Instruction manual

EtherNet/IP™ interface for Mass Flow / Pressure instruments

Doc. no.: 9.17.132K Date: 14-12-2023

ATTENTION
Please read this instruction manual carefully before installing and operating the instrument.
Not following the guidelines could result in personal injury and/or damage to the equipment.

Bronkhorst®

Disclaimer

The information in this manual has been reviewed and is believed to be wholly reliable. No responsibility, however, is assumed for inaccuracies. The material in this manual is for information purposes only.

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Symbols

Important information. Discarding this information could cause injuries to people or damage to the Instrument or installation.

Helpful information. This information will facilitate the use of this instrument.

Additional info available on the internet or from your local sales representative.

Warranty

Bronkhorst® products are warranted against defects in material and workmanship for a period of three years from the date of shipment, provided they are used in accordance with the ordering specifications and the instructions in this manual and that they are not subjected to abuse, physical damage or contamination.
Products that do not operate properly during this period may be repaired or replaced at no charge. Repairs are normally warranted for one year or the balance of the original warranty, whichever is the longer.

See also paragraph 9 of the Conditions of sales:
http://www.bronkhorst.com/files/corporate_headquarters/sales_conditions/en_general_terms_of_sales.pdf

The warranty includes all initial and latent defects, random failures, and undeterminable internal causes.

It excludes failures and damage caused by the customer, such as contamination, improper electrical hook-up, physical shock etc.

Re-conditioning of products primarily returned for warranty service that is partly or wholly judged non-warranty may be charged for.

Bronkhorst High-Tech B.V. or affiliated company prepays outgoing freight charges when any party of the service is performed under warranty, unless otherwise agreed upon beforehand. However, if the product has been returned collect to our factory or service center, these costs are added to the repair invoice. Import and/or export charges, foreign shipping methods/carriers are paid for by the customer.

Table of contents

1 GENERAL PRODUCT INFORMATION

1.1 INTRODUCTION

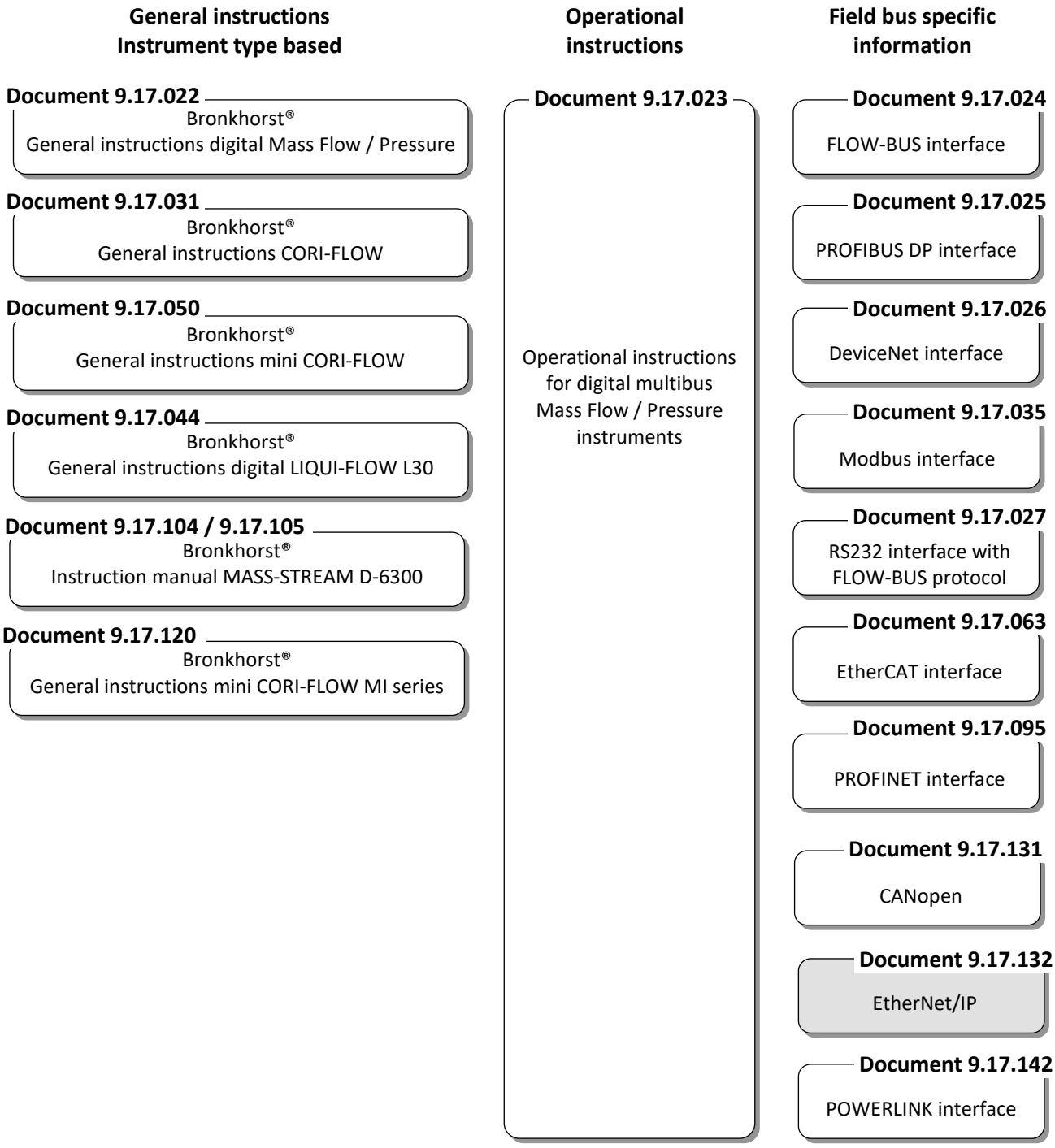
The EtherNet/IP interface offers a direct connection to EtherNet/IP Networks for Bronkhorst® digital mass-flow/pressure meters/controllers according to the Mass Flow Controller Profile specified by the ODVA.

This manual will explain how to install and operate a Bronkhorst® instrument to your EtherNet/IP system, and provides an overview of all instrument parameters available on EtherNet/IP.

1.2 REFERENCES TO OTHER APPLICABLE DOCUMENTS

Manuals and guides for digital instruments are modular. General instructions give information about the functioning and installation of instruments. Operational instructions explain the use of the digital instruments features and parameters. Field bus specific information explains the installation and use of the field bus installed on the instrument.

1.2.1 *Manuals and user guides:*



1.2.2 *Technical Drawings:*

Hook-up diagram MI-series Ethernet interfaces	(document nr. 9.16.200)
Hook-up diagram laboratory-style EtherNet/IP	(document nr. 9.16.215)
Hook-up diagram ML-series EtherNet/IP	(document nr. 9.16.222)
Hook-up diagram ES-FLOW Ethernet interfaces	(document nr. 9.16.251)
Hook-up diagram Industrial Ethernet M12	(document nr. 9.16.253)

1.2.3 *Software tooling:*

Bronkhorst FlowWare tools can be used to configure the address and baud rate of your Modbus instrument. Please refer to the Bronkhorst website for more details.

Bronkhorst FlowWare software tools can be acquired at
http://www.bronkhorst.com/en/downloads

2 QUICK START

By following these steps, you will quickly get your Bronkhorst EtherNet/IP device up and running. The following steps are generalized, and not specific to a type of PLC. For more detail on the steps, see the following chapters or refer to the chapters mentioned in the steps below. These will also show some of these steps with screenshots for two different pieces of PLC software (CODESYS and RSLogix5000).

1. Configure the device with the desired address (see chapter 3.3 Address configuration). DHCP is used by default.

2. Load the Bronkhorst EtherNet/IP EDS file (Bronkhorst_Meter_Controller_EtherNetIP.eds) into the PLC software.

3. Add the Bronkhorst Meter Controller device to the EtherNet/IP Scanner in the PLC.
   - Optionally some PLCs offer a scan function to check for devices on the network. This requires a live connection to the PLC, and the instrument should be connected to the EtherNet/IP interface of the PLC.

4. Set the address of the device to the address configured in step 1.

5. Select the desired IO Connection. This is usually one of the first options presented on the device page. A Bronkhorst Meter Controller offers 4 predefined IO connections that make use of the available Assemblies:
   - Basic (INT)
   - Extended (INT)
   - Basic (REAL)
   - Extended (REAL)

   These offer the parameter sets basic and extended in the data types INT and REAL. The data type only applies to the Flow, Setpoint, and Valve parameters, the Status and Override parameters are USINT.
   The parameters in the basic and extended set are:

Set	Direction (seen from instrument)	Parameter
Basic	In	Setpoint
	Out	Status
		Flow
Extended	In	Override
		Setpoint
	Out	Status
		Flow
		Setpoint
		Override
		Valve

   For details about the assemblies and parameters, see chapter 5.1 IO connections.

6. Set the desired configuration parameters. Most commonly used are:
   - Analog Sensor Gas Calibration Object Instance, which selects the active fluid.
   - Analog Sensor Data Unit, which sets the unit of the measure parameter. The default is counts, where 0 – 32000 is 0 – 100% full scale.
   - Single Stage Controller Data Unit, which sets the unit of the Setpoint parameter. The default is counts, where 0 – 32000 is 0 – 100% full scale.

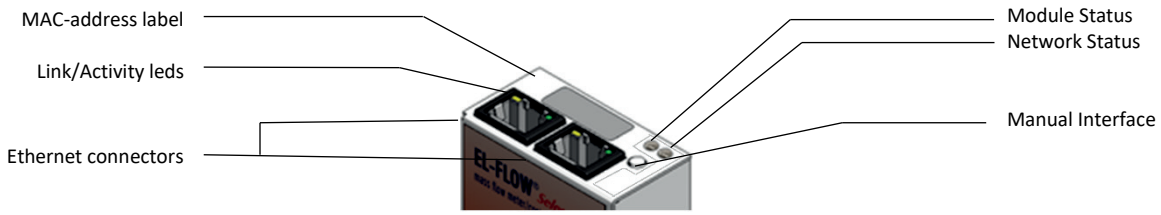
   For the full options for these parameters, either use the options provided in the PLC tool (availability depends on PLC tool used) or the Data Unit options table in chapter 5.3.3 S-Analog Sensor Object. ***Note: not all units are available on all instruments; availability depends on the sensor type of the instrument.***

7. With the instrument fully setup in the PLC, compile the program and load it into the PLC. Most PLCs will show the actual device parameters in the device overview in the PLC software. Here you can check that the expected values are received.

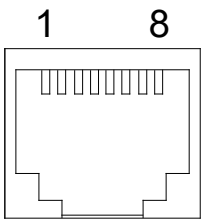
3 ETHERNET/IP INSTALLATION

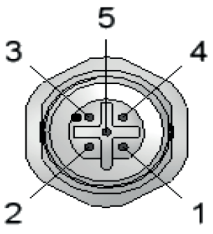
This chapter will get your instrument connected to power and to the network.

3.1 INSTRUMENT OVERVIEW



Ethernet connectors

RJ45 connector	Receptacle	Pin number	Description
		1	TX+
		2	TX-
		3	RX+
		4	Not used
		5	Not used
		6	RX-
		7	Not used
		8	Not used

M12 –D coded male Connector	Receptacle	Pin number	Description
		1	Transmit +
		2	Receive +
		3	Transmit -
		4	Receive -
		5	Not used

3.2 ETHERNET CABLING

For a robust communication in industrial environments it is advised to use high quality shielded Ethernet cable capable of Full Duplex 100Mbit communication.

More information about EtherNet/IP cabling can be found in the "Media Planning and Installation Manual" available at www.odva.org.

According to IEC 802.3 the maximum cable length for 100 Mbit Ethernet is 100 meters (100BaseT) between two nodes.

Example of POWERINK cable with M12-D-coded


3.3 ETHERNET/IP ADDRESS CONFIGURATION EXAMPLE - ROTARYSWITCH

3.3.1 *Configure the EtherNet/ip address in the instrument – RESET*

RESET - will restore the default network settings (this will erase all network address settings made previously, including any custom delivered static address).

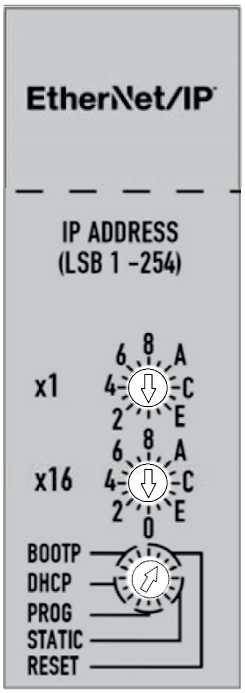
1-Set the "x1" rotary switch to "0"
2-Set the "x16" rotary switch to "0"
3-Set the Mode rotary switch to RESET
4-Power cycle (power OFF/ON) the instrument
5-Addresses are set to :

The Fieldbus1 IP Address	0.0.0.0
Default Fieldbus1 Subnet Mask	0.0.0.0
Default Fieldbus1 Gateway Address	0.0.0.0

Set to "0" →

Set to "0" →

Set to "RESET" →



3.3.2 *Configure the EtherNet/ip address in the instrument – STATIC default*

After performing a **RESET**

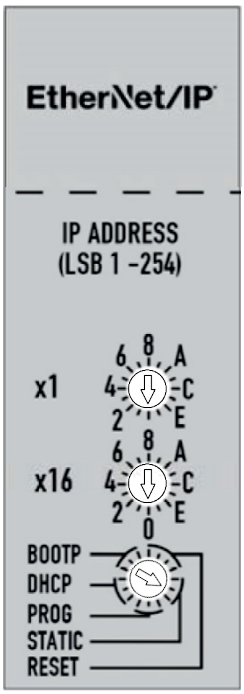
1-Set the Mode rotary switch to STATIC
2-Power cycle (power OFF/ON) the instrument
3-Addresses are set to :

Fieldbus1 IP Address will be set to	192.168.19.100
Default Fieldbus1 Subnet Mask	255.255.255.0
Default Fieldbus1 Gateway Address	192.168.19.0

Set to "0" →

Set to "0" →

Set to "STATIC" →



Result: instrument is available at IP address 192.168.19.100

3.3.3 *Configure the EtherNet/ip address in the instrument – STATIC custom*

After performing a **RESET**
When set to **STATIC** the LSB (LeastSignificantByte) of the IP Address can be set using the IP Address rotary switches. instrument can be configured to an IP address in the range of **192.168.19.1 to 192.168.19.255**

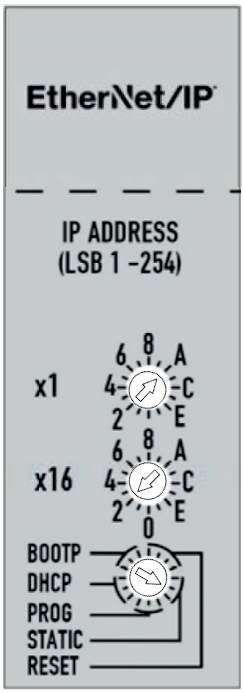
Example to set LSB to 42 (IP Address 192.168.19.42)
1-Set the Mode rotary switch to STATIC
2-Set the "x1" rotary switch to "A" which is 10 decimal
3-Set the "x16" rotary switch to "2" which is 2 x 16 = 32 decimal
4-Power cycle (power OFF/ON) the instrument
5-Addresses are set to :

Fieldbus1 IP Address	192.168.19.**42**
Default Fieldbus1 Subnet Mask	255.255.255.0
Default Fieldbus1 Gateway Address	192.168.19.0

Set to "A" →

Set to "2" →

Set to "STATIC" →

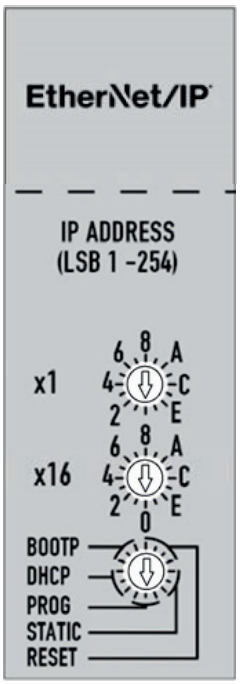


Result: instrument is available at IP address 192.168.19.42

3.3.4 *EtherNet/ip Address configuration example – PROG*

Example: Set IP Address to 162.168.19.10 via RS232 and Bronkhorst FLOWDDE Server software.

Illustration :
rotary switches for the address to 00 and the mode to PROG

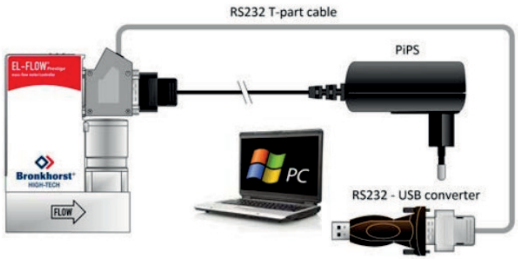


If the instrument has not accessible rotary switches they will be default on 00 and PROG.

PROG (default) :

IP address of the instrument can be programmed to a static address via software .

illustration: Instrument connected to a serial COM port of the PC via its RS232 connector



1. Set the rotary switches (if applicable) for the address to 00 and the mode to PROG
2. Connect the instrument to a COM port of the PC via its RS232 connector (respect hook-up!) .
3. From the FLOWDDE Server software menu Communication click Communication settings
and select the COM port to which the instrument is connected.
4. From the menu Communication click Open communication to open the communication.
5. Wait for the DDE server to scan the connected (FLOW-BUS) system until the message: Server is active and ready for any client.
6..Configure the FLOWDDE Server
- Flow-DDE: Server - > menu option 'Settings ' , uncheck 'Hide advance parameters"

7. Write / read the parameters
- Flow-DDE: Server - > menu menu option "Flow-BUS" --> "test Flow-BUS and DDE"

Actions to take:
- Parameter 7: (initreset) → Write value 64
- Parameter 7 (initreset)→ Read parameter and check value

- Parameter 390: Fieldbus1 IP address → Write value 192.168.19.16
- Parameter 390: Fieldbus1 IP address → Read parameter and check value

- Parameter 391: Fieldbus1 subnet mask → Write value 255.255.255.0
- Parameter 391: Fieldbus1 subnet mask → Read parameter and check value

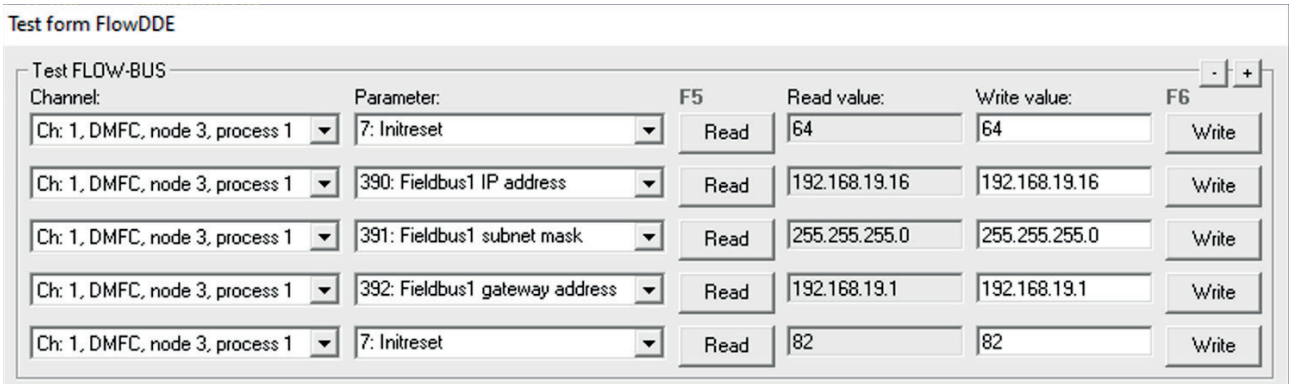
- Parameter 392: Fieldbus1 gateway address → Write value 192.168.19.1
- Parameter 392: Fieldbus1 gateway address → Read parameter and check value

- Parameter 7: (initreset) → Write value 82
- Parameter 7 (initreset) → Read parameter and check value

8. Power cycle (power OFF/ON) the instrument.

Result: instrument is available at IP address 192.168.19.16

Below is an illustration of the FLOWDDE Server software menu "test Flow-BUS and DDE"



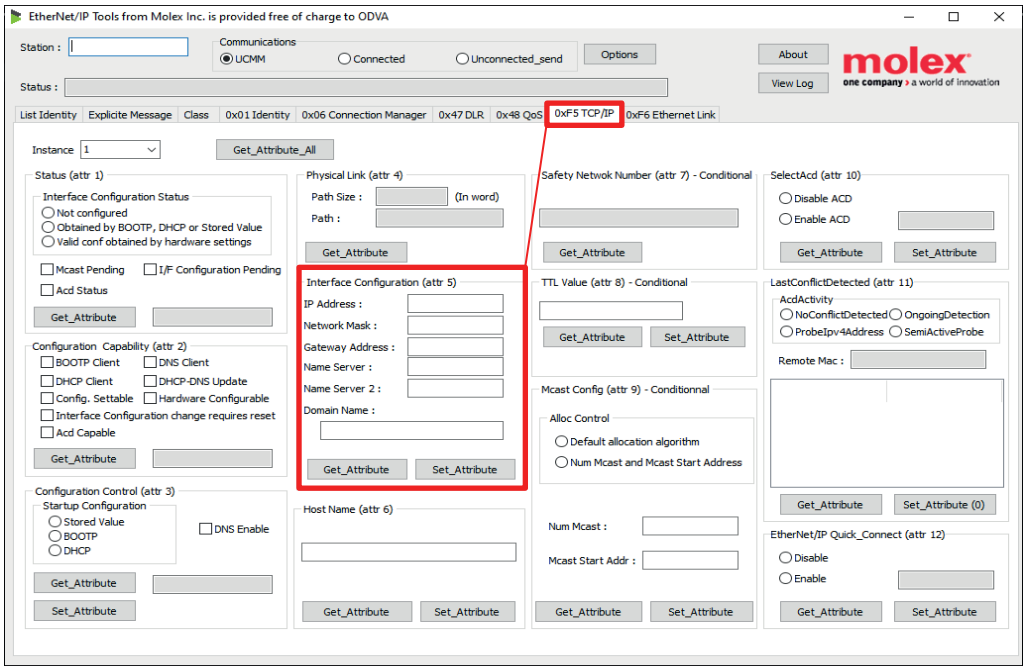
3.3.5 EtherNet/IP

For configuration of the address via EtherNet/IP use the parameters in the “Configuration Control” and the “Interface Configuration” attributes of the TCP/IP object of the device (object 0xF5, attributes 0x03 and 0x05). These parameters can be accessed from the PLC or from a special tool for configuring EtherNet/IP devices such as the Molex EtherNet/IP Tool. When changing the configuration via EtherNet/IP, the new settings are automatically applied when written. Therefore communication with the configuration tool may be lost.

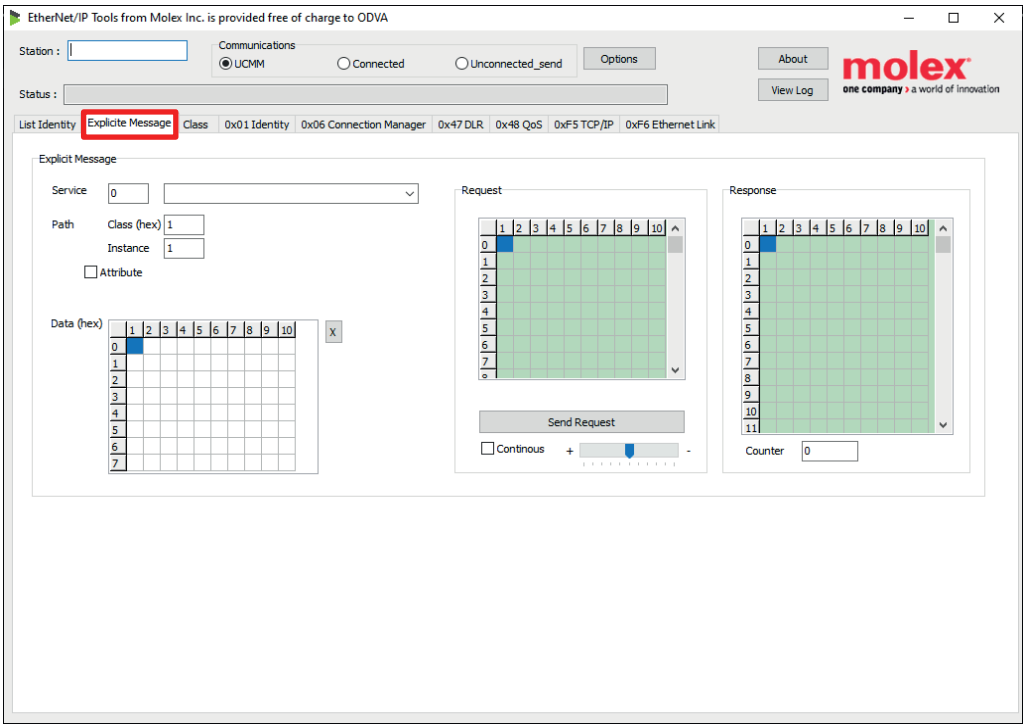
Link to landing page molex
https://tools.molex.com/molex/mysst/doCenter.action

Direct link to download
https://tools.molex.com/webdocs/mysst/EIP%20Tool%20v2.6.1.zip

Molex tool: Location for setting the address



Molex tool: Location for explicit message



4 INSTRUMENT CONFIGURATION

4.1 INSTRUMENT EDS-FILE

We provide an EDS file for our flow/pressure meter/controllers for EtherNet/IP, to offer easy access to the IO connections and configuration parameters/options available for Bronkhorst instruments. The generic EDS file for EtherNet/IP is called is called: **Bronkhorst_Meter_Controller_EtherNetIP.eds.** This EDS-file is a text-file which contains information about the options of EtherNet/IP interface of the instrument.

The following information is included in the EDS file:

Identification

- Model name Bronkhorst Meter Controller
- Vendor name Bronkhorst High-Tech B.V.
- Vendor code 706
- Product code 7
- Product type 26 (Mass Flow Controller)

Parameters

- Parameters that are included in the IO data.
  - Status
  - Flow
  - Setpoint
  - Override
  - Valve
- Parameters available for additional configuration.
- Non-Profile parameters.

Assemblies

- Combinations of parameters used in the IO Connections.

IO Connections

- Basic (INT)
- Extended (INT)
- Basic (REAL)
- Extended (REAL)

Profile Classes

- S-Device Supervisor
- S-Analog Sensor
- S-Analog Actuator
- S-Single Stage
- S-Gas Calibration

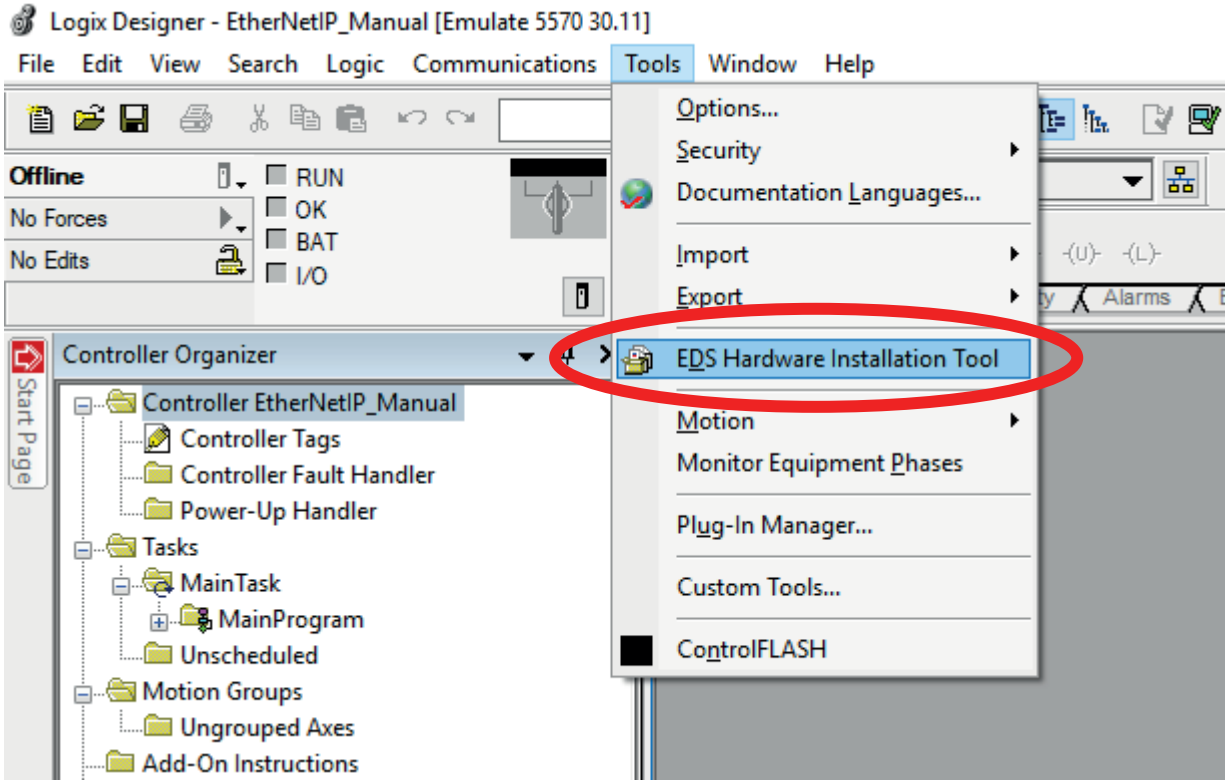
*The latest version of the **Bronkhorst_Meter_Controller_EtherNetIP.eds** file can be found in the BRONKHORST FIELDBUS FILES section on the Software Downloads page of the Bronkhorst website at: http://www.bronkhorst.com/download*

4.2 LOADING EDS FILE

The following images will show how to import the EDS file into the PLC software. For the examples we use RSLogix 5000 and CODESYS.

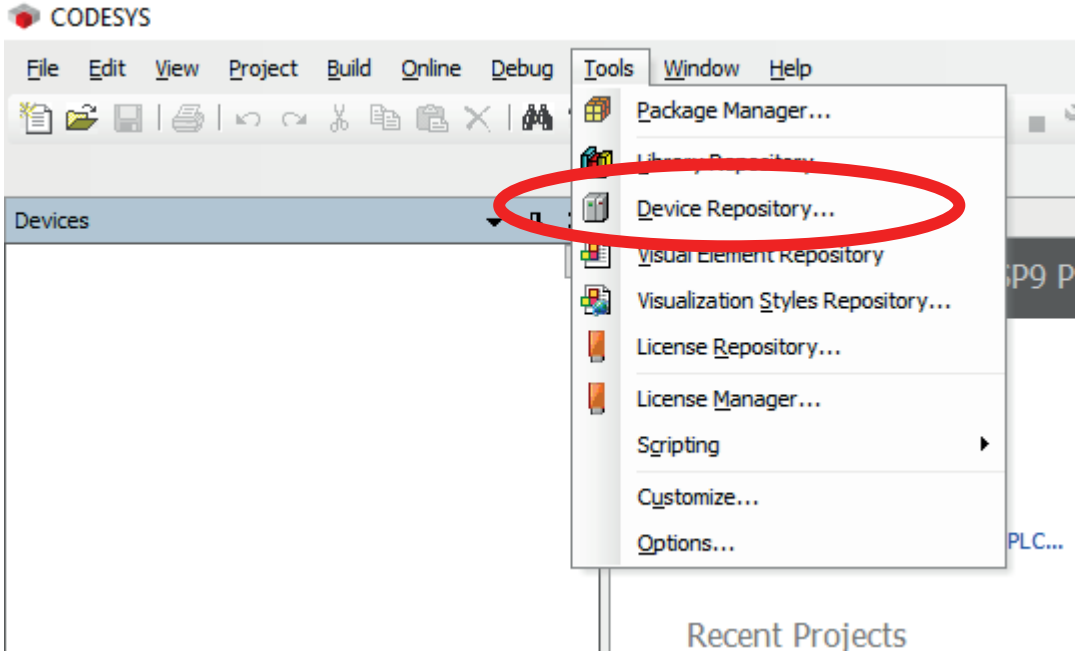
4.2.1 *RSLogix 5000*

Open the “EDS Hardware Installation Tool” and follow the steps in the EDS Wizard to import the Bronkhorst Meter Controller EDS file.



4.2.2 *CODESYS*

Open the “Device Repository” add import the EDS file into the appropriate repository. The device can now be added to an EtherNet/IP Scanner in the PLC project via the “Add Device” right-click option on the scanner.

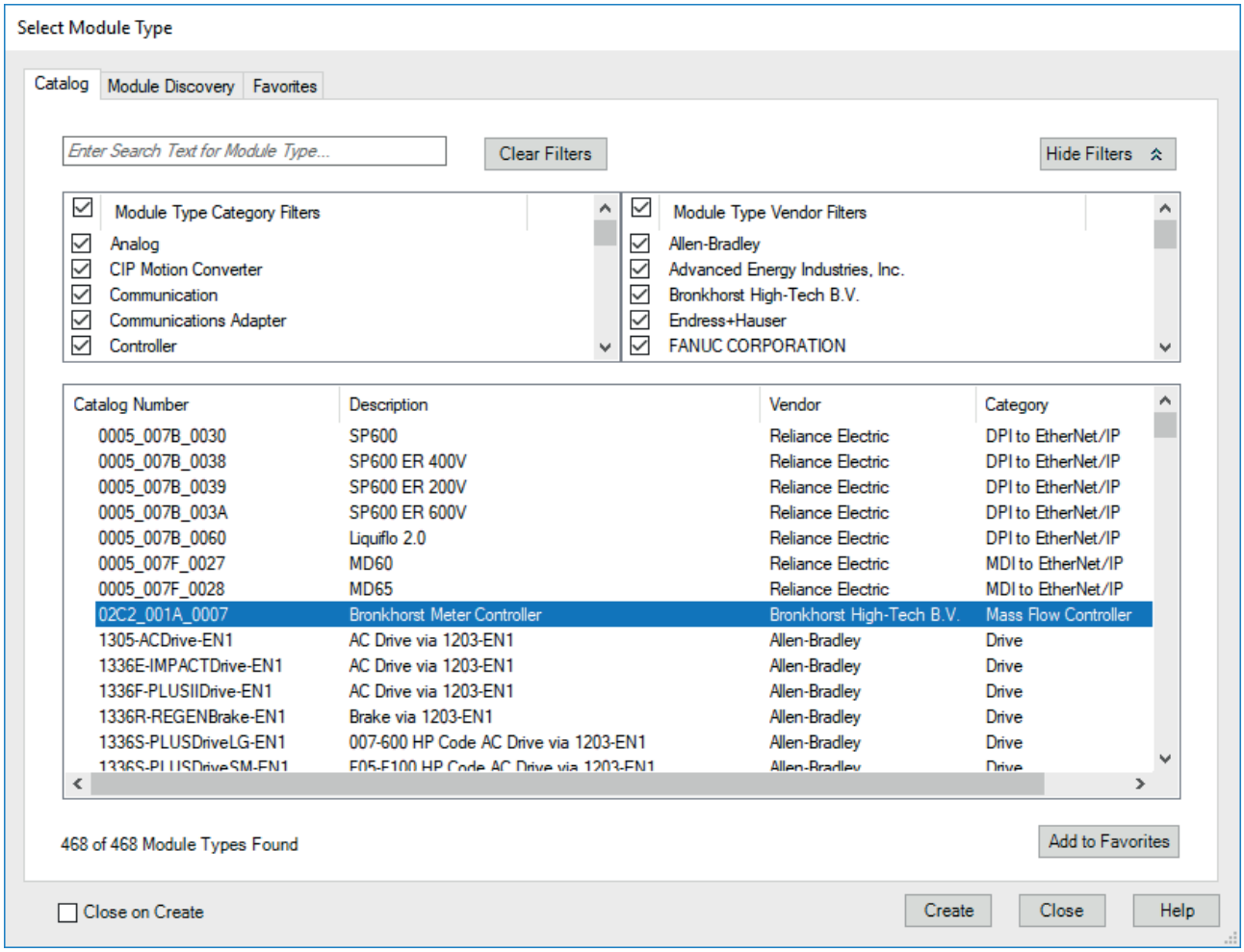


4.3 ADD ETHERNET/IP DEVICE TO CONFIGURATION

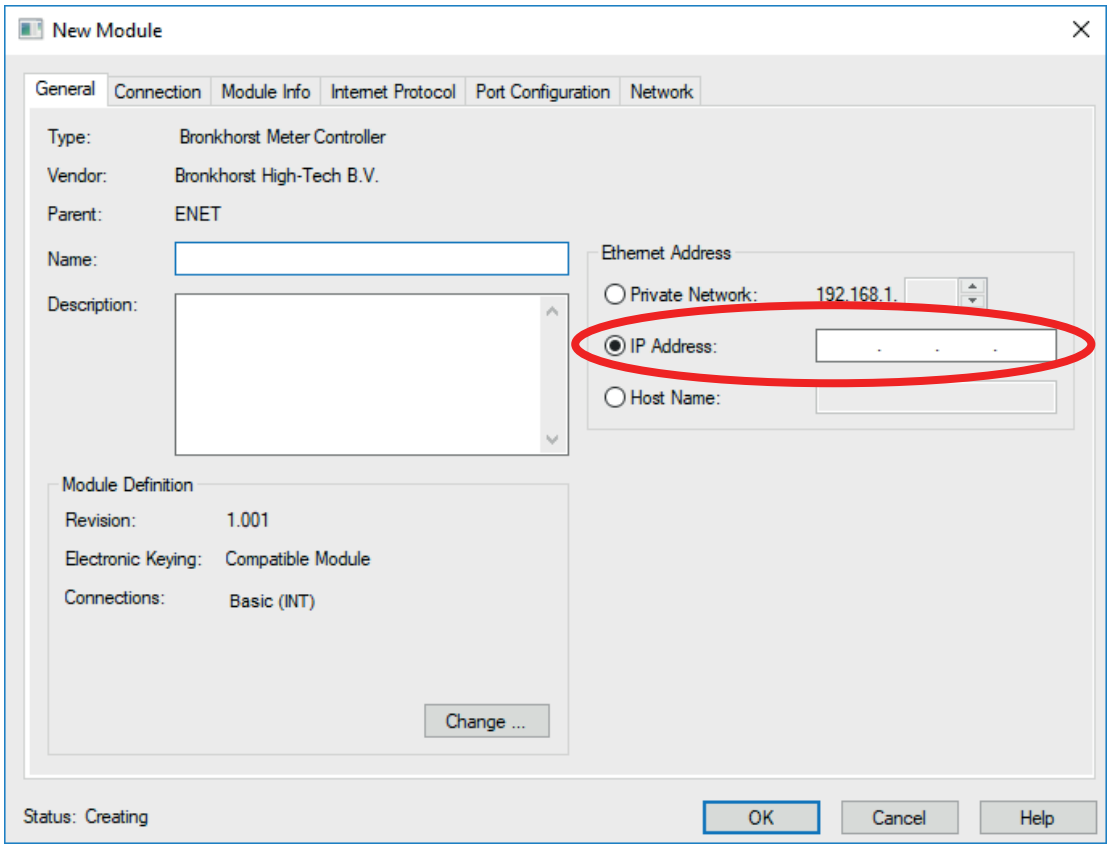
In next paragraphs some example screens will be showed of a master configuration tool to explain how to install a Bronkhorst® meter/controller EtherNet/IP slave. Examples are given for RSLogix5000 and CODESYS.

4.3.1 *RSLogix5000*

Right click on the Ethernet interface and click on add module. Select the Bronkhorst Meter Controller from the selection window, and click Create to add the module to the configuration.

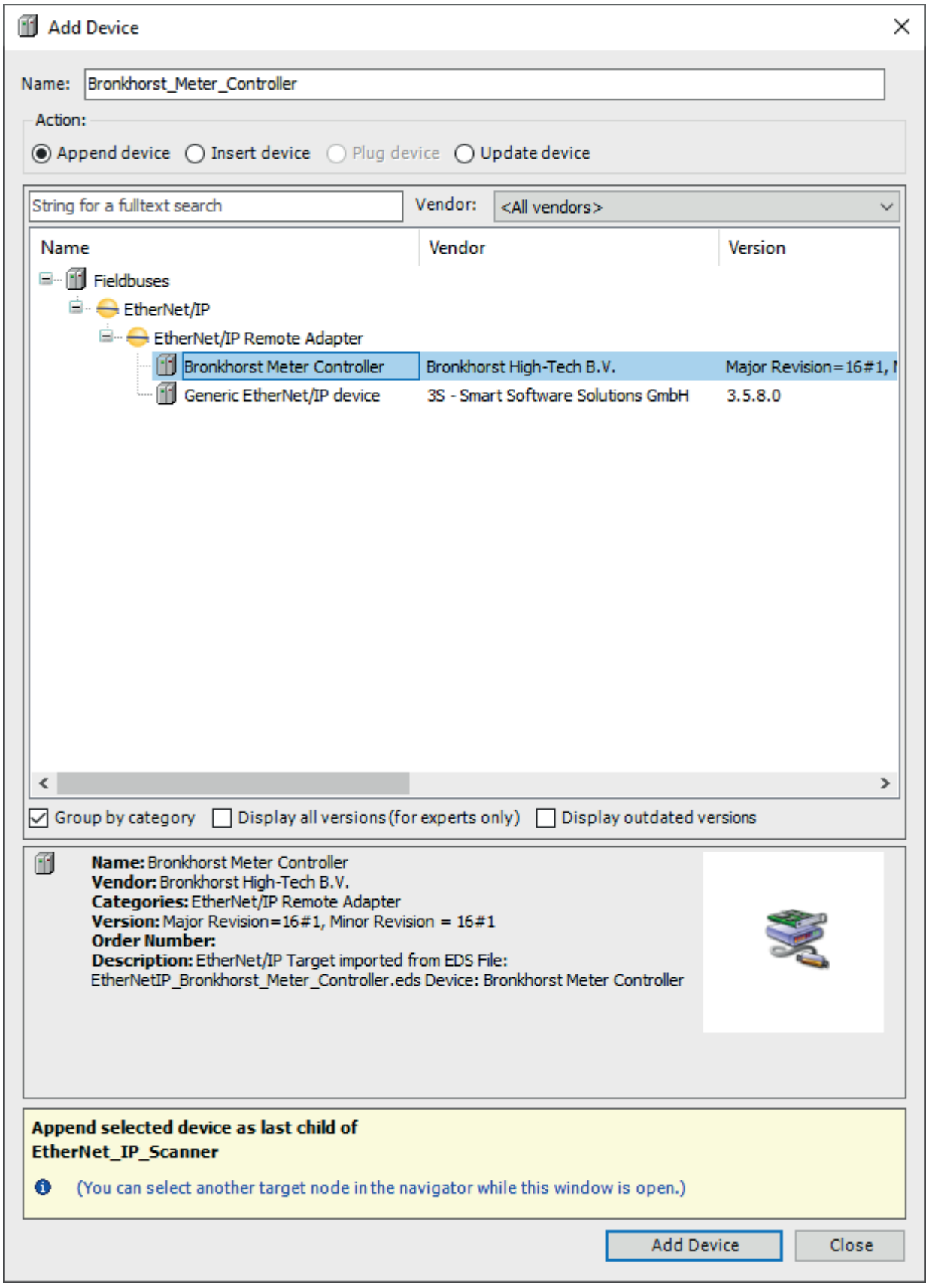


On the New Module screen, configure the IP address as well as the desired IO connection for the device.

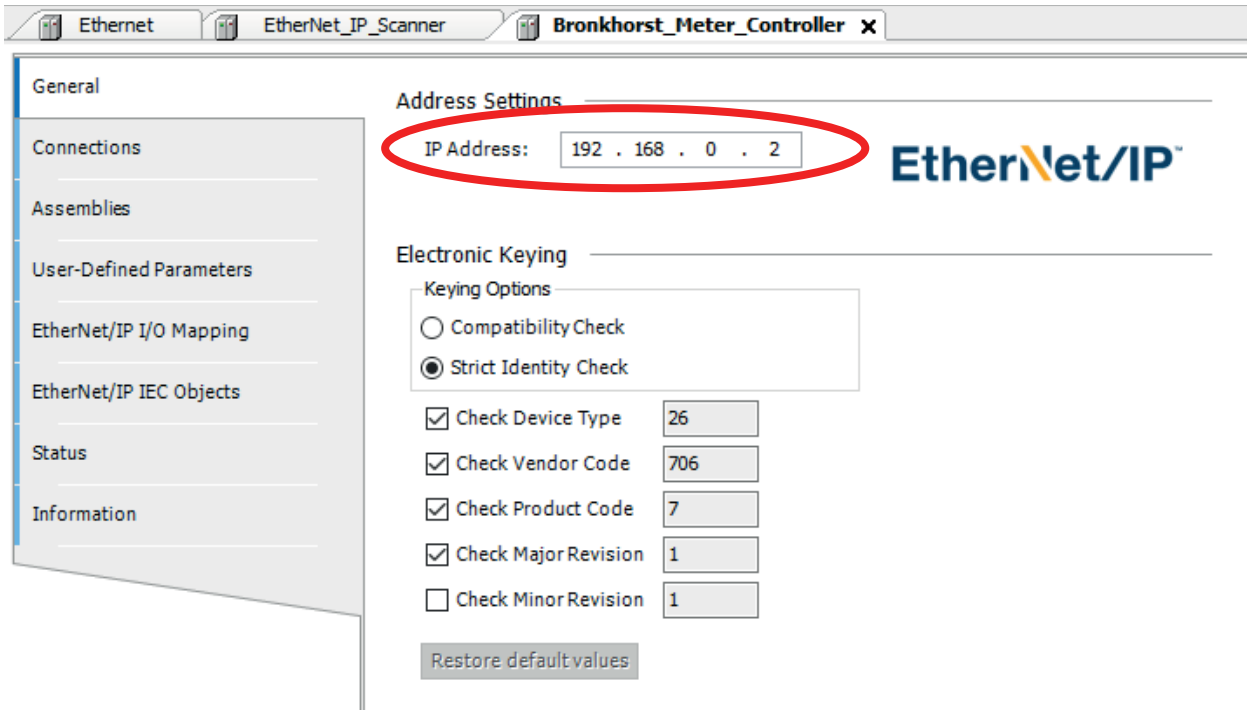


4.3.2 *CODESYS*

Right click the EtherNet/IP Scanner and click on Add Device. Select the Bronkhorst Meter Controller and click on Add Device to add the module to the configuration.



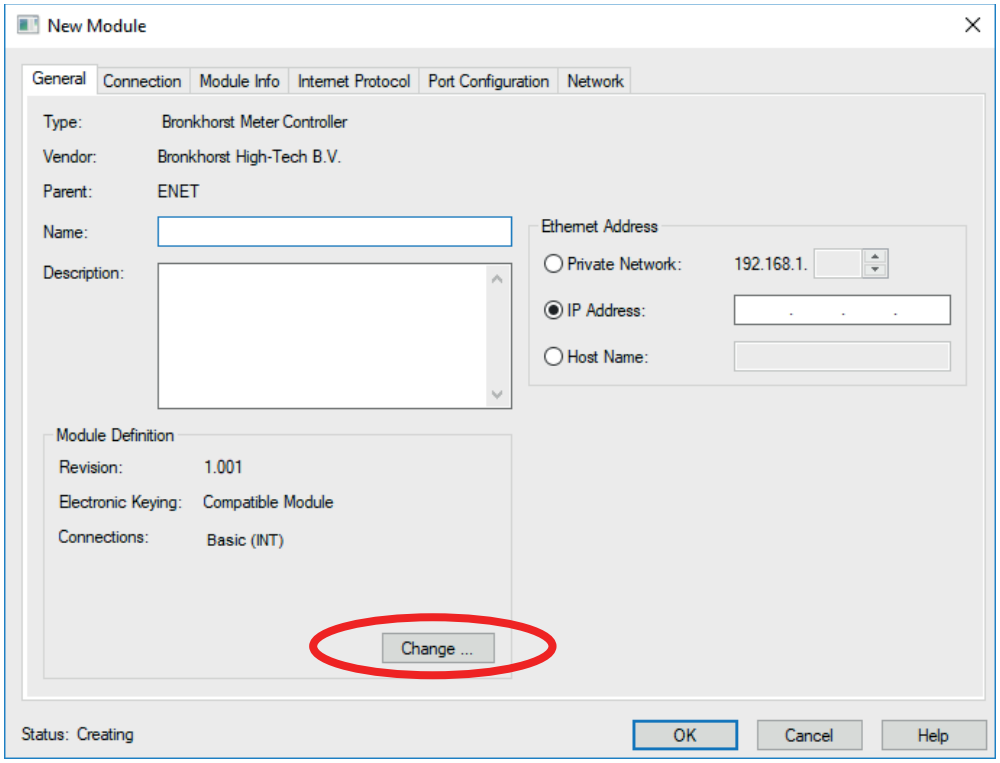
On the device configuration page (shown when double clicking on the added device in the Device tree view), configure the address of the device in the General page.

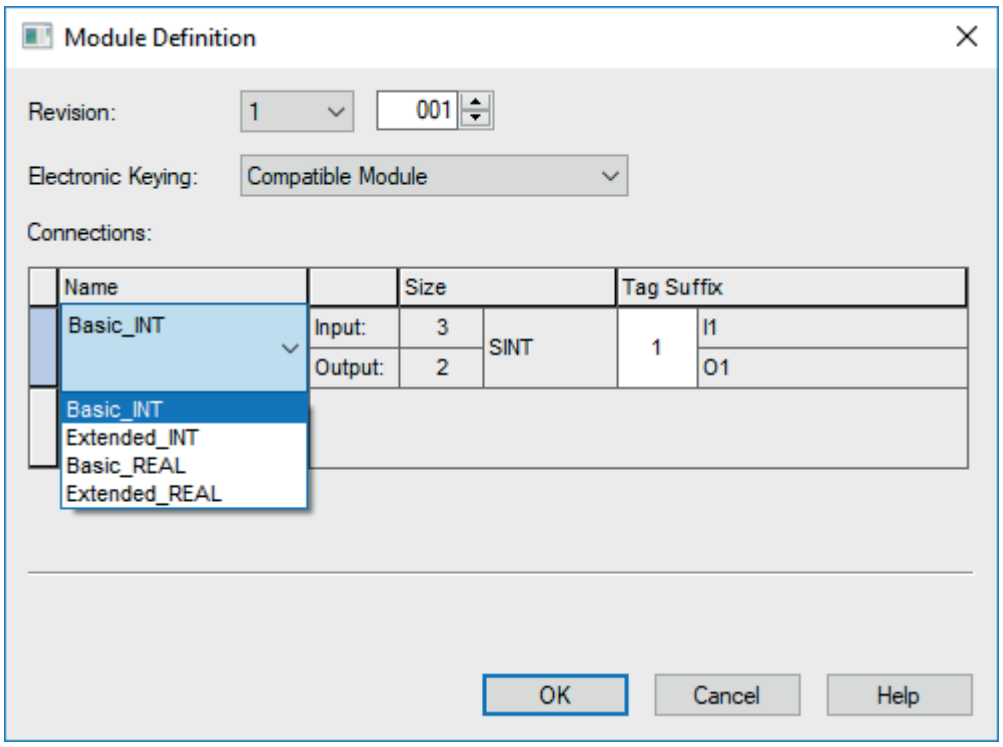


4.4 SELECT IO CONNECTION

Select the desired IO connection for this device. Choice is between the parameters in the connection, Basic or Extended, and the data type of some of the parameters, INT or REAL. For the full contents of the IO connections and assemblies, see Chapter 5.1 IO connections.

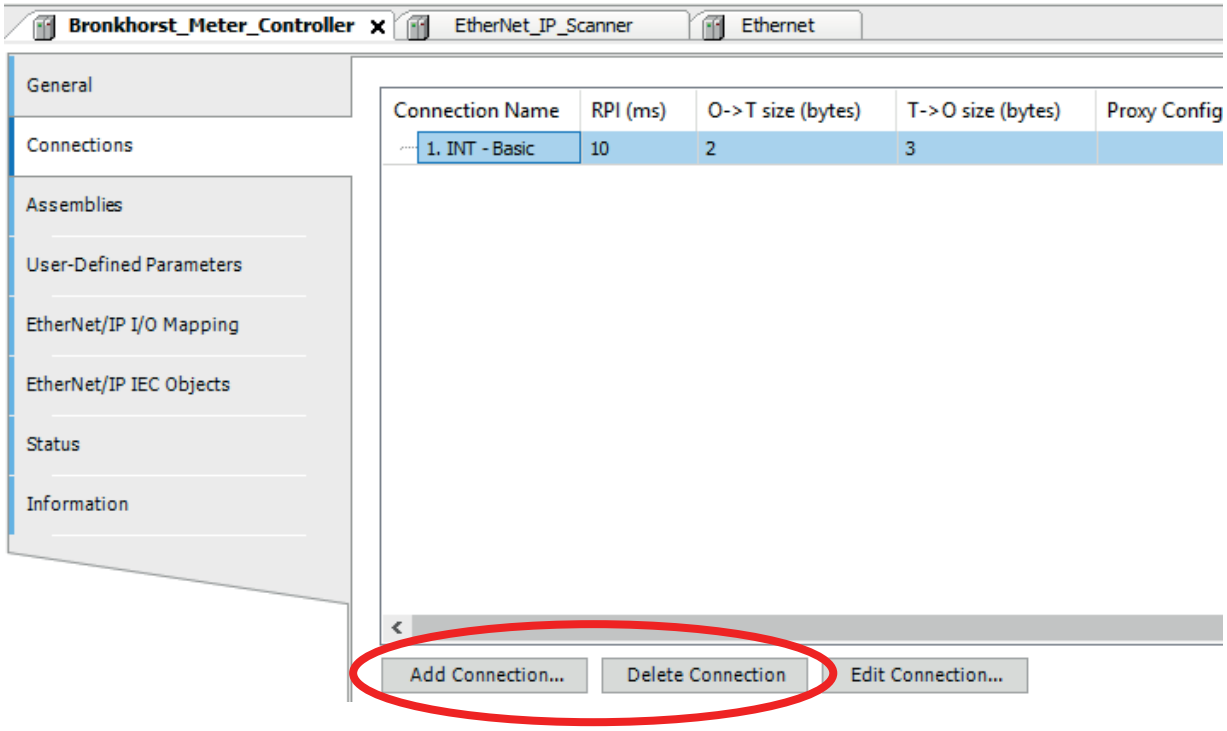
4.4.1 *RSLogix5000*



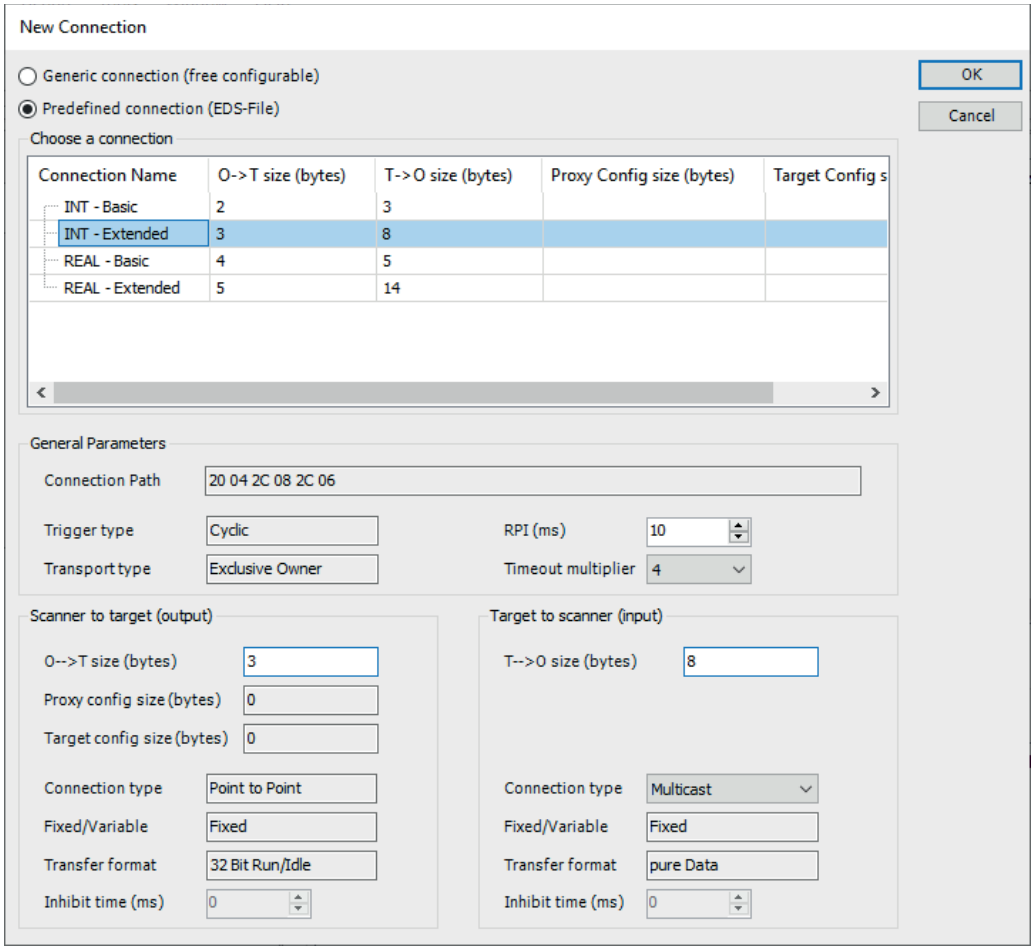


4.4.2 *CODESYS*

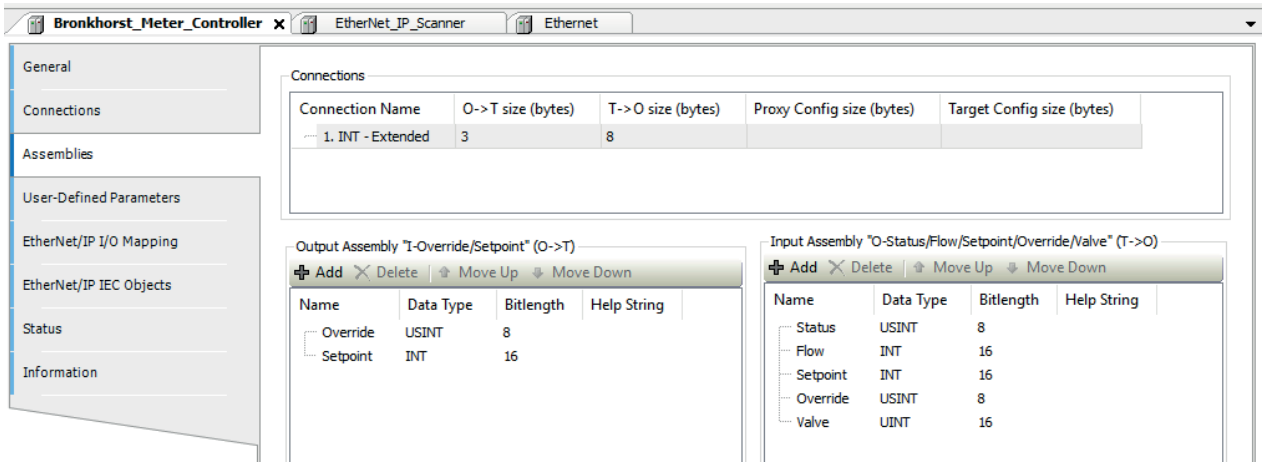
Navigate to the Connections page of the device page and delete the default IO Connection (Basic INT), if another connection is desired.



When the connection is deleted, click on Add Connection to select a new connection. In the New Connection window, select the desired connection and click OK to add the connection to the configuration of the device.



The Assemblies configuration page will show the contents of the selected IO connections, with the Input and Output assemblies built from the device parameters.



To connect the IO parameters to PLC variables, configure the IO Mapping in the EtherNet/IP I/O Mapping page of the device configuration.

4.5 CONFIGURATION PARAMETERS

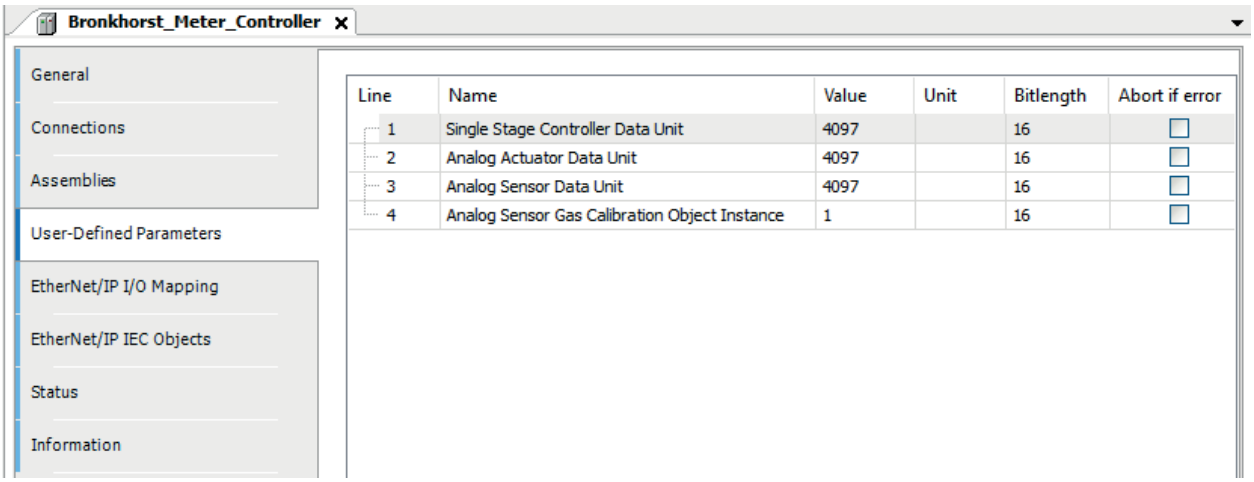
4.5.1 *RSLogix5000*

RSLogix5000 does not offer the functionality to send parameters to the instrument prior to connection setup. Instead a custom program in the PLC is required. Alternatively some of the parameters (the non-volatile parameters) can be changed using a separate tool (EtherNet/IP tool).

The primary parameters are the Data Unit for the Sensor, Actuator, and Controller classes. These affect the unit of the Measure, Setpoint, and Valve values in the IO data.

By default the data unit is set to counts. If another unit is desired, set the unit for the desired class. The value will be stored and will persist. When connecting the IO, the values will use the new data unit.

4.5.2 *CODESYS*



The User-Defined Parameters are sent before establishing the IO connection. Using the Data Unit parameters of the classes in the IO data, the unit of the Measure, Setpoint, and Valve parameters can be changed. To detect errors, use the Abort if error checkbox. This will stop configuration of the device if an error occurs here.

The data unit parameters are non-volatile, if they have been changed in a previous configuration they might not be set to defaults. Change the data unit to the desired unit using this mechanism, or perform a reset with option 1 via EtherNet/IP (reset the device to out of box settings).

5 OBJECTS AND SERVICES

Bronkhorst® MFC's consist of several objects with attributes and services for interfacing to EtherNet/IP. These objects are described below.

The EtherNet/IP Mass Flow Controller will be in "Idle" state after powered on or reset. In this state, the device will not allow the Master to use the Setpoint Attribute to control gas flow. Instead, gas flow will be controlled by the value previously set in the Analog Actuator Object's Safe-State Attribute and Safe-Value Attribute.

In order to activate the controller, the Master device establish an IO Connection. This will move the device into the Executing state. Alternatively the master can send a "Start" service request to the supervisor object of the Mass Flow Controller.

5.1 IO CONNECTIONS

The IO connections predefined in the EDS file, offer cyclic connections to the assemblies, which can be used to control several parameters of the instrument. IO connections use the lower latency UDP protocol to allow for fast messaging of cyclic process data. Of the four predefined IO connections, only one can be active at a time. When an IO connection is established the instrument will move to Executing state, which enables the PID controller for MFCs.

The following table list the IO connections available in the EDS file of the device.

IO Connection	Direction (seen from instrument)	Assembly	Size (bytes)	Parameter	Data Type	Size (bytes)
Basic INT	In	7	2	Setpoint	INT	2
	Out	2	3	Status	USINT	1
				Flow	INT	2
Extended INT	In	8	3	Override	USINT	1
				Setpoint	INT	2
	Out	6	8	Status	USINT	1
				Flow	INT	2
				Setpoint	INT	2
				Override	USINT	1
				Valve	UINT	2
Basic REAL	In	19	4	Setpoint	REAL	4
	Out	14	5	Status	USINT	1
				Flow	REAL	4
Extended REAL	In	20	5	Override	USINT	1
				Setpoint	REAL	4
	Out	18	14	Status	USINT	1
				Flow	REAL	4
				Setpoint	REAL	4
				Override	USINT	1
				Valve	REAL	4

There are two sets of connections available (Basic and Extended) in two different data types (INT and REAL). The data type only applies to the Setpoint, Flow, and Valve parameters in the assemblies in these connections. Upon establishment of the connection, the data type is set in the classes of the parameters (S-Analog Sensor, S-Analog Actuator, and the S-Single Stage Controller).

5.2 DEVICE CONFIGURATION

5.2.1 *Available parameter data*

Using the EDS-file in the configuration program of the master, following parameters are available in the standard EDS file for customizing the attributes in the assemblies or the profile classes:

1. Analog Sensor Gas Calibration Object Instance : selects calibration/fluid instance.: 1…8
2. Analog Sensor Data Unit : selects data unit for analog sensor attributes (measure)
3. Analog Sensor Alarm Mode : enables or disables the alarm
4. Analog Sensor Alarm Trip Point High : sets the upper limit for the alarm
5. Analog Sensor Alarm Trip Point Low : sets the lower limit for the alarm
6. Analog Actuator Data Unit : selects data unit for analog actuator attributes (valve)
7. Single Stage Controller Data Unit : selects data unit for controller attributes (setpoint)
8. Single Stage Controller Control Mode : selects the control mode for the single stage controller

Additional parameters can be added manually using the class, instance, and attribute id values from the tables in the previous chapters.

5.3 CLASSES

The following classes are supported by the device, and can be accessed using explicit messaging (acyclic messages). The classes prefixed with 'S-' are part of the MFC device profile. The Bronkhorst classes are custom defined classes that offer access to the most used Bronkhorst parameters, without conversion to CIP or EtherNet/IP specific units and types.

The PROPAR column shows how EtherNet/IP attributes are related to the internal variables of the instrument. This information can be useful for who is familiar with PROPAR or for diagnostics.

5.3.1 *Identity Object*

Class Code: 0x01
This object provides identification of and general information about the device. The Identity Object is present in all CIP products.

IDENTITY OBJECT'S INSTANCE ATTRIBUTES (Instance = 1)						
IDENTITY OBJECT	**ATTRI-BUTE**	**ATTRIBUTE NAME**	**SERVICE CODE**	**DATA TYPE**	**PROPAR**	**Comment**
0x01	0x01	Vendor Id	0x0E	UINT		706 (0x2C2)
0x01	0x02	Device Type	0x0E	UINT		26 (0x1A)
0x01	0x03	Product Code	0x0E	UINT	113,12	
0x01	0x04	Revision	0x0E	STRUCT		
0x01	0x05	Status	0x0E	WORD		
0x01	0x06	Serial Number	0x0E	UDINT		See Chapter 6.7 Serial number
0x01	0x07	Product Name	0x0E	SHORT-STRING		"Bronkhorst meter/controller"

IDENTITY OBJECT SERVICES			
IDENTITY OBJECT	**SERVICE CODE**	**SERVICE NAME**	**SERVICE DESCRIPTION**
0x01	0x05	Reset	Reset device, parameters: 0 = reset (like power cycle), 1 = load default values + reset
0x01	0x0E	Get_Attribute_Single	Returns the contents of the specified attribute
0x01	0x10	Set_Attribute_Single	Modifies an attribute value
0x01	0x4B	Wink_LEDs	Winks the LEDs on the device for identification purposes

5.3.2 *S-Device Supervisor Object*

Class Code 0x30
This object models the interface, functions and behavior associated with the management of application objects for devices within the “Hierarchy of Semiconductor Equipment Devices”

SUPERVISOR OBJECT’S INSTANCE ATTRIBUTES (Instance = 1)						
DEVICE SUPERVISOR OBJECT	**ATTRI-BUTE**	**ATTRIBUTE NAME**	**SERVICE CODE**	**DATA TYPE**	**PROPAR**	**Comment**
0x30	0x01	Number of Attributes	0x0E	USINT		20
0x30	0x02	Attribute List	0x0E	Array of USINT		
0x30	0x03	Manufacturer’s Device Type	0x0E	SHORT-STRING	113,1	“MFM" or "MFC”
0x30	0x04	SEMI Standard Revision	0x0E	SHORT-STRING		“E54-0997”
0x30	0x05	Manufacturer’s Name	0x0E	SHORT-STRING		“Bronkhorst High-Tech B.V.”
0x30	0x06	Manufacturer’s Model #	0x0E	SHORT-STRING	113,2	
0x30	0x07	Digital MFC Software Revision Level	0x0E	SHORT-STRING	113,5	“V1.23a”
0x30	0x08	EtherNet/IP Hardware Revision Level	0x0E	SHORT-STRING	113,7	“A”
0x30	0x09	Manufacturer’s Serial Number	0x0E	SHORT-STRING	113,3	Unique serial number for Bronkhorst instruments
0x30	0x0A	Device Configuration	0x0E	SHORT STRING	113,4	Manufacturer configuration
0x30	0x0B	Device Status	0x0E	USINT		
0x30	0x0C	Exception Status	0x0E	BYTE		
0x30	0x0D	Exception Detail Alarm	0x0E	STRUCT		
0x30	0x0E	Exception Detail Warning	0x0E	STRUCT		
0x30	0x0F	Alarm Enable	0x0E, 0x10	BOOL		0-1
0x30	0x10	Warning Enable	0x0E, 0x10	BOOL		0-1
0x30	0x13	Last Maintenance Date	0x0E	DATE	113,11	Service date
0x30	0x17	Running Hours	0x0E	UDINT	118,2	0-65535

Device status	
Attribute value	**State**
0	Undefined
1	Self-testing
2	Idle
3	Self-test Exception
4	Executing
5	Abort
6	Critical fault
7-50	Reserved by CIP
51-99	Device specific
100-255	Vendor specific

Exception Status		
Bit	**Exception status bit map, Bit 7 set to 0 Function**	**State**
0	Device specific definition	Alarm/device-common
1		Alarm/device-specific
2		Alarm/manufacturer-specific
3		reserved – is set to 0
4		Warning/device-common
5		Warning/device-specific
6		Warning/manufacturer-specific
7		1 = Expanded Method

When alarm is active bit 7 is always set. Bit 1 will be set when the Analog Sensor Status indicates a high or low flow alarm. For detail read either the Exception Detail Alarm parameter or the Analog Sensor Status attribute when bit 1 is set.

SUPERVISOR OBJECT SERVICES			
SUPERVISOR OBJECT	**SERVICE CODE**	**SERVICE NAME**	**SERVICE DESCRIPTION**
0x30	0x05	Reset	Resets the device to the **Self-Testing** state
0x30	0x06	Start	Starts the device execution by moving the device to the **Executing** state
0x30	0x07	Stop	Moves the device to the **Idle** state
0x30	0x0E	Get_Attribute_Single	Returns the contents of the specified attribute
0x30	0x10	Set_Attribute_Single	Modifies an attribute value
0x30	0x4B	Abort	Moves the device to the **Abort** state
0x30	0x4C	Recover	Moves the device out of the **Abort** state
0x30	0x4E	Perform_Diagnostics	Causes the device to perform a set of diagnostic routines

5.3.3 *S-Analog Sensor Object*

Class Code 0x31

The S-Analog Sensor Objects models the acquisition of a reading from a physical sensor in a device.

ANALOG SENSOR OBJECT'S INSTANCE ATTRIBUTES (Instance = 1)						
ANALOG SENSOR OBJECT	**ATTRI-BUTE**	**ATTRIBUTE NAME**	**SERVICE CODE**	**DATA TYPE**	**PROPAR**	**Comment**
0x31	0x01	Number of Attributes	0x0E	USINT		12
0x31	0x02	Attribute List	0x0E	Array of USINT		
0x31	0x03	Data Type	0x0E, 0x10	USINT		0xC3=INT, 0xCA=REAL
0x31	0x04	Data Unit	0x0E, 0x10	UINT		See Chapter 5.5
0x31	0x05	Reading Valid	0x0E	BOOL		0 = invalid, 1 = valid
0x31	0x06	Sensor Value	0x0E	INT or REAL[1]	1,0	see attribute 3 and 4 For data unit **counts** the value attribute will be in the range of 0..32767 where: 0 = no flow/pressure 32000 = max flow /pressure (100.0%) 32767 = max flow /pressure (102.4%) Note: 32767 is max. flow for data type INT. Max. flow REAL = 41943.04 (131.07%)
0x31	0x07	Status	0x0E	BYTE		1=High Alarm Exception, 2=Low Alarm Exception
0x31	0x08	Alarm Enable	0x0E, 0x10	BOOL		
0x31	0x0A	Full Scale	0x0E	INT		32000
0x31	0x11	Alarm Trip Point High	0x0E, 0x10	INT	97,1	see attribute 3 and 4
0x31	0x12	Alarm Trip Point Low	0x0E, 0x10	INT	97,2	see attribute 3 and 4
0x31	0x14	Alarm Settling Time	0x0E, 0x10	UINT	97,7	0-65000, alarm delay (msec)
0x31	0x1C	Auto zero status	0x0E	UINT		1 = busy, 0 = ready
0x31	0x23	Gas Calibration Object Instance	0x0E, 0x10	UINT		1-8 1 = fluid 1 selected

[1] Depends on the value assigned to the Data Type attribute. If the value of this attribute is 0xC3, the selected data type is Integer. If the value of this attribute is 0xCA, the selected data type will be the IEEE-754 single-precision floating-point.

ANALOG SENSOR OBJECT SERVICES			
ANALOG SENSOR OBJECT	**SERVICE CODE**	**SERVICE NAME**	**SERVICE DESCRIPTION**
0x31	0x0E	Get_Attribute_Single	Returns the contents of the specified attribute
0x31	0x10	Set_Attribute_Single	Modifies an attribute value
0x31	0x4B	Zero Adjust	Start auto zero

5.3.4 *S-Analog Actuator Object*

Class Code 0x32
The S-Analog Actuator Object models the interface to a physical actuator in a device.

ANALOG ACTUATOR OBJECT'S INSTANCE ATTRIBUTES (Instance = 1)						
ANALOG ACTUATOR OBJECT	**ATTRI-BUTE**	**ATTRIBUTE NAME**	**SERVICE CODE**	**DATA TYPE**	**PROPAR**	**Comment**
0x32	0x01	Number of Attributes	0x0E	USINT		7
0x32	0x02	Attribute List	0x0E	Array of USINT		
0x32	0x03	Data Type	0x0E, 0x10	USINT		0xC3=INT, 0xCA=REAL
0x32	0x04	Data Units	0x0E, 0x10	UINT		0x1001 = counts, 0x1007 = %
0x32	0x05	Override	0x0E, 0x10	USINT		
0x32	0x06	Actuator Value	0x0E, 0x10	INT or REAL[1]	114,1	See attribute 3 and 4 For data unit **counts** the value attribute will be in the range of 0..32767. Where: 0 = valve closed 32767 = valve fully open
0x32	0x07	Status	0x0E	BYTE		always 0
0x32	0x15	Safe State	0x0E, 0x10	USINT		
0x32	0x16	Safe Value	0x0E, 0x10	INT	114,6	

[1] Depends on the value assigned to the Data Type attribute. If the value of this attribute is 0xC3, the selected data type is Integer, and if the value of this attribute is 0xCA, the selected data type will be the IEEE-754 single-precision floating-point.

ANALOG ACTUATOR OBJECT SERVICES			
ANALOG ACTUATOR OBJECT	**SERVICE CODE**	**SERVICE NAME**	**SERVICE DESCRIPTION**
0x32	0x0E	Get_Attribute_Single	Returns the contents of the specified attribute
0x32	0x10	Set_Attribute_Single	Modifies an attribute value

5.3.5 *S-Single Stage Controller Object*

Class Code 0x33
The S-Single Stage Controller Object models a closed-loop control system within a device.

CONTROLLER OBJECT'S INSTANCE ATTRIBUTES (Instance = 1)						
SINGLE STAGE CONTROLLER OBJECT	**ATTRI-BUTE**	**ATTRIBUTE NAME**	**SERVICE CODE**	**DATA TYPE**	**PROPAR**	**Comment**
0x33	0x01	Number of Attributes	0x0E	USINT		6
0x33	0x02	Attribute List	0x0E	Array of USINT		
0x33	0x03	Data Type	0x0E, 0x10	USINT		0xC3=INT, 0xCA=REAL
0x33	0x04	Data Units	0x0E, 0x10	UINT		See Chapter 5.5
0x33	0x05	Control Mode	0x0E, 0x10	USINT		
0x33	0x06	Setpoint	0x0E, 0x10	INT or REAL[1]	1,1	See attribute 3 and 4. For data unit **counts** the setpoint attribute must be in the range of 0..32000. Where: 0 = min. setpoint (0%) 32000 = max. setpoint (100%)
0x33	0x0A	Status	0x0E	BYTE		
0x33	0x13	Ramp Rate	0x0E, 0x10	UDINT	1,2	Setpoint slope in msec (max. 255000 msec) Resolution is seconds.

[1] Depends on the value assigned to the Data Type attribute. If the value of this attribute is 0xC3, the selected data type is Integer, and if the value of this attribute is 0xCA, the selected data type will be the IEEE-754 single-precision floating-point.

CONTROLLER OBJECT SERVICES			
SINGLE STAGE CONTROLLER OBJECT	**SERVICE CODE**	**SERVICE NAME**	**SERVICE DESCRIPTION**
0x33	0x0E	Get_Attribute_Single	Returns the contents of the specified attribute
0x33	0x10	Set_Attribute_Single	Modifies an attribute value

Due to floating point precision and conversion between EtherNet/IP and internal instrument datatypes, the value written to the Single Stage Controller Value attribute might not exactly equal the actual value used in the instrument. The value read back on the Single Stage Controller Value attribute is the actual value used by the instrument.

5.3.6 *S-Gas Calibration Object*

Class Code 0x34
An S-Gas Calibration Object affects the behavior of an associated S-Analog Sensor object instance.

GAS CALIBRATION OBJECT'S CLASS ATTRIBUTES (Instance = 0)						
GAS CALIBRATION OBJECT	**ATTRI-BUTE**	**ATTRIBUTE NAME**	**SERVICE CODE**	**DATA TYPE**	**PROPAR**	**Comment**
0x34	0x02	Max Instance[1]	0x0E	UINT		8

GAS CALIBRATION OBJECT'S INSTANCE ATTRIBUTES (Instance = 1...8)						
GAS CALIBRATION OBJECT	**ATTRI-BUTE**	**ATTRIBUTE NAME**	**SERVICE CODE**	**DATA TYPE**	**PROPAR**	**Comment**
0x34	0x01	Number of attributes	0x0E	USINT		6
0x34	0x02	Attribute List	0x0E	Array of USINT		
0x34	0x03	Gas Standard number	0x0E	UINT		see list from SEMI
0x34	0x04	Valid Sensor instance	0x0E	UINT		1
0x34	0x05	Gas Symbol	0x0E	SHORT STRING	1,17	Fluid name
0x34	0x06	Full Scale	0x0E	STRUCT		Full scale capacity (REAL), capacity unit (UINT)
0x34	0x08	Calibration Date	0x0E	DATE	113,9	

GAS CALIBRATION OBJECT SERVICES			
GAS CALIBRATION OBJECT	**SERVICE CODE**	**SERVICE NAME**	**SERVICE DESCRIPTION**
0x34	0x0E	Get_Attribute_Single	Returns the contents of the specified attribute
0x34	0x10	Set_Attribute_Single	Modifies an attribute value

5.3.7 *Bronkhorst Sensor and Control object*

Note: To comply with the MFC profile, the Bronkhorst specific objects should not be used. As some parameters will influence the profile object functionality. When an IO connection is active, all write parameters in that connection that are mapped to one of these parameters internally, will be overwritten with the IO connection data.

CIP		Parameter	Access	Data Type	FlowDDE	Propar	
Class	Attribute					Process	Parameter
100	3	fMeasure (Actual Measure)	R	REAL	205	33	0
	4	fSetpoint (Actual Setpoint)	RW	REAL	206	33	3
	5	Measure (0-32000)	R	UINT	8	1	0
	6	Setpoint (0-32000)	RW	UINT	9	1	1
	7	Setpoint Slope	RW	USINT	10	1	2
	8	Valve output (Actuator Output Value)	RW	UDINT	55	114	1
	9	Control Mode	RW	USINT	12	1	4
	10	Alarm info (Device Status)	R	USINT	28	1	20
	11	Temperature	R	REAL	142	33	7
	12	Pressure	R	REAL	143	33	8
	13	Density	R	REAL	170	33	21

5.3.8 *Bronkhorst Advanced*

CIP		Parameter	Access	Data Type	FlowDDE	Propar	
Class	Attribute					Process	Parameter
101	3	Controller Speed	RW	REAL	254	114	30
	4	Dynamic Display Filter	RW	REAL	56	117	1
	5	Static Display Filter	RW	REAL	57	117	2
	6	IO Switch Status (shutoffs)	RW	UDINT	288	114	31
	7	Analog Input	R	INT	11	1	3
	8	Frequency (CORI-Flow)	R	REAL	149	33	9
	9	Controller Hysteresis (P800)	RW	REAL	361	114	15
	10	PID-Kp	RW	REAL	167	114	21
	11	PID-Ti	RW	REAL	168	114	22
	12	PID-Td	RW	REAL	169	114	23
	13	Monitor mode	RW	USINT	60	115	2
	14	Density Actual	R	REAL	270	116	15

5.3.9 *Bronkhorst Fluid Calibration*

CIP		Parameter	Access	Data Type	FlowDDE	Propar		Note
Class	Attribute					Process	Parameter	
102	3	Fluid Index	RW	USINT	24	1	16	Value 0…7
	4	Fluid Name	R	SHORT_STRING	25	1	17	
	5	Capacity 100%	RW	REAL	21	1	13	
	6	Capacity 0%	RW	REAL	183	33	22	
	7	Capacity Unit	RW	SHORT_STRING	129	1	31	
	8	Auto Zero (calibration mode = 22)	RW	USINT	NA	NA	NA	Write: 1 = start Read: 1 = busy Read: 0 = ready
	9	Calibration Certificate	R	SHORT_STRING	171	113	8	
	10	Calibration Date	R	SHORT_STRING	172	113	9	

5.3.10 *Bronkhorst Identification*

CIP		Parameter	Access	Data Type	FlowDDE	Propar	
Class	Attribute					Process	Parameter
103	3	Bronkhorst Model Number	R	SHORT_STRING	91	113	2
	4	Serial Number	R	SHORT_STRING	92	113	3
	5	Model Number	R	SHORT_STRING	208	113	4
	6	Firmware Version	R	SHORT_STRING	105	113	5
	7	User Tag	RW	SHORT_STRING	115	113	6

5.3.11 *Bronkhorst Alarm*

CIP		Parameter	Access	Data Type	FlowDDE	Propar		Note
Class	Attribute					Process	Parameter	
104	3	Alarm Reset	W	USINT	NA	NA	NA	write value 1 to reset
	4	Alarm Mode	RW	USINT	118	97	3	
	5	Alarm Delay	RW	USINT	182	97	7	
	6	Alarm Reset Enable	RW	USINT	156	97	9	
	7	Alarm Max Limit	RW	UINT	116	97	1	
	8	Alarm Min Limit	RW	UINT	117	97	2	
	9	Alarm Setpoint Mode	RW	USINT	120	97	5	
	10	Alarm New Setpoint	RW	UINT	121	97	6	

5.3.12 *Bronkhorst Counter*

CIP		Parameter	Access	Data Type	FlowDDE	Propar		Note
Class	Attribute					Process	Parameter	
105	3	Counter Reset	W	USINT	NA	NA	NA	write value 1 to reset
	4	Counter Mode	RW	USINT	130	104	8	
	5	Counter Reset Enable	RW	USINT	157	104	9	
	6	Counter Value	R	REAL	122	104	1	
	7	Counter Limit	RW	REAL	124	104	3	
	8	Counter Unit	RW	SHORT_STRING	128	104	7	
	9	Counter Setpoint Mode	RW	USINT	126	104	5	
	10	Counter New Setpoint	RW	UINT	127	104	6	
	11	Counter Controller Overrun Correction	RW	REAL	274	104	10	
	12	Counter Controller Gain	RW	REAL	275	104	11	

For all Bronkhorst attributes: R = Service 0x0E (Get Attribute Single), W = Service 0x10 (Set Attribute Single)

5.4 PARAMETER DATA TYPES

This section describes the data type specification syntaxes, data type value ranges and operations that can be performed on the defined data types.

Table 2-18: SUBSET OF ELEMENTARY DATA TYPES

Keyword	Description	Minimum range	Maximum range
BOOL	Boolean	0	1
SINT	Short Integer	-128	127
INT	Integer	-32768	32767
USINT	Unsigned Short Integer	0	255
UINT	Unsigned Integer	0	65535
UDINT	Unsigned Double Integer	0	4294967295
REAL	Floating Point	IEEE 754 single precision floating point	
DATE	Date only	D#1972-01-01	D#2151-06-06 (65536 days)
STRING	Character string (1 byte per character)	See IEC1131-3	
SHORT_STRING	Length (1 byte) followed by STRING	See IEC1131-3	

5.5 UNITS

The following units are available for Bronkhorst Meter Controllers. Note that the tables list all units that are available for all types of instruments. Not all units are available in all instruments. Therefore when selecting a unit, check if the selection is successful. When the unit can be set successfully, the unit is valid for the instrument.

5.5.1 *Generic*

Value	CIP Unit	Description
0x1001	Counts	See full scale of object for limit value
0x1007	Percent	0-100%

5.5.2 *Temperature*

Value	CIP Unit	Description
0x1200	°C	degree Celsius
0x1201	°F	degree Fahrenheit
0x1202	K	Kelvin

5.5.3 *Pressure*

Value	CIP Unit	Description
0x1300	psi	pound-force per square inch (psi)
0x1301	Torr	torr
0x1303	mmHg (0°C)	millimeter of mercury (at 0°C)
0x1304	inHg (0°C)	inch of mercury (at 0°C)
0x1305	cmH2O (25°C)	centimeter of water (at 25°C)
0x1306	inH2O (25°C)	inch of water (at 25°C)
0x1307	bar	bar
0x1308	mbar	Millibar
0x1309	Pa	pascal
0x130A	kPa	kilopascal
0x130B	atm	standard atmosphere
0x130D	mmH2O (25°C)	millimeter of water (at 25°C)
0x130E	hPa	hectopascal
0x1310	mH2O (68°F)	meter of water (at 68°F)
0x1312	MPa	megapascal
0x1313	gf/cm²	gram force per square centimeter
0x1314	kgf/cm²	kilogram force per square centimeter

5.5.4 *Flow*

The Standard and Normal units in CIP refer to the Standard set by SEMI, which defines standard conditions as 101.325 kPa absolute pressure (14.6959 psia) and a temperature of 0°C (32°F). Normal conditions are defined as 101.325 kPa absolute pressure (14.6959 psia) and a temperature of 20°C (68°F).

Units without the standard (S), or normal (N) prefix refer to Custom conditions.

Value	CIP Unit	Description
0x1400	SCCM	standard cubic centimeter per minute
0x1401	SLM	standard liter per minute
0x1402	CFM	cubic foot per minute
0x1404	kg/s	kilogram per second
0x1405	m3/s	cubic meter per second
0x1406	l/s	liter per second
0x1407	ml/s	milliliter per second
0x140E	mg/min	milligram per minute
0x140F	g/min	gram per minute
0x1410	kg/h	kilogram per hour
0x1411	ml/m	milliliter per minute
0x1412	ml/h	milliliter per hour
0x1413	l/m	liter per minute
0x1414	l/h	liter per hour
0x142A	cm^3/h	cubic centimeter per hour
0x142B	cm^3/min	cubic centimeter per minute
0x142C	cm^3/s	cubic centimeter per second
0x1432	m^3/h	cubic meter per hour
0x1433	m^3/min	cubic meter per minute
0x1436	g/h	gram per hour
0x1437	g/s	gram per second
0x1445	kg/min	kilogram per minute
0x1451	Nm^3/h	normal cubic meter per hour
0x1452	Nm^3/min	normal cubic meter per minute
0x1453	Nm^3/s	normal cubic meter per second
0x1455	Nl/h	normal liter per hour
0x1456	Nl/min	normal liter per minute
0x1457	Nl/s	normal liter per second
0x145E	Sm^3/h	standard cubic meter per hour
0x145F	Sm^3/min	standard cubic meter per minute
0x1460	Sm^3/s	standard cubic meter per second
0x1466	ft^3/h	cubic foot per hour
0x1467	ft^3/s	cubic foot per second
0x146C	SCFS	Standard cubic foot per second
0x146D	SCFM	Standard cubic foot per minute
0x146E	SCFH	Standard cubic foot per hour
0x1486	SLH	Standard liter per hour
0x1487	SLS	Standard liter per second

6 OBJECT PROPERTIES

6.1 PROFILE OBJECTS

All profile objects with the Data Type and Data Unit parameters, have to option to switch certain parameters to a different data type or unit. The data type and unit can be changed only when the device is not in Executing state.

The data type can be switched between INT (0xC3) and REAL (0xCA). The default type is INT. Performing a reset service will reset all data type and data units to default. Connecting to an IO connection of a certain type will set the data type of all classes to the data type of the connection.

The data unit can be changed as well. For the S-Analog Sensor and the S-Single Stage Controller classes see the unit list in Chapter 5.5 Units. For the S-Analog Actuator class only the units Counts (0x1001) and Percentage (0x1007) are available.

6.2 SUPERVISOR OBJECT

6.2.1 *Safe state*

*The **safe state** is active when the device is not in the EXECUTING state. In safe state, the valve will go the safe value configured in the analog actuator object. The device will move to executing state automatically upon establishment of an IO connection, or can be moved manually by sending the Start service to the Supervisor object.*

When a network error is detected while the device is in Executing state, it is set back to the Idle or Critical Fault state. In those states the valve is set to the Safe state (see attribute Safe State in Analog Actuator object). Such errors are shown by the LED's on the instrument. See the chapter "Troubleshooting"

6.2.2 *Exception Status*

Exception status is a single byte which indicates the status of alarms and warnings. The expanded method of alarm messaging is used, therefore bit 7 of this parameter is always set (128, 0x80, is therefore the normal, all ok, value). Bit 1 is used to indicate that a device alarm is active. Device alarms include the Analog Sensor High/Low Trip point alarms. When the alarm is active the exception status parameter value will be 130, or 0x82. For information about which alarm is active, read the alarm status parameter of the Analog Sensor object.

Bit	Meaning
0	alarm device common
1	alarm device specific
2	alarm manufacturer specific
3	Reserved
4	warning device common
5	warning device specific
6	warning manufacturer specific
7	1 = expanded method

6.3 SINGLE STAGE CONTROLLER

6.3.1 *Control mode*

The Control Mode is implemented as follows:

Control Mode	Actuator Value
0 (Normal)	set by attribute 6 (setpoint)
1 (Close)	0
2 (Open)	max. value
3 (Hold)	last used value
4 (Safe state)	safe value, (safe state attribute)

When Override attribute of Analog actuator (object 0x32, attribute 0x05) is set to a value other than 0, this attribute will override the Control Mode attribute.

6.4 ANALOG SENSOR OBJECT

6.4.1 *Alarm enable*

Attribute Alarm enable of Analog Sensor object is linked to propar 97;3 (Alarmmode).

Propar	EtherNet/IP
Alarm mode	**Alarm enable**
proc 97; par 3	**obj 0x31, attr 8**
ALRM_OFF (ALRM_RESPONSE) (ALRM_POWERFAILURE)	0 (off)
ALRM_MINMAX	1 (on)

When 0 is written to Alarm enable attribute, the internal alarm mode is always set to ALRM_OFF. The modes ALRM_RESPONSE and ALRM_POWERFAILURE can be set using the 'Alarm Mode' attribute of the Bronkhorst Alarm Class (see chapter 5.3.11 Bronkhorst Alarm)

More information can be found in the manual "917023 Operational instructions digital instruments"
This document can be found at: http://www.bronkhorst.com/en/downloads/instruction_manuals/

6.4.2 *Alarm Trip Points*

The Alarm Trip Point High and Low are set in the same unit and data type as the sensor measurement value (analog sensor data unit and type).

A value outside the valid range is rounded to the nearest value within the range. Note that the Trip Point values are dependent on the selected data types/units.

6.4.3 *Gas calibration object instance*

Indicates which Gas Calibration object instance is active for this object. The value of this attribute is equal to (fluid index + 1). Value 0 is not supported.

6.5 ANALOG ACTUATOR OBJECT INSTANCE

6.5.1 *Actuator value*

The followings data units are supported:
0x1001 (counts): 0 = valve closed, 32767 = valve fully open
0x1007 (percent): 0 = valve closed, 100 = valve fully open

The following data types are supported: 0xC3 (int) 0xCA (real)

6.5.2 *Override*

The Override attribute is implemented as follows:

Override	Value to Valve
0 (Normal)	set by attribute 6 (Actuator Value)
1 (Zero)	0
2 (Maximum value)	max. value
3 (Hold)	last used value
4 (Safe state)	See section 6.5.3.

6.5.3 *Safe state*

In the following table the implemented values of the Valve output are shown:

Safe state	Value to Valve
0 (zero/off)	0
1 (full scale/on)	max. value
2 (hold last value)	last used value
3 (use safe value)	Safe value (See section 5.3.4)

6.6 GAS CALIBRATION OBJECT INSTANCE

6.6.1 *Gas standard number*

The retrieval of the gas standard number is implemented as follows: the first 2 characters of the fluid name are interpreted as a decimal number. This number is returned as the gas standard number.

6.6.2 *Gas Symbol*

The fluid name is returned as the Gas Symbol.

6.7 SERIAL NUMBER

The EtherNet/IP serial number (attribute 6 of Identity object) is a unique unsigned 32 bit integer value, and is generated from the Serial Number parameter of the instrument.

MYY2ORDERNN

The M or other first character is omitted.
The year number is converted modulo 43.
The 2 is omitted.
The order number is added.
The NN is converted to a number where A = 1, AA = 27, and ZZ = 702.

Some examples:

Bronkhorst Serial Number	EtherNet/IP Serial Number
M18212645A	1812645001
M18212645Z	1812645026
M19209539AA	1909539027
M19210764ZZ	1910782702

7 TROUBLESHOOTING

7.1 LED INDICATIONS

7.1.1 *Network Status (NET)*

State	Led	Indication
Not powered No address	Off	Device is not online • The device may not be powered, look at module status LED • If the device is powered, there is not IP address. Configure and address, or wait for an address to be assigned by DHCP or BOOTP (when configured).
No connections	Flashing ● green 0.5 sec on 0.5 sec off	The device is online but has no established connections.
Connected	On ● green	Device is online and has an established connection.
Connection timeout	Flashing ● red 0.5 sec on 0.5 sec off	An IO connection is in the timed-out state.
Address conflict	On ● red	The device has a duplicate IP address, which has rendered it incapable of communicating on the network.
Device self-testing	Flashing ● red / ● green 0.5 sec on 0.5 sec off	The device is performing (power-up) self-test.

7.1.2 *Module Status (MOD)*

State	Led	Indication
No power	Off	There is no power applied to the device
Device standby	Flashing ● green 0.5 sec on 0.5 sec off	The device needs commissioning due to configuration missing, incomplete or incorrect.
Device operational	On ● green	The device is operating in normal condition.
Minor fault	Flashing ● red 0.5 sec on 0.5 sec off	The device has a minor fault, which is recoverable. An incorrect configuration is considered a minor fault.
Unrecoverable fault	On ● red	The device has an unrecoverable fault, may need replacing.
Device self-testing	Flashing ● red / ● green 0.5 sec on 0.5 sec off	The device is performing (power-up) self-test.

More information can be found in the manual "9.17.023 Operational instructions digital instruments"
This document can be found at: http://www.bronkhorst.com/en/downloads/instruction_manuals/

7.2 BUS DIAGNOSTICS

Using the Fieldbus1 Diagnostics parameter additional information about the state of the EtherNet/IP interface on the instrument can be found.

The diagnostics string has the following format: **DS**nn**MS**nn**NS**nn**AI**nn**AT**nn**CC**nnnn**RS**n

Field	Name	Description
DS	Device state	State of device supervisor.
MS	Module state	State of module (also visible on LEDs).
NS	Network state	State of network (also visible on LEDs).
AI	Active input assembly	ID of the active input assembly.
AT	Active assembly type	Type of the active input assembly (0xC3/INT or 0xCA/REAL).
CC	Connection count	Number of established connections.
RS	Rotary Status	Address mode (bit 0...2) and IP LSB used (bit 3).

8 SERVICE

For current information on Bronkhorst® and service addresses please visit our website:

http://www.bronkhorst.com

Do you have any questions about our products? Our Sales Department will gladly assist you selecting the right product for your application. Contact sales by e-mail:

sales@bronkhorst.com

For after-sales questions, our Customer Service Department is available with help and guidance. To contact CSD by e-mail:

aftersales@bronkhorst.com

No matter the time zone, our experts within the Support Group are available to answer your request immediately or ensure appropriate further action. Our experts can be reached at:

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