes	#0..#3 Damping Value, IEEE 754	
Response Data Bytes	#0..#3 Actual Damping Value, IEEE 754	
Response Codes	0 No Command Specific Error 3 Passed Parameter to Large 4 Passed Parameter to Small 5 Incorrect Byte Count	

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	Project Number:	

4.3 HART-Command 35 : Write Primary Variable Range Values		Revision
Request Data Bytes	#0 PV Upper and Lower Range Values Units Code, Table II #1..#4 Primary Variable Upper Range Value, IEEE 754 #5..#8 Primary Variable Lower Range Value, IEEE 754	
Response Data Bytes	#0 PV Upper and Lower Range Values Units Code, Table II #1..#4 Primary Variable Upper Range Value, IEEE 754 #5..#8 Primary Variable Lower Range Value, IEEE 754	
Response Codes	0 No Command Specific Error 2 Invalid Selection 5 Incorrect Byte Count 11 Upper Range Value too High 12 Upper Range Value too Low 13 Upper and Lower Range Values Out of Limits	
Comments	PV Upper Range Value = Qmax PV lower Range Value = 0	

4.4 HART-Command 38 : Reset Configuration Changed Flag		Revision
Request Data Bytes	none	
Response Data Bytes	none	
Response Codes	0 No Command Specific Error 5 Incorrect Byte Count	

4.5 HART-Command 40 : Enter/Exit Primary Variable Current Mode		Revision
Request Data Bytes	#0..#3 Fixed Primary Variable Current Level, IEEE 754, mA	
Response Data Bytes	#0..#3 Actual Fixed Primary Variable Current Level, IEEE 754, mA	
Response Codes	0 No Command Specific Error 3 Passed Parameter to Large (> 24.8 mA) 4 Passed Parameter to Small (< 3.85 mA) 5 Incorrect Byte Count 11 In Multidrop Mode	

4.6 HART-Command 44 : Write Primary Variable Units		Revision
Request Data Bytes	#0	Primary Variable Unit Code
Response Data Bytes	#0	Primary Variable Unit Code
Response Codes	0 2 5	No Command Specific Error Invalid Selection Incorrect Byte Count

4.7 HART-Command 45 : Trim Primary Variable Current DAC Zero		Revision
Request Data Bytes	#0..#3	Externally Measured Primary Variable Current Level, IEEE 754, Units of mA
Response Data Bytes	#0..#3	Actual Measured Primary Variable Current Level, IEEE 754, mA
Response Codes	0 3 4 5 9 11	No Command Specific Error Passed Parameter to Large (> 5mA) Passed Parameter to Small (< 3mA) Incorrect Byte Count Not in Proper Current Mode In Multidrop Mode

4.8 HART-Command 46 : Trim Primary Variable Current DAC Gain		Revision
Request Data Bytes	#0..#3	Externally Measured Primary Variable Current Level, IEEE 754, Units of mA
Response Data Bytes	#0..#3:	Actual Measured Primary Variable Current Level, IEEE 754, mA
Response Codes	0 3 4 5 9 11	No Command Specific Error Passed Parameter to Large (> 22mA) Passed Parameter to Small (< 18mA) Incorrect Byte Count Not in Proper Current Mode In Multidrop Mode

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	Project Number:	

4.9 HART-Command 48 : Read Additional Transmitter Status

Revision

Request Data Bytes	none			
Response Data Bytes	#0..#2	Additional Status Information		
		Statusbyte		
		#0, Bit 0	Error 8:	Negative Reference
		#0, Bit 1	Error 9:	Excitation
		#0, Bit 2		A: MAX-Alarm
		#0, Bit 3		B: MIN-larm
		#0, Bit 4	Error C:	Primary
		#0, Bit 5		Not used
		#0, Bit 6	Error E:	Totalizer >V
		#0, Bit 7	Error F:	Totalizer <R
		#1, Bit 0	Error 0:	Detector empty pipe
		#1, Bit 1	Error 1:	A/D-converter
		#1, Bit 2	Error 2:	Uref to small
		#1, Bit 3	Error 3:	Flow > 130%
		#1, Bit 4	Error 4:	Ext. output cut-off
		#1, Bit 5	Error 5:	EEPROM
		#1, Bit 6	Error 6:	Totalizer
		#1, Bit 7	Error 7:	Positive Reference
		#2, Bit 0		Automatical adjustment running
		#2, Bit 1	Error :	Automatical adjustment
		#2, Bit 2		Average Method of Flow running
		#2, Bit 3		Not used
		#2, Bit 4		Calibration protection switched on
		#2, Bit 5		Not used
		#2, Bit 6		Simulation running
		#2, Bit 7		Function test or Test Mode running
Response Codes	0	No Command Specific Error		
	5	Incorrect Byte Count		

5 Slot - Commands

The parameter of converters can be devided into three groups:

unsigned char-Variablen

Parameter of Menues with selective lists will be saved as "unsigned char", e.g. language:

German = 0
English = 1

unsigned int-Variables

Some figures which only show up integral will be saved as "unsigned int" , e.g. model number

float-Variables

The remaining figures are saved as float (IEEE 754) , e.g. damping

Following see each of the reading- and writing command and the table with the appropriate parameter of the three groups:

5.1 Unsigned-char-Variables

5.1.1 HART-Command 128 : Read unsigned-char-Variable		Revision
Request Data Bytes	#0 Slot-Index	
Response Data Bytes	#0 Slot-Index #1 Content of Slot	
Response Codes	0 No Command Specific Error 5 Incorrect Byte Count 6 Transmitter Specific Command Error -> Invalid Slot number	

5.1.2 HART-Command 129 : Write unsigned-char-Variable		Revision
Request Data Bytes	#0 Slot-Index #1 Content of Slot	
Response Data Bytes	#0 Slot-Index #1 Content of Slot	
Response Codes	0 No Command Specific Error 2 Invalid Selection 3 Parameter to large 5 Incorrect Byte Count 6 Transmitter Specific Command Error -> Invalid Slot number	

5.1.3 Table of „unsigned char“ -Variables

Slot-number	Parameter	Code	Sense		Revision
0	Language	0	German		
		1	English		
		2	French		
		4	Spanish		
1	Sie	43	1 mm	1/25 in	
		44	1.5 mm	1/17 in	
		45	2 mm	1/12 in	
		0	3 mm	1/10 in	
		1	4 mm	5/32 in	
		2	5 mm	3/16 in	
		3	6 mm	1/4 in	
		4	8 mm	5/16 in	
		5	10 mm	3/8 in	
		6	15 mm	1/2 in	
		7	20 mm	3/4 in	
		8	25 mm	1 in	
		9	32 mm	1-1/4 in	
		10	40 mm	1-1/2 in	
		11	50 mm	2 in	
		12	65 mm	2-1/2 in	
		13	80 mm	3 in	
		14	100 mm	4 in	
		15	125 mm	5 in	
		16	150 mm	6 in	
		17	200 mm	8 in	
		18	250 mm	10 in	
		19	300 mm	12 in	
		20	350 mm	14 in	
		21	400 mm	16 in	
		22	450 mm	18 in	
		23	500 mm	20 in	
		24	600 mm	24 in	
		25	700 mm	28 in	
		26	750 mm	30 in	
		27	800 mm	32 in	
		28	900 mm	36 in	
		29	1000 mm	40 in	
		30	1100 mm	42 in	
		31	1200 mm	48 in	
		32	1300 mm	51 in	
		46	1350 mm	53 in	
		33	1400 mm	54 in	
		34	1500 mm	60 in	
		35	1600 mm	64 in	
		36	1700 mm	66 in	

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Slot-number	Parameter	Code	Sense		Revision
		37	1800 mm	72 in	
		38	2000 mm	78 in	
		39	2100 mm	82 in	
		40	2200 mm	86 in	
		41	2300 mm	90 in	
		42	2400 mm	94 in	
2	Filter	0	aus		
		1	ein		
3	Unit Qmax	24	l/s		
		17	l/min		
		138	l/h		
		28	m3/s		
		131	m3/min		
		19	m3/h		
		29	m3/d		
		137	igps		
		18	igpm		
		30	igph		
		31	igpd		
		23	mgd		
		16	gpm		
		136	gph		
		132	bbl/s		
		133	bbl/min		
		134	bbl/h		
		135	bbl/d		
		73	kg/s		
		74	kg/min		
		75	kg/h		
		76	kg/d		
		77	t/min		
		78	t/h		
		79	t/d		
		70	g/s		
		71	g/min		
		72	g/h		
		80	lbs/s		
		81	lbs/min		
		82	lbs/h		
		240	programmable Unit /s		
		241	programmable Unit /min		
		242	programmable Unit /h		
		243	programmable Unit /d		
4	Unit Totalizer	41	l		
		43	m3		
		42	igal		
		40	gal		
		46	bbl		
		61	kg		

HART-Protocol		
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Slot-number	Parameter	Code	Sense	Revision
		62 60 63 244	t g lbs programmable unit	
5	programmable unit	0 1	Without density With density	
6	Terminal P1/P2	0 1 2 3 4 5 6 7 8 9 10 11 12	No function V/R-Signal Empty Pipe / Empty Pipe _ General-Alarm / General-Alarm _ MAX/MIN Alarm / MAX/MIN Alarm _ MIN Alarm / MIN Alarm _ MAX Alarm / MAX Alarm _ Measuring range 1/2 (only mode 2 meas. range autom.)	
7	Terminal X1	0 1 2 3	No function Ext. cut-off Totalizer reset Meas. Range ,1/2 (only mode 2 meas. range ext.)	
9	Iout at Alarm	0 1	High Low	
13	Detector empty pipe	0 1	off on	
14	Alarm empty pipe	0 1	off on	
15	Iout at Alarm empty pipe	0 1	High Low	
16	Simulation	0 1	off on	
17	Test-Mode	0 1	off on	
18	Totalizer function	0 1	Standard Differential Totalizer	
19 20	1. line display 2. line display	7 2 1 0 9 11 12 13 8 6	Q [Bargraph] Q [mA] Q [Unit] Q [%] Detector empty pipe Signal p/n Reference p/n Signal, Ref. Empty line TAG Number	

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Slot-number	Parameter	Code	Sense	Revision
		5	Totalizer <R	
		4	Totalizer >V	
		3	Totalizer	
		10	Line frequency	
21	1. Line multiplex display	7	Q [Bargraph]	
22	2. Line multiplex display	2	Q [mA]	
		1	Q [Unit]	
		0	Q [%]	
		9	Detector e.P.	
		11	Signal p/n	
		12	Reference p/n	
		13	Signal, Ref.	
		8	Empty line	
		6	TAG Number	
		5	Totalizer <R	
		4	Totalizer >V	
		3	Totalizer	
		10	Line frequency	
		14	Off	
23	Operating Mode	0	Standard	
		2	FAst	
		3	2 measuring ranges, auto	
		4	2 measuring ranges, ext.	
24	Flow direction	0	Forward	
		1	Foward-/Reverse	
25	Flow indication	0	normal	
		1	invers	

5.2 Unsigned-int-Variables

5.2.1 HART-Command 130 : Read-unsigned int-Variable		Revision
Request Data Bytes	#0 Slot-Index	
Response Data Bytes	#0 Slot-Index #1 Unit code #2..#3 Content of Slot	
Response Codes	0 No Command Specific Error 5 Incorrect Byte Count 6 Transmitter Specific Command Error -> Invalid Slotnumber	

5.2.2 HART-Command 131 : Write unsigned-int-Variable		Revision
Request Data Bytes	#0 Slot-Index #1 Unit code Content of Slot #2 MSB #3 LSB	
Response Data Bytes	#0 Slot-Index #1 Unit code Content of Slot #2 MSB #3 LSB	
Response Codes	0 No Command Specific Error 2 Invalid Selection -> Invalid Unit code 3 Parameter To Large -> Parameter to Large 4 Parameter To Small -> Parameter to small 5 Incorrect Byte Count -> Number Data bytes irregular 4 6 Transmitter Specific Command Error -> Invalid Slotnumber	

5.2.3 Table of „unsigned int“-Variables

Slot-number	Parameter	Impact	Revision
0	MAX Alarm	Unit % = 57 Minimum = 0 % Maximum = 130 %	
1	MIN Alarm	Unit % = 57 Minimum = 0 % Maximum = 130 %	
2	Instrument Address	Unit None = 250 Minimum = 0 Maximum = 15	
3	Overflow >V	Unit None = 250 Read only	
4	Overflow <R	Unit None = 250 Read only	
5	Power Failure Totalizer	Unit None = 250 Minimum = 0 Maximum = 0	

5.3 Float-Variablen

5.3.1 HART-Command 132 : Read float-Variable		Revision
Request Data Bytes	#0 Slot-Index	
Response Data Bytes	#0 Slot-Index #1 Unit code #2..#5 Content of Slot	
Response Codes	0 No Command Specific Error 5 Incorrect Byte Count 6 Transmitter Specific Command Error -> Invalid Slot number	

5.3.2 HART-Command 133 : Write unsigned-int-Variable		Revision
Request Data Bytes	#0 Slot-Index #1 Unit code #2..#5 Content of Slot	
Response Data Bytes	#0 Slot-Index #1 Unit code #2..#5 Content of Slot	
Response Codes	0 No Command Specific Error 2 Invalid Selection -> Invalid Unit code 3 Parameter To Large -> Parameter to Large 4 Parameter To Small -> Parameter to small 5 Incorrect Byte Count -> Number Data bytes irregular 4 6 Transmitter Specific Command Error -> Invalid Slot number	

5.3.3 Table der „Float“-Variables

Slot-number	Parameter	Impact				Revision
0	Qmax DN 10 m/s	Unit				
		l/s	24	kg/s	73	
		l/min	17	kg/min	74	
		l/h	138	kg/h	75	
		m3/s	28	kg/d	76	
		m3/min	131	t/min	77	
		m3/h	19	t/h	78	
		m3/d	29	t/d	79	
		igps	137	g/s	70	
		igpm	18	g/min	71	
		igph	30	g/h	72	
		igpd	31	lbs/s	80	
		mgd	23	lbs/min	81	
		gpm	16	lbs/h	82	
		gph	136	prog.Unit /s	240	
		bbl/s	132	prog.Unit /min	241	
		bbl/min	133	prog.Unit /h	242	
		bbl/h	134	prog.Unit /d	243	
		bbl/d	135			
		Minimun = 0.001 Maximum = 9999999 No input, if Range DN fixed (see unsigned char-Slot 29)				
1	Qmax	Unit				
		l/s	24	kg/s	73	
		l/min	17	kg/min	74	
		l/h	138	kg/h	75	
		m3/s	28	kg/d	76	
		m3/min	131	t/min	77	
		m3/h	19	t/h	78	
		m3/d	29	t/d	79	
		igps	137	g/s	70	
		igpm	18	g/min	71	
		igph	30	g/h	72	
		igpd	31	lbs/s	80	
		mgd	23	lbs/min	81	
		gpm	16	lbs/h	82	
		gph	136	prog.Unit /s	240	
		bbl/s	132	prog.Unit /min	241	
		bbl/min	133	prog.Unit /h	242	
		bbl/h	134	prog.Unit /d	243	
		bbl/d	135			

HART-Protocol		
Prepared by Name: **Holger Seebode** Date: **15.6.1998**	Instrument: **COPA/MAG-XM, 50XM2000** Software: **HART-Software** Identification: **D699B138 X.3-**	Revision: **1** Name: **Holger Seebode** Date: **5.10.1998**
	Project Number:	

Slot-number	Parameter	Impact	Revision
		Minimum = 0.02 oder 0.05 * QmaxDN (see unsigned char-Slot 28: Range <0.05RangeDN) Maximum = 1.5 * QmaxDN	
2	Qmax 2	Unit l/s 24 — kg/s 73 l/min 17 — kg/min 74 l/h 138 — kg/h 75 m3/s 28 — kg/d 76 m3/min 131 — t/min 77 m3/h 19 — t/h 78 m3/d 29 — t/d 79 igps 137 — g/s 70 igpm 18 — g/min 71 igph 30 — g/h 72 igpd 31 — lbs/s 80 mgd 23 — lbs/min 81 gpm 16 — lbs/h 82 gph 136 — prog.Unit /s 240 bbl/s 132 — prog.Unit /min 241 bbl/min 133 — prog.Unit /h 242 bbl/h 134 — prog.Unit /d 243 bbl/d 135 Minimum = 0.02 oder 0.05 * QmaxDN (see unsigned char-Slot 28: Range <0.05RangeDN) Maximum = Qmax	
3	Impulse	Unit /l 41 — /m3 43 /igal 42 — /gal 40 /bbl 46 — /kg 61 /t 62 — /g 60 /lbs 63 — /prog.Unit 244 Minimum = 0.001 / Totalizer Unit Maximum = 1000 / Totalizer Unit	
4	Impulse width	Unit Milliseconds = 253 (Special) Minimum = 0.1 ms Maximum = 2000ms	
5	Low Flow cut-off	Unit % = 57 Minimum = 0 % Maximum = 10 %	

HART-Protocol		
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	Project Number:	

Slot-number	Parameter	Impact	Revision
6	Damping	Unit s = 51 Minimum = 0.2 s Maximum = 100 s	
7	Density	Unit g/cm3 = 91 Minimum = 0.01 g/cm3 Maximum = 5.0 g/cm3	
8	System Zero Point	Unit Hz = 38 Minimum = -50 Hz Maximum = 50 Hz	
9	Unit factor	Unit Liter = 41 Minimum = 0.00001 Liter Maximum = 5000000 Liter	
10	Threshhold	Unit Hz = 38 Minimum = 0 Hz Maximum = 3000 Hz	
11	Totalizer >V	Unit /l 41 /m3 43 /igal 42 /gal 40 /bbl 46 /kg 61 /t 62 /g 60 /lbs 63 /prog.Unit 244 Minimum = 0 Maximum = 9999999	
12	Totalizer <R	Unit /l 41 /m3 43 /igal 42 /gal 40 /bbl 46 /kg 61 /t 62 /g 60 /lbs 63 /prog.Unit 244 Minimum = 0 Maximum = 9999999	
25	Frequency DLR	Unit Hz = 38 Read only	

HART-Protocol		
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	Project Number:	

Slot-number	Parameter	Impact	Revision
26	Low Alarm	Unit mA = 39 Minimum = 3 mA Maximum = 4 mA	
27	High Alarm	Unit mA = 39 Minimum = 20 mA Maximum = 30 mA	

5.4 Short Overview of Slot-Commands

Menue title	Variable types	Commands		Slot	Revision
		Lesen	Schreiben		
Language	unsigned char	128	129	0	
range (2)	unsigned char	128	129	1	
Filter	unsigned char	128	129	2	
Unit Qmax	unsigned char	128	129	3	
Unit Totalizer	unsigned char	128	129	4	
Progr. Unit	unsigned char	128	129	5	
Clamp P1/P2	unsigned char	128	129	6	
Clamp X1	unsigned char	128	129	7	
Iout at Alarm	unsigned char	128	129	9	
Detector empty pipe	unsigned char	128	129	13	
Alarm empty pipe	unsigned char	128	129	14	
Iout at Alarm empty pipe	unsigned char	128	129	15	
Simulation	unsigned char	128	129	16	
Test-Mode	unsigned char	128	129	17	
Totalizer function	unsigned char	128	129	18	
1. line display	unsigned char	128	129	19	
2. line display	unsigned char	128	129	20	
1. Line multiplex display	unsigned char	128	129	21	
2. Line multiplex display	unsigned char	128	129	22	
Operating mode	unsigned char	128	129	23	
Flow direction	unsigned char	128	129	24	
Directional sign	unsigned char	128	129	25	
MAX Alarm	unsigned int	130	131	0	
MIN Alarm	unsigned int	130	131	1	
Instrument Address	unsigned int	130	131	2	
Overflow >V	unsigned int	130		3	
Overflow <R	unsigned int	130		4	
Power Failure Totalizer	unsigned int	130	131	5	
Qmax DN 10 m/s	float	132	133	0	
Qmax	float	132	133	1	
Qmax 2	float	132	133	2	
Impulse (1)	float	132	133	3	
Impulse width (1)	float	132	133	4	
Low Flow cut-off	float	132	133	5	
Damping	float	132	133	6	
Density	float	132	133	7	
System Zero Point	float	132	133	8	
Unit factor	float	132	133	9	
Treshhold	float	132	133	10	
Totalizer >V	float	132	133	11	
Totalizer <R	float	132	133	12	
Frequency empty pipe detect	float	132		25	

HART-Protocol		
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	Project Number:	

Menue title	Variable types	Commands		Slot	Revision
		Lesen	Schreiben		
Low Alarm	float	132	133	26	
High Alarm	float	132	133	27	

Remarks:

1. Additionally to the „normal“ dependency (width -> OmaxDN etc) at changes of pulse width or pulse factor both parameter must be read once again to receive the values stored in the converter
2. To change the output range the service code has to be entered.

6 Further Customer accessible Commands

Here you find all further commands which are neither Universal, Common Practice nor Slot-Commands.

6.1 HART-Command 140 : Totalizer >V and Overflow >V delete	Revision
Request Data Bytes	none
Response Data Bytes	none
Response Codes	0 No Command Specific Error 5 Incorrect Byte Count

6.2 HART-Command 141 : Totalizer <R and Overflow <R delete	Revision
Request Data Bytes	none
Response Data Bytes	none
Response Codes	0 No Command Specific Error 5 Incorrect Byte Count

6.3 HART-Command 142 : Overflow >V delete	Revision
Request Data Bytes	none
Response Data Bytes	none
Response Codes	0 No Command Specific Error 5 Incorrect Byte Count

6.4 HART-Command 143 : Overflow <R delete	Revision
Request Data Bytes	none
Response Data Bytes	none
Response Codes	0 No Command Specific Error 5 Incorrect Byte Count

6.5 HART-Command 145 : Read Text of programmable Unit	Revision
Request Data Bytes	none
Response Data Bytes	#0..#3 Text of programmable Unit (ASCII) with terminator (0x00)
Response Codes	0 No Command Specific Error 5 Incorrect Byte Count

6.6 HART-Command 146 : Write Text of programmable Unit	Revision
Request Data Bytes	#0..#3 Text of programmable Unit (ASCII) with terminator (0x00)
Response Data Bytes	#0..#3 Text of programmable Unit (ASCII with terminator (0x00)
Response Codes	0 No Command Specific Error 5 Incorrect Byte Count

6.7 HART-Command 147 : Start System Zero Point Adjustment

Revision

Request Data Bytes	none	
Response Data Bytes	none	
Response Codes	0	No Command Specific Error
	5	Incorrect Byte Count
Remark		Receives converter command 147 he automatically start system zero point adjustment and answers all commands beside command 48 with „Access Restrict“ until he ends the adjustment. With command 48 the status of converter can be asked and it can be calculated whether the converter is in adjustment and whether the adjustment has been terminated successfully. (see command 48). The value of the new system zero point can be read with the according Slot-command.

6.8 HART-Command 150 : Load Data from external EEPROM

Revision

Request Data Bytes	none	
Response Data Bytes	none	
Response Codes	0	No Command Specific Error
	5	Incorrect Byte Count
	65	Achievement impossible as per failure EEPROM or Primary
	66	Impossible , because converter is in XM1000-Mode
	67	Impossible, because equipment data invalid

HART-Protocol		
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	Project Number:	

6.9 HART-Command 151 : Safe Data in external EEPROM	Revision

Request Data Bytes	none
Response Data Bytes	none
Response Codes	0 No Command Specific Error 5 Incorrect Byte Count 65 Achievement impossible as per failure EEPROM or Primary 66 Impossible , because converter is in XM1000-Mode

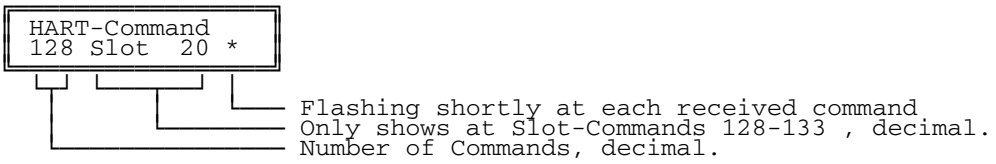
6.10	

7 Error Diagnostic at Hart

If HART-Communication does not work following items should be checked:

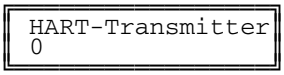
1. The converter has to be equipped with a HART-capable power oulet module .
2. The apparant ohmic resistance at power outlet must be between 250 and 500 ohm.

If all this is correct and the HART-communication still does not work the reception can be checked next. In sub-menue "Function Test" there is an item "HART-Command":



If nothing shows up here already the reception does not work. In this case you should check with an oscilloscope whether any HART-signal reaches the converter.The signal level is typical 1 mA_{pp} so one e.g. has a 500 apparent ohm resistance 1 mA_{pp} * 500 Ohm = 500 mV_{pp} signal.
If the signal comes up and the converter does not realize it is probably the fault of bad signal quality. In this case the test should be repeated under better conditions.

If the converter receives the HART-commands and the opposite side (e.g. Hand-heldcommunicator) still shows error the sending of the converter should be checked with an oscilloscope. This can be done with the test "HART-Transmitter":



After call the converter sends logical 0 (=2200Hz) and after key stroke logical 1 (=1200Hz
Furthermore should be checked with the oscilloscope whether the converter is answering to this command.

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