Communication Module M 700® FF 700(X)

Communication Unit for FOUNDATION FIELDBUS™

Fieldbus Foundation

METTLER TOLEDO

71963

Warranty

Defects occurring within 1 year from delivery date shall be remedied free of charge at our plant (carriage and insurance paid by sender). Sensors, fittings, and accessories: 1 year.

Return of products under warranty

Please contact our Service Team before returning a defective device. Ship the cleaned device to the address you have been given. If the device has been in contact with process fluids, it must be decontaminated/disinfected before shipment. In that case, please attach a corresponding certificate, for the health and safety of our service personnel.

Disposal

Please observe the applicable local or national regulations concerning the disposal of "waste electrical and electronic equipment".

Trademarks

The following registered trademarks are used in this instruction manual without further marking

SMARTMEDIA®
is a registered trademark of Toshiba Corp., Japan

FOUNDATION FIELDBUS™
is a trademark of Fieldbus Foundation, Austin, USA

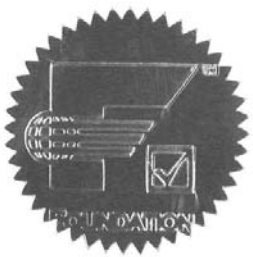
Mettler-Toledo AG,
Process Analytics, Industrie Nord, CH-8902 Urdorf,
Tel. +41 (44) 729 62 11 Fax +41 (44) 729 26 36
Subject to technical changes.

CE

FOUNDATION

FIELDBUS FOUNDATION
DEVICE REGISTRATION

Presented To:	Mettler Toledo GmbH, Process Analytics
Model:	M700 FF700
Device Type:	Measuring System for Liquid Analysis
ITK_Ver:	4.61
IT Campaign Number:	IT039100
Registration Date:	7/19/2006
DD Revision:	0x01
CFF Revision:	010101.cff



The above device has successfully completed rigorous testing by the Fieldbus Foundation and has received registration and the right to use the checkmark logo as specified by MT-045.

Heather Santos
Product Support Specialist

Richard J. Timoney
President

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Intended Use

The module is a communication unit for Foundation Fieldbus and allows digital communication via current modulation.

The FF 700 X module is intended for operation in locations subject to explosion hazards which require equipment of Group II, device category 2(1), gas/dust.

Conformity with FDA 21 CFR Part 11

In their directive "Title 21 Code of Federal Regulations, 21 CFR Part 11, Electronic Records; Electronic Signatures" the US American health agency FDA (Food and Drug Administration) regulates the production and processing of electronic documents for pharmaceutical development and production. This results in requirements for measuring devices used for corresponding applications. The following features ensure that the M 700(X) modular process analysis system meets the demands of FDA 21 CFR Part 11:

Electronic Signature
Access to the device functions is regulated and limited by individually adjustable codes – "Passcodes". This prevents unauthorized modification of device settings or manipulation of the measurement results. Appropriate use of these passcodes makes them suitable as electronic signature.

Audit Trail Log
Every change of device settings can be automatically recorded and documented in the Audit Trail Log on the SmartMedia card. The recording can be encrypted.

Safety Information

Application in Hazardous Locations

Caution!
Never try to open the module! If a repair should be required, return the module to our factory.

If the specifications in the instruction manual are not sufficient for assessing the safety of operation, please contact the manufacturer to make sure that your intended application is possible and safe.

Be sure to observe during installation:
- Switch off power supply before replacing or inserting a module.
- Before commissioning it must be proved that the device may be connected with other equipment.

Application in Hazardous Locations:
FF 700 X Module
When using the FF 700 X module, the stipulations for electrical installations in hazardous areas (EN 60079-14) must be observed. When installing the device outside the range of applicability of the 94/9/EC directive, the appropriate standards and regulations in the country of use must be observed. The module has been developed and manufactured in compliance with the applicable European guidelines and standards.

Compliance with the European Harmonized Standards for use in hazardous locations is confirmed by the EC-Type-Examination Certificate. Compliance with the European guidelines and standards is confirmed by the EC Declaration of Conformity.

There is no particular direct hazard caused by the operation of the device in the specified environment.

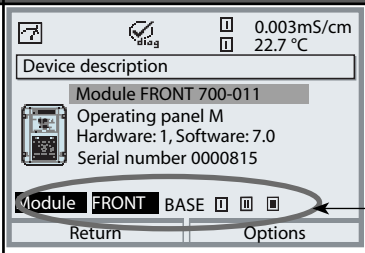
Software Version

FF 700(X) Module

Device Software M 700(X)
The FF 700(X) module is supported by software version 7.0 or higher.

Module Software FF 700(X)
Software version 1.0 18.09.2006

Query actual device/module software
When the analyzer is in measuring mode:
Press **menu** key, open Diagnostics menu.

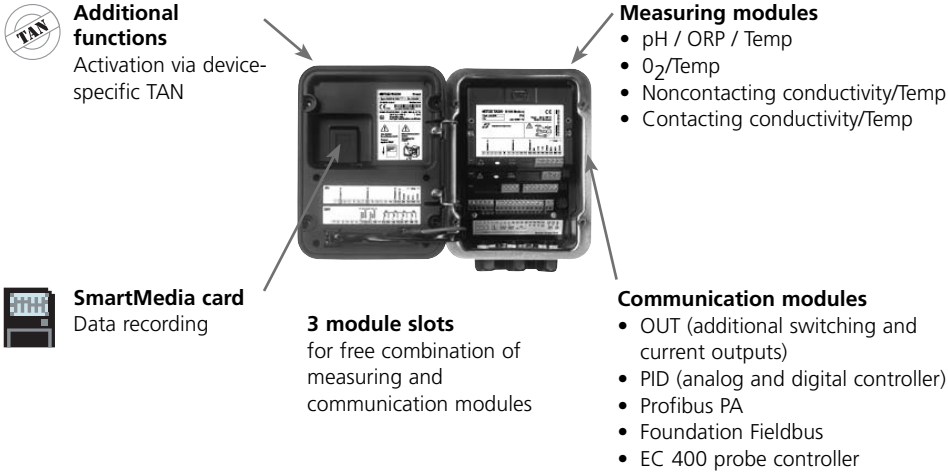
Menu	Display	Device description
diag		Provides information about all modules installed: Module type and function, serial number, hardware and software version and device options. Select the different modules (FRONT, BASE, slots 1 - 3) using the arrow keys.

Modular Concept

Basic Unit, Measuring Module, Additional Functions

The M 700(X) is an expandable modular process analysis system.
The basic unit (FRONT and BASE modules) provides three slots which can be equipped by the user with any combination of measuring or communication modules. The software capabilities can be expanded by additional functions (options). Additional functions must be ordered separately. They are supplied with a device-specific TAN for function release.

M 700(X) Modular Process Analysis System



Documentation

The basic unit is accompanied by a CD-ROM containing the complete documentation.
Latest product information as well as instruction manuals for earlier software releases are available at **www.mtpro.com**.

Short Description

Short Description: FRONT Module

4 captive screws
for opening the analyzer
(***Caution!*** Make sure that the gasket between FRONT and BASE is properly seated and clean!)

Transflective LC graphic display
(240 x 160 pixels)
white backlighting, high resolution and high contrast.

Measurement display

User interface
with plaintext menus as recommended by NAMUR.
Menu texts can be switched to: German, English, French, Italian, Swedish, and Spanish.
Intuitively acquirable menu logic, based on Windows standards.

Secondary displays

2 softkeys
with context-sensitive functions.

Red LED
signals failure (On) or maintenance request/function check (flashing) according to NE 44.

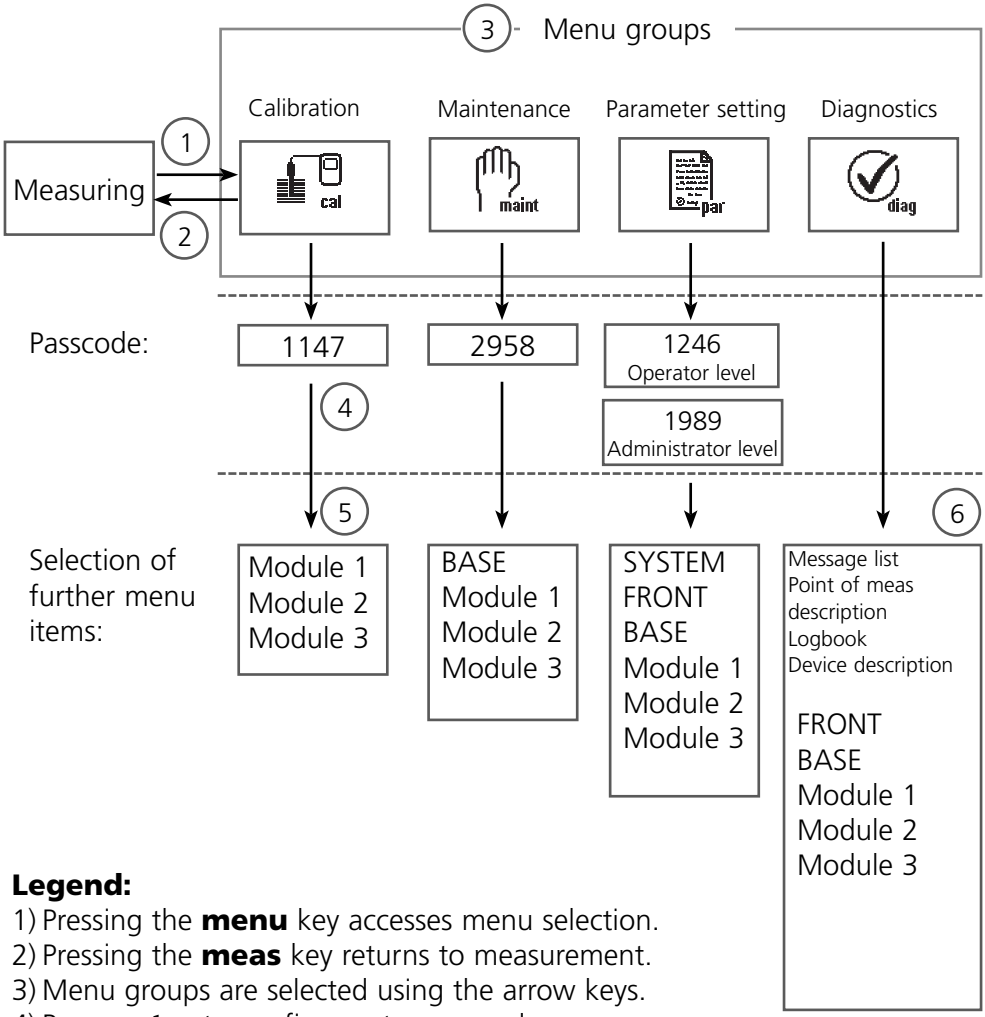
Green LED
Voltage supply okay

Control panel
3 function keys
(menu, meas, enter)
and 4 arrow keys for menu selection and data entries

5 self-sealing cable glands
M20 x 1.5
for entry of voltage supply and signal lines

Short Description: Menu Structure

Basic Functions: Calibration, Maintenance, Parameter Setting, Diagnostics



Legend:

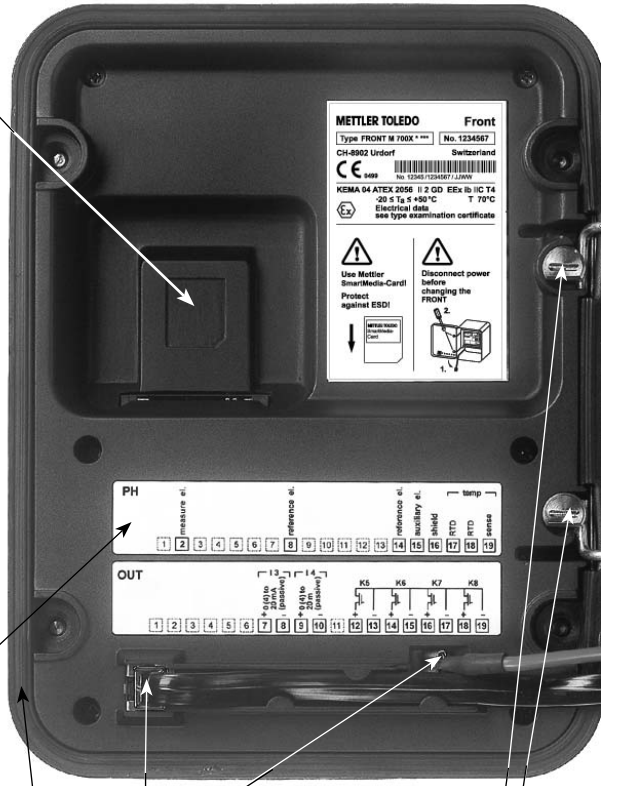
1) Pressing the **menu** key accesses menu selection.
2) Pressing the **meas** key returns to measurement.
3) Menu groups are selected using the arrow keys.
4) Press **enter** to confirm, enter passcode.
5) Further menu items are displayed.
6) Selected functions of the Diagnostics menu can be recalled via softkey even when in measuring mode.

Short Description: FRONT Module

View into the open device (FRONT module)

Slot for SmartMedia card

- Data recording
  The SmartMedia card expands the measurement recorder capacity to > 50000 records.
- Exchange of parameter sets
  5 parameter sets can be stored on the SmartMedia card. The 2 internal parameter sets can be switched by remote control.
  Configurations can be transmitted from one analyzer to the other.
- Function expansions
  are possible with additional software modules, which are released using transaction numbers (TAN)
- Software updates



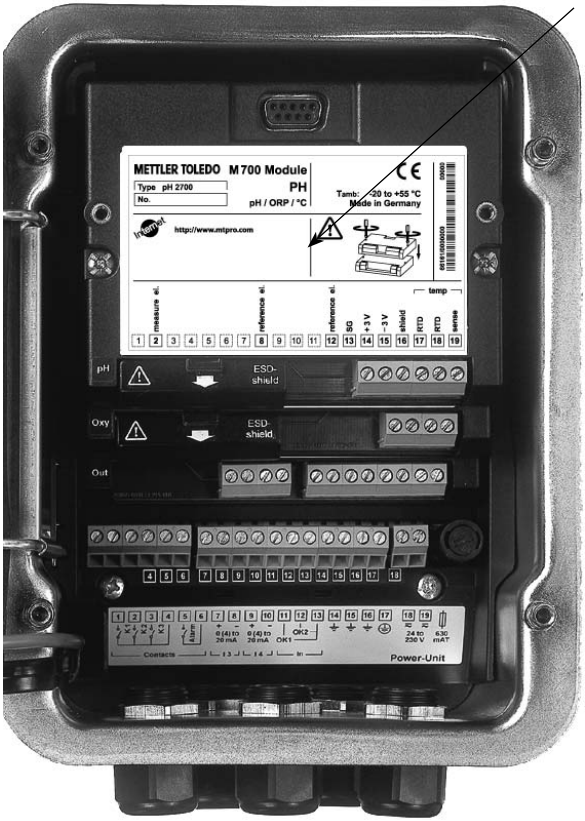
Terminal plates of "hidden" modules
Each module comes with an adhesive label containing the contact assignments. This label should be sticked to the inner side of the front (as shown). Then, the terminal assignments remain visible even if further modules are inserted.

Replacing the front module
Pull off power cord and ground wire. To separate the FRONT module from the BASE module, turn the retaining screws of the pivot hinge by 90°.

The circumferential sealing
guarantees IP 65 protection and allows spray cleaning / disinfection.
Caution! Keep clean!

Short Description: BASE Module

View into the open device (BASE module, 3 function modules installed)



Module equipment
Module identification: Plug & Play.
Up to 3 modules can be combined as desired. Several input and communication modules are available.

Notice
Only <u>one</u> module can be connected in addition to a i700 module.

BASE module
2 current outputs (free assignment of process variable) and 4 relay contacts, 2 digital inputs.
VariPower broad-range power supply, 20 ... 265 V AC/DC, suitable for all public mains supplies in the world.

Power supply units, IS version:
100 ... 230 V AC or
24 V AC/DC

Warning!
Do not touch the terminal compartment, there may be dangerous contact voltages!

Important notice concerning SmartMedia card
The SmartMedia card may be inserted or replaced with the power supply switched on. Before a memory card is removed, it must be "closed" in the maintenance menu. When closing the device, make sure that the sealing is properly seated and clean.

Foundation Fieldbus (FF) Technology

Foundation Fieldbus (FF) is a digital communication system that connects different field devices over a common cable and integrates them into a control system. Its application range covers manufacturing, process, and building automation. As fieldbus standard according to EN 61158-2 (IEC 1158-2) the Foundation Fieldbus ensures the communication of different devices over one bus line.

Basic Properties

The "Data Link Layer" of the Fieldbus Foundation protocol defines 3 device types:

- The **Active Link Master** plans all activities as "Link Active Scheduler" (LAS). It controls the complete data traffic on the bus. Several Link Masters on one bus increase safety, but only one is active at a time.

- **Basic devices** are peripheral devices such as valves, drives, transmitters, or analyzers. They can react acyclically to servicing, configuration and diagnostic tasks of the master. The Link Master cyclically reads the measurement data with status.

- **Bridges** can connect a network from different bus systems.

Bus Communication

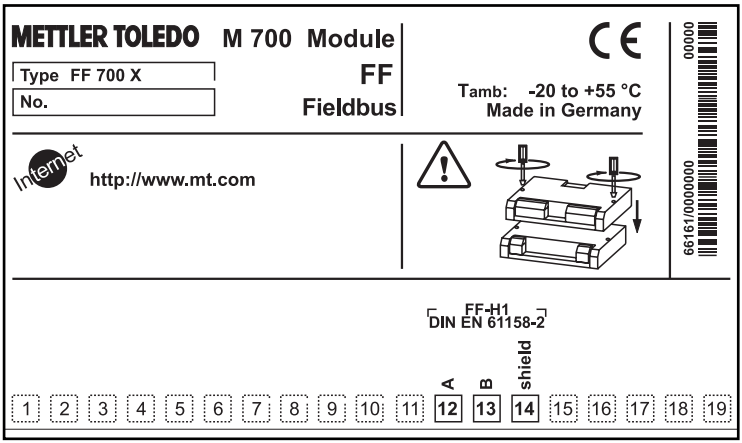
Foundation Fieldbus (FF) permits cyclic and acyclic services:

- **Cyclic Services - Scheduled Communication:**
  are used for transmission of measurement data with status information. The Link Active Scheduler maintains a list of transmission times for all data in all devices that need to be cyclically transmitted. When it is time to transmit data, the LAS issues a "Compel Data (CD)" start signal to the respective device. Upon receipt of the "Compel Data" signal, the device broadcasts the data to all devices on the fieldbus.

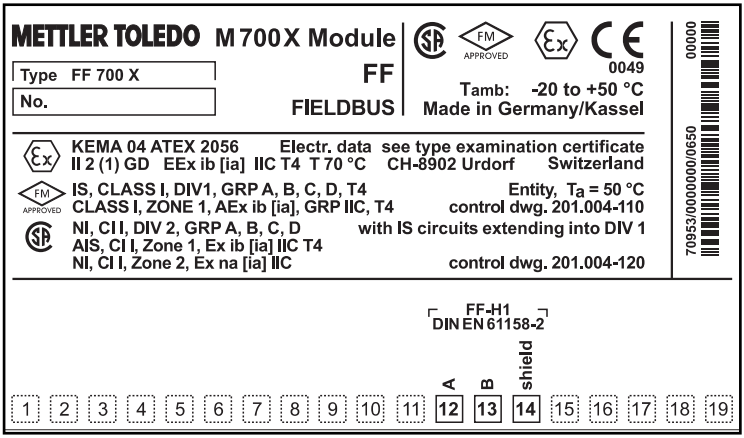
- **Acyclic Services - Unscheduled Communication:**
  are used for device configuration, remote maintenance, and diagnostics during operation.
  All devices are given the chance to send acyclic (unscheduled) messages between transmissions of cyclic (scheduled) data. The LAS grants permission to a device to broadcast acyclic messages by issuing a "Pass Token (PT)" message. Upon receipt of the "Pass Token", the device starts data transmission.

Terminal Plate

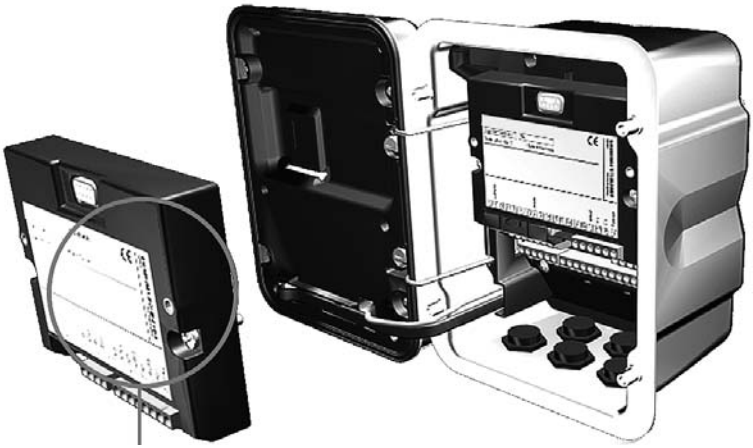
Terminal Plate FF 700 Module:



Terminal Plate FF 700 X Module:



Inserting the Module



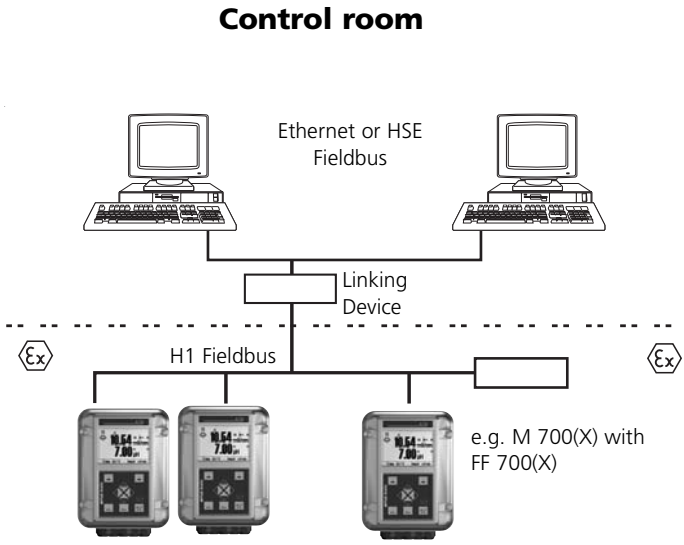
Thanks to the staggered arrangement of connectors and fastening screws the terminal strips of all modules are easy to access.

Make sure that the cable glands are tightly closed to protect against humidity.

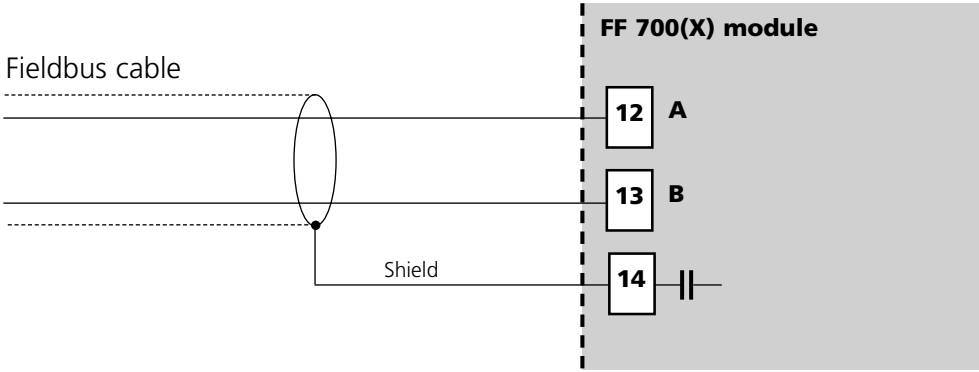
1. Switch off power supply
2. Open the device (loosen the 4 screws at the front)
3. Place module in slot (D-SUB connector)
4. Tighten fastening screws of the module
5. Connect signal lines
6. Close device, tighten screws at the front
7. Switch on power supply
8. Assigning process variables to AI blocks on the device
9. Set parameters

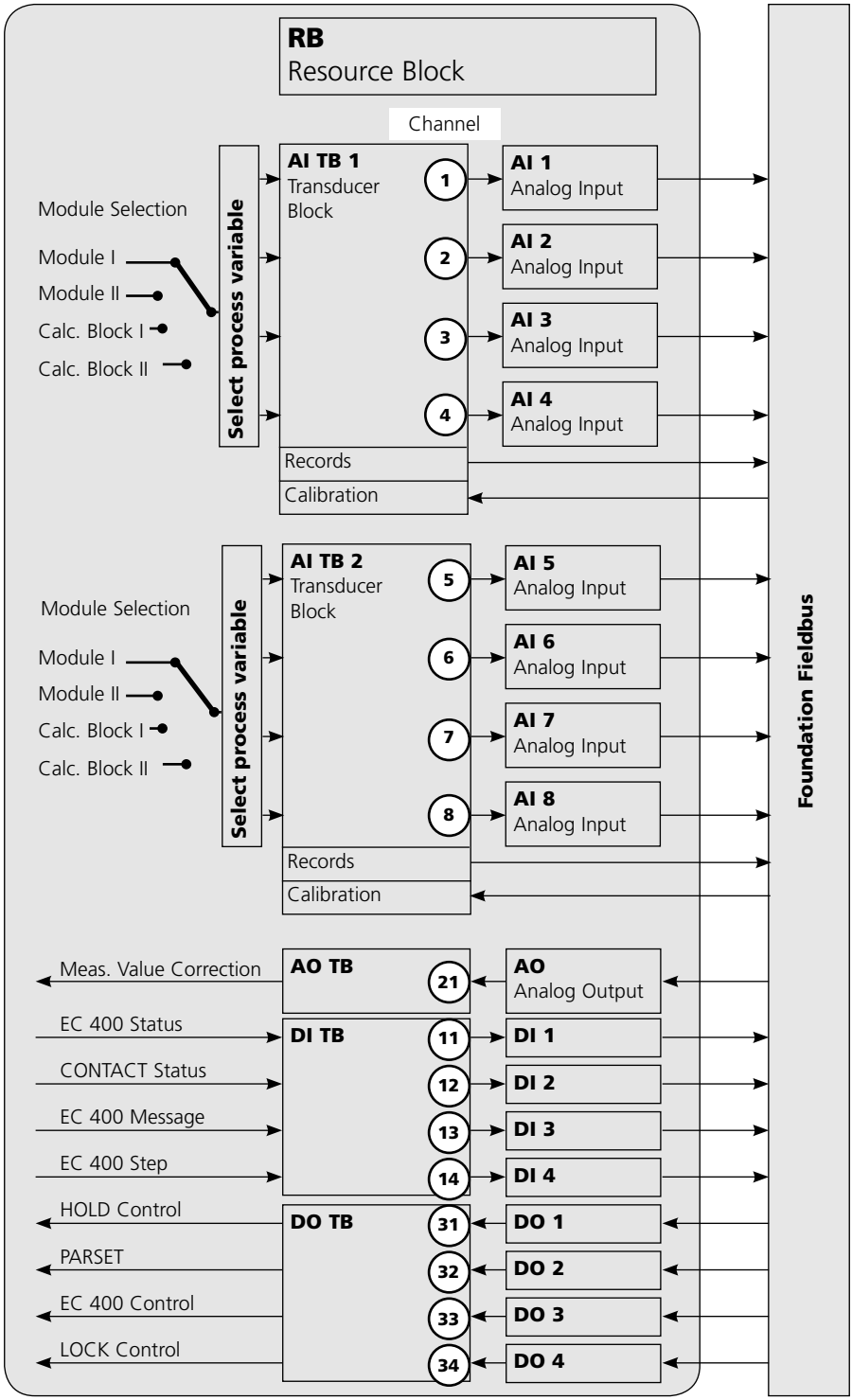
Foundation Fieldbus Installation

Basic build-up of a PROFIBUS system:



Electrical connection between module and Foundation Fieldbus is in accordance with FISCO (Fieldbus Intrinsically Safe Concept, www.fieldbus.org).




RB
Resource Block
Channel
AI TB 1
Transducer
Block
1
2
3
4
AI 1
Analog Input
AI 2
Analog Input
AI 3
Analog Input
AI 4
Analog Input
Records
Calibration
Module Selection
Module I
Module II
Calc. Block I
Calc. Block II
Select process variable
AI TB 2
Transducer
Block
5
6
7
8
AI 5
Analog Input
AI 6
Analog Input
AI 7
Analog Input
AI 8
Analog Input
Records
Calibration
Module Selection
Module I
Module II
Calc. Block I
Calc. Block II
Select process variable
Foundation Fieldbus
Meas. Value Correction
AO TB
21
AO
Analog Output
EC 400 Status
CONTACT Status
EC 400 Message
EC 400 Step
DI TB
11
12
13
14
DI 1
DI 2
DI 3
DI 4
HOLD Control
PARSET
EC 400 Control
LOCK Control
DO TB
31
32
33
34
DO 1
DO 2
DO 3
DO 4

Communication Model

See diagram on previous side

All variables and parameters of the transmitter are assigned to blocks.

Resource Block (RB)
Describes the transmitter characteristics (manufacturer, device name, operating status, general status).

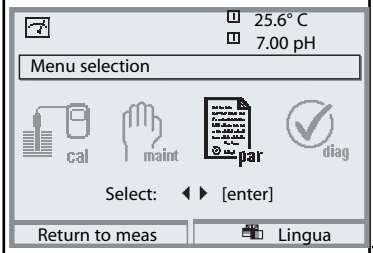
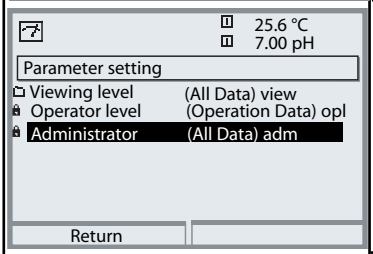
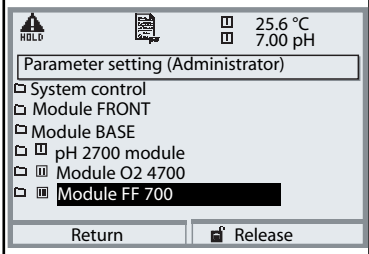
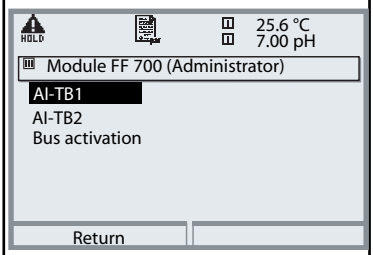
Analog Input Block (AI)
2 x 4 Analog Input Function Blocks provide for cyclic transmission of measured values (currently measured value with status, alarm limits, freely selectable process variable from up to 2 measuring modules).

Analog Input Transducer Block (AI TB)
Provides for acyclic data transmission. Calibration, configuration, and maintenance commands coming from the control station are processed in the Transducer Block. The sensor signal is first preprocessed in the Transducer Block. From here, the measured value is sent to the Analog Input Blocks where it can be further processed (limit values, scaling).

Connections (Channels)
The communication model shows the channel numbers for connecting the function blocks to the Transducer Blocks.

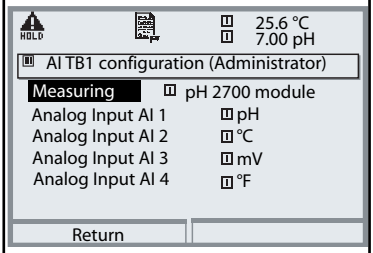
AI-TB Configuration on the Device

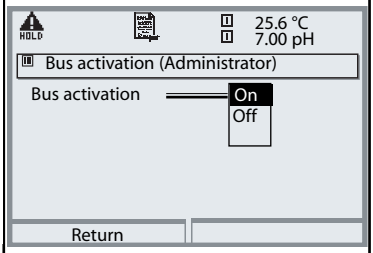
Assigning process variables to Analog Input Blocks on the device

Menu	Display	Assigning process variables to Analog Input Blocks
par		**Call up parameter setting** From the measuring mode: Press **menu** key to select menu. Select parameter setting using arrow keys, confirm with **enter**.
		**Administrator level:** Access to all functions, also passcode setting. Releasing or blocking a function for access from the Operator level.
		**Select module.** M 700 permits variable equipment with 2 measuring modules (and FF module). The available process variables are assigned via "AI-TB configuration".
		**Select AI-TB block:** Assign a module to an AI-TB block. The AI-TB block includes 4 Analog Input blocks to each of which you can assign a process variable from the module.

AI-TB Configuration on the Device

Assigning process variables to Analog Input Blocks on the device

Menu	Display	Assigning process variables to Analog Input Blocks
par		**Select AI-TB configuration:** Assign each process variable to one of the 4 Analog Input Blocks per TB. (See Page 26) **Caution!** The assignments made here also apply to the FF configuration for the connection of Analog Input Blocks to the channels of the AI Transducer Blocks! Be sure to make identical settings!

Menu	Display	Bus activation
par		**Bus activation** On: Access control by DCS (Control system programming required by customer!) Off: Device access via passcode or signature (Audit Trail) as usual **Notice:** If access control has inadvertently been activated, the device must be separated from the FF bus to make the menu accessible again.

For Copy: Individual Settings

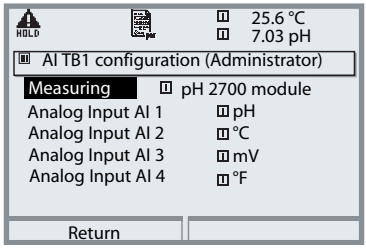
Assigning process variables to Analog Input Blocks on the device

AI Block	Process variable assigned
AI-TB1	Selected measuring module
	Analog Input Block AI 1
	Analog Input Block AI 2
	Analog Input Block AI 3
	Analog Input Block AI 4
AI-TB2	Selected measuring module
	Analog Input Block AI 5
	Analog Input Block AI 6
	Analog Input Block AI 7
	Analog Input Block AI 8

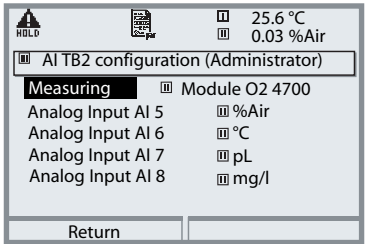
Offline Configuration

The AI blocks are divided into two groups (AI Transducer Blocks) which are each assigned to one measuring module. This allows control of functions in the measuring modules. If there is only one measuring module, both AI TBs can be assigned to the same module so that they can output more measured values cyclically. In this exemplary configuration there is a pH 2700 module in slot [I], an O2 4700 module in slot [II], and the FF 700 module in slot [III].

You can assign individual process variables from the selected measuring module to the different AI channels.

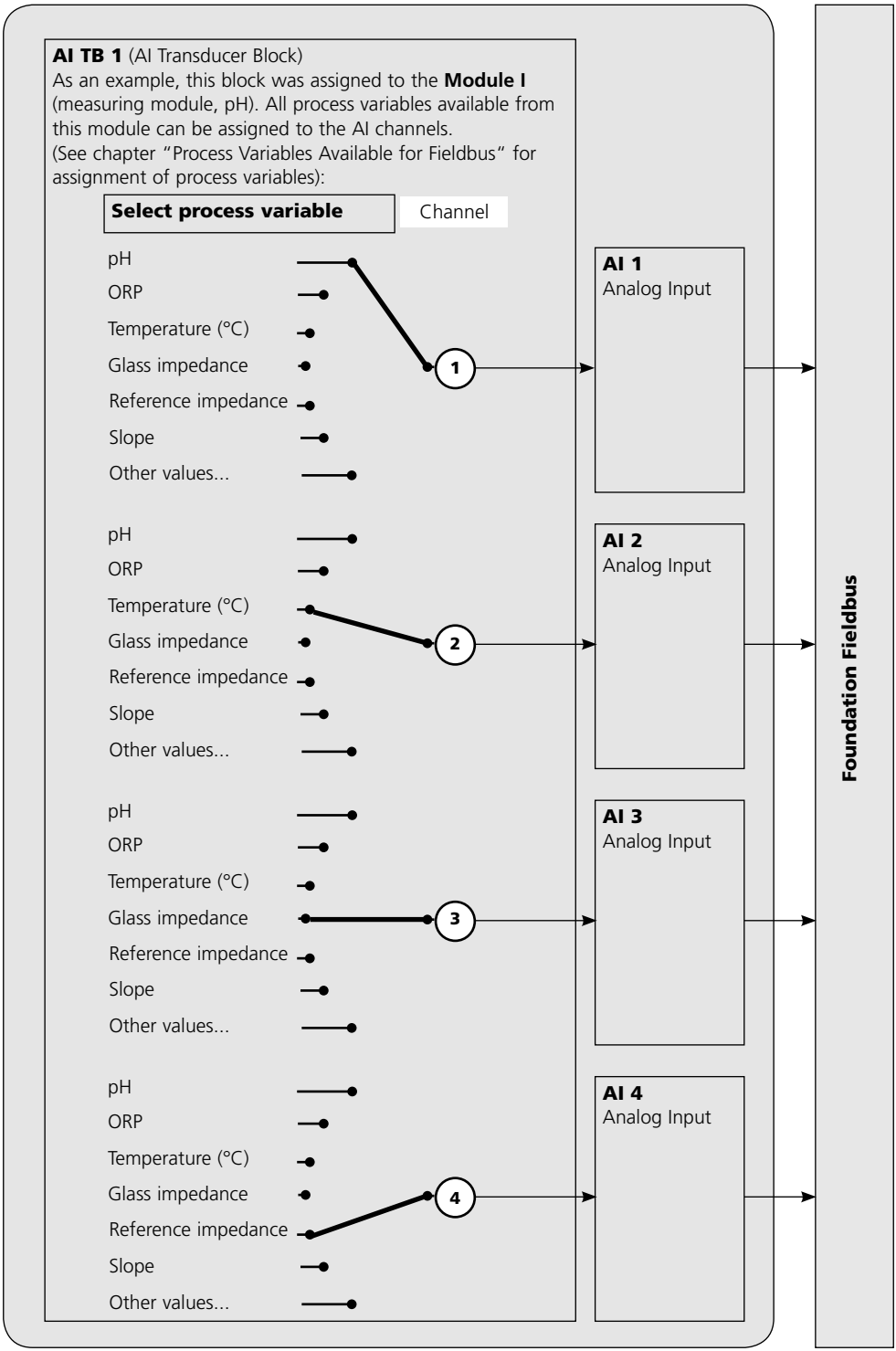


Example 1:
AI-TB1 is assigned to the pH 2700 module, therefore all process variables of the pH module are available for AI1 to AI4.



Example 2:
AI-TB1 is assigned to the O2 4700 module, therefore all process variables of the Oxy module are available for AI5 to AI8.

Bus communication on the Foundation Fieldbus can only function properly when during online configuration the blocks in the control system are set in accordance with the AI-TB configurations selected in the device configuration. The modular M 700 does not allow permanent assignment of process variables to AIs - any available module can be located in one of the three slots, which cannot be recognized from the control system.
Therefore you cannot preconfigure the device offline per DD from the control system.


AI TB 1 (AI Transducer Block)
As an example, this block was assigned to the Module I (measuring module, pH). All process variables available from this module can be assigned to the AI channels.
(See chapter "Process Variables Available for Fieldbus" for assignment of process variables):
Select process variable
Channel
pH
ORP
Temperature (°C)
Glass impedance
Reference impedance
Slope
Other values...
1
AI 1
Analog Input
2
AI 2
Analog Input
3
AI 3
Analog Input
4
AI 4
Analog Input
Foundation Fieldbus

Initial Commissioning

1. Supply the device with power.
2. Open the configuration program of the control system.
3. Load CFF file and DD.
   After the first connection establishment, the device answers as follows:

Device type FF 700_____0000000000
ID= 0001020D48_____0000000000 (e.g.)

4. Assign the desired name (PD_TAG) to the field device.

Setting the Resource Block (RB) parameters

5. Set the MODE_BLK. TARGET to Auto.

Setting the Analog Input Block (AI) parameters

6. Set MODE_BLK. TARGET to OOS (Out Of Service).
7. Select the desired process variable from the CHANNEL parameter (Observe parameter setting of FRONT module!).
8. Select the unit belonging to the process variable from the XD_SCALE parameter.
9. Select the unit belonging to the process variable from the OUT_SCALE parameter.
10. Set the LIN_TYPE linearization type to Direct and transmit the changes.
11. If these steps are not properly executed, the "Block Configuration Error" is generated when the block is set to "Auto".

Using the NI-FBUS Configurator from National Instruments, for example, you can graphically connect the function blocks and then load the system configuration in the device.

12. Download all data and parameters to the field device.
13. Set the target modes of all Analog Input Blocks to "Auto".

Analog Input Blocks

The module provides 8 analog input blocks (AI 1 ... AI 8).
An Analog Input Block contains the signal processing options for the process variable supplied from the Transducer Block.
The following parameters are available:

Example:

In the M 700 AI 1 is set to pH value, AI 2 is set to temperature:

Settings in AI 1:

Parameter	Value
CHANNEL	Module 1 – Channel 1 (pH)
XD_SCALE, UNITS_INDEX	pH
OUT_SCALE, UNITS_INDEX	pH
L_TYPE	Direct
MODE_BLK, ACTUAL	Auto

Settings in AI 2:

Parameter	Value
CHANNEL	Module 1 – Channel 2 (°C)
XD_SCALE, UNITS_INDEX	°C
OUT_SCALE, UNITS_INDEX	°C
L_TYPE	Direct
MODE_BLK, ACTUAL	Auto

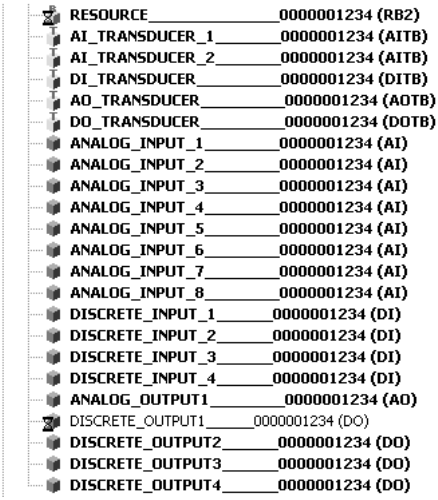
Caution!

When connecting the AIs to the AI TBs, you must select the process variable (measurement unit) corresponding to the measured value selected in the M 700 (see Page 22).
A faulty setting causes a Block Configuration Error in the AI function block.

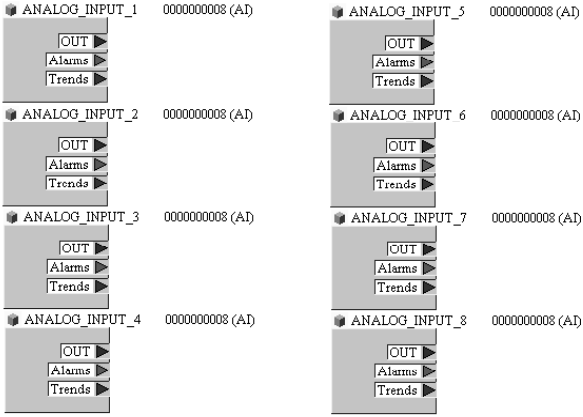
Configuration of AI TB

(Example: Configuration via NI-FBUS Configurator / National Instruments)

After connection of the M 700 FF 700 module to the Foundation Fieldbus the NI-FBUS Configurator shows this block overview (default setting: Fieldbus address 22)



Move all required AI blocks to the Function Block Application and start Download Configuration.



Configuration with Foundation Fieldbus

Commissioning on the Foundation Fieldbus

Only when the FF 700 module is competently configured, can the Foundation Fieldbus communication function properly. Different configuration tools from different manufacturers are available (e.g. NI-FBUS Configurator / National Instruments). They can be used to configure the device and the Foundation Fieldbus.

Notice:

Be sure to observe the operating instructions and the menu guidance of the control system or the configuration tool during installation and configuration via the control system.

Installing the DD (Device Description):

During initial installation the device description (*.cff, *.sym and *.ffo) must be installed in the control system .
For network projecting, you require the CFF file (Common File Format).

These files can be obtained from:

- the included CD
- internet: www.mt.com/pro
- Foundation Fieldbus: www.fieldbus.org.

Identifying the Transmitter

There are several possibilities to identify a FF transmitter in the network. The most important one is the “Device Identifier“ or DEV_ID. It consists of the manufacturer ID, device type, and serial number of the transmitter.

Corresponding to example given on Page 25, "Offline Configuration"

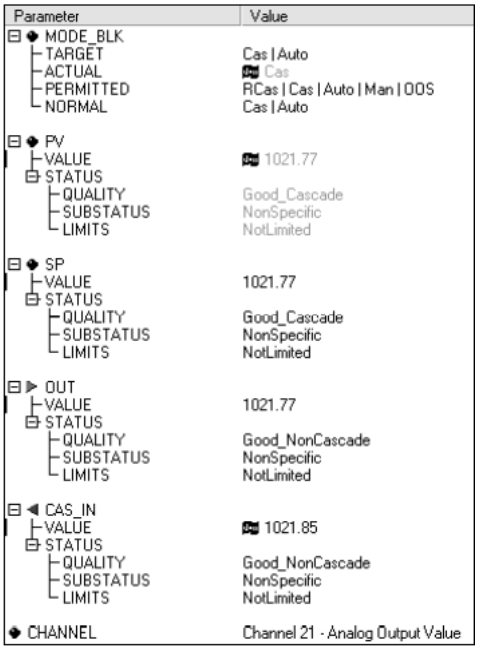
For parameter changes, you must set MODE_BLK/TARGET to OOS (Out of Service) since otherwise the error message NIF_ERR_WRONG_MODE_FOR_ REQUEST would appear for [Write Changes].

Analog_Input_1		
"Process" card:	CHANNEL	Module 1 - Channel 1
"Scaling" card:	XD_SCALE/UNITS_INDEX	pH
	OUT_SCALE/UNITS_INDEX	pH
	L_TYPE	Direct
Button	[Write Changes]	
Button	[Auto]	
Analog_Input_2		
"Process" card:	CHANNEL	Module 1 - Channel 2
"Scaling" card:	XD_SCALE/UNITS_INDEX	°C
	OUT_SCALE/UNITS_INDEX	°C
	L_TYPE	Direct
Button	[Write Changes]	
Button	[Auto]	
Analog_Input_3		
"Process" card:	CHANNEL	Module 1 - Channel 3
"Scaling" card:	XD_SCALE/UNITS_INDEX	mV
	OUT_SCALE/UNITS_INDEX	mV
	L_TYPE	Direct
Button	[Write Changes]	
Button	[Auto]	
Analog_Input_4		
"Process" card:	CHANNEL	Module 1 - Channel 4
"Scaling" card:	XD_SCALE/UNITS_INDEX	Mohm
	OUT_SCALE/UNITS_INDEX	Mohm
	L_TYPE	Direct
Button	[Write Changes]	
Button	[Auto]	

Analog_Input_5		
"Process" card:	CHANNEL	Module 2 - Channel 1
"Scaling" card:	XD_SCALE/UNITS_INDEX	%
	OUT_SCALE/UNITS_INDEX	%
	L_TYPE	Direct
Button	[Write Changes]	
Button	[Auto]	
Analog_Input_6		
"Process" card:	CHANNEL	Module 2 - Channel 2
"Scaling" card:	XD_SCALE/UNITS_INDEX	°C
	OUT_SCALE/UNITS_INDEX	°C
	L_TYPE	Direct
Button	[Write Changes]	
Button	[Auto]	
Analog_Input_7		
"Process" card:	CHANNEL	Module 2 - Channel 3
"Scaling" card:	XD_SCALE/UNITS_INDEX	mbar
	OUT_SCALE/UNITS_INDEX	mbar
	L_TYPE	Direct
Button	[Write Changes]	
Button	[Auto]	
Analog_Input_8		
"Process" card:	CHANNEL	Module 2 - Channel 4
"Scaling" card:	XD_SCALE/UNITS_INDEX	g/l
	OUT_SCALE/UNITS_INDEX	g/l
	L_TYPE	Direct
Button	[Write Changes]	
Button	[Auto]	

An external pressure sensor can be connected to the Analog Output Block (AO) through the Foundation Fieldbus network.

Analog_Output1		
"Process" card:	CHANNEL	Channel 21 (Analog Output Value)
"Scaling" card:	XD_SCALE/EU_100	9999
	XD_SCALE/UNITS_INDEX	mbar
	OUT_SCALE/EU_100	9999
	OUT_SCALE/UNITS_INDEX	mbar
"Limits" card	SP_HI_LIM	9999
Button	[Write Changes]	
Button	[Cascade]	



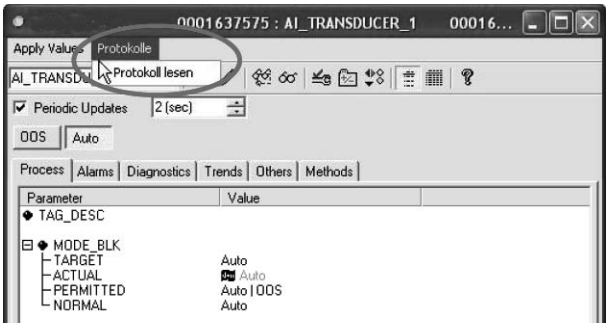
Then the AO Block should be in ACTUAL Mode Cas.
The coupled output value (AI) from the linked pressure transmitter appears at input CAS_IN.
In Cascade mode the measured OUT value is passed to the transmitter and is available to the system.
The parameter settings required for the DI and DO blocks are given on the following page.

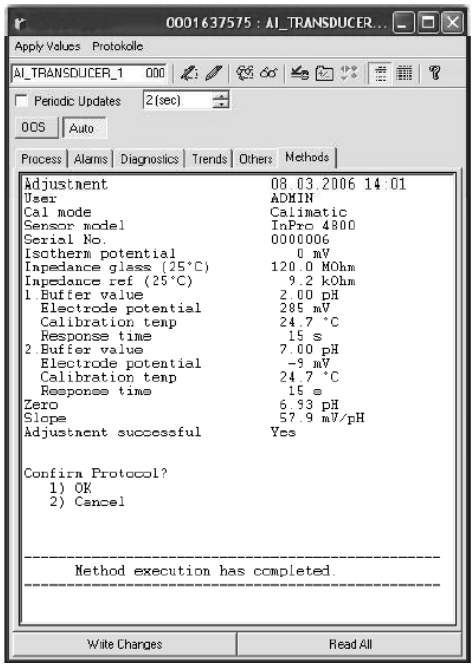
Discrete_Input_1			
"Process" card:	CHANNEL	Channel 11	Discrete Input Value
Button	[Write Changes]		
Button	[Auto]		
Discrete_Input_2			
"Process" card:	CHANNEL	Channel 12	Discrete Input Value
Button	[Write Changes]		
Button	[Auto]		
Discrete_Input_3			
"Process" card:	CHANNEL	Channel 13	Discrete Input Value
Button	[Write Changes]		
Button	[Auto]		
Discrete_Input_4			
"Process" card:	CHANNEL	Channel 14	Discrete Input Value
Button	[Write Changes]		
Button	[Auto]		
Discrete_Output1			
"Process" card:	CHANNEL	Channel 31	Discrete Output Value
Button	[Write Changes]		
Button	[Auto]		
Discrete_Output2			
"Process" card:	CHANNEL	Channel 32	Discrete Output Value
Button	[Write Changes]		
Button	[Auto]		
Discrete_Output3			
"Process" card:	CHANNEL	Channel 33	Discrete Output Value
Button	[Write Changes]		
Button	[Auto]		
Discrete_Output4			
"Process" card:	CHANNEL	Channel 34	Discrete Output Value
Button	[Write Changes]		
Button	[Auto]		

Calibration Protocols

Calibration Protocols

The protocols are transmitted in the AI TBs in binary form. The DD provides a method for converting them to a readable format. The method can be started with "Read protocol" in the "Protocol" menu of the AI TB.





Each AI TB of the FF module has a ring buffer which can store up to three protocols. A fourth protocol would overwrite the first protocol in that TB.

With "Read protocol", the calibration protocol of the respective module can be read out from the AI TB. The example shows the pH protocol of AI TB1. At the end of the method you can confirm the protocol (OK) and thus delete it from the ring buffer. After confirmation you will be informed if further data, i.e. another protocol, are available. Without confirmation (Cancel), you can re-read the protocol as often as you like.

Parameters of AI Transducer Blocks

All blocks correspond to the "FF-007-5.0 Specifications". Only the two AI-TB blocks have been extended (Index 14 ... 39). AI TB1 and AI TB2 can be assigned to different measuring modules in the M 700.

Index	Parameter	Description
	Standard parameters	
0	AITB	
1	ST_REV	
2	TAG_DESC	
3	STRATEGY	
4	ALERT_KEY	
5	MODE_BLK	
6	BLOCK_ERR	
7	UPDATE_EVT	
8	BLOCK_ALM	
9	TRANSDUCER_DIRECTORY	
10	TRANSDUCER_TYPE	
11	XD_ERROR	
12	COLLECTION_DIRECTORY	
13	PRIMARY_VALUE	Measured value channel 1
	Manufacturer-specific extensions: Measured values	
14	SECONDARY_VALUE	Measured value channel 2
15	THIRD_VALUE	Measured value channel 3
16	FOURTH_VALUE	Measured value channel 4
	Manufacturer-specific extensions: Product calibration	
17	CAL_SAMPLE_PRD	Starts the first part of product calibration
18	CAL_SAMPLE_PRD_STORED_VAL	Shows the value stored during the first part of product calibration
19	CAL_PRODUCT	Sets the value for the second part of product calibration
20	CAL_MODE_PRD	"Mode of ... calibration"
21	CAL_RESULT	Result of calibration

Parameters of AI Transducer Blocks

Index	Parameter	Description
	Manufacturer-specific extensions: Protocols	
22	PROTOCOL_STATUS	Status
23	PROTOCOL_DATA_0	Binary protocol data, part 1
24	PROTOCOL_DATA_1	
25	PROTOCOL_DATA_2	
26	PROTOCOL_DATA_3	
27	PROTOCOL_DATA_4	
28	PROTOCOL_DATA_5	
29	PROTOCOL_DATA_6	
30	PROTOCOL_DATA_7	
31	PROTOCOL_DATA_8	
32	PROTOCOL_DATA_9	
33	PROTOCOL_DATA_A	
34	PROTOCOL_DATA_B	
35	PROTOCOL_DATA_C	
36	PROTOCOL_DATA_D	
37	PROTOCOL_DATA_E	
38	PROTOCOL_DATA_F	Binary protocol data, part 16
39	PROTOCOL_CONFIRM	Save protocol

A ring buffer for up to 3 protocols is implemented in the module
The DD includes a method for presenting the protocol in a readable manner.
This method is called up in the "Protocol" menu of the AI TB Block.

Function Block AO

Cyclic transmission of an external correction value (e.g. pressure correction for O2 4700).

DI 1: EC 400 Status

Bit 7	6	5	4	3	2	1	0	Meaning
							1	Probe in MEASURE position (PROCESS)
						1		Probe in SERVICE position
					1			Service switch actuated
				1				EC 400 alarm
			1					EC 400 program running
0	0	0						No program
0	0	1						Program: Cleaning
0	1	0						Program: Cal 2point
0	1	1						Program: Cal 1point
1	0	0						Program: Parking
1	0	1						Program: USER 1
1	1	0						Program: USER 2
1	1	1						Program: Service

DI 2: CONTACTS / LOCK Status / ENABLE Request

Bit 7	6	5	4	3	2	1	0	Meaning
							1	Contact K4 active
						1		Contact K3 active
					1			Contact K2 active
				1				Contact K1 active
			1					CAL terminates AI-TB1 (1 min or until cal record collected)
		1						CAL terminates AI-TB2 (1 min or until cal record collected)
0	0							Measuring mode
0	1							Unconfirmed enable request
1	0							Confirmed enable request
1	1							Enable

DI Function Block EC 400 Messages

DI 3: EC 400 Messages

Bit 7	6	5	4	3	2	1	0	Meaning
							1	Probe maintenance request
						1		Media adapter maintenance request
					1			EC 400 basic device maintenance request
				1				Medium maintenance request
			1					Probe failure
		1						Media adapter failure
	1							EC 400 basic device failure
1								Calibration / Communication error

Explanation of EC 400 Messages: Maintenance request

Probe maintenance request	
U 231	Probe move time MEASURE (PROCESS)
U 234	Probe move time SERVICE
U 232	Proble wear counter
U 228	Probe cylinder untight
Media adapter maintenance request	
U 190	Buffer I almost empty
U 191	Buffer II almost empty
U 192	Cleaner almost empty
Maintenance request / EC 400 basic device	
U 233	Water pressure switch
U 229	Sensor dismount guard defective
U 235	Safety valve defective

Medium maintenance request	
U 241	Check water
U 242	Check buffer I
U 243	Check buffer II
U 244	Check cleaner
U 245	Check aux. valve I
U 246	Check aux. valve II

Explanation of EC 400 Messages: Failure

Probe failure	
U 230	Probe limit position MEASURE (PROCESS)
U 227	Probe limit position SERVICE
Media adapter failure	
U 194	Buffer I empty
U 195	Buffer II empty
U 196	Cleaner empty
EC 400 basic device failure	
U 220	Compressed air switch
U 225	Probe valve defective
U 224	EC 400 flooded
U 221	Sensor dismounted
Calibration / Communication error	
U 251	Calibration error

DI 4: EC 400 Step

Bit								Meaning
7	6	5	4	3	2	1	0	
							1	System in SINGLE_STEP
		X	X	X	X	X		Step 1 ... 30
	0							Reserved
0								Reserved

The half-automated EC 400 program control in Single-Step Mode can only be activated and triggered from the M 700. Control via bus is not possible, however the Single-Step Mode can be watched.

DO Function Blocks

DO 1: HOLD Control

Bit 7	6	5	4	3	2	1	0	Meaning
							1	System HOLD
						0		Reserved
					0			Reserved
				0				Reserved
			0					Reserved
		0						Reserved
	0							Reserved
0								Reserved

DO 2: PARSET

Bit 7	6	5	4	3	2	1	0	Meaning
							1	Parameter set B (internal)
				0	0	0		Parameter set not from card
				0	0	1		Parameter set 1 (card)
				0	1	0		Parameter set 2 (card)
				0	1	1		Parameter set 3 (card)
				1	0	0		Parameter set 4 (card)
				1	0	1		Parameter set 5 (card)
			0					Reserved
		0						Reserved
	0							Reserved
0								Reserved

DO 3: EC 400 Control

Bit 7	6	5	4	3	2	1	0	Meaning
							X	Reserved
						1		Probe in SERVICE position (MEASURE = 0)
					1			Manual, Time control Off (Auto, Time control On = 1)
				X				Reserved
			X					Reserved
0	0	0						No program start
0	0	1						Program: Cleaning
0	1	0						Program: Cal 2point
0	1	1						Program: Cal 1point
1	0	0						Program: Parking
1	0	1						Program: USER 1
1	1	0						Program: USER 2
1	1	1						No program start

DO 4: LOCK Control

Bit 7	6	5	4	3	2	1	0	Meaning
						0	0	Measuring mode
						0	1	Enabled
						1	0	Busy
						1	1	Not used
					X			Reserved
				X				Reserved
			X					Reserved
		X						Reserved
	X							Reserved
X								Reserved

Enable / Lock via DCS

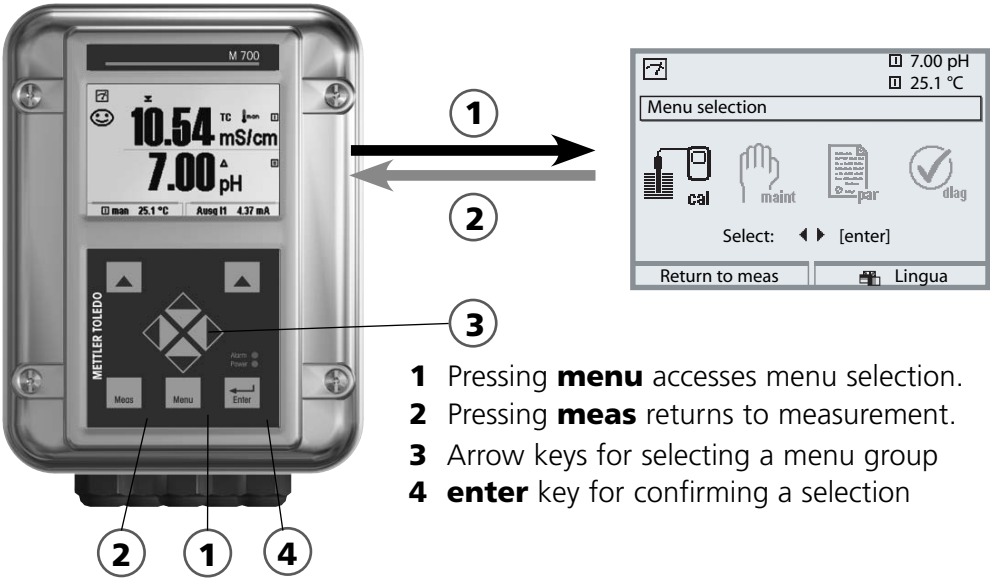
Caution: Control system programming required by customer!

Enable / Lock M 700 for on-site calibration via DCS.
The DI 1 and DO 4 function blocks are used for communicating with the DCS (control system programming required by customer).

Step 1:	The user calls up the cal menu, for example, on the device. An "Enable request running ..." window appears instead of the passcode prompt. An enable request message is sent to the DCS.
Step 2:	The DCS confirms the request, still without a decision. Now, a message window opens on the control system where the plant operator selects the decision Yes/No. Until a decision is made, the display reads "Wait for enable signal from DCS ..."
Step 3:	The decision has been made: YES: The window disappears and the user is prompted to enter the passcode (or signature for AuditTrail). Now, he may use the menu. NO: A "Request denied!" window appears and the device returns to measuring mode.
Step 4:	After the menu system has been exited, the DCS receives a message that manual operation is terminated. This erases the authorization.

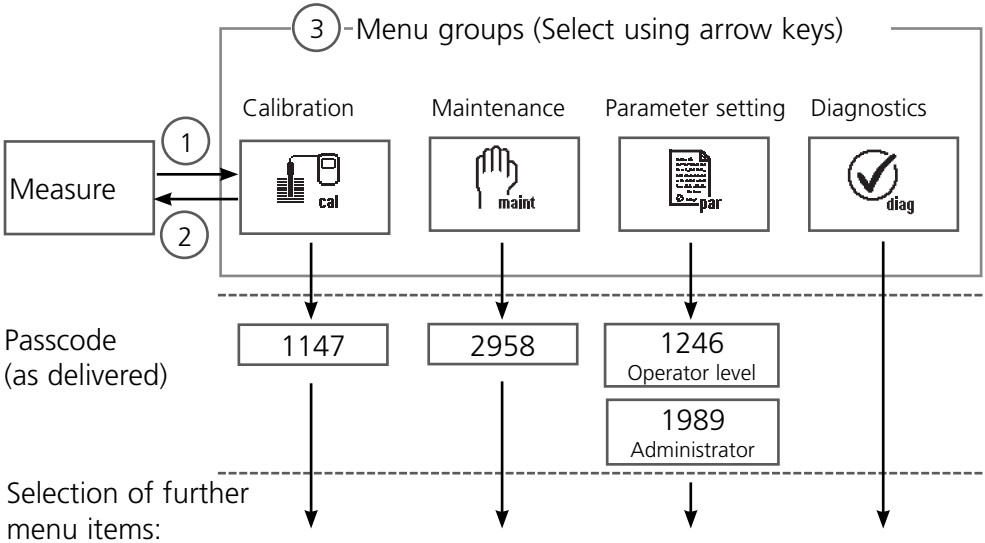
Menu Selection

After switching on, the analyzer performs an internal test routine and automatically detects the number and type of modules installed.
Then, the analyzer goes to measuring mode.



1 Pressing **menu** accesses menu selection.
2 Pressing **meas** returns to measurement.
3 Arrow keys for selecting a menu group
4 **enter** key for confirming a selection

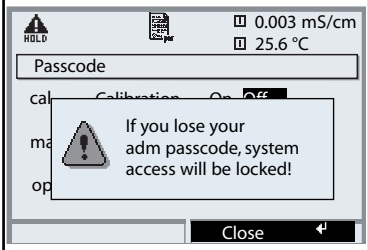
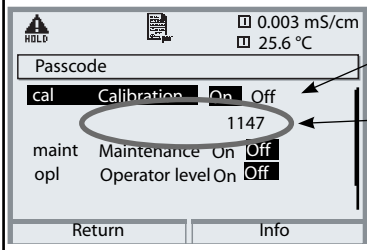
Menu Structure



Passcode Entry

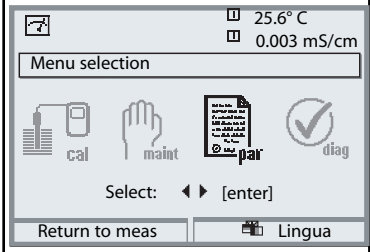
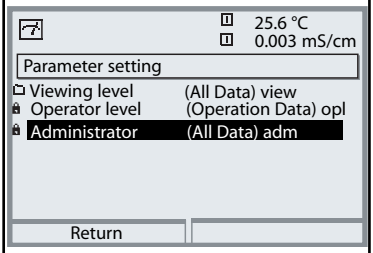
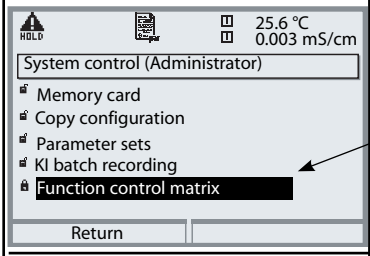
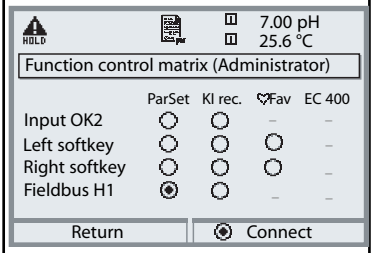
To enter a passcode:
Select the position using the left/right keys,
then edit the number using the up/down keys.
When all numbers have been entered, confirm with **enter**.

To change a passcode
- Open the menu selection (**menu**)
- Select parameter setting
- Administrator level, enter passcode
- Select System control: Passcode entry

Menu	Display	System control: Passcode entry
par		**Changing a passcode: "Passcode entry" menu** When this menu is opened, the analyzer displays a warning (Fig.). Passcodes (factory settings): Calibration (cal) 1147 Maintenance (maint) 2958 Operator level (opl) 1246 Administrator level (adm) 1989 **Caution** If you lose the Administrator passcode, system access is locked! Please consult our technical support!
		To change a passcode, select "On" using the arrow keys. Confirm with **enter**. Select the position using the **left/right** keys, then edit the number using the **up/down** keys. When all numbers have been entered, confirm with **enter**.

Function Control Matrix

Controlling parameter set selection / KI recorder via Fieldbus H1
Parameter setting/Administrator level/System control/Function control matrix

Menu	Display	Control via Foundation Fieldbus
par		**Call up parameter setting** From the measuring mode: Press **menu** key to select menu. Select parameter setting using arrow keys, confirm with **enter**.
		**Administrator level:** Access to all functions, also passcode setting. Releasing or blocking a function for access from the Operator level.
		At the Administrator level: Select "System control", then "Function control matrix".
		**Function control matrix** Clear assignment: control element/ function. Example: Fieldbus H1 controls the parameter set selection.

Specifications

Specifications M 700 FF 700(X)

Foundation Fieldbus FF-H1 (EEx ia IIC)	Digital communication in hazardous areas via current modulation
Physical interface	According to IEC 61158-2
Transfer rate	31.25 kbits/s
Communication protocol	FF-816
Profile	FF_H1 (Foundation Fieldbus)
Bus address	Visible on the device but not adjustable
Supply voltage (FISCO)	Bus supply: 9 … 17.5 V Linear barrier: 9 … 24 V
Current consumption	< 12 mA
Max. current in case of fault (FDE)	< 17 mA
FF communication model	Certified to ITK 4.6
1 Physical Block	Device description
5 transducer blocks	Connection to signal processing
8 AI Function blocks	Output of measured values with status via the Fieldbus
4 DI function blocks	Output of messages with status via the Fieldbus
4 DO Function blocks	Control via the Fieldbus
1 AO function block	for analog compensation signals (e.g. O_2 process pressure)

General Data

Explosion protection (IS module only)	ATEX: See rating plate: KEMA 03 ATEX 2056 II 2 (1) GD EEx ib [ia] IIC T4 T 70 °C FM: NI, Class I, Div 2, GP A, B, C, D T4 with IS circuits extending into Division 1 Class I, Zone 2, AEx nA, Group IIC, T4 Class I, Zone 1, AEx me ib [ia] IIC, T4 CSA: NI, Class I, Div 2, Group A, B, C, D with IS circuits extending into Division 1 AIS, Class I, Zone 1, Ex ib [ia] IIC, T4 NI, Class I, Zone 2, Ex nA [ia] IIC
EMC Emitted interference Immunity to interference	NAMUR NE 21 and EN 61326 VDE 0843 Part 20 /01.98 EN 61326/A1 VDE 0843 Part 20/A1 /05.99 Class B Industry
Lightning protection	EN 61000-4-5, Installation Class 2
Nominal operating conditions	Ambient temperature: –20 ... +55 °C (Ex: max. +50 °C) Rel. humidity: 10 ... 95 % not condensing
Transport/Storage temperature	–20 ... +70 °C
Screw clamp connector	Single wires and flexible leads up to 2.5 mm^2

Process Variables (Fieldbus)

Process variables which can be assigned to Analog Input Blocks (AI):

Module Types pH: pH 2700(X)
pH 2700i(X)
EC 700(X)

Measured value	Unit of measure
pH value	pH
Electrode voltage	mV
Electrode potential (ORP)	mV
rH value	rH
Glass impedance	Ohm
Reference impedance	Ohm
Temperature	°C
Temperature	°F
pH zero point	pH
pH slope	mV/pH

Calculation Block pH / pH

Measured value	Unit of measure
Delta pH value	pH
Delta ORP	mV
Delta temperature	°C

Process Variables (Fieldbus)

Process variables which can be assigned to Analog Input Blocks (AI):

Module Types O_2: O2 4700(X) O2 4700(X) ppb
O2 4700i(X) O2 4700i(X) ppb

Measured value	Unit of measure
Saturation (Air)	%
Saturation (O2)	%
Concentration	mg/l
Concentration	ppm
Volume concentration (GAS)	%
Volume concentration (GAS)	ppm
Sensor current	nA
Temperature	°C
Temperature	°F
Air pressure	mbar
DO partial pressure	mbar
Zero	nA
Slope	nA/mbar
Current input	mA

Calculation Block O_2 / O_2

Measured value	Unit of measure
Delta saturation (Air)	%
Delta saturation (O_2)	%
Delta temperature	°C
Delta O_2 concentration	mg/l
Delta O_2 concentration	ppm
Delta volume conc. (gas)	%
Delta volume conc. (gas)	ppm

Process Variables (Fieldbus)

Process variables which can be assigned to Analog Input Blocks (AI):

Module Types Cond: Cond 7700(X)

Measured value	Unit of measure
Conductivity	µS/cm
Resistivity	Ohm/cm
Concentration	%
Concentration	g/kg
Temperature	°C
Temperature	°F
cell constant	cm^{-1}
USP value	%

Calculation Block Cond / Cond

Measured value	Unit of measure
Delta conductivity	µS/cm
Delta resistivity	Ohm/cm
Delta temperature	°C
Ratio	
Passage	%
Rejection	%
Deviation	%
pH value	pH

Process Variables (Fieldbus)

Process variables which can be assigned to Analog Input Blocks (AI):

Module Types Cond Ind: Cond Ind 7700(X)

Measured value	Unit of measure
Conductivity	µS/cm
Resistivity	Ohm/cm
Concentration	%
Concentration	g/kg
Temperature	°C
Temperature	°F
Zero	S/cm
Cell factor	(value only)

Calculation Block Cond Ind / Cond Ind

Measured value	Unit of measure
Delta conductivity	µS/cm
Delta resistivity	Ohm/cm
Delta temperature	°C
Ratio	
Passage	%
Rejection	%
Deviation	%

Process Variables (Fieldbus)

Process variables which can be assigned to Analog Input Blocks (AI):

Module Types CO_2: CO_2 5700i

Measured value	Unit of measure
Saturation	%
Concentration	mg/l
Temperature	°C
Partial pressure	p'
Glass impedance	Mohm
Reference impedance	kohm
Temperature	°F
Zero	pH
Slope	mV/pH

Calculation Block pH / pH

Measured value	Unit of measure
Delta saturation	%
Delta concentration	mg/l
Delta temperature	°C

Index

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