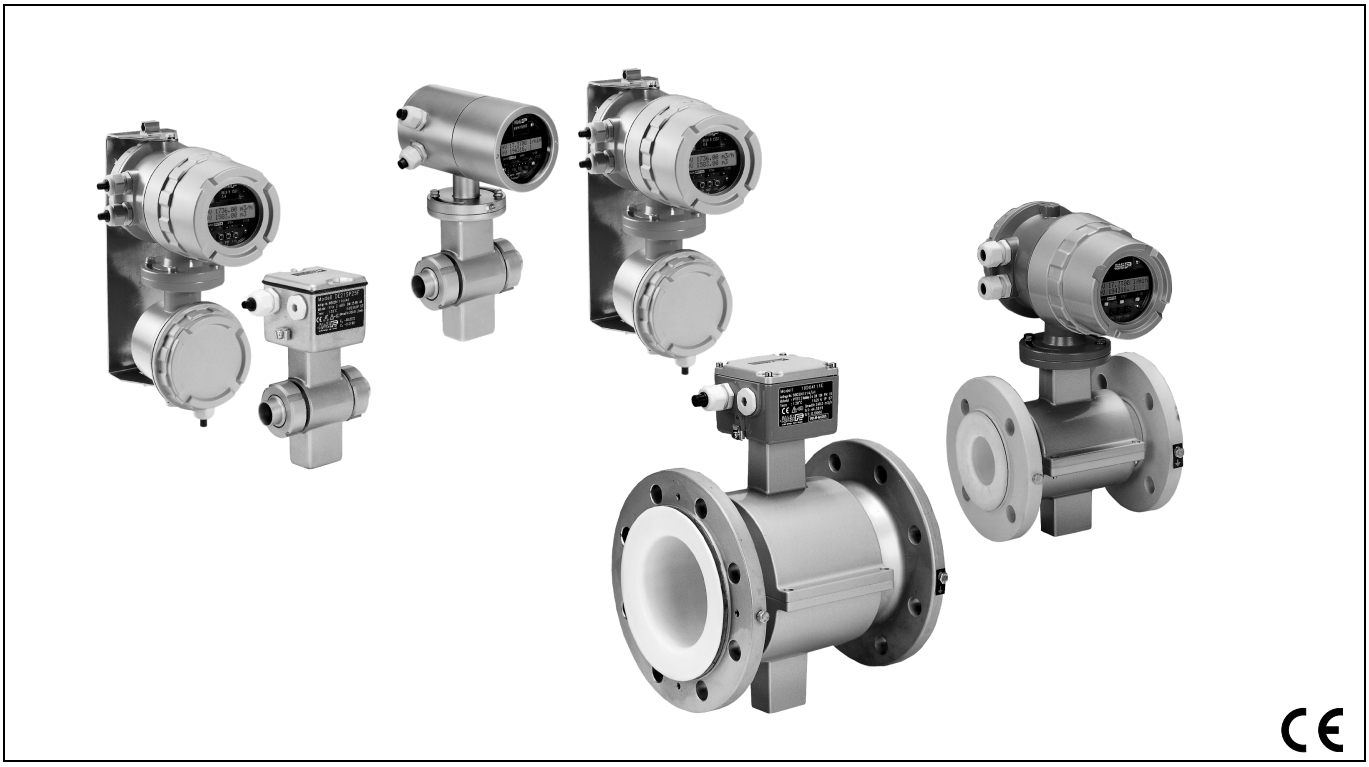
COPA-XE/MAG-XE

HART-Protocol

Valid for software level X.10 and up
EEPROM Part No. D699B180U01

Instruction Bulletin

D184B108U02 Rev. 00 / 05.99



HART-Protocol

COPA/MAG-XE
50XE4000

HART-Command Overview
for the
Special Software D699B180U01

HART-Protocol					
Prepared Name: Date:	by **Holger Seebode** **9 July 1998**	Instrument: Software: Designation:	**COPA/MAG-XE, 50XE4000** **HART-Software** **D699B180 X.10**	Revision: Name: Date:	**0** **Holger Seebode** **9 July 1998**
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1 Revision Log

Revision No.	Revision Softw.	Date	New Pages	Revised Pages	Name
0	X.10	9.07.1998	Initial release	-	HS

2 Introduction

This overview lists all the available HART-Commands. It includes both the Universal and Common Practice Commands as well as those Special Commands which contain Slot- or other commands.
In order to recognize revisions to earlier Command Overview lists, it had previously been necessary to check each command for changes. This is no longer necessary, because revisions to existing commands are identified in the Section 1 "Revision Log".
In addition, by numbering each section independently, paper savings can be achieved because only the revised sections need be replaced when they are affected by a change.

This documentation applies to the following Software Versions:

X.10

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 = B-F&P
	#2	Manufacturer Device Type	= 8 = XE4000
	#3	Number of Request Preambles	= 8
	#4	Revision Level of Universal Command	= 5
	#5	Revision Level of Transmitter Document	= 0
	#6	Software Revision Level	= 1
	#7	Hardware Revision Level	= 0 or 1
	#8	Flags, none defined at this time	= 0
	#9	Device Identification Number, 24 Bit, MSB	= 0
	#10	Device Identification Number, 24 Bit	= MSB Instrument No.
	#11	Device Identification Number, 24 Bit, LSB	= LSB Instrument 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	
Comments		Primary Variable => Flowrate	

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	

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
Comments		Primary Variable = Flowrate, units see unsigned char-Slot 3
		Secondary Variable = Totalizer >F, units see unsigned char-Slot 4
		Tertiary Variable = Totalizer <R, units see unsigned char-Slot 4
		Fourth Variable = Flowrate, units see 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 = F&P
	#2	Manufacturer Device Type	= 8 = XE4000
	#3	Number of Request Preambles	= 8
	#4	Revision Level of Universal Command	= 5
	#5	Revision Level of Transmitter Document	= 0
	#6	Software Revision Level	= 1
	#7	Hardware Revision Level	= 0 or 1
	#8	Flags, none defined at this time	= 0

	#9	Device Identification Number, 24 Bit, MSB	= 0
	#10	Device Identification Number, 24 Bit	= MSB Instrument No.
	#11	Device Identification Number, 24 Bit, LSB	= LSB Instrument No.
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	
Comments		Sensor Serial Number = 0 Upper Sensor Limit = RangeDN Lower Sensor Limit = 0 Minimum Span = 0.02 or 0.05 * RangeDN, (see unsigned char-Slot 28: Range <0.05RangeDN)	

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	
Comments		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 =B-F&P	

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 Common 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	
Comments	Transmitter Variables: 0 = Flowrate 1 = Totalizer >F 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	

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 No Command Specific Error 2 Invalid Selection 5 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 No Command Specific Error 3 Passed Parameter to Large (> 5mA) 4 Passed Parameter to Small (< 3mA) 5 Incorrect Byte Count 9 Not in Proper Current Mode 11 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 No Command Specific Error 3 Passed Parameter to Large (> 22mA) 4 Passed Parameter to Small (< 18mA) 5 Incorrect Byte Count 9 Not in Proper Current Mode 11 In Multidrop Mode	

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-Alarm
		#0, Bit 4	Error C:	Primary
		#0, Bit 5		Not used
		#0, Bit 6	Error E:	Totalizer >F
		#0, Bit 7	Error F:	Totalizer <R
		#1, Bit 0	Error 0:	Empty Pipe Detector
		#1, Bit 1	Error 1:	A/D-Converter
		#1, Bit 2	Error 2:	Uref too small
		#1, Bit 3	Error 3:	Flowrate > 130%
		#1, Bit 4	Error 4:	Ext. zero return
		#1, Bit 5	Error 5:	EEPROM
		#1, Bit 6	Error 6:	Totalizer
		#1, Bit 7	Error 7:	Positive reference
		#2, Bit 0		Automatic adjustment active
		#2, Bit 1	Error :	Automatic adjustment
		#2, Bit 2		Average determination active
		#2, Bit 3		Not used
		#2, Bit 4		Certified protection turned on
		#2, Bit 5		Not used
		#2, Bit 6		Simulation active
		#2, Bit 7		Function Test or Test Mode active
Response Codes	0	No Command Specific Error		
	5	Incorrect Byte Count		

5 Slot - Commands

The converter parameters can be divided into three groups:

unsigned char-Variables

Parameters in menus with selection tables are stored as "unsigned char" variables, e.g. Language:

German = 0
English = 1

unsigned int-Variables

Certain numeric values which occur only as integers are stored as "unsigned int" variables, e.g. Instrument Number.

float-Variables

The remaining values are stored as float (IEEE 754) variables, e.g. Damping.

The individual Read- and Write Commands for the three groups are listed in the following tables together with their corresponding parameters.

5.1 Unsigned-char-Variables

5.1.1 HART-Command 128 : Lese unsigned-char-Variable		Revision
Request Data Bytes	#0 Slot-Index	
Response Data Bytes	#0 Slot-Index #1 Slot contents	
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 Slot contents	
Response Data Bytes	#0 Slot-Index #1 Slot contents	
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 „unsigned char“ -Variables Table

Slot-Number	Parameter	Code Number	Meaning		Revision
0	Language	0	German		
		1	English		
		2	French		
		4	Spanish		
1	Meter size	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	
2	Filter	0	off		
		1	on		
3	Units 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		

Slot-Number	Parameter	Code Number	Meaning	Revision
		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 units /s	
		241	programmable units /min	
		242	programmable units /h	
		243	programmable units /d	
4	Units totalizer	41	l	
		43	m3	
		42	igal	
		40	gal	
		46	bbl	
		61	kg	
		62	t	
		60	g	
		63	lbs	
		244	programmable units	
5	Programmable units	0	without density	
		1	with density	
6	Terminals P7/G2	0	No function	
		13	F/R-Signal _	
		1	F/R-Signal /	
		2	Empty pipe /	
		3	Empty pipe _	
		4	General-Alarm /	
		5	General-Alarm _	
		6	MAX/MIN Alarm /	
		7	MAX/MIN Alarm _	
		8	MIN Alarm /	
		9	MIN Alarm _	
		10	MAX Alarm /	
		11	MAX Alarm _	
7	Terminals X1/G2	0	No function	
		1	Ext. zero return	
		2	Totalizer reset	
9	Iout at Alarm	0	High	
		1	Low	

Slot-Number	Parameter	Code Number	Meaning	Revision
13	Empty Pipe Detector	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 Difference totalizer	
19 20	1st Line 2nd Line	7 2 1 0 9 11 12 13 8 6 5 4 3 10	Q [Bargraph] Q [mA] Q [units] Q [%] Detector E.p. Signal p/n Reference p/n Signal, Ref. Blank line TAG Number Totalizer <R Totalizer >F Totalizer Line frequency	
21 22	1st Line multiplex 2nd Line multiplex	7 2 1 0 9 11 12 13 8 6 5 4 3 10 14	Q [Bargraph] Q [mA] Q [units] Q [%] Detector E.p. Signal p/n Reference p/n Signal, Ref. Blank line TAG Number Totalizer <R Totalizer >F Totalizer Line frequency off	
23	Operating Mode	0 2	Standard Fast	
24	Flow Direction	0 1	Forward Forward/reverse	
25	Direction Indication	0 1	normal inverse	

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 Units Code #2..#3 Slot contents	
Response Codes	0 No Command Specific Error 5 Incorrect Byte Count 6 Transmitter Specific Command Error -> Invalid Slot Number	

5.2.2 HART-Command 131 : Write unsigned-int-Variable		Revision
Request Data Bytes	#0 Slot-Index #1 Units Code Slot contents #2 MSB #3 LSB	
Response Data Bytes	#0 Slot-Index #1 Units Code Slot contents #2 MSB #3 LSB	
Response Codes	0 No Command Specific Error 2 Invalid Selection -> Invalid Units Code 3 Parameter To Large -> Parameter too large 4 Parameter To Small -> Parameter too small 5 Incorrect Byte Count -> Number of data bytes not equal to 4 6 Transmitter Specific Command Error -> Invalid Slot Number	

5.2.3 „unsigned int“-Variables Table

Slot-Number	Parameter	Meaning	Revision
0	MAX Alarm	Units % = 57 Minimum = 0 % Maximum = 130 %	
1	MIN Alarm	Units % = 57 Minimum = 0 % Maximum = 130 %	
2	Instrument Address	Units None = 250 Minimum = 0 Maximum = 15	
3	Overflow >F	Units None = 250 Read only	
4	Overflow <R	Units None = 250 Read only	
5	Mains Interrupt Counter	Units None = 250 Minimum = 0 Maximum = 0	

5.3 Float-Variables

5.3.1 HART-Command 132 : Read float-Variable		Revision
Request Data Bytes	#0 Slot-Index	
Response Data Bytes	#0 Slot-Index #1 Units Code #2..#5 Slot contents	
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 float-Variable		Revision
Request Data Bytes	#0 Slot-Index #1 Units Code #2..#5 Slot contents	
Response Data Bytes	#0 Slot-Index #1 Units Code #2..#5 Slot contents	
Response Codes	0 No Command Specific Error 2 Invalid Selection -> Invalid Units Code 3 Parameter To Large 4 Parameter To Small 5 Incorrect Byte Count -> Number of data bytes not equal to 4 6 Transmitter Specific Command Error -> Invalid Slot Number	

5.3.3 „Float“-Variables Table

Slot-Number	Parameter	Meaning				Revision
0	RangeDN 10 m/s	Units				
		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. units /s	240	
		bbl/s	132	prog. units /min	241	
		bbl/min	133	prog. units /h	242	
		bbl/h	134	prog. units /d	243	
		bbl/d	135			
		Minimum = 0.001 Maximum = 9999999 No entry when Range DN is fixed (see unsigned char-Slot 29I)				
1	Qmax	Units				
		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. units /s	240	
		bbl/s	132	prog. units /min	241	
		bbl/min	133	prog. units /h	242	
		bbl/h	134	prog. units /d	243	
		bbl/d	135			
		Minimum = 0.02 or 0.05 * RangeDN				

Slot-Number	Parameter	Meaning	Revision
		(see unsigned char-Slot 28: Range <0.05RangeDN) Maximum = RangeDN	
3	Pulse	Units /l 41 /m3 43 /igal 42 /gal 40 /bbl 46 /kg 61 /t 62 /g 60 /lbs 63 /prog. units 244 Minimum = 0.001 / totalizer unit Maximum = 1000 / totalizer unit	
4	Pulse Width	Units Milliseconds = 253 (Special) Minimum = 0.1 ms Maximum = 2000ms	
5	Low Flow Cutoff	Units % = 57 Minimum = 0 % Maximum = 10 %	
6	Damping	Units s = 51 Minimum = 0.2 s Maximum = 100 s	
7	Density	Units g/cm3 = 91 Minimum = 0.01 g/cm3 Maximum = 5.0 g/cm3	
8	System Zero	Units Hz = 38 Minimum = -50 Hz Maximum = 50 Hz	
9	Units Factor	Units Liter = 41 Minimum = 0.00001 Liter Maximum = 5000000 Liter	
10	Threshold	Units Hz = 38 Minimum = 0 Hz Maximum = 3000 Hz	
11	Totalizer >F	Units /l 41 /m3 43	

Slot-Number	Parameter	Meaning	Revision
		/igal 42 /bbl 46 /t 62 /lbs 63 /gal 40 /kg 61 /g 60 /prog. units 244 Minimum = 0 Maximum = 9999999	
12	Totalizer <R	Units /l 41 /igal 42 /bbl 46 /t 62 /lbs 63 /m3 43 /gal 40 /kg 61 /g 60 /prog. units 244 Minimum = 0 Maximum = 9999999	
25	Frequency EPD	Units Hz = 38 Read only	
26	Low Alarm	Units mA = 39 Minimum = 3 mA Maximum = 4 mA	
27	High Alarm	Units mA = 39 Minimum = 20 mA Maximum = 30 mA	

5.4 Condensed Slot-Command Overview

Menu Name	Variable Type	Command		Slot	Revision
		Read	Write		
Language	unsigned char	128	129	0	
Meter Size (2)	unsigned char	128	129	1	
Filter	unsigned char	128	129	2	
Units Qmax	unsigned char	128	129	3	
Units Totalizer	unsigned char	128	129	4	
Prog. Units	unsigned char	128	129	5	
Terminals P7/G2	unsigned char	128	129	6	
Terminals X1/G2	unsigned char	128	129	7	
Iout at Alarm	unsigned char	128	129	9	
Empty Pipe Detector	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	unsigned char	128	129	19	
2. Line	unsigned char	128	129	20	
1. Line multiplex	unsigned char	128	129	21	
2. Line multiplex	unsigned char	128	129	22	
Operating Mode	unsigned char	128	129	23	
Flow Direction	unsigned char	128	129	24	
Direction Indication	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 >F	unsigned int	130		3	
Overflow <R	unsigned int	130		4	
Mains Interrupt Counter	unsigned int	130	131	5	
RangeDN 10 m/s	float	132	133	0	
Qmax	float	132	133	1	
Pulse (1)	float	132	133	3	
Pulse Width (1)	float	132	133	4	
Low Flow Cutoff	float	132	133	5	
Damping	float	132	133	6	
Density	float	132	133	7	
System Zero	float	132	133	8	
Units Factor	float	132	133	9	
Threshold	float	132	133	10	
Totalizer >F	float	132	133	11	
Totalizer <R	float	132	133	12	
Frequency EPD	float	132		25	
Low Alarm	float	132	133	26	
High Alarm	float	132	133	27	

Comments:

1. In addition to the „standard " relationships (Meter Size -> RangeDN etc.) which are fixed, when the Pulse Width or the Pulse Factor (Pulse) values are changed, *both* parameters must be read again in order for the values to be stored in the converter.
2. To change the Meter Size, it is necessary to enter the Service-Code.

6 Other User Accessible Commands

All the remaining Commands are listed in this Section; Universal, Common Practice and Slot-Commands.

6.1 HART-Command 140 : Totalizer >F and Overflow >F Reset		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 Reset		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 >F Reset		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 Reset		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 Programmable Units Text		Revision
Request Data Bytes	none	
Response Data Bytes	#0..#3 Text for the programmable units (ASCII) with End character (0x00)	
Response Codes	0 No Command Specific Error 5 Incorrect Byte Count	

Error! Bookmark not defined.

6.6 HART-Command 146 : Write Programmable Units Text		Revision
Request Data Bytes	#0..#3 Text for the programmable units (ASCII) with End character (0x00)	
Response Data Bytes	#0..#3 Text for the programmable units (ASCII) with End character (0x00)	
Response Codes	0 No Command Specific Error 5 Incorrect Byte Count	

6.7 HART-Command 147 : Start Automatic System Zero Adjust		Revision
Request Data Bytes	none	
Response Data Bytes	none	
Response Codes	0 No Command Specific Error 5 Incorrect Byte Count	
Comments	If the converter receives the Command 147, the automatic zero adjustment procedure is initiated and the response to all Commands, except Command 48, is „Access Restrict“ until the procedure has been completed. The Command 48 can be used to ascertain the status of the converter to determine if the converter is in the adjustment mode or if the adjustment procedure has been successfully completed (see Command 48). The value of new system zero can be read with the corresponding 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 Execution not possible because Error EEPROM or Primary active 67 Not possible because system data invalid	

6.9 HART-Command 151 : Store 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 Execution not possible because Error EEPROM or Primary active	

6.10 HART-Command 153 : Start 50s Average Determination for the Flowrate		Revision
Request Data Bytes	none	
Response Data Bytes	none	
Response Codes	0 No Command Specific Error 5 Incorrect Byte Count	

6.11 HART-Command 154 : Read 50s Average Value of the Flowrate		Revision
Request Data Bytes	none	
Response Data Bytes	none	
Response Codes	0 No Command Specific Error 5 Incorrect Byte Count 16 Access denied, average determination in process or no average value available	

7 Factory Commands

7.1 Factory Slot-Commands

7.1.1 Factory „unsigned char“- Variables Table

Slot-Number	Parameter	Code Number	Meaning	Revision
26	Module	0 1	None Pulse output	
27	RangeDN velocity	0 1	10 m/s 33.33 ft/s	
28	Range<.05RangeDN	0 1	off on	
29	Range DN	0 1	Fixed Programmable	
30 31	Debit Excitation Excitation	0 1 2 3 4 5 6 7 8 9 10 11 12 13	6.25 Hz AC/DC 7.5 Hz AC/DC 12.5 Hz AC/DC 15 Hz AC/DC 25 Hz AC/DC 30 Hz AC/DC 6.25 Hz DC 7.5 Hz DC 12.5 Hz DC 15 Hz DC 25 Hz DC 30 Hz DC negative positive	
32	Analog range	7 6 5 4 3 2 1 0	V = 8 auto. V = 4 auto. V = 2 auto. V = 1 auto. V = 8 man. V = 4 man. V = 2 man. V = 1 man.	
33	Preamplifier	0 1	yes no	

7.1.2 Factory „unsigned int“- Variables Table

Slot-Number	Parameter	Meaning	Revision
6	Service-Code	Units None = 250 Minimum = 0 Maximum = 9999	
7	Instrument No.	Units None = 250 Minimum = 0 Maximum = 65535	
8	Calibration Mode	Units None = 250 Minimum = 0 Maximum = 65535	

7.1.3 Factory „float“- Variables Table

Slot-Number	Parameter	Meaning	Revision
13	Span adjust >F	Units % = 57 Minimum = 250 % Maximum = 300 %	
14	Span adjust <R	Units % = 57 Minimum = -300 % Maximum = -250 %	
15	Zero adjust	Units % = 57 Minimum = -5 % Maximum = 5 %	
16	Adjust Iout 4 mA	Units mA = 39 Minimum = 2 mA Maximum = 6 mA	
17	Adjust Iout 20 mA	Units mA = 39 Minimum = 15 mA Maximum = 25 mA	
18	Calibration	Units % = 57 Minimum = -10 % Maximum = 10 %	
19	Span Cs 6.25 Hz	Units % = 57 Minimum = 15 % or -15 % Maximum = 200 % -200%	
20	Zero Cz 6.25 Hz	Units % =57 Minimum = -5 % Maximum = 5 %	
21	Span Cs 12.5 Hz	Units % = 57 Minimum = 15 % or -15 % Maximum = 200 % -200%	

Slot-Number	Parameter	Meaning	Revision
22	Zero Cz 12.5 Hz	Units % =57 Minimum = -5 % Maximum = 5 %	
23	Span Cs 25 Hz	Units % = 57 Minimum = 15 % or -15 % Maximum = 200 % -200%	
24	Zero Cz 25 Hz	Units % =57 Minimum = -5 % Maximum = 5 %	

7.1.4 Condensed Slot-Command Overview

Menu Name	Variable Type	Command		Slot	Revision
		Read	Write		
Module	unsigned char	128	129	26	
RangeDN velocity	unsigned char	128	129	27	
Range<.05RangeDN	unsigned char	128	129	28	
Range DN	unsigned char	128	129	29	
Debit Excitation	unsigned char	128	129	30	
Excitation	unsigned char	128	129	31	
Analog range	unsigned char	128	129	32	
Preamplifier	unsigned char	128	129	33	
Service-Code	unsigned int	130	131	6	
Instrument No.	unsigned int	130	131	7	
Calibration mode	unsigned int	130	131	8	
Span adjust >F	float	132	133	13	
Span adjust <R	float	132	133	14	
Zero adjust	float	132	133	15	
Adjust Iout 4 mA	float	132	133	16	
Adjust Iout 20 mA	float	132	133	17	
Calibration	float	132	133	18	
Span Cs 6.25 Hz	float	132	133	19	
Zero Cz 6.25 Hz	float	132	133	20	
Span Cs 12.5 Hz	float	132	133	21	
Zero Cz 12.5 Hz	float	132	133	22	
Span Cs 25 Hz	float	132	133	23	
Zero Cz 25 Hz	float	132	133	24	

7.2 Other Factory Commands

7.2.1 HART-Command 148 : Load Primary Data		Revision
Request Data Bytes	none	
Response Data Bytes	none	
Response Codes	0 No Command Specific Error 5 Incorrect Byte Count 65 Execution not possible because Error EEPROM or Primary active	

7.2.2 HART-Command 149 : Store Primary Data		Revision
Request Data Bytes	none	
Response Data Bytes	none	
Response Codes	0 No Command Specific Error 5 Incorrect Byte Count 65 Execution not possible because Error EEPROM or Primary active	

7.2.3 HART-Command 152 : Initialize External EEPROM		Revision
Request Data Bytes	0..1 Code Number (unsigned integer)	
Response Data Bytes	none	
Response Codes	0 No Command Specific Error 68 Incorrect Code Number or Byte Count not equal to two	

7.2.4 HART-Command 155 : Start Auto. Primary Zero Adjust		Revision
Request Data Bytes	0..1	Code Number (unsigned integer)
Response Data Bytes	none	
Response Codes	0 16 68	No Command Specific Error Access denied, average determination in process Incorrect Code Number or Byte Count not equal to two
Comments		If the converter receives the Command 155, the automatic flowmeter primary zero adjustment procedure is initiated and the response to all Commands, except Command 48, is „Access Restrict“ until the procedure has been completed. The Command 48 can be used to ascertain the status of the converter to determine if the converter is in the adjustment mode or if the adjustment procedure has been successfully completed (see Command 48). The value of new system zero can be read with the corresponding Slot-Command.

7.2.5 HART-Command 156 : Start Auto. Primary Span Adjust		Revision
Request Data Bytes	0..1	Code Number (unsigned integer)
Response Data Bytes	none	
Response Codes	0 16 68	No Command Specific Error Access denied, average determination in process Incorrect Code Number or Byte Count not equal to two
Comments		If the converter receives the Command 156, the automatic flowmeter primary span adjustment procedure is initiated and the response to all Commands, except Command 48, is „Access Restrict“ until the procedure has been completed. The Command 48 can be used to ascertain the status of the converter to determine if the converter is in the adjustment. After the adjustment procedure has been completed the span value based on the Master and the determined span value must be stored in the converter again.

8 Troubleshooting Hart

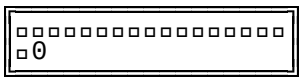
When the HART-Communication does not function properly, the following items should be checked:

1. A HART-Capable current output module must be installed in the converter.
2. The load for the current output must be between 250 and 500 Ohms.
3 The Instrument Address must be entered in the Data Link menu

If these steps have been taken and the HART-Communication is still not operative, the receive function should be checked first. The function "HART-Command" is located in the submenu "Function Test":

If there is no indication the receive function is inoperative. In this case a check should be made with an oscilloscope to determine if a HART-Signal is present at the converter. The typical signal level is 1 mApp, which produces a voltage across a 500 Ohm load of 1 mApp * 500 Ohm = 500 mVpp.
If a signal is present which is not recognized by the converter, the cause is probably poor signal quality. In this case the test should be repeated under more favorable conditions.

If the HART-Commands are received by the converter but at the other end (e.g. Hand-Held-Communicator) an error message is displayed, the converter send signal should be checked with an oscilloscope. A command can be transmitted using the "HART-Transmitter" in the submenu "Function Test":



When the function is initiated the converter transmits a logic 0 (=2200Hz) signal and after a button is pressed the converter transmits a logic 1 (=1200Hz) signal.

In addition, a check should be made with an oscilloscope to determine if the converter answers the command.

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