User Guide
MC5 Fieldbus Option for PROFIBUS PA

beamex

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Dear user,

We have made every effort to ensure the accuracy of the contents of this manual. Should any errors be detected, we would greatly appreciate to receive suggestions to improve the quality of the contents of this manual.

The above not withstanding, we can assume no responsibility for any errors in this manual or their eventual consequences.

We reserve rights to make modifications to this manual without any further notice.

For more detailed technical data about MC5 Multifunction Calibrator, please refer to MC5 User Guide or contact the manufacturer.

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Contents

General

MC5's fieldbus option for PROFIBUS PA allows you to calibrate PROFIBUS PA fieldbus instruments. All you need is a fieldbus compatible MC5 and a FI5 Fieldbus Interface suited for your fieldbus type.

The MC5/FI5 for PROFIBUS PA features listed below are presented in more detail further on in this manual.

- Takes the role of PROFIBUS Master when connecting to PROFIBUS segment.
- Capability to read and edit the instrument Tag.
- Read and assign the instrument Node Address.
- Read and edit the Transducer Block parameters.
- Device Descriptions supported.

Note.
MC5/FI5 does not support Device Description Methods.

What is Fieldbus

Fieldbus is an industrial digital communications network specifically designed for process automation use. It is meant to replace the existing standard 4 … 20 mA analog signal.

Fieldbus technology has been around since late 80's, but developing an international standard took a long time. There still are several different types of fieldbus implementations, but some of them have become more dominant than others. The two most widely spread types are:

- **PROFIBUS** (www.profibus.com/pb/profibus/process/).
- **FOUNDATION Fieldbus** (www.fieldbus.org/) and

Both are based on IEC fieldbus standard, 61158.

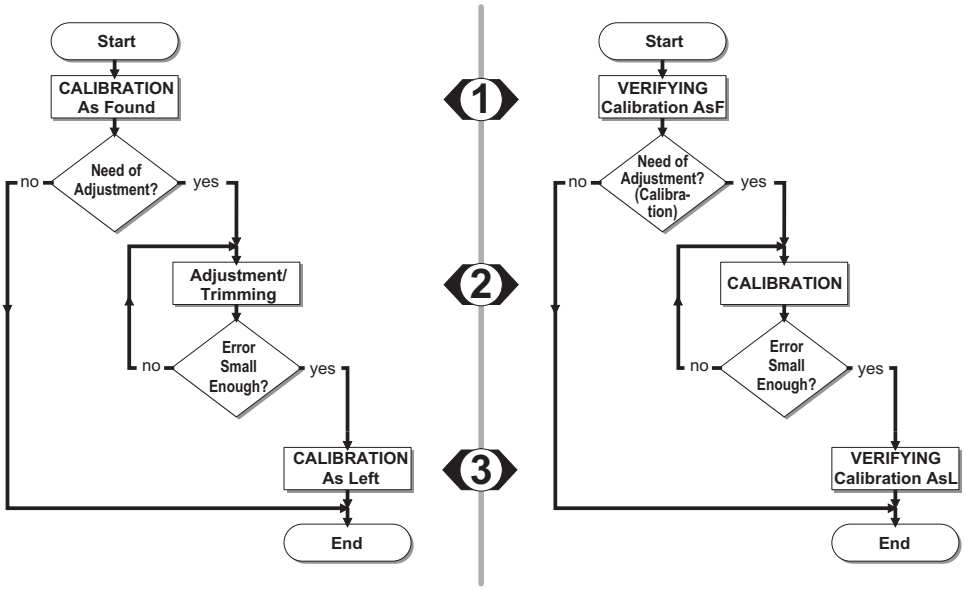
Terminology

There are some inconsistencies between the terminologies used when calibrating/adjusting/trimming traditional analog instruments and new fieldbus instruments.

For both instrument types, the procedure has three phases:

1. Comparing the instrument against a more accurate device (calibrator). This documents the instrument's state "As Found". If all is well (instrument is accurate enough), the 2nd and 3rd phase are not needed.
2. Adjusting/trimming the instrument.
3. Re-comparing to create an "As Left" document of the instrument's state after adjustment/trimming.

The leftmost picture below presents the terms used when calibrating analog instruments. The rightmost one shows the terms used in fieldbus instruments and fieldbus control system software. The numbers of the three phases are shown in the middle.



For analog instruments the term "**Calibration**" is used for comparison phases (1st and 3rd). Phase two is called "**Adjustment**" or "**Trimming**".

In the user interfaces and manuals of fieldbus instruments and fieldbus control system software, the second phase is called "**Calibration**", "Adjustment" and/or "Trimming". So, to avoid confusion Beamex uses the term "**Verifying Calibration**" for the comparison phases in fieldbus environment.

Notes and Warnings

This manual describes the use of MC5 and FI5 for PROFIBUS PA. For a more general fieldbus information, please refer to your fieldbus control system manuals as well as the manuals for instruments to be calibrated.

Terms like **Function Block Parameters** [**AUTO**, **OOS** (Out of Service), **MAN**], **Physical Block, Transducer Block** etc. should be familiar before attempting to calibrate any fieldbus instruments.

The more instruments a fieldbus segment contains, the slower the communication is. Be patient.

WARNINGS!

Do not connect two master devices (e.g. MC5/FI5, a Field Communicator or a control system) at the same time to the same fieldbus segment! They clash and make the fieldbus segment unstable. Only one master device may be connected to a PROFIBUS PA segment at any time.

When calibrating an instrument that is part of a live segment (part of a control system), disconnect the instrument from the segment as instructed in chapter "Calibration Procedure of a Fieldbus Instrument, General" on page 4. Failure follow the instructions may result in unexpected behavior of the control system. The consequences may be serious damage, injuries or death!

Using MC5 and FI5 to change the parameters of an instrument may result in discrepancies: A fieldbus host control system may mirror all instrument parameters in its permanent database. In such a case, when returning an instrument with changed parameters to a live segment, ensure that the parameters are also available in the control system's permanent database. Also verify that the new parameters do not result in an unstable control loop.

MC5, FI5 and PROFIBUS PA

Beamex's MC5 and FI5 together are the master of a PROFIBUS PA fieldbus segment. Since a PROFIBUS PA segment supports only one master per segment, MC5 and FI5 cannot be connected to a fieldbus segment that already has a master device. Thus doing a verifying calibrating for a PROFIBUS PA instrument requires that the instrument is disconnected from a control system (live fieldbus segment).

Calibration Procedure of a Fieldbus Instrument, General

This chapter presents the broad outline of a calibration procedure when calibrating a PROFIBUS PA instrument using MC5 and FI5. The focus is on presenting requirements unique for PROFIBUS PA. Being aware of the details presented here allows you to perform a safe and fluent calibration procedure.

A more detailed description of connecting MC5 and FI5 to a PROFIBUS PA as well as performing the actual calibration is presented further on in this manual.

1. Preparing for the Calibration Procedure

If the instrument to be calibrated is part of a fieldbus segment already having a master device, you must disconnect the instrument. The following list presents a safe disconnecting procedure.

- If the instrument is part of a control system (live segment), make sure the control loop the instrument belongs to is set to manual
- Set the instrument's Transducer Block in Out of Service (**OOS**) mode (if applicable). This informs the control system that the instrument's input signal is not available (usable). Note that certain instruments do not have an Out of Service (**OOS**) mode at all. Then this phase is not applicable for that particular instrument.
- Make sure any other dependencies are set to manual or other corresponding state.
- If the Control System requires it, set the instrument as a "**Spare Device**" in the control system ("**Off Line**" in some systems).

See chapter **Notes and Warnings** on page 3 for possible risks when working in a live segment.

2. Verifying Calibration, As Found

Connect the instrument to MC5/FI5 using one of the method presented in chapter **Connecting to a PROFIBUS PA Instrument**, starting from page 9. Perform the Verifying Calibration using MC5/FI5 for PROFIBUS PA as presented in chapters further on. Verifying Calibration of fieldbus instruments is basically done as the calibration of analog and HART® instruments. The minor differences that exist are due to the instrument's fully digital output.

3. Calibration (Trimming, Adjusting)

Calibrate (Trim, Adjust) the fieldbus instrument using MC5/FI5 as presented in chapters further on.

> *Note.*
> *MC5 and FI5 affect only the instrument's Transducer Block. It is there the instrument's calibration parameters are located.*

4. Verifying Calibration, As Left

Again, perform the Verifying Calibration using MC5/FI5 as presented in chapters further on.

5. Returning the Instrument to a Live Fieldbus Segment

Returning an instrument to a live fieldbus segment requires opposite tasks than those done in step 1.

Again, see chapter **Notes and Warnings** on page 3 for possible problems when returning instruments to a live segment.

Device Descriptions

Each fieldbus instrument type is unique in what kind of parameters it has in its memory. A few common parameters are similar in all devices, but to fully communicate with a fieldbus instrument, you need to have a device description file that defines all the parameters in the instrument.

Device description files are done by the instrument manufacturers and made available via manufacturer's and certain fieldbus sites.

MC5 accesses only the instrument's Transducer Block. Therefore Beamex publishes special device descriptions for MC5 and the instruments connected to it. Please contact Beamex if you need device descriptions for new instruments. For contact info, see the first pages of this manual.

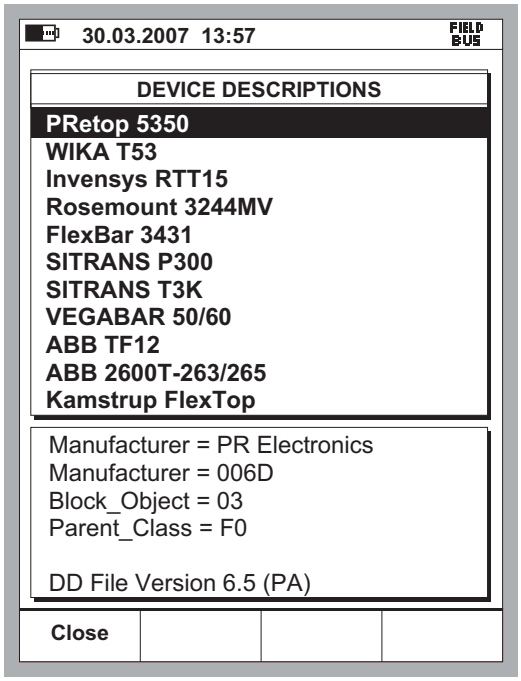
The following chapters describe how available device descriptions can be viewed in MC5 and also how to add new device descriptions to MC5.

Viewing Device Descriptions in MC5

To view device descriptions saved in MC5's memory, press:
D/Menu
C/Others and
4/Device Description Information.

Each row in the list is a device description.

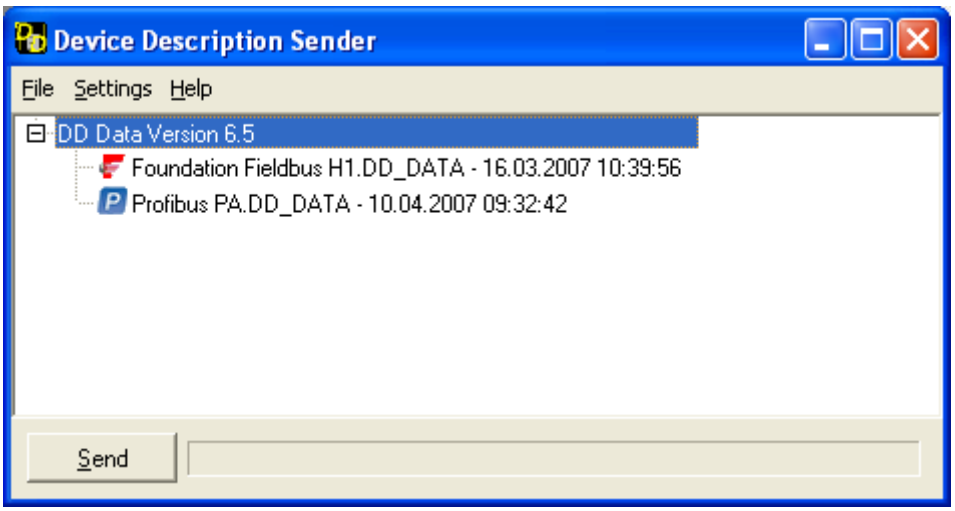
The lower window displays detailed data for the highlighted device and the version number of the Device Description File in MC5.



If the same device name is shown twice in the list, there is some difference in the **Device Type**, **Device Revision** and/or **DD Revision** detail data.

Device Description Sender

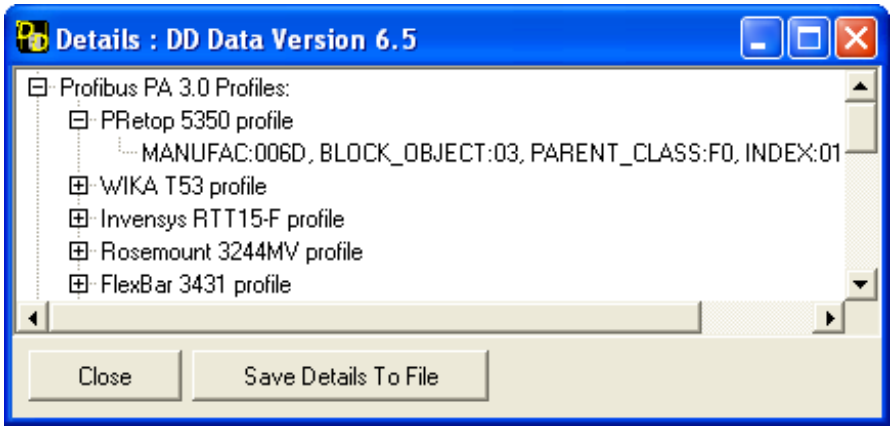
Beamex offers a tool for sending device descriptions to MC5.



Running the Device Description Sender software opens a window with a list of device description data it contains.

Hint.
If the highlight is as shown in the picture above, both FOUNDATION Fieldbus and PROFIBUS PA device descriptions are sent to MC5. If you, e.g. have PROFIBUS PA instruments only, highlight corresponding row and send only PROFIBUS PA instrument device descriptions to MC5.

Click the secondary mouse button to view details of the selected set of device data (the secondary mouse button is the rightmost button, if you use the mouse with your right hand).
Details window:



Please contact Beamex if you need Device Descriptions for new instruments. For contact info, see the first pages of this manual.

Fieldbus Instruments and Beamex's Calibration Database Software

CMX Calibration Management Software V2, revision 2.1 and later support fieldbus instruments.

Older calibration software (QM6, QD3 etc.) do not support fieldbus instruments.

Connecting to a PROFIBUS PA Instrument

The following subchapters present different connection methods.

In order for MC5/FI5 to be able to communicate with a PROFIBUS PA instrument, the instrument may not be controlled by any other PROFIBUS master than MC5/FI5. When connecting a PROFIBUS PA instrument to MC5/FI5, MC5/FI5 is the fieldbus master.

For advice on how to remove an instrument from a live segment, see chapter **Calibration Procedure of a Fieldbus Instrument, General** on page 4. For further information, please refer to your fieldbus control system manuals as well as the instrument's manual.

Chapter **Notes and Warnings** on page 3 contains information of things to be aware of when working with live segments.

Notes.

There are no polarity requirements when connecting FI5 to a fieldbus.

FI5 takes the power supply from the fieldbus, not via the FI5/MC5 serial communication cable.

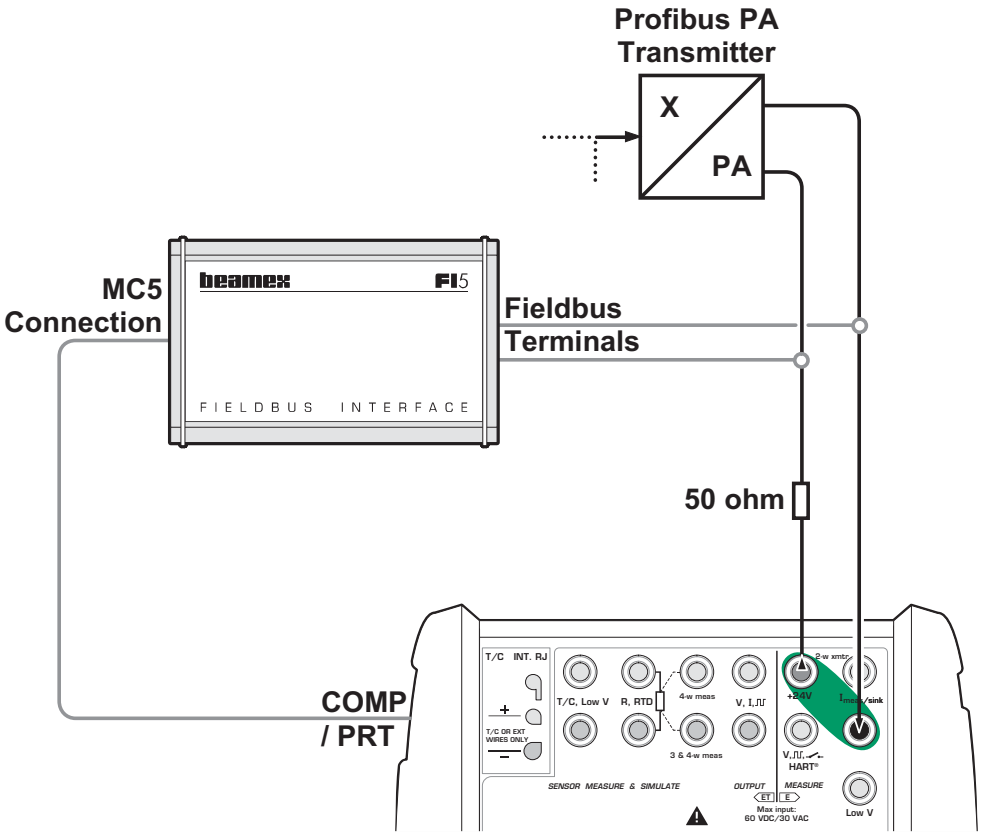
The current consumption of FI5 is between 15 to 20 mA. The current consumption of fieldbus instruments are typically between 10 to 20 mA each.

None of the methods presented do require that the connections are done using a fieldbus compliant cable. A pair of standard measurement cables can be used. However, when using longer connecting cables there may be need for fieldbus terminators.

Method 1: Supply from the Calibrator

In this method, MC5 supplies the power for the fieldbus "stub".

The following picture presents the connections when you want MC5 to provide the power supply without measuring the current consumption:



MC5 provides the power supply and receives fieldbus data via FI5 Fieldbus Interface. Depending on the instrument's input signal, it is either generated/simulated or measured with MC5 (not included in the picture).

MC5's power supply is always available provided the E module is not assigned for other duties in either Basic Mode window.

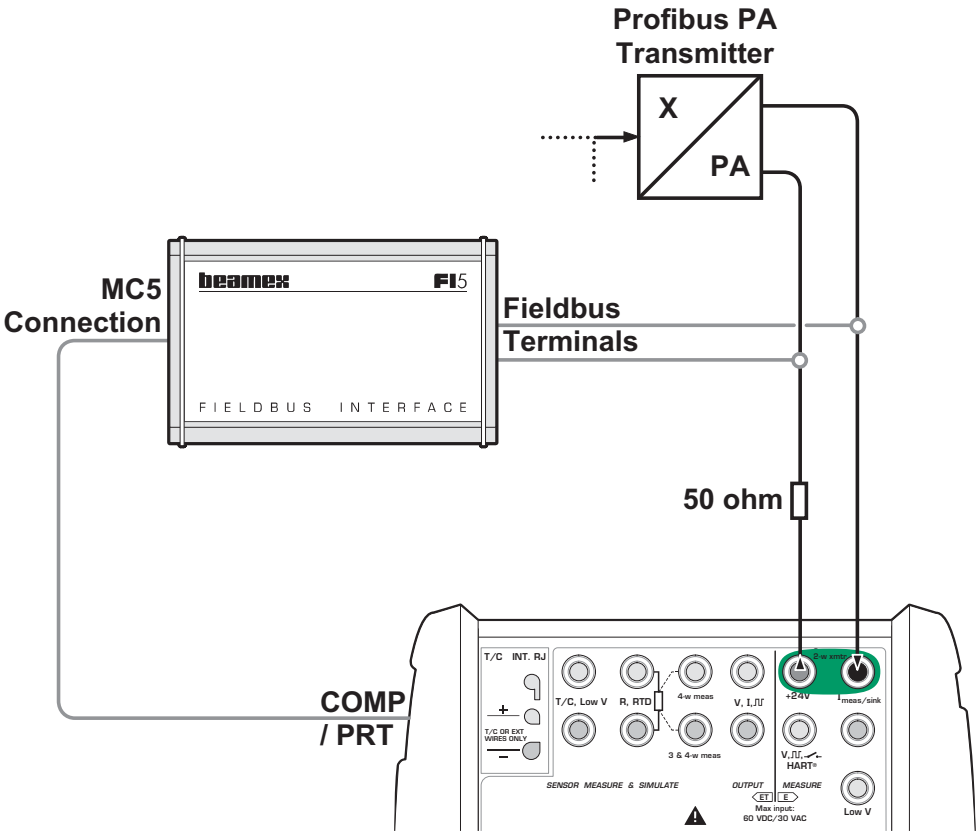
Notes.

Ensure that the loop also includes a resistor with a resistance of approx. 50 ohms between MC5 and the network. See also notes on page 9.

To be able to use this method, MC5 needs to be fieldbus compatible, i.e. able to source current both for FI5 and the fieldbus instrument(s). See notes on page 9 for current consumption specifications.
Max. load for a fieldbus compatible MC5 is approx. 40 mA.
Max. load for a non-fieldbus compatible MC5 is 25 mA.

If you have a non-fieldbus compatible MC5, please contact Beamex to have it serviced to be fieldbus compatible. Beamex's contact info is in the beginning of this manual. Meanwhile, use the method presented on next page.

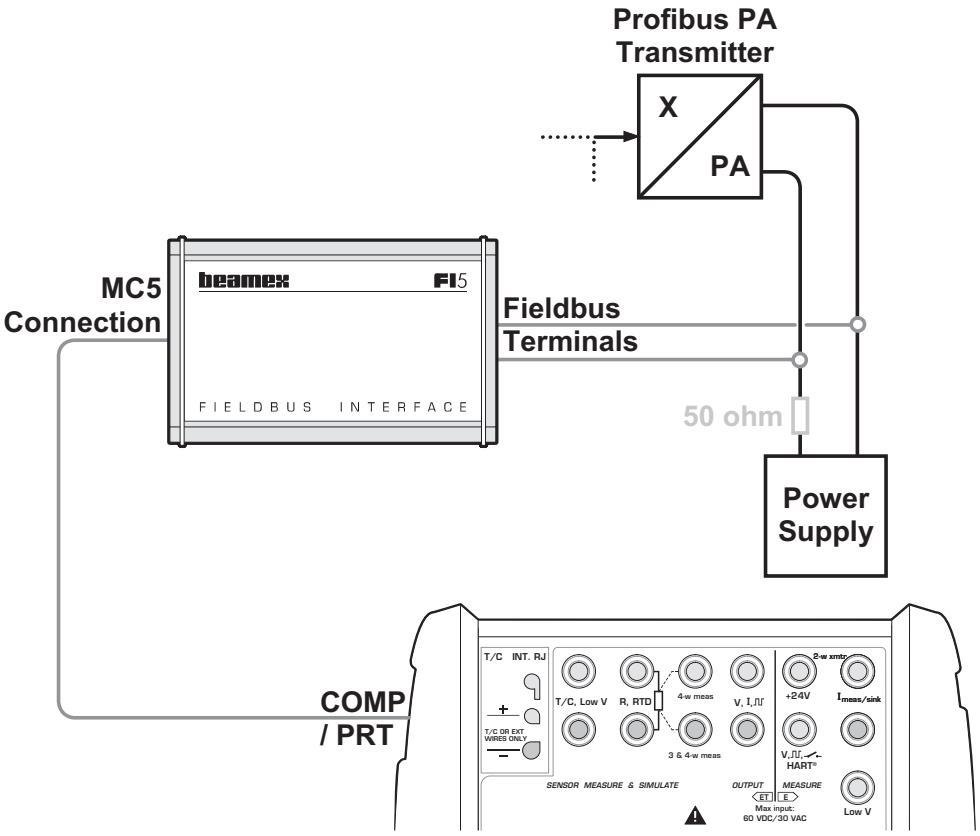
If you want to monitor the current consumption of the fieldbus "stub" and FI5, configure one of MC5's windows to source current (Quantity "**Current**" and Function/Port "**E: I(meas)**"). Then do the connections as shown in the picture below.



Method 2: External Supply

In this method a separate power supply provides the loop power for the fieldbus "stub".

The following picture presents the connections:



MC5 receives fieldbus data via FI5 Fieldbus Interface. Depending on the instrument's input signal, it is either generated/simulated or measured with MC5 (not included in the picture).

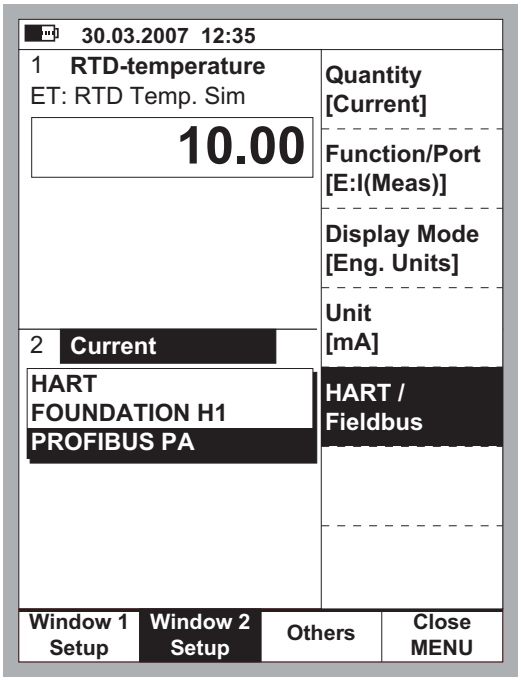
Note.
When using fieldbus compliant power supplies, no additional resistors are needed. With conventional power supplies, include an approx. 50 ohm resistor between the power supply and the network.

Fieldbus and MC5's Basic Mode

Connecting to a PROFIBUS PA Instrument

To initiate communication with a fieldbus instrument, press:
D/Menu,
B/Window 2 Setup, if needed and
5/HART / Fieldbus.

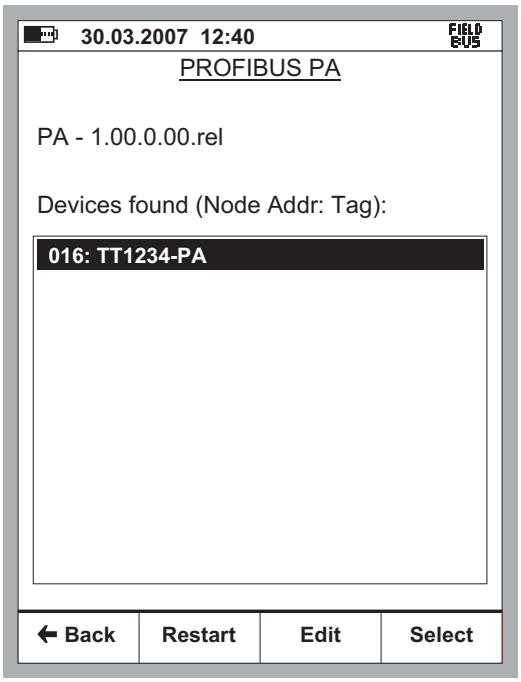
Select
PROFIBUS PA
from the pop-up list.



Notes.
The HART / Fieldbus menu options are disabled if the other window already has one of the available Fieldbus communications active. Change the setup of the other window to enable the HART / Fieldbus menu option.

Refer to chapter **Connecting to a PROFIBUS PA Instrument** on page 9 for information on how to connect MC5 and a fieldbus instrument.

MC5 searches for fieldbus devices connected to FI5 and opens a window similar to the one seen to the right.



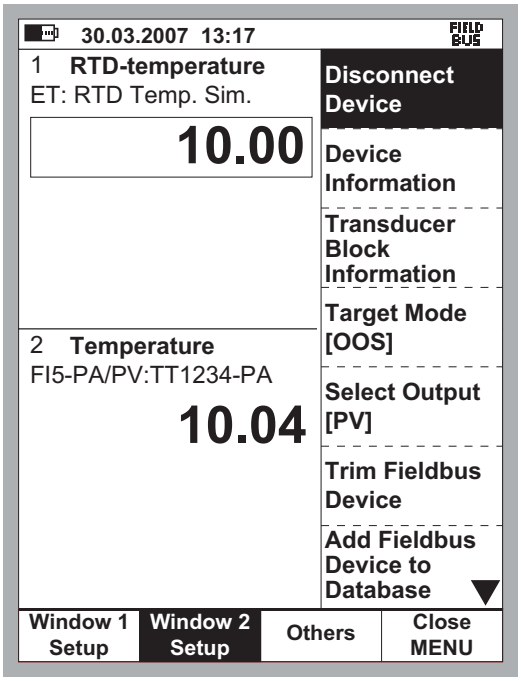
Use the ***C***/Edit button to edit the selected instrument's **Tag** and/or its **Node Address**.

Choose the instrument by pressing ***D***/Select (optionally either the ↵ or the ⑨ key).

Note.
If MC5 does not have required Device Descriptions, full communication cannot be initiated. In this case a window opens telling what kind of Device Description is needed. Contact Beamex to receive instructions on how to correct the problem.

After required instrument data is read, MC5 returns to Basic Mode with the fieldbus instrument assigned to the chosen window. The measurement quantity of the window where the fieldbus instrument was selected to is automatically changed to the quantity of the fieldbus instrument's primary value.

The standard Window Setup menu is replaced by a fieldbus menu (see adjacent picture).



Fieldbus Window Setup Menu

A window reserved for fieldbus communication has its own menu. All menu items are presented in the following subchapters.

Disconnect Device

This option disconnects the fieldbus instrument from MC5/FI5.

To disconnect, select
D/Menu and
B/Window 2 Setup, if needed
1/Disconnect Device.

The fieldbus communication is terminated and the fieldbus menu is replaced by the standard Window Setup menu.

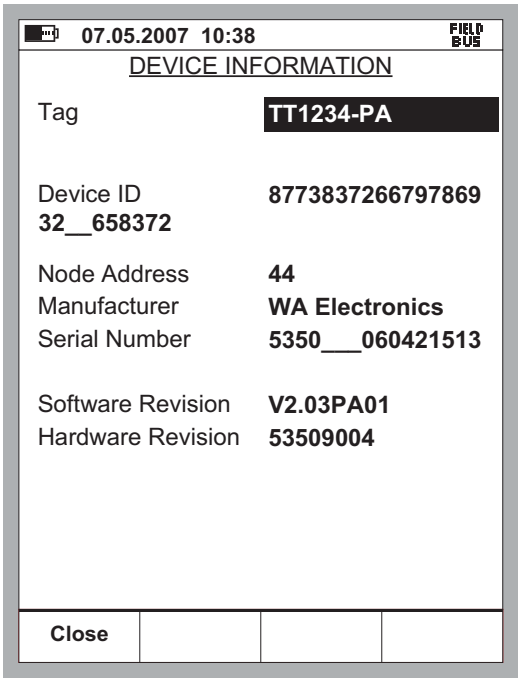
Device Information

To open the Device Information window, press

D/Menu and
B/Window 2 Setup, if needed
2/Device Information.

This window contains read-only information of the connected instrument.

Note that the **Tag** and **Node Address** fields cannot be edited here. It is done while connecting to the instrument using the ***C***/Edit Function Key.

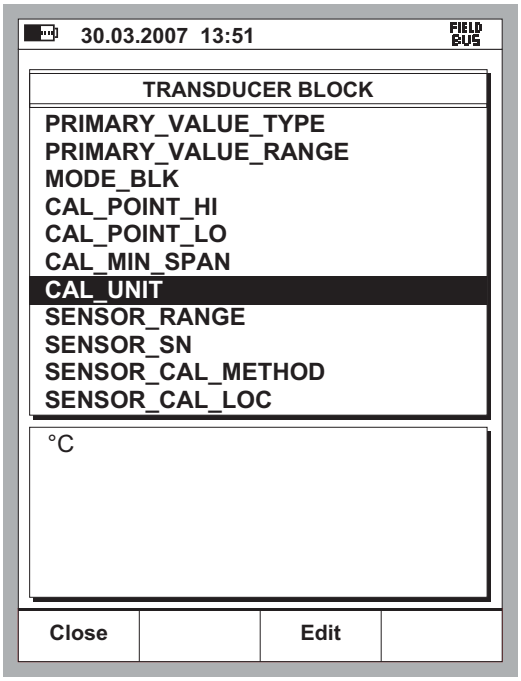


Transducer Block Information

To open the Transducer Block Information window, press

D/Menu and
B/Window 2 Setup, if needed
3/Transducer Block Information.

The contents of this window depend on the connected instrument. This is because Transducer Block parameters vary from instrument to instrument.



Normally you do not need to edit any of the parameters shown here. The most likely one in need of editing is the unit. If MC5 supports the unit, it is shown as in the example picture above. If MC5 does not support the unit, a numeric value is shown instead of the unit.

Notes.

To quickly browse through the list of parameters use MC5's ⑧ and ⓪ keys.

When editing a unit field, MC5 displays the numeric code for the unit (the code is as defined in fieldbus specifications). Please refer to ***Appendix 1, Codes in Profibus PA Profile Version 3.0*** *on page 28,* ***Appendix 2, Codes in Profibus PA Profile Version 2.0*** *on page 33, or the instrument's manual to see which numeric code corresponds to which unit.*

Several other Transducer Block parameters are also edited using a numeric code.

Target Mode

Target Mode is an important Transducer Block parameter while calibrating instruments. That's why it is directly available via MC5's menu.

Use this to set the instrument in either **OOS - Out Of Service** or **Auto - Automatic** mode.

See also chapter **Notes and Warnings** on page 3

Select Output

Select Output is another important Transducer Block parameter directly available via MC5's menu. The available options vary depending on the instrument at hand.

Some instruments require that another output is selected when trimming/adjusting the instrument. That is why the selection of output is made easily available.

Trim Fieldbus Device

This option allows you to trim/adjust a fieldbus instrument without performing a Verifying Calibration.

When selected, you first need to enter instrument data as presented in MC5 User Guide's Section D (Chapter **Maintaining MC5's Instrument database**).

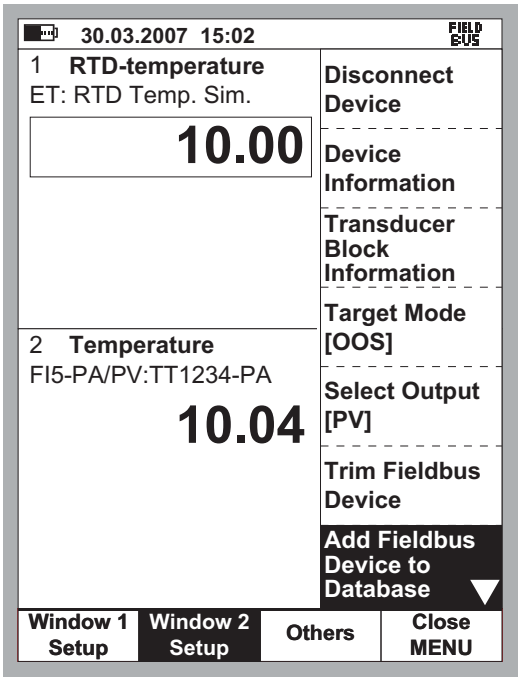
The rest of the trimming/adjustment procedure is done as presented in chapter **Calibrating (Trimming, Adjusting) a Fieldbus Instrument** on page **24** of this manual.

Add a Fieldbus Device to Database

This is a semi-automatic tool for adding a fieldbus instrument to MC5's instrument database. To start adding, press

D/Menu and
B/Window 2 Setup, if needed
7/Add Fieldbus Device to Database.

The instrument is added and MC5 places some default values for calibration related fields that are missing in the instrument's memory.

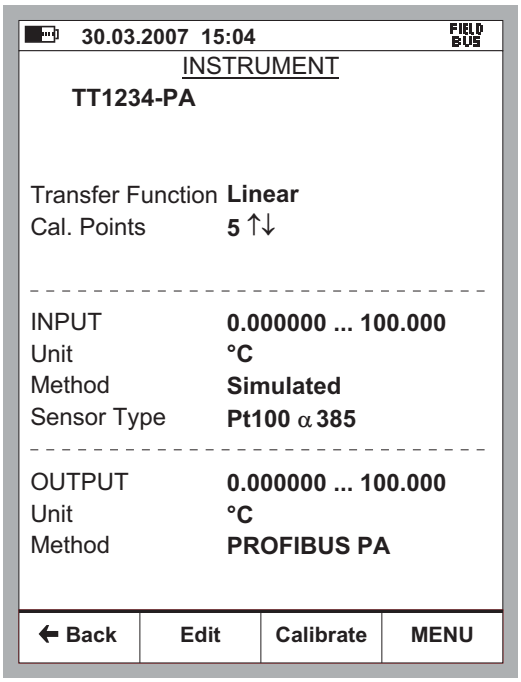


Note.
MC5 supports Tags and Device IDs that have max. 25 characters. Longer Tags and Device IDs are truncated.

The following table presents which Physical Block parameter in a PROFIBUS PA instrument gets linked to which field in MC5 when adding a fieldbus instrument to MC5:

PROFIBUS PA Instrument Parameters	Corresponding Fields in MC5
TAG_DESC	Position ID
DEVICE_ID	Device ID
DEVICE_SER_NUM	Serial Number

When the instrument is added to MC5, a display like the adjacent picture opens.



To edit the default values, press ***B***/Edit. Edit/check at least the following fields:

- **Error Calculation Method**
- **Reject if >**
- **Input Port**
- **Input Range**
- **Input Unit**
- **Output Range**
- **Output Unit**
- **Calibration Method**
- **Calibration Points**

For more information MC5's instrument database, see section D in your MC5 User Guide.

The **Output Method** for a PROFIBUS PA fieldbus instrument is always "**PROFIBUS PA**".

Notes.

MC5 sets its own internal default values to the input and output ranges. Check/edit them in order to create valid Verifying Calibrations.

When adding a fieldbus instrument to MC5, the measurement unit is fetched from the fieldbus instrument. If MC5 does not support the unit, you need to change it to a unit supported by MC5. Verifying Calibration and Trimming is not possible when a unit not supported by MC5 is in use in the fieldbus instrument. See ***Appendix 1, Codes in Profibus PA Profile Version 3.0*** *on page 28 or* ***Appendix 2, Codes in Profibus PA Profile Version 2.0*** *on page 33, for lists of supported units.*

For information on how to change the instrument's unit, see chapter ***Transducer Block Information*** *on page 16.*

Unit

To change the unit used in MC5's display, press

D/Menu,
B/Window 2 Setup, if needed
8 (opens the second page of the menu) and
4/Display Unit.

Notes.

In Basic Mode, the unit used in MC5's display need not be the same as in the instrument itself. Fieldbus instruments use numeric codes for the units they support. When connecting to an instrument, MC5 gets the unit from the instrument. If the unit is not supported in MC5, the unit's numeric code is shown and the Quantity is set to "None". Verifying Calibration and Trimming is not possible when a unit not supported by MC5 is in use in the fieldbus instrument. See ***Appendix 1, Codes in Profibus PA Profile Version 3.0*** *on page 28 or* ***Appendix 2, Codes in Profibus PA Profile Version 2.0*** *on page 33, for lists of supported units.*

This setting does not alter the unit used in the instrument. For information on how to change the instrument's unit, see chapter ***Transducer Block Information*** *on page 16.*

Performing a Verifying Calibration

Selecting the Instrument

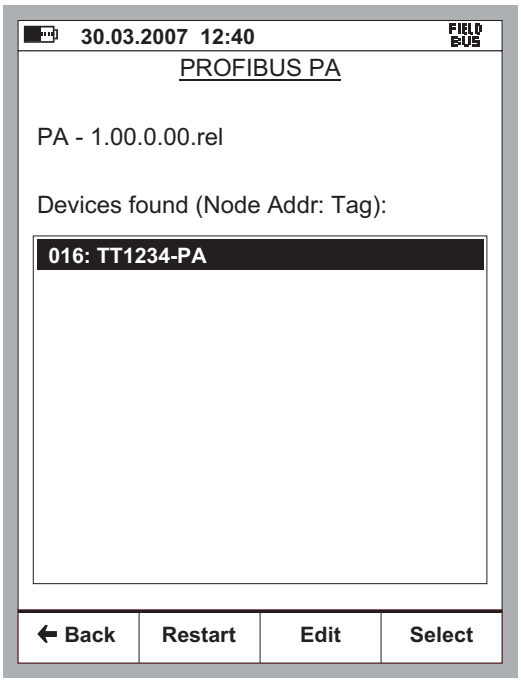
To be able to calibrate a fieldbus instrument, it has to be added to MC5's instrument database.

Adding the instruments can be done using the utility described in chapter **Add a Fieldbus Device to Database** on page 18. Additionally, you can also manually enter the instrument data into MC5's instrument database.

From **Basic Mode**, go to **Calibration Mode** (***A***/Calibration Mode). Then select the instrument to be calibrated from MC5's list of available instruments.

If you are already connected to the fieldbus instrument (fieldbus communication started in Basic Mode), MC5 continues directly from the Instrument Window to the Calibration Windows.

If fieldbus communication is not started, MC5 prompts you to start the communication and select the instrument in a window similar to the adjacent picture.

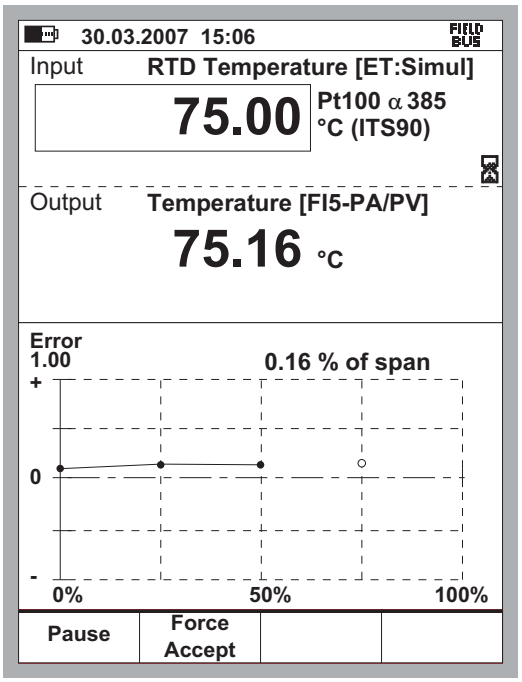


MC5 accepts the fieldbus instrument as the instrument to be calibrated only if its instrument data matches with the data of the instrument selected in MC5.

Note.
The instrument data in MC5 and in the instrument to be connected need to match.

Doing the Verifying Calibration

Doing a Verifying Calibration for a fieldbus instrument does not differ from the calibration of a non-fieldbus instrument with similar input quantity, input method and output quantity. Refer to the examples in MC5 User Guide's Part D.



Note.

When adding a fieldbus instrument to MC5, the measurement unit is fetched from the fieldbus instrument. If MC5 does not support the unit, you need to change it to a unit supported by MC5. Verifying Calibration and Trimming is not possible when a unit not supported by MC5 is in use in the fieldbus instrument. See ***Appendix 1, Codes in Profibus PA Profile Version 3.0*** *on page 28 or* ***Appendix 2, Codes in Profibus PA Profile Version 2.0*** *on page 33, for lists of supported units.*

For information on how to change the instrument's unit, see chapter ***Transducer Block Information*** *on page 16.*

Calibrating (Trimming, Adjusting) a Fieldbus Instrument

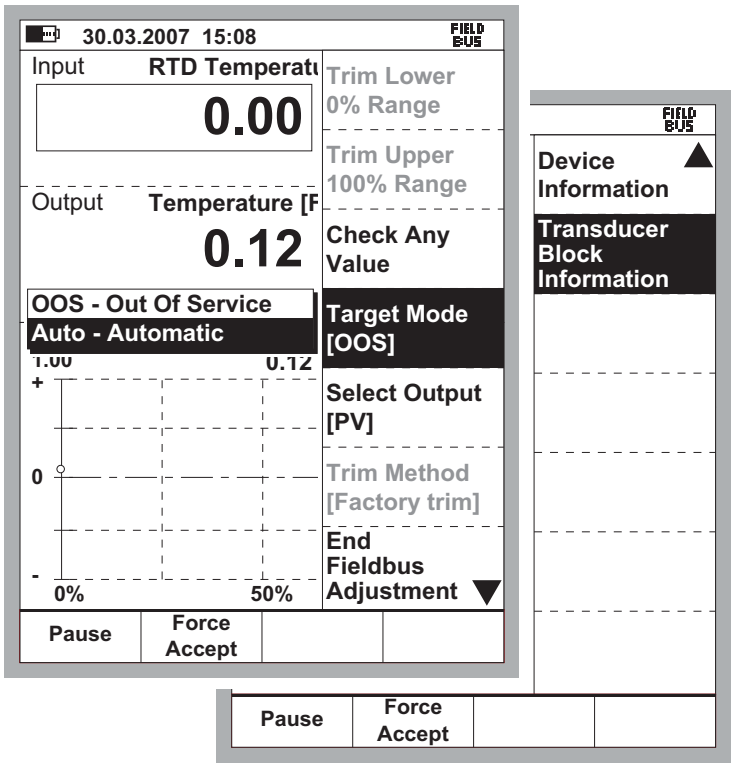
To start Calibrating (Trimming, Adjusting) a Fieldbus Instrument in Calibration Mode, press

D/Menu and

1/Start Fieldbus Adjustment

while viewing the calibration windows.

The opened menu has two pages as shown in the adjacent picture.



The actual Calibrating (Trimming, Adjusting) procedure varies depending on the instrument at hand.
Please refer to your fieldbus instrument's manual for device specific information.

The following list present the most common steps together with some hints on what to additional steps may be included:

1. Certain fieldbus instruments require that the mode of the Transducer Block is set to Out of Service Mode before any Calibration (Trimming, Adjustment) is allowed.
   Use the Fieldbus Instrument Adjustment menu's ***4***/Target Mode option to set the mode.
   Also check the note at the end of this chapter.

2. If some of the options in the Fieldbus Instrument Adjustment menu's items are greyed (refer to the picture on the previous page), the selected output for that particular instrument cannot be trimmed. Change the output using menu option ***5***/Select Output.
3. When enabled, check the Trim Method option in the Fieldbus Instrument Adjustment menu. It should be as stated in the instrument's manual (Transducer Block parameter **SENSOR_CAL_METHOD**).
4. Some instruments have extra parameters that need to be set before Trimming can be performed, e.g **CAL_UNIT** and **TRIM_MODE**.
   For these parameters, use the Transducer Block Information option on the second page of the Fieldbus Instrument Adjustment menu to see/edit all Transducer Block parameters. When the menu is opened, press ***8*** to see the second menu. Then select ***2***/Transducer Block Information.
5. To perform the actual trimming procedure, do as follows:
   Select the ***1***/Trim Lower 0% Range option from the Fieldbus Instrument Adjustment menu.
   - If the input signal is generated/simulated with MC5, the input signal is automatically set to span zero value.
   - For instruments where MC5 measures the input and another device generates/simulates the instrument's input, set the input to span zero value.

   In both cases, MC5's Input window displays the instrument's input signal. The Output window displays the digital output of the instrument.
6. The lower part of the Output window includes an additional trim field. Use either the ***C***/Fetch Function Key to copy the value shown in the input window or manually enter a value the digital output should be trimmed to. Then use the ***D***/Send Function Key to trim the zero point.
   The corrected value is sent to Transducer Block parameter, **CAL_POINT_LO** (or similar, depending on the instrument at hand).

7. Then select the ***2***/Trim Upper 100% Range option from the Fieldbus Instrument Adjustment menu. Otherwise, the trimming procedure is similar to phases 5 and 6.
   In this case, the corrected value is sent to Transducer Block parameter, **CAL_POINT_HI** (or similar, depending on the instrument at hand).
   Note.
   You may also check the trim of any point by using the menu's ***3****/Check Any Value option.*
8. Setting the calibration date in the fieldbus is done by editing the following (or corresponding) Transducer Block parameters:
   SENSOR_CAL_DATA
   SENSOR_CAL_WHO
   SENSOR_CAL_LOC
   To edit these parameters, use the Transducer Block Information option on the second page of the Fieldbus Instrument Adjustment menu to see/edit all Transducer Block parameters. When the menu is opened, press ***8*** to see the second menu. Then select ***2***/Transducer Block Information.
9. To end the trimming procedure, reset all the fields that were modified while enabling Calibration (Trimming, Adjusting), e.g. ***4***/Target Mode, ***6***/Trim Method etc.

Note.

*The PV output value of some PROFIBUS PA instruments "freeze" when the mode of the Transducer Block is set to "**OOS**". The instrument's input signal is however still received and you may trim the instrument anyhow. When the Transducer block is set to "**Auto**" again, the new trim values are automatically taken into use and the output is "alive" again.*

Fieldbus Communication Settings

You may view/edit fieldbus settings in Basic Mode by pressing:

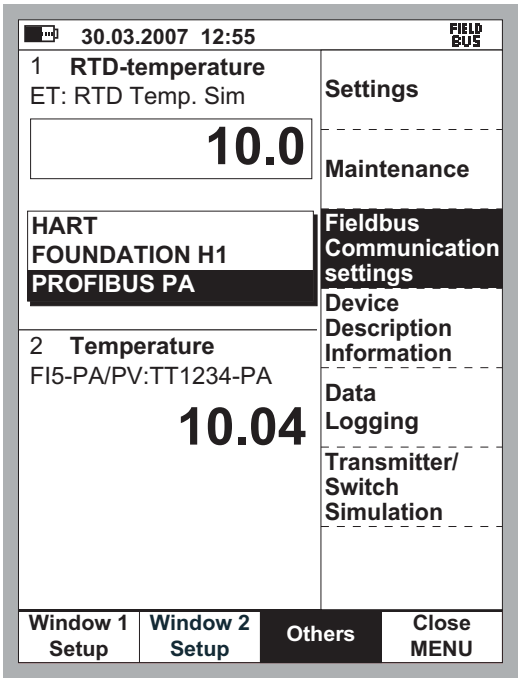
D/Menu,
C/Others,
3/Fieldbus Communication Settings.

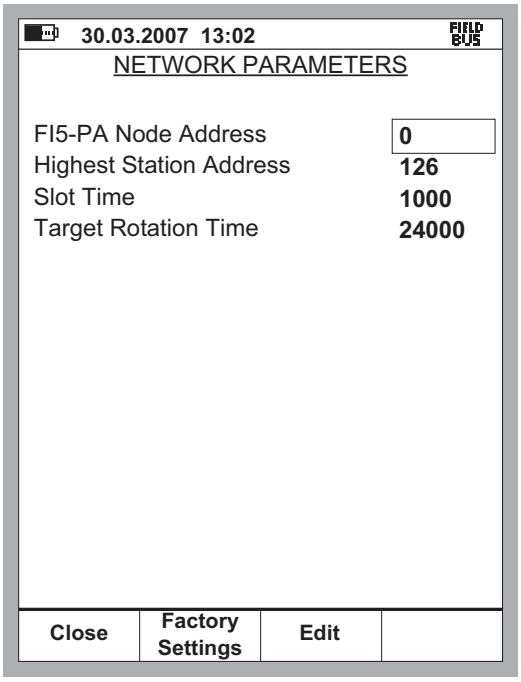
Select PROFIBUS PA from the pop-up list.

A window opens where the communication settings are presented (see picture below).

Normally you do not need to chance the default settings (seen in the adjacent picture).

Consult your fieldbus instruments' manual when you plan to change the communication settings. Otherwise you may lose connection with it.





Appendix 1, Codes in Profibus PA Profile Version 3.0

Note.
Certain instruments may not support all codes listed here. When in doubt, please consult the instrument's manual.

Temperature Units

Unit Code in Fieldbus Instruments	Displayed Unit in Fieldbus Instruments	Displayed Unit in MC5
1000	K	K
1001	°C	°C
1002	°F	°F
1003	°R	°R

Frequency Units

Unit Code in Fieldbus Instruments	Displayed Unit in Fieldbus Instruments	Displayed Unit in MC5
1077	Hz	Hz
1081	kHz	kHz
1083	cpm	cpm

Pressure Units

Unit Code in Fieldbus Instruments	Displayed Unit in Fieldbus Instruments	Displayed Unit in MC5
1130	Pa	Pa
1132	MPa	MPa
1133	kPa	kPa
1136	hPa	hPa
1137	bar	bar
1138	mbar	mbar
1139	torr	torr
1140	atm	atm
1141	psi	psi
1142	psia	psia
1143	psig	psig
1144	gf/cm^2	gf/cm^2
1145	kgf/cm^2	kgf/cm^2
1146	inH_2O	inH_2O
1147	$inH_2O(4°C)$	inH_2O @ 4°C
1148	$inH_2O(68°F)$	inH_2O @ 68°F

Cont…

Pressure units, continued

Unit Code in Fieldbus Instruments	Displayed Unit in Fieldbus Instruments	Displayed Unit in MC5
1149	mmH2O	mmH_2O
1150	mmH2O(4°C)	mmH2O @ 4°C
1151	mmH2O(68°F)	mmH2O @ 68°F
1152	ftH2O	ftH2O
1153	ftH2O(4°C)	ftH2O @ 4°C
1154	ftH2O(68°C)	ftH2O @ 68°F
1155	inHg	inHg
1156	inHg(4°C)	inHg @ 4°C
1157	mmHg	mmHg
1158	mmHg(4°C)	mmHg @ 4°C

Electrical Units

Unit Code in Fieldbus Instruments	Displayed Unit in Fieldbus Instruments	Displayed Unit in MC5
1211	mA	mA
1212	µA	µA
1240	V	V
1243	mV	mV
1244	µV	µV
1281	ohm	Ω
1284	kohm	kΩ

Linearization Types (Variable LIN_TYPE)

Linearization Type, Code	Description
0	no linearisation (mandatory)
1	linearisation table (optional)
10	Square root (optional)
20	cylindrical lying container (optional)
21	spherical container (optional)
50	equal percentage 1:33 (optional)
51	equal percentage inverse (quick opening) 1:33 (optional)
52	equal percentage 1:50 (optional)
53	equal percentage inverse (quick opening) 1:50 (optional)
54	equal percentage 1:25 (optional)
55	equal percentage inverse (quick opening) 1:25 (optional)
100	RTD Pt10 a=0.003850 (IEC 751, DIN 43760, JIS C1604-97, BS1904)
101	RTD Pt50 a=0.003850 (IEC 751, DIN 43760, JIS C1604-97, BS1904)
102	RTD Pt100 a=0.003850 (IEC 751, DIN 43760, JIS C1604-97, BS1904)

Cont…

Linearization Types, continued

Linearization Type, Code	Description
103	RTD Pt200 a=0.003850 (IEC 751, DIN 43760, JIS C1604-97, BS1904)
104	RTD Pt500 a=0.003850 (IEC 751, DIN 43760, JIS C1604-97, BS1904)
105	RTD Pt1000 a=0.003850 (IEC 751, DIN 43760, JIS C1604-97, BS1904)
106	RTD Pt10 a=0.003916 (JIS C1604-81)
107	RTD Pt50 a=0.003916 (JIS C1604-81)
108	RTD Pt100 a=0.003916 (JIS C1604-81)
109	RTD Pt10 a=0.003920 (MIL-T-24388)
110	RTD Pt50 a=0.003920 (MIL-T-24388)
111	RTD Pt100 a=0.003920 (MIL-T-24388)
112	RTD Pt200 a=0.003920 (MIL-T-24388)
113	RTD Pt500 a=0.003920 (MIL-T-24388)
114	RTD Pt1000 a=0.003920 (MIL-T-24388)
115	RTD Pt100 a=0.003923 (SAMA RC21-4-1966)
116	RTD Pt200 a=0.003923 (SAMA RC21-4-1966)
117	RTD Pt100 a=0.003926 (IPTS-68)
118	RTD Ni50 a=0.006720 (Edison curve #7)
119	RTD Ni100 a=0.006720 (Edison curve #7)
120	RTD Ni120 a=0.006720 (Edison curve #7)
121	RTD Ni1000 a=0.006720 (Edison curve #7)
122	RTD Ni50 a= 0.006180 (DIN 43760)
123	RTD Ni100 a= 0.006180 (DIN 43760)
124	RTD Ni120 a= 0.006180 (DIN 43760)
125	RTD Ni1000 a= 0.006180 (DIN 43760)
126	RTD Cu10 a=0.004270
127	RTD Cu100 a=0.004270
128	TC Type B, Pt30Rh-Pt6Rh (IEC 584, NIST MN 175, DIN 43710,BS 4937, ANSI MC96.1, JIS C1602, NF C42-321)
129	TC Type C (W5), W5-W26Rh (ASTM E 988)
130	TC Type D (W3), W3-W25Rh (ASTM E 988)
131	TC Type E, Ni10Cr-Cu45Ni (IEC584, NIST MN 175, DIN 43710,BS 4937, ANSI MC96.1, JIS C1602, NF C42-321)
132	TC Type G (W), W-W26Rh (ASTM E 988)
133	TC Type J, Fe-Cu45Ni (IEC 584, NIST MN 175, DIN 43710,BS 4937, ANSI MC96.1, JIS C1602, NF C42-321)
134	TC Type K, Ni10Cr-Ni5 (IEC 584, NIST MN 175, DIN 43710,BS 4937, ANSI MC96.1, JIS C1602, NF C42-321)
135	TC Type N, Ni14CrSi-NiSi (IEC 584, NIST MN 175, DIN 43710,BS 4937, ANSI MC96.1, JIS C1602, NF C42-321)
136	TC Type R, Pt13Rh-Pt (IEC 584, NIST MN 175, DIN 43710,BS 4937, ANSI MC96.1, JIS C1602, NF C42-321)

Cont…

Linearization Types, continued

Linearization Type, Code	Description
137	TC Type S, Pt10Rh-Pt (IEC 584, NIST MN 175, DIN 43710,BS 4937, ANSI MC96.1, JIS C1602, NF C42-321)
138	TC Type T, Cu-Cu45Ni (IEC 584, NIST MN 175, DIN 43710,BS 4937, ANSI MC96.1, JIS C1602, NF C42-321)
139	TC Type L, Fe-CuNi (DIN 43710)
140	TC Type U, Cu-CuNi (DIN 43710)
141	TC Type Pt20/Pt40, Pt20Rh-Pt40Rh (ASTM E 1751)
142	TC Type Ir/Ir40, Ir-Ir40Rh (ASTM E 1751)
143	TC Platinel II
144	TC Ni/NiMo
145 - 239	reserved
240	Manufacturer specific
249	Manufacturer specific
250	Not used
251	None
252	Unknown
253	Special

Methods for Calculating the Primary Value, PV (Variable SENSOR_MEAS_TYPE)

PV Calculation, Code	Description
0	PV = SV_1
1	PV = SV_2
128	PV = SV_1 - SV_2 Difference
129	PV = SV_2 - SV_1 Difference
192	PV = ½ * (SV_1 + SV_2) Average
193	PV = ½ * (SV_1 + SV_2) Average but SV_1 or SV_2 if the other is wrong
194-219	reserved
220-239	manufacturer specific

Lead Breakage and Short Circuit Detection (Variable SENSOR_WIRE_CHECK_1(2))

Sensor Wire Check, Code	Description
0	Lead breakage and short circuit detection enabled
1	Lead breakage detection enabled, short circuit detection disabled
2	Lead breakage detection disabled, short circuit detection enabled
3	Lead breakage and short circuit detection disabled

Reference Junction Type (Variable RJ_TYPE)

Reference Junction Type, Code	Description
0	No reference: Compensation is not used (e.g. for TC Type B).
1	Internal: Reference junction temperature is measured by the device itself via an internal or external mounted sensor.
2	External: The fixed value EXTERNAL_RJ_VALUE is used for compensation. The reference junction must be kept at a constant temperature (e.g. by a reference junction thermostat).

Connection to the sensor (Variable SENSOR_CONNECTION)

Sensor Connection, Code	Description
0	2 wires
1	3 wires
2	4 wires

Appendix 2, Codes in Profibus PA Profile Version 2.0

Note.
Certain instruments may not support all codes listed here. When in doubt, please consult the instrument's manual.

Temperature Units

Unit Code in Fieldbus Instruments	Displayed Unit in Fieldbus Instruments	Displayed Unit in MC5
32	°C	°C
33	°F	°F
34	°R	°R
35	K	K

Frequency Units

Unit Code in Fieldbus Instruments	Displayed Unit in Fieldbus Instruments	Displayed Unit in MC5
38	Hz	Hz

Pressure Units

Unit Code in Fieldbus Instruments	Displayed Unit in Fieldbus Instruments	Displayed Unit in MC5
1	inH_2O	inH_2O
2	InHg	inHg
3	ftH_2O	ftH_2O
4	mmH_2O	mmH_2O
5	mmHg	mmHg
6	psi	psi
7	bar	bar
8	mbar	mbar
9	gf/cm^2	gf/cm^2
10	kgf/cm^2	kgf/cm^2
11	Pa	Pa
12	kPa	kPa
13	torr	torr
14	atm	atm
237	MPa	MPa
238	$inH_2O(4°C)$	inH_2O @ 4°C
239	$mmH_2O(4°C)$	mmH_2O @ 4°C

Electrical Units

Unit Code in Fieldbus Instruments	Displayed Unit in Fieldbus Instruments	Displayed Unit in MC5
36	mV	mV
37	Ohm	Ω
39	mA	mA
58	V	V
163	kOhm	kΩ

Unit Used in Calibration (Variable CAL_UNIT)

Calibration Unit, Code	Description
1	inH2O @ 68 °F
2	inHg @ 0 °C
3	ftH2O @ 68 °F
4	mmH2O @ 68 °F
5	mmHg @ 0 °C
6	psi
7	bar
8	mbar
9	g/cm2
10	kg/cm2
11	pascals
12	Kilopascals
13	torr
14	atm

Notes

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