Data Link Description
D184B108U10

Electromagnetic Flowmeter
FXT4000 (COPA-XT)
HART-Protocol

Industrial IT enabled

Valid for Software Versions from A.20
D699C003U01

HART FIELD COMMUNICATIONS PROTOCOL

ABB

Electromagnetic Flowmeter

Data Link Description

D184B108U10

07.2006

Rev. 01

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HART-Protocol	
Instrument:	**COPA-XT, DT4000**
Software:	**Standard-Software**
Identification:	**D699C003 A.21**
Project number:	**9803D5001**
Prepared by:	
Name:	**Eggert Appel**
Date:	**15.9.1998**
Revision:	**01**
Name:	**Andreas Thöne**
Date:	**20.06.2006**

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1 Revision Log

Revision		Date	New Pages	Revised Pages	Name
No.	Software				
0	A.10	15.Sep 1998	New	-	AP
1	A.21	20. Jun 2006	-	Page 25 (low flow cut off)	Thn

2 Introduction

This overview lists all the available HART-Commands. It includes the Universal and Common Practice commands as well as the Special commands such as Slot and Other commands.
In the past, in order to recognize revisions to previous Command Overview lists it was necessary to check each command to determine if it had been revised. This is no longer necessary, because revisions to commands are now clearly identified in their Revision block in the Command table.

This document is valid for the following software versions:

from A.20

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-Fischer&Porter
	#2	Manufacturer Device Type	= 9 = DT4000
	#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 Number
	#11	Device Identification Number, 24 Bit, LSB	= LSB Instrument Number
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 => 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	
Comment	Primary Variable = Flowrate, for units see unsigned char-Slot 3 Secondary Variable = Totalizer >V, for units see unsigned char-Slot 4 Tertiary Variable = Totalizer <R, for units see unsigned char-Slot 4 Fourth Variable = Flowrate, for 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 = ABB-Fischer&Porter
	#2	Manufacturer Device Type	= 9 = DT4000
	#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 Number
	#11	Device Identification Number, 24 Bit, LSB	= LSB Instrument 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 = Range DN Lower Sensor Limit = 0 Minimum Span = 0.05 * Range DN,	

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, in 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	= Range
		PV Lower Range Value	= 0
		PV Damping Value	= Damping
		Write Protect Code	= 251 = Not Implemented
		Private Label Distributor	= 18 =ABB-Fischer&Porter

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 #1 #2 #3	Transmitter Variable assigned to Slot #0 Transmitter Variable assigned to Slot #1 Transmitter Variable assigned to Slot #2 Transmitter Variable assigned to Slot #3	
Response Data Bytes	#0 #1 #2..#5 #6 #7 #8..#11 #12 #13 #14..#17 #18 #19 #20..#23	Transmitter Variable assigned to Slot #0 Slot #0 Unit Code Slot #0 Variable, IEEE 754 Transmitter Variable assigned to Slot #1 Slot #1 Unit Code Slot #1 Variable, IEEE 754 Transmitter Variable assigned to Slot #2 Slot #2 Unit Code Slot #2 Variable, IEEE 754 Transmitter Variable assigned to Slot #3 Slot #3 Unit Code Slot #3 Variable, IEEE 754	
Response Codes	0 2 5	No Command Specific Error Invalid Selection Incorrect Byte Count	
Comment		Transmitter Variables:	Four variables can be read using the implemented Slot commands (see Tables 5.3.3 and 7.1.3)

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 3 4 5	No Command Specific Error Passed Parameter to Large Passed Parameter to Small 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	
Comment	PV Upper Range Value = Range 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

4.9 HART-Command 48 : Read Additional Transmitter Status

Revision

Request Data Bytes	none	Request Data Bytes		
Response Data Bytes	#0..#2	Response Data Bytes		
		Status byte		
		#0, Bit 0		Not used
		#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		Function test
		#0, Bit 6	Error E:	Totalizer >F
		#0, Bit 7	Error F:	Totalizer <R
		#1, Bit 0		Not used
		#1, Bit 1	Error 1:	A/D-Converter
		#1, Bit 2		Not used
		#1, Bit 3	Error 3:	Flowrate > 105%
		#1, Bit 4		Not used
		#1, Bit 5	Error 5:	EEPROM
		#1, Bit 6	Error 6:	Totalizer
		#1, Bit 7		Not used
		#2, Bit 0		Automatic adjustment in progress
		#2, Bit 1	Error :	Automatic adjustment
		#2, Bit 2		Average measurement in progress
		#2, Bit 3		Not used
		#2, Bit 4		Not used
		#2, Bit 5		Not used
		#2, Bit 6		Simulation in progress
		#2, Bit 7		Function test or Test Mode in progress
Response Codes	0	No Command Specific Error		
	5	Incorrect Byte Count		

5 Slot - Commands

The converter parameters can be categorized into three groups:

unsigned char-Variables

Parameters from menus with selection lists are stored as "unsigned char", e.g. Language :

German = 0
English = 1

unsigned int-Variables

Some numbers, which are always integers, are stored as "unsigned int", e.g. Instrument Number.

float-Variables

The remaining numbers are stored as "float" (floating point numbers) (IEEE 754), e.g. Damping.

In the following tables the read and write commands for the three groups are listed together with their corresponding parameter.

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 Contents of the 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 Contents of the Slot	
Response Data Bytes	#0 Slot-Index #1 Contents of the 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 Tabelle der „unsigned char“ -Variablen

Slot-nummer	Parameter	Kennziffer	Bedeutung		Revision
0	Language	0	German		
		1	English		
1	Meter Size	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	
2	Filter	0	Off		
		1	On		
3	Units Range	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 units /s		
		241	Programmable units /min		
		242	Programmable units /h		
4	Units Totalizer	41	l		
		43	m3		
		42	igal		
		40	gal		
		46	bbl		
		61	kg		

Slot-nummer	Parameter	Kennziffer	Bedeutung	Revision
		62 60 63 244	t g lbs Programmable units	
5	Programmable Units	0 1	Without density With density	
6	Programmable Output	0 14 13 1 4 5 6 7 8 9 10 11	No function Pulse output F/R-Signal _ F/R-Signal / General alarm / General alarm _ MAX/MIN alarm / MAX/MIN alarm _ MIN alarm / MIN alarm _ MAX alarm / MAX alarm _	
9	Iout at Alarm	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 11 8 6 5 4 3	Q [Bargraph] Q [mA] Q [units] Q [%] Signal p/n Blank line TAG Number Totalizer <R Totalizer >F Totalizer	
21 22	1st Line multiplex 2nd Line multiplex	7 2 1 0 11 8 6 5 4 3 14	Q [Bargraph] Q [mA] Q [units] Q [%] Signal p/n Blank line TAG Number Totalizer <R Totalizer >F Totalizer Off	
24	Flow Direction	0 1	Forward Forward/Reverse	
25	Direction Indicator	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 Contents of Slot	
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 Contents of Slot #2 MSB #3 LSB	
Response Data Bytes	#0 Slot-Index #1 Units code Contents of Slot #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	
Comment	The units code received from the Master is ignored during the command processing and the valid, programmed value is returned with the answer	

5.2.3 Table of „unsigned int“-Variables

Slot Number	Parameter	Meaning	Revision
0	MAX Alarm	units % = 57 Minimum = 0 % Maximum = 105 %	
1	MIN Alarm	units % = 57 Minimum = 0 % Maximum = 105 %	
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 Contents of the 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 float-Variable		Revision
Request Data Bytes	#0 Slot-Index #1 Units code #2..#5 Contents of the Slot	
Response Data Bytes	#0 Slot-Index #1 Units code #2..#5 Contents of the Slot	
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	
Comment	The units code received from the Master is ignored during the command processing and the valid, programmed value is returned with the answer	

5.3.3 Table of „Float“-Variables

Slot Number	Parameter	Meaning	Revision
0	Range DN 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 Comment: Range DN 10m/s is read only!!	0
1	Range	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 = 0.05 * Range DN Maximum = Range DN	
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 units Maximum = 1000 / totalizer units	
4	Pulse Width	units Milliseconds = 253 (Special)	

Slot Number	Parameter	Meaning	Revision
		Minimum = 0.1 ms Maximum = 2000 ms	
5	Low Flow Cutoff	units % = 57 Minimum = Maximum =	0 % $\frac{\text{RangeMax}}{Q_{max}(\text{flowrangesetting}}$ x0,5% 10 %
6	Damping	units s = 51 Minimum = Maximum =	2 s 100 s
7	Density	units g/cm3 = 91 Minimum = Maximum =	0.01 g/cm3 5.0 g/cm3
8	System Zero	units Hz = 38 Minimum = Maximum =	-50 Hz 50 Hz
9	Units Factor	units Liter = 41 Minimum = Maximum =	0.00001 Liter 5000000 Liter
11	Totalizer >F	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	
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	

5.4 Condensed Overview, Slot-Commands

Menu Title	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 Range	unsigned char	128	129	3	
Units Totalizer	unsigned char	128	129	4	
Prog. Units	unsigned char	128	129	5	
Prog. Output	unsigned char	128	129	6	
Iout at Alarm	unsigned char	128	129	9	
Simulation	unsigned char	128	129	16	
Test-Mode	unsigned char	128	129	17	
Totalizer Function	unsigned char	128	129	18	
1st Line	unsigned char	128	129	19	
2nd Line	unsigned char	128	129	20	
1st Line multiplex	unsigned char	128	129	21	
2nd Line multiplex	unsigned char	128	129	22	
Flow Direction	unsigned char	128	129	24	
Direction Indicator	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	
Range DN 10 m/s	float	132		0	
Range	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	
Totalizer >F	float	132	133	11	
Totalizer <R	float	132	133	12	

Comments:

1. In addition to the „normal“ relationships (Meter Size -> Range DN etc.) the parameters Pulse Width and Pulse (pulse factor) must *both* be read again after either is changed in order to store the values in the converter.
2. In order to change the Meter Size, the Service Code must be entered first.

6 Other User Accessible Commands

In this chapter, all the remaining commands are listed which are not Universal, Common Practice or 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	Programmable units text (ASCII) with end character (0x00)
Response Codes	0 5	No Command Specific Error Incorrect Byte Count

6.6 HART-Command 146 : Write Programmable Units Text		Revision
Request Data Bytes	#0..#3	Programmable units text (ASCII) with end character (0x00)
Response Data Bytes	#0..#3	Programmable units text (ASCII) with end character (0x00)
Response Codes	0 5	No Command Specific Error 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 5	No Command Specific Error Incorrect Byte Count
Comment		When the converter receives Command 147, the automatic system zero adjustment routine is initiated and it responds to all commands, except Command 48, with the message „Access Restricted“ until the adjustment routine has been completed. Command 48 can be used to request the status of the converter, and thereby determine, if the converter is actively processing an adjustment routine (see Command 48). The new system zero adjustment value can be read using 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 Action not possible, due to Error EEPROM or Primary 67 Not possible, 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 Action not possible, due to Error EEPROM or Primary	

6.10 HART-Command 153 : Start 50s Average Measurement of 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 Flowrate		Revision
Request Data Bytes	none	
Response Data Bytes	#0 Units code #1..#4 50s Flowrate – average value	
Response Codes	0 No Command Specific Error 5 Incorrect Byte Count 16 Access denied, average measurement not yet completed or average value not available	

7 Internal Factory Commands

7.1 Internal Factory Slot-Command

7.1.1 Table Internal Factory „unsigned char“- Variables

Slot Number	Parameter	Code No.	Meaning	Revision
27	Range DN velocity	0 1	10 m/s 33.33 ft/s	

7.1.2 Table Internal Factory „unsigned int“- Variables

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 Table Internal Factory „float“- Variables

Slot Number	Parameter	Meaning	Revision
13	Span adjust >F	Units % = 57 Minimum = 80 % Maximum = 120 %	
14	Span adjust <R	Units % = 57 Minimum = -120 % Maximum = -80 %	
15	Zero adjust	Units % = 57 Minimum = -5 % Maximum = 5 %	
16	Adjust Iout 4 mA	Units mA = 39 Minimum = 3 mA Maximum = 5 mA	
17	Adjust Iout 20 mA	Units mA = 39 Minimum = 18 mA Maximum = 22 mA	
18	Calibration	Units % = 57 Minimum = -10 % Maximum = 10 %	
23	Span Cs 25 Hz	Units % = 57 Minimum = -110 % Maximum = 110 %	
24	Zero Cz 25 Hz	Units % =57 Minimum = -5 % Maximum = 5 %	

7.1.4 Condensed Overview, Slot-Commands

Menu Name	Variable Type	Command		Slot	Revision
		Read	Write		
Range DN velocity	unsigned char	128	129	27	
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 25 Hz	float	132	133	23	
Zero Cz 25 Hz	float	132	133	24	

7.2 Other Internal 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 Action denied, due to Error EEPROM or Primary	

Fehler! Textmarke nicht definiert.

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 Action denied, due to Error EEPROM or Primary	

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 Code number incorrect or Byte Count not equal to two	

7.2.4 HART-Command 155 : Start Auto. Flowmeter Primary Zero Adjustment		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 value measurement in progress Code number incorrect or Byte Count not equal to two
Comment		When the converter receives Command 155, the automatic flowmeter primary zero adjustment routine is initiated and it responds to all commands, except Command 48, with the message „Access Restricted“ until the adjustment routine has been completed. Command 48 can be used to request the status of the converter, and thereby determine, if the converter is actively processing an adjustment routine (see Command 48). The new flowmeter primary zero adjustment value can be read using the corresponding Slot-Command.

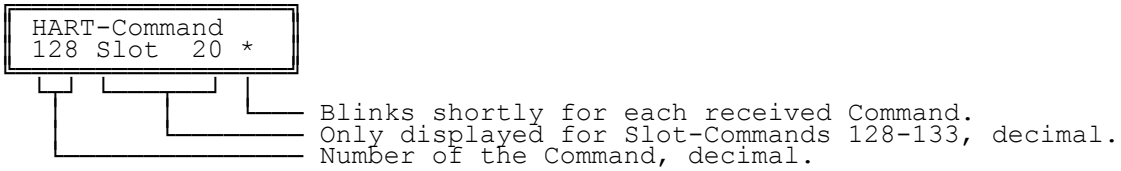
7.2.5 HART-Command 156 : Start auto. Flowmeter Primary Span Adjustment		Revision
Request Data Bytes	0..1	Code number (unsigned integer)
Response Data Bytes	none	
Response Codes	0 16 68	No Command Specific Error Access denied, average value measurement in progress Code number incorrect or Byte Count not equal to two
Comment		When the converter receives Command 156, the automatic flowmeter primary span adjustment routine is initiated and it responds to all commands, except Command 48, with the message „Access Restricted“ until the adjustment routine has been completed. Command 48 can be used to request the status of the converter, and thereby determine, if the converter is actively processing an adjustment routine (see Command 48). After the adjustment routine has been completed, the new flowmeter primary span adjustment value determined by the converter, based on the Master, must be stored in the converter.

8 Error Search for Hart

When the HART-Communication is not functioning, the following items should be checked:

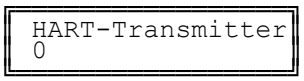
1. That a HART-capable current output module is installed in the converter.
2. That the current output load is between 250 and 500 Ohms.
3. The correct Instrument Address is entered in the Menu "Data Link"

If the above checks have been satisfactorily completed and the HART-Communication still does not function, a command received should be checked next. In the submenu "Function Test" the function "HART-Command" is available:



If this display is blank, the receive function is inoperative. In this case an oscilloscope can be used to check if a HART-signal actually arrives at the converter. The signal level is typically 1 mA_{pp}, so that across a 500 Ohm load the signal voltage would be 1 mA_{pp} * 500 Ohm = 500 mV_{pp}.
If a signal is being received but is not recognized by the converter, a poor signal quality may be the cause. In this case the test should be repeated under more favorable conditions.

If the converter receives the HART-Commands while the other device (e.g. Hand-Held-Communicator) still indicates an error, the send signal from the converter should be checked with an oscilloscope. This can be done using the "HART-Transmitter" selection in the submenu "Function Test":



After this function is selected, the converter transmits a logic 0 (=2200 Hz) and after any key is pressed, a logic 1 (=1200 Hz).

In addition, the oscilloscope should be used to check if the converter responds to the command.

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ABB is continually improving its products. As a result, technical information in this document is subject to change

Printed in the Fed. Rep. of Germany (07.2006)

D184B108U10 Rev. 01

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