



ETHERNET/MFC 010 Supplementary instructions

EtherNet/IP™ interface box in combination with
MFC 010

Description of EtherNet/IP™ interface box

Firmware version: V1.06-3

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1.1 Scope of the document

These instructions are supplementary to the signal converter handbook. For all other data, use the relevant chapters of the handbook. If you do not have this document, please contact the nearest office or download them from the internet site.

It is assumed that the reader of this document has got basic knowledge of common industrial protocol (CIP™) data model.

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CIP is a trademark of ODVA, Inc.

1.2 Getting started

The MFC 010 based mass flowmeter will be connected to EtherNet/IP™ networks through an external interface box. The integration, configuration and operation of this interface box is described in this document.

The purpose of this chapter is to give a short description on how to install the EtherNet/IP™ interface box and get it up and running, transferring data between the KROHNE MFC 010 and the EtherNet/IP™ network.



WARNING!

This is a class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.



Perform the following steps when installing the EtherNet/IP™ interface box:

- ① Mount the module (for details refer to *Mounting the EtherNet/IP™ interface box* on page 7).
- ② Connect the EtherNet/IP™ interface box to the industrial Ethernet network (for details refer to *External view of the device* on page 6).
- ③ Connect the power cable and apply power.
- ④ Access the configuration web pages.
 - Connect a PC to the Ethernet network and open a web browser. Enter the IP address of the EtherNet/IP™ interface box to access the configuration web pages. If the IP address of the EtherNet/IP™ interface box is unknown, use the Anybus IPconfig tool to find it.
 - Configure the TCP/IP settings (for details refer to *TCP/IP interface object (class F5h)* on page 19).
- ⑤ Configure the parameters of the device connection and connect the EtherNet/IP™ interface box to the device.

2.1 Technical data

Measuring system

Description	The EtherNet/IP™ interface box is used to provide a seamless connection between a mass flowmeter and an EtherNet/IP™ network. The EtherNet/IP™ interface box enables the scanner of the EtherNet/IP™ network to control the field device. No proprietary configuration software is needed. All necessary configuration can be made via the built-in web interface or engineering tool using the EDS.
Network settings	DHCP: On
	Hostname: <none>
	Port 1 Ethernet link speed: Auto
	Port 2 Ethernet link speed: Auto

Operating conditions

Temperature	Operating temperature: -20...+70°C / -4...+158°F
	Storage temperature: -20...+85°C / -4...+185°F
Relative humidity	The product is designed for a relative humidity of 5% to 95% non-condensing.

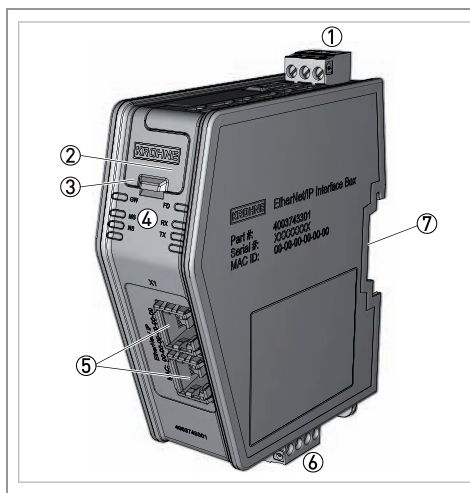
Installation conditions

Mounting	The EtherNet/IP™ interface box can be physically installed by mounting it onto a DIN rail.
Dimensions	L x w x h [mm]: 101 x 35 x 109.8 (without connector); L x w x h [inch]: 4 x 1.4 x 4.3 (without connector)
Weight	144 g / 0.3 lb (with connector)

Electrical connection

Supply voltage	The EtherNet/IP™ interface box requires a 24 V (-60%/+25%) DC power source.
Power consumption	The typical power consumption is 150 mA at 24 V.
Protective earth (PE) requirements	In order to achieve proper EMC behaviour, the product must be connected to protective earth (PE) via the DIN rail connector. If the DIN rail cannot be used, PE must be connected to the power connector. We cannot guarantee proper EMC behaviour unless these PE requirements are fulfilled. Note: According to the EtherNet/IP™ specification, the shield of each RJ-45 connector is not directly connected to PE. There shall however be a low impedance connection of infrastructure components, such as patch panels, to PE.

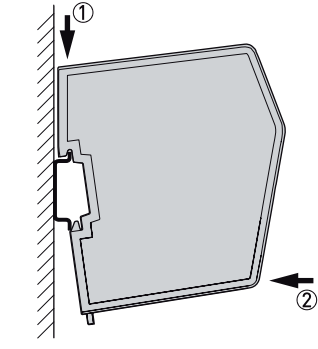
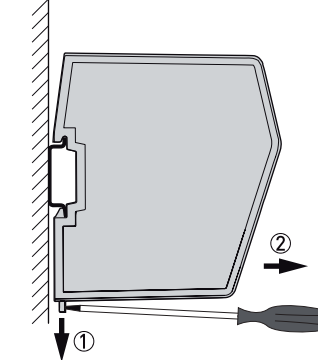
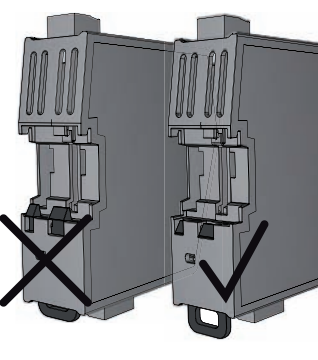
2.2 External view of the device



①	Power connector This connector is used to apply power to the EtherNet/IP™ interface box. It is also used to connect protective earth (PE) to the power connector.
②	USB port This port is intended for authorised service personnel use only.
③	Factory reset button This button can be used to perform a reset to factory settings.
④	Status LEDs
⑤	EtherNet/IP™ connectors 2-port switch with daisy chain functionality.
⑥	Modbus RTU connector
⑦	DIN rail connector The DIN rail mechanism fastens the EtherNet/IP™ interface box to a DIN rail and connects it to the protective earth (PE).

2.3 Mounting the EtherNet/IP™ interface box

The EtherNet/IP™ interface box can be physically installed by mounting it onto a DIN rail.

	DIN rail mounting Make sure the DIN rail fastening mechanism on the back of the module is in a fixed and closed position, i.e. pushed all the way up. To mount the module, first hook it on to the DIN rail (①), then push it against the DIN rail to make it snap on (②).
	DIN rail unmounting To unmount the module, a screwdriver is needed. Use the screwdriver to push the fastening bracket on the back of the module down until it locks in a fixed and open position (①). Then unhook the module from the DIN rail (②)
	Fixed and closed position Do not leave the module with the DIN rail fastening mechanism in a fixed and open position. This may eventually wear the fastening mechanism out so it cannot be used efficiently. Be sure to push the DIN rail fastening mechanism back into the fixed and closed position after unmounting the module.

2.4 Status LEDs

LED	Description	State	Status
GW	Gateway status	Off	Power off
		Green	Operational
		Flashing green	Standby/Configuring
		Red	Faulty: Fatal error
		Flashing red	Incorrect configuration
MS	Ethernet/IP™ module status	Off	Power off
		Green	Controlled by a scanner in run state
		Flashing green	Not configured or scanner in idle state
		Red	Major fault
		Flashing red	Recoverable fault
NS	Ethernet/IP™ network status	Off	Power off or no IP address
		Green	Online, connection established
		Flashing green	Online, no connection established
		Red	Duplicate IP address, fatal error
		Flashing red	Connections timed out
FD	Field device connection status	Off	Power off
		Green	Normal communication
		Flashing green	Start-up
		Red	Fatal error
		Flashing red	Wrong Modbus device
RX	Modbus RX	Yellow	Data received through serial line
TX	Modbus TX	Yellow	Data send through serial line

2.5 Field device connector

The connector used to connect to the field device is located at the bottom of the EtherNet/IP™ interface box.

Terminal	Description
PE	PE/shield
A	RS-485 A line (+)
B	RS-485 B line (-)
GND	RS-485 signal ground



DANGER!

- Proper grounding is mandatory for reliable operation of the device.
- Shield and signal ground shall not be interconnected.

2.6 Power connector

Terminal	Description
+	+24 VDC
-	Supply ground
Earth symbol	PE (protective earth)


DANGER!

MFC 010 power supply with 12 VDC is needed!


CAUTION!

The terminal tightening torque must be between 0.5...0.8 Nm / 5...7 lbs-in.

2.7 Ethernet connectors

The two standard Ethernet connectors (RJ45) are marked as "X1" and are located on the front of the EtherNet/IP™ interface box.


DANGER!

Properly shielded cables shall be used for reliable operation of the device.

	LED	Description
	1	Not connected
	2	Not connected
	3	Link/Activity LED (port 1)
	4	Link/Activity LED (port 2)

Link/Activity LED 3/4

LED state	Description
Off	No link, no activity
Green	Link (100 Mbit/s) established
Green, flickering	Activity (100 Mbit/s)
Yellow	Link (10 Mbit/s) established
Yellow, flickering	Activity (10 Mbit/s)

2.8 Factory reset button

The reset button is used to set the EtherNet/IP™ interface box back to factory settings.

In order to reset the EtherNet/IP™ interface box to factory defaults press the reset button for at least 5 seconds. The EtherNet/IP™ interface box will be reboot afterwards.

The status LEDs will be yellow as long as the reset button is pressed.

Factory settings

Interface settings for Modbus RTU

Modbus Slave Address	1
Baud rate	19200 kbit/s
Parity	Even
RS-485 terminaton	Active
RS-485 polarization	Active
Write timeout	500 ms
Disconnect timeout	500 ms

Network settings

DHCP	On
Hostname	<none>
Port 1 Ethernet link speed	Auto
Port 2 Ethernet link speed	Auto

User access settings

Web access password	0000
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3.1 Introduction

The EtherNet/IP™ interface box is used to provide a seamless connection between a mass flowmeter and an EtherNet/IP™ network. The EtherNet/IP™ interface box enables the scanner of the EtherNet/IP™ network to control the field device.

No proprietary configuration software is needed. All necessary configuration can be made via the built-in web interface or engineering tool using the EDS.

3.2 List of abbreviations

API	Actual packet interval
CIP™	Common industrial protocol
CoS	Change of state
DLR	Device level ring
EDS	Electronic data sheet
QoS	Quality of service

3.3 Features

The EtherNet/IP™ interface box supports the following features:

- 2 EtherNet/IP™ ports with
 - Support for Beacon-based DLR and linear network topology
 - Galvanically isolated bus electronics
 - 10/100 Mbit, full/half duplex operation
- Choice of two pre-defined sets of input data
- Modbus RTU port with configurable termination and polarisation
- Web server with field device specific user interface
 - Status information
 - Access to all parameters of the flowmeter
 - Calibration procedures
 - Settings page
 - Diagnostic information

3.4 Configure EtherNet/IP™

The EtherNet/IP™ interface box is an EtherNet/IP™ adapter (slave) on the EtherNet/IP™ network. The general settings for the adapter interface are configured using the configuration web pages (for details refer to *Features* on page 11).

We provide an EDS for interaction and configuration of the field device.

3.5 Communication with the field device

The EtherNet/IP™ interface box communicates via Modbus RTU Protocol with the attached field device.

The following parameters can be configured:

- Modbus slave address of the field device
- Baud rate
- Parity
- Termination and polarization
- Write timeout
- Disconnect time

After power up, the EtherNet/IP™ interface box tries to connect with the field device until the connection can be established. As long as no connection is established LED FD is flashing green. If a compatible field device is connected, LED FD will switch to green. Otherwise LED FD will be flashing red.

The EtherNet/IP™ interface box can be used with the following field devices:

- OPTIMASS 1010 C
- OPTIMASS 3010 C
- OPTIMASS 7010 C

If the connection is disturbed or interrupted longer than the specified disconnect time, the EtherNet/IP™ interface box will shut down the connection and try to reconnect.

When the baud rate, the parity or the Modbus slave address is changed and a device is connected, the change will be performed in the field device. Afterwards the connection will be re-established with the changed parameters.

This chapter specifies the CIP™ object implementation in the EtherNet/IP™ interface box.



INFORMATION!

Parameter changes will only become visible at the EtherNet/IP™ interface box after they were successfully written to the field device.

The following CIP™ objects are accessible through the EtherNet/IP™ interface box

Class	Object
01h	Identity Object
02h	Message Router Object
04h	Assembly Object
06h	Connection Manager Object
47h	Device Level Ring Object
48h	Quality of Services Object
F5h	TCP/IP Object
F6h	Ethernet Link Object
03A1h	Parameter group: Measurement
0300h	Parameter group: Process input
0310h	Parameter group: Filters and Offsets
0320h	Parameter group: Status Configuration
0330h	Parameter group: Process Control
0335h	Parameter group: Diagnosis
0340h	Parameter group: Flow Calibration Coefficients
0350h	Parameter group: Density
0360h	Parameter group: Concentration
0400h	Parameter group: Totalisers
0450h	Parameter group: Device
0451h	Parameter group: Advanced Service

Unconnected CIP™ routing is supported, which means that a message can be sent to a device without first setting up a connection.

4.1 Identity object (class 01h)

The following common services are implemented for the identity object.

Service Name / Description	Implemented for:	
	Class	Instance
Get_Attributes_All	Yes	Yes
Reset For instance 1 the reset types 0 and 1 will be supported. Type 0: 'Power Cycling Reset' This service emulates a power cycling of the module. Type 1: 'Default configuration reset' This service sets the default configuration and performs a reset.	No	Yes
Get_Attribute_Single	Yes	Yes
Set_Attribute_Single	No	Yes

The following class attributes are supported for the identity object.

Attribute ID	Access	Name	Data Type	Value
1	Get	Revision	UINT	1

The following instances are implemented for the identity object.

Instance	Revision Attribute
1	KROHNE EtherNet/IP interface

4.1.1 Instance 1

Instance 1 provides identity information about the EtherNet/IP™ interface box.

Attribute ID	Access	Name	Data Type	Value
1	Get	Vendor ID	UINT	1291
2	Get	Device Type	UINT	43
3	Get	Product Code	UINT	1000
4	Get	Revision	Struct of: {USINT, USINT}	1.2
5	Get	Status	WORD	Refer to following table.
6	Get	Serial Number	UDINT	Unique serial number
7	Get	Product Name	SHORT_STRING	"EtherNet/IP Mass Flow Meter"

Bit no.	Name
0	Module Owned
1	(reserved)
2	Configured (This bit shows if the product has other settings than the default configuration)
3	(reserved)
4...7	Extended Device Status: Value : Meaning 0000b Unknown 0010b Faulted I/O connection 0011b No I/O connection established 0100b Non-volatile configuration bad 0110b Connection in Run mode 0111b Connection in Idle mode (other) (reserved)
8	Set for minor recoverable faults
9	Set for minor unrecoverable faults
10	Set for major recoverable faults
11	Set for major unrecoverable faults
12...15	(reserved)

4.2 Assembly object (class 04h)

The assembly object uses static assemblies and holds the process data sent/received by the host application.

The following common services are implemented for the assembly object.

Service Name	Implemented for:	
	Class	Instance
Get_Attribute_Single	Yes	Yes
Set_Attribute_Single	No	Yes

The following class attributes are supported for the assembly object.

Attribute ID	Access	Name	Data Type	Value
1	Get	Revision	UINT	2
2	Get	Max Instance	UINT	(Highest instance number)

4.2.1 Instance 3 Attributes (Heartbeat, Input-only)

This instance is used as heartbeat for input-only connections.

Attribute ID	Access	Name	Data Type	Value
3	Set	Data	N/A	- (The data size of this attribute is zero)

4.2.2 Instance 4 Attributes (Heartbeat, Listen-only)

This instance is used as heartbeat for listen-only connections.

Attribute ID	Access	Name	Data Type	Value
3	Set	Data	N/A	- (The data size of this attribute is zero)

4.2.3 Instance 6 Attributes (Heartbeat, Input-only Extended)

This instance is used as heartbeat for input-only extended connections and does not carry any attributes. If the connection times out, the module does not switch to error state.

4.2.4 Instance 7 Attributes (Heartbeat, Listen-only Extended)

This instance is used as heartbeat for listen-only extended connections and does not carry any attributes.

4.2.5 Instance 100 (Input Assembly 1)

Attribute ID	Access	Name	Data Type	Value
3	Get	Produced data	Array of BYTE	For details refer to <i>Assembly objects (class 04h)</i> on page 47.

4.2.6 Instance 101 (Input Assembly 2)

Attribute ID	Access	Name	Data Type	Value
3	Get	Produced data	Array of BYTE	For details refer to <i>Assembly objects (class 04h)</i> on page 47.

4.2.7 Instance 110 (Configuration data)

Configuration data that is sent through the "Forward_Open"-service will be written to this instance.

Attribute ID	Access	Name	Data Type	Value
3	Get	Data	Array of BYTE	For details refer to <i>Assembly objects (class 04h)</i> on page 47.

The originator (e.g. Controller/PLC) initiates "Forward/Open" upon connection establishment and sends the configuration data to the EtherNet/IP™ interface box. The EtherNet/IP™ interface box checks, if the amount of configuration data and the parameters are valid. If an error occurs during these checks, the EtherNet/IP™ interface box rejects the connection. When the originator initiates "Forward/Open" on a connection without parameters (i.e. data length zero), the connection will always be accepted.

4.3 Connection manager (class 06h)

The following common services are implemented for the connection manager.

Service Name	Implemented for:	
	Class	Instance
Forward_Open	Yes	No
Forward_Close	No	No

No attributes are supported for the connection manager.

No instances are implemented for the connection manager.

4.4 DLR Object (class 47h)

The following common services are implemented for the DLR object.

Service Name	Implemented for:	
	Class	Instance
Get_Attributes_All	No	Yes
Set_Attribute_Single	Yes	Yes

The following class attributes are supported for the DLR object.

Attribute ID	Access	Name	Data Type	Value
1	Get	Revision	UINT	2

A single instance (instance 1) is supported.

Attribute ID	Access	Name	Data Type	Value
1	Get	Network Topology	USINT	0 = Linear 1 = Ring
2	Get	Network Status	USINT	0 = Normal 1 = Ring Fault 2 = Unexpected Loop Detect 3 = Partial Network Fault 4 = Rapid Fault/Restore Cycle
10	Get	Active Supervisor Address	Struct of: UDINT Array of 6 USINT	Ring supervisor
12	Get	Capability Flags	DWORD	0x00000002

4.5 QoS object (class 48h)

The following common services are implemented for the QoS object.

Service Name	Implemented for:	
	Class	Instance
Get_Attribute_Single	Yes	Yes
Set_Attribute_Single	No	Yes

The following class attributes are supported for the QoS object.

Attribute ID	Access	Name	Data Type	Value
1	Get	Revision	UINT	1

A single instance (instance 1) is supported.

Attribute ID	Access	Name	Data Type	Value
1	Set	802.1Q Tag Enable	USINT	0 = Disable (default) 1 = Enable
4	Set	DSCP Urgent	USINT	Default = 55
5	Set	DSCP Scheduled	USINT	Default = 47
6	Set	DSCP High	USINT	Default = 43
7	Set	DSCP Low	USINT	Default = 31
8	Set	DSCP Explicit	USINT	Default = 27

4.6 TCP/IP interface object (class F5h)

The following common services are implemented for the TCP/IP interface object.

Service Name	Implemented for:	
	Class	Instance
Get_Attribute_Single	Yes	Yes
Set_Attribute_Single	No	Yes
Get_And_Clear	No	Yes

The following class attributes are supported.

Attribute ID	Access	Name	Data Type	Value
1	Get	Revision	UINT	2

A single instance (instance 1) is supported.

Attribute ID	Access	Name	Data Type	Value
1	Get	Status	DWORD	
2	Get	Configuration Capability	DWORD	0000 0086h - or - 0000 0096h - or - 0000 00A6h - or - 0000 00B6h
3	Get/Set	Configuration Control	DWORD	0 = Configuration from NVS 2 = Configuration from DHCP
4	Get	Physical Link Object	Struct of: UINT Padded EPATH	2 words 20 F6 24 01 (Enet Link Object instance 1)
5	Get/Set	Interface Configuration	Struct of: UDINT UDINT UDINT UDINT UDINT STRING	IP Address Network Mask Gateway Address Primary DNS Secondary DNS Default Domain Name for not fully qualified host names
6	Get/Set	Host Name	STRING	Host name when using DHCP
8	Get/Set	TTL Value	USINT	Time to Live value for EtherNet/IP multicast packets
9	Get/Set	Multicast Config	Struct of: USINT USINT UINT UDINT	Allocation Control Reserved Number of multicast addresses to allocate (1-4) Multicast starting address

Attribute ID	Access	Name	Data Type	Value
10	Get/Set	Select Acd	BOOL	Activates the use of ACD
11	Set	Last Conflict Detected	Struct of: USINT USINT[6] USINT[28]	Acid Activity Remote MACArpPdu

4.7 Ethernet link object (class F6h)

The following common services are implemented for the Ethernet link object.

Service Name	Implemented for:	
	Class	Instance
Get_Attribute_Single	Yes	Yes
Get_Attribute_All	Yes	Yes
Set_Attribute_Single	No	Yes
Get_And_Clear	No	Yes

The following class attributes are supported.

Attribute ID	Access	Name	Data Type	Value
1	Get	Revision	UINT	3
2	Get	Max Instance	UINT	3
3	Get	Number of Instances	UINT	3

The following common services are implemented for the Ethernet link object.

Attribute ID	Access	Name	Data Type	Value
1	Get	Interface Speed	UDINT	10 or 100 Mbit/s
2	Get	Interface Flags	DWORD	Refer to ENet/IP Spec.
3	Get	Physical Address	ARRAY of 6 USINTs	MAC Address
4	Get	Interface Counters	Struct of: UDINT UDINT UDINT UDINT UDINT UDINT UDINT UDINT UDINT UDINT UDINT UDINT	In Octets In Ucast packets In NUCast packets In Discards In Errors In Unknown Protos Out Octets Out Ucast packets Out NUCast packets Out Discards Out Errors

Attribute ID	Access	Name	Data Type	Value
5	Get	Media Counters	Struct of: UDINT UDINT UDINT UDINT UDINT UDINT UDINT UDINT UDINT UDINT UDINT	Alignment Errors FCS Errors Single Collisions SQE Test Errors Deferred Transmits Late Collisions Excessive Collisions MAC Transmit Errors Carrier Sense Errors Frame Too Long MAC Receive Errors
6	Get/Set	Interface Control	Struct of: WORD UINT	Control Bits Forced Interface Speed
7	Get	Interface Type	USINT	-
8	Get	Interface State	USINT	Current state of the interface: operational, disabled, etc. Refer to section 5-4.3.2.8 of CIP Spec., volume 2
9	St	Admin State	USINT	Administrative State: 1: Enable interface 2: Disable interface Refer to section 5-4.3.2.9 of CIP Spec., volume 2
10	Get	Interface Label	SHORT_STRING	Instance 1: Port1 Instance 2: Port2

4.8 Parameter objects

CIP class	Group name
03A1h	Parameter group: Measurement
0300h	Parameter group: Process input
0310h	Parameter group: Filters and Offsets
0320h	Parameter group: Status Configuration
0330h	Parameter group: Process Control
0335h	Parameter group: Diagnosis
0340h	Parameter group: Flow Calibration Coefficients
0350h	Parameter group: Density
0360h	Parameter group: Concentration
0400h	Parameter group: Totalisers
0450h	Parameter group: Device
0451h	Parameter group: Advanced Service

These objects grant access to the values of the parameter in the defined parameter groups.

The following common services are implemented for these objects.

Service Name	Implemented for:	
	Class	Instance
Get_Attribute_All	No	Yes
Set_Attributes_All	No	Yes
Get_Attribute_Single	Yes	Yes
Set_Attribute_Single	No	Yes

The following class attributes are supported for these objects.

Attribute ID	Access	Name	Data Type	Value
1	Get	Revision	UINT	1
2	Get	Max Instance	UINT	
3	Get	Number of instances	UINT	

Any write service to the EtherNet/IP™ interface box will be checked for write access, validity and plausibility. Parameter changes in the EtherNet/IP™ interface box are stored non-volatile directly after change of parameter "Inconsistent CIP Data" (pending changes) value from 1 to 0 (Class 0321h, Instance 1, Attribute 1).

The parameter list contains the following information:

Name	Name of the parameter
Group	Name of the parameter group in which the parameter is listed
Class	Class for CIP access to the value of this parameter
Instance	Instance for CIP access to the value of this parameter
Attribute	Attribute for CIP access to the value of this parameter
Protection level	Information about the access rights RO – Read only parameter CT – Parameter is read only, when custody transfer mode is active Service – Parameter can be written in service mode only

4.9 Parameter group "Measurement" (class 03A1h)

Name	Instance	Attribute	Protection Level	Name	Instance	Attribute	Protection Level
Mass Flow	1	1	R0	Concentration 1 Mass Total	14	1	R0
Unit: Mass Flow	1	2	R0	Unit: Concentration 1 Mass Total	14	2	R0
Status: Mass Flow	1	3	R0	Status: Concentration 1 Mass Total	14	3	R0
Density	2	1	R0	Concentration 1 Volume Total	15	1	R0
Unit: Density	2	2	R0	Unit: Concentration 1 Volume Total	15	2	R0
Status: Density	2	3	R0	Status: Concentration 1 Volume Total	15	3	R0
Temperature	3	1	R0	Concentration 2 Mass Total	16	1	R0
Unit: Temperature	3	2	R0	Unit: Concentration 2 Mass Total	16	2	R0
Status: Temperature	3	3	R0	Status: Concentration 2 Mass Total	16	3	R0
Volume Flow	4	1	R0	Concentration 2 Volume Total	17	1	R0
Unit: Volume Flow	4	2	R0	Unit: Concentration 2 Volume Total	17	2	R0
Status: Volume Flow	4	3	R0	Status: Concentration 2 Volume Total	17	3	R0
Concentration 1 Mass Flow	5	1	R0	Additional Mass Total	18	1	R0
Unit: Concentration 1 Mass Flow	5	2	R0	Unit: Additional Mass Total	18	2	R0
Status: Concentration 1 Mass Flow	5	3	R0	Status: Additional Mass Total	18	3	R0
Concentration 1 Volume Flow	6	1	R0	Additional Volume Total	19	1	R0
Unit: Concentration 1 Volume Flow	6	2	R0	Unit: Additional Volume Total	19	2	R0
Status: Concentration 1 Volume Flow	6	3	R0	Status: Additional Volume Total	19	3	R0
Concentration 2 Mass Flow	7	1	R0	Tube Frequency	20	1	R0
Unit: Concentration 2 Mass Flow	7	2	R0	Unit: Tube Frequency	20	2	R0
Status: Concentration 2 Mass Flow	7	3	R0	Status: Tube Frequency	20	3	R0
Concentration 2 Volume Flow	8	1	R0	Measuring Tube Strain	21	1	R0
Unit: Concentration 2 Volume Flow	8	2	R0	Unit: Measuring Tube Strain	21	2	R0
Status: Concentration 2 Volume Flow	8	3	R0	Status: Measuring Tube Strain	21	3	R0
Concentration 1	9	1	R0	Inner Cylinder Strain	22	1	R0
Unit: Concentration 1	9	2	R0	Unit: Inner Cylinder Strain	22	2	R0
Status: Concentration 1	9	3	R0	Status: Inner Cylinder Strain	22	3	R0
Concentration 2	10	1	R0	Sensor A Level	23	1	R0
Unit: Concentration 2	10	2	R0	Unit: Sensor A Level	23	2	R0
Status: Concentration 2	10	3	R0	Status: Sensor A Level	23	3	R0
Velocity	11	1	R0	Sensor B Level	24	1	R0
Unit: Velocity	11	2	R0	Unit: Sensor B Level	24	2	R0
Status: Velocity	11	3	R0	Status: Sensor B Level	24	3	R0
Mass Total	12	1	R0	Drive Level	25	1	R0
Unit: Mass Total	12	2	R0	Unit: Drive Level	25	2	R0
Status: Mass Total	12	3	R0	Status: Drive Level	25	3	R0
Volume Total	13	1	R0				
Unit: Volume Total	13	2	R0				
Status: Volume Total	13	3	R0				

Each instance represents one measurement and contains the measurements value, unit and status.

Meaning of the status bits

- Bit 0: Reserved
- Bit 1: Parameter is active (1) or inactive (0)
- Bit 2 - 5: Reserved
- Bit 6-7: Process data status
 - 11 – Good
 - 01 – Uncertain (Connection to the field device faulty)
 - 10 – reserved
 - 00 – Bad (Connection to field device lost)

4.9.1 Parameter "Mass Flow"

To change unit of "Mass Flow" edit parameter "Mass Flow Unit" (Class 0450h, Instance 1, Attribute 13).

Engineering units according to CIP™ specification:

UnitCode	Name	Symbol
1404h	kilogram per second	kg/s
140Bh	pound per second	lb/s
140Ch	pound per minute	lb/min
140Dh	pound per hour	lb/h
140Eh	milligrams per minute	mg/min
140Fh	grams per minute	g/min
1410h	kilograms per hour	kg/h

4.9.2 Parameter "Density"

To change unit of "Density" edit parameter "Density Unit" (Class 0450h, Instance 1, Attribute 14).

Engineering units according to CIP™ specification:

UnitCode	Name	Symbol
2F07h	kilograms per cubic meter	kg/m ³
2F08h	grams per cubic centimeter	g/cm ³
2F0Bh	pounds per gallon	lb/gal
2F0Ch	pounds per cubic foot	lb/ft ³
2F0Dh	pounds per cubic inch	lb/in ³
2F0Eh	grams per milliliter	g/mL
2F0Fh	grams per liter	g/L
2F10h	kilograms per liter	kg/L
2F11h	micrograms per liter	μg/L
2F12h	micrograms per cubic meter	μg/m ³

4.9.3 Parameter "Temperature"

To change unit of "Temperature" edit parameter "Temperature Unit" (Class 0450h, Instance 1, Attribute 15).

Engineering units according to CIP™ specification:

UnitCode	Name	Symbol
1200h	degree Celcius	°C
1201h	degree Fahrenheit	°F
1202h	kelvin	K
1203h	degree Rankine	°R
1204h	decidegree Celcius	°C/10
1205h	decidegree Fahrenheit	°F/10
1206h	decikelvin	K/10
1207h	decidegree Rankine	°R/10

4.9.4 Parameter "Volume Flow"

To change unit of "Volume Flow" edit parameter "Volume Flow Unit" (Class 0450h, Instance 1, Attribute 16).

Engineering units according to CIP™ specification:

UnitCode	Name	Symbol
1402h	cubic foot per minute	ft ³ /min
1405h	cubic meter per second	m ³ /s
1406h	liter per second	L/s
1407h	milliliter per second	mL/s
1408h	gallon per second	gal/s
1409h	gallon per minute	gal/min
140Ah	gallon per hour	gal/h
1411h	milliliter per minute	mL/m
1412h	milliliter per hour	mL/h
1413h	liter per minute	L/m
1414h	liter per hour	L/h

4.9.5 Parameter "Concentration 1 Mass Flow"

To change unit of "Concentration 1 Mass Flow" edit parameter "Concentration 1 Mass Flow Unit" (Class 0450h, Instance 1, Attribute 17).

Engineering units according to CIP™ specification:

UnitCode	Name	Symbol
1404h	kilogram per second	kg/s
140Bh	pound per second	lb/s
140Ch	pound per minute	lb/min
140Dh	pound per hour	lb/h
140Eh	milligrams per minute	mg/min
140Fh	grams per minute	g/min
1410h	kilograms per hour	kg/h

The corresponding status flag of the measurement status indicates if the concentration measurement option is activated.

Concentration measurement option is active, if "Concentration 1 Function" is not one of 0 (De-activated), 1 (Off) or 8 (% Volume).

4.9.6 Parameter "Concentration 1 Volume Flow"

To change unit of "Concentration 1 Volume Flow" edit parameter "Concentration 1 Volume Flow Unit" (Class 0450h, Instance 1, Attribute 18).

Engineering units according to CIP™ specification:

UnitCode	Name	Symbol
1402h	cubic foot per minute	ft ³ /min
1405h	cubic meter per second	m ³ /s
1406h	liter per second	L/s
1407h	milliliter per second	mL/s
1408h	gallon per second	gal/s
1409h	gallon per minute	gal/min
140Ah	gallon per hour	gal/h
1411h	milliliter per minute	mL/m
1412h	milliliter per hour	mL/h
1413h	liter per minute	L/m
1414h	liter per hour	L/h

The corresponding status flag of the measurement status indicates if the concentration measurement option is activated.

Concentration measurement option is active, if "Concentration 1 Function" is 8 [% Volume].

4.9.7 Parameter "Concentration 2 Mass Flow"

To change unit of "Concentration 2 Mass Flow" edit parameter "Concentration 2 Mass Flow Unit" (Class 0450h, Instance 1, Attribute 19).

Engineering units according to CIP™ specification:

UnitCode	Name	Symbol
1404h	kilogram per second	kg/s
140Bh	pound per second	lb/s
140Ch	pound per minute	lb/min
140Dh	pound per hour	lb/h
140Eh	milligrams per minute	mg/min
140Fh	grams per minute	g/min
1410h	kilograms per hour	kg/h

The corresponding status flag of the measurement status indicates if the concentration measurement option is activated.

Concentration measurement option is active, if "Concentration 2 Function" is not one of 0 (De-activated), 1 (Off) or 8 [% Volume].

4.9.8 Parameter "Concentration 2 Volume Flow"

To change unit of "Concentration 2 Volume Flow" edit parameter "Concentration 2 Volume Flow Unit" (Class 0450h, Instance 1, Attribute 20).

Engineering units according to CIP™ specification:

UnitCode	Name	Symbol
1402h	cubic foot per minute	ft ³ /min
1405h	cubic meter per second	m ³ /s
1406h	liter per second	L/s
1407h	milliliter per second	mL/s
1408h	gallon per second	gal/s
1409h	gallon per minute	gal/min
140Ah	gallon per hour	gal/h
1411h	milliliter per minute	mL/m
1412h	milliliter per hour	mL/h
1413h	liter per minute	L/m
1414h	liter per hour	L/h

The corresponding status flag of the measurement status indicates if the concentration measurement option is activated.

Concentration measurement option is active, if "Concentration 2 Function" is 8 (% Volume).

4.9.9 Parameter "Concentration 1"

The unit of measurement depends on parameter "Concentration 1 Function" (Class 0360h, Instance 1, Attribute 3).

Engineering units according to CIP™ specification:

UnitCode	Name	Symbol
0F02h	°Brix	°Brix
0F03h	% Mass	% Mass
0F04h	°Baumé 144.3	°Baumé 144.3
0F05h	°Baumé 145.0	°Baumé 145.0
0F06h	% NaOH	% NaOH
0F07h	°Plato	°Plato
0F08h	% Volume	% Volume
0F09h	°API	°API

The corresponding status flag of the measurement status indicates if the concentration measurement option is activated.

Concentration measurement option is active, if "Concentration 1 Function" is not one of 0 (De-activated) or 1 (Off).

4.9.10 Parameter "Concentration 2"

The unit of measurement depends on parameter "Concentration 2 Function" (Class 0360h, Instance 1, Attribute 6).

Engineering units according to CIP™ specification:

UnitCode	Name	Symbol
0F02h	°Brix	°Brix
0F03h	% Mass	% Mass
0F04h	°Baumé 144.3	°Baumé 144.3
0F05h	°Baumé 145.0	°Baumé 145.0
0F06h	% NaOH	% NaOH
0F07h	°Plato	°Plato
0F08h	% Volume	% Volume
0F09h	°API	°API

The corresponding status flag of the measurement status indicates if the concentration measurement option is activated.

Concentration measurement option is active, if "Concentration 2 Function" is not one of 0 (De-activated) or 1 (Off).

4.9.11 Parameter "Velocity"

To change unit of "Velocity" edit parameter "Velocity Unit" (Class 0450h, Instance 1, Attribute 23).

Engineering units according to CIP™ specification:

UnitCode	Name	Symbol
2B00h	meter per second	m/s
2B01h	centimeter per second	cm/s
2B02h	kilometer per hour	km/h
2B03h	speed of light (in vacuum)	c
2B04h	mile per hour	mi/h
2B05h	knot (nautical mile per hour)	knot
2B06h	foot per second	ft/s
2B07h	inch per second	in/s

4.9.12 Parameter "Mass Total"

To change unit of "Mass Total" edit parameter "Mass Total Unit" (Class 0450h, Instance 1, Attribute 24).

Engineering units according to CIP™ specification:

UnitCode	Name	Symbol
2500h	kilogram	kg
2501h	gram	g
2502h	milligram	mg
2503h	metric ton (megagram)	t
2504h	ounce (avoirdupois)	oz
2505h	pound (avoirdupois)	lb
2506h	short ton (2000 lb)	Ston

4.9.13 Parameter "Volume Total"

To change unit of "Volume Total" edit parameter "Volume Total Unit" (Class 0450h, Instance 1, Attribute 25).

Engineering units according to CIP™ specification:

UnitCode	Name	Symbol
2E00h	cubic meter	m ³
2E01h	liter	L
2E02h	milliliter	mL
2E03h	kiloliter	kL
2E04h	cubic yard	yd ³
2E05h	cubic foot	ft ³
2E06h	cubic inch	in ³
2E07h	gallon (U.S.)	gal
2E08h	quart (U.S. liquid)	quart
2E09h	pint (U.S. liquid)	pt
2E0Ah	ounce (U.S. fluid)	fl oz
2E0Bh	barrel (U.S.)	bbl

4.9.14 Parameter "Concentration 1 Mass Total"

To change unit of "Concentration 1 Mass Total" edit parameter "Concentration 1 Mass Total Unit" (Class 0450h, Instance 1, Attribute 26).

Engineering units according to CIP™ specification:

UnitCode	Name	Symbol
2500h	kilogram	kg
2501h	gram	g
2502h	milligram	mg
2503h	metric ton (megagram)	t
2504h	ounce (avoirdupois)	oz
2505h	pound (avoirdupois)	lb
2506h	short ton (2000 lb)	Ston

The corresponding status flag of the measurement status indicates if the concentration measurement option is activated.

Concentration measurement option is active, if "Concentration 1 Function" is not one of 0 (De-activated), 1 (Off) or 8 (% Volume).

4.9.15 Parameter "Concentration 1 Volume Total"

To change unit of "Concentration 1 Volume Total" edit parameter "Concentration 1 Volume Total Unit" (Class 0450h, Instance 1, Attribute 27).

Engineering units according to CIP™ specification:

UnitCode	Name	Symbol
2E00h	cubic meter	m ³
2E01h	liter	L
2E02h	milliliter	mL
2E03h	kiloliter	kL
2E04h	cubic yard	yd ³
2E05h	cubic foot	ft ³
2E06h	cubic inch	in ³
2E07h	gallon (U.S.)	gal
2E08h	quart (U.S. liquid)	quart
2E09h	pint (U.S. liquid)	pt
2E0Ah	ounce (U.S. fluid)	fl oz
2E0Bh	barrel (U.S.)	bbl

The corresponding status flag of the measurement status indicates if the concentration measurement option is activated.

Concentration measurement option is active, if "Concentration 1 Function" is 8 (% Volume).

4.9.16 Parameter "Concentration 2 Mass Total"

To change unit of "Concentration 2 Mass Total" edit parameter "Concentration 2 Mass Total Unit" (Class 0450h, Instance 1, Attribute 28).

Engineering units according to CIP™ specification:

UnitCode	Name	Symbol
2500h	kilogram	kg
2501h	gram	g
2502h	milligram	mg
2503h	metric ton (megagram)	t
2504h	ounce (avoirdupois)	oz
2505h	pound (avoirdupois)	lb
2506h	short ton (2000 lb)	Ston

The corresponding status flag of the measurement status indicates if the concentration measurement option is activated..

Concentration measurement option is active, if "Concentration 2 Function" is not one of 0 (De-activated), 1 (Off) or 8 (% Volume).

4.9.17 Parameter "Concentration 2 Volume Total"

To change unit of "Concentration 2 Volume Total" edit parameter "Concentration 2 Volume Total Unit" (Class 0450h, Instance 1, Attribute 29).

Engineering units according to CIP™ specification:

UnitCode	Name	Symbol
2E00h	cubic meter	m ³
2E01h	liter	L
2E02h	milliliter	mL
2E03h	kiloliter	kL
2E04h	cubic yard	yd ³
2E05h	cubic foot	ft ³
2E06h	cubic inch	in ³
2E07h	gallon (U.S.)	gal
2E08h	quart (U.S. liquid)	quart
2E09h	pint (U.S. liquid)	pt
2E0Ah	ounce (U.S. fluid)	fl oz
2E0Bh	barrel (U.S.)	bbl

The corresponding status flag of the measurement status indicates if the concentration measurement option is activated.

Concentration measurement option is active, if "Concentration 2 Function" is 8 (% Volume).

4.9.18 Parameter "Additional Mass Total"

To change unit of "Additional Mass Total" edit parameter "Additional Mass Total Unit" (Class 0450h, Instance 1, Attribute 30).

Engineering units according to CIP™ specification:

UnitCode	Name	Symbol
2500h	kilogram	kg
2501h	gram	g
2502h	milligram	mg
2503h	metric ton (megagram)	t
2504h	ounce (avoirdupois)	oz
2505h	pound (avoirdupois)	lb
2506h	short ton (2000 lb)	Ston

The corresponding status flag of the measurement status indicates if the concentration measurement option is activated.

Concentration measurement option is active, if "Additional Totaliser Source" is 1 (Mass Total)

or

"Additional Totaliser Source" is 3 (Concentration 1 Total) and "Concentration 1 Function" is not one of 0 (De-activated), 1 (Off) or 8 (% Volume)

or

"Additional Totaliser Source" is 4 (Concentration 2 Total) and "Concentration 2 Function" is not one of 0 (De-activated), 1 (Off) or 8 (% Volume).

4.9.19 Parameter "Additional Volume Total"

To change unit of "Additional Volume Total" edit parameter "Additional Volume Total Unit" (Class 0450h, Instance 1, Attribute 31).

Engineering units according to CIP™ specification:

UnitCode	Name	Symbol
2E00h	cubic meter	m ³
2E01h	liter	L
2E02h	milliliter	mL
2E03h	kiloliter	kL
2E04h	cubic yard	yd ³
2E05h	cubic foot	ft ³
2E06h	cubic inch	in ³
2E07h	gallon (U.S.)	gal
2E08h	quart (U.S. liquid)	quart
2E09h	pint (U.S. liquid)	pt
2E0Ah	ounce (U.S. fluid)	fl oz
2E0Bh	barrel (U.S.)	bbl

The corresponding status flag of the measurement status indicates if the concentration measurement option is activated.

Concentration measurement option is active, if "Additional Totaliser Source" is 2 (Volume Total)

or

"Additional Totaliser Source" is 3 (Concentration 1 Total) and "Concentration 1 Function" is 8 (% Volume)

or

"Additional Totaliser Source" is 4 (Concentration 2 Total) and "Concentration 2 Function" is 8 (% Volume).

4.9.20 Parameter "Tube Frequency"

To change unit of "Tube Frequency" edit parameter "Tube Frequency Unit" (Class 0450h, Instance 1, Attribute 32).

Engineering units according to CIP™ specification:

UnitCode	Name	Symbol
1F00h	Hertz	Hz
1F01h	kilohertz	kHz
1F02h	megahertz	MHz
1F03h	gigahertz	GHz

4.9.21 Parameter "Measuring Tube Strain"

To change unit of "Measuring Tube Strain" edit parameter "Measuring Tube Strain Unit" (Class 0450h, Instance 1, Attribute 33).

Engineering units according to CIP™ specification:

UnitCode	Name	Symbol
2800h	ohm	Ω
2801h	milliohm	m Ω
2802h	microohm	$\mu\Omega$
2803h	nanoohm	n Ω
2804h	picoohm	p Ω
2805h	femtoohm	f Ω
2806h	kiloohm	k Ω
2807h	megaohm	M Ω
2808h	gigaohm	G Ω

4.9.22 Parameter "Inner Cylinder Strain"

To change unit of "Inner Cylinder Strain" edit parameter "Inner Cylinder Strain Unit" (Class 0450h, Instance 1, Attribute 34).

Engineering units according to CIP™ specification:

UnitCode	Name	Symbol
2800h	ohm	Ω
2801h	milliohm	m Ω
2802h	microohm	$\mu\Omega$
2803h	nanoohm	n Ω
2804h	picoohm	p Ω
2805h	femtoohm	f Ω
2806h	kiloohm	k Ω
2807h	megaohm	M Ω
2808h	gigaohm	G Ω

4.9.23 Parameter "Sensor Level A"

To change unit of "Sensor Level A" edit parameter "Sensor Level A Unit" (Class 0450h, Instance 1, Attribute 35).

Engineering units according to CIP™ specification:

UnitCode	Name	Symbol
1007h	Percent	%

4.9.24 Parameter "Sensor Level B"

To change unit of "Sensor Level B" edit parameter "Sensor Level B Unit" (Class 0450h, Instance 1, Attribute 36).

Engineering units according to CIP™ specification:

UnitCode	Name	Symbol
1007h	Percent	%

4.9.25 Parameter "Drive Level"

To change unit of "Drive Level" edit parameter "Drive Level Unit" (Class 0450h, Instance 1, Attribute 37).

Engineering units according to CIP™ specification:

UnitCode	Name	Symbol
1007h	Percent	%

4.10 Parameter group "Process Input" (class 0300h)

Name	Instance	Attribute	Protection Level
Begin Zero Calibration	1	1	-
Mass Flow Zero Calibration Status	1	2	R0
Zero Calibration Percent	1	3	R0
Temperature During Last Zero Calibration	1	4	R0
Sensor Type	1	5	service, CT
Sensor Size	1	6	service
Sensor Material	1	7	service
Tube Amplitude	1	8	service
Meter Correction	1	9	CT
Pipe Diameter	1	10	-
User Flow Offset	1	11	CT
Maximum Sensor Temperature Specification	1	12	service
Minimum Sensor Temperature Specification	1	13	service

4.11 Parameter group "Filters and Offsets" (class 0310h)

Name	Instance	Attribute	Protection Level
Measurement Time Constant	1	1	-
Pressure Suppression Duration	1	2	-
Pressure Suppression Cut-off	1	3	-
Flow Direction	1	4	CT
Low Flow Threshold	1	5	CT
Flow Mode	1	6	CT

4.12 Parameter group "Status Configuration" (class 0320h)

Name	Instance	Attribute	Protection Level
Reset Errors	1	1	-
Reset Warnings	1	2	-
System Error Flag	1	3	R0
Process Warning Flag	1	4	R0
System Error Flags	1	5	R0
Process Warning Flags	1	6	R0
Stored System Error Flags	1	7	R0
Stored Process Warning Flags	1	8	R0
System State	1	9	R0
Gateway Status	1	10	R0
EtherNet/IP Module Status	1	11	R0
EtherNet/IP Network Status	1	12	R0
Modbus Status	1	13	R0

The parameter "Gateway Status" (Class 0320h, Instance 1, Attribute 10) represents the status of LED GW.

Value	LED state
0	Off
1	Red
2	Flashing red
3	Green
4	Flashing green

The parameter "EtherNet/IP Module Status" (Class 0320h, Instance 1, Attribute 11) represents the status of LED MS.

Value	LED state
0	Off
1	Red
2	Flashing red
3	Green
4	Flashing green

The parameter "EtherNet/IP Network Status" (Class 320h, Instance 1, Attribute 12) represents the status of LED NS.

Value	LED state
0	Off
1	Red
2	Flashing red
3	Green
4	Flashing green

The parameter "Modbus Status" (Class 0320h, Instance 1, Attribute 13) represents the status of the LED FD.

Value	LED state
0	Off
1	Red
2	Flashing Red
3	Green
4	Flashing Green

4.13 Parameter group "Process Control" (class 0330h)

Name	Instance	Attribute	Protection Level
Process Control Status	1	1	R0
Internal Process Control Function	1	2	CT
Internal Process Control Condition	1	3	CT
Internal Process Control Maximum Limit	1	4	-
Internal Process Control Minimum Limit	1	5	-

4.14 Parameter group "Diagnosis" (class 0335h)

Name	Instance	Attribute	Protection Level
Maximum Instrument Temperature	1	1	R0
Minimum Instrument Temperature	1	2	R0
2 Phase Warning Level	1	3	service
2 Phase Signal	1	4	R0

4.15 Parameter group "Flow Calibration Coefficients" (class 0340h)

Name	Instance	Attribute	Protection Level
CF1	1	1	service, CT
CF2	1	2	service, CT
CF3	1	3	service, CT
CF4	1	4	service, CT
CF5	1	5	service, CT
CF6	1	6	service, CT
CF7	1	7	service, CT
CF8	1	8	service, CT
CF9	1	9	R0
CF10	1	10	R0
CF11	1	11	service, CT
CF12	1	12	service, CT
CF13	1	13	service, CT
CF14	1	14	service, CT
CF15	1	15	service, CT
CF16	1	16	service, CT
CF17	1	17	service, CT
CF18	1	18	service, CT
CF19	1	19	service, CT
CF20	1	20	service, CT
CF21	1	21	service, CT
CF22	1	22	service, CT
CF23	1	23	service, CT
CF24	1	24	service, CT
CF25	1	25	service, CT
CF26	1	26	service, CT
CF27	1	27	service, CT

4.16 Parameter group "Density" (class 0350h)

Name	Instance	Attribute	Protection Level
Initiate Single Point Density Calibration	1	1	CT
Initiate Two Point Density Calibration	1	2	CT
Continue Two Point Density Calibration	1	3	CT
Reset to Factory Density Calibration	1	4	CT
Density Calibration Status	1	5	R0
DCF1	1	6	R0
DCF2	1	7	R0
DCF3	1	8	R0
DCF4	1	9	R0
DCF5	1	10	R0
DCF6	1	11	R0
DCF7	1	12	R0
DCF8	1	13	R0
Density Mode	1	14	CT
Density Calibration Product Type	1	15	-
Referred Density Reference Temperature	1	16	-
Fixed Density Value	1	17	-
Referred Density Slope	1	18	-
Calibration Density	1	19	-
Density Averaging	1	20	Service

4.17 Parameter group "Concentration" (class 0360h)

Name	Instance	Attribute	Protection Level
Enable Concentration Calculation	1	1	-
Concentration Type	1	2	-
Concentration 1 Function	1	3	-
Concentration 1 Product	1	4	-
Concentration 1 Offset	1	5	-
Concentration 2 Function	1	6	-
Concentration 2 Product	1	7	-
Concentration 2 Offset	1	8	-
Concentration Coefficient 2	1	9	-
Concentration Coefficient 3	1	10	-
Concentration Coefficient 4	1	11	-
Concentration Coefficient 5	1	12	-

Name	Instance	Attribute	Protection Level
Concentration Coefficient 6	1	13	-
Concentration Coefficient 7	1	14	-
Concentration Coefficient 8	1	15	-
Concentration Coefficient 9	1	16	-
Concentration Coefficient 10	1	17	-
Concentration Coefficient 11	1	18	-
Concentration Coefficient 12	1	19	-

4.18 Parameter group "Totalisers" (class 0400h)

Name	Instance	Attribute	Protection Level
Reset Totalisers	1	1	CT
Reset Additional Totaliser	1	2	-
Additional Totaliser Source	1	3	-

4.19 Parameter group "Device" (class 0450h)

Name	Instance	Attribute	Protection Level
Save Changes to EEPROM	1	1	-
Request STANDBY Mode	1	2	CT
Request STOP Mode	1	3	CT
Request MEASURE Mode	1	4	-
Discard Previous Write Operations	1	5	-
Basic Access State	1	6	R0
Service Access State	1	7	R0
Custody Transfer Mode State	1	8	R0
Parameters Changed in Field Device, Awaiting 'Save Changes to EEPROM'	1	9	R0
Basic Access Password	1	10	-
Service Access Password	1	11	-
Custody Transfer Mode Password	1	12	-
Mass Flow Unit	1	13	-
Density Unit	1	14	-
Temperature Unit	1	15	-
Volume Flow Unit	1	16	-
Concentration 1 Mass Flow Unit	1	17	-

Name	Instance	Attribute	Protection Level
Concentration 1 Volume Flow Unit	1	18	-
Concentration 2 Mass Flow Unit	1	19	-
Concentration 2 Volume Flow Unit	1	20	-
Concentration 1 Unit	1	21	R0
Concentration 2 Unit	1	22	R0
Velocity Unit	1	23	-
Mass Total Unit	1	24	-
Volume Total Unit	1	25	-
Concentration 1 Mass Total Unit	1	26	-
Concentration 1 Volume Total Unit	1	27	-
Concentration 2 Mass Total Unit	1	28	-
Concentration 2 Volume Total Unit	1	29	-
Additional Mass Total Unit	1	30	-
Additional Volume Total Unit	1	31	-
Tube Frequency Unit	1	32	-
Measuring Tube Strain Unit	1	33	-
Inner Cylinder Strain Unit	1	34	-
Sensor A Level Unit	1	35	R0
Sensor B Level Unit	1	36	R0
Drive Level Unit	1	37	R0
Year of Manufacture	1	38	service
MFC010 Serial Number	1	39	service, CT
System Serial Number	1	40	service, CT
Meter Serial Number	1	41	service, CT
Save Changes to EEPROM with Mass Total	1	42	-
Save Changes to EEPROM with Volume Total	1	43	-
Device Tag	1	44	-

The parameters “...” set the engineering units for the measurement values. For details refer to *Parameter group “Measurement” (class 03A1h)* on page 23.

4.20 Parameter group "Gateway Status" (class 0321h)

Name	Instance	Attribute	Protection Level	Description
Inconsistent CIP data (changes pending)	1	1	R0	Contains a flag, that signals if inconsistent CIP™ data is present, because of pending changes (0 – no inconsistency / 1- changes pending).
Modbus frames received ok	1	2	R0	Contains the number of frames that were received without errors since power up.
Modbus frames sent ok	1	3	R0	Contains the number of frames that were sent without errors since power up.
Modbus frame response errors/timeouts	1	4	R0	Contains the number of frame with response errors or timeouts since power up.
Modbus slave disconnects	1	5	R0	Contains the number of disconnects of the MFC device since power up.
Modbus full scans	1	6	R0	Contains the number of full parameter scans of the MFC device since the last MFC device connect
Modbus group cycles	1	7	R0	Contains the number of group parameter scans of the MFC device since the last MFC device connect.
Modbus full scan cycle time min	1	8	R0	Contains the minimal time of a full parameter scan of the MFC device since the last MFC device connect.
Modbus full scan cycle time max	1	9	R0	Contains the maximal time of a full parameter scan of the MFC device since the last MFC device connect.
Modbus full scan cycle time avg	1	10	R0	Contains the mean time of a full parameter scan of the MFC device since the last MFC device connect.
Modbus group cycle time min	1	11	R0	Contains the minimal time of a group parameter scan of the MFC device since the last MFC device connect.
Modbus group cycle time max	1	12	R0	Contains the maximal time of a group parameter scan of the MFC device since the last MFC device connect.
Modbus group cycle time avg	1	13	R0	Contains the mean time of a group parameter scan of the MFC device since the last MFC device connect.
Modbus exception Illegal Function	1	14	R0	Contains the number of modbus exceptions "Illegal Function" since power up.
Modbus exception Illegal Data Address	1	15	R0	Contains the number of modbus exceptions "Illegal Data Address" since power up.
Modbus exception Illegal Data Value	1	16	R0	Contains the number of modbus exceptions "Illegal Data Value" since power up.
Modbus exception Slave Device Busy	1	17	R0	Contains the number of modbus exceptions "Slave Device Busy" since power up.
RS485 error receive CRC	1	18	R0	Contains the number of CRC errors when receiving a telegram over the serial RS485 interface since power up.
RS485 error receive expected bytes mismatch	1	19	R0	Contains the number of expected byte mismatches when receiving a telegram over the serial RS485 interface since power up.
RS485 error receive timeouts	1	20	R0	Contains the number of timeouts when receiving a telegram over the serial RS485 interface since power up.
RS485 error response CRC errors	1	21	R0	Contains the number of CRC errors when receiving a response over the serial RS485 interface since power up.

5.1 Class 1 connection

General details

Class 1 connections are used to transfer I/O data and can be established to instances in the assembly object. Each class 1 connection will establish two data transports - one consuming and one producing. The heartbeat instances can be used for connections that shall only access inputs. Class 1 connections use UDP transport.

- Total number of supported class 1 connections: 4
- Supported API: 2...3200 ms
- T → O connection type: Point-to-point, Multicast
- O → T connection type: Point-to-point
- Supported trigger types: Cyclic, CoS

Connection types

For further information refer to *Assembly object (class 04h)* on page 15.

1. Exclusive-Owner connections

- Max no. of Exclusive-Owner connections: 1

1.1 Process values without configuration

- Connection point O → T: Assembly object, instance 96h (Size: 0 Bytes)
- Connection point T → O: Assembly object, instance 64h (Size: 86 Bytes)

1.2 Process values with configuration

- Connection point O → T: Assembly object, instance 96h (Size: 0 Bytes)
- Connection point T → O: Assembly object, instance 64h (Size: 86 Bytes)
- Configuration Data: Assembly object, instance 6Eh (Size: 144/166¹ Bytes)

1.3 Extended process values without configuration

- Connection point O → T: Assembly object, instance 96h (Size: 0 Bytes)
- Connection point T → O: Assembly object, instance 65h (Size: 165 Bytes)

1.4 Extended process values with configuration

- Connection point O → T: Assembly object, instance 96h (Size: 0 Bytes)
- Connection point T → O: Assembly object, instance 65h (Size: 165 Bytes)
- Configuration Data: Assembly object, instance 6Eh (Size: 144/166¹ Bytes)

¹ Depends on custody lock mode.

For further information refer to *Assembly object (class 04h)* on page 15.

2. Input-Only connections

- Max no. of Input-Only connections: Up to 41

2.1 Input Only

- Connection point O → T: Assembly object, instance 03h (Size: 0 Bytes)
- Connection point T → O: Assembly object, instance 64h (Size: 86 Bytes)

2.2 Input Only Ext

If the connection times out, the EtherNet/IP™ interface box won't change to error state.

- Connection point O → T: Assembly object, instance 04h (Size: 0 Bytes)
- Connection point T → O: Assembly object, instance 64h (Size: 86 Bytes)

3. Listen-Only connections

This type of connection requires another connection in order to exist. If that connection (Exclusive-Owner or Input-Only) is closed, the Listen-Only connection will be closed as well.

- Max no. of Listen-Only connections: Up to 42

3.1 Listen Only

- Connection point O → T: Assembly object, instance 06h (Size: 0 Bytes)
- Connection point T → O: Assembly object, instance 64h (Size: 86 Bytes)

3.2 Listen Only Ext

If the connection times out, the EtherNet/IP™ interface box won't change to error state.

- Connection point O → T: Assembly object, instance 07h (Size: 0 Bytes)
- Connection point T → O: Assembly object, instance 64h (Size: 86 Bytes)

5.1.1 Assembly objects (class 04h)

Process values (Instance 100)

This input assembly contains all measurements values and status parameters.

Name	Group	Class	Instance	Attribute
System State	Status Configuration	0320h	1	9
System Error Flags	Status Configuration	0320h	1	5
Process Warning Flags	Status Configuration	0320h	1	6
Mass Flow	Measurement	03A1h	1	1
Density	Measurement	03A1h	2	1
Temperature	Measurement	03A1h	3	1
Volume Flow	Measurement	03A1h	4	1
Concentration 1 Flow	Measurement	03A1h	5/6 ①	1
Concentration 2 Flow	Measurement	03A1h	7/8 ②	1
Concentration 1	Measurement	03A1h	9	1
Concentration 2	Measurement	03A1h	10	1
Velocity	Measurement	03A1h	11	1
Mass Total	Measurement	03A1h	12	1
Volume Total	Measurement	03A1h	13	1
Concentration 1 Total	Measurement	03A1h	14/15 ①	1
Concentration 2 Total	Measurement	03A1h	16/17 ②	1
Additional Total	Measurement	03A1h	18/19 ③	1
Tube Frequency	Measurement	03A1h	20	1
Measuring Tube Strain	Measurement	03A1h	21	1
Inner Cylinder Strain	Measurement	03A1h	22	1
Sensor A Level	Measurement	03A1h	23	1
Sensor B Level	Measurement	03A1h	24	1
Drive Level	Measurement	03A1h	25	1

① Depends on parameter "Concentration 1 Function"

② Depends on parameter "Concentration 2 Function"

③ Depends on parameter "Additional Totaliser Source"

Extended process values (Instance 101)

This input assembly contains device status parameters and the combination of all measurements values, engineering units and measurement status parameters.

Name	Group	Class	Instance	Attribute
System State	Status Configuration	0320h	1	9
System Error Flags	Status Configuration	0320h	1	5
Process Warning Flags	Status Configuration	0320h	1	6
Mass Flow	Measurement	03A1h	1	1
Unit: Mass Flow	Measurement	03A1h	1	2
Status: Mass Flow	Measurement	03A1h	1	3
Density	Measurement	03A1h	1	1
Unit: Density	Measurement	03A1h	1	2
Status: Density	Measurement	03A1h	1	3
Temperature	Measurement	03A1h	3	1
Unit: Temperature	Measurement	03A1h	3	2
Status: Temperature	Measurement	03A1h	3	3
Volume Flow	Measurement	03A1h	4	1
Unit: Volume Flow	Measurement	03A1h	4	2
Status: Volume Flow	Measurement	03A1h	4	3
Concentration 1 Flow	Measurement	03A1h	5/6 ①	1
Unit: Concentration 1 Flow	Measurement	03A1h	5/6 ①	2
Status: Concentration 1 Flow	Measurement	03A1h	5/6 ①	3
Concentration 2 Flow	Measurement	03A1h	7/8 ②	1
Unit: Concentration 2 Flow	Measurement	03A1h	7/8 ②	2
Status: Concentration 2 Flow	Measurement	03A1h	7/8 ②	3
Concentration 1	Measurement	03A1h	9	1
Unit: Concentration 1	Measurement	03A1h	9	2
Status: Concentration 1	Measurement	03A1h	9	3
Concentration 2	Measurement	03A1h	10	1
Unit: Concentration 2	Measurement	03A1h	10	2
Status: Concentration 2	Measurement	03A1h	10	3
Velocity	Measurement	03A1h	11	1
Unit: Velocity	Measurement	03A1h	11	2
Status: Velocity	Measurement	03A1h	11	3
Mass Total	Measurement	03A1h	12	1
Unit: Mass Total	Measurement	03A1h	12	2
Status: Mass Total	Measurement	03A1h	12	3
Volume Total	Measurement	03A1h	13	1
Unit: Volume Total	Measurement	03A1h	13	2
Status: Volume Total	Measurement	03A1h	13	3
Concentration 1 Total	Measurement	03A1h	14/15 ①	1

Name	Group	Class	Instance	Attribute
Unit: Concentration 1 Total	Measurement	03A1h	14/15 ①	2
Status: Concentration 1 Total	Measurement	03A1h	14/15 ①	3
Concentration 2 Total	Measurement	03A1h	16/17 ②	1
Unit: Concentration 2 Total	Measurement	03A1h	16/17 ②	2
Status: Concentration 2 Total	Measurement	03A1h	16/17 ②	3
Additional Total	Measurement	03A1h	18/19 ③	1
Unit: Additional Total	Measurement	03A1h	18/19 ③	2
Status: Additional Total	Measurement	03A1h	18/19 ③	3
Tube Frequency	Measurement	03A1h	20	1
Unit: Tube Frequency	Measurement	03A1h	20	2
Status: Tube Frequency	Measurement	03A1h	20	3
Measuring Tube Strain	Measurement	03A1h	21	1
Unit: Measuring Tube Strain	Measurement	03A1h	21	2
Status: Measuring Tube Strain	Measurement	03A1h	21	3
Inner Cylinder Strain	Measurement	03A1h	22	1
Unit: Inner Cylinder Strain	Measurement	03A1h	22	2
Status: Inner Cylinder Strain	Measurement	03A1h	22	3
Sensor A Level	Measurement	03A1h	23	1
Unit: Sensor A Level	Measurement	03A1h	23	2
Status: Sensor A Level	Measurement	03A1h	23	3
Sensor B Level	Measurement	03A1h	24	1
Unit: Sensor B Level	Measurement	03A1h	24	2
Status: Sensor B Level	Measurement	03A1h	24	3
Drive Level	Measurement	03A1h	25	1
Unit: Drive Level	Measurement	03A1h	25	2
Status: Drive Level	Measurement	03A1h	25	3

① Depends on parameter "Concentration 1 Function"

② Depends on parameter "Concentration 2 Function"

③ Depends on parameter "Additional Totaliser Source"

Configuration parameters (Instance 110)

When providing configuration data upon establishing a class 1 connection, the size of the configuration data, the range and access rights of each parameter will be validated. Connection will only be granted if this procedure fully succeeds.

There are two different sets of parameters, the full parameters list and the reduced parameters list. Some parameters in the full parameter list are read-only if the field device is in custody transfer mode. These parameters are not included in the reduced parameters list. The reduced parameter list can be used if the field device is in custody transfer mode. The reduced configuration excludes all parameters with protection level "CT".

Name	Group	Class	Instance	Attribute	Protection Level
Pipe Diameter	Process Input	0300h	1	10	-
Measurement Time Constant	Filters and Offsets	0310h	1	1	-
Pressure Suppression Duration	Filters and Offsets	0310h	1	2	-
Pressure Suppression Cut-off	Filters and Offsets	0310h	1	3	-
Internal Process Control Maximum Limit	Process Control	0330h	1	4	-
Internal Process Control Minimum Limit	Process Control	0330h	1	5	-
Density Calibration Product Type	Density	0350h	1	15	-
Referred Density Reference Temperature	Density	0350h	1	16	-
Fixed Density Value	Density	0350h	1	17	-
Referred Density Slope	Density	0350h	1	18	-
Calibration Density	Density	0350h	1	19	-
Concentration Type	Concentration	0360h	1	2	-
Concentration 1 Function	Concentration	0360h	1	3	-
Concentration 1 Product	Concentration	0360h	1	4	-
Concentration 1 Offset	Concentration	0360h	1	5	-
Concentration 2 Function	Concentration	0360h	1	6	-
Concentration 2 Product	Concentration	0360h	1	7	-
Concentration 2 Offset	Concentration	0360h	1	8	-
Concentration Coefficient 2	Concentration	0360h	1	9	-
Concentration Coefficient 3	Concentration	0360h	1	10	-
Concentration Coefficient 4	Concentration	0360h	1	11	-
Concentration Coefficient 5	Concentration	0360h	1	12	-
Concentration Coefficient 6	Concentration	0360h	1	13	-
Concentration Coefficient 7	Concentration	0360h	1	14	-
Concentration Coefficient 8	Concentration	0360h	1	15	-
Concentration Coefficient 9	Concentration	0360h	1	16	-
Concentration Coefficient 10	Concentration	0360h	1	17	-
Concentration Coefficient 11	Concentration	0360h	1	18	-
Concentration Coefficient 12	Concentration	0360h	1	19	-

Name	Group	Class	Instance	Attribute	Protection Level
Additional Totaliser Source	Totalisers	0400h	1	3	-
Mass Flow Unit	Device	0450h	1	13	-
Density Unit	Device	0450h	1	14	-
Temperature Unit	Device	0450h	1	15	-
Volume Flow Unit	Device	0450h	1	16	-
Concentration 1 Mass Flow Unit	Device	0450h	1	17	-
Concentration 1 Volume Flow Unit	Device	0450h	1	18	-
Concentration 2 Mass Flow Unit	Device	0450h	1	19	-
Concentration 2 Volume Flow Unit	Device	0450h	1	20	-
Velocity Unit	Device	0450h	1	23	-
Mass Total Unit	Device	0450h	1	24	-
Volume Total Unit	Device	0450h	1	25	-
Concentration 1 Mass Total Unit	Device	0450h	1	26	-
Concentration 1 Volume Total Unit	Device	0450h	1	27	-
Concentration 2 Mass Total Unit	Device	0450h	1	28	-
Concentration 2 Volume Total Unit	Device	0450h	1	29	-
Additional Mass Total Unit	Device	0450h	1	30	-
Additional Volume Total Unit	Device	0450h	1	31	-
Tube Frequency Unit	Device	0450h	1	32	-
Measuring Tube Strain Unit	Device	0450h	1	33	-
Inner Cylinder Strain Unit	Device	0450h	1	34	-
Meter Correction	Process Input	0300h	1	9	CT
User Flow Offset	Process Input	0300h	1	11	CT
Flow Direction	Filters and Offsets	0310h	1	4	CT
Low Flow Threshold	Filters and Offsets	0310h	1	5	CT
Flow Mode	Filters and Offsets	0310h	1	6	CT
Internal Process Control Function	Process Control	0330h	1	2	CT
Internal Process Control Condition	Process Control	0330h	1	3	CT
Density Mode	Density	0350h	1	14	CT

5.2 Class 3 connection

The EtherNet/IPTM interface also supports class 3 connections. Please refer to "MFC device parameters" on page 21 for a full list of parameters supported by the field device.

General details

Class 3 connections are used to establish connections towards the message router. Thereafter, the connection is used for explicit messaging. Class 3 connections use TCP transport.

- No. of simultaneous class 3 connections: 16
- Supported API: 2...10000 ms
- T → O Connection type: Point-to-point
- O → T Connection type: Point-to-point
- Supported trigger type: Application

Problem	Solution
Connection between EtherNet/IP™ interface box and field device cannot be established.	Switch Modbus signals A and B of connector X2 to ensure, that the signals are not inverted.
	Verify Modbus settings (baud rate, parity, Modbus slave address) through the web interface.
	Perform a factory reset at the EtherNet/IP™ interface box (for details refer to <i>Factory reset button</i> on page 10).
	When LED FD is flashing red, the MFC device type or firmware is not supported.
IP address of the EtherNet/IP™ interface box unknown	Perform factory reset and provide IP address by DHCP server.
Web server is not accessible though IP address is known.	Check via the EtherNet/IP™ controller/PLC, if the webpage access was deactivated via CIP™.







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- Variable area flowmeters
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