Instruction manual

PROFINET IO-Device interface for digital multibus Mass Flow / Pressure / Gateway instruments

Doc. no.: 9.17.095J Date: 22-01-2024

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

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Copyright

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 section 9 (Guarantee) of the Conditions of sales:
www.bronkhorst.com/about/conditions-of-sales/

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.

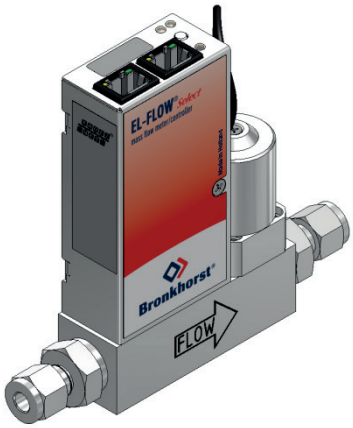
Table of contents

1 GENERAL PRODUCT INFORMATION

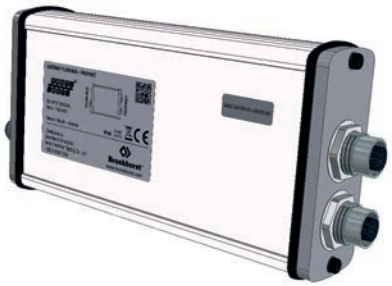
1.1 INTRODUCTION

This manual will explain how to install a Bronkhorst® instrument to your PROFINET system. It only contains information which is needed most.

More detailed information about PROFINET can be obtained from the website of the (international) PROFINET organization (www.profibus.com) or the PROFINET organization of your country (if available).



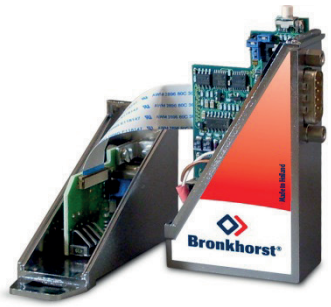
Example of a Bronkhorst® instrument with PROFINET interface



Example of a Bronkhorst® Gateway with PROFINET interface

1.2 MULTIBUS TYPES

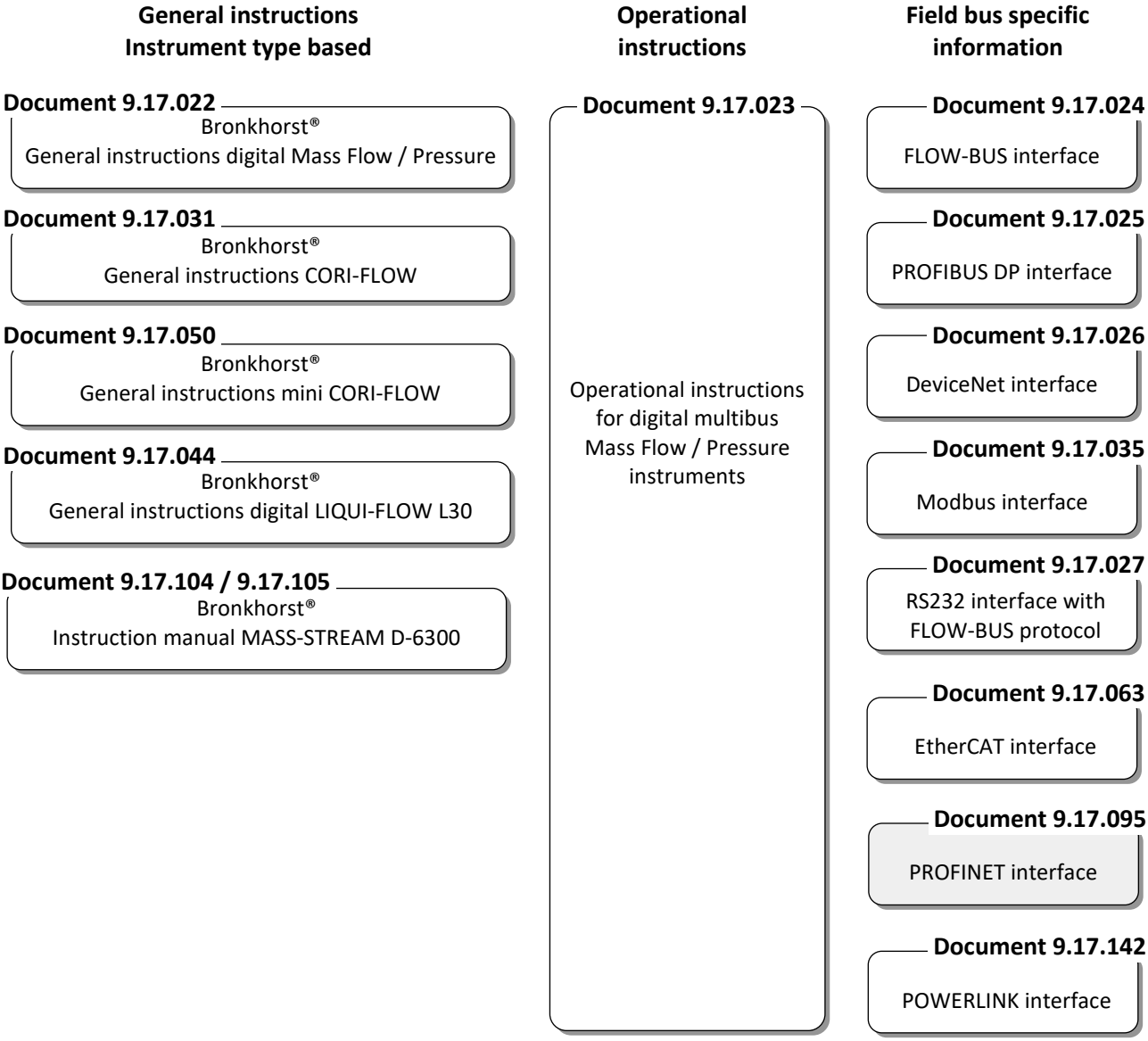
The Bronkhorst® digital instruments offers great flexibility thanks to the "multibus" concept, whereby the instruments can be equipped with an on-board interface with DeviceNet™, PROFIBUS DP, PROFINET, Modbus, EtherCAT, POWERLINK or FLOW-BUS protocol.



1.3 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. Fieldbus specific information explains the installation and use of the field bus installed on the instrument.

1.3.1 Manuals and user guides:



1.3.2 Technical Drawings:

Hook-up diagram MBC3 laboratory-style PROFINET	(document nr. 9.16.147)
Hook-up diagram gateway PROFINET industrial	(document nr. 9.16.181)
Hook-up diagram ES-FLOW Ethernet interfaces	(document nr. 9.16.251)
Hook-up diagram industrial Ethernet M12	(document nr. 9.16.253)

1.3.3 Software tooling:

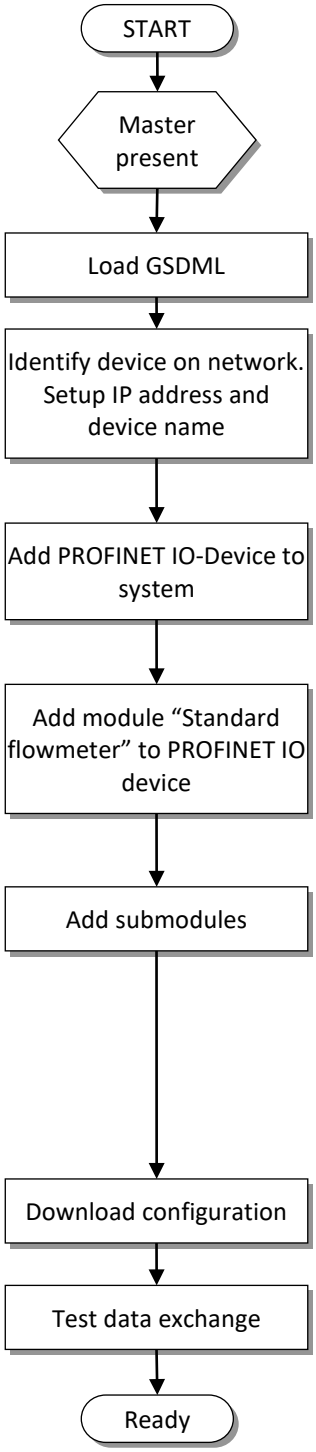
Flowfix
FlowDDE

GSDML file for meter/controller:	GSDML-Vx.y-BHT-Flowmeters-yyyymmdd.xml
GDSML file for Gateway:	GSDML-Vx.y-BHT-Gateway-yyyymmdd.xml

All these documents and software can be found at:
www.bronkhorst.com/downloads/

1.4 SHORT FORM START-UP

All necessary settings for this module are already performed at Bronkhorst®.
To follow next steps carefully is the quickest way to get this module operational in your own PROFINET environment.



Make sure your master has been installed to the PROFINET system

Load GSDML-file into the configuration tool (software at PROFINET master). There are different GDSML-files for the instrument and the Gateway:

- For meter/controller: GSDML-Vx.y-BHT-Flowmeters-yyyymmdd.xml
- For Gateway: GSDML-Vx.y-BHT-Gateway-yyyymmdd.xml

Perform a network scan to identify the devices connected to the network. Setup the device’s IP-address and device name.

Select "Bronkhorst meter/controller" or “Gateway” and add new instrument to the bus (with configuration tool).

Depending on the instrument type a “module” can be added to slot 1 of the PROFINET IO-Device.
NOTE: at this point, the GSDML-file only supports Standard flowmeter.

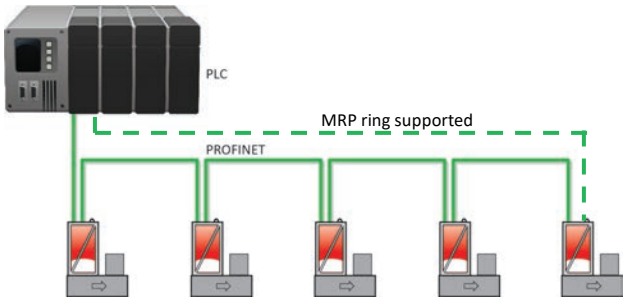
Submodules can be added to the subslots of the module. The submodules represent the parameters of the device (i.e. measure or setpoint). These modules will be read/written cyclically.

Download all configuration settings into your master.

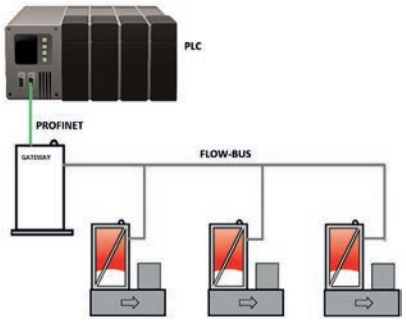
Test data-exchange communication between your master and the instrument(s).

1.5 FUNDAMENTALS OF PROFINET

PROFINET is an industry technical standard for data communication over Industrial Ethernet and is used for data exchange between IO-Controllers (PLC, etc.) and IO-Devices (slaves, field devices). It uses the proven communication model and application view of PROFIBUS DP and extends it by Ethernet as the communication medium.

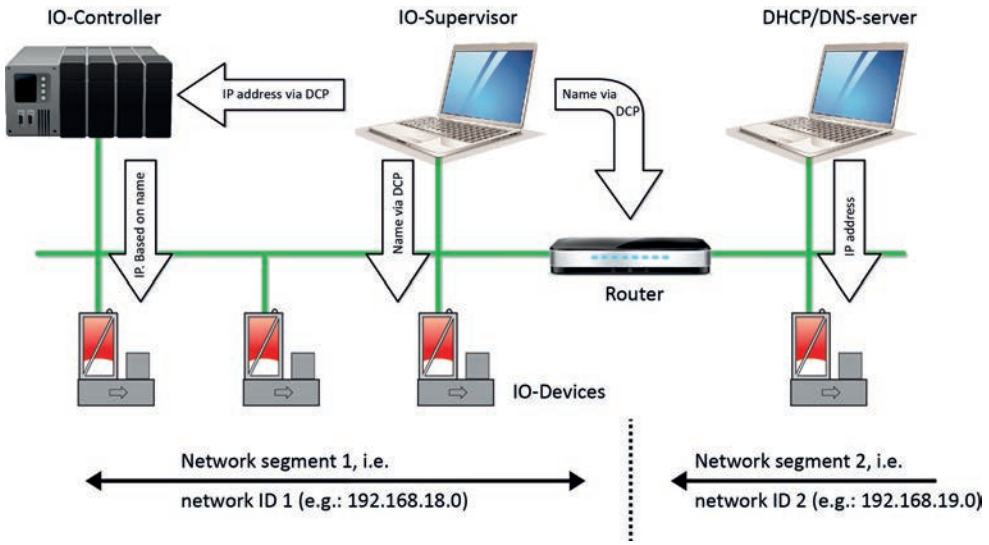


Simple PROFINET system.



Gateway PROFINET system

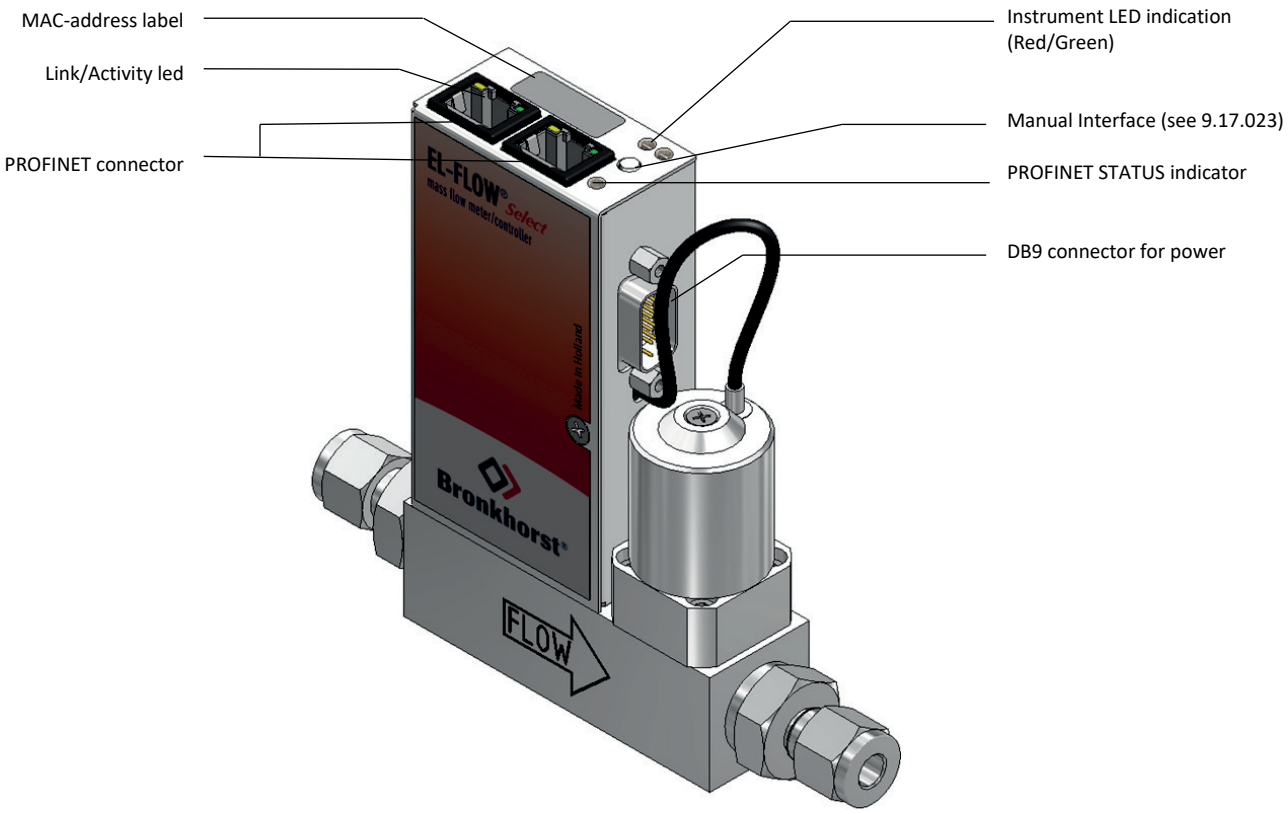
PROFINET is a master/slave bus system. Bronkhorst® instruments and Gateway are all slaves. There is no mutual communication between PROFINET slaves, only between a master and slave. The Media Redundancy Protocol (MRP) is supported, and can be optional used (see dashed lines in the figure above). The slaves are addressed using MAC addresses and IP addresses. The figure below shows a network that comprises two subnets. These are represented by the different Network-IDs (subnet mask). For PROFINET IO field devices, address resolution is based on the symbolic name of the device, to which a unique MAC address is assigned. After the system is configured, the engineering tool loads all information required for data exchange to the IO-Controller, including the IP addresses of the connected IO-Devices. Based on the name (and the associated MAC address), an IO-Controller can recognize the configured field devices and
assign them the specified IP addresses using the DCP protocol (Discovery and Configuration Protocol) integrated in PROFINET IO. Alternatively, addressing can be performed via a DHCP server Following address resolution, the system powers up and parameters are transmitted to the IO-Devices. The system is then available for productive data traffic.



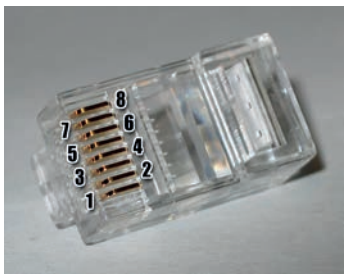
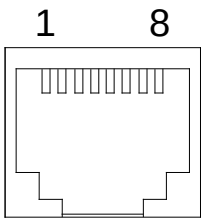
- **Master configuration software.**
  The IP-address and Device name can be configured with the Master configuration software.
  TIA portal from Siemens and the PLC type S7-1500 is used in this manual.
  Most master configuration software tools work in the same way, because PROFINET is a standardized fieldbus system. Only on details and program operation things could be different.
  Read user manual carefully for correct operation of other programs than TIA portal
- **Bronkhorst® tooling software: eq FlowFix, FlowDDE and FlowView**
  The Bronkhorst® tooling software is able to communicate with the instrument via RS232 using a special cable. If you don't have such a cable, ask your local sales representative.

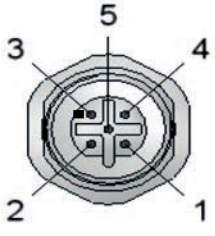
2 PROFINET INSTALLATION

2.1 INSTRUMENT OVERVIEW



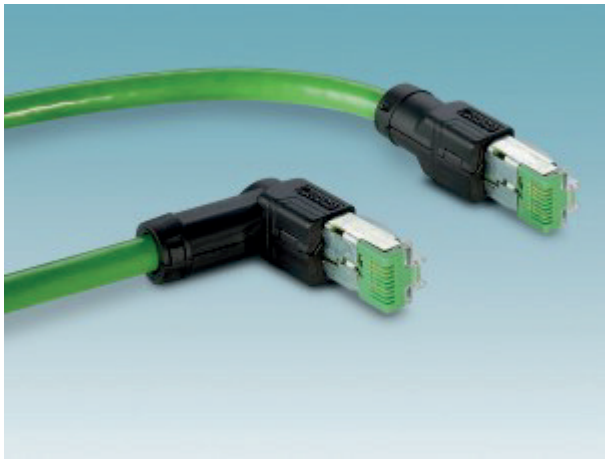
2.2 PIN ASSIGNMENT PROFINET

RJ45 Connector	Receptacle	Pin number	Wire color	Description
		1	Yellow	Transmit +
		2	Orange	Transmit -
		3	White	Receive +
		4		Not used
		5		Not used
		6	Blue	Receive -
		7		Not used
		8		Not used

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

2.3 CONNECTION CABLES PROFINET

For a robust communication it is advised to use the dedicated PROFINET cable that uses a 4-wire robust quad cable. The electrical performance is optimised for 100Base-Tx and shielded against interference.



Example of a PROFINET cable with RJ45

Example of a PROFINET cable with M12-D coded

More information about PROFINET cables can be found at:
www.profibus.com

2.3.1 PROFINET connection

The Bronkhorst® instruments are equipped with two RJ45 or M12-D connectors. Both connectors can be used as input or output. One of the PROFINET connectors can be used to connect the instrument with the PROFINET master and the other connector can be used to connect to another PROFINET instruments.

According to IEC 802.3 the maximum cable length for 100 MBaud Ethernet is 100m (100BaseT), e.g. between two instruments.

2.3.2 PROFINET bus termination

A bus terminator (e.g. using bus terminating resistors) is not necessary.

2.4 POWER CONNECTOR

The laboratory style instrument is powered through the DB9 female connector.
The industrial style instrument is powered through the M12-A or 8DIN female connector.
See par. 1.3.2 technical drawings for more information about the power connector.

3 INSTRUMENT CONFIGURATION

3.1 INSTRUMENT GSDML-FILE

Each type PROFINET instrument has its own GSDML-file with instrument specifications to tell the master configuration software which facilities/features the instruments offers to the PROFINET system. For Bronkhorst® meter/controller the file is called: GSDML-Vx.y-BHT-Flowmeters-yyyymmdd.xml. This file is available on the Multibus documentation/software tool CD and can be downloaded from the Bronkhorst® web-site.

A current version of the GSDML file can be downloaded from www.bronkhorst.com (search for 'GSDML')

The GSDML file is a xml file containing:

- Device identification info. This contains general information like:
  - Vendor (Bronkhorst)
  - Vendor ID (0x02F3)
  - Product family.
- Device Access Point (DAP) contains information about:
  - Used hardware
  - Ethernet related settings
  - Supported features.

  The following Device Access Points are available:
    - DAP1: Bronkhorst Flow meter/controller
    - DAP2: Bronkhorst Pressure meter/controller
    - DAP3: Bronkhorst Multi-channel meter/controller
    - DAP4: Bronkhorst PID controller

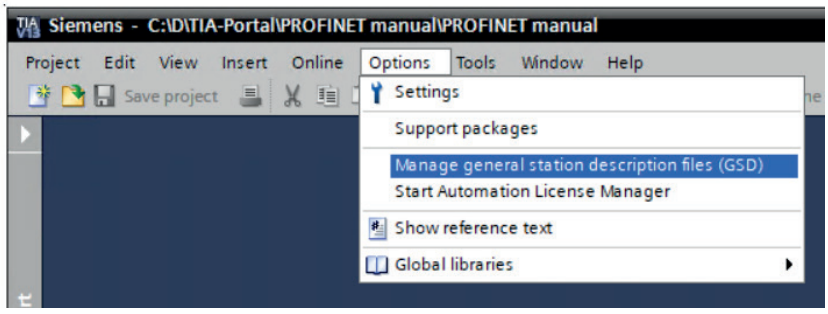
- Modules
  Modules represent Bronkhorst® devices (i.e. Flowmeters, pressure controllers etc.). Modules can be assigned to a slot of the PROFINET IO-Device. Depending on the hardware, 1 to 3 modules can be assigned.
- Submodules
  Submodules represent the variables of the Module. Submodules can be added to the cyclic IO by assigning them to a subslot of the corresponding slot.

3.2 CONFIGURATION SOFTWARE

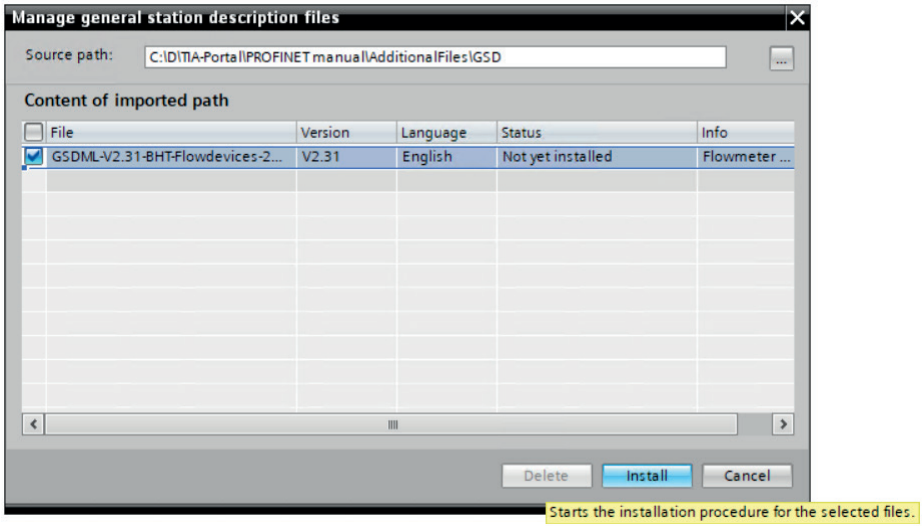
In this manual we use as an example the software tool “TIA portal from Siemens”.

3.3 LOAD GSDML-FILE

Select [Manage general station description files (GSD)] in the [Options] menu.



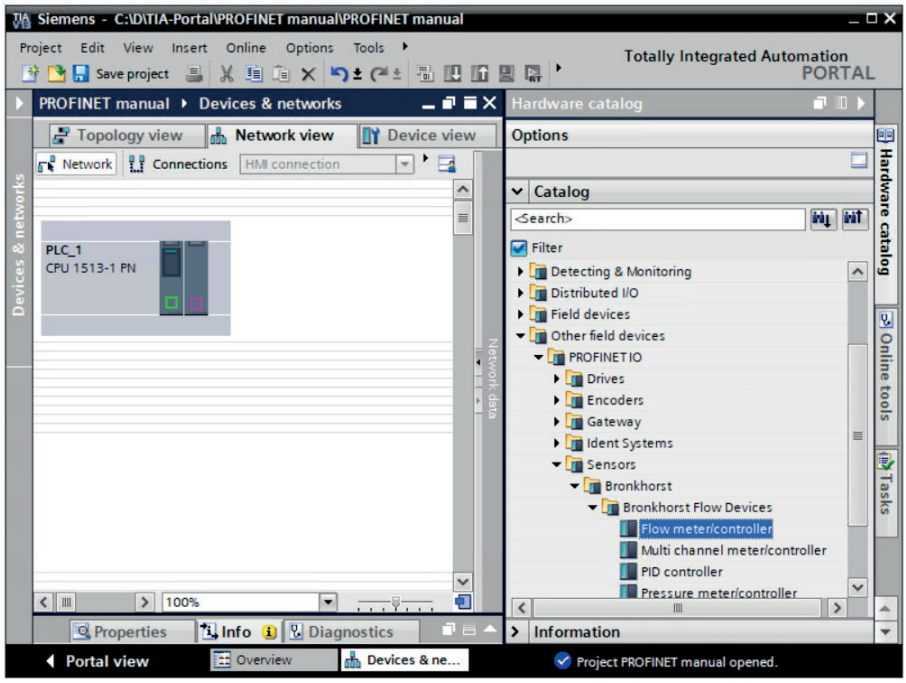
Select the file: GSDML-Vx.y-BHT-Flowmeters-yyyymmdd.xml, load and install this file.



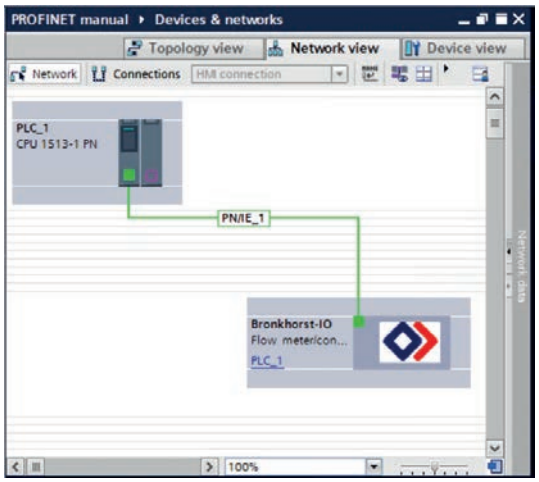
The Bronkhorst devices will now be available in the hardware catalog.

3.4 ADD AN INSTRUMENT TO PROFINET IO

Select the appropriate Bronkhorst device, for example the “Flow meter/controller” from the [Hardware Catalog] and add it to your system.



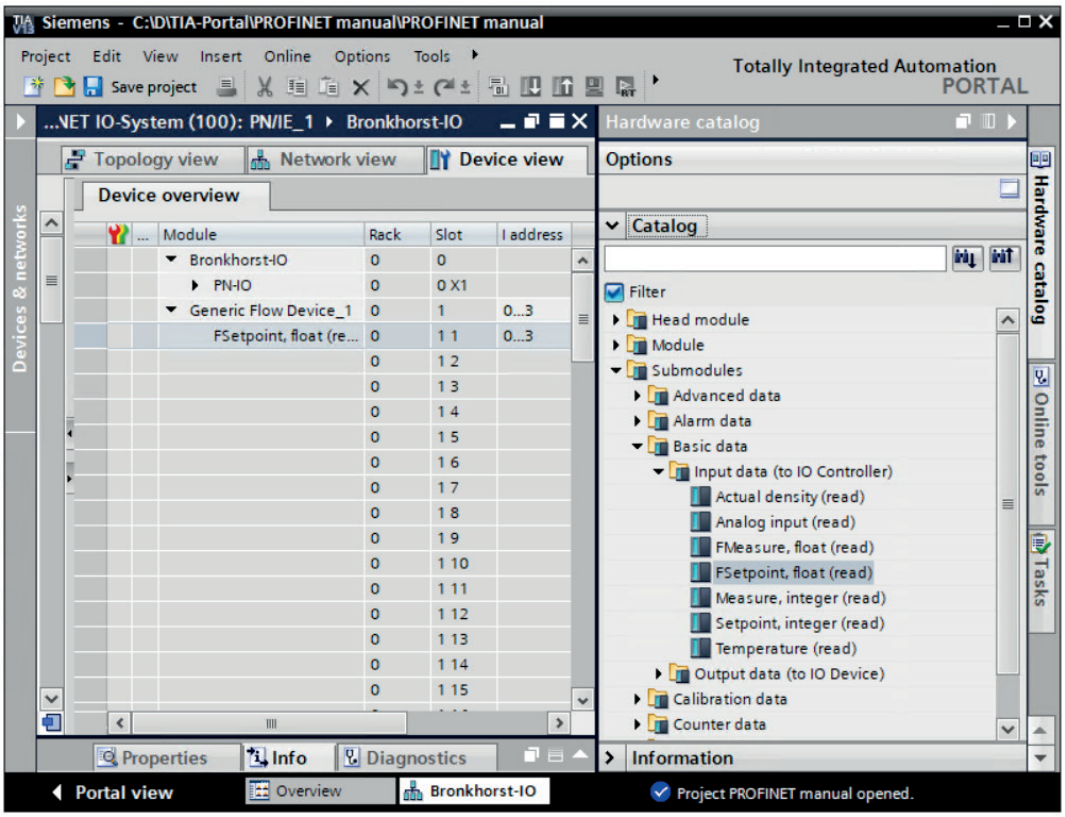
Connect the Bronkhorst instrument with PROFINET to the PLC.



3.5 INSTRUMENT CONFIGURATION SETTINGS

Bronkhorst® PROFINET instruments offer many available modules/parameters for operation of the instruments. These modules/parameters can be selected by means of the master configuration tooling software.

After installing the slave to the PROFINET system, point to actual slave and select: [setup]. [Device overview]. In the [Hardware Catalog] all available modules are listed. Select those instrument variables you want to use. The selected modules will be displayed in the [Device overview].



- In the example above the flow measurement “Fsetpoint, float (read)” is selected. You can drag and drop submodules from the catalog into the device view.

3.6 CYCLIC PARAMETER ACCESS (INSTRUMENT SPECIFIC)

The parameters of the instrument can be accessed cyclically by its name, e.g.:

- "Measure, integer (read)": to access the measurement value
- "Setpoint, integer (write)": write the setpoint to the controller

Cyclic Parameter	Proc/Param
Measure, integer (read)	1/0
Fmeasure, float (read)	33/0
Setpoint, integer (read)	1/1
Setpoint, integer (write)	1/1
Fsetpoint, float (read)	33/3
Fsetpoint, float (write)	33/3
Analog input (read)	1/3
Temperature (read)	33/7
Actual density (read)	116/15
Control mode (read)	1/4
Control mode (write)	1/4
Setpoint slope (read)	1/2
Setpoint slope (write)	1/2
Valve output (read)	114/1
Valve output (write)	114/1
Fluid number (read)	1/16
Fluid number (write)	1/16
Fluid name (read)	1/17
Capacity 100 % (read)	1/13
Capacity 0 % (read)	33/22
Capacity unit string (read)	1/31
Calibration mode (read)	115/1
Calibration mode (write)	115/1
Serial number (read)	113/3
BHT Model number (read)	113/2
Firmware version (read)	113/5
Identification number (read)	113/12
Device type (read)	113/1
Usertag (read)	113/6
Usertag (write)	113/6
Customer model number (read)	113/4
Alarm maximum limit (read)	97/1
Alarm maximum limit (write)	97/1
Alarm minimum limit (read)	97/2

Cyclic Parameter	Proc/Param
Alarm minimum limit (write)	97/2
Alarm mode (read)	97/3
Alarm mode (write)	97/3
Alarm setpoint mode (read)	97/5
Alarm setpoint mode (write)	97/5
Alarm new setpoint (read)	97/6
Alarm new setpoint (write)	97/6
Alarm delay time (read)	97/7
Alarm delay time (write)	97/7
Reset alarm enable (read)	97/9
Reset alarm enable (write)	97/9
Counter value (read)	104/1
Counter unit (read)	104/2
Counter limit (read)	104/3
Counter limit (write)	104/3
Counter setpoint mode (read)	104/5
Counter setpoint mode (write)	104/5
Counter new setpoint (read)	104/6
Counter new setpoint (write)	104/6
Counter unit string (read)	104/7
Counter mode (read)	104/8
Counter mode (write)	104/8
Reset counter enable (read)	104/9
Reset counter enable (write)	104/9
Counter controller overrun correction (read)	104/10
Counter controller overrun correction (write)	104/10
Counter controller gain (read)	104/11
Counter controller gain (write)	104/11
Alarm info (read)	1/20
Reset (write)	115/8
Initreset (write)	0/10
IO switch status (read)	114/31
IO switch status (write)	114/31

*More information about modules/parameters or an example of counter and alarm usage can be found in document **Operational instructions digital instruments** (doc. no. 9.17.023), which can be downloaded from www.bronkhorst.com/downloads/.*
Parameter descriptions can be found in the manual by searching for the process/parameter combination (Proc/Param), e.g. search for "1/0" to find the definition of "Measure, integer (read)".

3.7 A-CYCLIC PARAMETER ACCESS.

All parameters can be read/written using A-cyclic communication. To address these parameters, a parameter index is used. This index is built of:

1 An instance ID.
This is the flowmeter instance. In case of a single channel device the instance ID is always 0 and refers to the device on slot 1.
In case of a multichannel device
0 = MFC on slot 1.
1 = MFC on slot 2.
2 = MFC on slot 3.

2 A process number.
Process numbers are listed in the “Parameter list in FlowDDE” or the parameter table in chapter 3.6.

3 A parameter number.
Parameter numbers are listed in the “Parameter list in FlowDDE” or the parameter table in chapter 3.6.

The a-cyclic parameter index can be calculated as follows
Index = (instance * 4096) + (process * 32) + parameter

A list with frequently used parameters can be found in appendix A.

A-cyclic requests must be addressed to the hardware ID of the Profinet interface (slot 0-Head).

4 GATEWAY CONFIGURATION

Note: For instrument configuration read chapter 3.

When the gateway is in safe-state (no active fieldbus communication between PLC and gateway) all instruments behind the gateway will be moved to safe-state (control mode 22) when supported. When moving out of safe-state, all instruments behind the gateway will be moved to digital operation mode (control mode 0).

MBC2 instruments do not support safe-state, when the gateway is in safe-state MBC2 instruments will keep observing the last setpoint.

Analog operated instruments will be forced to digital operation mode by the safe-state mechanism of the gateway (this also applies to MBC2 instruments). To use analog operated instruments with the gateway, always add the control mode parameter of analog instruments to the cyclic write parameters of the gateway with the value 1 (for analog operation).

4.1 GATEWAY GSDML-FILE

Each type PROFINET instrument has its own GSDML-file with instrument specifications to tell the master configuration software which facilities/features the instruments offers to the PROFINET system. For the Bronkhorst Gateway the file is called: GSDML-Vx.y-BHT-Gateway-yyyymmdd.xml. This file is available on the Multibus documentation/software tool CD and can be downloaded from the Bronkhorst web-site.

A current version of the GSDML file can be downloaded from www.bronkhorst.com (search for 'GSDML')

The GSDML file is a xml file containing:

- Device identification info. This contains general information like:
  - Vendor (Bronkhorst)
  - Vendor ID (0x02F3)
  - Product family.
- Device Access Point (DAP) contains information about:
  - Used hardware
  - Ethernet related settings
  - Supported features.

  The following Device Access Points are available:
    - DAP1: Bronkhorst GATEWAY

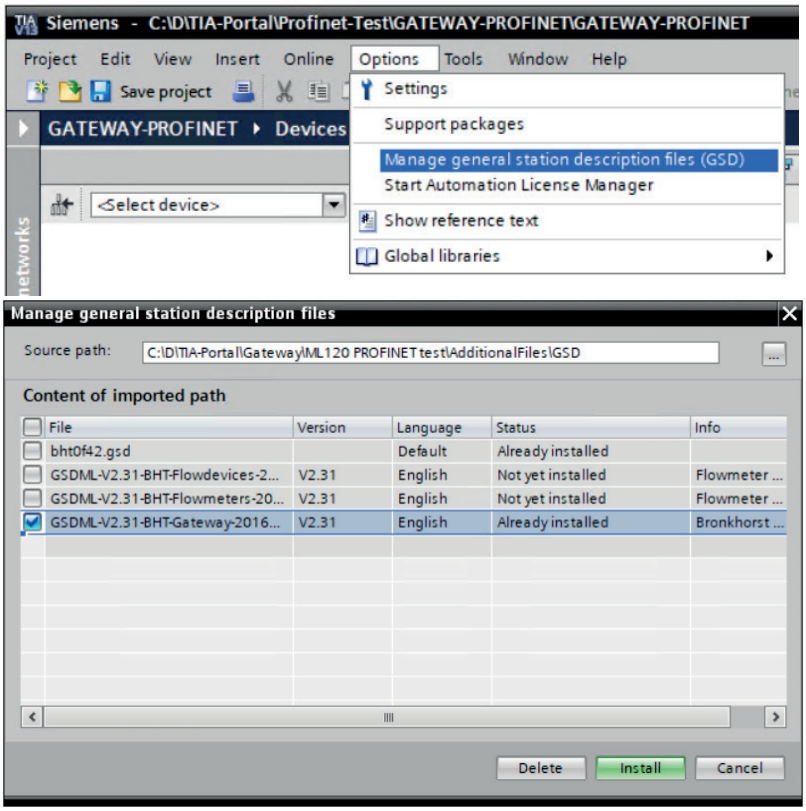
- Modules
  Modules represent Bronkhorst devices (i.e. Gateway, Flowmeters, pressure controllers etc.). Modules can be assigned to a slot of the PROFINET IO-Device. For the Gateway only 1 module can be assigned.
- Submodules
  Submodules represent the variables of the Module. Submodules can be added to the cyclic IO by assigning them to a subslot of the corresponding slot.

4.1 CONFIGURATION SOFTWARE

In this manual we use as an example the software tool “TIA portal from Siemens”.

4.2 LOAD GSDML-FILE

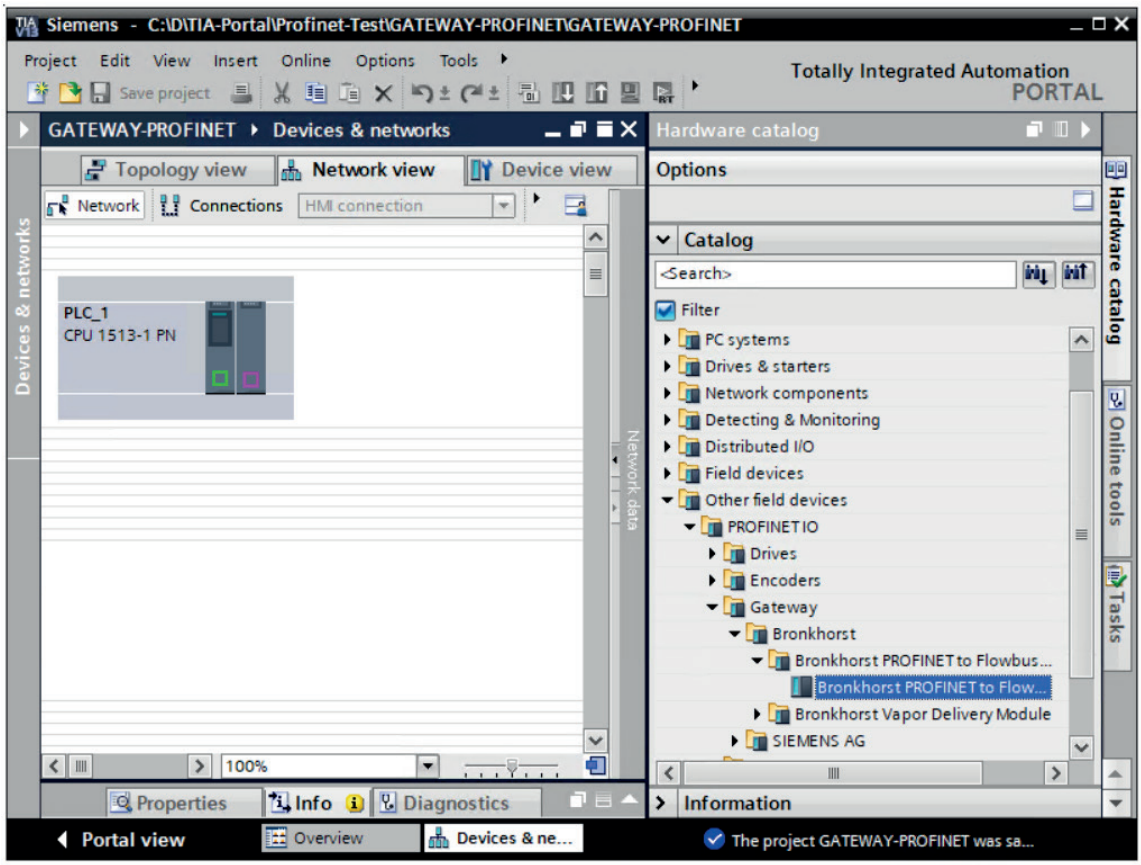
Select [Manage general station description files (GSD)] in the [Options] menu.
Load the GSDML-file (GSDML-Vx.y-BHT-Gateway-yyyymmdd.xml) into the configuration software.



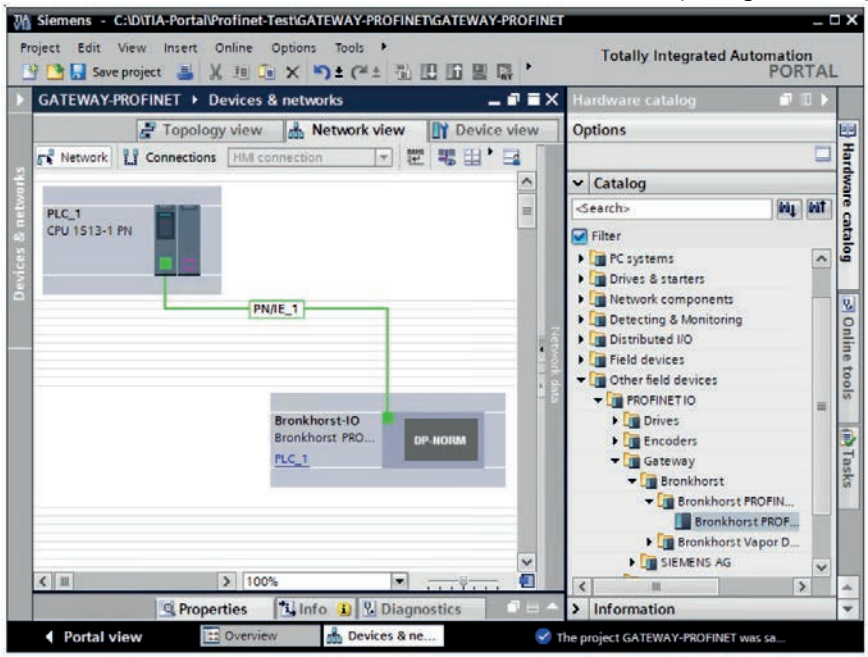
The Bronkhorst devices will now be available in the hardware catalog.

4.3 ADD GATEWAY TO PROFINET IO

Select Bronkhorst Gateway device “Bronkhorst PROFINET to Flow-bus” from the [Hardware Catalog] and add it into your system.



Connect the Bronkhorst instrument with PROFINET to the PLC (see figure below).

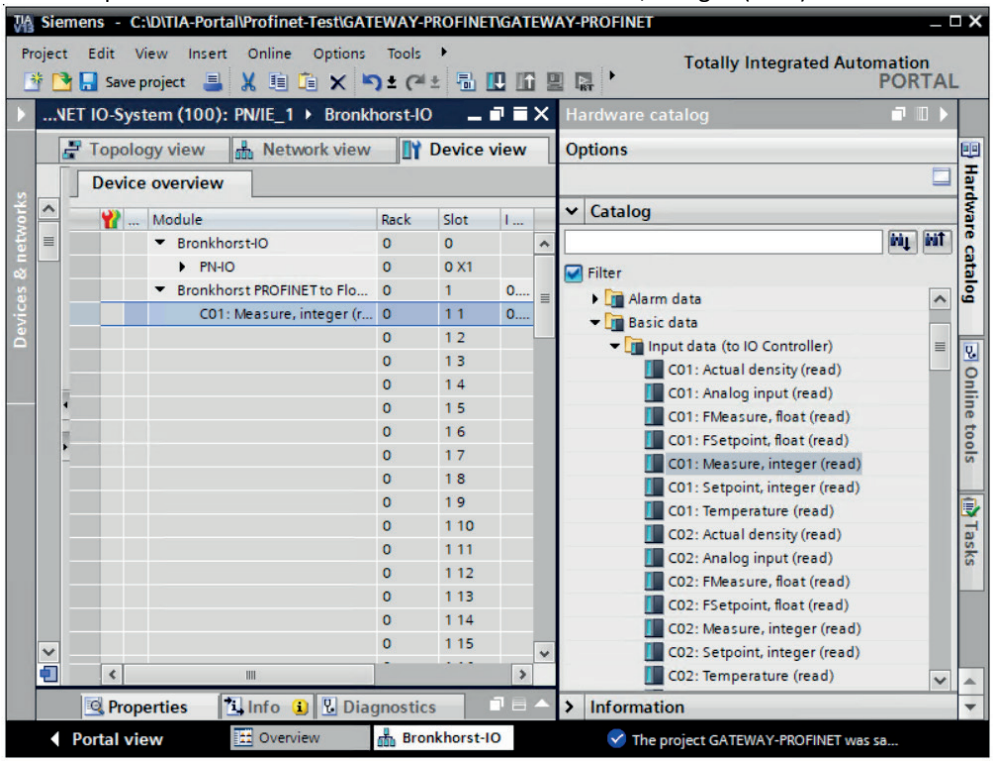


4.4 GATEWAY CONFIGURATION SETTINGS

Bronkhorst PROFINET Gateways offer many available modules/parameters for operation of the instruments. These modules/parameters can be selected by means of the master configuration tooling software.

After installing the Gateway to the PROFINET system, point to actual slave and select: [setup]. [Device overview]. In the [Hardware Catalog] all available modules are listed. Select those instrument variables you want to use. The selected modules will be displayed in the [Device overview].

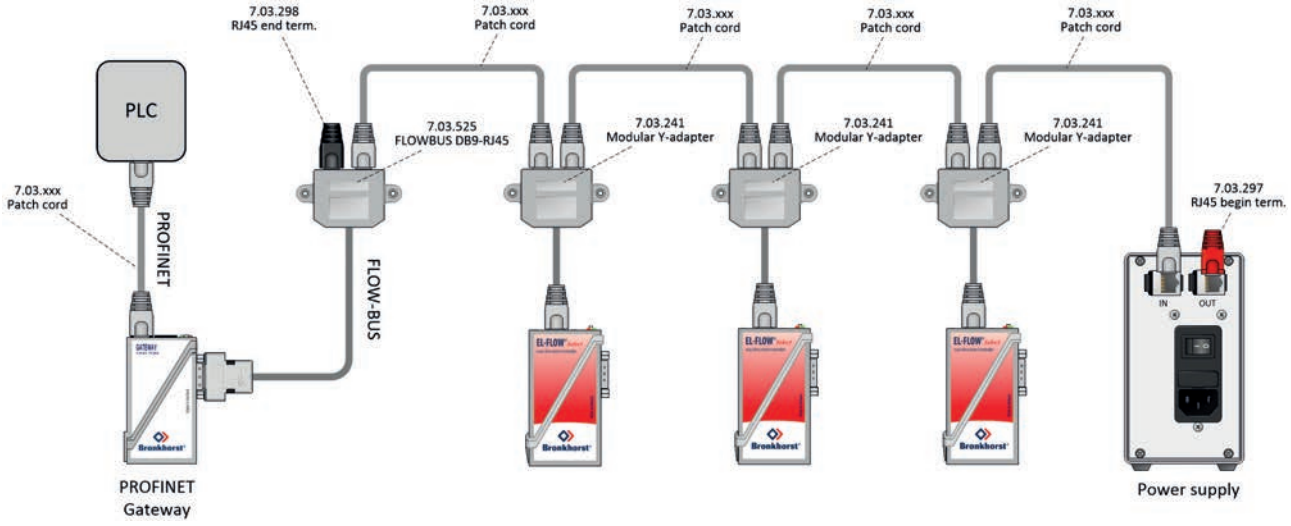
As next step the cyclic parameters you want to use in your application can be selected from the Hardware catalog. In the example below the flow measurement “C01 Measure, integer (read)” is selected and “dragged”into the device.



4.5 CYCLIC GATEWAY PARAMETER ACCESS

4.5.1 FLOW-BUS node addressing

The Bronkhorst meter/controllers (nodes) have to be connected to the Gateway through FLOW-BUS. Each device connected to the FLOW-BUS must have its own unique FLOW-BUS node address. The default FLOW-BUS node address of the Gateway is 2. This default can be changed (see Appendix B: GATEWAY FLOW-BUS node address setup). The PROFINET master can access the Gateway and the connected FLOW-BUS instruments (nodes) within FLOW-BUS address range [Gateway FLOW-BUS address + 1] … [Gateway FLOW-BUS address + 16]. The gateway cannot access instruments outside this range.



4.5.2 PROFINET parameter access (Gateway specific)

The PROFINET master can access the parameters of the Gateway and the connected instruments (within the FLOW-BUS addressing range). The physical FLOW-BUS node address is converted into a channel number:

- C00 (Channel 0): Is the Gateway with FLOW-BUS address X
- C01 (Channel 1): Is the instrument with FLOW-BUS address X+1
- C02 (Channel 2): Is the instrument with FLOW-BUS address X+2
- C03 (Channel 3): Is the instrument with FLOW-BUS address X+3
- …..
- C16 (Channel 16): Is the instrument with FLOW-BUS address X+16

The parameters of each instrument can be accessed by selecting the Channel number prefix: C<channel number> followed by the instrument parameter name, e.g.:

• “C03 Measure, integer (read)": to access the measurement value of FLOW-BUS node-address X+3
• “C04 Measure, integer (read)": to access the measurement value of FLOW-BUS node-address X+4

Short resume of PROFINET Gateway configurations:
Gateway (C00) + C01..C15 – Max 16 adjacent FLOW-BUS nodes.
Maximum number of modules = 60

Example:
The maximum of 60 modules can be divided over the maximum of 16 FLOW-BUS nodes.

The table below shows the parameters for Channel XX (CXX). The range of CXX is from C01 up to C16.

Node number + Parameter	Proc/Param
CXX Measure, integer (read)	1/0
CXX Measure, float (read)	33/0
CXX Setpoint, integer (read)	1/1
CXX Setpoint, integer (write)	1/1
CXX Setpoint, float (read)	33/3
CXX Setpoint, float (write)	33/3
CXX Analog input (read)	1/3
CXX Temperature (read)	33/7
CXX Density (read)	116/15
CXX Control mode (read)	1/4
CXX Control mode (write)	1/4
CXX Setpoint slope (read)	1/2
CXX Setpoint slope (write)	1/2
CXX Valve output (read)	114/1
CXX Valve output (write)	114/1
CXX Fluid number (read)	1/16
CXX Fluid number (write)	1/16
CXX Fluid name (read)	1/17
CXX Capacity 100 % (read)	1/13
CXX Capacity 0 % (read)	33/22
CXX Capacity unit string (read)	1/31
CXX Calibration mode (read)	115/1
CXX Calibration mode (write)	115/1
CXX Serial number (read)	113/3
CXX Model number (read)	113/2
CXX Firmware version (read)	113/5
CXX Identnumber (read)	113/12
CXX Device type (read)	113/1
CXX Usertag (read)	113/6
CXX Usertag (write)	113/6
CXX Manufacturer config (read)	113/4
CXX Alarm maximum limit (read)	97/1
CXX Alarm maximum limit (write)	97/1
CXX Alarm minimum limit (read)	97/2
CXX Alarm minimum limit (write)	97/2
CXX Alarm mode (read)	97/3
CXX Alarm mode (write)	97/3
CXX Alarm setpoint mode (read)	97/5
CXX Alarm setpoint mode (write)	97/5
CXX Alarm new setpoint (read)	97/6
CXX Alarm new setpoint (write)	97/6
CXX Alarm delay time (read)	97/7
CXX Alarm delay time (write)	97/7
CXX Reset alarm enable (read)	97/9
CXX Reset alarm enable (write)	97/9
CXX Counter value (read)	104/1
CXX Counter unit (read)	104/2
CXX Counter limit (read)	104/3
CXX Counter limit (write)	104/3
CXX Counter setp. mode (read)	104/5
CXX Counter setp. mode (write)	104/5
CXX Counter new setpoint (read)	104/6
CXX Counter new setpoint (write)	104/6
CXX Counter unit string (read)	104/7
CXX Counter mode (read)	104/8
CXX Counter mode (write)	104/8
CXX Reset counter enable (read)	104/9
CXX Reset counter enable (write)	104/9
CXX Counter overrun cor. (read)	104/10
CXX Counter overrun cor. (write)	104/10
CXX Counter control gain (read)	104/11

Node number + Parameter	Proc/Param
CXX Counter control gain (write)	104/11
CXX Alarm info (read)	1/20
CXX Reset (write)	115/8
CXX Initreset (write)	0/10
CXX Status (read)	115/20
CXX Status out position (read)	115/21
CXX General purpose IO (read)	114/31
CXX General purpose IO (write)	114/31

*More information about modules/parameters or an example of counter and alarm usage can be found in document **Operational instructions digital instruments** (doc. no. 9.17.023), which can be downloaded from www.bronkhorst.com/downloads/.*
Parameter descriptions can be found in the manual by searching for the process/parameter combination (Proc/Param), e.g. search for "1/0" to find the definition of "Measure, integer (read)".

4.6 A-CYCLIC GATEWAY PARAMETER ACCESS.

A-Cyclic data is supported for the PROFINET instruments, but not available for the PROFINET GATEWAY .

4.6.1 Gateway parameters

The PROFINET parameters of the GATEWAY all start with: GATEWAY followed by the parameter, e.g. "GATEWAY Status (read)". The parameters of the GATEWAY are listed in the table below.

GATEWAY Parameters	Description
GATEWAY version (read)	Gateway firmware version
GATEWAY FLOWBUS status (read)	16 bit integer which contains flowbus status bits 0 means that flowbus is working correct. Bit 0: when 1: No bus communication. Bit 1: when 1: Communication but no tokens received. Bit 2: when 1: Many communication errors (node occupied?). Bit 15: when 1: Flowbus disabled.
GATEWAY Number of FLOWBUS nodes (read)	Represents the number of active flowbus nodes within the gateway node range (3-19).
GATEWAY FLOWBUS live list (read)	Array of 16 bytes with nodes active on the corresponding address. 255 means that no node is active on that address.
GATEWAY Safe state (read)	Read 0: nodes are in normal operating mode. Read 1: nodes are in safe state
GATEWAY Safe state (write)	Write 0: disables safe state Write 1: enable safe state

5 SLAVE ADDRESSING

5.1 GENERAL

Addressing a PROFINET IO-Device is done by means of a device name and IP-addresses.

5.2 MAC ADDRESS

The MAC address of the device is an unique address and is listed on the sticker on the device. The MAC address cannot be changed but can be used to identify the device on the network.

5.3 IP ADDRESS AND DEVICE NAME

When configuring the PROFINET IO network, each device is given a logical device name to identify the device. The user is free to choose the name. An IP-address is also assigned to the device. This IP address is unique within the network.

5.4 FACTORY RESET.

The PROFINET factory reset, sets the ip-address, subnetmask, gateway and device name to their default values.
The PROFINET factory reset does not apply to the device functions. For resetting the device's factory settings, please refer to the user manual 9.17.023.

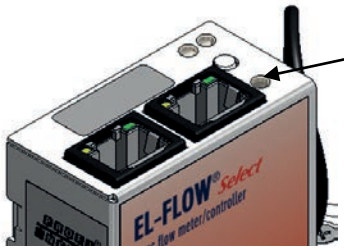
6 SAFE STATE

If PROFINET communication problems occur, so when instrument is not in data exchange mode, the instrument forces the valve (controllers only) into a safe state mode. This safe state depends on the type of valve. NC valves will be closed, NO valves will be opened fully. The green and red Led on top of the instrument indicates this mode by a short flash: 0.1 sec on, 2 sec off. As long as there is no data exchange between master and slave the instrument will stay in this mode. It will leave this mode automatically when data exchange starts. Via the RS232 communication interface it is possible to force the instrument out of the safe state by changing the control mode to a value other than 0. At for example control mode = 18 (RS232) or control mode = 1 (Analog input) the instrument will not get into safe state.

7 TROUBLESHOOTING

7.1 PROFINET STATUS INDICATOR

Bronkhorst® instruments contain an PROFINET two color status led: green and red. The led indicates the actual PROFINET run state (green) and the actual link state (red).
The status led has several indicator states, which are applicable for both green and red. They are described in the table below.



PROFINET status indicator *):
Green: Run state
Red: Link state

*) not available on industrial housing

Indicator state	Definition
on	The indicator is constantly on
off	The indicator is constantly off
blinking	The indicator is repeatedly on for 200 ms and off for 200 ms
single flash	The indicator is repeatedly on for 200 ms and off for 1000 ms
double flash	The indicator shows repeatedly a sequence of two short flashes (200 ms), separated by an off phase (200 ms), followed by a long off phase (1000 ms)

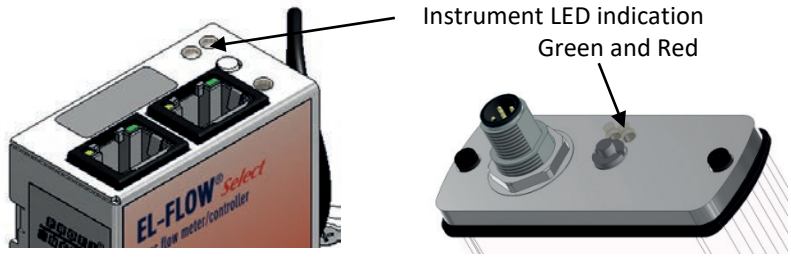
7.1.1 PROFINET run state indicator

Run state	Indicator state (green)
PROFINET interface not started (yet)	off
PROFINET interface in Init state	blinking
PROFINET interface started correctly	on

7.1.2 PROFINET link state indicator

Link status	Indicator state (red)
Application relation established with IO-controller	off
Link status OK, No Application relation with IO-controller	blinking
No link.	on

7.2 INSTRUMENT LED INDICATION



Led	Time	Indication
Green		
off	Continuously	Power-off or program not running
on	Continuously	Normal running/operation mode
short flash	0.1 sec on, 2 sec off	• Initialization mode • Secured parameters can be changed • Safe state active
normal flash	0.2 sec on, 0.2 sec off	Special function mode Instrument is busy performing any special function. E.g. auto-zero or self-test
Red		
off	Continuously	No error, application relation established.
short flash	0.1 sec on, 2 sec off	No application relation established.
long flash	2 sec on, 0.1 sec off	Configuration error. For example, a requested parameter is not available.
on	Continuously	Critical error in PROFINET interface hardware
Wink Mode	**Green Red Green Red (alternating)**	
normal wink	0.2 sec on, 0.2 sec off	Wink mode By a command send via PROFINET the instrument can “wink” with Led’s to indicate its position in a (large) system
slow wink	1 sec on, 1 sec off	Alarm indication: minimum alarm, limit/maximum alarm; power-up alarm or limit exceeded or batch reached.
fast wink	0.1 sec on, 0.1 sec off	Switch-released, selected action started

7.3 TROUBLESHOOTING HINTS AND TIPS

PROFINET problems	
No Communication	• Check power supply and cabling. • Check all PROFINET settings at your master. Master and slave settings for use of memory modules must be the same. Select at least one module e.g. 'Measure, integer (read)' otherwise there will be no data-exchange. • Check IP address, Subnetmask and gateway settings of interface (slave) • Try to reset the instrument and/or restart your master. • Make sure all settings for your slave are downloaded to your master (otherwise it won't work). • Contact PROFINET sales representative or service department.
Flow is not reacting to setpoint commands	• In case of PROFINET communication problems instrument will put it's valve into a safe state. This will close (NC) or open the valve fully (NO). When data exchange between master and slave has been re-established, instrument will respond to setpoint again. For overruling safe state via RS232 interface, see setpoint /control modes in chapter 2.5 from doc. nr. 9.17.023, (digital instrument description).
Red Led has long flash	• Make sure the requested parameters are available in the particular Bronkhorst® PROFINET-slave. • Delete the PROFINET slave configuration and add a new slave in your software, this will remove a corruption in the software configuration.

GATEWAY	FLOW-BUS problems

No Communication	• Check power supply and cabling.
	• Check all FLOW-BUS settings of the GATEWAY and attached instruments (see Appendix C: GATEWAY FLOW-BUS node address setup).
	• Check the if there are no FLOW-BUS address node conflicts: All attached instruments must have an unique node address. The Gateway can only communicate with instruments with node address: "Gateway FLOW-BUS address +1" up to "Gateway FLOW-BUS address +16"
	• Try to reset the instrument and/or restart your GATEWAY.
	• Use the following GATEWAY parameters to debug your FLOW-BUS communication:
	  • GATEWAY number of nodes (read)
	  • GATEWAY FLOWBUS live list (read)
	  • GATEWAY FLOWBUS status (read)
	  • See example in Appendix C

8 SERVICE

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

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:

+31 859 02 18 66

Bronkhorst High-Tech B.V.
Nijverheidsstraat 1A
NL-7261 AK Ruurlo
The Netherlands

9 APPENDIX A: A-CYCLIC PARAMETER INDICES

A-Cyclic data is supported for the PROFINET instruments, but not available for the PROFINET GATEWAY .

					Instance: 0		Instance: 1		Instance: 2	
Parameter name:	Type:	Process	Parameter	Length:	Index (Dec):	Index (Hex):	Index (Dec):	Index (Hex):	Index (Dec):	Index (Hex):
Measure	integer	1	0	2	32	0x20	4128	0x1020	8224	0x2020
Fmeasure	float	33	0	4	1056	0x420	5152	0x1420	9248	0x2420
Setpoint	integer	1	1	2	33	0x21	4129	0x1021	8225	0x2021
Fsetpoint	float	33	3	4	1059	0x423	5155	0x1423	9251	0x2423
Analog Input	integer	1	3	2	35	0x23	4131	0x1023	8227	0x2023
Temperature	float	33	7	4	1063	0x427	5159	0x1427	9255	0x2427
Actual Density	float	116	15	4	3727	0xE8F	7823	0x1E8F	11919	0x2E8F
Control mode	integer	1	4	1	36	0x24	4132	0x1024	8228	0x2024
Setpoint slope	integer	1	2	2	34	0x22	4130	0x1022	8226	0x2022
Valve output	integer	114	1	4	3649	0xE41	7745	0x1E41	11841	0x2E41
Fluid number	integer	1	16	1	48	0x30	4144	0x1030	8240	0x2030
Fluid name	string	1	17	10	49	0x31	4145	0x1031	8241	0x2031
Capacity 100%	float	1	13	4	45	0x2D	4141	0x102D	8237	0x202D
Capacity 0%	float	33	22	4	1078	0x436	5174	0x1436	9270	0x2436
Capacity unit string	string	1	31	7	63	0x3F	4159	0x103F	8255	0x203F
Calibration mode	integer	115	1	1	3681	0xE61	7777	0x1E61	11873	0x2E61
Serial number	string	113	1	20	3617	0xE21	7713	0x1E21	11809	0x2E21
BHT model number	string	113	2	23	3618	0xE22	7714	0x1E22	11810	0x2E22
Firmware Version	string	113	5	6	3621	0xE25	7717	0x1E25	11813	0x2E25
Identification number	integer	113	12	1	3628	0xE2C	7724	0x1E2C	11820	0x2E2C
Device type	string	113	1	6	3617	0xE21	7713	0x1E21	11809	0x2E21
Usertag	string	113	6	16	3622	0xE26	7718	0x1E26	11814	0x2E26
Customer model number	string	113	4	16	3620	0xE24	7716	0x1E24	11812	0x2E24
Alarm maximum limit	integer	97	1	2	3105	0xC21	7201	0x1C21	11297	0x2C21
Alarm minimum limit	integer	97	2	2	3106	0xC22	7202	0x1C22	11298	0x2C22
Alarm mode	integer	97	3	1	3107	0xC23	7203	0x1C23	11299	0x2C23
Alarm setpoint mode	integer	97	5	1	3109	0xC25	7205	0x1C25	11301	0x2C25
Alarm new setpoint	integer	97	6	2	3110	0xC26	7206	0x1C26	11302	0x2C26
Alarm delay time	integer	97	7	1	3111	0xC27	7207	0x1C27	11303	0x2C27
Reset alarm enable	integer	97	9	1	3113	0xC29	7209	0x1C29	11305	0x2C29
Counter value	float	104	1	4	3329	0xD01	7425	0x1D01	11521	0x2D01
Counter unit	integer	104	2	1	3330	0xD02	7426	0x1D02	11522	0x2D02
Counter limit	float	104	3	4	3331	0xD03	7427	0x1D03	11523	0x2D03
Counter setpoint mode	integer	104	5	1	3333	0xD05	7429	0x1D05	11525	0x2D05
Counter new setpoint	integer	104	6	2	3334	0xD06	7430	0x1D06	11526	0x2D06
Counter unit string	string	104	7	4	3335	0xD07	7431	0x1D07	11527	0x2D07
Counter mode	integer	104	8	1	3336	0xD08	7432	0x1D08	11528	0x2D08
Reset counter enable	integer	104	9	1	3337	0xD09	7433	0x1D09	11529	0x2D09
Counter controller overrun correction	float	104	10	4	3338	0xD0A	7434	0x1D0A	11530	0x2D0A
Counter controller gain	float	104	11	4	3339	0xD0B	7435	0x1D0B	11531	0x2D0B
Alarm info	integer	1	20	1	52	0x34	4148	0x1034	8244	0x2034
Reset	integer	115	8	1	3688	0xE68	7784	0x1E68	11880	0x2E68
Initreset	integer	0	10	1	10	0xA	4106	0x100A	8202	0x200A
IO swich status	integer	114	31	4	3679	0xE5F	7775	0x1E5F	11871	0x2E5F

10 APPENDIX B: GATEWAY FLOW-BUS NODE ADDRESS SETUP

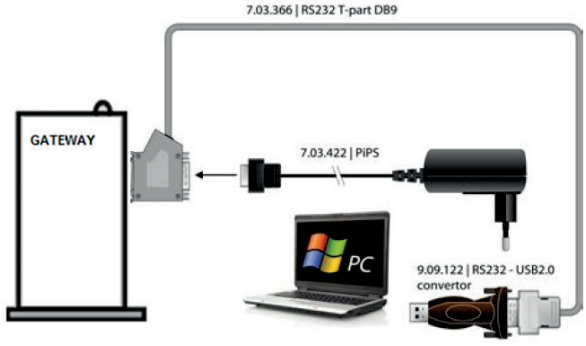
Default the GATEWAY will be delivered to customers on FLOW-BUS address 2 and with a baud rate of 187500 baud.

The FLOW-BUS node address of the Bronkhorst® GATEWAY can be changed to fit the instrument in your existing FLOW-BUS network. Changing the GATEWAY FLOW-BUS Node address can be done in the following ways.

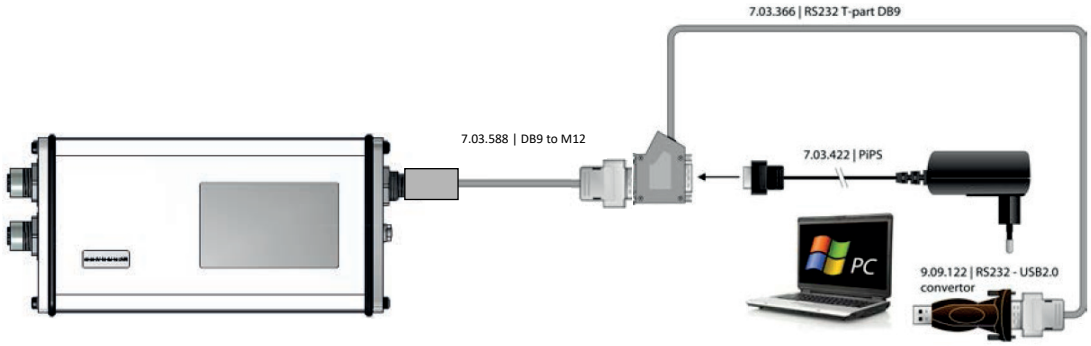
Step 1: Bus Configuration Mode
Activate Configuration mode of the gateway, see chapter "BUS CONFIGURATION MODE" in document **Operational instructions digital instruments** (doc. no. 9.17.023).

Step 2: Change FLOW-BUS settings: using RS232 and FlowDDE
'Off-line' via the RS232 communication port by means of FlowDDE. This PC software program can be used to read/change parameters, including the FLOW-BUS Node address.

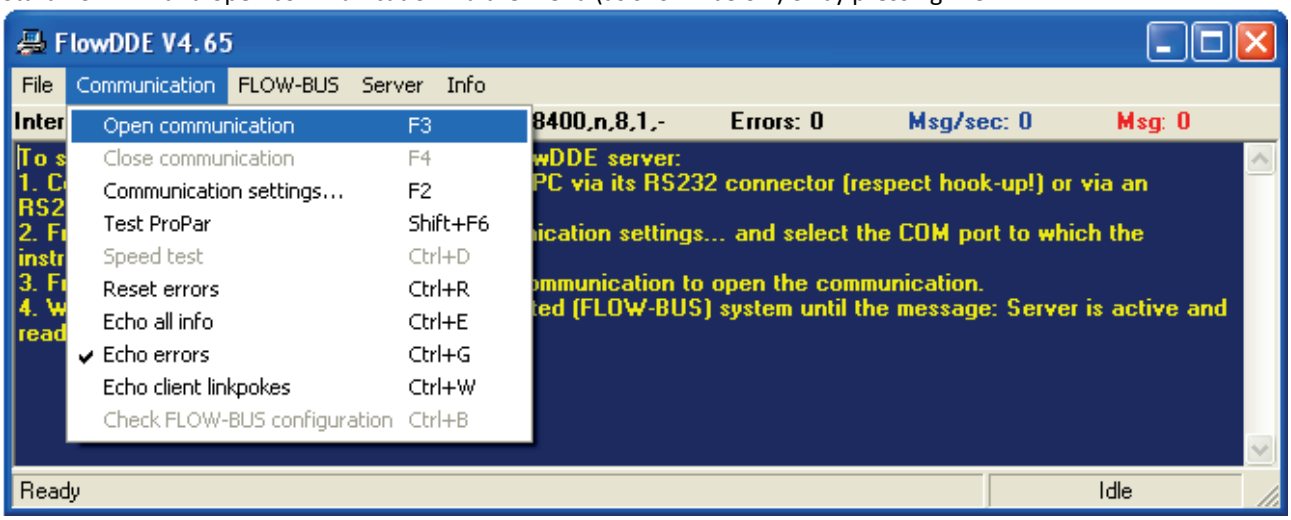
Connect your Bronkhorst® GATEWAY to a free COM-port using the special cable with on one side a T-part with male and female sub-D 9 connector and on the other side a female sub-D 9 connector (part number 7.03.366). The single sub-D 9 connector should be connected to your COM-port (or via USB converter, part number 9.09.122) and the female sub-D 9 of the T-part to the male sub-D 9 of the instrument (see picture below) . Standard cables are approx. 3 meters. Maximum length between PC and instrument allowed is approximately 10 meters.



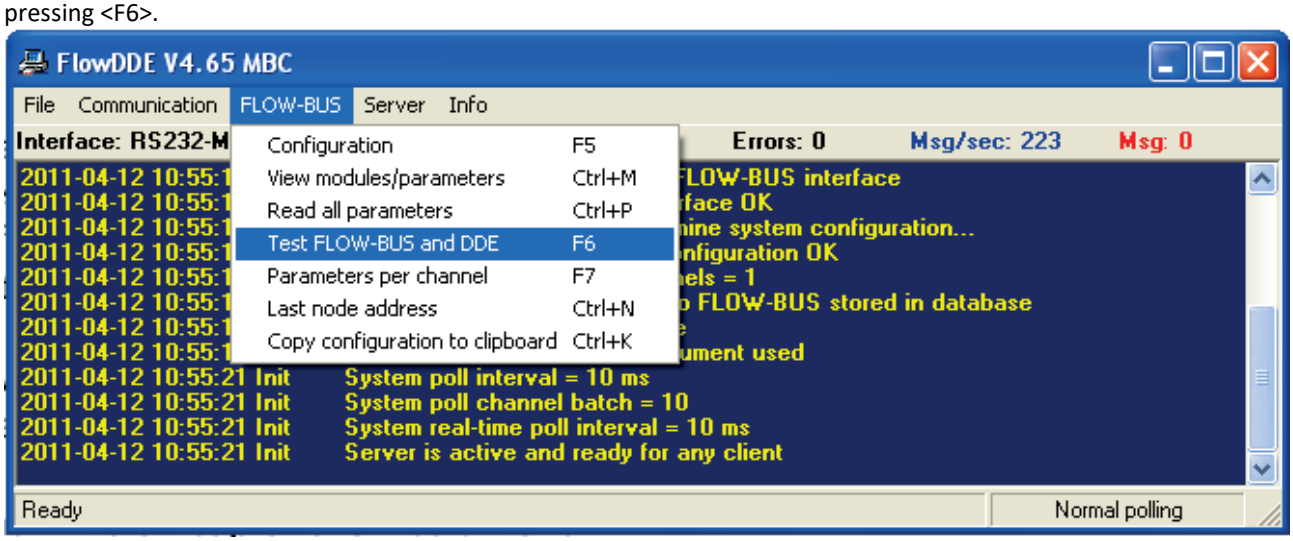
In case of the industrial version use the M12 to DB9 cable (part number 7.03.588) to connect the M12-A connector of the Gateway to the T-part (see picture below).



Start FlowDDE and open communication via the menu (as shown below) or by pressing <F3>.



Once the DDE server is active, open the FlowDDE Test Form via the menu (as shown below) or by pressing <F6>.



The following screen appears:

To read/change the Gateway FLOW-BUS Node address, parameter “309: Bus2” address must be selected.
To change this parameter, parameter “7: Initreset” has to be set to ‘64’ first.

Valid values for the Gateway FLOW-BUS Node address are between 1 and 120,

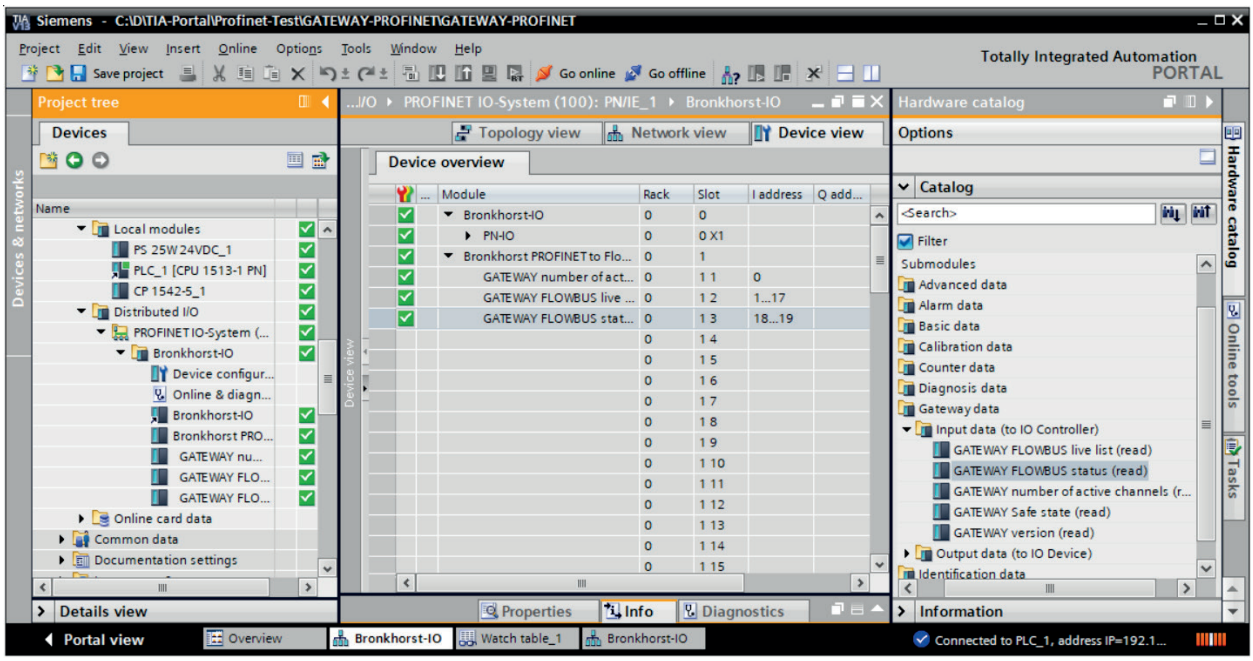
Parameter “307: Bus2 mode“ : write value 0 (Configuration mode will be de-activated, likely communication will be lost, Your FLOWDDE communication will stop immediately.)

Note: There are no hardware switches available on the Bronkhorst® instruments for Slave address and Baud rate setting.

11 APPENDIX C: GATEWAY FLOW-BUS DEBUG EXAMPLE

The FLOW-BUS communication problems can be debugged by using the following “Gateway data” Input data parameters:

- GATEWAY Number of active channels (read)
- GATEWAY FLOWBUS live list (read)
- GATEWAY FLOWBUS status (read)

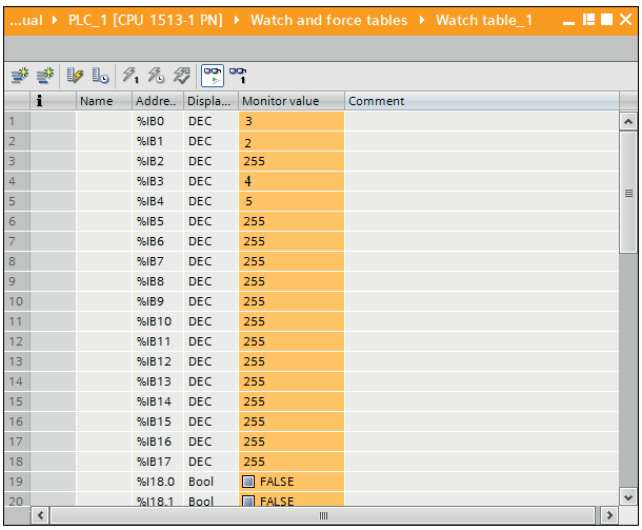


GATEWAY Number of nodes (read): returns the number of FLOW-BUS nodes detected by the GATEWAY. The GATWAY itself is also a FLOW-BUS node.

For example in the figure right:

- %IB0 “GATEWAY Number of nodes (read)” = 3 means:
  - 3 FLOW-BUS nodes detected: 1 GATEWAY and 2 instruments

GATEWAY FLOWBUS live list (read): returns the list of active detected nodes on the FLOW-BUS.



For example in the figure right:

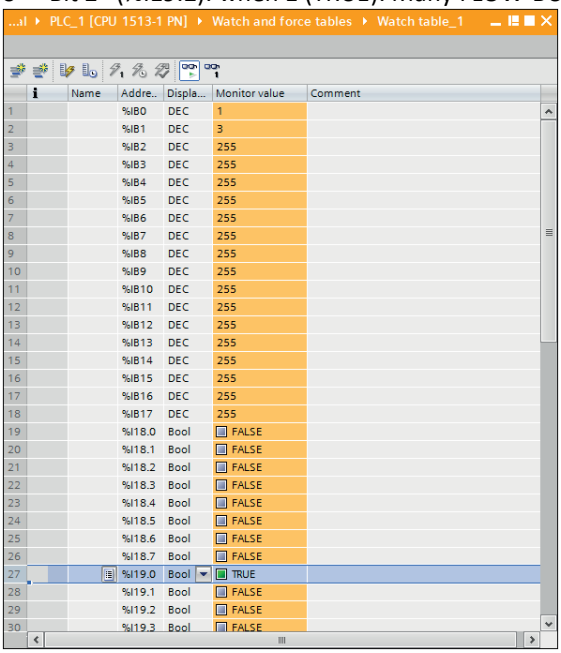
- %IB1 “GATEWAY FLOWBUS live list (read)” = 2 means:
  - GATEWAY is detected on FLOW-BUS address 2
- %IB2 “GATEWAY FLOWBUS live list (read)” = **255** means:
  - **NO** instrument detected on FLOW-BUS address 3
- %IB3 “GATEWAY FLOWBUS live list (read)” = 4 means:
  - Instrument detected on FLOW-BUS address 4
- %IB4 “GATEWAY FLOWBUS live list (read)” = 5 means:
  - Instrument detected on FLOW-BUS address 5
- %IB5 “GATEWAY FLOWBUS live list (read)” = 255 means:
  - **NO** instrument detected on FLOW-BUS address 6

GATEWAY FLOWBUS status (read): returns the status of the FLOW-BUS in a 16 bits integer.
0 (all bits 0) means that FLOW-BUS is working correct. In case of not zero, the individual Bits have a meaning and can be checked.

TIA-portal first show the High Word followed by the Low Word:

- Status Bit 8 … Bit15 are mapped on %I8.0 ... %I8.7:
  - Bit 15(%I18.7) : when 1 (TRUE): FLOW-BUS disabled

- Status Bit 0 … Bit7 are mapped on %I9.0 .. . %I9.7:
  - Bit 0 (%I19.0): when 1 (TRUE): No bus FLOW-BUS communication
  - Bit 1 (%I19.1): when 1 (TRUE): FLOW-BUS Communication but no tokens received
  - Bit 2 (%I19.2): when 1 (TRUE): Many FLOW-BUS communication errors



	Name	Addre..	Displa...	Monitor value	Comment
1		%IB0	DEC	1	
2		%IB1	DEC	3	
3		%IB2	DEC	255	
4		%IB3	DEC	255	
5		%IB4	DEC	255	
6		%IB5	DEC	255	
7		%IB6	DEC	255	
8		%IB7	DEC	255	
9		%IB8	DEC	255	
10		%IB9	DEC	255	
11		%IB10	DEC	255	
12		%IB11	DEC	255	
13		%IB12	DEC	255	
14		%IB13	DEC	255	
15		%IB14	DEC	255	
16		%IB15	DEC	255	
17		%IB16	DEC	255	
18		%IB17	DEC	255	
19		%I18.0	Bool	FALSE	
20		%I18.1	Bool	FALSE	
21		%I18.2	Bool	FALSE	
22		%I18.3	Bool	FALSE	
23		%I18.4	Bool	FALSE	
24		%I18.5	Bool	FALSE	
25		%I18.6	Bool	FALSE	
26		%I18.7	Bool	FALSE	
27		%I19.0	Bool	TRUE	
28		%I19.1	Bool	FALSE	
29		%I19.2	Bool	FALSE	
30		%I19.3	Bool	FALSE	

The error situation of Bit 0 (No FLOW-BUS communication) could be caused by a Gateway that is still in the “bus Configuration mode”. This can be solved by disabling the “configuration mode” of the Gateway.