Supplementary Installation and Operating Instructions

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General

These Instructions are supplementary to the "Installation and Operating Instructions IFC 090 K / F" dated 12/96. The details given there, in particular the Safety Information, are valid and should be observed. These Supplementary Instructions provide only additional information for device operation and connection to a PROFIBUS-PA fieldbus.

Attention: Please set the controller to manual mode before changing parameters of the IFC 090.

Items included with supply

In addition to the standard scope of supply, these Supplementary Instructions for the IFC 090 with PROFIBUS-PA interface, plus a diskette with all available GSD files of KROHNE devices.

Software history

<table>
<thead>
<tr>
<th>Issued</th>
<th>Signal converter</th>
<th>User program</th>
<th>Instructions</th>
</tr>
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<tbody>
<tr>
<td>month/year</td>
<td>Hardware</td>
<td>Firmware</td>
<td>Hardware</td>
</tr>
<tr>
<td>09/98</td>
<td>PROFIBUS-PA Module</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>05/99</td>
<td>PROFIBUS-PA Module</td>
<td>2.00/99050 5</td>
<td>PC</td>
</tr>
<tr>
<td>07/00</td>
<td>PROFIBUS-PA Module</td>
<td>2.00/</td>
<td>PC</td>
</tr>
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</table>

1. PROFIBUS-PA

The above diagram shows a typical instrumentation with PROFIBUS-PA devices in hazardous and non-hazardous locations, including connection of conventional devices (e.g. with 4-20mA signals) to the PROFIBUS-PA. The PROFIBUS-PA is normally connected to a segment coupler which, among other things, carries out conversion to the PROFIBUS-DP. Here, it needs to be noted in particular that the segment coupler is normally set to a fixed baud rate on the DP side.
Further information on the planning and operation of PROFIBUS-PA networks is to be found in the KROHNE brochure “PROFIBUS-PA networks”.

1.1 GSD
All available GSD files of KROHNE devices – including those of the IFC 090, of course - are supplied together with each device. The GSD contains information that is needed for project planning of the PROFIBUS-DP/PA communication network. The relevant data files must be loaded into the project planning system/master system before start-up of the bus system.

For example, the following applies to COMET 200 or COM PROFIBUS from Siemens:
- all GSD files (*.GSD) into the directory of the GSD files, e.g. *\GSD
- all BMP files (*.BMP) into the directory of the bit maps, e.g. *\BITMAPS

In STEP7, the GSD file is automatically copied into the respective directory with “install new GSD” (in the HW-Config Menu: EXTRAS). After that, the bit map must be copied into the directory *\SIEMENS\STEP7\S7data\Nsbmp. Following “catalog updating” the device can be placed in the project. This will then enable the cyclic communication (measured values and status).

1.2 PROFIBUS-PA profile
The IFC 090 supports the PROFIBUS-PA Profile Version 2.0. Additionally, all relevant parameters in the device are offered via the PROFIBUS-PA interface. The IFC 090 defines the following blocks:

- Three Function Blocks (FB): One Analog Input-FB for flow and two Totalizer-FBs for totalizers. During configuration of the network you can distinguish between two different kind of totalizers. First the temporary Profibus totalizers (PA-Tot.1/2) which will be resetted after power on. These totalizers are according Profil 2.0. You also can choose the permanently stored device totalizers (Device-Tot.1/2). These device totalizers will be mapped to the totalizer function blocks whereas limits and the unit of this block can be used together with the device totalizers. Reset function is possible as well.
- One transducer block for electromagnetic flow measurement. This block provides the parameters defined in Profile 2.0.
- One physical block. This block contains the parameters defined in Profile 2.0, and also all device-specific parameters in the form of an appendix.

1.3 Meaning of measurement and status information
During integration of the KROHNE device into the PROFIBUS master you can choose which values should be transferred via PROFIBUS. This can be done by using the GSD file. Each value which is a 4 Byte Float Format according IEEE Standard 754 Short Real Number a status byte follows. That means each measurement value consists of 4 byte value plus 1 byte status. Other measurement values will directly follow as 5 Byte package if configured during integration. Below the meaning of the status byte is described:

<table>
<thead>
<tr>
<th>Bit n</th>
<th>Bit n+1</th>
<th>Bit n+2</th>
<th>Bit n+3</th>
</tr>
</thead>
<tbody>
<tr>
<td>VZ</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Exponent</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Mantissa</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Mantissa</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

Example: 40 F0 00 00 (hex) = 0100 0000 1111 0000 0000 0000 0000 0000 (binary)

Calculation:
Value = \((-1)^{\text{VZ}} \times 2^{(\text{Exponent} - 127)} \times (1 + \text{Mantissa})\)

Value = \((-1)^{0} \times 2^{(129 - 127)} \times (1 + 2^7 + 2^2 + 2^\text{-1})\) = 7.5
The meaning of the status byte is as following:

<table>
<thead>
<tr>
<th>Quality</th>
<th>Quality-Substatus</th>
<th>Limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gr</td>
<td>Gr</td>
<td>QS</td>
</tr>
<tr>
<td>2^7</td>
<td>2^6</td>
<td>2^5</td>
</tr>
<tr>
<td>2^4</td>
<td>2^3</td>
<td>2^2</td>
</tr>
<tr>
<td>2^1</td>
<td>2^0</td>
<td></td>
</tr>
</tbody>
</table>

- 0 0 0 0 0 0 0 0 0 = bad
- 0 0 0 0 0 0 0 0 1 = uncertain
- 0 0 0 0 0 0 1 0 0 = good (Non Cascade)
- 1 1 1 1 1 1 1 1 1 = good (Cascade) - not supported

Status = bad

- 0 0 0 0 0 0 0 0 0 = non-specific
- 0 0 0 0 0 0 0 0 1 = configuration error
- 0 0 0 0 0 1 0 0 0 = not connected
- 0 0 0 0 1 0 0 0 0 = device failure
- 0 0 0 1 0 0 0 0 0 = sensor failure
- 0 0 0 1 0 0 0 1 0 = no communication (last usable value)
- 0 0 0 1 0 0 1 0 0 = no communication (no usable value)
- 0 0 0 1 1 0 1 1 1 = out of service

Status = uncertain

- 0 0 0 0 0 0 0 0 0 = non-specific
- 0 0 0 0 0 0 1 0 0 = last usable value
- 0 0 0 0 0 1 0 0 0 = substitute-set
- 0 0 0 0 1 0 0 0 0 = initial value
- 0 0 0 1 0 0 0 0 0 = sensor conversion not accurate
- 0 0 0 1 0 0 0 1 0 = engineering unit violation (unit not in the valid set)
- 0 0 0 1 0 1 0 0 0 = sub-normal
- 0 0 0 1 1 0 1 1 1 = configuration error

Status = good (Non-Cascade)

- 0 0 0 0 0 0 0 0 0 = ok
- 0 0 0 0 0 0 0 0 1 = active block alarm
- 0 0 0 0 0 0 1 0 0 = active advisory alarm (priority < 8)
- 0 0 0 0 0 1 1 0 0 = active critical alarm (priority > 8)
- 0 0 0 1 0 0 0 0 0 = unacknowledged block alarm
- 0 0 0 1 0 0 1 0 0 = unacknowledged advisory alarm
- 0 0 0 1 1 0 0 0 0 = unacknowledged critical alarm
- 0 0 0 1 1 0 0 0 0 = initiate fail safe
- 0 0 0 1 1 0 0 0 1 = maintenance required

Status = Limits

- 0 0 0 0 0 0 0 0 0 = ok
- 0 0 0 0 0 0 0 0 1 = low limited
- 0 0 0 0 0 0 0 1 0 = high limited
- 0 0 0 0 0 0 1 1 0 = constant

Check the first two quality bits in order to get the quality information of the measurement value:

- Good (non Cascade) measurement value is ok and can be used without restrictions
- Uncertain measurement value can be used but the accuracy can not be guaranteed (e.g. measurement value has been frozen or A/D converter is saturated)
- Bad measurement value is bad don’t use it
- Good (Cascade) not supported because it’s not applicable for measurement devices

Diagnostics

If the device has been detected an error additional diagnostic information will be send to the master. The meaning of the additional information is described within the GSD file under UNIT_DIAG_BIT(i).
2. Electrical connection (see Section 2 in the Installation and Operating Instructions)

2.1 Interconnection of devices in the hazardous location

We recommend that a PROFIBUS-PA network in the hazardous location be projected in accordance with PTB's FISCO model (see KROHNE brochure "PROFIBUS-PA networks"). The FISCO-Model may be used, if:

- all electrical components which should be connected to the bus must be approved according the FISCO model (even the termination),
- the maximum cable length does not exceed 1000 m,
- the values of the cable are within the following ranges $R' = 15...150\ \Omega/km$; $L' = 0,4...1m\ H/km$; $C' = 80...200nF/km$,
- the approved input values of the field devices ($Uo$, $Io$, $Po$) are matchable with the output values of the power supply (e.g. segment coupler) which means $U_i \leq U_o$, $I_i \leq I_o$ und $P_i \leq P_o$.

2.2 Bus cable

Further limitations to the cable than the FISCO limitations are not existent. Nevertheless a twisted pair and shielded cable is strongly recommended. The good quality cable could have the following data: $44\ \Omega/km$, $<90nF/km$, $<3dB$ attenuation at $39kHz$ and $100\ Ohm$ impedance at $31,25kHz$.

2.3 Shielding and grounding

For optimum electromagnetic compatibility of systems it is extremely important that the system components, and particularly the bus cables connecting the components, be shielded and that such shields - if possible - form an unbroken cover, electrically speaking.

Hence it follows that, for use in non-hazardous duty systems, the cable shield should be grounded as often as possible.

In "Ex" systems an adequate equipotential bonding in the hazardous and non-hazardous location along the entire fieldbus installation is strongly recommended. Multiple grounding of the shield is also of advantage.

Note: The use of twisted and shielded cables is strongly recommended, otherwise EMC protection of the IFC 090 cannot be assured.

2.4 PROFIBUS-PA connection

Connect the bus cable as shown in the figure.

- Connect the cable cores to terminals D and D .
- Polarity reversal will not have any effect.
- The cable shield should be connected with minimum length to the FE functional ground.
- The equipotential bonding conductor must be connected to the device by connecting it to FE functional ground.
3. Menu settings for PROFIBUS-PA

The following settings need to be made for operation of the IFC 090 on a PROFIBUS-PA network. Note that the address can be set by the service “set slave address” as well.

### Function (Fct.) | Description
--- | ---
3.8 TAG NO. | Text, measuring-point tag (max. 10 characters). Characters assignable to each place:
- A-Z, a-z, 0-9 or "_" (blank character)
3.9 COM | Select function for the communication port:
- OFF
- HART
- PROFI PA
Press key to transfer to subfunction "ADDRESS".
ADDRESS | Set address
Range:
- 00-15 for HART (default 00)
- 00-126 for PROFI PA (default 126)
Press key to return to Fct. 3.9 COM

4. Technical data, PROFIBUS Ident-No. F401

| Hardware | Software |
--- | --- |
Physical to IEC 61158-2 and the FISCO model
Bus characteristics 9..30 V; 0.3 A max.; 4.2 W max.
Base current 10 mA
FDE yes; separate fault clearance electronics provided
Fault current 6 mA; (fault current = max. continuous current – base current)
Starting current lower than the base current
“Ex” approval EEx ia IIC T6 or EEx lb IIC/IIB T6 in conformity with the FISCO model independent of polarity
Connection | GSD all KROHNE GSD files supplied on diskette
Device profile complete implementation of Profile B, V2.0
Functional blocks flow [m^3/h], totalizer1[m^3], totalizer2 [m^3]
mentioned units are default units
Address range 0-126, default 126, “set slave address” supported
Operator control local display and operator interface at device
SAP’s 1: typically the number of service access points is equal to the number of class 2 masters (operating tools)