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

ABB
HART-Protocol

COPA/MAG-XE
50XE4000

HART-Command Overview
for the
Special Software  D699B180U01
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## 1 Revision Log

<table>
<thead>
<tr>
<th>Revision No.</th>
<th>Softw.</th>
<th>Date</th>
<th>New Pages</th>
<th>Revised Pages</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>X.10</td>
<td>9.07.1998</td>
<td>Initial release</td>
<td>-</td>
<td>HS</td>
</tr>
</tbody>
</table>
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

<table>
<thead>
<tr>
<th>Request Data Bytes</th>
<th>Response Data Bytes</th>
</tr>
</thead>
<tbody>
<tr>
<td>none</td>
<td>#0 Device Type Code for Expansion = 254</td>
</tr>
<tr>
<td></td>
<td>#1 Manufacturer Identification Code = 18 = B-F&amp;P</td>
</tr>
<tr>
<td></td>
<td>#2 Manufacturer Device Type = 8 = XE4000</td>
</tr>
<tr>
<td></td>
<td>#3 Number of Request Preambles = 8</td>
</tr>
<tr>
<td></td>
<td>#4 Revision Level of Universal Command = 5</td>
</tr>
<tr>
<td></td>
<td>#5 Revision Level of Transmitter Document = 0</td>
</tr>
<tr>
<td></td>
<td>#6 Software Revision Level = 1</td>
</tr>
<tr>
<td></td>
<td>#7 Hardware Revision Level = 0 or 1</td>
</tr>
<tr>
<td></td>
<td>#8 Flags, none defined at this time = 0</td>
</tr>
<tr>
<td></td>
<td>#9 Device Identification Number, 24 Bit, MSB = 0</td>
</tr>
<tr>
<td></td>
<td>#10 Device Identification Number, 24 Bit = MSB Instrument No.</td>
</tr>
<tr>
<td></td>
<td>#11 Device Identification Number, 24 Bit, LSB = LSB Instrument No.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Response Codes</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 No Command Specific Error</td>
</tr>
<tr>
<td>5 Incorrect Byte Count</td>
</tr>
</tbody>
</table>

#### 3.2 HART-Command 1: Read Primary Variable

<table>
<thead>
<tr>
<th>Request Data Bytes</th>
<th>Response Data Bytes</th>
</tr>
</thead>
<tbody>
<tr>
<td>none</td>
<td>#0 Primary Variable Unit Code (Table 2)</td>
</tr>
<tr>
<td></td>
<td>#1..#4 Primary Variable, IEEE 754</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Response Codes</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 No Command Specific Error</td>
</tr>
<tr>
<td>5 Incorrect Byte Count</td>
</tr>
</tbody>
</table>

**Comments** Primary Variable => Flowrate

#### 3.3 HART-Command 2: Read Current and Percent of Range

<table>
<thead>
<tr>
<th>Request Data Bytes</th>
<th>Response Data Bytes</th>
</tr>
</thead>
<tbody>
<tr>
<td>none</td>
<td>#0..#3 Analog Output Current mA, IEEE 754</td>
</tr>
<tr>
<td></td>
<td>#4..#7 Percent of Range, IEEE 754</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Response Codes</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 No Command Specific Error</td>
</tr>
<tr>
<td>5 Incorrect Byte Count</td>
</tr>
</tbody>
</table>
### 3.4 HART-Command 3 : Read all dynamic Variables and Current

<table>
<thead>
<tr>
<th>Request Data Bytes</th>
<th>none</th>
</tr>
</thead>
<tbody>
<tr>
<td>Response Data Bytes</td>
<td>#0..#3 Analog Output Current mA, IEEE 754</td>
</tr>
<tr>
<td></td>
<td>#4 Primary Variable Unit Code (Table 2)</td>
</tr>
<tr>
<td></td>
<td>#5..#8 Primary Variable, IEEE 754</td>
</tr>
<tr>
<td></td>
<td>#9 Secondary Variable Unit Code (Table 2)</td>
</tr>
<tr>
<td></td>
<td>#10..#13 Secondary Variable, IEEE 754</td>
</tr>
<tr>
<td></td>
<td>#14 Tertiary Variable Unit Code (Table 2)</td>
</tr>
<tr>
<td></td>
<td>#15..#18 Tertiary Variable, IEEE 754</td>
</tr>
<tr>
<td></td>
<td>#19 4th Variable Unit Code (Table 2)</td>
</tr>
<tr>
<td></td>
<td>#20..#23 4th Variable, IEEE 754</td>
</tr>
<tr>
<td>Response Codes</td>
<td>0 No Command Specific Error</td>
</tr>
<tr>
<td></td>
<td>5 Incorrect Byte Count</td>
</tr>
<tr>
<td>Comments</td>
<td>Primary Variable = Flowrate, units see unsigned char-Slot 3</td>
</tr>
<tr>
<td></td>
<td>Secondary Variable = Totalizer &gt;F, units see unsigned char-Slot 4</td>
</tr>
<tr>
<td></td>
<td>Tertiary Variable = Totalizer &lt;R, units see unsigned char-Slot 4</td>
</tr>
<tr>
<td></td>
<td>Fourth Variable = Flowrate, units see unsigned char-Slot 3</td>
</tr>
</tbody>
</table>

### 3.5 HART-Command 6 : Write Polling Address

<table>
<thead>
<tr>
<th>Request Data Bytes</th>
<th>#0 Polling Address of Device</th>
</tr>
</thead>
<tbody>
<tr>
<td>Response Data Bytes</td>
<td>#0 Polling Address of Device</td>
</tr>
<tr>
<td>Response Codes</td>
<td>0 No Command Specific Error</td>
</tr>
<tr>
<td></td>
<td>2 Invalid Selection</td>
</tr>
<tr>
<td></td>
<td>5 Incorrect Byte Count</td>
</tr>
</tbody>
</table>

### 3.6 HART-Command 11 : Read Unique Identifier Associated With Tag

<table>
<thead>
<tr>
<th>Request Data Bytes</th>
<th>#0..#5 Tag, Packed ASCII</th>
</tr>
</thead>
<tbody>
<tr>
<td>Response Data Bytes</td>
<td>#0 Device Type Code for Expansion = 254</td>
</tr>
<tr>
<td></td>
<td>#1 Manufacturer Identification Code = 18 = F&amp;P</td>
</tr>
<tr>
<td></td>
<td>#2 Manufacturer Device Type = 8 = XE4000</td>
</tr>
<tr>
<td></td>
<td>#3 Number of Request Preambles = 8</td>
</tr>
<tr>
<td></td>
<td>#4 Revision Level of Universal Command = 5</td>
</tr>
<tr>
<td></td>
<td>#5 Revision Level of Transmitter Document = 0</td>
</tr>
<tr>
<td></td>
<td>#6 Software Revision Level = 1</td>
</tr>
<tr>
<td></td>
<td>#7 Hardware Revision Level = 0 or 1</td>
</tr>
<tr>
<td></td>
<td>#8 Flags, none defined at this time = 0</td>
</tr>
</tbody>
</table>
### HART-Protocol

<table>
<thead>
<tr>
<th>Prepared by</th>
<th>Instrument:</th>
<th>Software:</th>
<th>Designation:</th>
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<tr>
<td>Holger Seebode</td>
<td>COPA/MAG-XE, 50XE4000</td>
<td>HART-Software</td>
<td>D699B180 X.10</td>
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</table>

<table>
<thead>
<tr>
<th>Revision:</th>
<th>Name:</th>
<th>Date:</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Holger Seebode</td>
<td>9 July 1998</td>
</tr>
</tbody>
</table>

| #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

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>No Command Specific Error</td>
</tr>
<tr>
<td>5</td>
<td>Incorrect Byte Count</td>
</tr>
</tbody>
</table>

### 3.7 HART-Command 12 : Read Message

<table>
<thead>
<tr>
<th>Request Data Bytes</th>
<th>none</th>
</tr>
</thead>
<tbody>
<tr>
<td>Response Data Bytes</td>
<td>#0..#23 Message, Packed ASCII</td>
</tr>
<tr>
<td>Response Codes</td>
<td>0 No Command Specific Error</td>
</tr>
<tr>
<td></td>
<td>5 Incorrect Byte Count</td>
</tr>
</tbody>
</table>

### 3.8 HART-Command 13 : Read Tag, Descriptor, Date

<table>
<thead>
<tr>
<th>Request Data Bytes</th>
<th>none</th>
</tr>
</thead>
<tbody>
<tr>
<td>Response Data Bytes</td>
<td>#0..#5 Tag, Packed-ASCII</td>
</tr>
<tr>
<td></td>
<td>#6..#17 Descriptor, Packed-ASCII</td>
</tr>
<tr>
<td></td>
<td>#18..#20 Date: Day, Month, Year</td>
</tr>
<tr>
<td>Response Codes</td>
<td>0 No Command Specific Error</td>
</tr>
<tr>
<td></td>
<td>5 Incorrect Byte Count</td>
</tr>
</tbody>
</table>

### 3.9 HART-Command 14 : Read Primary Variable Sensor Information

<table>
<thead>
<tr>
<th>Request Data Bytes</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Response Data Bytes</td>
<td>#0..#2 Sensor Serial Number MSB, 24-bit unsigned integer</td>
</tr>
<tr>
<td></td>
<td>#3 Sensor Limits/Min Span units, Table II Unit Codes</td>
</tr>
<tr>
<td></td>
<td>#4..#7 Upper Sensor Limit, IEEE754</td>
</tr>
<tr>
<td></td>
<td>#8..#11 Lower Sensor Limit, IEEE754</td>
</tr>
<tr>
<td></td>
<td>#12..#15 Minimum Span, IEEE754</td>
</tr>
<tr>
<td>Response Codes</td>
<td>0 No Command Specific Error</td>
</tr>
<tr>
<td>Comments</td>
<td>Sensor Serial Number = 0</td>
</tr>
<tr>
<td></td>
<td>Upper Sensor Limit = RangeDN</td>
</tr>
<tr>
<td></td>
<td>Lower Sensor Limit = 0</td>
</tr>
<tr>
<td></td>
<td>Minimum Span = 0.02 or 0.05 * RangeDN, (see unsigned char-Slot 28: Range &lt;0.05RangeDN)</td>
</tr>
<tr>
<td></td>
<td>5 Incorrect Byte Count</td>
</tr>
</tbody>
</table>
3.10 HART-Command 15 : Read Primary Variable Output Information

<table>
<thead>
<tr>
<th>Request Data Bytes</th>
<th>Response Data Bytes</th>
</tr>
</thead>
<tbody>
<tr>
<td>none</td>
<td>#0 Alarm Select Code, Table VI</td>
</tr>
<tr>
<td></td>
<td>#1 Primary Variable Transfer Function Code, Table III</td>
</tr>
<tr>
<td></td>
<td>#2 Primary Variable Range Values units Code, Table II</td>
</tr>
<tr>
<td></td>
<td>#3..#6 Primary Variable Upper Range Value, IEEE754</td>
</tr>
<tr>
<td></td>
<td>#7..#10 Primary Variable Lower Range Value, IEEE754, always Zero</td>
</tr>
<tr>
<td></td>
<td>#11..#14 Primary Variable Damping Value, IEEE754, units of Seconds</td>
</tr>
<tr>
<td></td>
<td>#15 Write Protect Code, Table VII</td>
</tr>
<tr>
<td></td>
<td>#16 Private Label Distributor Code, Table VIII</td>
</tr>
</tbody>
</table>

Response Codes

<p>| |</p>
<table>
<thead>
<tr>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>0 No Command Specific Error</td>
</tr>
<tr>
<td>5 Incorrect Byte Count</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Request Data Bytes</th>
<th>Response Data Bytes</th>
</tr>
</thead>
<tbody>
<tr>
<td>none</td>
<td>#0..#2 Final Assembly Number</td>
</tr>
</tbody>
</table>

Response Codes

<p>| |</p>
<table>
<thead>
<tr>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>0 No Command Specific Error</td>
</tr>
<tr>
<td>5 Incorrect Byte Count</td>
</tr>
</tbody>
</table>

3.12 HART-Command 17 : Write Message

<table>
<thead>
<tr>
<th>Request Data Bytes</th>
<th>Response Data Bytes</th>
</tr>
</thead>
<tbody>
<tr>
<td>#0..#23 Message, Packed-ASCII</td>
<td>#0..#23 Message, Packed-ASCII</td>
</tr>
</tbody>
</table>

Response Codes

<p>| |</p>
<table>
<thead>
<tr>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>0 No Command Specific Error</td>
</tr>
<tr>
<td>5 Incorrect Byte Count</td>
</tr>
</tbody>
</table>
### 3.13 HART-Command 18 : Write Tag, Descriptor, Date

<table>
<thead>
<tr>
<th>Request Data Bytes</th>
<th>Response Data Bytes</th>
<th>Response Codes</th>
</tr>
</thead>
<tbody>
<tr>
<td>#0..#5 Tag, Packed-ASCII</td>
<td>#0..#5 Tag, Packed-ASCII</td>
<td>0 No Command Specific Error</td>
</tr>
<tr>
<td>#6..#17 Descriptor, Packed-ASCII</td>
<td>#6..#17 Descriptor, Packed-ASCII</td>
<td>5 Incorrect Byte Count</td>
</tr>
<tr>
<td>#18..#20 Date: Day, Month, Year</td>
<td>#18..#20 Date: Day, Month, Year</td>
<td></td>
</tr>
</tbody>
</table>

### 3.14 HART-Command 19 : Write Final Assembly Number

<table>
<thead>
<tr>
<th>Request Data Bytes</th>
<th>Response Data Bytes</th>
<th>Response Codes</th>
</tr>
</thead>
<tbody>
<tr>
<td>#0..#2 Final Assembly Number</td>
<td>#0..#2 Final Assembly Number</td>
<td>0 No Command Specific Error</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5 Incorrect Byte Count</td>
</tr>
</tbody>
</table>
## 4 Common Practice Commands

### 4.1 HART-Command 33 : Read Transmitter Variables

<table>
<thead>
<tr>
<th>Request Data Bytes</th>
<th>Response Data Bytes</th>
</tr>
</thead>
<tbody>
<tr>
<td>#0 Transmitter Variable assigned to Slot #0</td>
<td>#0 Transmitter Variable assigned to Slot #0</td>
</tr>
<tr>
<td>#1 Transmitter Variable assigned to Slot #1</td>
<td>#1 Slot #0 Unit Code</td>
</tr>
<tr>
<td>#2 Transmitter Variable assigned to Slot #2</td>
<td>#2..#5 Slot #0 Variable, IEEE 754</td>
</tr>
<tr>
<td>#3 Transmitter Variable assigned to Slot #3</td>
<td>#6 Transmitter Variable assigned to Slot #1</td>
</tr>
<tr>
<td></td>
<td>#7 Slot #1 Unit Code</td>
</tr>
<tr>
<td></td>
<td>#8..#11 Slot #1 Variable, IEEE 754</td>
</tr>
<tr>
<td></td>
<td>#12 Transmitter Variable assigned to Slot #2</td>
</tr>
<tr>
<td></td>
<td>#13 Slot #2 Unit Code</td>
</tr>
<tr>
<td></td>
<td>#14..#17 Slot #2 Variable, IEEE 754</td>
</tr>
<tr>
<td></td>
<td>#18 Transmitter Variable assigned to Slot #3</td>
</tr>
<tr>
<td></td>
<td>#19 Slot #3 Unit Code</td>
</tr>
<tr>
<td></td>
<td>#20..#23 Slot #3 Variable, IEEE 754</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Response Codes</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 No Command Specific Error</td>
<td>Transmitter Variables:</td>
</tr>
<tr>
<td>2 Invalid Selection</td>
<td>0 = Flowrate</td>
</tr>
<tr>
<td>5 Incorrect Byte Count</td>
<td>1 = Totalizer &gt;F</td>
</tr>
<tr>
<td></td>
<td>2 = Totalizer &lt;R</td>
</tr>
</tbody>
</table>

### 4.2 HART-Command 34 : Write Primary Variable Damping Value

<table>
<thead>
<tr>
<th>Request Data Bytes</th>
<th>Response Data Bytes</th>
</tr>
</thead>
<tbody>
<tr>
<td>#0..#3 Damping Value, IEEE 754</td>
<td>#0..#3 Actual Damping Value, IEEE 754</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Response Codes</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>0 No Command Specific Error</td>
<td>0</td>
</tr>
<tr>
<td>3 Passed Parameter to Large</td>
<td>3</td>
</tr>
<tr>
<td>4 Passed Parameter to Small</td>
<td>4</td>
</tr>
<tr>
<td>5 Incorrect Byte Count</td>
<td>5</td>
</tr>
</tbody>
</table>
### 4.3 HART-Command 35 : Write Primary Variable Range Values

<table>
<thead>
<tr>
<th>Request Data Bytes</th>
<th>#0 PV Upper and Lower Range Values units Code, Table II</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>#1..#4 Primary Variable Upper Range Value, IEEE 754</td>
</tr>
<tr>
<td></td>
<td>#5..#8 Primary Variable Lower Range Value, IEEE 754</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Response Data Bytes</th>
<th>#0 PV Upper and Lower Range Values units Code, Table II</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>#1..#4 Primary Variable Upper Range Value, IEEE 754</td>
</tr>
<tr>
<td></td>
<td>#5..#8 Primary Variable Lower Range Value, IEEE 754</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Response Codes</th>
<th>0 No Command Specific Error</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2 Invalid Selection</td>
</tr>
<tr>
<td></td>
<td>5 Incorrect Byte Count</td>
</tr>
<tr>
<td></td>
<td>11 Upper Range Value too High</td>
</tr>
<tr>
<td></td>
<td>12 Upper Range Value too Low</td>
</tr>
<tr>
<td></td>
<td>13 Upper and Lower Range Values Out of Limits</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Comments</th>
<th>PV Upper Range Value = Qmax</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PV lower Range Value = 0</td>
</tr>
</tbody>
</table>

### 4.4 HART-Command 38 : Reset Configuration Changed Flag

<table>
<thead>
<tr>
<th>Request Data Bytes</th>
<th>none</th>
</tr>
</thead>
</table>

<table>
<thead>
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<th>Response Data Bytes</th>
<th>none</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Response Codes</th>
<th>0 No Command Specific Error</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>5 Incorrect Byte Count</td>
</tr>
</tbody>
</table>

### 4.5 HART-Command 40 : Enter/Exit Primary Variable Current Mode

<table>
<thead>
<tr>
<th>Request Data Bytes</th>
<th>#0..#3 Fixed Primary Variable Current Level, IEEE 754, mA</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Response Data Bytes</th>
<th>#0..#3 Actual Fixed Primary Variable Current Level, IEEE 754, mA</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Response Codes</th>
<th>0 No Command Specific Error</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3 Passed Parameter to Large (&gt; 24.8 mA)</td>
</tr>
<tr>
<td></td>
<td>4 Passed Parameter to Small (&lt; 3.85 mA)</td>
</tr>
<tr>
<td></td>
<td>5 Incorrect Byte Count</td>
</tr>
<tr>
<td></td>
<td>11 In Multidrop Mode</td>
</tr>
</tbody>
</table>
### 4.6 HART-Command 44 : Write Primary Variable Units

<table>
<thead>
<tr>
<th>Request</th>
<th>Data Bytes</th>
<th>#0 Primary Variable Unit Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Response</td>
<td>Data Bytes</td>
<td>#0 Primary Variable Unit Code</td>
</tr>
<tr>
<td>Response</td>
<td>Codes</td>
<td>0 No Command Specific Error</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2 Invalid Selection</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5 Incorrect Byte Count</td>
</tr>
</tbody>
</table>

### 4.7 HART-Command 45 : Trim Primary Variable Current DAC Zero

<table>
<thead>
<tr>
<th>Request</th>
<th>Data Bytes</th>
<th>#0..#3 Externally Measured Primary Variable Current Level, IEEE 754, units of mA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Response</td>
<td>Data Bytes</td>
<td>#0..#3 Actual Measured Primary Variable Current Level, IEEE 754, mA</td>
</tr>
<tr>
<td>Response</td>
<td>Codes</td>
<td>0 No Command Specific Error</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3 Passed Parameter to Large (&gt; 5mA)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4 Passed Parameter to Small (&lt; 3mA)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5 Incorrect Byte Count</td>
</tr>
<tr>
<td></td>
<td></td>
<td>9 Not in Proper Current Mode</td>
</tr>
<tr>
<td></td>
<td></td>
<td>11 In Multidrop Mode</td>
</tr>
</tbody>
</table>

### 4.8 HART-Command 46 : Trim Primary Variable Current DAC Gain

<table>
<thead>
<tr>
<th>Request</th>
<th>Data Bytes</th>
<th>#0..#3 Externally Measured Primary Variable Current Level, IEEE 754, units of mA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Response</td>
<td>Data Bytes</td>
<td>#0..#3: Actual Measured Primary Variable Current Level, IEEE 754, mA</td>
</tr>
<tr>
<td>Response</td>
<td>Codes</td>
<td>0 No Command Specific Error</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3 Passed Parameter to Large (&gt; 22mA)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4 Passed Parameter to Small (&lt; 18mA)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5 Incorrect Byte Count</td>
</tr>
<tr>
<td></td>
<td></td>
<td>9 Not in Proper Current Mode</td>
</tr>
<tr>
<td></td>
<td></td>
<td>11 In Multidrop Mode</td>
</tr>
</tbody>
</table>
### 4.9 HART-Command 48: Read Additional Transmitter Status

<table>
<thead>
<tr>
<th>Request Data Bytes</th>
<th>none</th>
</tr>
</thead>
<tbody>
<tr>
<td>Response Data Bytes</td>
<td>#0..#2 Additional Status Information</td>
</tr>
</tbody>
</table>

#### 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

#### 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

<table>
<thead>
<tr>
<th>Request Data Bytes</th>
<th>#0 Slot-Index</th>
</tr>
</thead>
</table>
| 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

| Request Data Bytes | #0 Slot-Index  
|--------------------|---------------|
| 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

<table>
<thead>
<tr>
<th>Slot-Number</th>
<th>Parameter</th>
<th>Code Number</th>
<th>Meaning</th>
<th>Revision</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Language</td>
<td>0</td>
<td>German</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>English</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
<td>French</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4</td>
<td>Spanish</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Meter size</td>
<td>0</td>
<td>3 mm</td>
<td>1/10 in</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>4 mm</td>
<td>5/32 in</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
<td>5 mm</td>
<td>3/16 in</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3</td>
<td>6 mm</td>
<td>1/4 in</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4</td>
<td>8 mm</td>
<td>5/16 in</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5</td>
<td>10 mm</td>
<td>3/8 in</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6</td>
<td>15 mm</td>
<td>1/2 in</td>
</tr>
<tr>
<td></td>
<td></td>
<td>7</td>
<td>20 mm</td>
<td>3/4 in</td>
</tr>
<tr>
<td></td>
<td></td>
<td>8</td>
<td>25 mm</td>
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<td></td>
<td>9</td>
<td>32 mm</td>
<td>1-1/4 in</td>
</tr>
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<td>10</td>
<td>40 mm</td>
<td>1-1/2 in</td>
</tr>
<tr>
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<td></td>
<td>11</td>
<td>50 mm</td>
<td>2 in</td>
</tr>
<tr>
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<td></td>
<td>12</td>
<td>65 mm</td>
<td>2-1/2 in</td>
</tr>
<tr>
<td></td>
<td></td>
<td>13</td>
<td>80 mm</td>
<td>3 in</td>
</tr>
<tr>
<td></td>
<td></td>
<td>14</td>
<td>100 mm</td>
<td>4 in</td>
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<td></td>
<td>15</td>
<td>125 mm</td>
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<td>200 mm</td>
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</tr>
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<td>18</td>
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</tr>
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</tr>
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</tr>
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</tr>
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<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>19</td>
<td>m3/h</td>
<td></td>
</tr>
<tr>
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<td>Parameter</td>
<td>Code Number</td>
<td>Meaning</td>
<td>Revision</td>
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</tr>
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<td>g/h</td>
<td></td>
</tr>
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<td></td>
<td>80</td>
<td>lbs/s</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>81</td>
<td>lbs/min</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>82</td>
<td>lbs/h</td>
<td></td>
</tr>
<tr>
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<td>240</td>
<td>programmable units /s</td>
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</tr>
<tr>
<td></td>
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<td>programmable units /min</td>
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</tr>
<tr>
<td></td>
<td></td>
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<td>programmable units /h</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>243</td>
<td>programmable units /d</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Units totalizer</td>
<td>41</td>
<td>l</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>43</td>
<td>m³</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>42</td>
<td>gal</td>
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</tr>
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</tr>
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<td></td>
<td></td>
<td>62</td>
<td>t</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>60</td>
<td>g</td>
<td></td>
</tr>
<tr>
<td></td>
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<td></td>
</tr>
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<td></td>
<td></td>
<td>244</td>
<td>programmable units</td>
<td></td>
</tr>
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<td>5</td>
<td>Programmable units</td>
<td>0</td>
<td>without density</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
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<td>with density</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Terminals P7/G2</td>
<td>0</td>
<td>No function</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>13</td>
<td>F/R-Signal /</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>F/R-Signal /</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
<td>Empty pipe /</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3</td>
<td>Empty pipe /</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4</td>
<td>General-Alarm /</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>5</td>
<td>General-Alarm /</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>6</td>
<td>MAX/MIN Alarm /</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>7</td>
<td>MAX/MIN Alarm /</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>8</td>
<td>MIN Alarm /</td>
<td></td>
</tr>
<tr>
<td></td>
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<td>MIN Alarm /</td>
<td></td>
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<td></td>
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<td>10</td>
<td>MAX Alarm /</td>
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<td>9</td>
<td>Iout at Alarm</td>
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<td>High</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>Low</td>
<td></td>
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</tbody>
</table>
## HART-Protocol

**Prepared by:** Holger Seebode  
**Date:** 9 July 1998

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

### Slot-Number Parameter Code Number Meaning Revision

<table>
<thead>
<tr>
<th>Slot-Number</th>
<th>Parameter</th>
<th>Code Number</th>
<th>Meaning</th>
<th>Revision</th>
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<tbody>
<tr>
<td>13</td>
<td>Empty Pipe Detector</td>
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<td>on</td>
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<td>Q [Bargraph]</td>
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<td>0</td>
<td>Q [%]</td>
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<td>4</td>
<td>Totalizer &gt;F</td>
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<td></td>
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<td>Q [Bargraph]</td>
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<td>2nd Line multiplex</td>
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<td>Q [mA]</td>
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<td>Q [units]</td>
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<td>0</td>
<td>Q [%]</td>
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<td>Signal p/n</td>
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<td>Reference p/n</td>
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<td>Totalizer &gt;F</td>
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<td></td>
<td></td>
<td>3</td>
<td>Totalizer</td>
<td></td>
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<td></td>
<td></td>
<td>10</td>
<td>Line frequency</td>
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</tr>
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<td></td>
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<td></td>
</tr>
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<td>23</td>
<td>Operating Mode</td>
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<td></td>
<td></td>
<td>2</td>
<td>Fast</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>Flow Direction</td>
<td>0</td>
<td>Forward</td>
<td></td>
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<td></td>
<td></td>
<td>1</td>
<td>Forward/reverse</td>
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<td>25</td>
<td>Direction Indication</td>
<td>0</td>
<td>normal</td>
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<td>inverse</td>
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5.2 Unsigned-int-Variables

### 5.2.1 HART-Command 130 : Read-unsigned int-Variable

<table>
<thead>
<tr>
<th>Request Data Bytes</th>
<th>#0 Slot-Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>Response Data Bytes</td>
<td>#0 Slot-Index</td>
</tr>
<tr>
<td>#1 Units Code</td>
<td></td>
</tr>
<tr>
<td>#2..#3 Slot contents</td>
<td></td>
</tr>
<tr>
<td>Response Codes</td>
<td>0 No Command Specific Error</td>
</tr>
<tr>
<td>5 Incorrect Byte Count</td>
<td></td>
</tr>
<tr>
<td>6 Transmitter Specific Command Error -&gt; Invalid Slot Number</td>
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### 5.2.2 HART-Command 131 : Write unsigned-int-Variable

<table>
<thead>
<tr>
<th>Request Data Bytes</th>
<th>#0 Slot-Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1 Units Code</td>
<td></td>
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<tr>
<td>Slot contents</td>
<td></td>
</tr>
<tr>
<td>#2 MSB</td>
<td></td>
</tr>
<tr>
<td>#3 LSB</td>
<td></td>
</tr>
<tr>
<td>Response Data Bytes</td>
<td>#0 Slot-Index</td>
</tr>
<tr>
<td>#1 Units Code</td>
<td></td>
</tr>
<tr>
<td>Slot contents</td>
<td></td>
</tr>
<tr>
<td>#2 MSB</td>
<td></td>
</tr>
<tr>
<td>#3 LSB</td>
<td></td>
</tr>
<tr>
<td>Response Codes</td>
<td>0 No Command Specific Error</td>
</tr>
<tr>
<td>2 Invalid Selection -&gt; Invalid Units Code</td>
<td></td>
</tr>
<tr>
<td>3 Parameter Too Large -&gt; Parameter too large</td>
<td></td>
</tr>
<tr>
<td>4 Parameter Too Small -&gt; Parameter too small</td>
<td></td>
</tr>
<tr>
<td>5 Incorrect Byte Count -&gt; Number of data bytes not equal to 4</td>
<td></td>
</tr>
<tr>
<td>6 Transmitter Specific Command Error -&gt; Invalid Slot Number</td>
<td></td>
</tr>
</tbody>
</table>
## 5.2.3 „unsigned int“-Variables Table

<table>
<thead>
<tr>
<th>Slot-Number</th>
<th>Parameter</th>
<th>Meaning</th>
<th>Revision</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>MAX Alarm</td>
<td>Units: % = 57</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Minimum = 0 %, Maximum = 130 %</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>MIN Alarm</td>
<td>Units: % = 57</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Minimum = 0 %, Maximum = 130 %</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Instrument Address</td>
<td>Units: None = 250</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Minimum = 0, Maximum = 15</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Overflow &gt;F</td>
<td>Units: None = 250</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Read only</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Overflow &lt;R</td>
<td>Units: None = 250</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Read only</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Mains Interrupt Counter</td>
<td>Units: None = 250</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Minimum = 0, Maximum = 0</td>
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</tr>
</tbody>
</table>
5.3 Float-Variables

### 5.3.1 HART-Command 132 : Read float-Variable

<table>
<thead>
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<td>#0 Slot-Index</td>
<td>#0 Slot-Index</td>
</tr>
<tr>
<td></td>
<td>#1 Units Code</td>
</tr>
<tr>
<td></td>
<td>#2...#5 Slot contents</td>
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</tbody>
</table>

**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

<table>
<thead>
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<th>Request Data Bytes</th>
<th>Response Data Bytes</th>
</tr>
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<tbody>
<tr>
<td>#0 Slot-Index</td>
<td>#0 Slot-Index</td>
</tr>
<tr>
<td>#1 Units Code</td>
<td>#1 Units Code</td>
</tr>
<tr>
<td>#2...#5 Slot contents</td>
<td>#2...#5 Slot contents</td>
</tr>
</tbody>
</table>

**Response Codes**
- 0 No Command Specific Error
- 2 Parameter Too Large
- 4 Parameter Too 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

<table>
<thead>
<tr>
<th>Slot-Number</th>
<th>Parameter</th>
<th>Meaning</th>
<th>Revision</th>
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<tbody>
<tr>
<td>0</td>
<td>RangeDN 10 m/s</td>
<td>Units</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>l/s 24  kg/s</td>
<td>73</td>
</tr>
<tr>
<td></td>
<td></td>
<td>l/min 17  kg/min</td>
<td>74</td>
</tr>
<tr>
<td></td>
<td></td>
<td>l/h 138  kg/h</td>
<td>75</td>
</tr>
<tr>
<td></td>
<td></td>
<td>m3/s 28  kg/d</td>
<td>76</td>
</tr>
<tr>
<td></td>
<td></td>
<td>m3/min 131  t/min</td>
<td>77</td>
</tr>
<tr>
<td></td>
<td></td>
<td>m3/h 19  t/h</td>
<td>78</td>
</tr>
<tr>
<td></td>
<td></td>
<td>m3/d 29  t/d</td>
<td>79</td>
</tr>
<tr>
<td></td>
<td></td>
<td>igps 137  g/s</td>
<td>70</td>
</tr>
<tr>
<td></td>
<td></td>
<td>igpm 18  g/min</td>
<td>71</td>
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<td>igph 30  g/h</td>
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<td>igpd 31  lbs/s</td>
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<td></td>
<td></td>
<td>mgd 23  lbs/min</td>
<td>81</td>
</tr>
<tr>
<td></td>
<td></td>
<td>gpm 16  lbs/h</td>
<td>82</td>
</tr>
<tr>
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<td></td>
<td>gph 136  prog. units /s</td>
<td>240</td>
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<td></td>
<td>bbl/s 132  prog. units /min</td>
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<td></td>
<td>bbl/min 133  prog. units /h</td>
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<tr>
<td></td>
<td></td>
<td>bbl/h 134  prog. units /d</td>
<td>243</td>
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<td></td>
<td></td>
<td>bbl/d 135</td>
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Minimum = 0.001
Maximum = 9999999
No entry when Range DN is fixed
(see unsigned char-Slot 29l)

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<th>Qmax</th>
<th>Units</th>
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<td>73</td>
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<tr>
<td></td>
<td></td>
<td>l/min 17  kg/min</td>
<td>74</td>
</tr>
<tr>
<td></td>
<td></td>
<td>l/h 138  kg/h</td>
<td>75</td>
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<td></td>
<td></td>
<td>m3/s 28  kg/d</td>
<td>76</td>
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<tr>
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<td></td>
<td>m3/min 131  t/min</td>
<td>77</td>
</tr>
<tr>
<td></td>
<td></td>
<td>m3/h 19  t/h</td>
<td>78</td>
</tr>
<tr>
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<td></td>
<td>m3/d 29  t/d</td>
<td>79</td>
</tr>
<tr>
<td></td>
<td></td>
<td>igps 137  g/s</td>
<td>70</td>
</tr>
<tr>
<td></td>
<td></td>
<td>igpm 18  g/min</td>
<td>71</td>
</tr>
<tr>
<td></td>
<td></td>
<td>igph 30  g/h</td>
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<td></td>
<td>igpd 31  lbs/s</td>
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<td>mgd 23  lbs/min</td>
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<td>gpm 16  lbs/h</td>
<td>82</td>
</tr>
<tr>
<td></td>
<td></td>
<td>gph 136  prog. units /s</td>
<td>240</td>
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<tr>
<td></td>
<td></td>
<td>bbl/s 132  prog. units /min</td>
<td>241</td>
</tr>
<tr>
<td></td>
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<td>bbl/min 133  prog. units /h</td>
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<td>bbl/d 135</td>
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Minimum = 0.02 or 0.05 * RangeDN

---

5.3-2
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<td>(see unsigned char-Slot 28: Range &lt;0.05RangeDN) Maximum = RangeDN</td>
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<td>Pulse</td>
<td>Units</td>
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<tr>
<td></td>
<td>/l</td>
<td>41 /m³</td>
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<tr>
<td></td>
<td>/gal</td>
<td>42 /gal</td>
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<tr>
<td></td>
<td>/bbl</td>
<td>46 /kg</td>
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<tr>
<td></td>
<td>/t</td>
<td>62 /g</td>
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<tr>
<td></td>
<td>/lbs</td>
<td>63 /prog. units</td>
</tr>
<tr>
<td></td>
<td>Minimum =</td>
<td>0.001 / totalizer unit</td>
</tr>
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<td></td>
<td>Maximum =</td>
<td>1000 / totalizer unit</td>
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<td>Pulse Width</td>
<td>Units</td>
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<td>Milliseconds =</td>
<td>253 (Special)</td>
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<tr>
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<td>Minimum =</td>
<td>0.1 ms</td>
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<td></td>
<td>Maximum =</td>
<td>2000 ms</td>
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<tr>
<td>5</td>
<td>Low Flow Cutoff</td>
<td>Units</td>
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<tr>
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<td>% = 57</td>
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<tr>
<td></td>
<td>Minimum =</td>
<td>0 %</td>
</tr>
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<td></td>
<td>Maximum =</td>
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<td>Units</td>
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<td>s = 51</td>
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</tr>
<tr>
<td></td>
<td>Minimum =</td>
<td>0.2 s</td>
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<tr>
<td></td>
<td>Maximum =</td>
<td>100 s</td>
</tr>
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<td>Density</td>
<td>Units</td>
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<td>g/cm³ = 91</td>
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<tr>
<td></td>
<td>Minimum =</td>
<td>0.01 g/cm³</td>
</tr>
<tr>
<td></td>
<td>Maximum =</td>
<td>5.0 g/cm³</td>
</tr>
<tr>
<td>8</td>
<td>System Zero</td>
<td>Units</td>
</tr>
<tr>
<td></td>
<td>Hz = 38</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Minimum =</td>
<td>-50 Hz</td>
</tr>
<tr>
<td></td>
<td>Maximum =</td>
<td>50 Hz</td>
</tr>
<tr>
<td>9</td>
<td>Units Factor</td>
<td>Units</td>
</tr>
<tr>
<td></td>
<td>Liter = 41</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Minimum =</td>
<td>0.00001 Liter</td>
</tr>
<tr>
<td></td>
<td>Maximum =</td>
<td>50000000 Liter</td>
</tr>
<tr>
<td>10</td>
<td>Threshold</td>
<td>Units</td>
</tr>
<tr>
<td></td>
<td>Hz = 38</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Minimum =</td>
<td>0 Hz</td>
</tr>
<tr>
<td></td>
<td>Maximum =</td>
<td>3000 Hz</td>
</tr>
<tr>
<td>11</td>
<td>Totalizer &gt;F</td>
<td>Units</td>
</tr>
<tr>
<td></td>
<td>/l</td>
<td>41 /m³</td>
</tr>
</tbody>
</table>

Project Number: 5.3-3
<table>
<thead>
<tr>
<th>Slot-Number</th>
<th>Parameter</th>
<th>Meaning</th>
<th>Revision</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>/gal</td>
<td>42</td>
<td>/gal</td>
</tr>
<tr>
<td></td>
<td>/bbl</td>
<td>46</td>
<td>/kg</td>
</tr>
<tr>
<td></td>
<td>/t</td>
<td>62</td>
<td>/g</td>
</tr>
<tr>
<td></td>
<td>/lbs</td>
<td>63</td>
<td>/prog. units</td>
</tr>
<tr>
<td></td>
<td>Minimum = 0</td>
<td></td>
<td>Maximum = 9999999</td>
</tr>
<tr>
<td>12</td>
<td>Totalizer &lt;R</td>
<td>Units</td>
<td>/l</td>
</tr>
<tr>
<td></td>
<td>/gal</td>
<td>42</td>
<td>/gal</td>
</tr>
<tr>
<td></td>
<td>/bbl</td>
<td>46</td>
<td>/kg</td>
</tr>
<tr>
<td></td>
<td>/t</td>
<td>62</td>
<td>/g</td>
</tr>
<tr>
<td></td>
<td>/lbs</td>
<td>63</td>
<td>/prog. units</td>
</tr>
<tr>
<td></td>
<td>Minimum = 0</td>
<td></td>
<td>Maximum = 9999999</td>
</tr>
<tr>
<td>25</td>
<td>Frequency EPD</td>
<td>Units</td>
<td>Hz = 38</td>
</tr>
<tr>
<td></td>
<td>Read only</td>
<td></td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>Low Alarm</td>
<td>Units</td>
<td>mA = 39</td>
</tr>
<tr>
<td></td>
<td>Minimum = 3 mA</td>
<td></td>
<td>Maximum = 4 mA</td>
</tr>
<tr>
<td>27</td>
<td>High Alarm</td>
<td>Units</td>
<td>mA = 39</td>
</tr>
<tr>
<td></td>
<td>Minimum = 20 mA</td>
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<td>Maximum = 30 mA</td>
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### 5.4 Condensed Slot-Command Overview

<table>
<thead>
<tr>
<th>Menu Name</th>
<th>Variable Type</th>
<th>Command Slot</th>
<th>Revision</th>
</tr>
</thead>
<tbody>
<tr>
<td>Language</td>
<td>unsigned char</td>
<td>128 129</td>
<td>0</td>
</tr>
<tr>
<td>Meter Size (2)</td>
<td>unsigned char</td>
<td>128 129</td>
<td>1</td>
</tr>
<tr>
<td>Filter</td>
<td>unsigned char</td>
<td>128 129</td>
<td>2</td>
</tr>
<tr>
<td>Units Qmax</td>
<td>unsigned char</td>
<td>128 129</td>
<td>3</td>
</tr>
<tr>
<td>Units Totalizer</td>
<td>unsigned char</td>
<td>128 129</td>
<td>4</td>
</tr>
<tr>
<td>Prog. Units</td>
<td>unsigned char</td>
<td>128 129</td>
<td>5</td>
</tr>
<tr>
<td>Terminals P7/G2</td>
<td>unsigned char</td>
<td>128 129</td>
<td>6</td>
</tr>
<tr>
<td>Terminals X1/G2</td>
<td>unsigned char</td>
<td>128 129</td>
<td>7</td>
</tr>
<tr>
<td>Iout at Alarm</td>
<td>unsigned char</td>
<td>128 129</td>
<td>9</td>
</tr>
<tr>
<td>Empty Pipe Detector</td>
<td>unsigned char</td>
<td>128 129</td>
<td>13</td>
</tr>
<tr>
<td>Alarm Empty pipe</td>
<td>unsigned char</td>
<td>128 129</td>
<td>14</td>
</tr>
<tr>
<td>Iout at Alarm Empty pipe</td>
<td>unsigned char</td>
<td>128 129</td>
<td>15</td>
</tr>
<tr>
<td>Simulation</td>
<td>unsigned char</td>
<td>128 129</td>
<td>16</td>
</tr>
<tr>
<td>Test-Mode</td>
<td>unsigned char</td>
<td>128 129</td>
<td>17</td>
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<tr>
<td>Totalizer Function</td>
<td>unsigned char</td>
<td>128 129</td>
<td>18</td>
</tr>
<tr>
<td>1. Line</td>
<td>unsigned char</td>
<td>128 129</td>
<td>19</td>
</tr>
<tr>
<td>2. Line</td>
<td>unsigned char</td>
<td>128 129</td>
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</tr>
<tr>
<td>1. Line multiplex</td>
<td>unsigned char</td>
<td>128 129</td>
<td>21</td>
</tr>
<tr>
<td>2. Line multiplex</td>
<td>unsigned char</td>
<td>128 129</td>
<td>22</td>
</tr>
<tr>
<td>Operating Mode</td>
<td>unsigned char</td>
<td>128 129</td>
<td>23</td>
</tr>
<tr>
<td>Flow Direction</td>
<td>unsigned char</td>
<td>128 129</td>
<td>24</td>
</tr>
<tr>
<td>Direction Indication</td>
<td>unsigned char</td>
<td>128 129</td>
<td>25</td>
</tr>
<tr>
<td>MAX Alarm</td>
<td>unsigned int</td>
<td>130 131</td>
<td>0</td>
</tr>
<tr>
<td>MIN Alarm</td>
<td>unsigned int</td>
<td>130 131</td>
<td>1</td>
</tr>
<tr>
<td>Instrument Address</td>
<td>unsigned int</td>
<td>130 131</td>
<td>2</td>
</tr>
<tr>
<td>Overflow &gt;F</td>
<td>unsigned int</td>
<td>130 131</td>
<td>3</td>
</tr>
<tr>
<td>Overflow &lt;R</td>
<td>unsigned int</td>
<td>130 131</td>
<td>4</td>
</tr>
<tr>
<td>Mains Interrupt Counter</td>
<td>unsigned int</td>
<td>130 131</td>
<td>5</td>
</tr>
<tr>
<td>RangeDN 10 m/s</td>
<td>float</td>
<td>132 133</td>
<td>0</td>
</tr>
<tr>
<td>Qmax</td>
<td>float</td>
<td>132 133</td>
<td>1</td>
</tr>
<tr>
<td>Pulse (1)</td>
<td>float</td>
<td>132 133</td>
<td>3</td>
</tr>
<tr>
<td>Pulse Width (1)</td>
<td>float</td>
<td>132 133</td>
<td>4</td>
</tr>
<tr>
<td>Low Flow Cutoff</td>
<td>float</td>
<td>132 133</td>
<td>5</td>
</tr>
<tr>
<td>Damping</td>
<td>float</td>
<td>132 133</td>
<td>6</td>
</tr>
<tr>
<td>Density</td>
<td>float</td>
<td>132 133</td>
<td>7</td>
</tr>
<tr>
<td>System Zero</td>
<td>float</td>
<td>132 133</td>
<td>8</td>
</tr>
<tr>
<td>Units Factor</td>
<td>float</td>
<td>132 133</td>
<td>9</td>
</tr>
<tr>
<td>Threshold</td>
<td>float</td>
<td>132 133</td>
<td>10</td>
</tr>
<tr>
<td>Totalizer &gt;F</td>
<td>float</td>
<td>132 133</td>
<td>11</td>
</tr>
<tr>
<td>Totalizer &lt;R</td>
<td>float</td>
<td>132 133</td>
<td>12</td>
</tr>
<tr>
<td>Frequency EPD</td>
<td>float</td>
<td>132 133</td>
<td>25</td>
</tr>
<tr>
<td>Low Alarm</td>
<td>float</td>
<td>132 133</td>
<td>26</td>
</tr>
<tr>
<td>High Alarm</td>
<td>float</td>
<td>132 133</td>
<td>27</td>
</tr>
</tbody>
</table>
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

<table>
<thead>
<tr>
<th>Request Data Bytes</th>
<th>none</th>
</tr>
</thead>
<tbody>
<tr>
<td>Response Data Bytes</td>
<td>none</td>
</tr>
<tr>
<td>Response Codes</td>
<td>0 No Command Specific Error</td>
</tr>
<tr>
<td>Codes</td>
<td>5 Incorrect Byte Count</td>
</tr>
</tbody>
</table>

#### 6.2 HART-Command 141 : Totalizer <R and Overflow <R Reset

<table>
<thead>
<tr>
<th>Request Data Bytes</th>
<th>none</th>
</tr>
</thead>
<tbody>
<tr>
<td>Response Data Bytes</td>
<td>none</td>
</tr>
<tr>
<td>Response Codes</td>
<td>0 No Command Specific Error</td>
</tr>
<tr>
<td>Codes</td>
<td>5 Incorrect Byte Count</td>
</tr>
</tbody>
</table>

#### 6.3 HART-Command 142 : Overflow >F Reset

<table>
<thead>
<tr>
<th>Request Data Bytes</th>
<th>none</th>
</tr>
</thead>
<tbody>
<tr>
<td>Response Data Bytes</td>
<td>none</td>
</tr>
<tr>
<td>Response Codes</td>
<td>0 No Command Specific Error</td>
</tr>
<tr>
<td>Codes</td>
<td>5 Incorrect Byte Count</td>
</tr>
</tbody>
</table>

#### 6.4 HART-Command 143 : Overflow <R Reset

<table>
<thead>
<tr>
<th>Request Data Bytes</th>
<th>none</th>
</tr>
</thead>
<tbody>
<tr>
<td>Response Data Bytes</td>
<td>none</td>
</tr>
<tr>
<td>Response Codes</td>
<td>0 No Command Specific Error</td>
</tr>
<tr>
<td>Codes</td>
<td>5 Incorrect Byte Count</td>
</tr>
</tbody>
</table>
### 6.5 HART-Command 145 : Read Programmable Units Text

<table>
<thead>
<tr>
<th>Request</th>
<th>Data Bytes</th>
<th>none</th>
</tr>
</thead>
<tbody>
<tr>
<td>Response</td>
<td>Data Bytes</td>
<td>#0..#3 Text for the programmable units (ASCII) with End character (0x00)</td>
</tr>
<tr>
<td>Response</td>
<td>Codes</td>
<td>0 No Command Specific Error</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5 Incorrect Byte Count</td>
</tr>
</tbody>
</table>

Error! Bookmark not defined.

### 6.6 HART-Command 146 : Write Programmable Units Text

<table>
<thead>
<tr>
<th>Request</th>
<th>Data Bytes</th>
<th>#0..#3 Text for the programmable units (ASCII) with End character (0x00)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Response</td>
<td>Data Bytes</td>
<td>#0..#3 Text for the programmable units (ASCII) with End character (0x00)</td>
</tr>
<tr>
<td>Response</td>
<td>Codes</td>
<td>0 No Command Specific Error</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5 Incorrect Byte Count</td>
</tr>
</tbody>
</table>

### 6.7 HART-Command 147 : Start Automatic System Zero Adjust

<table>
<thead>
<tr>
<th>Request</th>
<th>Data Bytes</th>
<th>none</th>
</tr>
</thead>
<tbody>
<tr>
<td>Response</td>
<td>Data Bytes</td>
<td>none</td>
</tr>
<tr>
<td>Response</td>
<td>Codes</td>
<td>0 No Command Specific Error</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5 Incorrect Byte Count</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Request</th>
<th>Data Bytes</th>
<th>Response</th>
<th>Data Bytes</th>
<th>Response Codes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>none</td>
<td>none</td>
<td>none</td>
<td>0: No Command Specific Error</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>5: Incorrect Byte Count</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>65: Execution not possible because Error EEPROM or Primary active</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>67: Not possible because system data invalid</td>
</tr>
</tbody>
</table>

### 6.9 HART-Command 151: Store Data in External EEPROM

<table>
<thead>
<tr>
<th>Request</th>
<th>Data Bytes</th>
<th>Response</th>
<th>Data Bytes</th>
<th>Response Codes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>none</td>
<td>none</td>
<td>none</td>
<td>0: No Command Specific Error</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>5: Incorrect Byte Count</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>65: Execution not possible because Error EEPROM or Primary active</td>
</tr>
</tbody>
</table>

### 6.10 HART-Command 153: Start 50s Average Determination for the Flowrate

<table>
<thead>
<tr>
<th>Request</th>
<th>Data Bytes</th>
<th>Response</th>
<th>Data Bytes</th>
<th>Response Codes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>none</td>
<td>none</td>
<td>none</td>
<td>0: No Command Specific Error</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>5: Incorrect Byte Count</td>
</tr>
</tbody>
</table>
### HART-Protocol

<table>
<thead>
<tr>
<th>Prepared by</th>
<th>Instrument:</th>
<th>Software:</th>
<th>Designation:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Holger Seebode</td>
<td>COPA/MAG-XE, 50XE4000</td>
<td>HART-Software</td>
<td>D699B180 X.10</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Revision:</th>
<th>Name:</th>
<th>Date:</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Holger Seebode</td>
<td>9 July 1998</td>
</tr>
</tbody>
</table>

**Project Number:**

### 6.11 HART-Command 154 : Read 50s Average Value of the Flowrate

<table>
<thead>
<tr>
<th>Request Data Bytes</th>
<th>none</th>
</tr>
</thead>
<tbody>
<tr>
<td>Response Data Bytes</td>
<td>none</td>
</tr>
</tbody>
</table>
| 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

<table>
<thead>
<tr>
<th>Slot-Number</th>
<th>Parameter</th>
<th>Code Number</th>
<th>Meaning</th>
<th>Revision</th>
</tr>
</thead>
<tbody>
<tr>
<td>26</td>
<td>Module</td>
<td>0</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>Pulse output</td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>RangeDN velocity</td>
<td>0</td>
<td>10 m/s</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>33.33 ft/s</td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>Range&lt;.05RangeDN</td>
<td>0</td>
<td>off</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>on</td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>Range DN</td>
<td>0</td>
<td>Fixed</td>
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<td></td>
<td></td>
<td>1</td>
<td>Programmable</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>Debit Excitation</td>
<td>0</td>
<td>6.25 Hz AC/DC</td>
<td></td>
</tr>
<tr>
<td>31</td>
<td>Excitation</td>
<td>1</td>
<td>7.5 Hz AC/DC</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
<td>12.5 Hz AC/DC</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3</td>
<td>15 Hz AC/DC</td>
<td></td>
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<tr>
<td></td>
<td></td>
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<td>25 Hz AC/DC</td>
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</tr>
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<td></td>
<td></td>
<td>5</td>
<td>30 Hz AC/DC</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>6</td>
<td>6.25 Hz DC</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>7</td>
<td>7.5 Hz DC</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>8</td>
<td>12.5 Hz DC</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>9</td>
<td>15 Hz DC</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>10</td>
<td>25 Hz DC</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>11</td>
<td>30 Hz DC</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>12</td>
<td>negative</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>13</td>
<td>positive</td>
<td></td>
</tr>
<tr>
<td>32</td>
<td>Analog range</td>
<td>7</td>
<td>V = 8 auto.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>6</td>
<td>V = 4 auto.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>5</td>
<td>V = 2 auto.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4</td>
<td>V = 1 auto.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3</td>
<td>V = 8 man.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
<td>V = 4 man.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>V = 2 man.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>0</td>
<td>V = 1 man.</td>
<td></td>
</tr>
<tr>
<td>33</td>
<td>Preamplifier</td>
<td>0</td>
<td>yes</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>no</td>
<td></td>
</tr>
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</table>
### 7.1.2 Factory „unsigned int“- Variables Table

<table>
<thead>
<tr>
<th>Slot-Number</th>
<th>Parameter</th>
<th>Meaning</th>
<th>Revision</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>Service-Code</td>
<td>Units</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>None = 250</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Minimum = 0</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Maximum = 9999</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Instrument No.</td>
<td>Units</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>None = 250</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Minimum = 0</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Maximum = 65535</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Calibration Mode</td>
<td>Units</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>None = 250</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Minimum = 0</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Maximum = 65535</td>
<td></td>
</tr>
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</table>
7.1.3 Factory „float“- Variables Table

<table>
<thead>
<tr>
<th>Slot-Number</th>
<th>Parameter</th>
<th>Meaning</th>
<th>Revision</th>
</tr>
</thead>
<tbody>
<tr>
<td>13</td>
<td>Span adjust &gt;F</td>
<td>Units % = 57</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Minimum = 250 %</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Maximum = 300 %</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Span adjust &lt;R</td>
<td>Units % = 57</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Minimum = -300 %</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Maximum = -250 %</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Zero adjust</td>
<td>Units % = 57</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Minimum = -5 %</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Maximum = 5 %</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Adjust Iout 4 mA</td>
<td>Units mA = 39</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Minimum = 2 mA</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Maximum = 6 mA</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Adjust Iout 20 mA</td>
<td>Units mA = 39</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Minimum = 15 mA</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Maximum = 25 mA</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Calibration</td>
<td>Units % = 57</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Minimum = -10 %</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Maximum = 10 %</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>Span Cs 6.25 Hz</td>
<td>Units % = 57</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Minimum = 15 % or -15 %</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Maximum = 200 % or -200%</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>Zero Cz 6.25 Hz</td>
<td>Units % =57</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Minimum = -5 %</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Maximum = 5 %</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>Span Cs 12.5 Hz</td>
<td>Units % = 57</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Minimum = 15 % or -15 %</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Maximum = 200 % or -200%</td>
<td></td>
</tr>
</tbody>
</table>
### HART-Protocol

**Prepared by:**
- Name: Holger Seebode
- Date: 9 July 1998

**Instrument:** COPA/MAG-XE, 50XE4000
**Software:** HART-Software
**Designation:** D699B180 X.10

**Revision:**
- Name: Holger Seebode
- Date: 9 July 1998

**Project Number:** 7.1-4

<table>
<thead>
<tr>
<th>Slot-Number</th>
<th>Parameter</th>
<th>Meaning</th>
<th>Revision</th>
</tr>
</thead>
<tbody>
<tr>
<td>22</td>
<td>Zero Cz 12.5 Hz</td>
<td>Units % = 57</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Minimum = -5 %</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Maximum = 5 %</td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>Span Cs 25 Hz</td>
<td>Units % = 57</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Minimum = 15 % or -15 %</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Maximum = 200 % or -200 %</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>Zero Cz 25 Hz</td>
<td>Units % = 57</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Minimum = -5 %</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Maximum = 5 %</td>
<td></td>
</tr>
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</table>
### 7.1.4 Condensed Slot-Command Overview

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

### 7.2.1 HART-Command 148 : Load Primary Data

<table>
<thead>
<tr>
<th>Request Data Bytes</th>
<th>none</th>
</tr>
</thead>
<tbody>
<tr>
<td>Response Data Bytes</td>
<td>none</td>
</tr>
<tr>
<td>Response Codes</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>65</td>
</tr>
</tbody>
</table>

### 7.2.2 HART-Command 149 : Store Primary Data

<table>
<thead>
<tr>
<th>Request Data Bytes</th>
<th>none</th>
</tr>
</thead>
<tbody>
<tr>
<td>Response Data Bytes</td>
<td>none</td>
</tr>
<tr>
<td>Response Codes</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>65</td>
</tr>
</tbody>
</table>

### 7.2.3 HART-Command 152 : Initialize External EEPROM

<table>
<thead>
<tr>
<th>Request Data Bytes</th>
<th>0..1</th>
<th>Code Number (unsigned integer)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Response Data Bytes</td>
<td>none</td>
<td></td>
</tr>
<tr>
<td>Response Codes</td>
<td>0</td>
<td>No Command Specific Error</td>
</tr>
<tr>
<td></td>
<td>68</td>
<td>Incorrect Code Number or Byte Count not equal to two</td>
</tr>
</tbody>
</table>
### 7.2.4 HART-Command 155 : Start Auto. Primary Zero Adjust

<table>
<thead>
<tr>
<th>Request Data Bytes</th>
<th>0..1 Code Number (unsigned integer)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Response Data Bytes</td>
<td>none</td>
</tr>
<tr>
<td>Response Codes</td>
<td>0 No Command Specific Error</td>
</tr>
<tr>
<td></td>
<td>16 Access denied, average determination in process</td>
</tr>
<tr>
<td></td>
<td>68 Incorrect Code Number or Byte Count not equal to two</td>
</tr>
<tr>
<td>Comments</td>
<td>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.</td>
</tr>
</tbody>
</table>

### 7.2.5 HART-Command 156 : Start Auto. Primary Span Adjust

<table>
<thead>
<tr>
<th>Request Data Bytes</th>
<th>0..1 Code Number (unsigned integer)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Response Data Bytes</td>
<td>none</td>
</tr>
<tr>
<td>Response Codes</td>
<td>0 No Command Specific Error</td>
</tr>
<tr>
<td></td>
<td>16 Access denied, average determination in process</td>
</tr>
<tr>
<td></td>
<td>68 Incorrect Code Number or Byte Count not equal to two</td>
</tr>
<tr>
<td>Comments</td>
<td>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.</td>
</tr>
</tbody>
</table>
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":

```
+557 Command
Slot 20 *
```

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":

```
+557 7UDQVPLWHU
0
```

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.
ABB Automation Products GmbH

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http://www.abb.com/automation