PLUTO Ethernet Gateway

User Manual

GATE-EIP	**EtherNet/IP™**
GATE-EC	**EtherCAT®**
GATE-S3	**Sercos III**
GATE-PN	**PROFINET**
GATE-MT	**Modbus TCP**

Reference:

No:	Text
1	Pluto Operating instructions, Hardware 2TLC172001Mxxyy_z Pluto Programming manual 2TLC172002Mxxyy_z Pluto Gateway Manual 2TLC172009Mxxyy_z
2	www.odva.org Homepage for CIP with used by EtherNet/IP.

EtherNet/IP is a registered trademark by ODVA.

EtherCAT® is a registered trademark and patented technology, licensed by Beckhoff Automation GmbH, Germany.

Sercos is a registered trademark by Sercos International and Sercos North America.

PROFINET is a trademark by PI Organization (www.profibus.com).

Modbus TCP is according to the Modbus Organization (www.modbus.org).

Table of contents:

1 Version information

This document is valid for:

Hardware version : 2.3

Firmware version
- GATE-EIP : 2.14 and higher.
- GATE-EC : 1.2 and higher.
- GATE-S3 : 1.2 and higher.
- GATE-PN : 1.1 and higher.
- GATE-MT : 1.1 and higher.

Updates in 2TLC172285M0203_A:
- Added cyber security disclaimer (2).
- Added GATE-E2 replacement information (3.3).
- Disable by default all extra service (FTP, TFTP, Web and telnet) (5.3).
- Added support for TFTP server (5.3.4).
- Added support for Pluto remote monitors (2.1.4 and 5.5.11).
- Added support for device firmware update via serial terminal and telnet (5.6).
- Added support for EoE on GATE-EC (7).
- Added support for PROFINET with GATE-PN (9).
- Added support for Modbus TCP with GATE-MT (10).

Updates in 2TLC172285M0203_B:
- Links to the cyber security disclaimer for some functions and commands (2).
- Add cyber security deployment chapter (2.1).
- Changed the web server login handling from secure to weak security (5.3.5).
- Added timeout handling for telnet login (5.3.6).
- Updated installation and mounting instructions.
- Added and updated text for many chapters.
- Added information regarding approvel for CE and CSA (12.2).

2 Cyber security disclaimer

This gateway product is designed to be connected and to communicate information and data via a network interface, which should be connected to a secure network. It is your sole responsibility to provide and continuously ensure a secure connection between the product and your network or any other network (as the case may be) and to establish and maintain appropriate measures (such as but not limited to the installation of firewalls, application of authentication measures, encryption of data, installation of antivirus programs, etc.) to protect the product, the network, its system and interfaces against any kind of security breaches, unauthorized access, interference, intrusion, leakage and/or theft of data or information. ABB Ltd and its affiliates are not liable for damages and/or losses related to such security breaches, unauthorized access, interference, intrusion, leakage and/or theft of data or information.

Although ABB provides functionality testing on the products and updates that we release, you should institute your own testing program for any product updates or other major system updates (to include but not limited to code changes, configuration file changes, third party software updates or patches, hardware change out, etc.) to ensure that the security measures that you have implemented have not been compromised and system functionality in your environment is as expected.

For more information/contact regarding ABB cyber security see:

http://www.abb.com/cybersecurity

2.1 Cyber security deployment

2.1.1 Hardening FTP/TFTP

The FTP and TFTP services are only added to the device for firmware updates (used during development). Firmware update (see 5.6) shall not be done via these services and the preferred way for all firmware updates is to use the PC port (see 4.1.2.2).

The device service FTP (see 5.3.3) and TFTP (see 5.3.4) shall only be enabled if there are very strong requirements for its usage and first after made a cyber security assessment of the system.

2.1.2 Limit network connections

When commission a network system it’s important to address the cyber security problems by making a cyber security assessment of the system. Example of methods to reduce security vulnerabilities are:

- Network connection.
  Limit the connections with routers/firewall and similar products.

- Network access control.
  Add some control/limitations on the network by routers/firewall and similar products.

- Network monitor.
  If needed add products which can monitor the network access and traffic.

Contact any cyber security personal for making a good cyber security assessment of the system.

2.1.3 Service, Account and Password handling

The gateway product has network services which uses the two default accounts admin and user. There are no other valid accounts. The two accounts have default passwords. If any network services using any of these accounts is enabled it's recommended that the default password is changed.

For more information about the different services see chapter 5.3.
For more information about enable/disable services see chapter 5.5.16.
For more information about password see chapter 5.5.17.

When enabling any service the user shall handle cyber and network security by implementing appropriate measures in this area.

2.1.4 Pluto remote monitor handling

The gateway product has together with Pluto Manager the possibility to make remote monitor of Pluto safety PLC system. By default this service is disabled in the gateway, but it can easily be enabled with the "remote" command (see 5.5.11) via the serial terminal connection (see 4.1.2.2) on the device. The Pluto remote monitor handling within the product is handled by the telnet server (see 5.3.6) with its cyber security limitations.

When using Pluto remote monitor handling the user shall handle cyber and network security by implementing appropriate measures in this area.

The Pluto remote monitor behavior is depending on good network conductivity on both the Pluto bus network and the Ethernet network.

2.1.5 PC port usage

The PC port (see 4.1.2.2) shall **only** be used for local terminal access to the device and are not secured for any external access handling.

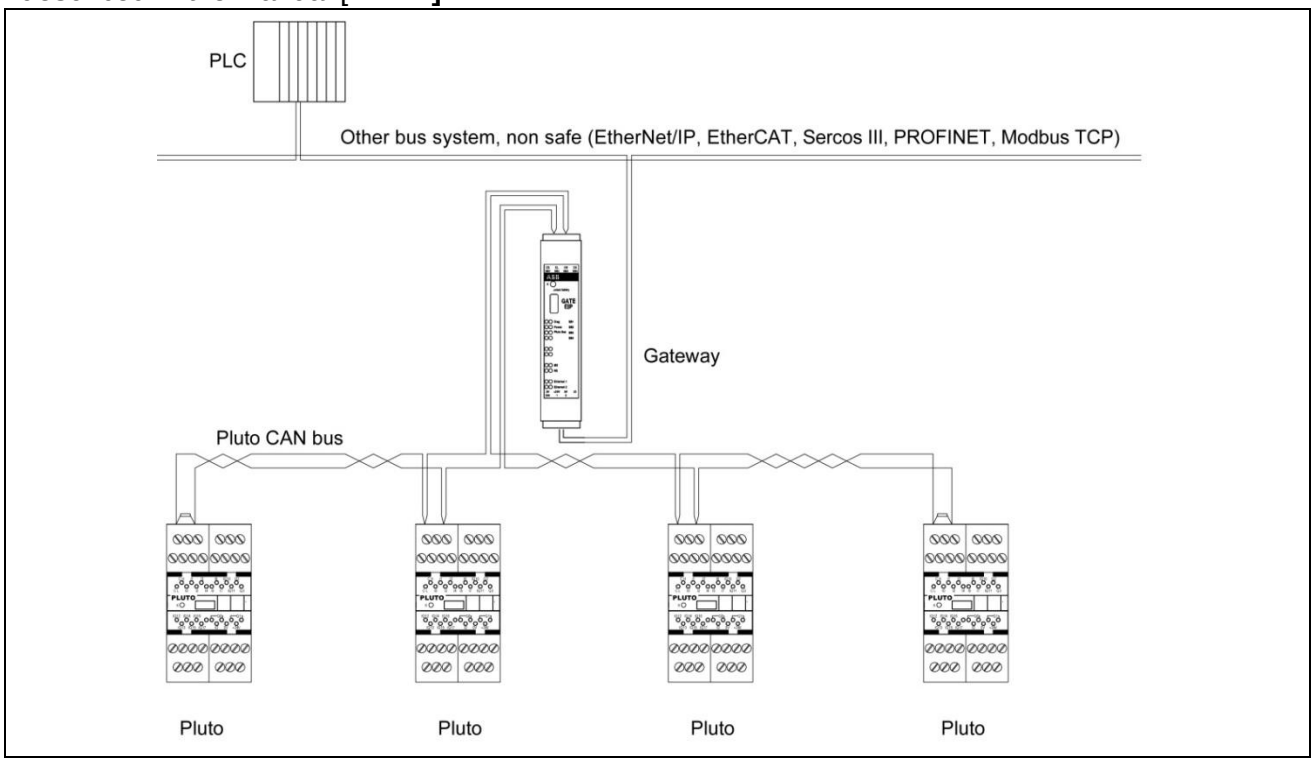
3 General

The Ethernet gateways are a series of gateways for different industry Ethernet protocols. Each model is dedicated to one industry Ethernet protocol. The following list gives a summary of the existing industry Ethernet gateways:

- GATE-EIP (2TLA020071R9000) for EtherNet/IP.
- GATE-EC (2TLA020071R9100) for EtherCAT.
- GATE-S3 (2TLA020071R9200) for SERCOS III.
- GATE-PN (2TLA020071R9300) for PROFINET.
- GATE-MT (2TLA020071R9400) for Modbus TCP.

In addition to the industry Ethernet protocol each device also has support for FTP server, TFTP server, web server and telnet server (for remote monitor).

The Pluto Safety PLC system and the gateways GATE-P1/P2, -D1/D2, -C1/C2 and -E1/E2 are described in the manual [**REF 1].**



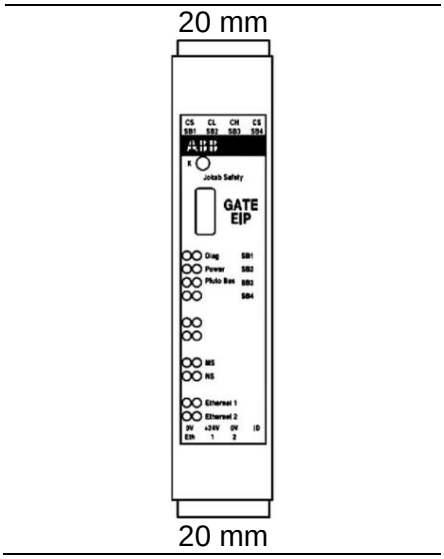
3.1 Installation

The device shall be installed according to the information within this manual.

3.1.1 Mounting

The device shall be mounted on a 35 mm DIN rail.

For ventilation requirement the device shall be mounted vertical with minimum 20 mm free space on top/bottom side, see figure below.



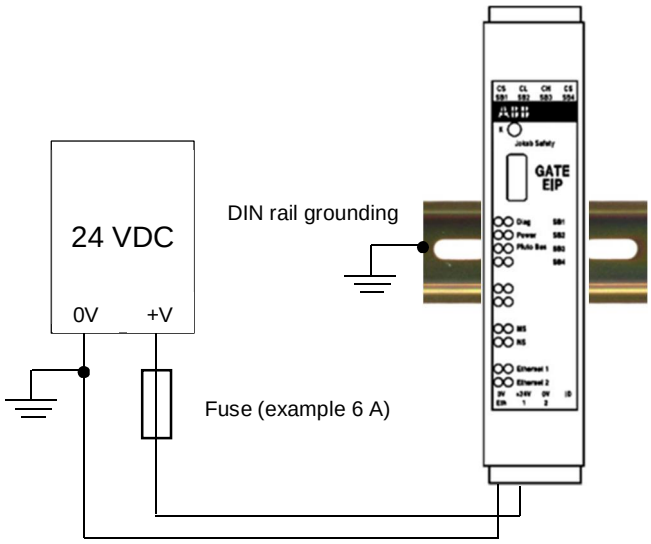
The device shall be installed indoors and its enclosure is IP20. The device shall therefore be installed in cabinet for proper environmental protection, see technical data chapter 12.2.

3.1.2 Electrical installation

The device is designed for applications which fulfil IEC-EN 60204-1.

The device is powered by 24 VDC (4.8 W/0.2 A) and it has internal fuse (2 A) protection. External fuse (type C characteristic) shall be used to protect the electrical wiring (according to UL 2550 VW-1 or equivalent) to the device and the value of the fuse is depending on the installation (example 6 A type C characteristic using minimum 0.75 mm^2 wiring).

Enclosure and terminals are able to reach temperatures above 60 °C in ambient temperatures of up to 55 °C. The electrical wiring (cables) shall therefore meet the specification of minimum 65 °C.
Boîtier et bornes sont capables d'atteindre des températures supérieures à 60 °C à des températures ambiantes jusqu'à 55 °C. Le câblage électrique (câbles) doit donc répondre à la spécification minimale de 65 °C.



The device shall be installed in a system (the complete system) using a common ground system e.g. proper potential equalization is necessary.

When mounted on the DIN rail the device ground (0V) is connected via a capacitor to the DIN rail. Therefore the DIN rail shall be connected to the system ground, see the figure above.

The user can install a disconnecting device if needed on the power line; or use an external fuse which is approved to be used as disconnecting device. The device also has detachable terminal blocks which can be used as a disconnection device.

3.2 Maintenance and service

The device has no requirements regarding maintenance or service.

3.3 GATE-E2 replacement

The GATE-EIP, GATE-PN and GATE-MT are functional replacements for GATE-E2 within the different industry Ethernet protocols with the following notes,

- Power terminal plug is changed, see 4.1.1.2.
- Pluto bus terminal plug is changed, see 4.1.1.2.
- There is no support for GATE-E2 local data request/response service object/function.
- There is no support for GATE-E2 pass through service object/function.
- There is no support for GATE-E2 binary server.

4 Hardware

The Ethernet gateway is housed in a 22.5 mm enclosure with 35 mm DIN rail mounting.

Top side

Front panel

Bottom side

4.1 Connection, indication and switches

The gateway has connections, indications and switches on four sides.

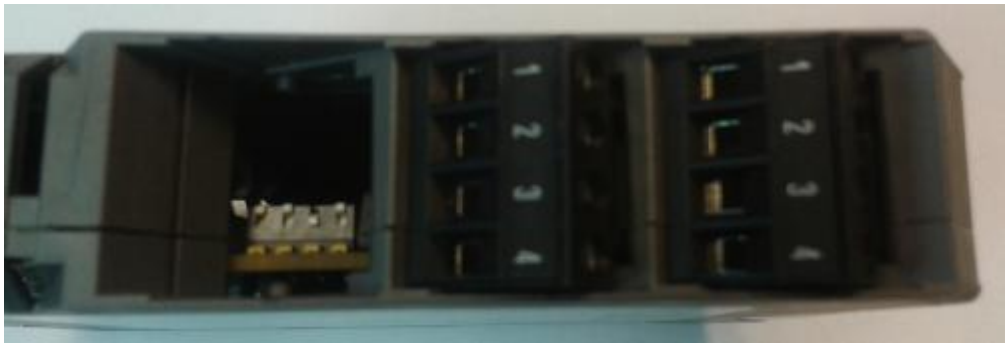
- Two connections and one configuration switch on the top side see 4.1.1.
- One connection and several indicators on the front panel, see 4.1.2.
- Three connections on the bottom side see 4.1.3.
- One connection to DIN rail, see 3.1.

4.1.1 Top side

The following connectors are positioned on the gateways top side (in order from front to back):

- ABB StatusBus terminal.
- Pluto bus terminal.
- Switch setting (behind cover).

Terminals on the top side, with cover over the switch.



Terminals on the top side, with cover removed and switch accessible.

4.1.1.1 ABB StatusBus terminal

This terminal is currently not used.
It has the following connections.

PIN	Label	Description
1	SB4	-
2	SB3	-
3	SB2	-
4	SB1	-

The terminal connector is of type Phoenix MSTBT 2,5/4-ST BK BD:1-4 (Phoenix 1944259).

4.1.1.2 Pluto bus terminal

Connection to Pluto bus (CAN bus) which has a functional electrical insulation and has the connection according to the following table.

PIN	Label	Description
1	CS	Pluto bus, CAN shield.
2	CH	Pluto bus, CAN high.
3	CL	Pluto bus, CAN low.
4	CS	Pluto bus, CAN shield.

The terminal connector is of type Phoenix MSTBT 2,5/4-ST BK BD:1-4 (Phoenix 1944259).

4.1.1.3 Configuration switch

Behind a cover is a small DIP switch for configuration of gateway node number. (Switch pos. 1 and 2 currently not used).

The gateway node number is set according to the table below.

Switch pos. 3	Switch pos. 4	Function
Up	Up	Gateway node number 0.
Up	Down	Gateway node number 1.
Down	Up	Gateway node number 2.
Down	Down	Gateway node number 3.

For more information see chapter 5.1.4.2.

4.1.2 Front panel

The status indicators (LED) are located on the front panel. They are grouped in four groups for an easy overview. On the front panel there is also a push (“K”) button, and a PC port connector.

4.1.2.1 “K” button

The “K” button is used for commands which need confirmation by a person who is at the physical place where the Pluto system with the gateway is situated.

4.1.2.2 PC port

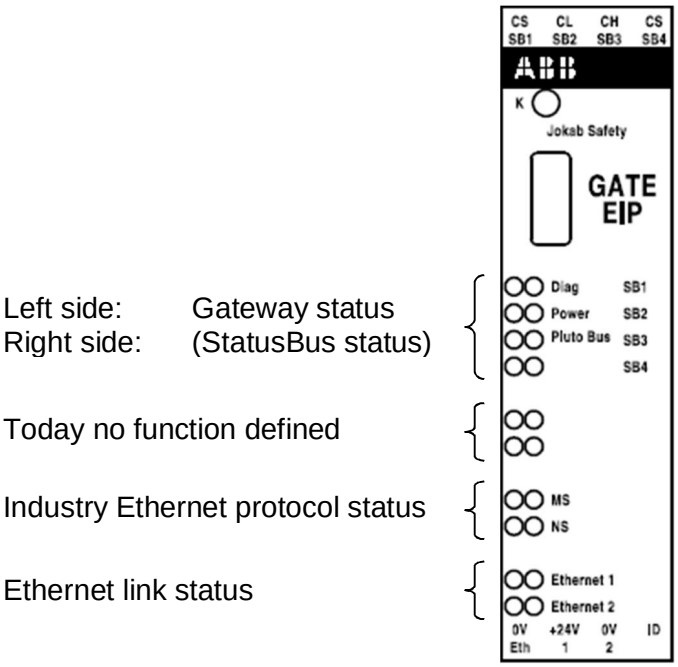
On the front there is a four pin PC port connector where the ABB serial cable or ABB USB cable can be connected for configuration and/or troubleshooting of the gateway.

For connection between the gateway and a PC, one of the ABB cables and the terminal tool in ABB Pluto Manager software can be used. It’s also possible to use any other terminal software and, if so, the following serial configuration shall be used:

- Baud rate 57.6 kbit/s
- Data bits 8
- Stop bits 1
- Parity none
- Flow control none

The PC-port shall **only** be used for local terminal access to the device and are not secured for any external access handling.

4.1.2.3 Indicators (LED)



4.1.2.3.1 Gateway status

The gateway status has four indicators, of which only three has defined functions:

- The yellow “Diag” indicator will light shortly at start up but shall during normal operation not lightning. If this indicator has a steady light it is an error indication and the device shall be replaced.
- The green “Power” indicator will light when the software is running in normal non-error state.
- The green “Pluto Bus” indicator will indicate the status of the Pluto bus. For more information see chapter 5.1.3.

LED	Diag	Power	EtherNet/IP	Remark
OFF			Unit off	
GREEN Steady	OFF		Running	
YELLOW/RED Toggling			Second bootloader	Diag/Power is toggling 1 Hz. More information see chapter 5.6.6.
else			Device faulty	

The device will come to the second bootloader stage during startup if there is no valid firmware in the device. This shall normally not be the case but if the FLASH memory for some reason is corrupted this can happen. It’s possible to restore the firmware via the second bootloader, for more information see chapter 5.6.6.

4.1.2.3.2 Ethernet protocol status

The Ethernet protocol status indicators are two combined red/green indicators giving the possibility for two status indications. Each Ethernet protocol has its own defined behavior on these indicators and the behavior is defined in the chapter for each protocol.

4.1.2.3.3 Ethernet link status

The Ethernet link status is two combined yellow/green indicators giving the status for each Ethernet port (see connectors on bottom side chapter 4.1.3.1 and 4.1.3.2). Each color has the following status information related the Ethernet port.

- Yellow indicator — flashing light indicates Ethernet traffic on the port.
  E.g. no flashing indicates no Ethernet traffic on the port.
- Green indicator — steady light indicates Ethernet connection.
  E.g. no light indicates no Ethernet connection.

For the green indicator the “Ethernet connection” only means there is a cable connection between the gateway and the other Ethernet device (Ethernet switch, other device or PC). It is not an indication of data traffic; this is indicated by the Ethernet protocol status indicators.

For EtherCAT there is a different coding of the link status, see chapter 7.3.1.

4.1.3 Bottom side

The following connectors are positioned on the gateways bottom side (in order from front to back):

- Ethernet port 1 (EtherCAT this is the IN port)
- Ethernet port 2 (EtherCAT this is the OUT port)
- Power terminal

4.1.3.1 Ethernet port 1

This is the first Ethernet port on the gateway and it shall be the main port to connect to the network. For “daisy chain” connecting on EtherCAT this is the **input connector**.

Connection is standard RJ45 connector and the cable used shall be (minimum) according to Cat5e S/FTP (shielded cable).

4.1.3.2 Ethernet port 2

This is the second Ethernet port on the gateway and it shall be the secondary port to connect to the network. For “daisy chain” connecting on EtherCAT this is the **output connector**.

Connection is standard RJ45 connector and the cable used shall be (minimum) according to Cat5e S/FTP (shielded cable).

4.1.3.3 Power terminal

The unit is powered with 24 VDC using this terminal connection 1 and 2.

On this terminal it is possible to connect an ABB IDFIX device for future use (has today no function).

Terminal	Description
1	0V
2	+24VDC
3	0V
4	IDFIX

The terminal connector is of type Phoenix MSTBT 2,5/4-ST BK BD:1-4 (Phoenix 1944259).

5 Common configuration

This chapter contains information about configuration which is common for all models of the Ethernet gateways described in this manual.

5.1 Pluto bus

The Pluto bus is a CAN bus which means that the connection shall follow the common rules for all CAN buses. For more information about this see Pluto Safety PLC hardware manual [**REF 1]**.

5.1.1 Connection

The connector for the Pluto bus is located on the top side of the enclosure (normal mounting).
If the gateway is placed at the beginning or at the end of the bus line a 120 Ω terminating resistor must be mounted. For Pluto bus terminal connection see chapter 4.1.1.2.

5.1.2 Baud rate detection

The gateway will automatically detect the baud rate when there is traffic on the Pluto bus. Once detected, the baud rate setting will remain while there is traffic on the bus. If the traffic is interrupted for 5 seconds or more the automatic baud rate detection will be restarted.

5.1.3 Status indication

The front panel LED indicator labeled Pluto bus indicates the status of the Pluto bus.

LED – Pluto bus		Description	Remark
GREEN **off** with short **on** flash		Pluto bus baud rate search.	When bus is not connected or no traffic on the bus.
GREEN **on** with short **off** flash		Pluto bus traffic detected and baud rate set.	

5.1.4 Gateway node number

The gateway needs to have a node number on the Pluto bus which makes it possible for the device to send data to the Pluto system via the “Data to Pluto” function. It is possible to select node number in the range of 0 – 15.

> **Note**: The node number setting is important to differ between several gateways when using “Data to Pluto”.

The gateway node number can be set in several ways; by PLC (via industry Ethernet protocol), DIP switch or terminal command. Best practice is to let the PLC set the gateway node number.

5.1.4.1 Set by PLC

The gateway node number can be set via the industry Ethernet protocol from the connected PLC master. When setting the gateway node number from the PLC it’s possible to select node number in the range of 0 – 15, compared to only the range of 0 – 3 when using the DIP switch.

The configuration parameter shall be set according to the table below. The default value is 0 which means that the node number has been read from the DIP switch.

Value	Function
0 (default)	Gateway node number from DIP switch.
1	Gateway node number 0.
2	Gateway node number 1.
3	Gateway node number 2.
4	Gateway node number 3.
5	Gateway node number 4.
6	Gateway node number 5.
7	Gateway node number 6.
8	Gateway node number 7.
9	Gateway node number 8.
10	Gateway node number 9.
11	Gateway node number 10.
12	Gateway node number 11.
13	Gateway node number 12.
14	Gateway node number 13.
15	Gateway node number 14.
16	Gateway node number 15.

Note: If the DIP switch is changed and the device is restarted the gateway will use the DIP switch node number until it's overwritten by the PLC.

5.1.4.2 Set by DIP switch

The gateway has a DIP switch (for backwards capability with previous units) where it is possible to set the node number of the unit to a value between 0 – 3. The value of the DIP switch is only read at power on. For more information about the DIP switch see chapter 4.1.1.3.

5.1.4.3 Set by terminal command

It is also possible to set the gateway node number via terminal command if no other ways are possible to use. For more information see chapter 5.5.11.

5.2 IP address assignment

Each type of product will at delivery have a default IP address and IP address handling according to the device industry Ethernet protocols preferred setting, for more information see chapter for the relevant industry Ethernet protocol.

For some of the Ethernet gateways (GATE-EC and GATE-PN) there is no manual assignment of the IP address. In these systems the master PLC will assign IP address to the device during commissioning. For these devices the rest of this chapter has no meaning.

The IP address can be assigned and changed in several ways,

- Static address.
  - Via the industry Ethernet protocol if this is supported.
  - Via the PC port on the front panel (see chapter 4.1.2.2).
  - Via telnet server (see chapter 5.3.6).
  - Via web server (see chapter 5.3.4).
- DHCP address setting.
- BOOTP address setting.

Normally many master units on the industry Ethernet protocol has some functions to handle and change the device IP address when connected to the network. How to do this depends on the used industry controller and no deeper information regarding this can be given here.

The second best way is to connect a terminal program to the PC port on the front panel. Via this interface it is possible to view the current IP address setting with the “bw” command. The IP address can be change by using the “ipaddr” command, see chapter 5.5.15.

5.3 Network services

The Ethernet gateways have several Ethernet network services. These services are:

Service	Default setting
ICMP Ping command.	**Enabled** Can’t be disabled.
The device industry Ethernet Protocol.	**Enabled** Can’t be disabled.
FTP server for software update.	**Disabled** Can be enabled/disabled by the user.
TFPT server for software update.	**Disabled** Can be enabled/disabled by the user.
Web server for status monitor and software update.	**Disabled** Can be enabled/disabled by the user.
Telnet server for remote monitor.	**Disabled** Can be enabled/disabled by the user.

For cyber security reasons the FTP, TFTP, Web and telnet servers are disabled by default. If the user needs the functionality with one or several of these services they can be enabled by the user using terminal commands, see chapter 5.5.16.

It is important that the user before enabling any of the services read the relevant chapter for the service to get knowledge in the service functionality and its cyber security limitations.

5.3.1 ICMP Ping command

The device will respond on any ICMP ping command which is sent to the device IP address. This service is by default always enabled and can’t be disabled.

```
C:\>ping 192.168.0.100

Pinging 192.168.0.100 with 32 bytes of data:
Reply from 192.168.0.100: bytes=32 time=2ms TTL=64
Reply from 192.168.0.100: bytes=32 time=1ms TTL=64
Reply from 192.168.0.100: bytes=32 time=1ms TTL=64
Reply from 192.168.0.100: bytes=32 time=1ms TTL=64

Ping statistics for 192.168.0.100:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 1ms, Maximum = 2ms, Average = 1ms
C:\>
```

5.3.2 Industry Ethernet Protocol

The industry Ethernet protocol is different for the different gateway models, but it is either EhterNet/IP, EtherCAT, Sercos III, PROFINET or Modbus TCP. One of these protocols will be running on the device and can’t be disabled e.g. it will always be active for any connection.

5.3.3 FTP server

Cyber security is an important part when enabling this function, see chapter 2.

The FTP server is used to upload new firmware to the device if firmware upgrade is needed. To upload new firmware to the FTP server the operator need to enter the correct user account and the corresponding password for the account. For more information regarding user name and password see chapter 5.5.17.

The FTP server is using the standard FTP server ports 20 and 21.

By default the FTP server is disabled and this is the preferred setting for this server. For firmware update the preferred way is to use the PC port. If the user wants to use the FTP server and explore this server on the network it can be enabled, see chapter 5.5.16.

When connecting to the FTP server you need to enter account and the password for the account. The FTP server supports two fixed accounts, where each account has different access rights to the file system. These accounts and their access rights are:

- admin
  This account has access to the complete file system and is normally only used by ABB to make production test and settings if needed.
  This account is used to make firmware update via the FTP server, which is not a recommended procedure. For alternative methods see chapter 5.6.

- user
  Doesn't have any access to the FTP server.

Note that using the FTP access shall only be used for firmware update if no other ways are possible. See chapter 5.6.

Using the FTP server and making changes to the file data may corrupt the device. So when making the update via the FTP server it's important to follow the described information carefully and do not make any other changes to the device file structure. For more information see chapter 5.6.4.

Summary: **Don't enable** the FTP server if you don't have specific needs for it.
Note that password is sent as clear text over the network during login process!
Always change the default passwords for the accounts, see chapter 5.5.17.
Data traffic to/from FTP server is not encrypted.

5.3.4 TFTP server

Cyber security is an important part when enabling this function, see chapter 2.

The TFTP server is used to upload new firmware to the device if firmware upgrade is needed. This service is disabled because the preferred way to update the device firmware is via the PC port.

The TFTP server is using the standard FTP server ports 69.

By default the TFTP server is disabled. If the user wants to disable/enable the TFTP server see chapter 5.5.16.

Summary: **Don't enable** the TFTP server if you don't have specific needs for it.
The TFTP server is by default **disabled**.
There is **no account handling or password handling** on this service.
Data traffic to/from telnet server is not encrypted.

5.3.5 Web server

Cyber security is an important part when enabling this function, see chapter 2.

The web server can be used to see status information. On this status page there are links to pages for changing IP address and for firmware upload to the unit. The status page is open for all to access but the other two pages are password protected, see 5.5.17.

The web server is using the standard web server port 80.

By default the web server is disabled. For firmware update the preferred way is to use the PC port, see chapter 5.6. If the user want to use the web server and explore this server on the network it can be enabled, see chapter 5.5.16.

To access the firmware update page, and the change IP configuration page, it is necessary to first create a login entering account and select a password for the account. The web server supports two fixed accounts for access to these pages:

- admin
  Access to both the IP configuration page and the firmware update page.

- user
  No access.

Summary: Enable the web server **only if** you need this function.
The web login has **weak encryption** login handling (**near clear text**).
Always change the default passwords for the accounts, see chapter 5.5.17.
Data traffic to/from web server is not encrypted.

Enabling the web server for only access of the status page is not possible. It can be done in a partial secure way if a **very strong and never used password** is set for the admin account.

5.3.6 Telnet server

Cyber security is an important part when enabling this function, see chapter 2.

The telnet server is a network terminal interface similar to the PC port on the unit's front panel. This gives the user the possibility to access the unit via the network for remote monitoring of the connected Pluto system.

By default the telnet server is disabled. If the user want to use the telnet server and explore this server on the network it can be enabled. This can be done in two ways,

- For easy enabling Pluto remote monitor see chapter 5.5.11.
- For complete service enable/disable see chapter 5.5.16.

When the telnet server is enabled it will by default listen on port number 50100. This can be changed when using the service enable/disable command (5.5.16).

When connecting to the telnet server you need to enter account and the password for the account. The login process (entering of account or password) is limited to 30 seconds, if this time is exceeded the connection will automatically close. The telnet server supports two fixed accounts where each account has different access rights to the gateways functions. These accounts and their access rights are:

- admin
  Full access rights e.g. can both change configuration and write data to the Pluto PLC system. This account can be disabled when the telnet server is enabled, if this access is not needed over the Ethernet port, see chapter 5.5.16.

- user
  Read only access rights e.g. the user can only read and monitor data but not change anything within the gateway configuration or the Pluto PLC system. The account is intended to remote monitor access.

Password for the accounts can be change see chapter 5.5.17.

Summary: Enable the telnet server **only if** you need this function.
Note that password is sent as clear text over the network during login process!
Always change the default passwords for the accounts, see chapter 5.5.17.
Data traffic to/from telnet server is not encrypted.
The telnet server supports only **one** client connection.

Below is an example of login and logout (exit) to the telnet server. Note that the exit command needs to be ended with an Enter to be executed.

```
login: user
password: ****
***********************************
 EtherNet/IP gateway
***********************************
 Name         : GATE-EIP
 Article no   : 2TLA020071R9000
 Serial number: 4096
***********************************
 Vendor ID    : 950
 Product code : 1100
 Device type  : 43
***********************************
 Software ver : 1.13.0
 Software date: 2014-12-04
***********************************
 ABB AB, Jokab Safety
 www.abb.com/jokabsafety
***********************************
eip_gw> exit
```

5.4 Verification of configuration

Via the terminal commands (5.5) it is possible to check the status of the gateway and also to see which configuration the gateway has received from the master. For more information see the “bs”, “bw” and “bc” commands in chapter 5.5.

5.5 Terminal commands

Terminal commands can be used via a connection to the device PC port or via its telnet server (if enabled). With these terminal commands it’s possible to check and read the status of the unit and also if needed change the configuration.

Each gateway has a unique prompt on the terminal output:

- GATE-EIP eip_gw>
- GATE-S3 s3_gw>
- GATE-EC ec_gw>
- GATE-PN pn_gw>
- GATE-MT mt_gw>

The prompt can be visible by pressing the ESC button. This will also exit any current active commands which can be active from previous usage of the PC port.

For handling the terminal interface the “h” command will always list all valid commands see 5.5.1.

5.5.1 h – help

With the online help command it’s possible to see which commands are available via the terminal connection. This will mainly differ when connected via the telnet server depending on which account is used during the login process.

Below is a list of all valid commands. Commands can be entered with both capital and lower case letters.

```
eip_gw> h
I       [Pluto node[.address]]       read input
Q       [Pluto node[.address]]       read output
GM      [Pluto node[.address]]       read global memory
M       [Pluto node[.address]]       read memory bit
R       [Pluto node[.address]]       read register
DR      [Pluto node[.address]]       read double register
S       [Pluto node[.address]]       read sequence step
SM      [Pluto node[.address]]       read system memory bit
SR      [Pluto node[.address]]       read system register
SDR     [Pluto node[.address]]       read system double register
ASIS    [Pluto node[.address]]       read AS-i safety input
ASI     [Pluto node[.address[.sub]]] read AS-i input
ASQ     [Pluto node[.address[.sub]]] read AS-i output
GW      [gateway node.address]       read gateway register
ADD     [gateway node[.area]]        read gateway additional data
TO      [gateway node[.area[.reg]]]  read gateway data to Pluto
BG      view gateway nodes on Pluto bus
BS      view Pluto nodes on Pluto bus
BC      view gateway configuration
BW      view Ethernet configuration
N       view gateway node information
V       view gateway version information
H       view gateway help list
TIME    view gateway uptime
RESET   restart gateway
TEST    run gateway production test
EXIT    logout telnet
```

```
CN      change gateway node number
ADDC    clear  gateway additional data configuration
ADDS    change gateway additional data configuration
CTP     change gateway data to Pluto configuration
IPADDR change gateway IP address
SERVER change gateway Ethernet services
PW      change gateway password
LOUT    change gateway telnet auto logout
DOUT    disconnect telnet clients
DEF     restore to the default factory settings
SYS     download new gateway firmware
REMOTE enable remote monitoring of Pluto system
eip_gw>
```

5.5.2 View Pluto data

It's possible to view Pluto data via the terminal command for checking data in a selected Pluto. The list below (from the help command) shows which data can be viewed,

```
I       [Pluto node[.address]]        read input
Q       [Pluto node[.address]]        read output
GM      [Pluto node[.address]]        read global memory
M       [Pluto node[.address]]        read memory bit
R       [Pluto node[.address]]        read register
DR      [Pluto node[.address]]        read double register
S       [Pluto node[.address]]        read sequence step
SM      [Pluto node[.address]]        read system memory bit
SR      [Pluto node[.address]]        read system register
SDR     [Pluto node[.address]]        read system double register
ASIS    [Pluto node[.address]]        read AS-i safety input
ASI     [Pluto node[.address[.sub]]] read AS-i input
ASQ     [Pluto node[.address[.sub]]] read AS-i output
```

The syntax for the parameters is "command[<Pluto node>[.<register[A/B]>[.subregister]]]" where Pluto node is the Pluto node number (0 – 31) and register is depending on command. For ASI and ASQ command there is also a selection of A/B-slave plus an additional sub register.

When viewing a register it's possible to make following commands,

- Enter : step to next register (+1).
- Backspace : step to previous register (-1).
- '.' : step to next register (+1).
- ',' : step to previous register (-1).
- 'h' : switch between decimal and hexadecimal presentation.
- ESC : exit the view command.

5.5.3 View gateway data

It's possible to check the configuration of the gateway with several commands.

```
GW      [gateway node.address]        read gateway register
ADD     [gateway node[.area]]         read gateway additional data
TO      [gateway node[.area[.reg]]]   read gateway data to Pluto
```

The gateway have most data viewed by "bs/bw/bc/add/to" commands accessible via register reading using the "gw" command and some additional information see chapter 13. By using the "gw" command it's also possible to read this data from other gateway via the Pluto bus.

The syntax for the "gw" command is "gw<gateway node>.<register address>" to read information from any gateway node on the Pluto bus. To read information from the connected device it's possible to use the "gw<register address>" command. E.g. if no or only one parameter is added to the command it will view the information for the connected gateway register and with no parameter starting at register 0. If the command has two parameters then the first is the gateway node

number (0 – 15) and the second it the register number. Explanation of the different registers within the gateway is listed in Appendix A, gateway registers. (Chapter 13).

When viewing a register it's possible to make the following commands,

- Enter : step to next register (+1).
- Backspace : step to previous register (-1).
- '.' : step to next register (+1).
- ',' : step to previous register (-1).
- 'h' : switch between decimal and hexadecimal presentation.
- ESC : exit the view command.

The "add" and "to" commands will view the current value of additional data area for "add" command and the current data to Pluto data with the "to" command. By these commands it's then possible to see what additional data the gateway receives from the Pluto bus, and which data will be transmitted on the Pluto bus.

5.5.4 bg – gateway network status

With this command it is possible to see which gateways are on the Pluto bus network. It's important that all gateways on the Pluto bus have unique node number.

In the example below the "bg" command finds a gateway node number 0, which is the gateway where the command was given (connected). As gateway node number 1 there is a GATE-C2 (CANopen), number 2 is GATE-E2 (Ethernet), number 3 is GATE-D2 (DeviceNet) and as gateway node number 6 there is a GATE-EIP (EtherNet/IP).

```
eip_gw> bg
-------------------------------------
Gateway  0 : Connected      Gateway  8 : -
Gateway  1 : GATE-C2        Gateway  9 : -
Gateway  2 : GATE-E2        Gateway 10 : -
Gateway  3 : GATE-D2        Gateway 11 : -
Gateway  4 : -              Gateway 12 : -
Gateway  5 : -              Gateway 13 : -
Gateway  6 : GATE-EIP       Gateway 14 : -
Gateway  7 : -              Gateway 15 : -
-------------------------------------
eip_gw>
```

5.5.5 bs – Pluto bus status

With this command it's possible to check the Pluto bus settings and status.

In the example below the device is operational on the Pluto bus as gateway node number 0 and the current detected Pluto bus speed is 125 kbit/s. On the Pluto bus there is only one Pluto with node number 10 active and it's a Pluto B20 v2.

```
eip_gw> bs
-------------------------------------
Gateway node number: 0
Pluto bus speed: 125 kbits
-------------------------------------
Pluto  0 : -         Pluto 16 : -
Pluto  1 : -         Pluto 17 : -
Pluto  2 : -         Pluto 18 : -
Pluto  3 : -         Pluto 19 : -
Pluto  4 : -         Pluto 20 : -
Pluto  5 : -         Pluto 21 : -
Pluto  6 : -         Pluto 22 : -
Pluto  7 : -         Pluto 23 : -
Pluto  8 : -         Pluto 24 : -
Pluto  9 : -         Pluto 25 : -
```

```
Pluto 10 : B20 v2    Pluto 26 : -
Pluto 11 : -         Pluto 27 : -
Pluto 12 : -         Pluto 28 : -
Pluto 13 : -         Pluto 29 : -
Pluto 14 : -         Pluto 30 : -
Pluto 15 : -         Pluto 31 : -
-------------------------------------
eip_gw>
```

5.5.6 bc – gateway configuration status

With this command it is possible to check and verify the configuration of the gateways application objects for data to Pluto and the additional data configuration.

Configuration and changes of this data are normally done via the configuration functions on the industry Ethernet protocol, but can also be done via terminal commands “ctp” see chapter 5.5.14, “addc” see chapter 5.5.12 and “adds” see chapter 5.5.13.

The example below of the “bc” command give that the “Data to Pluto” function is enabled for all data packet area, industry Ethernet protocol write timeout is disabled (e.g. 0 ms) and the Pluto bus update time is set to 100 ms.

For additional data there are three areas which has configuration. Area 0 is configured to receive data from Pluto node 5 with data of type “Error Code” (IO-type number 100), area 1 to receive data from Pluto node 10 with data of type “USER:01” (IO-type number 1) and area 10 will receive data from Pluto node 10 with data of type “B46” (IO-type number 101).

```
eip_gw> bc
-------------------------------------
Data to Pluto
 Packet area 0: Enabled
 Packet area 1: Enabled
 Packet area 2: Enabled
 Packet area 3: Enabled
 EtherNet/IP write timeout: 0 ms
 Pluto bus update time: 100 ms
-------------------------------------
Additional data configuration
 Area Pluto IO-type | Area Pluto IO-type | Area Pluto IO-type | Area Pluto IO-type
   0     5  ErrCode |   1    10  USER: 1 |  10    10  B46     |
-------------------------------------
eip_gw>
```

IO-type translation information:

Short name	Long name	IO-type number
USER:xx	User block number xx.	1 – 99
ErrCode	Error Code.	100
B46	B46 I20-I47.	101
ASIsaf2	AS-i node 16-31 safe inputs.	102
ASI0103	AS-i node 1-3 standard input.	103
ASI0407	AS-i node 4-7 standard input.	104
ASI0811	AS-i node 8-11 standard input.	105
ASI1215	AS-i node 12-15 standard input.	106
ASI1619	AS-i node 16-19 standard input.	107
ASI2023	AS-i node 20-13 standard input.	108
ASI2427	AS-i node 24-27 standard input.	109
ASI2831	AS-i node 28-31 standard input.	110
Global	Pluto global.	111
B42 ASi	B42 AS-i I20-I47.	112
ASISaf1	AS-i node 1-15 safe input.	113

5.5.7 bw – industry Ethernet protocol status

With this command it is possible to check the network settings and see status for the device Ethernet ports.

The first section displays the current status of the industry Ethernet protocol for the device. In this example it's the EtherNet/IP status as it's a GATE-EIP.

Next are network settings with the device MAC address together with the current network IP address setting (in this case using DHCP with the IP address 192.168.130.212). IP address assignment can be changed using command "ipaddr" see chapter 5.5.15.

Next section views the current status of each of the Ethernet ports.

The last section shows the current additional network service status and the number of connected clients to the telnet server if enabled. Enable/disable of these additional network services is done with the "server" command see chapter 5.5.16.

```
eip_gw> bw
-------------------------------------
EtherNet/IP status
Module Status: Device operational
Network Status: No connections
-------------------------------------
MAC address  : 02:C0:FF:E0:69:FF
IP address   : 192.168.130.212
Subnetmask   : 255.255.255.0
Gateway      : 0.0.0.0
Address mode : DHCP
-------------------------------------
Port   : 1
Speed  : 100 MBITS
Duplex : FULL
Port   : 2
Speed  : NO CONNECTION
Duplex : NO CONNECTION
-------------------------------------
FTP port       : DISABLED
TFTP port      : DISABLED
Web port       : DISABLED
Telnet port    : DISABLED (50100)
Telnet admin   : DISABLED
Telnet clients : 0 (1)
-------------------------------------
eip_gw>
```

5.5.8 v – version information

At startup of the unit it will print out the version on the PC port. This information can also be viewed by making a "v" command. Some of the information is common for all products, but some is specific for each industry Ethernet protocol.

Below is an example of version information for a GATE-EIP product using industry Ethernet protocol EhterNet/IP. Firmware version and date will match the current firmware in the device.

```
eip_gw> v
**********************************
 EtherNet/IP gateway
**********************************
 Name         : GATE-EIP
```

```
 Article no   : 2TLA020071R9000
 Serial number: 105
**********************************
 Vendor ID    : 950
 Product code : 1100
 Device type  : 43
**********************************
 Firmware ver : 2.13.0
 Firmware date: 2015-11-12
**********************************
 ABB AB, Jokab Safety
 www.abb.com/jokabsafety
**********************************
eip_gw>
```

This command checks the device password storage. If there is a storage error the device will restore to the default factory password. When this error is detected the following information will be printed. Any additional service which is enabled will then be disabled and the device will make a restart to ensure that the services are disabled.

```
eip_gw> v
**********************************
...
**********************************

Missing password information restored!
All service disabled, make restart.

“... the device will then make a restart!”
```

This command checks if the device has any additional network services enabled which is exposing the admin account. If so, it will check if this account uses the default password and if so this notification will be printed. This is being a cyber security problem and the password shall be changed, see chapter 5.5.17.

```
eip_gw> v
**********************************
...
**********************************

==================================
============== NOTE ==============
=== Admin has default password ===
==================================

eip_gw>
```

5.5.9 reset – restart the unit

With this command it is easy to restart the unit. This restart will be similar to a power restart.

```
eip_gw> reset
Reset gateway? (y/n) y
Reset...
eip_gw>
```

5.5.10 test – test command

This command is used during ABB production test and is used together with a specific test system. This command cannot be used to test the device without the test system. The command is only presented in the help listing and in this document so it’s not hidden. If this command is started the device need to be restarted via power off/on sequence to be operational.

5.5.11 cn – change gateway node number

With the command “cn” it is possible to change the gateway node number on the Pluto bus. This shall normally not be needed because this configuration can normally be done via the industry Ethernet protocol.

Below is an example when the gateway node number for the unit is set to node number 9 (e.g. enter selection 10).

```
eip_gw> cn
Gateway node number:
 0: Configured by DIP switch
 1: Node number 0
 2: Node number 1
 3: Node number 2
 4: Node number 3
 5: Node number 4
 6: Node number 5
 7: Node number 6
 8: Node number 7
 9: Node number 8
10: Node number 9
11: Node number 10
12: Node number 11
13: Node number 12
14: Node number 13
15: Node number 14
16: Node number 15
Select [0-16] : 10
Set node number to 9.
eip_gw>
```

5.5.12 addc – clear additional data configuration

With the command “addc” it is possible to clear the current additional data configure, e.g. all configuration for the additional data elements like from which Pluto and which IO-type for all the additional data areas will be cleared. The status of the set configuration can be checked using the “bc” command.

```
eip_gw> addc
Clear additional data configuration [Yes/No] ? y
Configuration cleared.
eip_gw>
```

5.5.13 adds – configure additional data

With the command “adds” it is possible to configure one additional data area and by using it several times all the areas can be configured. This shall normally not be needed because this configuration shall normally be done using the industry protocol device configuration.

The example below shows setting additional area zero (0) to get data from Pluto 1 and the IO-type is 100 (e.g. error code from the selected Pluto). The status of the set configuration can be checked using the “bc” command.

```
eip_gw> adds
Configure additional data area [0-31] : 0
Receive data from Pluto node number [0-31] : 1
IO-type :
 -    0 = Not used
 - 1-99 = User block
 -  100 = Error Code
 -  101 = B46 I20-I47
 -  102 = AS-i node 16-31 safe input
```

```
 -  103 = AS-i node  1- 3 standard input
 -  104 = AS-i node  4- 7 standard input
 -  105 = AS-i node  8-11 standard input
 -  106 = AS-i node 12-15 standard input
 -  107 = AS-i node 16-19 standard input
 -  108 = AS-i node 20-23 standard input
 -  109 = AS-i node 24-27 standard input
 -  110 = AS-i node 28-31 standard input
 -  111 = Pluto global
 -  112 = B42 AS-i I20-I47
 -  113 = AS-i node 1-15 safe input
 -  114 = D45 I20-I47
Select IO-type [0-255] : 100
Configuration done.
eip_gw>
```

5.5.14 ctp – configure “Data to Pluto”

With the command “ctp” it is possible to configure “Data to Pluto” setting. This shall normally not be needed because this configuration shall normally be done using the industry protocol device configuration.

The example below shows a setting of data to Pluto where all packet area 0 – 3 are enabled (previously disabled), timeout is not changed (e.g. 0 ms mean timeout is disabled) and update time is changed from 100 ms to 150 ms. The status of the set configuration can be checked using the “bc” command.

```
eip_gw> ctp
Enable packet area 0 (disabled) [Yes/No]? y
Enable packet area 1 (disabled) [Yes/No]? y
Enable packet area 2 (disabled) [Yes/No]? y
Enable packet area 3 (disabled) [Yes/No]? y
EtherNet/IP write timeout (0 ms) [0-60000 ms]:
Pluto bus update time (100 ms) [0-255 ms]: 150
Setting done.
eip_gw>
```

5.5.15 ipaddr – change IP address

The “ipaddr” command is not implemented on EtherCAT and PROFINET as these protocols has other protocol depending way to set the IP address of the device.

With the command “ipaddr” it’s possible to change the units IP address on the network. This IP address can be set as,

- Static, a fixed IP address set via terminal command.
- DHCP, the unit will try to get IP address from DHCP server on the network.
- BOOTP, the unit till try to get IP address using BOOTP.

Below is an example where the IP address is set to a static address 192.168.130.212 on a network using subnet mask of 255.255.255.0 and a default gateway of 0.0.0.0. Which setting to use depends on the network where the unit will be connected. The unit will use the new IP address after a reset/power restart. Verify the setting by using the “bw” command after the unit has been restarted.

```
eip_gw> ipaddr
Address mode STATIC/BOOTP/DHCP (S/B/D) : s (STATIC)
IP address   : 192.168.130.212
Subnetmask   : 255.255.255.0
Gateway      : 0.0.0.0
To make changes active, restart the unit.
Reset gateway? (y/n) y
Reset...
```

```
eip_gw>
```

If your network/system is using DHCP it is only to change the setting to DHCP mode. After reset/power restart the unit will try to get its IP address from the networks DHCP server. Status of this can be seen using the “bw” command.

```
eip_gw> ipaddr
Address mode STATIC/BOOTP/DHCP (S/B/D) : d (DHCP)
To make changes active, restart the unit.
Reset gateway? (y/n) y
Reset...
eip_gw>
```

If your network/system is using BOOTP it is only to change the setting to BOOTP mode. After reset/power restart the unit will try to get its IP address using the BOOTP protocol. Status of this can be seen using the “bw” command.

```
eip_gw> ipaddr
Address mode STATIC/BOOTP/DHCP (S/B/D) : b (BOOTP)
To make changes active, restart the unit.

Reset gateway? (y/n) y
Reset...
eip_gw>
```

5.5.16 server – enable/disable service

Cyber security is an important part when enabling these functions, see chapter 2.

With the command “server” it is possible to enable/disable some of the network services like the FTP, TFTP, web and telnet server. The standard industry Ethernet protocol server for each device can’t be disabled.

Below is an example where all the services are disabled. To change the services the unit need to be reset/power restarted. The status of the enabled/disabled services can be checked using the “bw” command.

```
eip_gw> server
FTP server is disabled (Enable/Disable) : d (DISABLED)
TFTP server is disabled (Enable/Disable) : d (DISABLED)
Web server is disabled (Enable/Disable) : d (DISABLED)
Telnet server is enabled (Enable/Disable) : d (DISABLED)
Telnet admin is disabled (Enable/Disable) : d (DISABLED)
Telnet port is 50100 (1025 - 65000) : 50100
To make changes active, restart the unit.
Reset gateway? (y/n) y
Reset...
eip_gw>
```

When FTP, Web or telnet server with admin is enabled, the command will prompt for a new password for the admin account if the device has the default password. To activate the change the unit needs to be restarted.

```
eip_gw> server
FTP server is disabled (Enable/Disable) : d (DISABLED)
TFTP server is disabled (Enable/Disable) : d (DISABLED)
Web server is disabled (Enable/Disable) : e (ENABLED)
Telnet server is disabled (Enable/Disable) : e (ENABLED)
Telnet admin is disabled (Enable/Disable) : e (ENABLED)
Telnet port is 50100 (1025 - 65000) :
Admin account has default password,
Password : ******
```

```
Password : ******
Password changed!
To make changes active, restart the unit.
Reset gateway? (y/n) y
Reset...
eip_gw>
```

The status of the enabled/disabled services can be checked using the “bw” command.

5.5.17 pw – set password

With the command “pw” it is possible to change the password for connecting to the FTP server, using update and IP address change on web-server and remote login on telnet server.
The device has two accounts with fixed names “admin” and “user”, note that the account names are lower case letters. For description of which privilege each account has on the FTP, web and telnet server, see information for each server in chapter 5.3.

Password for each account has the following default settings and it’s important that the user of the unit changes these to something else, and do not use the default password in an operational system.

- Account: admin (lower case) password: private
- Account: user (lower case) password: user

To change the password for each account use the terminal command “pw” and follow the instructions for input of the account, old password, new password and retype the new password. After a successful change of the password the unit needs to be restarted to activate the new password. When changing both accounts you can change the first without restart and then restart the unit after setting the second accounts password.

Note: Password need to be at least 6 characters and it’s not allowed to use any of the default passwords or any of the account names!

```
eip_gw> pw
User name    : user
Old password : ****
New password : ******
New password : ******
Password changed!
eip_gw>
```

If wrong old password has been entered or if the two new passwords don´t match you will get information about it and the password will not be changed.

```
eip_gw> pw
User name    : user
Old password : ******
New password : ******
New password : ******
Old password mismatch, password not changed!
eip_gw>
```

5.5.17.1 Restore **default password - pw**

The password restore procedure is started by using the pw command with user name=restore. This will start the restore procedure.

```
eip_gw> pw
User name    : restore
Restore default password, this will restart the device.
Do you want to continue [Yes/No]? y
```

```
Press push button on device.
Enter "abc80" on terminal: abc80
Press push button on device.
Password set to default, device will be restarted!
eip_gw>
```

This can only be executed via the PC port and NOT via the telnet terminal!

If “lout” is enabled this procedure may fail so there is a similar procedure possible from the login prompt, see chapter 5.5.17.2.

5.5.17.2 Restore default password - lout

If the “lout” handling have been enabled and there is a need to restore the password this can be done at the login prompt which will start the restore procedure.

```
login: restore
Restore default password, this will restart the device.
Do you want to continue [Yes/No]? y
Press push button on device.
Enter "abc80" on terminal: abc80
Press push button on device.
Password set to default, device will be restarted!
eip_gw>
```

This can only be executed via the PC port and NOT via the telnet terminal!

5.5.18 lout – logout time

With the command “lout” it is possible to set a terminal logout time in minutes. This will give an automatic logout of the terminal function if no new input is received during this time period. The behavior is different between the PC port and the telnet terminal.

For the PC port the logout will not be shown but when new input is entered after logout timeout the user will be prompted for user and password to get access to the terminal functions again. The user and password accounts are the same as is used for other services and more information is in chapter 5.5.17. An example below shows a “power-up start” of the gateway with the logout handling enabled. When the user presses a key the login text will be printed and the user can enter user name and the associated password. If correct account information has been entered the gateway prompt will be printed and the user has access to the terminal interface.

```
**********************************
 EtherNet/IP gateway
**********************************
 Name         : GATE-EIP
 Article no   : 2TLA020071R9000
 Serial number: 4096
**********************************
 Vendor ID    : 950
 Product code : 1100
 Device type  : 43
**********************************
 Firmware ver : 1.13.0
 Firmware date: 2014-12-09
**********************************
 ABB AB, Jokab Safety
 www.abb.com/jokabsafety
**********************************
```

```
eip_gw>
login: user
password: ****
eip_gw>
```

For a telnet connection the logout will give that the gateway will close the connection with the client and the client will be disconnected. The user then needs to reconnect to the gateway and login as usual with user name and password.

By default this function is disabled at delivery.

5.5.19 dout – disconnect telnet clients

With the command “dout” it is possible to disconnect any connected clients to the telnet server. This can only be executed via the PC port and NOT via the telnet terminal!

5.5.20 def – restore default factory settings

With this command it is possible to restore the device to the default factory settings,

- IP address assignment.
- Configuration of “Data to Pluto”.
- Clear configuration of additional data.
- Set default server enable/disable settings.
- Set default password for the accounts.
- Clear device station name (GATE-PN).
- Read gateway node number from the **current** DIP switch setting.

Note: This will force the gateway to restart to make all new setting valid!

```
eip_gw> def
Restore the device to the default factory settings? (y/n) y
Device at default factory settings, making a restart.
eip_gw>
```

5.5.21 sys – firmware update of the unit

For firmware update of the device there is a sys command which is documented in a separate chapter 5.6.1.

5.5.22 remote – enable/disable remote operation of Pluto system

Cyber security is an important part when enabling this function, see chapter 2.

The command “remote” is a quick command for enable/disable the remote operation of Pluto system using the gateways telnet server. When enabling this function it’s possible to make remote monitoring of a Pluto system via the Ethernet (Internet) network.

When enabled it’s important to note the network limitations for the telnet server (see 5.3.6) and make appropriate actions to handle network cyber security issues in a good way (see 2).

Below is an example where the service is enabled without, and with changing the default password for the remote monitor service account (account user see 5.3.6).

Without changing the password (this will force the password to the default password for the user account which in principal is same as no password):

```
eip_gw> remote
```

```
Enable remote monitoring of Pluto system (y/n)? y
Add password protection for remote monitoring of Pluto system (y/n)? n
To make changes active, restart the unit.
Reset gateway? (y/n) y
Reset...
eip_gw>
```

With changing the password (min 6 characters in password, see 5.5.17):

```
eip_gw> remote
Enable remote monitoring of Pluto system (y/n)? y
Add password protection for remote monitoring of Pluto system (y/n)? y
Set password for remote monitoring of Pluto system,
Password : ******
Password : ******
Password changed!
To make changes active, restart the unit.
Reset gateway? (y/n) y
Reset...
eip_gw>
```

5.5.23 name – change the device station name (GATE-PN)

For GATE-PN (PROFINET) there is a device station name. This device station name is used by the PROFINET master PLC to connect to the device and assigned an IP address. This device station name is by default not set. When commissioning the device the PROFINET master PLC software has a discovery tool (DCP) to find the device on the network and with it set the device station name.

```
pn_gw> name
Current station name: oldname
New station name: newname
New station name saved!
pn_gw>
```

5.5.24 Silent commands

For remote monitor handling via Pluto Manager the terminal also handles silent commands. These commands start with a “%” character and are not echoed back to the operator. As these commands are intended to be used only by Pluto Manager they are not documented within this manual.

5.6 Firmware update

Firmware update of the gateway can be made in many ways. This chapter gives information of the possible ways. The preferred way is always to use the terminal port as this is always enabled for firmware update. All other ways, via Ethernet services, are normally not enabled (by default).

The possible ways are (the preferred alternative is to use the terminal port):

- Via the **terminal port** using the hardware connector on the front panel. Using Pluto Manager for easy update or use a standard terminal program which has the send files functionality.

- Via the **telnet server** using the Ethernet interface in similar way as the terminal port. The telnet server is by **default disabled**, for more information see chapter 5.3.6. Even for telnet it's possible for easy update to using Pluto Manager with network setting of IP address.

- Via the **web server** using the Ethernet interface. The web server is by **default disabled**, for more information see chapter 5.3.4.

- Via the **FTP server** using the Ethernet interface. The FTP server is by **default disabled**, for more information see chapter 5.3.3. **Not recommended** procedure for firmware updated.

- Via the **FoE for EtherCAT device** using the Ethernet interface. The FoE handling is described in a chapter under the EtherCAT protocol, see chapter 7.5.3.

- Via the **TFTP server** using the Ethernet interface. The TFTP server is by **default disabled**, for more information see chapter 5.6.5. TFTP server is common used in Sercos systems.

- Via **the terminal port** when device has started in second bootloader stage, see chapter 4.1.2.3.1.

The following sub chapters will describe all these ways.

5.6.1 Firmware update via terminal using Pluto Manager

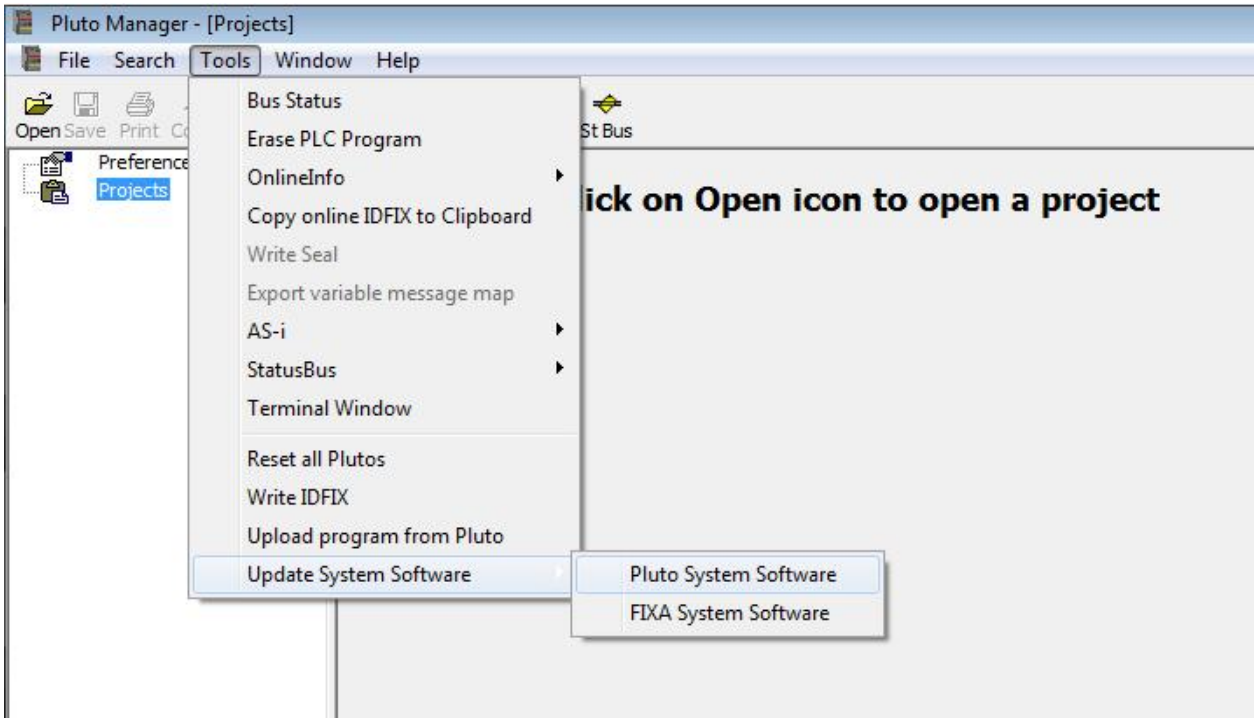
The preferred way for firmware update is to use Pluto Manager and cable connected to the PC port on the front panel. This solution gives an easy way to retrieve the latest firmware for the device and also a guiding tool to making the firmware update of the device without any knowledge of the gateway firmware commands.

For this update you need the new firmware in file format with file extension "**.ghx**" which normally is retrieved by Pluto Manager automatically for the ABB firmware site.

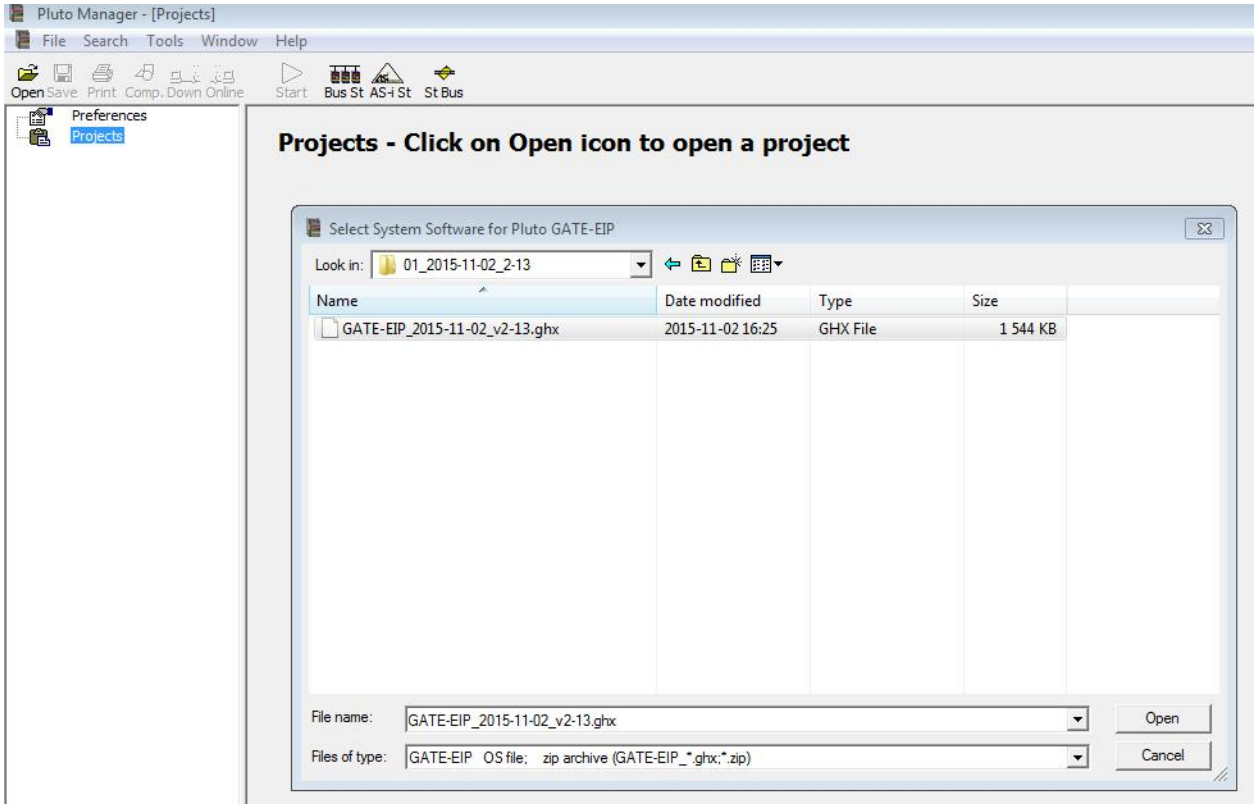
This update functionality is also present via the telnet server (if enabled). It's then important that the telnet login is performed using the admin account because this function is not present for the user account.

Note: Normally the firmware update via the PC port will work with the device up and running the industry Ethernet protocol. It can sometimes fail and therefore it can be useful to disconnect the Ethernet ports during the update process.

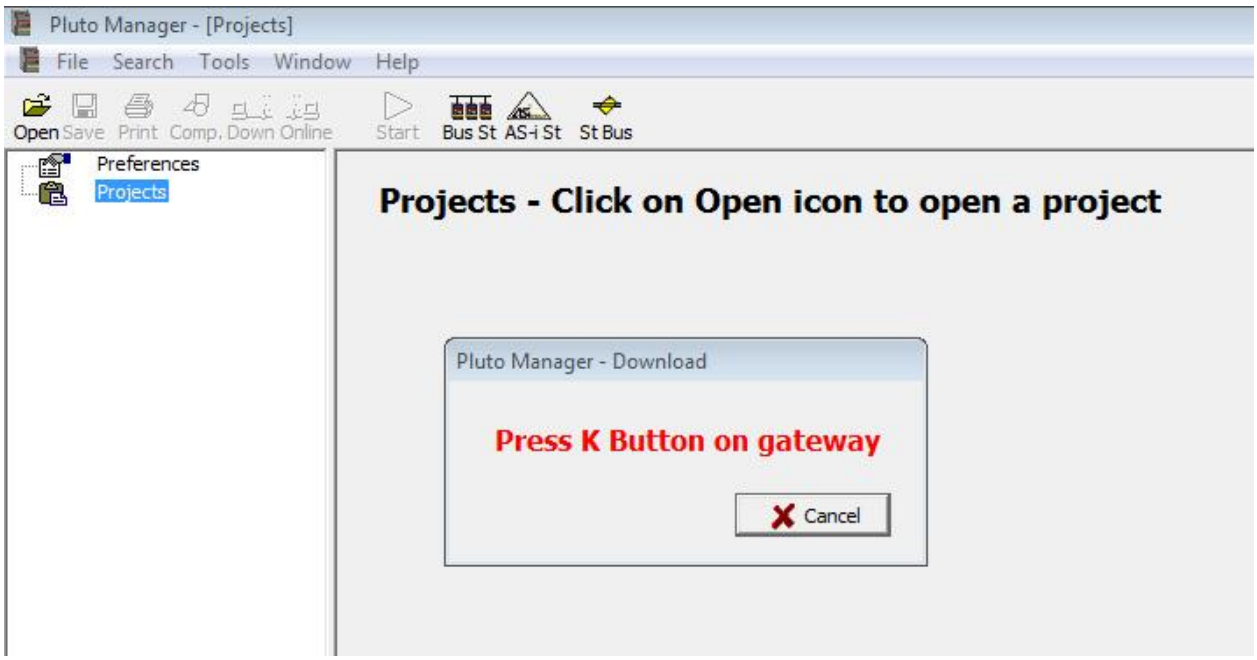
Start Pluto Manager and under Preferences select the COM port and connect the serial cable to the terminal port on the gateways front panel. Then select under tools "Update System Software" and then "Pluto System Software", se picture below.



A file selector will appear, asking for a GATE-EIP firmware file (e.g. connected in this example to a GATE-EIP gateway). Browse for the firmware file and then select open.

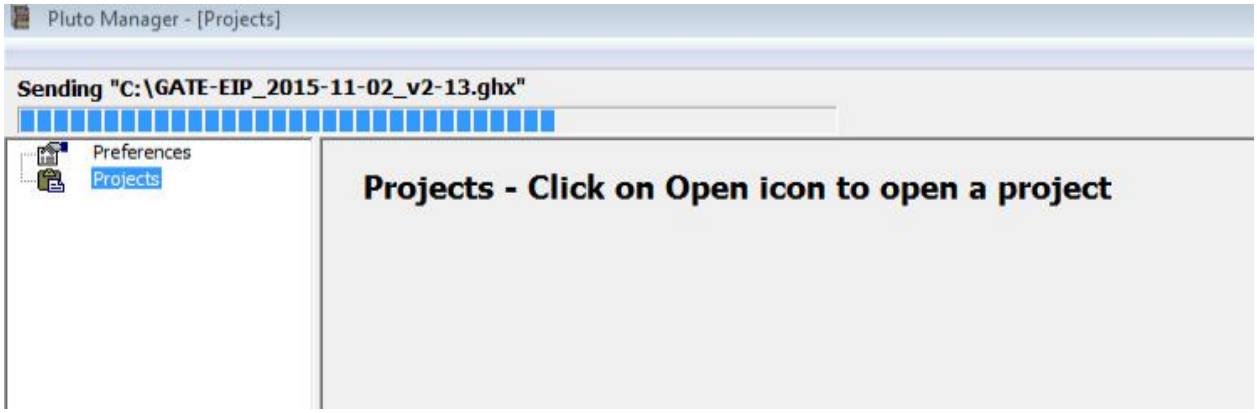


A flashing text “Press K Button on gateway” will pop-up, then push the “K” button on the gateways front panel and the firmware download will start.

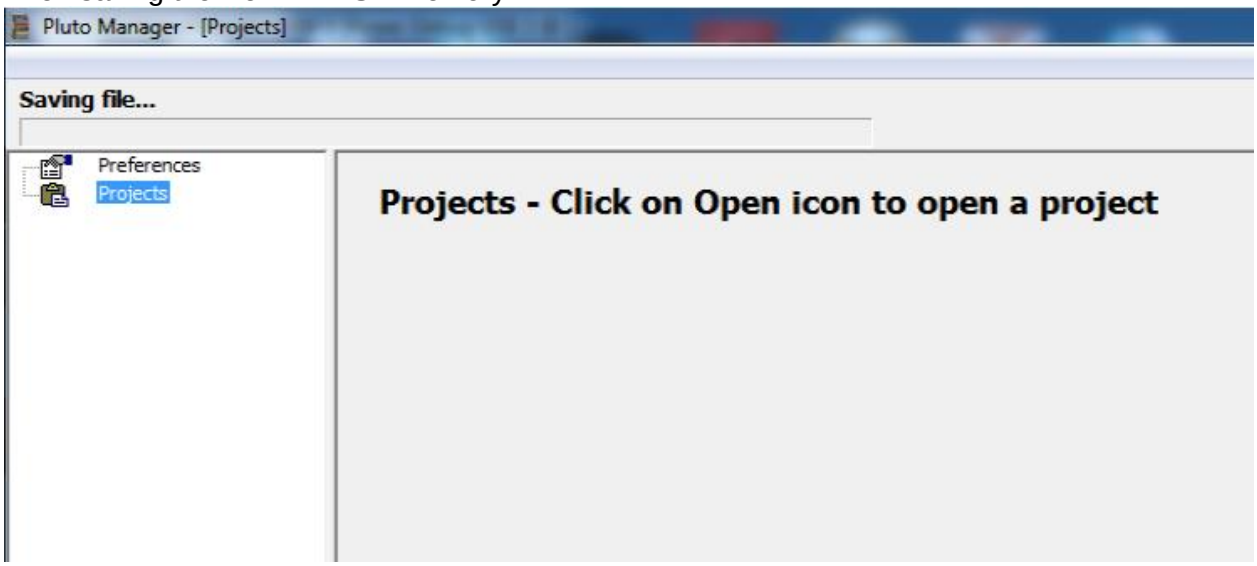


The complete download and installation will take about 5 minutes.

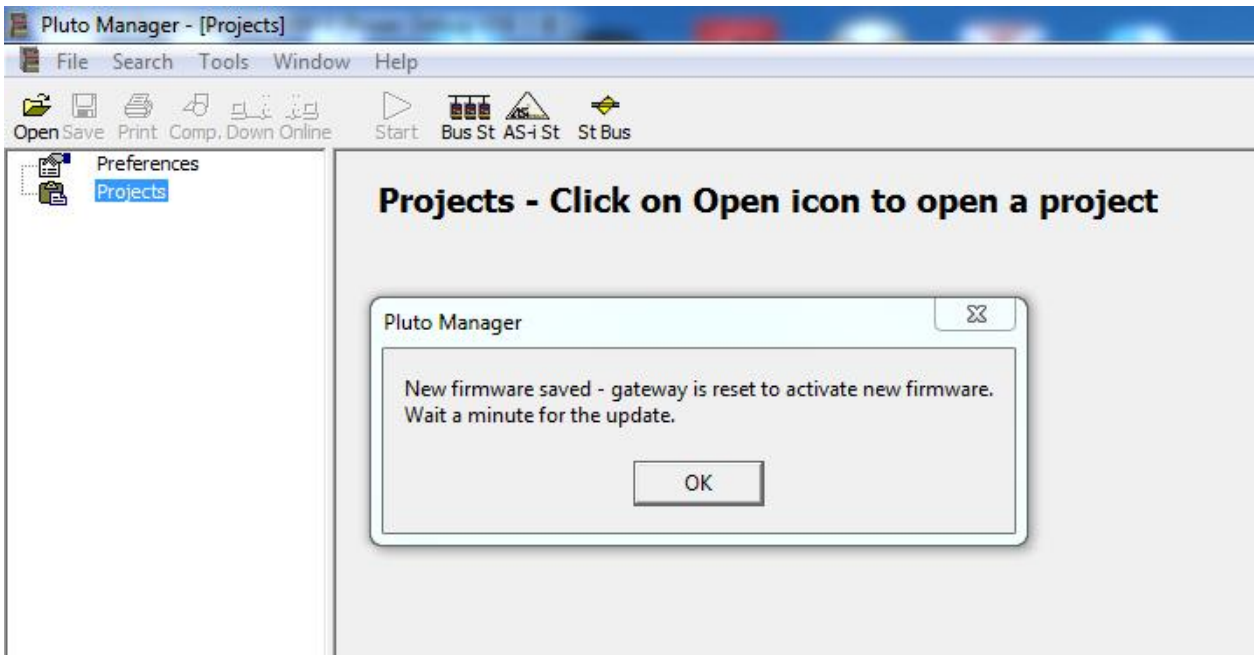
First download of the firmware file:



Then saving the file in FLASH memory:



After the firmware is saved make a restart of the gateway:



During the restart the gateway will make some checking of the downloaded file and if all is fine it will start the execution of the new firmware.

5.6.2 Firmware update via terminal

Device firmware can be updated vid the terminal hardware interface on the front panel and/or via the telnet server is it's enabled. The procedure is in principal the same for both of these connections to the device.

For this update you need the new firmware in file format with file extension "**.ghx**".

This update functionality is also present via the telnet server (if enabled). It's then important that the telnet login is performed using the admin account because this function is not present for the user account.

Note: Normally the firmware update via the PC port will work with the device up and running the industry Ethernet protocol. It can sometimes fail and therefore is can be useful to disconnect the Ethernet ports during the update process.

To make the firmware update you need enter the command "sys" and **press enter**!

```
eip_gw> sys
Press push button on device!
```

Now you need to press the push button on the front panel on the device to confirm this operation.

```
eip_gw> sys
Press push button on device!
Send file...
```

Now you get a prompt saying that you shall send the firmware file. In Pluto Manager you select the "Send File" button and select the correct firmware file which will have a file extension named ".ghx". In Pluto Manager you maybe need to change the "Files of type:" to "Any file (*.*)" to be able to find the file with this file extension. When selected the file transfer is started and it will take about 4 to 5 minutes to transfer the file via the serial terminal port.

```
eip_gw> sys
Press push button on device!
```

```
Send file...
Saving file...
New firmware saved, restart device to activate new firmware!
Reset gateway? (y/n) y
Reset...
eip_gw>
```

After the transfer the device will save the received file “Saving file…” which will take about 10 to 20 seconds.

To activate the new firmware the device need to be restarted via power cycle or using the reset command to restart it. During the startup the device will check the downloaded firmware so this device start will take a bit longer then a normal power up start.

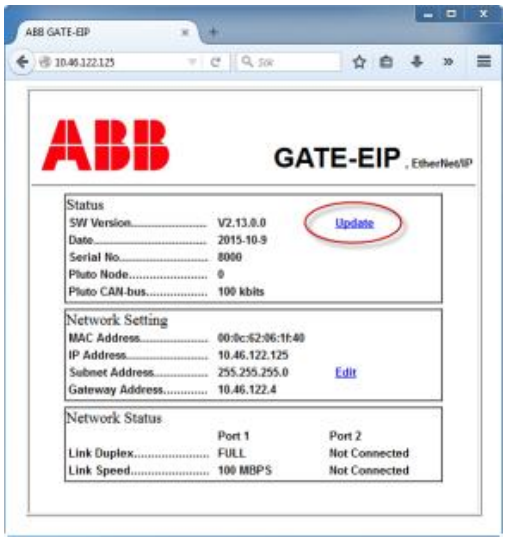
There is no information if the check of the downloaded file fails, the only way to verify firmware version is via the version command which is also printed on the terminal at power up.

5.6.3 Firmware update via web server

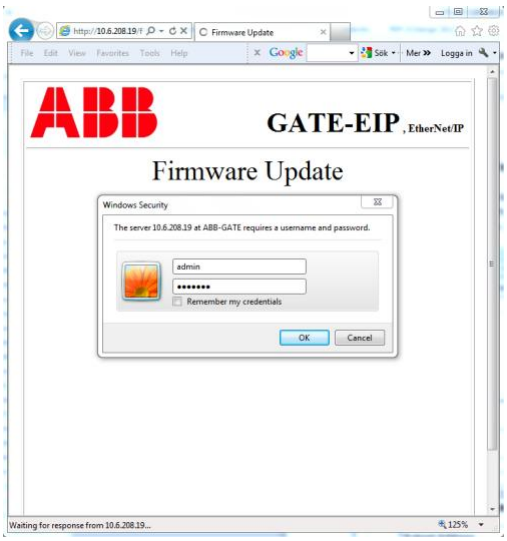
Device firmware can be updated via the web server interface which is easy and fast if you have Ethernet connection to the device and if the web server is enabled. If you don’t have the IP address of the device you maybe need to get it from the device via the terminal command “bw”.

For this update you need the new firmware in file format with file extension “**.NXF**”.

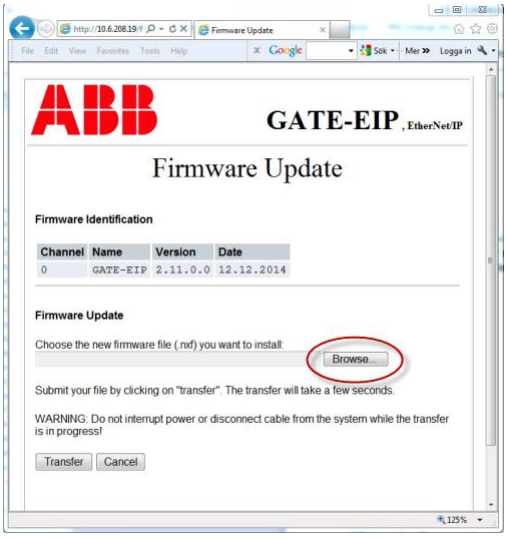
By connecting to the unit’s web server you will get the start page which will give some information about the unit. On this page there is a text named “Update” which has a link to the update page,



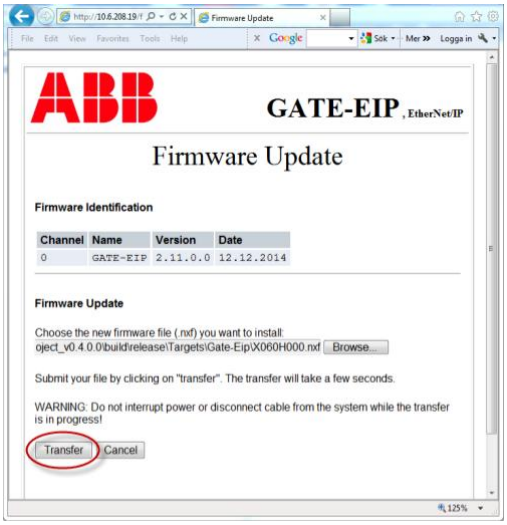
When pressing the Update-link you need to enter the correct user name and password to be able to make the update. The user name for update is “admin” and password is according to what you have set it to be, see chapter 5.5.17.



When entering the correct user/password information you will have access to the firmware update page or “Firmware Update” as it is called. On this page there is information about the current firmware version e.g. which gateway it is as GATE-EIP, firmware version and the date for the firmware build. To update the firmware you now need to browse to the new firmware file using the “Browse” button. You then need to navigate to the new firmware file which shall have the extension named “**.NXF**”.



When you select the file you are ready to transfer the file to the gateway by pressing the “Transfer” button. When the transfer is complete the page updates say “Reset device to activate the new firmware”. The easiest way is to do a power off/on to the unit, or to make a reset command via the terminal interface. At next power on the LED will not flash as normal because the device is making the firmware update which will take 15-20 seconds. When that is done a normal power on is automatically performed and the new firmware is up and running.



After the restart of the device it can be good to verify that the device is running the new firmware via the web server start page where the new version number shall be visible.

5.6.4 Firmware update via FTP server

Device firmware can be updated vid the FTP server if it's enabled, but our advice is to always have the FTP server disabled and using one of the other ways to update the firmware in the device.

Note that using the FTP access and making changes to the file data may corrupt the device so make the update via the FTP server need following the described information carefully and not make any other changes to the device file structure.

For this update you need the new firmware in file format with file extension "**.NXF**".
Any FTP client will be able to transfer the firmware file to the device so this description will not be targeted a specific FTP client. These steps shall be performed to make the update,

- Login to the FTP server using the admin account (see chapter 5.5.17).
  For more information about the FTP server see chapter 5.3.3.
- On the device file structure move to this directory.
  PORT_2/FWUPDATE
- Put the selected "**.NXF**" file into this directory.
- Close the FTP client.
- Restart the device.
- Verify the firmware version via the terminal command "v" (version).

Below is an example using the windows FTP tool to gateway with IP address 192.168.0.100,

```
C:\>cd path_to_file

C:\path_to_file> ftp
ftp> open 192.168.0.100
Connected to 192.168.0.100.
220 Welcome!
User (192.168.0.100:(none)): admin
331 User name okay, need password.
Password:
```

```
230 Password Accepted.
ftp> cd port_2
250 CWD command successful.
ftp> cd fwupdate
250 CWD command successful.
ftp> put gate-eip.nxf
200 PORT command successful.
150 File status ok; about to open data connection.
226 Transfer is successful.
ftp: 657716 bytes sent in 15,23Seconds 43,19Kbytes/sec.
ftp> ls
200 PORT command successful.
150 Path ok; about to open data connection.
-rw-------   7 User1    Group1      657716 Jan 01 1970 GATE-EIP.NXF
226 1 matches total.
ftp: 69 bytes received in 0,20Seconds 0,34Kbytes/sec.
ftp> close
221 Goodbye.  You uploaded 643 and downloaded 0 kbytes.
ftp> quit

C:\path_to_file>
```

After restart of the device it can be good to verify that the device is running the new firmware via the web server start page there the new version number shall be visible.

5.6.5 Firmware update via TFTP server

Device firmware can be updated vid the TFTP server if the enabled.

For this update you need the new firmware in file format with file extension "**.NXF**".
Below show the command for uploading new firmware by using the windows TFTP client tool,

```
C:\> tftp -i 192.168.0.100 PUT GATE-S3.NXF
Transfer successful: 815792 bytes in 21 second(s), 38847 bytes/s

C:\>
```

Note the usage of the "**-i**" option which means **binary or octet transfer** of the data.

The IP address in the example shall be changed to the device IP address. Use the "bw" command if the device has any assigned address. The selected file (in the example above GATE-S3.NXF) shall be in the current directory, use the "cd" command to move to the directory there the firmware file is located.

After transfer of the new firmware the device shall be restarted simply by power off/on to the unit.

5.6.6 Firmware update at second bootloader

If the device for some reason doesn't find any valid firmware it will stop at the second bootloader with indications according to chapter 4.1.2.3.1. It's then possible to download the firmware via the terminal PC port using a special tool. Please contact the support for more information regarding this restore procedure.

6 GATE-EIP, EtherNet/IP

The Ethernet gateway GATE-EIP is an Ethernet gateway handling the industry Ethernet protocol EtherNet/IP which is defined by ODVA. It is build according to ODVA,

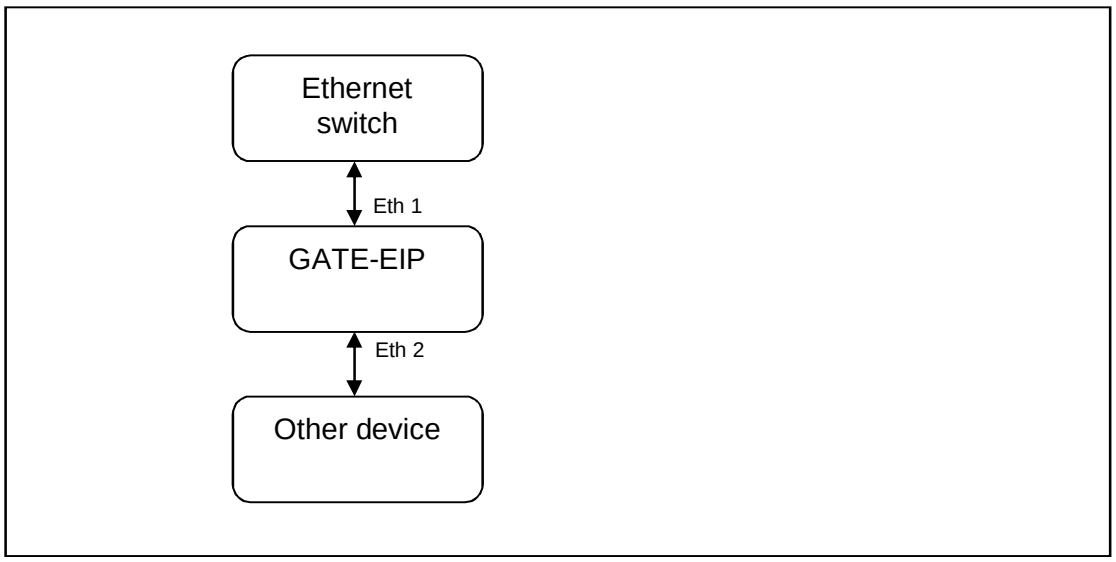
- CIP Volume 1 Edition 3.16
- CIP Volume 2 EtherNet/IP Adaption of CIP Edition 1.17
- Minimum cycle time is 10 ms.

6.1 Ethernet Connection

The gateway is connected to EtherNet/IP network using standard Ethernet connector and cable according to chapter 4.1.3.1 and 4.1.3.2. Both Ethernet ports have the same functionality and can be connected as desired. Normally Ethernet port 1 shall be used to connect to a network switch and Ethernet port 2 can be used to connect to other Ethernet device on the network if desired.

Each port can handle connection in both 10 and 100 Mbit/s using half or full duplex. The port automatically configures the port so it can be connected without using any special cross connected cabled.

The gateway has two Ethernet ports, and therefore it's possible to connect another device on the same Ethernet switch output by connection the other device to the second Ethernet port on the gateway. This will however increase the network traffic and may decrease the performance of the gateway device.



6.2 IP address configuration

The default IP address assignment for the unit is using DHCP to get an IP address on the network (preferred solution for EtherNet/IP device). From many vendors using EtherNet/IP there are tools to retrieve the IP address from the device when using DHCP, see your EtherNet/IP PLC vendor documentation.

If this is not working there are other ways to configure the IP address of the device, see chapter 5.2.

6.3 Status indication

On the gateway with EtherNet/IP there are two dual color LEDs for EtherNet/IP status indications. They are named Module Status (Mod status) and Network Status (Net status). The tables below explain the indicators status information.

6.3.1 Module Status

LED		EtherNet/IP	Remark
OFF		Unit off	
GREEN flashing		Standby	
GREEN steady		Operational	
RED flashing		Minor fault	
RED steady		Major fault	
GREEN/RED flashing		Start-up/Test	

6.3.2 Network Status

LED		EtherNet/IP	Remark
OFF		Unit off	If module status flashing green then the unit is missing IP address.
GREEN flashing		No connection	
GREEN steady		Connected	
RED flashing		Connection timeout	
RED steady		Duplicate IP	
GREEN/RED flashing		Start-up/Test	

6.4 Service port information

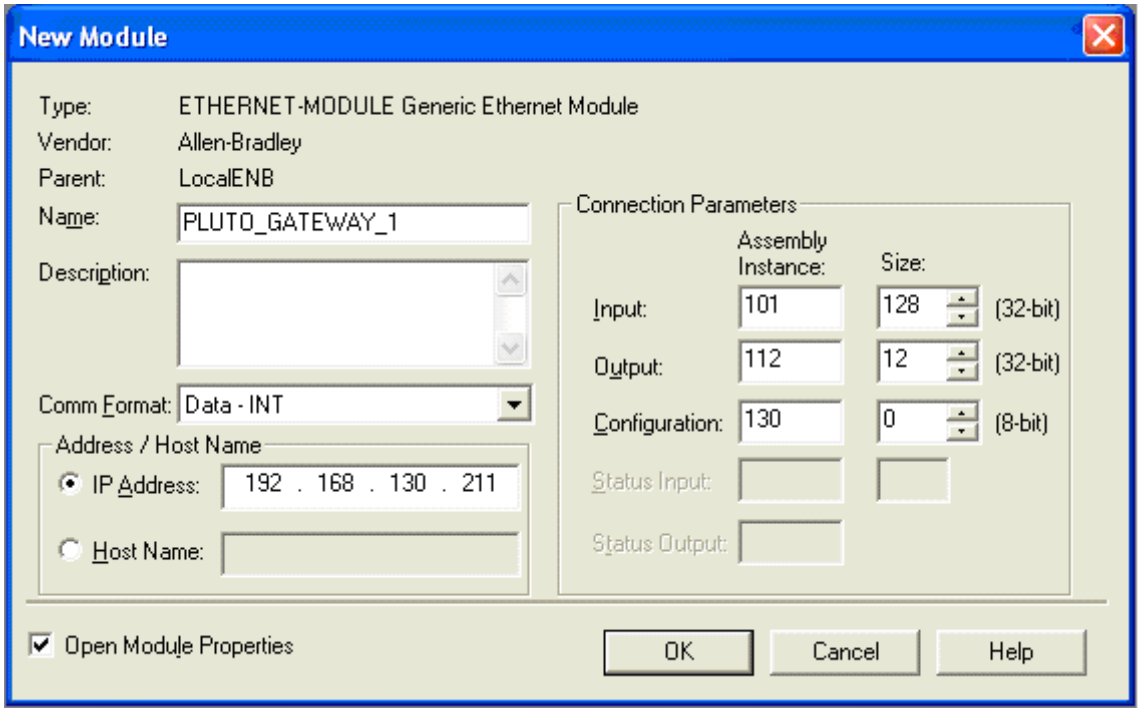
The EtherNet/IP service is using several network ports on the device.

Port		Description
TCP	44818	Encapsulation messages based on TCP and Explicit messaging.
UDP	1024	Receive encapsulated CIP Service responses.
	2222	Implicit messaging (IO messaging).
	44818	Encapsulation messages based on UDP.

6.5 Rockwell integration

The EtherNet/IP protocol in the gateway has been implemented according to EtherNet/IP object description in appendix chapter 14.

Example of configuration of an Allen-Bradley Rockwell system under I/O configuration and Ethernet add new module for communication of type Generic Ethernet Module,



Important settings are:

- Name of the Ethernet unit which will give names to the controller tags as,
  PLUTO_GATEWAY_1:C control data
  PLUTO_GATEWAY_1:I input data
  PLUTO_GATEWAY_1:O output data
- IP address of the gateway (see chapter 5.2).
- Communication data size format (Comm Format, preferred format is "**Data – INT**").
- Input assembly instance number and size.
- Output assembly instance number and size.
- Configuration assembly instance number and size.
- Requested Packet Interval (RPI).
- Set configuration data.

Input assembly setting

If only input data is used the size can be any of the three showed in the table. If output data is used or will maybe be used in future the size of INT shall be used.

Input data	Instance number	Instance size		
		Data - SINT	**Data – INT**	Data – DINT
Status Only	100	4	2	1
Data Only	101	256	128	64
Status and Data	102	260	130	65

Data structure for each instance is like the table below. For detailed information about each part see chapter 11.1 (status), 11.2 (Data from Pluto) and 11.3 (Additional Data from Pluto). The table

below indicates on which byte/word the data is located in depending on data type and used assembly number (no mapping for DINT data have been shown in this table).

Data	Data - SINT (byte)			**Data - INT (word)**		
	100	101	102	100	101	102
Status	0 – 3	-	0 – 3	0 – 1	-	0 – 1
Data Pluto 0	-	0 – 3	4 – 7	-	0 – 1	2 – 3
Data Pluto 1	-	4 – 7	8 – 11	-	2 – 3	4 – 5
Data Pluto 2	-	8 – 11	12 – 15	-	4 – 5	6 – 7
Data Pluto 3	-	12 – 15	16 – 19	-	6 – 7	8 – 9
Data Pluto 4	-	16 – 19	20 – 23	-	8 – 9	10 – 11
Data Pluto 5	-	20 – 23	24 – 27	-	10 – 11	12 – 13
Data Pluto 6	-	24 – 27	28 – 31	-	12 – 13	14 – 15
Data Pluto 7	-	28 – 31	32 – 35	-	14 – 15	16 – 17
Data Pluto 8	-	32 – 35	36 – 39	-	16 – 17	18 – 19
Data Pluto 9	-	36 – 39	40 – 43	-	18 – 19	20 – 21
Data Pluto 10	-	40 – 43	44 – 47	-	20 – 21	22 – 23
Data Pluto 11	-	44 – 47	48 – 51	-	22 – 23	24 – 25
Data Pluto 12	-	48 – 51	52 – 55	-	24 – 25	26 – 27
Data Pluto 13	-	52 – 55	56 – 59	-	26 – 27	28 – 29
Data Pluto 14	-	56 – 59	60 – 63	-	28 – 29	30 – 31
Data Pluto 15	-	60 – 63	64 – 67	-	30 – 31	32 – 33
Data Pluto 16	-	64 – 67	68 – 71	-	32 – 33	34 – 35
Data Pluto 17	-	68 – 71	72 – 75	-	34 – 35	36 – 37
Data Pluto 18	-	72 – 75	76 – 79	-	36 – 37	38 – 39
Data Pluto 19	-	76 – 79	80 – 83	-	38 – 39	40 – 41
Data Pluto 20	-	80 – 83	84 – 87	-	40 – 41	42 – 43
Data Pluto 21	-	84 – 87	88 – 91	-	42 – 43	44 – 45
Data Pluto 22	-	88 – 91	92 – 95	-	44 – 45	46 – 47
Data Pluto 23	-	92 – 95	96 – 99	-	46 – 47	48 – 49
Data Pluto 24	-	96 – 99	100–103	-	48 – 49	50 – 51
Data Pluto 25	-	100–103	104–107	-	50 – 51	52 – 53
Data Pluto 26	-	104–107	108–111	-	52 – 53	54 – 55
Data Pluto 27	-	108–111	112–115	-	54 – 55	56 – 57
Data Pluto 28	-	112–115	116–119	-	56 – 57	58 – 59
Data Pluto 29	-	116–119	120–123	-	58 – 59	60 – 61
Data Pluto 30	-	120–123	124–127	-	60 – 61	62 – 63
Data Pluto 31	-	124–127	128–131	-	62 – 63	64 – 65
Additional Data 00	-	128–131	132–135	-	64 – 65	66 – 67
Additional Data 01	-	132–135	136–139	-	66 – 67	68 – 69
Additional Data 02	-	136–139	140–143	-	68 – 69	70 – 71
Additional Data 03	-	140–143	144–147	-	70 – 71	72 – 73
Additional Data 04	-	144–147	148–151	-	72 – 73	74 – 75
Additional Data 05	-	148–151	152–155	-	74 – 75	76 – 77
Additional Data 06	-	152–155	156–159	-	76 – 77	78 – 79
Additional Data 07	-	156–159	160–163	-	78 – 79	80 – 81
Additional Data 08	-	160–163	164–167	-	80 – 81	82 – 83
Additional Data 09	-	164–167	168–171	-	82 – 83	84 – 85
Additional Data 10	-	168–171	172–175	-	84 – 85	86 – 86
Additional Data 11	-	172–175	176–179	-	86 – 86	88 – 89
Additional Data 12	-	176–179	180–183	-	88 – 89	90 – 91
Additional Data 13	-	180–183	184–187	-	90 – 91	92 – 93
Additional Data 14	-	184–187	188–191	-	92 – 93	94 – 95
Additional Data 15	-	188–191	192–195	-	94 – 95	96 – 97
Additional Data 16	-	192–195	196–199	-	96 – 97	98 – 99

Data	Data - SINT (byte)			**Data - INT (word)**		
	100	101	102	100	101	102
Additional Data 17	-	196–199	200–203	-	98 – 99	100–101
Additional Data 18	-	200–203	204–207	-	100–101	102–103
Additional Data 19	-	204–207	208–211	-	102–103	104–105
Additional Data 20	-	208–211	212–215	-	104–105	106–107
Additional Data 21	-	212–215	216–219	-	106–107	108–109
Additional Data 22	-	216–219	220–223	-	108–109	110–111
Additional Data 23	-	220–223	224–227	-	110–111	112–113
Additional Data 24	-	224–227	228–231	-	112–113	114–115
Additional Data 25	-	228–231	232–235	-	114–115	116–117
Additional Data 26	-	232–235	236–239	-	116–117	118–119
Additional Data 27	-	236–239	240–243	-	118–119	120–121
Additional Data 28	-	240–243	244–247	-	120–121	122–123
Additional Data 29	-	244–247	248–251	-	122–123	124–125
Additional Data 30	-	248–251	252–255	-	124–125	126–127
Additional Data 31	-	252–255	256–259	-	126–127	128–129

Output assembly setting

It is recommended to only use INT data for output data because output data is 16-bits registers.
For description of “Data to Pluto” structure see chapter 11.4.

Input data	Instance number	Instance size		
		Data - SINT	**Data – INT**	Data – DINT
Data to Pluto (Output data)	112	-	12	-
Input only (No data to Pluto)	128	0	0	0

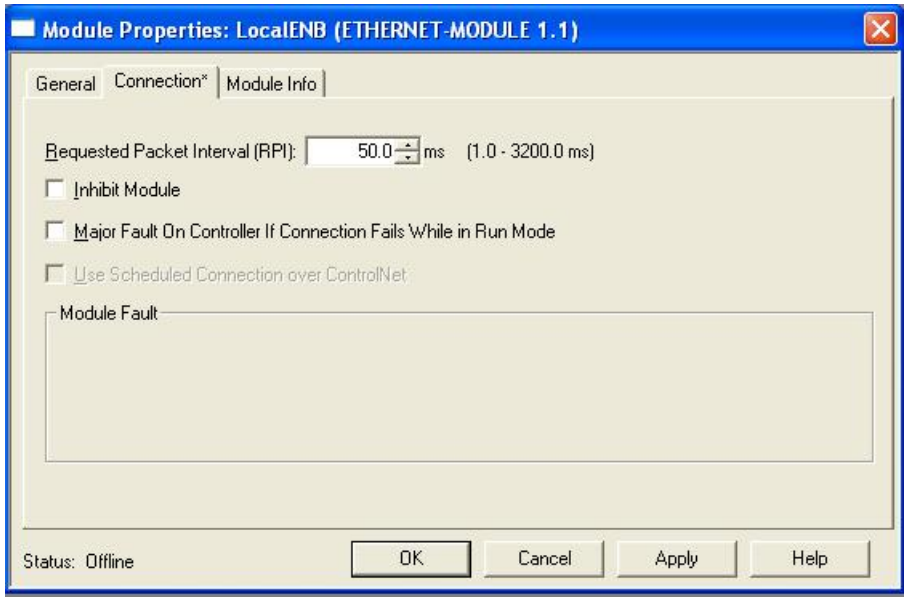
Configuration assembly setting

There is no configuration data so size is zero.

Input data	Instance number	Instance size		
		Data - SINT	**Data – INT**	Data – DINT
Configuration data	130	0	0	0

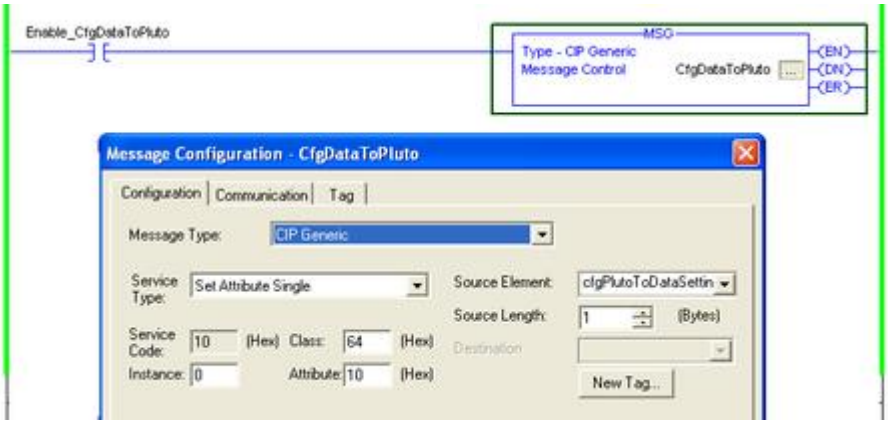
Requested Packet Interval (RPI)

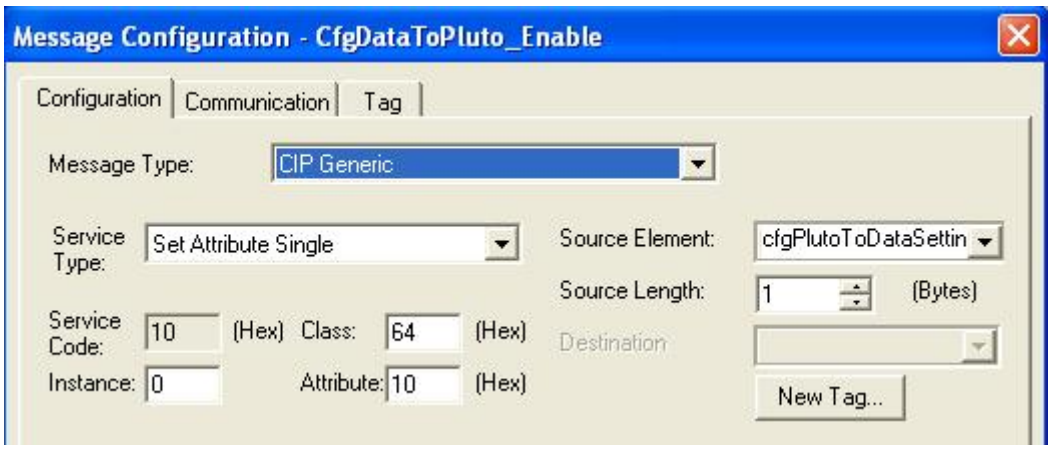
Under the connection tab the Requested Packet Interval (RPI) shall be set to desired value, but it shall not be less than 10 ms.



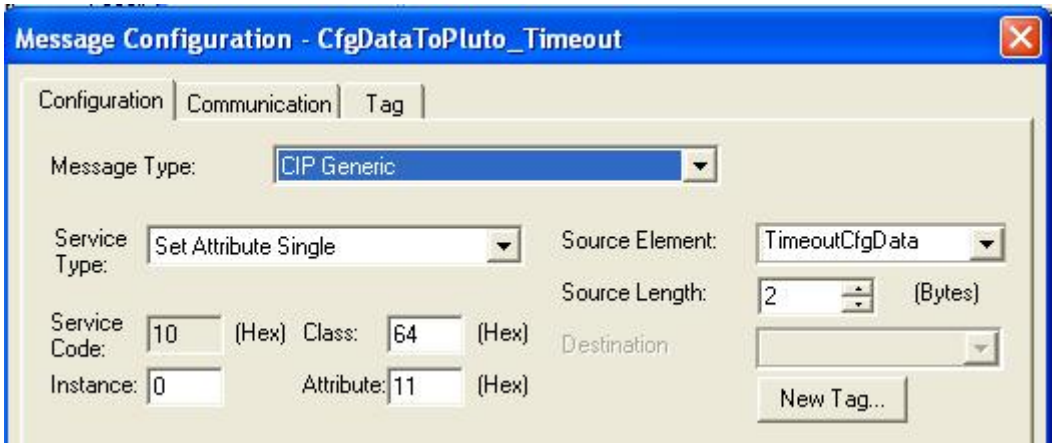
Set configuration data

After the PLC has established connection and/or done a reconnection to the gateway, the PLC can/shall send configuration messages to the gateway if needed. It is possible to send configuration data by using message blocks. Configuration settings are related to “Data to Pluto” information to enable packet area (attribute 0x10) and timeout (attribute 0x11), see example below and chapter 11.4.





Example of setup message. Set enable bits by a write to attribute 0x10.



Example of setup message. Set timeout value by a write to attribute 0x11.

There is also configuration get/set for additional data via the same feature but using other attribute numbers in the message. For more information see appendix and also chapter 11.3.

7 GATE-EC, EtherCAT

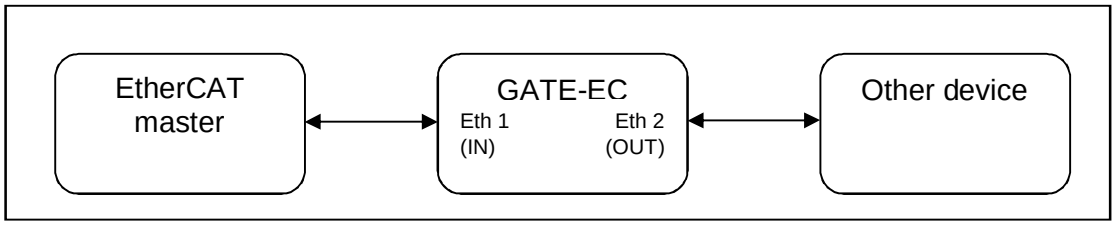
The Ethernet gateway GATE-EC is an Ethernet gateway handling the industry Ethernet protocol EtherCAT which is defined by EtherCAT Technology Group and build according to,

- IEC 61158 Part 2-6 Type 12 documents (ETG.1000 V1.0.3).
- EtherCAT Protocol Enhancements (ETG.1020 V1.0.0).
- Minimum cycle time is 500 µs.
- The device support FoE (File transfer over EtherCAT) see chapter 5.4.3.
- The device support EoE (Ethernet over EtherCAT) for access to FTP, TFTP, web and telnet server.
- Support for hot connect (second slave address, also used for Omron PLC).

For more information see EtherCAT bus master documentation how to use these functions.

7.1 Ethernet Connection

The gateway is connected to EtherCAT network using standard Ethernet connector and cable according to chapter 4.1.3.1 and 4.1.3.2. As EtherCAT is a bus where each device has an input and output side the “Eth 1” port is the input port (IN) and “Eth 2” is the output port (OUT), see figure below.



7.2 IP address configuration

The IP address assignment for the unit is managed by the EtherCAT master and can’t be changed in any other ways.

7.3 Status indication

On the gateway with EtherCAT there are two LEDs for link indication and two LEDs for EtherCAT status indications. The link LEDs are named “Ethernet 1” and “Ethernet 2”. The status LEDs are named RUN and ERR. The table below explains the indicators status information.

7.3.1 Link/Activity

LED		EtherCAT	Remark
OFF		Port closed	
GREEN Flickering		Port open	Link and activity.
GREEN Steady		Port open	Link and no activity.

7.3.2 RUN Status

LED		EtherCAT	Remark
OFF		Init	
GREEN Blinking		Pre-Operational	
GREEN Single Flash		Safe-Operational	
GREEN Flickering		Initialization or Bootstrap	
GREEN Steady		Operational	

7.3.3 Error Status

LED		EtherCAT	Remark
OFF		No error	
RED Blinking		Invalid Configuration	
RED Single Flash		Unsolicited State Change	
RED Double Flash		Application Watchdog Timeout	
RED Flickering		Booting Error	
RED Steady		PDI Watchdog Timeout	

7.3.4 LED handling

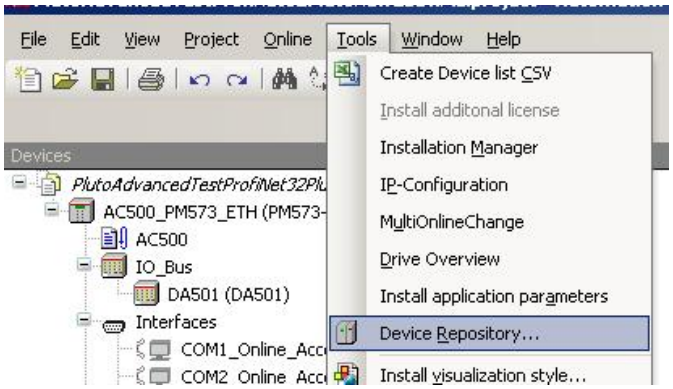
Indicator states	Definition
On	The indicator shall be constantly on.
Off	The indicator shall be constantly off.
Flickering	The indicator shall turn on and off iso-phase with a frequency of 10 Hz: on for 50 ms and off for 50 ms.
Blinking	The indicator shall turn on and off iso-phase with a frequency of 2.5 Hz: on for 200 ms followed by off for 200 ms.
Single Flash	The indicator shall show one short flash (200 ms) followed by a long off phase (1000 ms).
Double Flash	The indicator shall show a sequence of two short flashes (200 ms), separated by an off phase (200 ms), and followed by a long off phase (1000 ms).

7.4 ABB AC500 integration

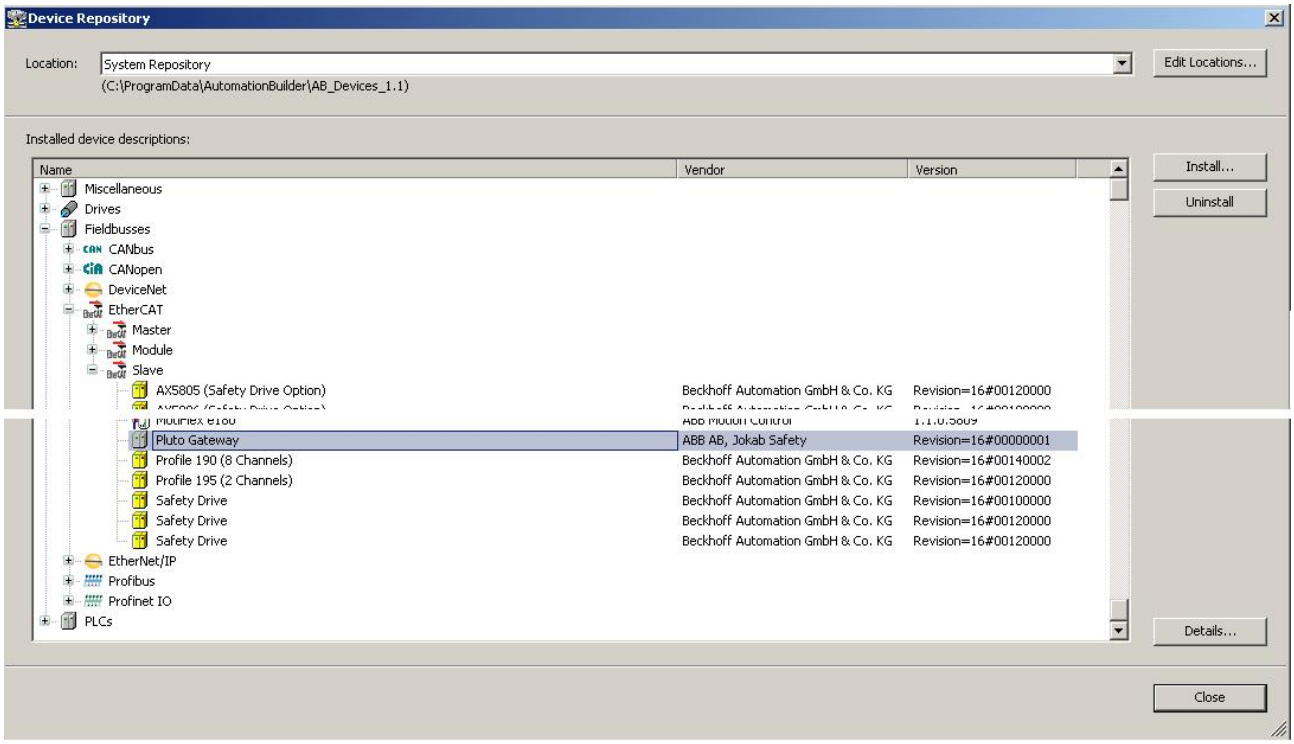
This example shows a simple implementation of the Gate-EC in an ABB AC500 PLC, using a CM579-ETHCAT communication module. It doesn't show any actual program, just how the "to" and "from" variables via the gateway Gate-EC are setup. Automation Builder V1.1.1717 was used. All settings are default unless otherwise said so.

7.4.1 Device repository and XML file

In Automation Builder under the Tools menu, start the "Device Repository" tool.

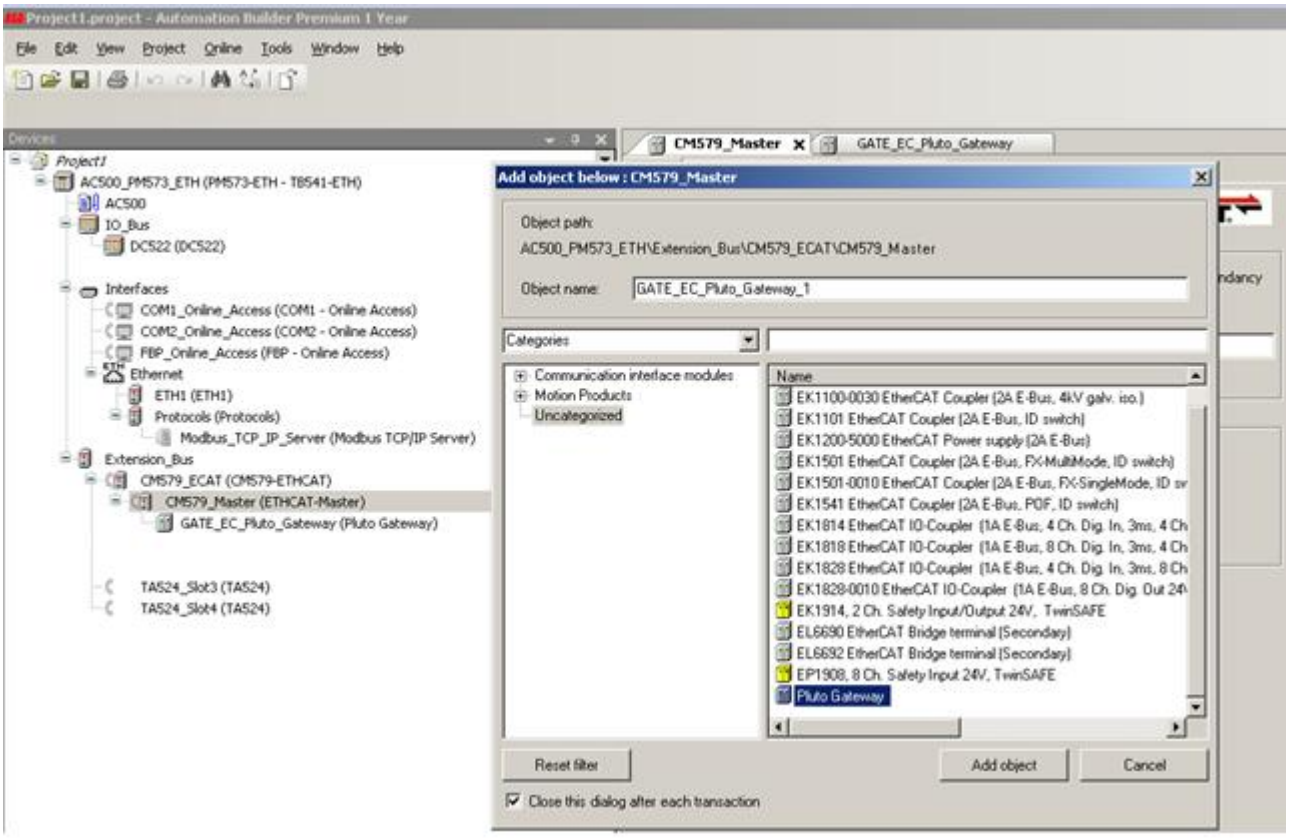


Use the "Install…" button and point at the file's location. Please note that it is included in Pluto Manager, under the Help menu. The result is shown in the picture below.



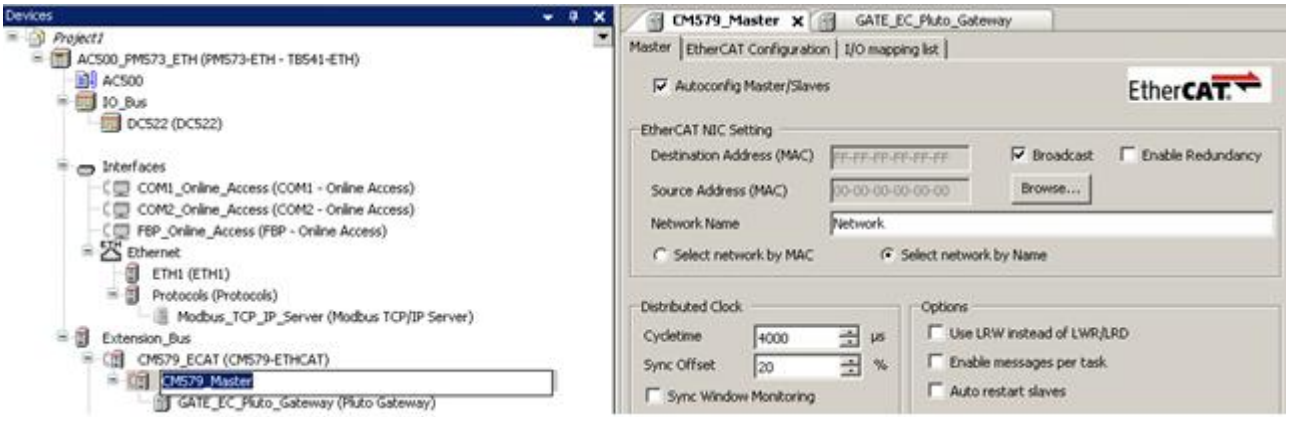
7.4.2 Hardware

After adding the CM579-ETHCAT communication module right-click and add the Gate-EC object.



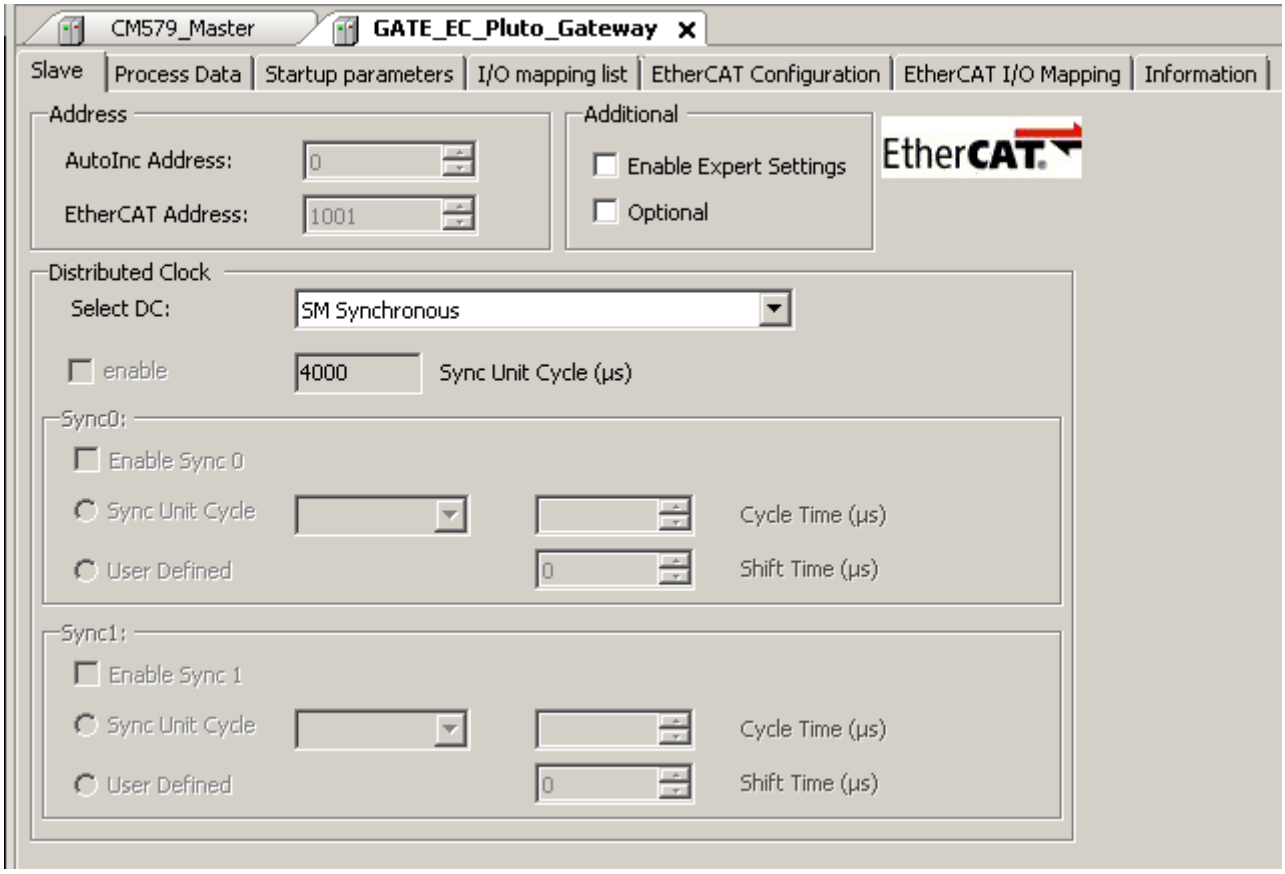
7.4.3 CM_579 Master

Settings for the CM579-ETHCAT master.

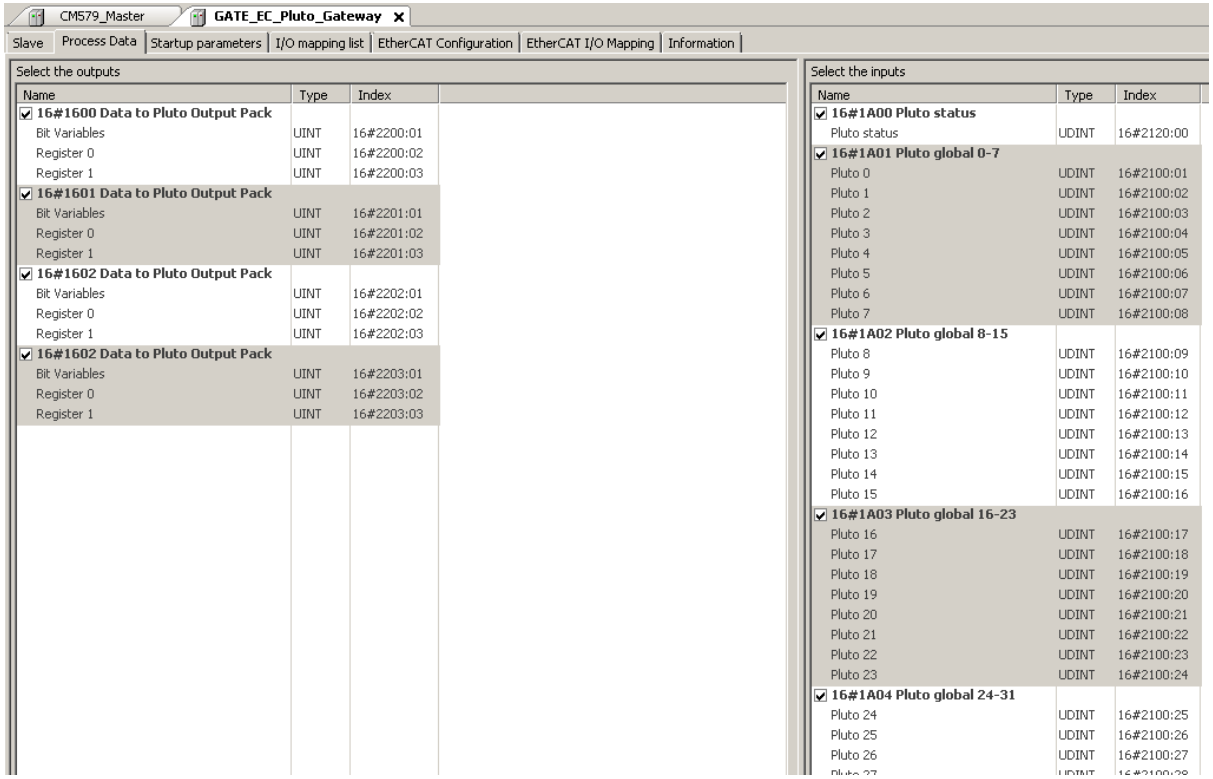


7.4.4 Gate_EC_Pluto_Gateway

The picture below shows the default settings used for the gateway.

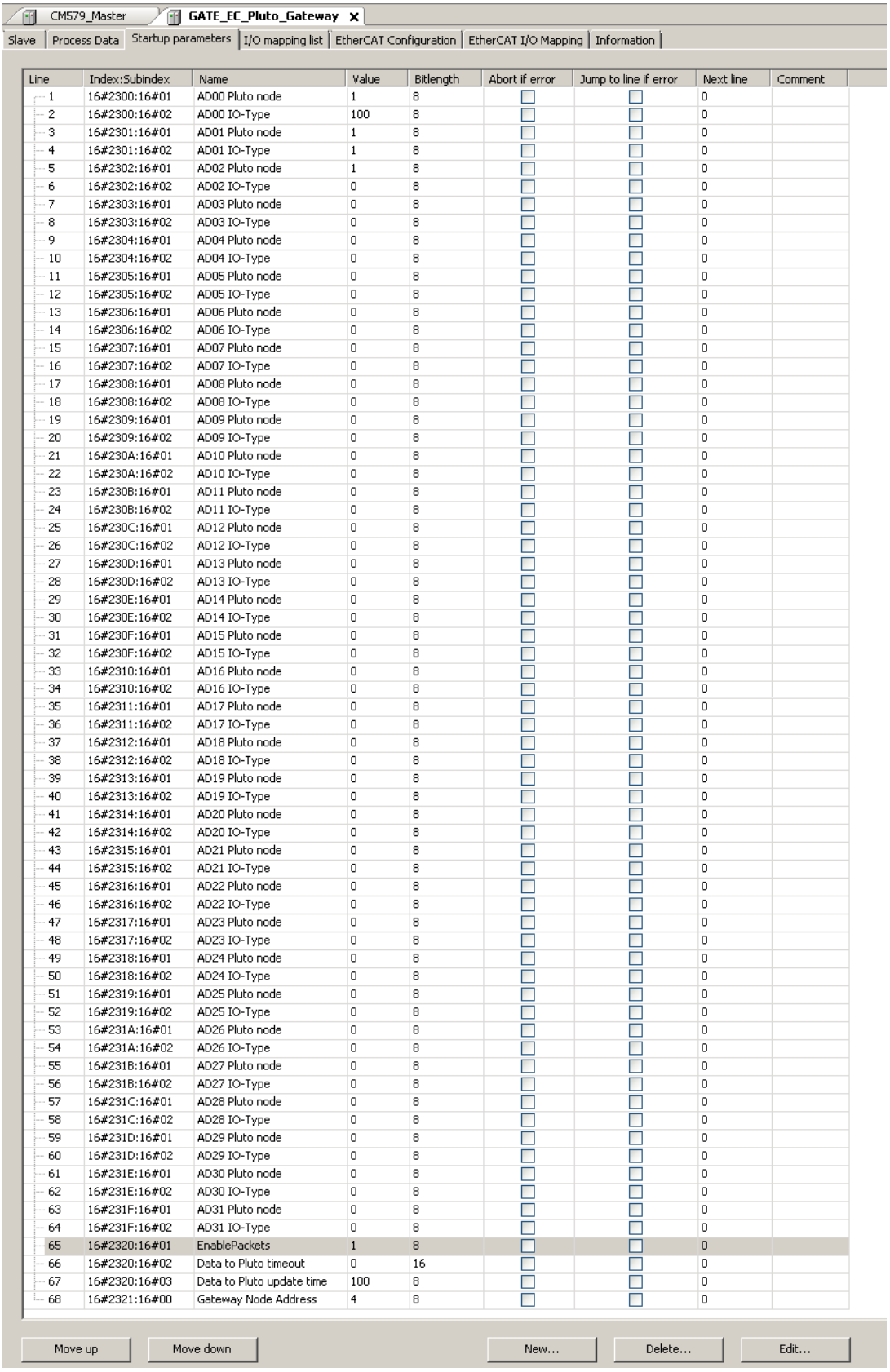


In this example everything has been included but it doesn't have to be so.



7.4.5 Startup parameters

It is advised to include all “Additional Data” areas so they are initialized to zero at startup.

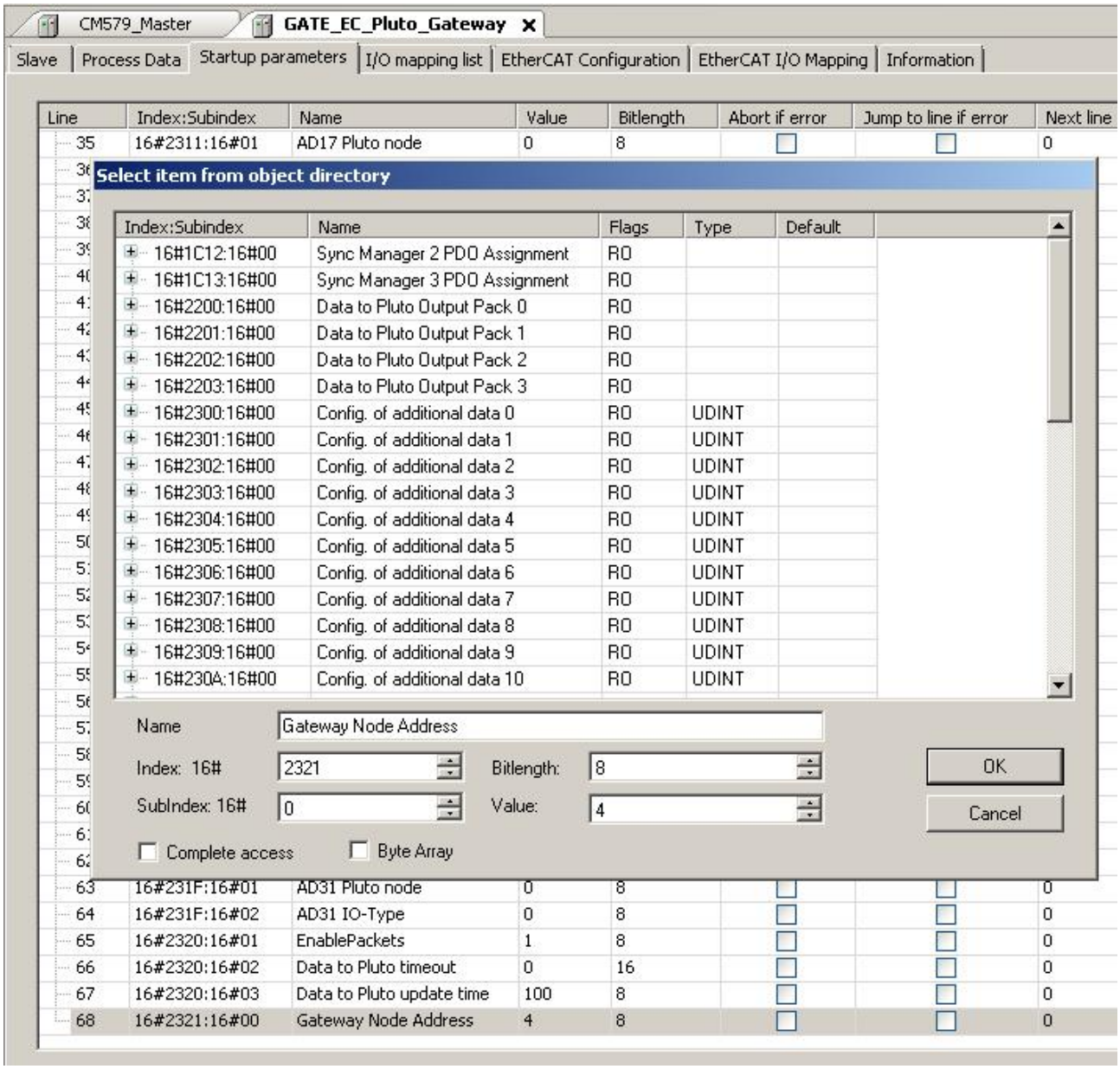


Line	Index:Subindex	Name	Value	Bitlength	Abort if error	Jump to line if error	Next line	Comment
1	16#2300:16#01	AD00 Pluto node	1	8	☐	☐	0	
2	16#2300:16#02	AD00 IO-Type	100	8	☐	☐	0	
3	16#2301:16#01	AD01 Pluto node	1	8	☐	☐	0	
4	16#2301:16#02	AD01 IO-Type	1	8	☐	☐	0	
5	16#2302:16#01	AD02 Pluto node	1	8	☐	☐	0	
6	16#2302:16#02	AD02 IO-Type	0	8	☐	☐	0	
7	16#2303:16#01	AD03 Pluto node	0	8	☐	☐	0	
8	16#2303:16#02	AD03 IO-Type	0	8	☐	☐	0	
9	16#2304:16#01	AD04 Pluto node	0	8	☐	☐	0	
10	16#2304:16#02	AD04 IO-Type	0	8	☐	☐	0	
11	16#2305:16#01	AD05 Pluto node	0	8	☐	☐	0	
12	16#2305:16#02	AD05 IO-Type	0	8	☐	☐	0	
13	16#2306:16#01	AD06 Pluto node	0	8	☐	☐	0	
14	16#2306:16#02	AD06 IO-Type	0	8	☐	☐	0	
15	16#2307:16#01	AD07 Pluto node	0	8	☐	☐	0	
16	16#2307:16#02	AD07 IO-Type	0	8	☐	☐	0	
17	16#2308:16#01	AD08 Pluto node	0	8	☐	☐	0	
18	16#2308:16#02	AD08 IO-Type	0	8	☐	☐	0	
19	16#2309:16#01	AD09 Pluto node	0	8	☐	☐	0	
20	16#2309:16#02	AD09 IO-Type	0	8	☐	☐	0	
21	16#230A:16#01	AD10 Pluto node	0	8	☐	☐	0	
22	16#230A:16#02	AD10 IO-Type	0	8	☐	☐	0	
23	16#230B:16#01	AD11 Pluto node	0	8	☐	☐	0	
24	16#230B:16#02	AD11 IO-Type	0	8	☐	☐	0	
25	16#230C:16#01	AD12 Pluto node	0	8	☐	☐	0	
26	16#230C:16#02	AD12 IO-Type	0	8	☐	☐	0	
27	16#230D:16#01	AD13 Pluto node	0	8	☐	☐	0	
28	16#230D:16#02	AD13 IO-Type	0	8	☐	☐	0	
29	16#230E:16#01	AD14 Pluto node	0	8	☐	☐	0	
30	16#230E:16#02	AD14 IO-Type	0	8	☐	☐	0	
31	16#230F:16#01	AD15 Pluto node	0	8	☐	☐	0	
32	16#230F:16#02	AD15 IO-Type	0	8	☐	☐	0	
33	16#2310:16#01	AD16 Pluto node	0	8	☐	☐	0	
34	16#2310:16#02	AD16 IO-Type	0	8	☐	☐	0	
35	16#2311:16#01	AD17 Pluto node	0	8	☐	☐	0	
36	16#2311:16#02	AD17 IO-Type	0	8	☐	☐	0	
37	16#2312:16#01	AD18 Pluto node	0	8	☐	☐	0	
38	16#2312:16#02	AD18 IO-Type	0	8	☐	☐	0	
39	16#2313:16#01	AD19 Pluto node	0	8	☐	☐	0	
40	16#2313:16#02	AD19 IO-Type	0	8	☐	☐	0	
41	16#2314:16#01	AD20 Pluto node	0	8	☐	☐	0	
42	16#2314:16#02	AD20 IO-Type	0	8	☐	☐	0	
43	16#2315:16#01	AD21 Pluto node	0	8	☐	☐	0	
44	16#2315:16#02	AD21 IO-Type	0	8	☐	☐	0	
45	16#2316:16#01	AD22 Pluto node	0	8	☐	☐	0	
46	16#2316:16#02	AD22 IO-Type	0	8	☐	☐	0	
47	16#2317:16#01	AD23 Pluto node	0	8	☐	☐	0	
48	16#2317:16#02	AD23 IO-Type	0	8	☐	☐	0	
49	16#2318:16#01	AD24 Pluto node	0	8	☐	☐	0	
50	16#2318:16#02	AD24 IO-Type	0	8	☐	☐	0	
51	16#2319:16#01	AD25 Pluto node	0	8	☐	☐	0	
52	16#2319:16#02	AD25 IO-Type	0	8	☐	☐	0	
53	16#231A:16#01	AD26 Pluto node	0	8	☐	☐	0	
54	16#231A:16#02	AD26 IO-Type	0	8	☐	☐	0	
55	16#231B:16#01	AD27 Pluto node	0	8	☐	☐	0	
56	16#231B:16#02	AD27 IO-Type	0	8	☐	☐	0	
57	16#231C:16#01	AD28 Pluto node	0	8	☐	☐	0	
58	16#231C:16#02	AD28 IO-Type	0	8	☐	☐	0	
59	16#231D:16#01	AD29 Pluto node	0	8	☐	☐	0	
60	16#231D:16#02	AD29 IO-Type	0	8	☐	☐	0	
61	16#231E:16#01	AD30 Pluto node	0	8	☐	☐	0	
62	16#231E:16#02	AD30 IO-Type	0	8	☐	☐	0	
63	16#231F:16#01	AD31 Pluto node	0	8	☐	☐	0	
64	16#231F:16#02	AD31 IO-Type	0	8	☐	☐	0	
65	16#2320:16#01	EnablePackets	1	8	☐	☐	0	
66	16#2320:16#02	Data to Pluto timeout	0	16	☐	☐	0	
67	16#2320:16#03	Data to Pluto update time	100	8	☐	☐	0	
68	16#2321:16#00	Gateway Node Address	4	8	☐	☐	0	

Please note that the “EnablePackets” startup parameter value has been set to 1, only enabling packet 0. To enable all four available packets this must be set to 15.

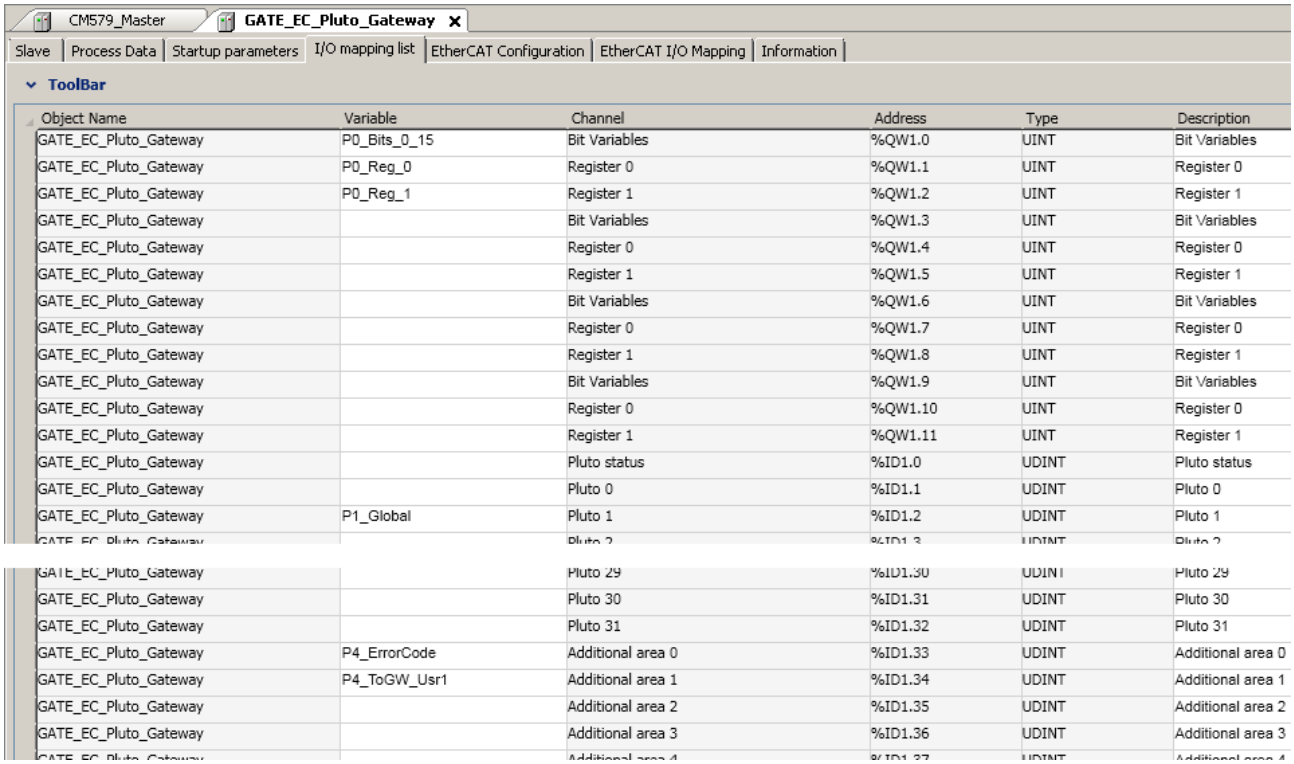
See bullet 11.4 for a description of line 65, 66 and 67.

Edit the settings of an object as required. The example project below show how the gateway's node number on the Pluto bus is set to 4.



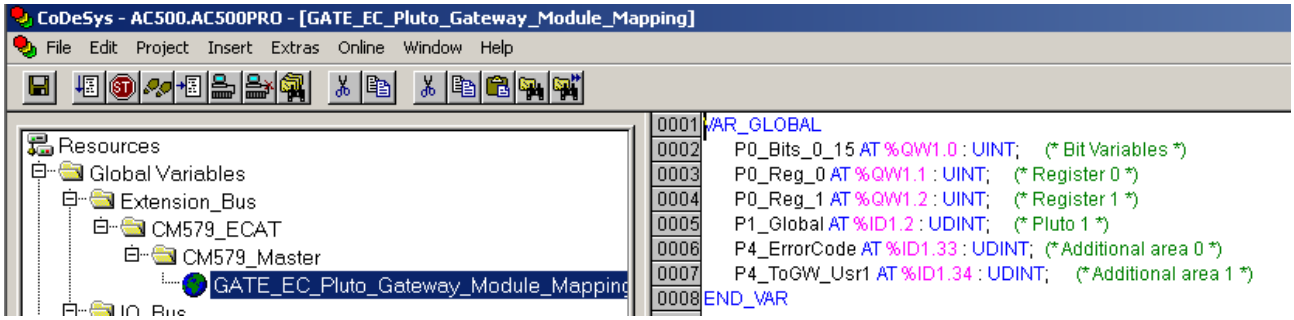
7.4.6 I/O mapping list

Enter the names of the variables that will be used in the CoDeSys environment.



Object Name	Variable	Channel	Address	Type	Description
GATE_EC_Pluto_Gateway	P0_Bits_0_15	Bit Variables	%QW1.0	UINT	Bit Variables
GATE_EC_Pluto_Gateway	P0_Reg_0	Register 0	%QW1.1	UINT	Register 0
GATE_EC_Pluto_Gateway	P0_Reg_1	Register 1	%QW1.2	UINT	Register 1
GATE_EC_Pluto_Gateway		Bit Variables	%QW1.3	UINT	Bit Variables
GATE_EC_Pluto_Gateway		Register 0	%QW1.4	UINT	Register 0
GATE_EC_Pluto_Gateway		Register 1	%QW1.5	UINT	Register 1
GATE_EC_Pluto_Gateway		Bit Variables	%QW1.6	UINT	Bit Variables
GATE_EC_Pluto_Gateway		Register 0	%QW1.7	UINT	Register 0
GATE_EC_Pluto_Gateway		Register 1	%QW1.8	UINT	Register 1
GATE_EC_Pluto_Gateway		Bit Variables	%QW1.9	UINT	Bit Variables
GATE_EC_Pluto_Gateway		Register 0	%QW1.10	UINT	Register 0
GATE_EC_Pluto_Gateway		Register 1	%QW1.11	UINT	Register 1
GATE_EC_Pluto_Gateway		Pluto status	%ID1.0	UDINT	Pluto status
GATE_EC_Pluto_Gateway		Pluto 0	%ID1.1	UDINT	Pluto 0
GATE_EC_Pluto_Gateway	P1_Global	Pluto 1	%ID1.2	UDINT	Pluto 1
GATE_EC_Pluto_Gateway		Pluto 29	%ID1.30	UDINT	Pluto 29
GATE_EC_Pluto_Gateway		Pluto 30	%ID1.31	UDINT	Pluto 30
GATE_EC_Pluto_Gateway		Pluto 31	%ID1.32	UDINT	Pluto 31
GATE_EC_Pluto_Gateway	P4_ErrorCode	Additional area 0	%ID1.33	UDINT	Additional area 0
GATE_EC_Pluto_Gateway	P4_ToGW_Usr1	Additional area 1	%ID1.34	UDINT	Additional area 1
GATE_EC_Pluto_Gateway		Additional area 2	%ID1.35	UDINT	Additional area 2
GATE_EC_Pluto_Gateway		Additional area 3	%ID1.36	UDINT	Additional area 3

Result as shown in the CoDeSys environment programming tool.



7.5 Beckhoff TwinCAT integration

This chapter will describe how to use the gateway GATE-EC with Beckhoff TwinCAT system.

7.5.1 Add device description file

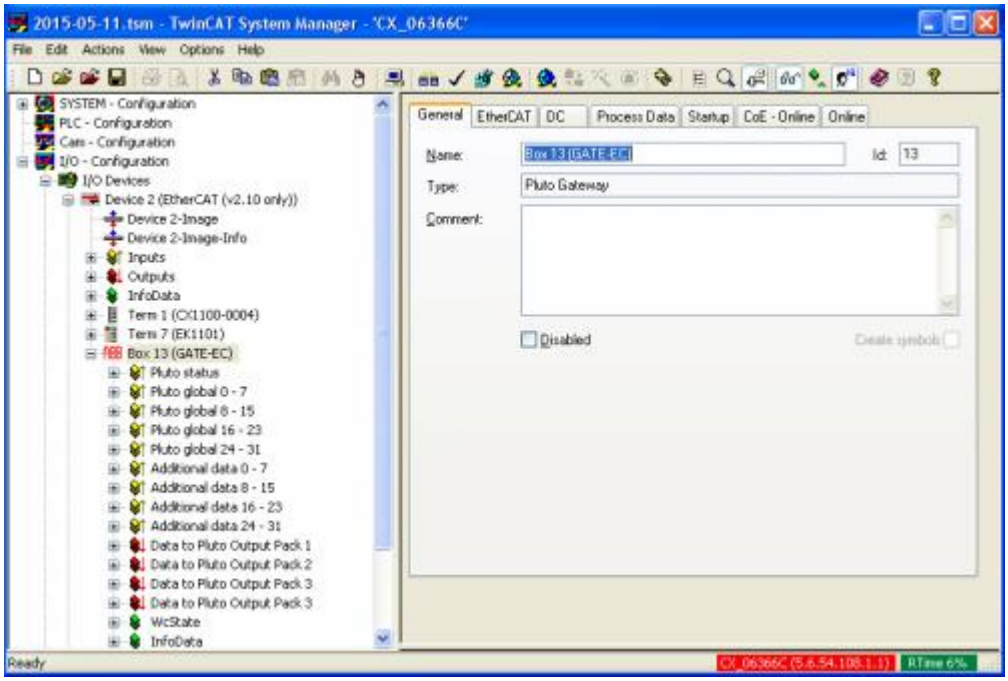
The description file for EtherCAT is called ESI XML files. For the gateway GATE-EC this file is named “ABB_JokabSafety_GATE-EC.xml”. Installation is easily done by copying the file into the correct TwinCAT directory.

For TwinCAT 2 copy the file into “TwinCAT\Io\EtherCAT” directory.

After the installation of the file you need to restart system manager so it will reread the configuration directory for new information.

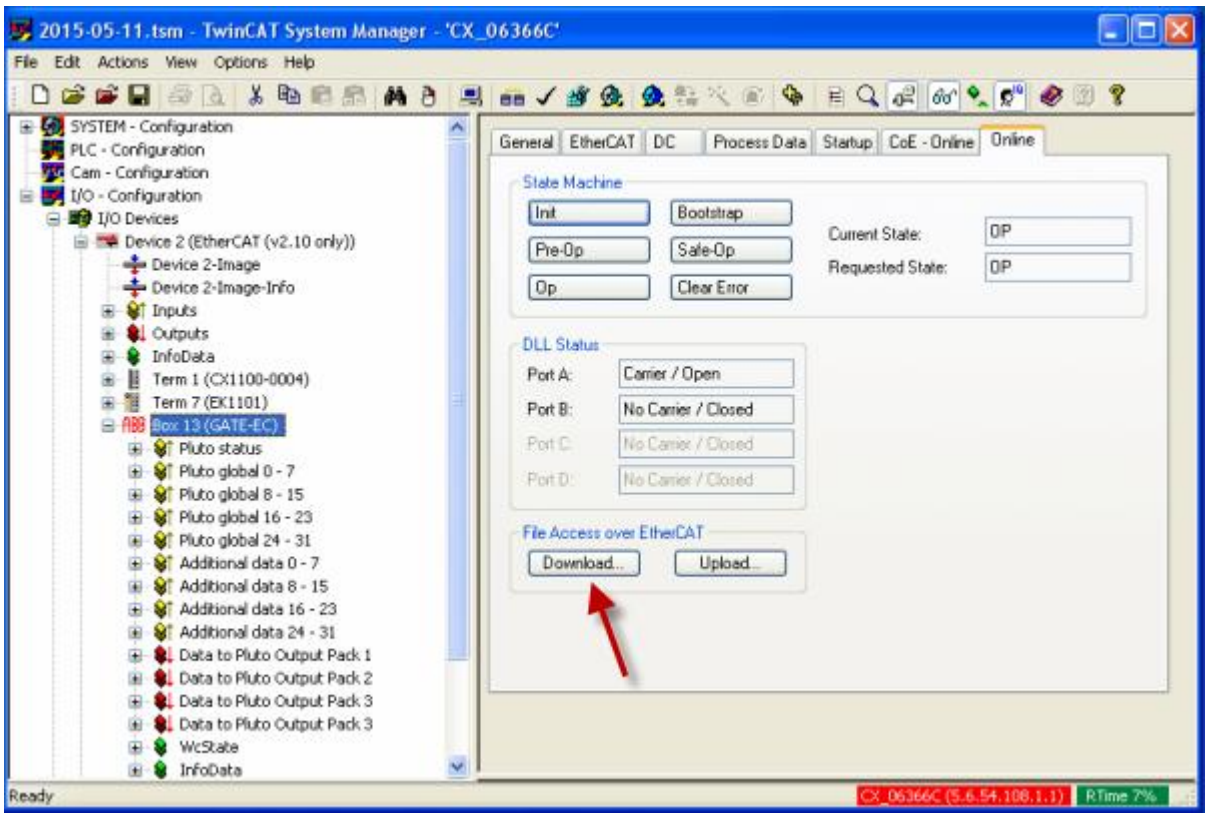
7.5.2 Scan system for the device

The unit will be easily installed into a system by scanning the system for boxes. During this scan it will detect the gateway GATE-EC and generate a box for it where all settings and data then will be available, see picture below.

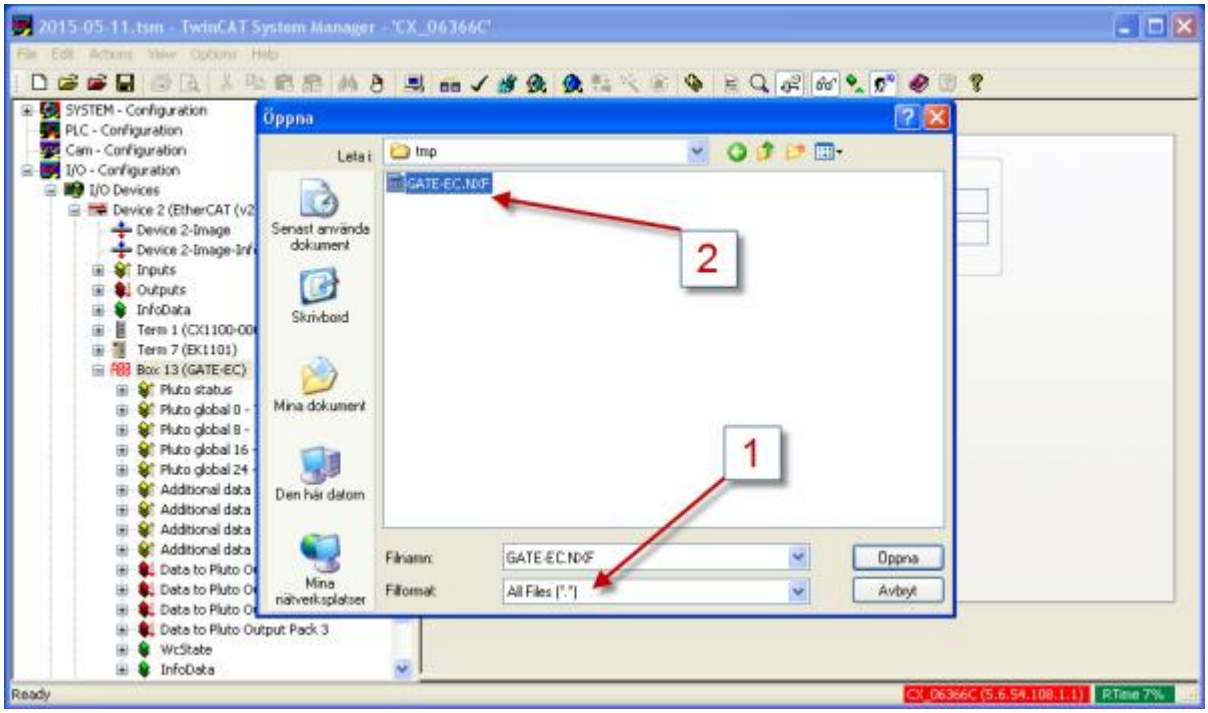


7.5.3 Firmware update

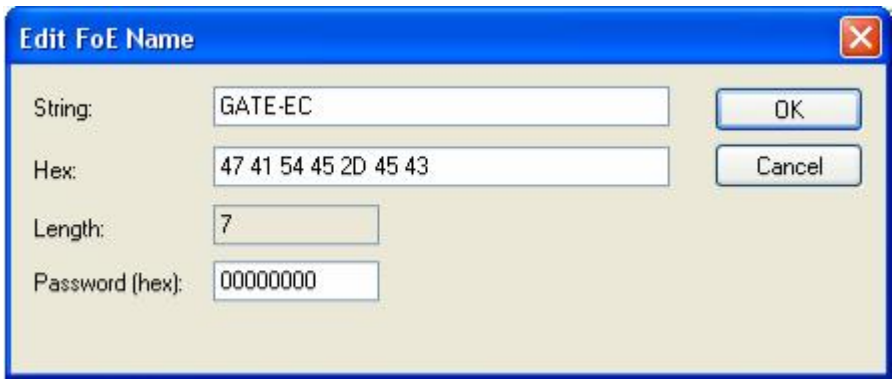
With system supporting FoE (File access over EtherCAT) it’s possible to update the device firmware in the gateway GATE-EC. In a Beckhoff TwinCAT system the file download button can be found in the “Online” tab of the device,



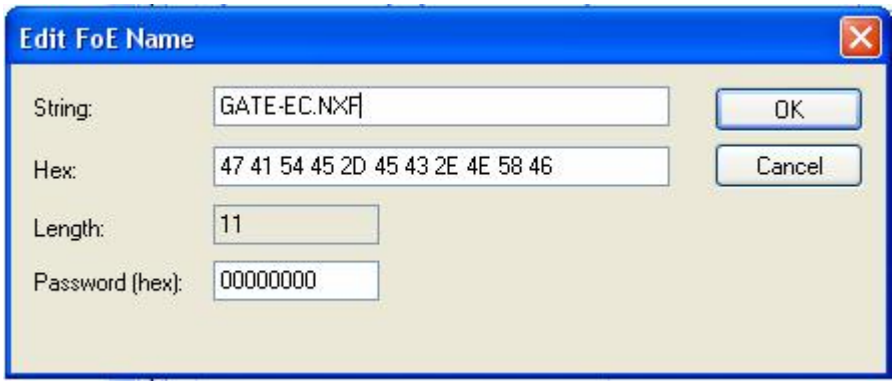
When pressing the “Download…” button the first steps will be to select the firmware file which shall be sent to the device. To be able to see the file you need first to change so you can see all files (1) and then navigate to the file which shall be named “GATE-EC.NXF” (2) and then click open.



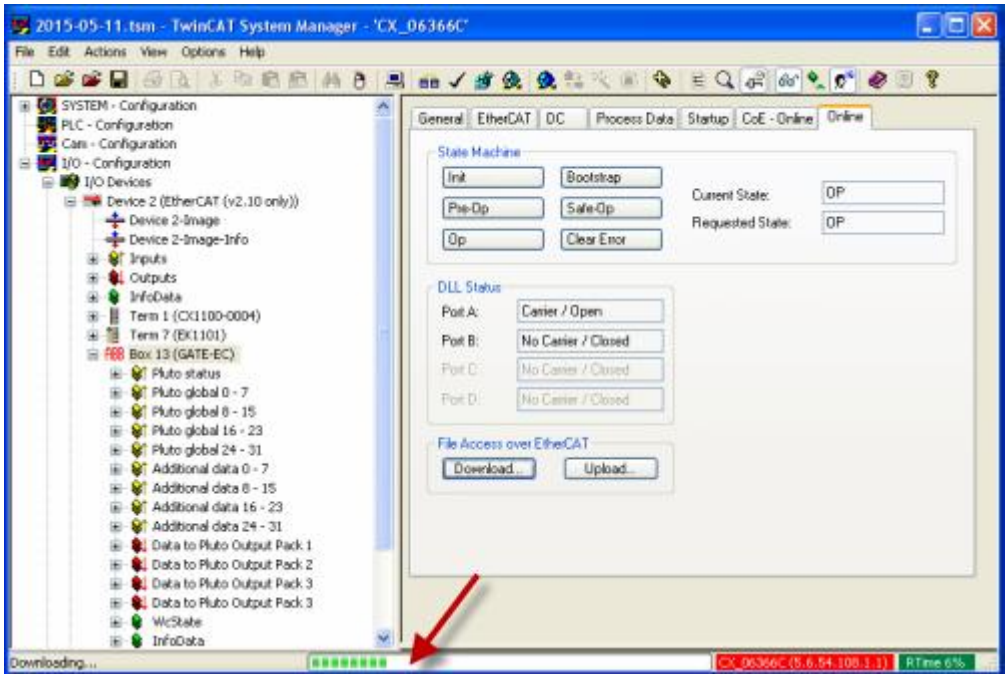
You will now get a dialog for the FoE file name transfer similar to this one,



In this dialog you need to add the suffix of the file ".NXF" so the dialog will look like below,



Click OK button and the file transfer will start and you will see a download progress bar in the TwinCAT window,



When the download is finished the gateway unit need to be restarted to start running the downloaded application.

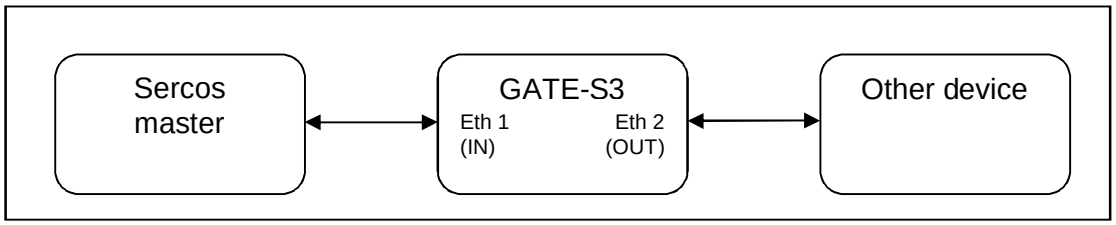
8 GATE-S3, Sercos III

The Ethernet gateway GATE-S3 is an Ethernet gateway handling the industry Ethernet protocol Sercos III according to,

- Communication Spec. V1.1.2.1.7 (March 30, 2009).
- Sercos Communication Profile V1.1.2.1.1 (March 31, 2009).
- Function Specific Profile IO V1.1.2.1.4 (May 11, 2009).
- Internet Protocol Services V1.3.1 - 1.2 (February 10, 2011).
- Minimum cycle time is 500 µs.

8.1 Ethernet Connection

The gateway is connected to Sercos III network using standard Ethernet connector and cable according to chapter 4.1.3.1 and 4.1.3.2. As Sercos III is a bus where each device has an input and output side the “Eth 1” port is the input port and “Eth 2” is the output port, see figure below.

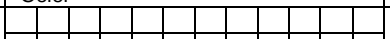
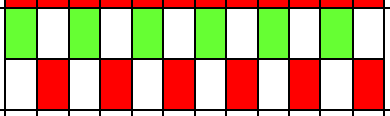


8.2 IP address configuration

The IP address assignment for the unit is by default set to 192.168.0.100. It can be changed via the terminal port (or via the web server if enabled). For Sercos III the last not connected port in the chain can be used for normal Ethernet connections and this is valid for the GATE-S3 also. So if the “Eth 2” port is not used for Sercos III connection to other Sercos device this port is free for normal TCP/IP access on the Sercos system. This is done by connecting a computer with correct IP address settings, and then it’s possible to access the gateways web server (if enabled) this way and also other services/functions/devices via the TCP/IP protocol.

8.3 Status indication

On the gateway with Sercos III there are one dual colors LED for Sercos III status indication, named S3. Currently this is not a true dual color LED as stated in the Sercos specification but it has the same behavior. The tables below explain the indicators status information, when both the green and red light the color shall be orange.

Pattern	Color	Description	Priority	Comment
1		NRT-Mode	0	No SERCOS communication
2		CP0	0	Communication phase 0 is active
3		CP1	0	Communication phase 1 is active
4		CP2	0	Communication phase 2 is active
5		CP3	0	Communication phase 3 is active
6		CP4	0	Communication phase 4 is active
7		HP0	1	Device is in hot-plug phase 0
8		HP1	1	Device is in hot-plug phase 1
9		HP2	1	Device is in hot-plug phase 2
10		Fast forward ⇒ Loopback	2	RT-state has changed from fast-forward to loopback
11		Application error	3	See GDP & FSP Status codes class error
12		MST losses ≥ (S-0-1003/2)	4	As long as the communication warning (S-DEV.Bit15) in the Device Status is present, at least 2 sec.
13		Communication error	5	See SCP Status codes class error
14		Identification	6	Invoked by (C-DEV.Bit 15 in the Device Control) or SIP Identification request
15		Watchdog error	7	Application is not running
	3 seconds, each flash 250 ms.			

8.4 Service port information

The Sercos III service is using several network ports on the device.

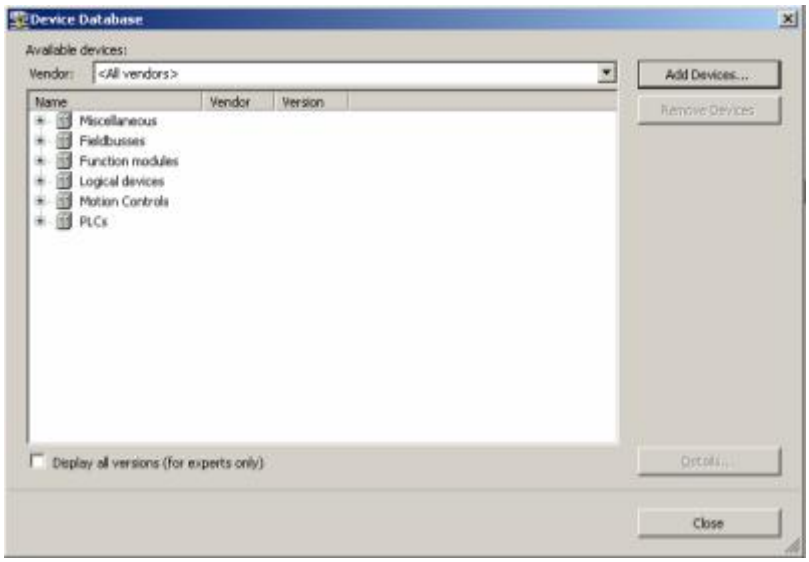
Port		Description
UDP	35021	Encapsulation messages based on UDP.

8.5 Bosch-Rexroth IndraWorks integration

This chapter will highlight some aspects on integrating gateway GATE-S3 with a Bosch-Rexroth IndraWorks system.

8.5.1 Add device description file

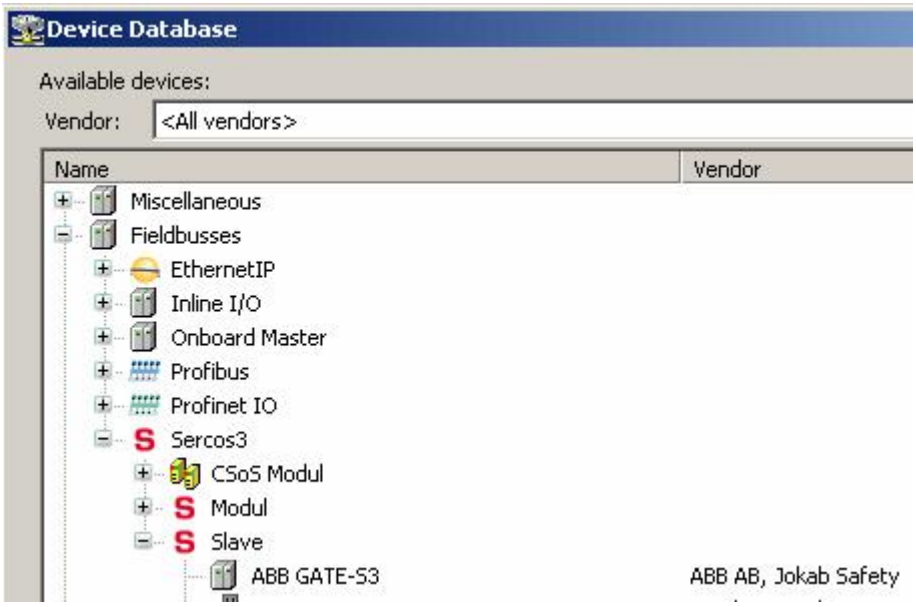
Select in IndraWorks menu “Tools” and “Device Database…” which will bring up this window,



Press the ”Add Devices…” button and select the description file for the gateway GATE-S3 device which is named something like

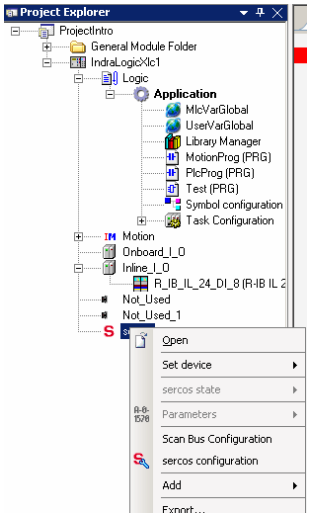
”SDDML#3.0#ABB_AB_JOKAB_SAFETY#ABB_GATE-S3#2015-03-25.xml”.

If a correct installation you can see the device in the “Device database” under the directory “Fieldbusses” – “Sercos3” – “Slave” – “ABB GATE-S3”, see picture below.

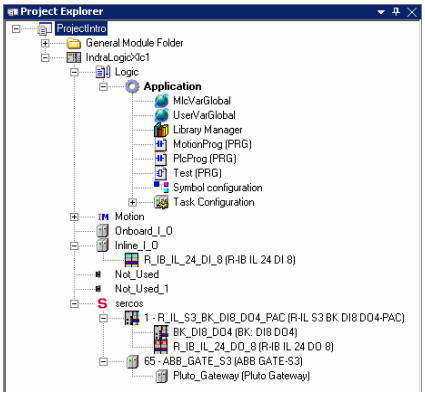


8.5.2 Scan system for the device

The unit will be easily installed into a system by scanning the Sercos bus by right click on the Sercos bus in the project and select “Scan Bus Configuration”. During this scan it will detect the gateway GATE-S3 and add it to the project via the “Scan Bus Configuration” windows which will follow the scan of the bus.

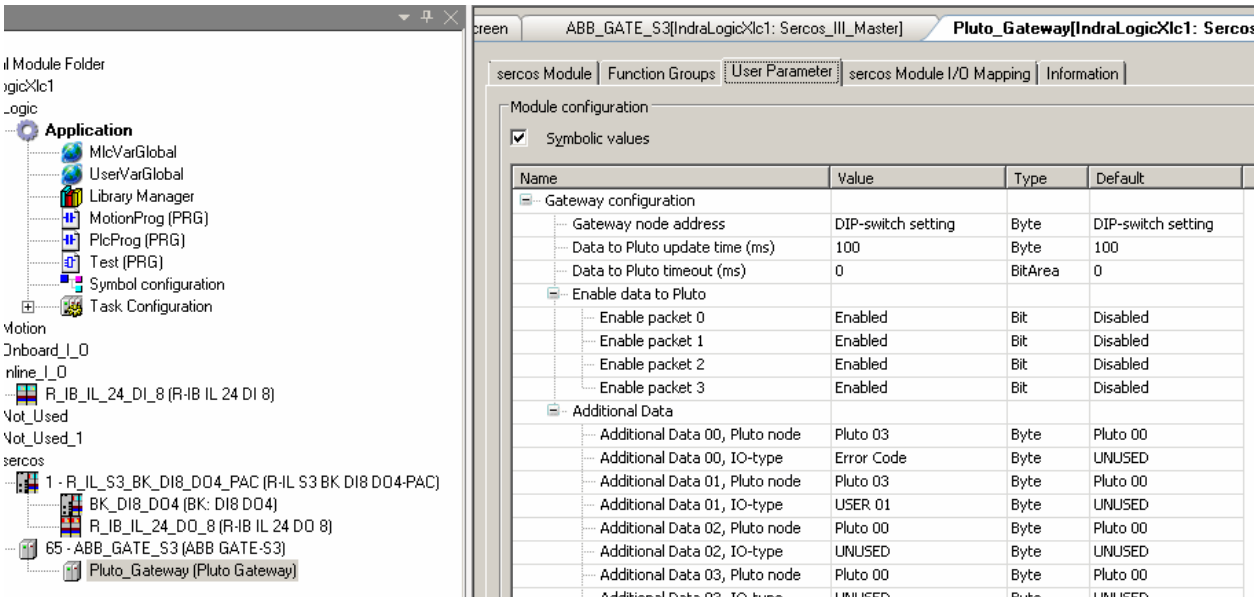


After adding the device the project explorer will view the gateway in a way similar to the example below,



8.5.3 Gateway configuration

By clicking on the two gateway modules in the project explorer it's now possible to configure the gateway device as needed. For example the startup configuration can be updated via "User Parameter" tab.



9 GATE-PN, PROFINET

The Ethernet gateway GATE-PN is an Ethernet gateway handling the industry Ethernet protocol PROFINET which is defined by PI Organization. It is build according to,

- Specification for PROFINET, Version 2.31.
- IRT Top (“Red phase”) will be supported.
- Minimum cycle time 2ms for RTC1 and 1ms for RTC3.

Note: Limitation
Minimum cycle time of 1 and 2 ms are today only possible when the Pluto system has maximum 8 Pluto units. For cycle time below 10 ms the limits are maximum 16 Pluto units. From 10 ms and up, a full Pluto system can be used.

9.1 Description file

The description file (GSSML) is the description file which shall be imported into the master PLC configuration tool.

The description file has two access points,

- GATE-E2 (Compatibility Mode).
  This access point shall only be used as a backward compatibility access point when making direct replacement of GATE-E2 device.

  Shall not be used for new system configuration!

- GATE-PN.
  This is the access point which shall be used in new system configurations.

For more information see PROFINET description appendix at chapter 17.

9.2 Data format

Pluto data in chapter 11 (Pluto global data 11.2, Pluto additional data 11.3 and data to Pluto 11.4) is in little endian format but data received/transmitted via PROFINET will in the master PLC be in big endian format. The table below show how this effects how data is arranged in the master PLC memory.

Unsigned32			
PLC memory	Weight	Pluto global byte order see 11.2	Additional byte order see 11.3
0	MSB	3	3
1		2	2
2		1	1
3	LSB	0	0

Unsigned16	
PLC memory	Weight
0	MSB
1	LSB

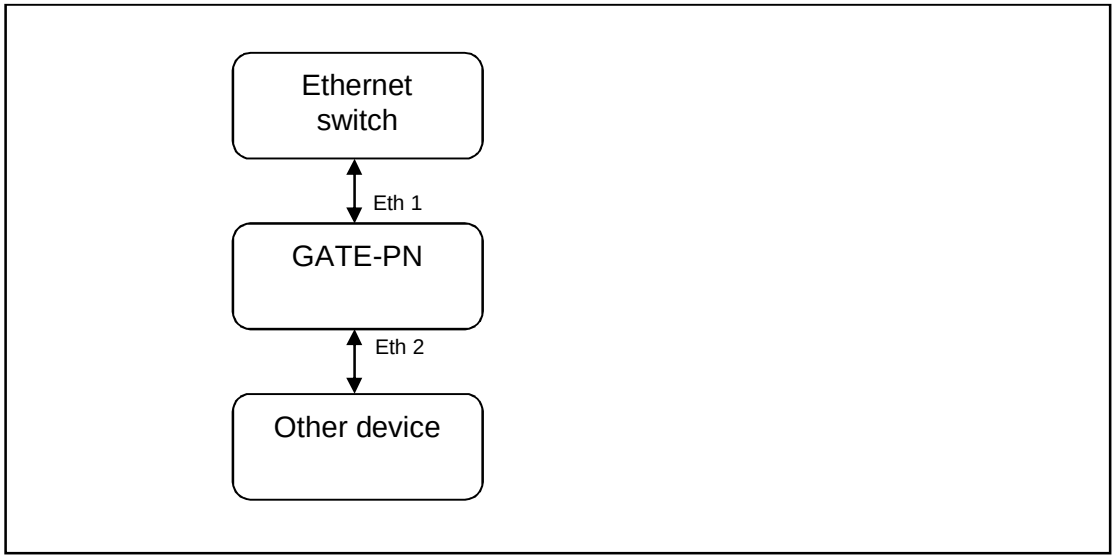
9.3 Ethernet Connection

The gateway is connected to PROFINET network using standard Ethernet connector and cable according to chapter 4.1.3.1 and 4.1.3.2. Both Ethernet ports have the same functionality and can be connected as desired. Normally Ethernet port 1 shall be used to connect to a network switch and Ethernet port 2 can be used to connect to other Ethernet device on the network if desired.

Each port can handle connection in both 10 and 100 Mbit/s using half or full duplex. The port automatically configures the port so it can be connected without using any special cross connected cabled.

The gateway has two Ethernet ports, and therefore it's possible to connect another device on the same Ethernet switch output by connection the other device to the second Ethernet port on the gateway. This will however increase the network traffic and may decrease the performance of the gateway device.

The gateway can be installed in a PROFINET IRT network even that the gateway itself doesn't have any real time data update performance.



9.4 IP address configuration

The IP address assignment for the unit is managed by the PROFINET master and can't be changed in any other way.

Instead of the IP address the device station name must be assigned using any DCP handling program within the master PLC configuration tool or similar standalone program. When the device has a device station name the master PLC will configure and assigned IP address according to the master configuration data.

9.5 Status indication

On the gateway with PROFINET there are two dual color LEDs for PROFINET status indications. They are named SF (System Failure) and BF (Bus Failure). The tables below explain the indicators status information.

9.5.1 SF (System Failure)

LED		PROFINET	Remark
OFF		No system error.	
RED steady		Red steady on when diagnostic error.	Currently the device doesn't have any diagnostic handling.
GREEN flashing		Device identification via the "blink" command from master device.	Flashing is 1 Hz for minimum 3 seconds.

9.5.2 BF (Bus Failure)

LED		PROFINET	Remark
OFF		No bus error.	
RED flashing		Ethernet cable connected but not connection.	
RED steady		No Ethernet cable connection on any port.	

9.6 Service port information

The PROFINET service is using several network ports on the device.

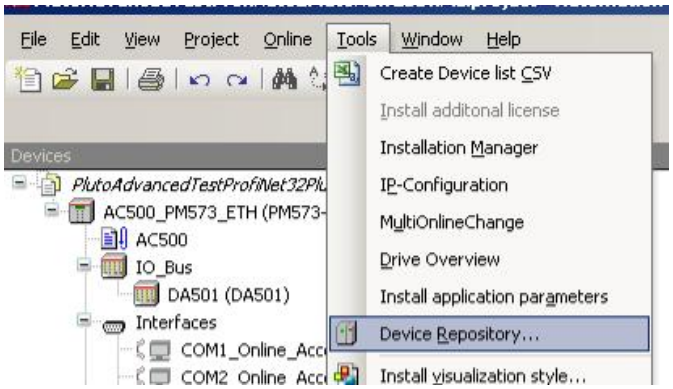
Port		Description
UDP	161	SNMP is mandatory for PROFINET.
	34964	PROFInet RPC Endpointmapper Port.
	49152	PROFInet RPC Device Server.

9.7 ABB AC500 implementation

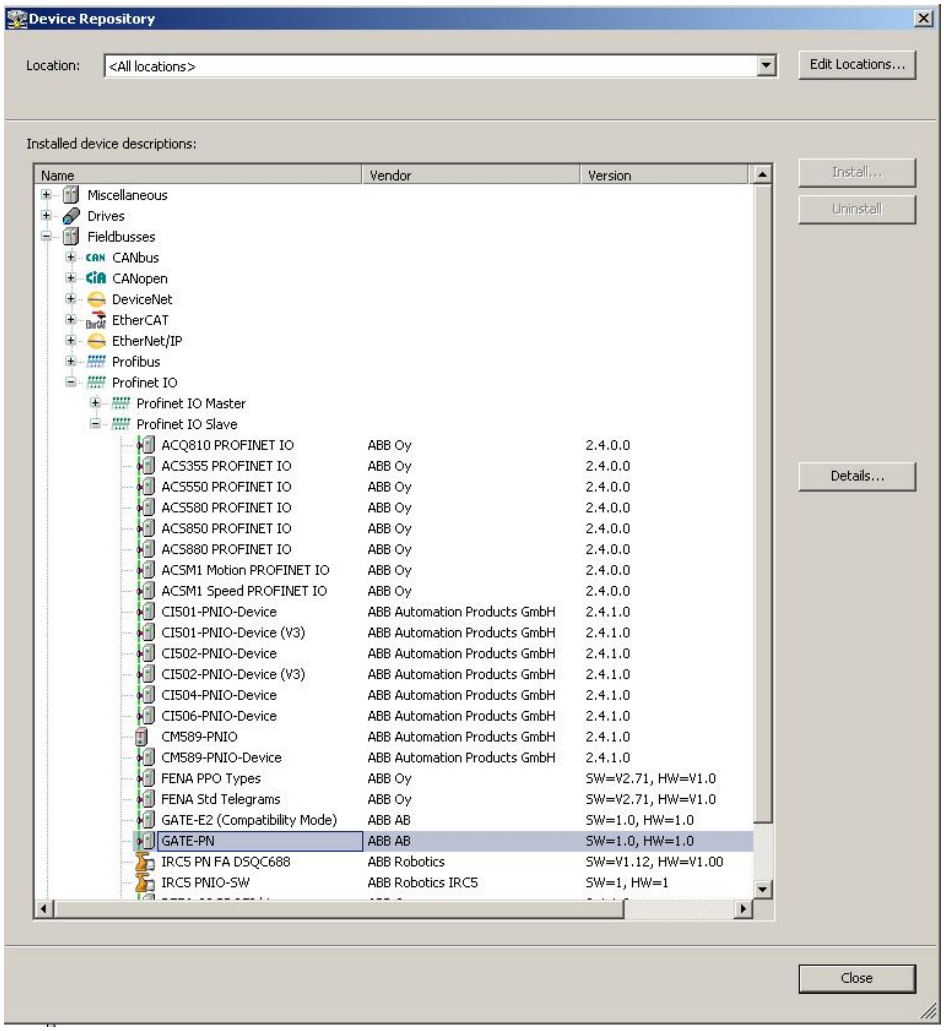
This example shows a simple implementation of the Gate-PN in an ABB AC500 PLC, using a CM579-PNIO communication module. It doesn't show any actual program, just how the "to" and "from" variables via the gateway Gate-PN are setup. Automation Builder V1.1.1717 was used.

9.7.1 Device repository and XML file

In Automation Builder under the Tools menu, start the "Device Repository" tool.



Use the "Install…" button and point at the file's location. Please note that it is included in Pluto Manager, under the Help menu. The result is shown in the picture below.

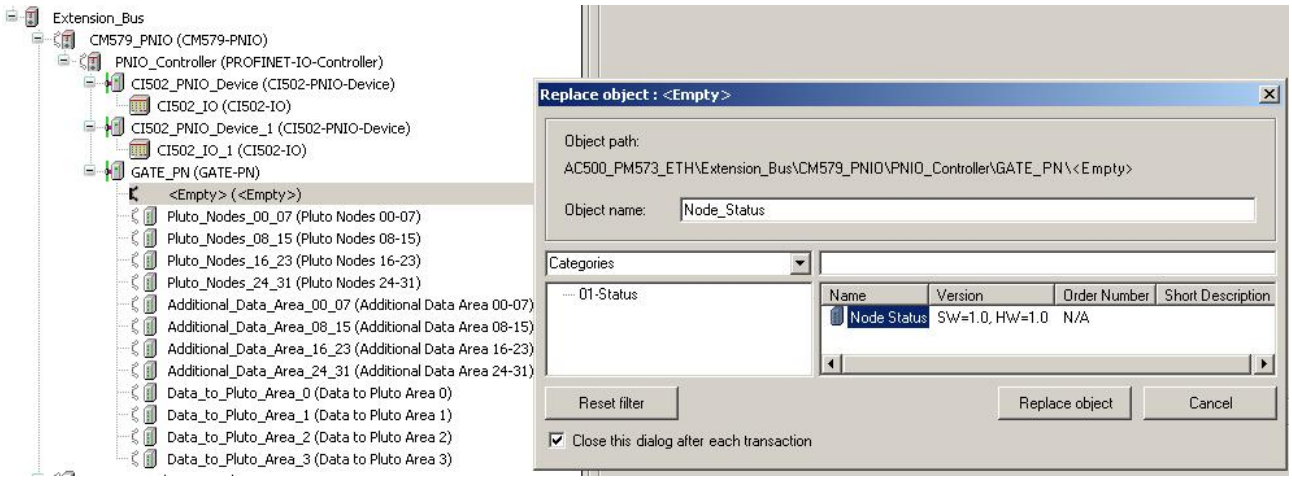


9.7.2 Hardware

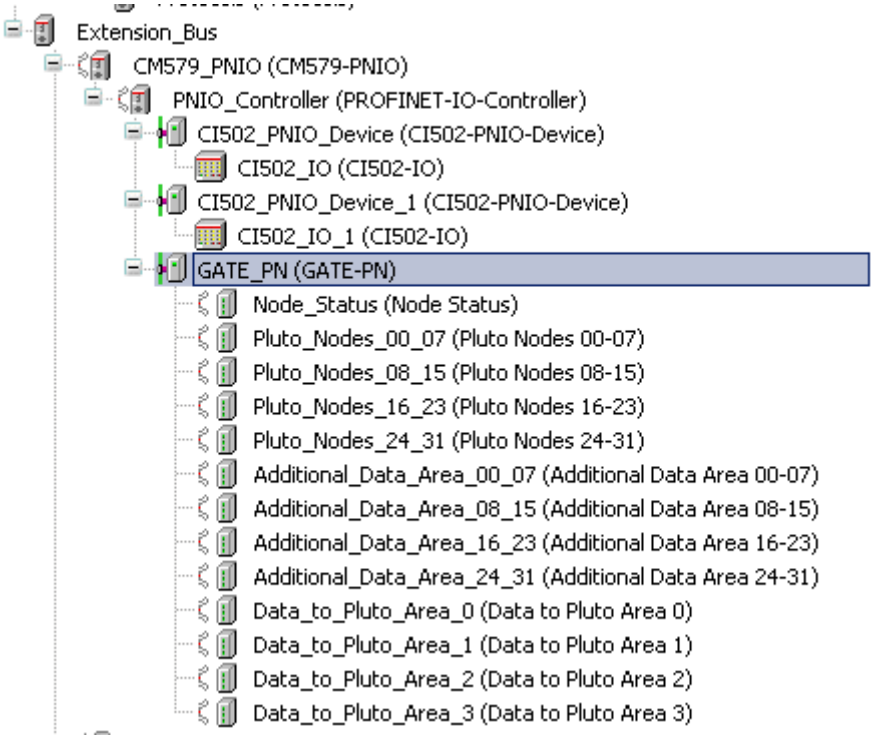
After adding the CM579-PNIO communication module right-click and add the Gate-PN object.

9.7.2.1 Adding objects

Add objects by right-clicking. Please note that each object under the Gate-PN has a specific place in the structure. “Node_Status” below must always be in the first location, “Pluto_Nodes_00_07” in the second, “Pluto_Nodes_08_15 in the third”, and so on.

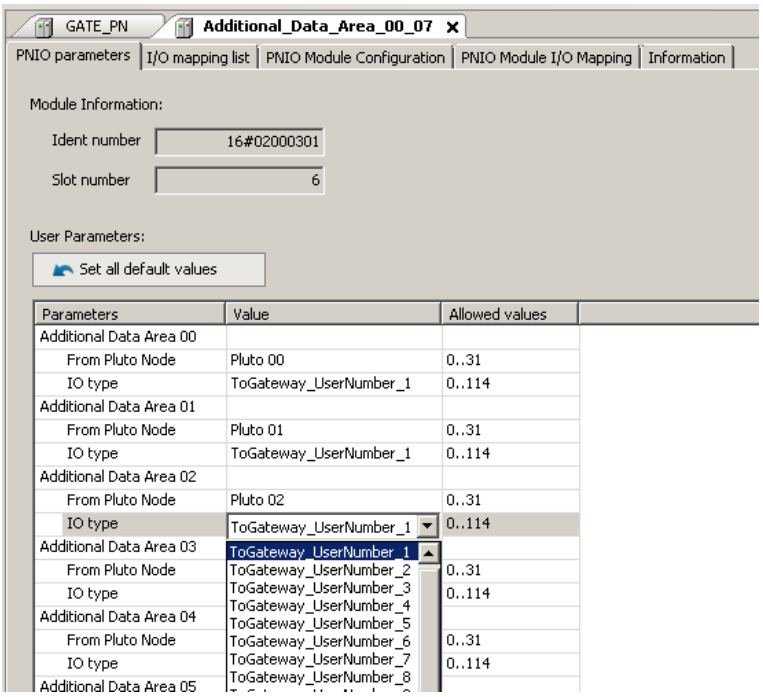


The result when all object has been added. Please note that you may need to configure some objects further.



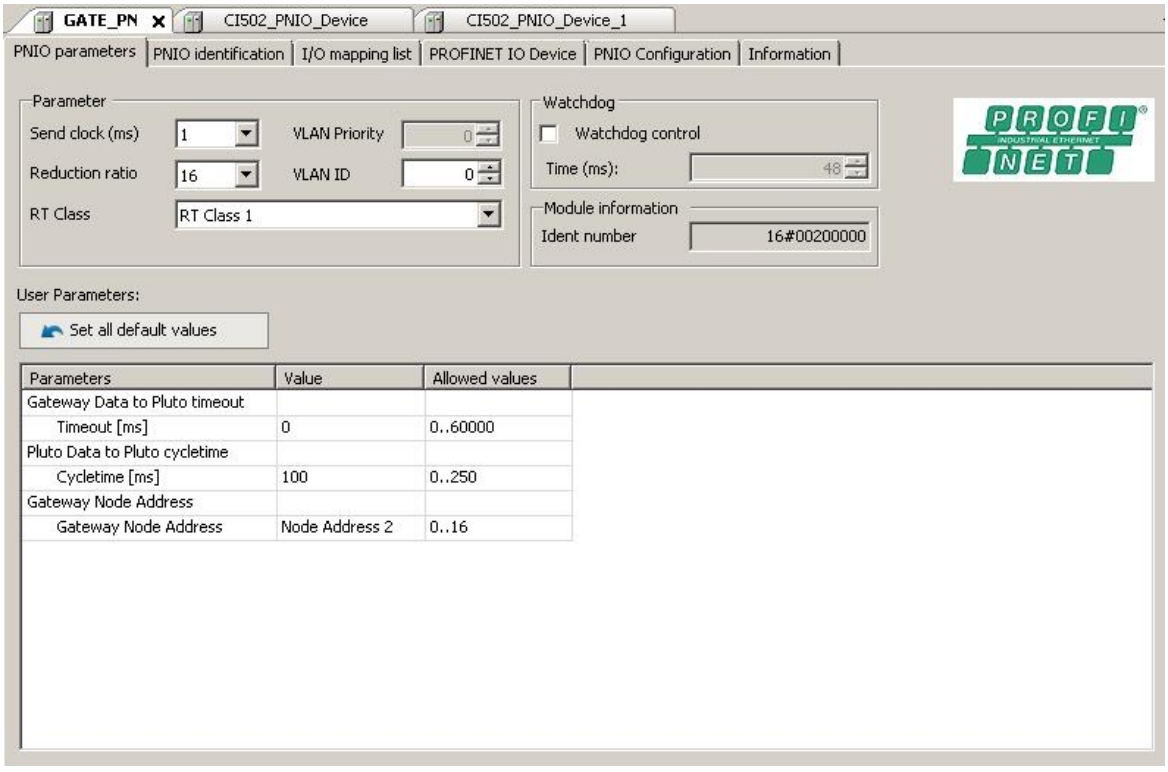
9.7.2.2 Configuring objects

In the picture below it is shown how each Additional Data area is configured. Each area, 0 to 31, must be configured so that it knows which Pluto unit is should expect data from and what type it should be. See chapter 11.3.



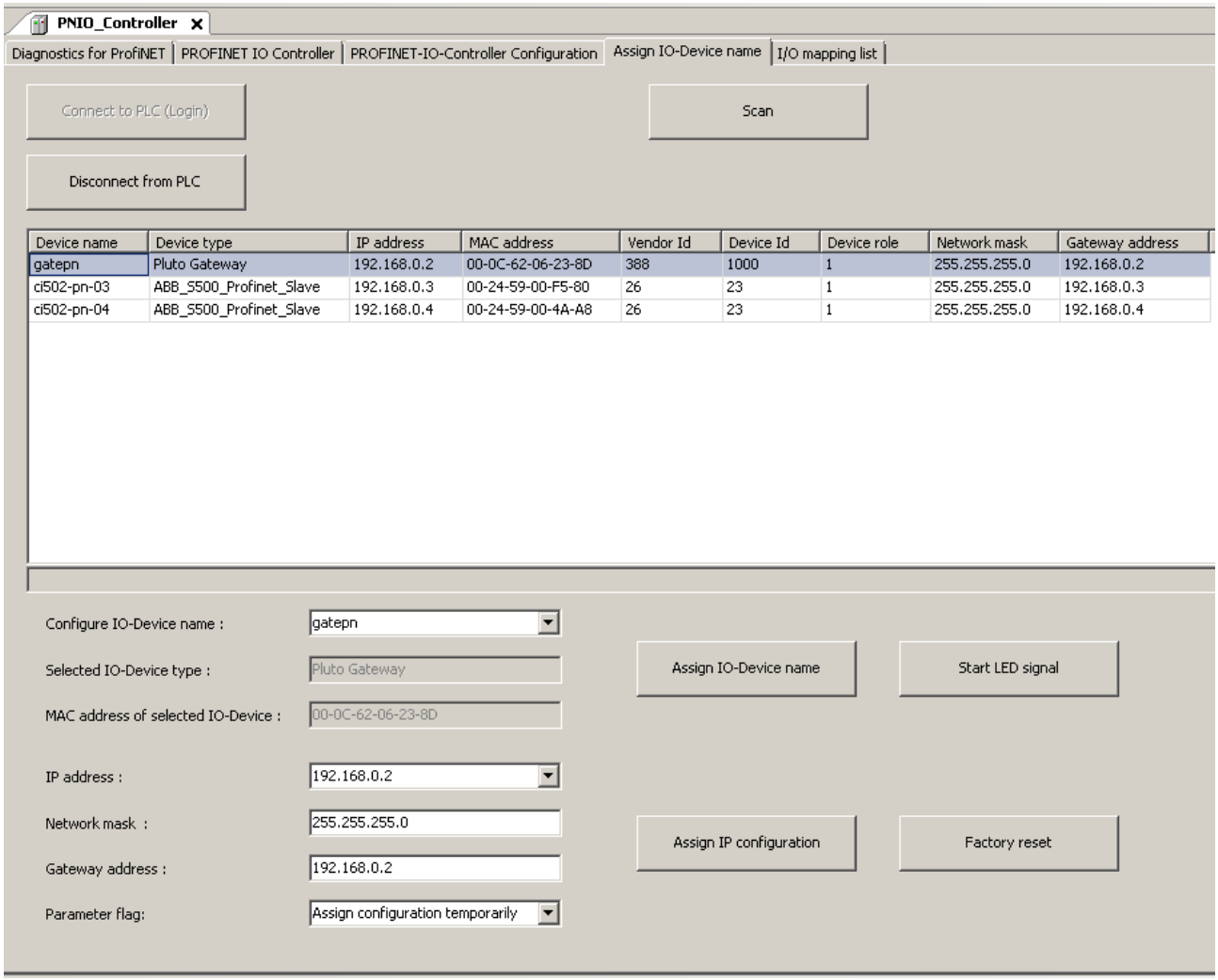
9.7.2.3 Configuring Gate-PN

The Gate-PN in the picture has been configured for a request interval of 16 ms. You can also set its node number (address) on the Pluto bus here, instead of using the DIP switches on the gateway. See bullet 11.4.



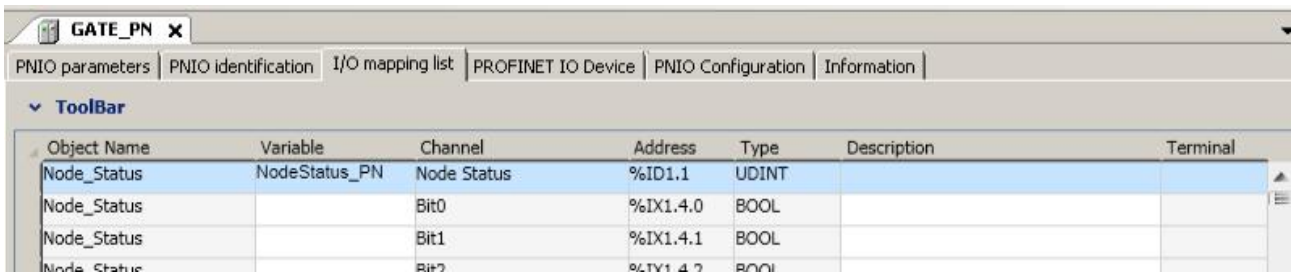
9.7.3 PROFINET name

Either use Pluto Manager, Tools menu, Terminal Window (NAME command), and a programming cable connected to the gateway, or use the tool under the CM579-PNIO communication module to assign a PROFINET name to the gateway. This will establish communication with the gateway.

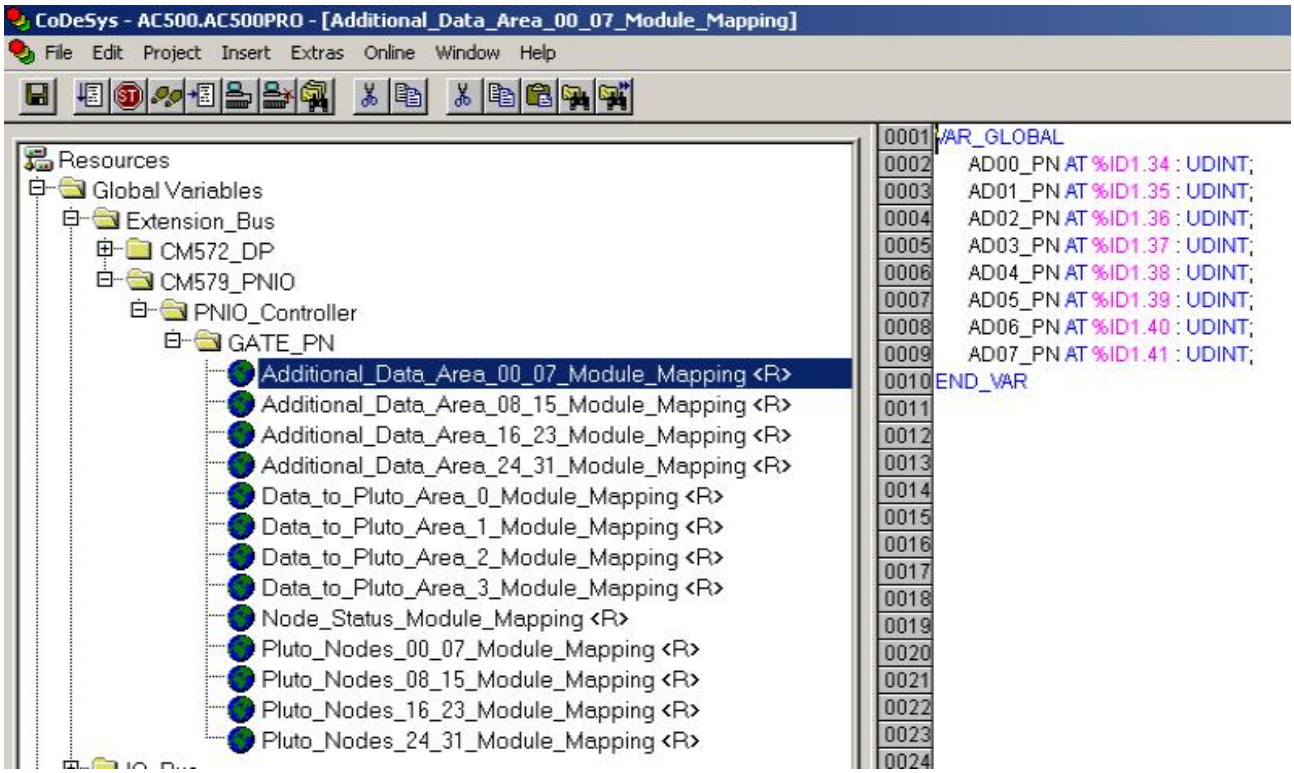


9.7.4 Assigning variable names

Use the I/O mapping list to assign variables their names.



This is how they will show up in the CoDeSys environment, ready to be used.

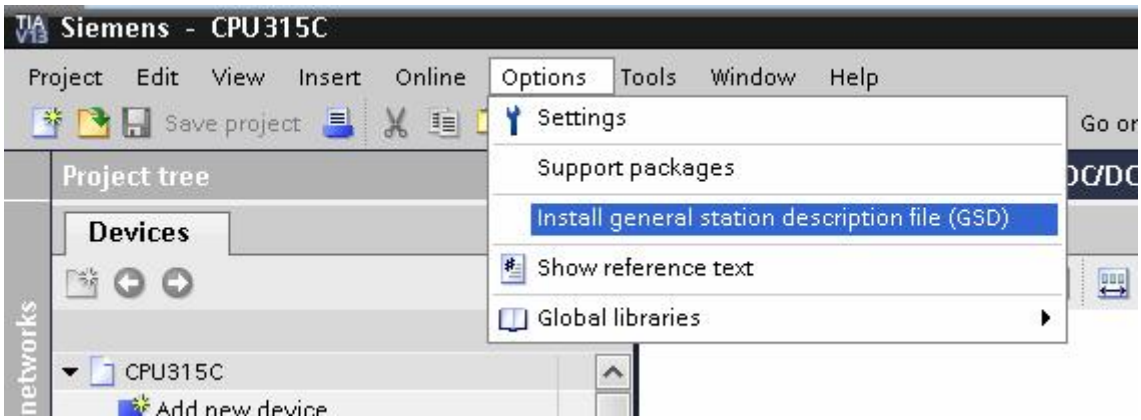


9.8 Siemens integration

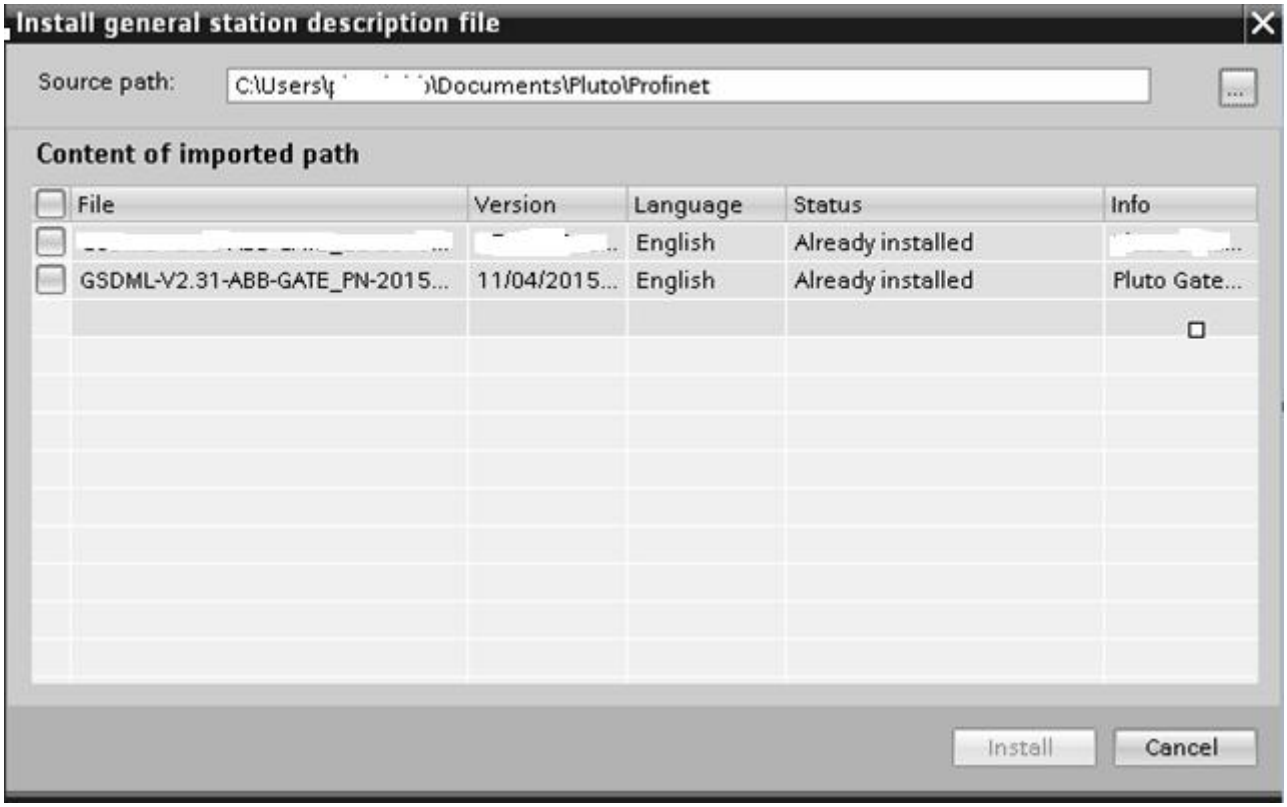
This example shows a simple implementation of the Gate-PN in a Siemens S-1200 PLC, using its internal PROFINET. It doesn't show any actual program, just how the "to" and "from" variables via the gateway Gate-PN are setup. Siemens TIA portal V13 was used.

9.8.1 Install GSD XML file

Under the "Options" menu choose "Install general…".

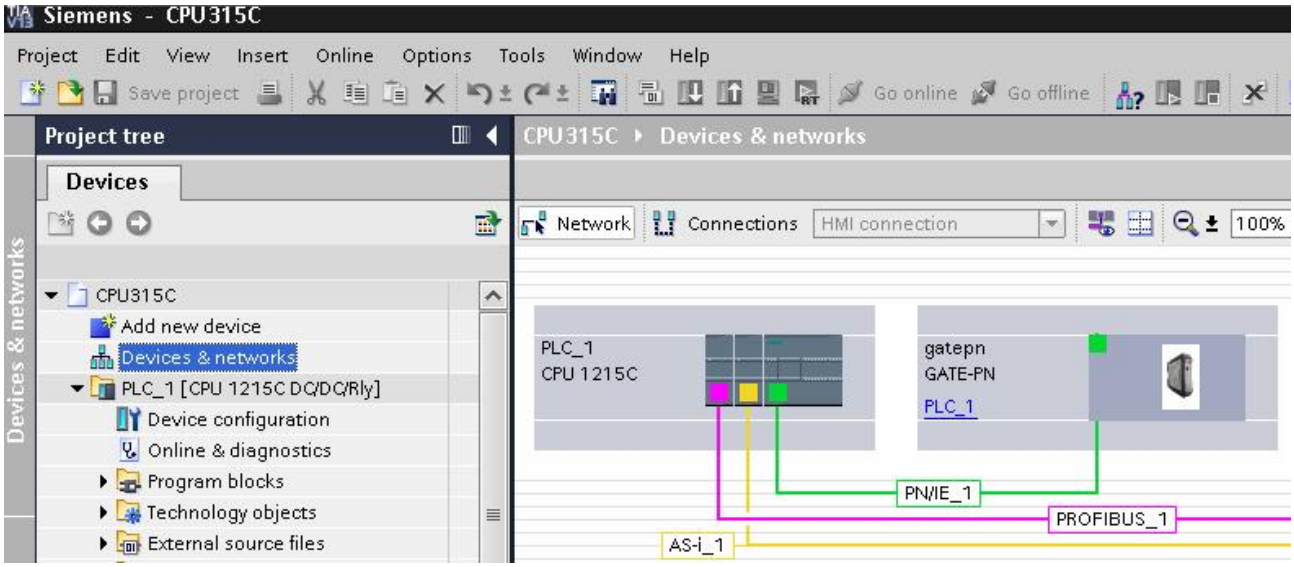


Use the "Install…" button and point at the file's location. Please note that it is included in Pluto Manager, under the Help menu. The result is shown in the picture below.



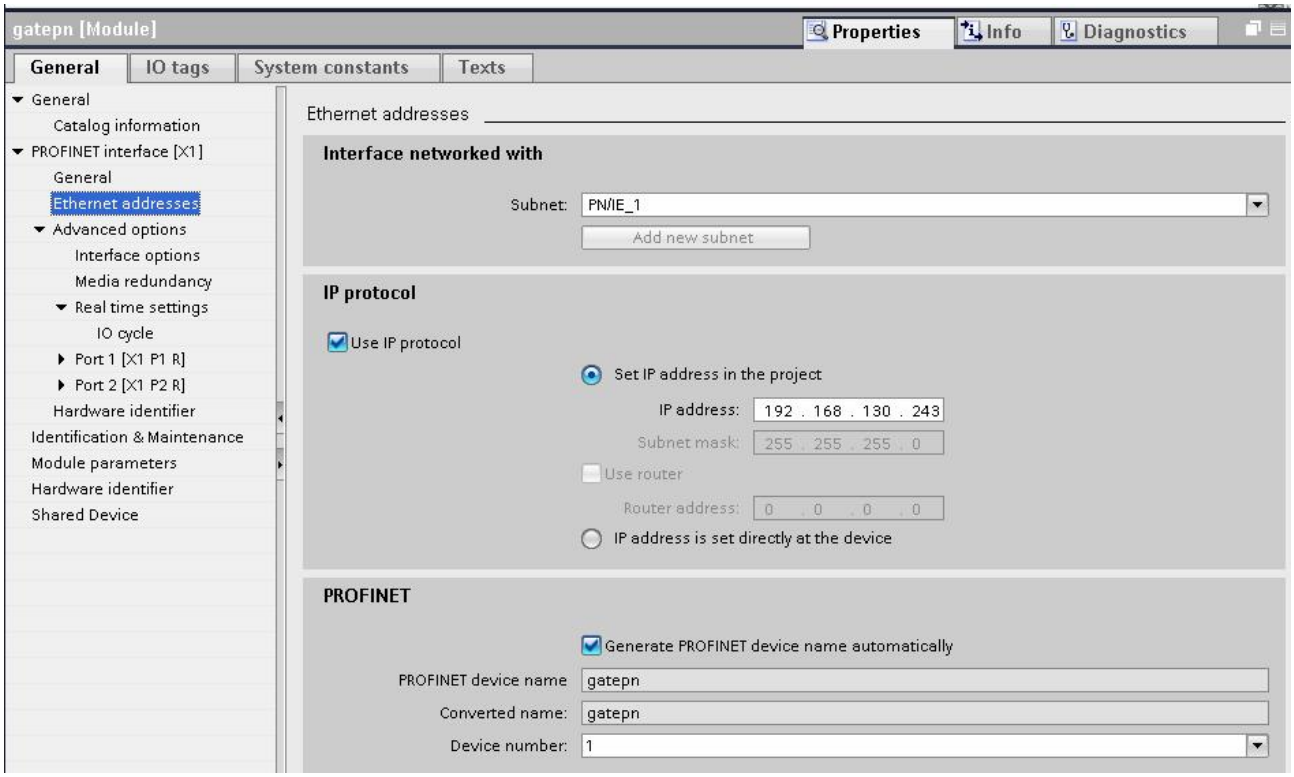
9.8.2 Add the device to the PROFINET network

Use the “Devices & Networks” to add the Gate-PN. Please note that the PLC and gateway must be linked to each other with PROFINET network intended to be used.



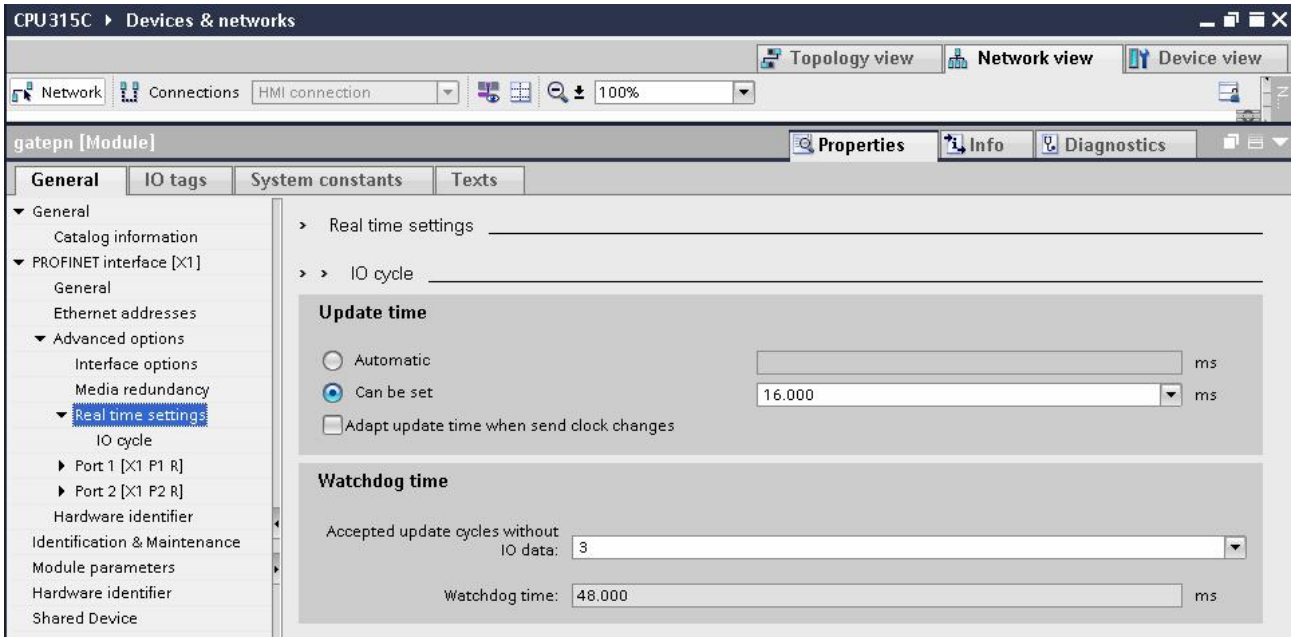
9.8.2.1 PROFINET name and IP address

Mark the gateway and use Properties to set its IP address. The name is default “gatepn”. This can be changed either via Pluto Manager, Tools menu, Terminal Window (NAME command), and a programming cable connected to the gateway, or use “Online access” and connect to the gateway if it’s reachable, use “Functions” to assign the name and IP address.



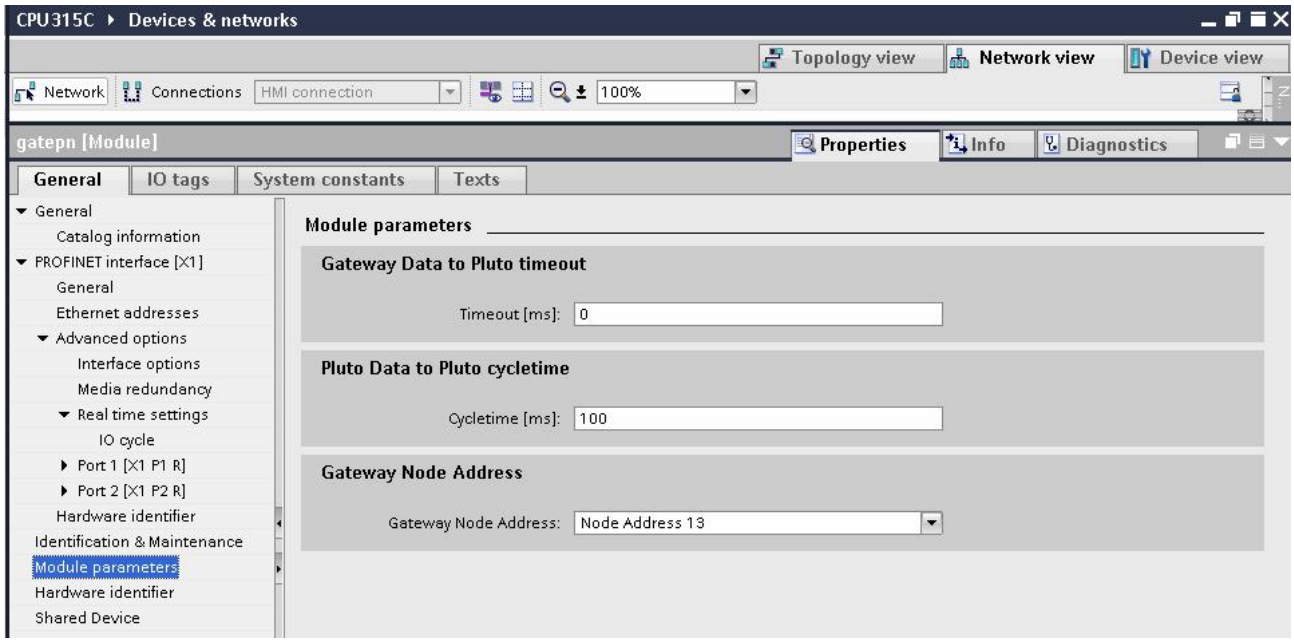
9.8.2.2 IO Cycle

Set the gateway's IO cycle, either automatically or manually. Here it's been set manually to 16 ms.



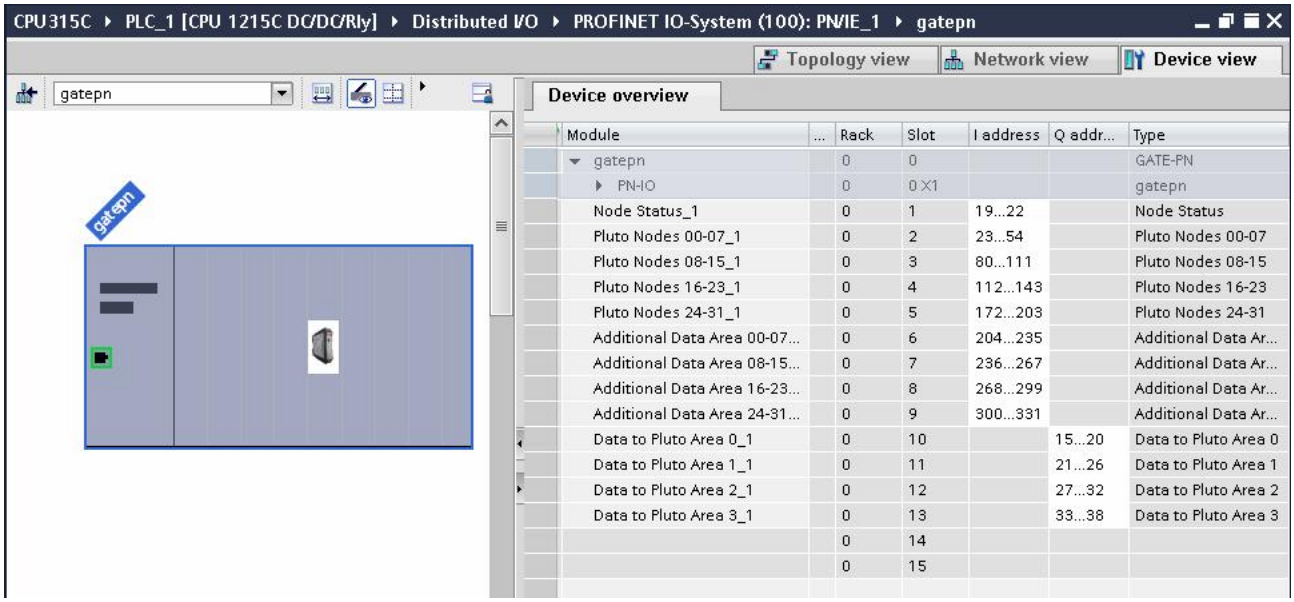
9.8.2.3 Module parameters of the Head module

Under the "Module parameters" tab settings concerning the gateways behavior on the Pluto bus is setup. See bullet 11.4.



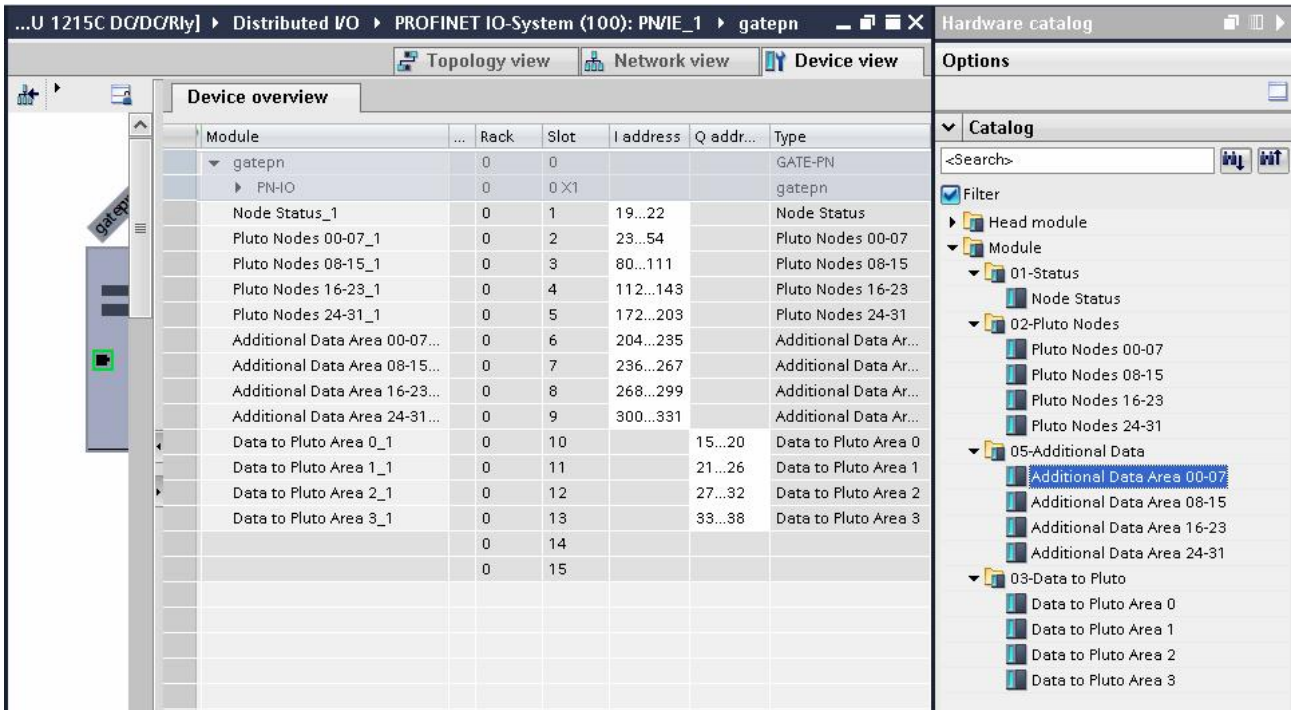
9.8.2.4 Device view

Adding module is done under the “Device view”.



9.8.2.4.1 Adding modules under the Head module

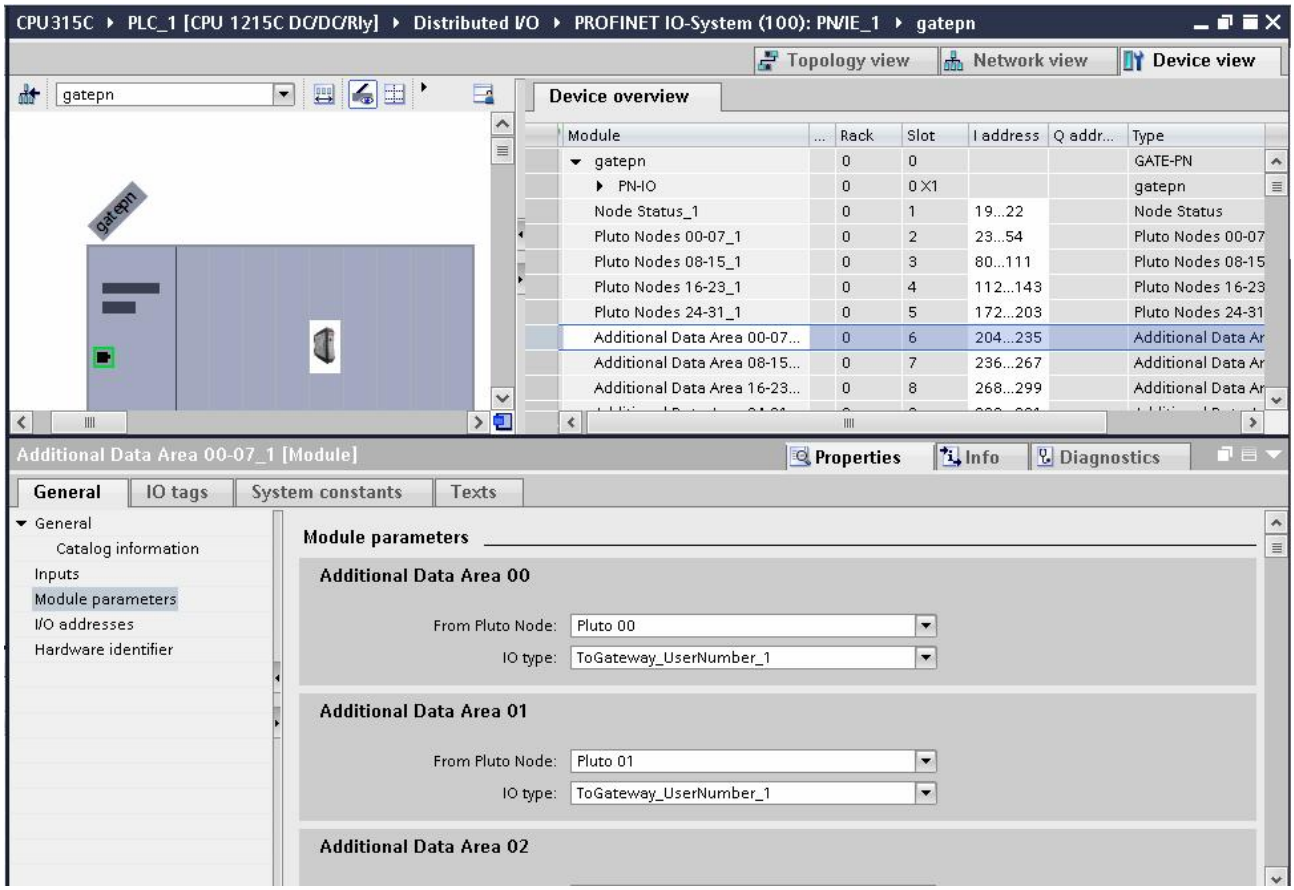
Drag and drop the modules intended to be used from the “Hardware catalog”. Please note that each module has its intended fixed placement. “Node Status” first, “Pluto Nodes 00-07” second, and so on. As shown in the picture.



9.8.2.4.2 Module parameters of modules under the Head module

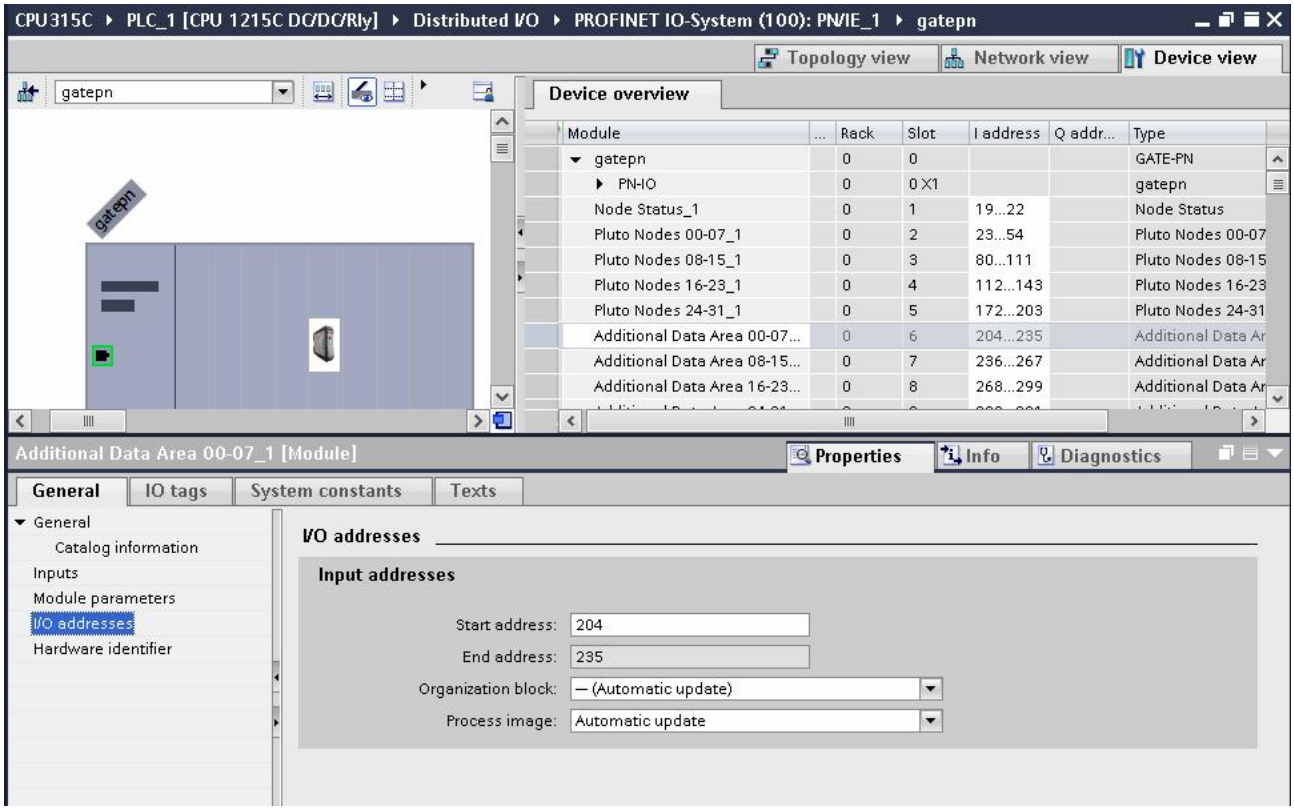
To configure module parameters such as “Additional data” parameters mark the module and use the “Module parameters” tab. Configure which Pluto node the additional data area is expecting data from and what IO type it is. See bullet 11.3.

In this example “Additional Data Area 00” is set to receive data from Pluto node 0 of the IO type 1. IO type 1 means that in the Pluto project a “ToGateway_User_X” (where X is A, B or C) is used. See bullet 11.3.2.3, network 3.



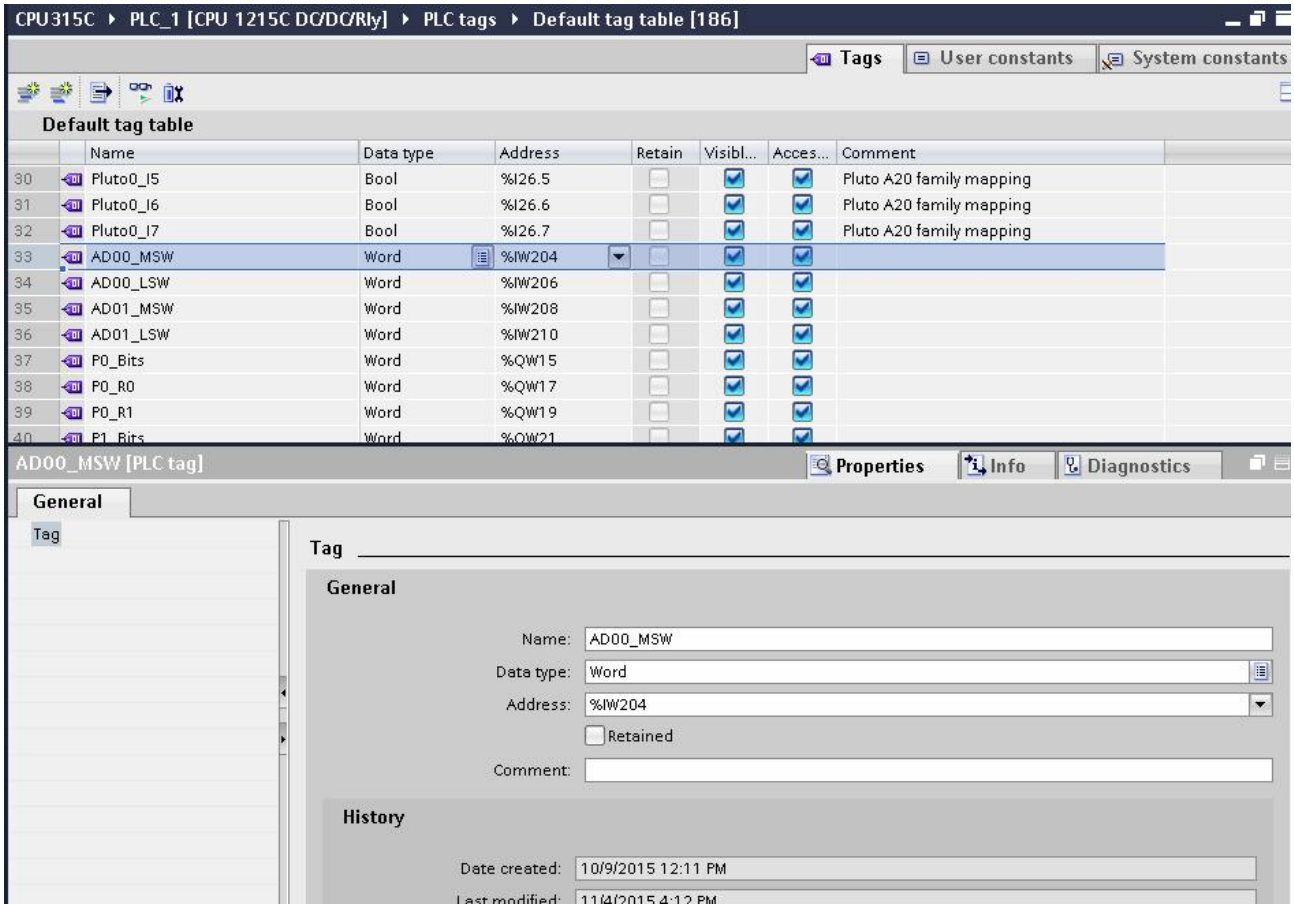
9.8.2.4.3 Addressing of in- and out-data

Point the modules to the intended input address or output address. In this example this has been done automatically.



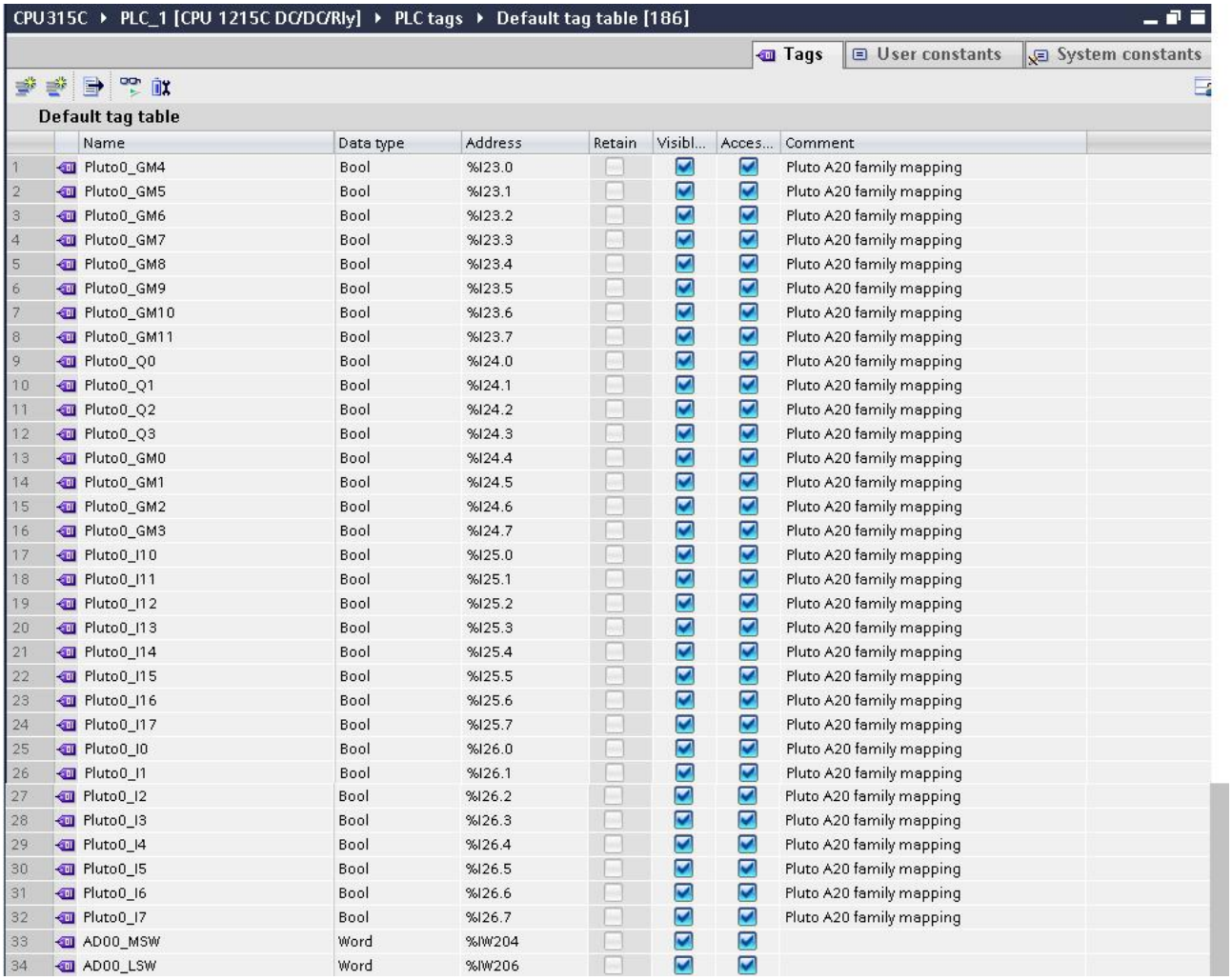
9.8.2.5 Tag list

Give the tags their intended name and point it to the correct address. See bullet 9.8.2.4.3 above for the “Additional data” area 0’s address.



9.8.2.5.1 Example of Pluto A20 family mapping

See chapter 11, bullet 11.2 for the Global variables mapping and bullet 11.3 for the “Additional Data” mapping. Plus bullet 9.2 for the data format.



	Name	Data type	Address	Retain	Visibl...	Acces...	Comment
1	Pluto0_GM4	Bool	%I23.0		☑	☑	Pluto A20 family mapping
2	Pluto0_GM5	Bool	%I23.1		☑	☑	Pluto A20 family mapping
3	Pluto0_GM6	Bool	%I23.2		☑	☑	Pluto A20 family mapping
4	Pluto0_GM7	Bool	%I23.3		☑	☑	Pluto A20 family mapping
5	Pluto0_GM8	Bool	%I23.4		☑	☑	Pluto A20 family mapping
6	Pluto0_GM9	Bool	%I23.5		☑	☑	Pluto A20 family mapping
7	Pluto0_GM10	Bool	%I23.6		☑	☑	Pluto A20 family mapping
8	Pluto0_GM11	Bool	%I23.7		☑	☑	Pluto A20 family mapping
9	Pluto0_Q0	Bool	%I24.0		☑	☑	Pluto A20 family mapping
10	Pluto0_Q1	Bool	%I24.1		☑	☑	Pluto A20 family mapping
11	Pluto0_Q2	Bool	%I24.2		☑	☑	Pluto A20 family mapping
12	Pluto0_Q3	Bool	%I24.3		☑	☑	Pluto A20 family mapping
13	Pluto0_GM0	Bool	%I24.4		☑	☑	Pluto A20 family mapping
14	Pluto0_GM1	Bool	%I24.5		☑	☑	Pluto A20 family mapping
15	Pluto0_GM2	Bool	%I24.6		☑	☑	Pluto A20 family mapping
16	Pluto0_GM3	Bool	%I24.7		☑	☑	Pluto A20 family mapping
17	Pluto0_I10	Bool	%I25.0		☑	☑	Pluto A20 family mapping
18	Pluto0_I11	Bool	%I25.1		☑	☑	Pluto A20 family mapping
19	Pluto0_I12	Bool	%I25.2		☑	☑	Pluto A20 family mapping
20	Pluto0_I13	Bool	%I25.3		☑	☑	Pluto A20 family mapping
21	Pluto0_I14	Bool	%I25.4		☑	☑	Pluto A20 family mapping
22	Pluto0_I15	Bool	%I25.5		☑	☑	Pluto A20 family mapping
23	Pluto0_I16	Bool	%I25.6		☑	☑	Pluto A20 family mapping
24	Pluto0_I17	Bool	%I25.7		☑	☑	Pluto A20 family mapping
25	Pluto0_I0	Bool	%I26.0		☑	☑	Pluto A20 family mapping
26	Pluto0_I1	Bool	%I26.1		☑	☑	Pluto A20 family mapping
27	Pluto0_I2	Bool	%I26.2		☑	☑	Pluto A20 family mapping
28	Pluto0_I3	Bool	%I26.3		☑	☑	Pluto A20 family mapping
29	Pluto0_I4	Bool	%I26.4		☑	☑	Pluto A20 family mapping
30	Pluto0_I5	Bool	%I26.5		☑	☑	Pluto A20 family mapping
31	Pluto0_I6	Bool	%I26.6		☑	☑	Pluto A20 family mapping
32	Pluto0_I7	Bool	%I26.7		☑	☑	Pluto A20 family mapping
33	AD00_MSW	Word	%IW204		☑	☑	
34	AD00_LSW	Word	%IW206		☑	☑	

10 GATE-MT, Modbus TCP

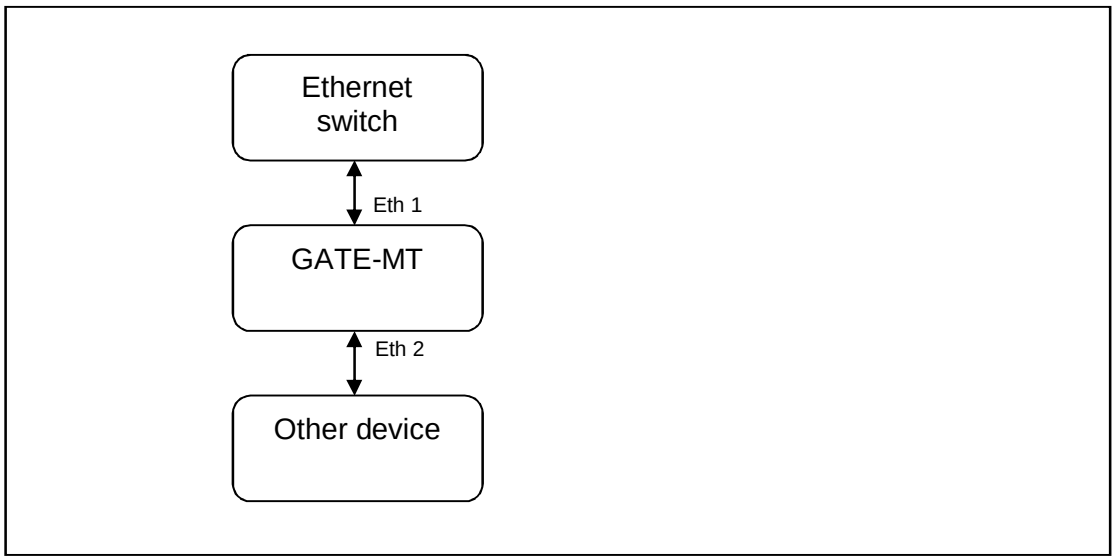
The Ethernet gateway GATE-MT is an Ethernet gateway handling the industry Modbus TCP which is defined by Modbus Organization. It is build according to,

- MODBUS Application Protocol Specification, V1.1a, June 4, 2004.
- MODBUS Messaging on TCP/IP Implementation Guide, V1.0a, June 4, 2004.
- Minimum 500 request per seconds for one steady open connection with about 1 ms response time.
- Maximum of 8 client connections.

10.1 Ethernet Connection

The gateway is connected to Ethernet network using standard Ethernet connector and cable according to chapter 4.1.3.1 and 4.1.3.2. Both Ethernet ports have the same functionality and can be connected as desired. Normally Ethernet port 1 shall be used to connect to a network switch and Ethernet port 2 can be used to connect to other Ethernet device on the network if desired.

Each port can handle connection in both 10 and 100 Mbit/s using half or full duplex. The port automatically configures the port so it can be connected without using any special cross connected cabled.



10.2 IP address configuration

The default IP address assignment for the unit is using DHCP to get an IP address on the network. If this is not working there are other ways to configure the IP address of the device, see chapter 5.2.

10.3 Status indication

On the gateway with Modbus TCP there are two dual color LEDs for status indications. They are named RUN and ERR (Error). The tables below explain the indicators status information.

10.3.1 RUN

LED		Modbus TCP	Remark
OFF			
GREEN flashing		Waiting for connection.	Flashing with 5 Hz.
GREEN steady		Connection established.	

10.3.2 ERR

LED		Modbus TCP	Remark
OFF		No error.	
RED flashing		System error.	Flashing with 2 Hz. Need device replacement.
RED steady		Communication error.	Need device replacement.

10.4 Service port information

The Modbus service is using several network ports on the device.

Port		Description
TCP	502	Modbus TCP port.

10.5 Integration and configuration

The integration of the device into a system is depending on the system controller.

By default the device uses DHCP to get its IP address and then the easiest way to get this IP address is to use the terminal interface and the “bw” command.

When the IP address is known then standard Modbus TCP communication can be setup using methods described in the appendix for Modbus TCP, see chapter 0.

In this chapter there is a sub chapter (18.6) describing the configuration of the device from the master PLC or by another controller unit. It is recommended to write the complete configuration area even only data need to be changed from the default values. This helps if replacing an existing device with a device used in other machine/system with other configuration then the default settings.

10.6 ABB AC500 integration

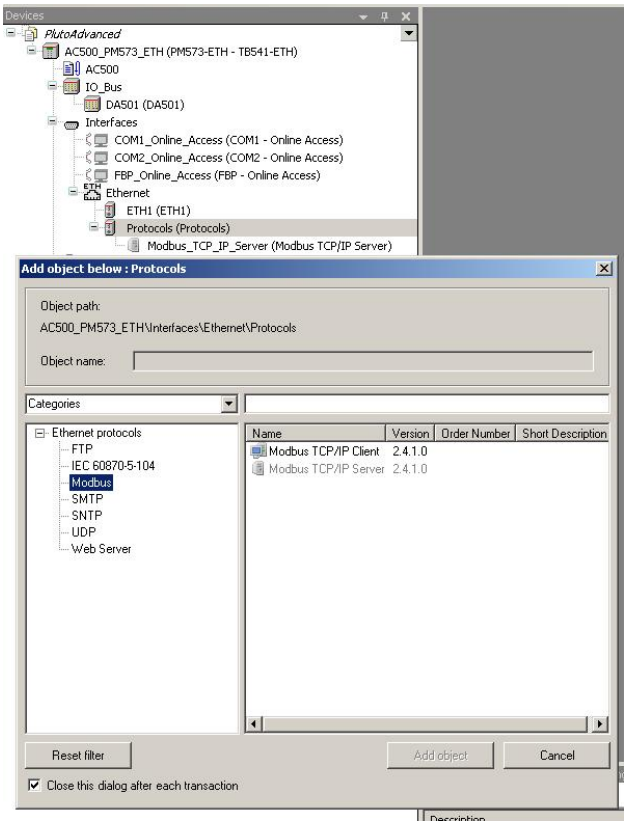
This example shows a simple implementation of the Gate-MT in an ABB AC500 PM573-ETH controller using Automation Builder V1.1.1.1717. It doesn't show error handling, it's up to the user to implement this.

The example shows, by using a simple state-machine, how the different steps are done. Configuring, reading status of Pluto units online, reading global data, reading additional data, and sending data to the Pluto, via the Gate-MT.

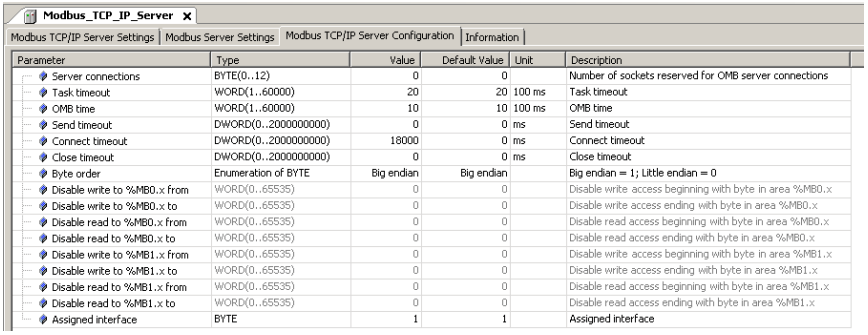
This example does not explain in detail the workings of the ABB AC500 and CoDeSys environment. For this refer to its relevant documentation.

10.6.1 Hardware configuration

Add the "Modbus_TCP_IP_Server" object to the "Ethernet-Protocols" object by using the "Add object" function. Choose "Modbus" and then "Modbus TCP/IP Server".



In this example the default setting are used.



10.6.2 CoDeSys implementation

This part will show how the gateway is read and written in the CoDeSys environment.

10.6.2.1 Structured Flow Chart Implementation

Create a Structured Flow Chart POU, Program – SFC, here named “Modbus_TCP_GateMT”.

10.6.2.1.1 Variables

The data to and from the gateway are stored in the following global variables in the CoDeSys environment.

Please note that the Packets to Pluto variable here is initialized in [0] and [1] so all packets transmitted are valid when transmitted.

```
0001 VAR_GLOBAL
0002     Status_Pluto_Units_Online:DWORD:=0;
0003     Global_Data_Pluto_Unit_0_to_31:ARRAY [0..31] OF DWORD:=0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0;
0004     Additional_Data_Area_0_to_31:ARRAY [0..31] OF DWORD:=0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0;
0005     Packets_To_Pluto_0_to_3:ARRAY [0..13] OF WORD:=14,15,0,0,0,0,0,0,0,0,0,0,0,0; (* Length, Valid packets, Packet 0, 16 bits, two 16-bit registers, etc *)
0006 END_VAR
```

The following variables are initialized in the SFC, they concern the configuration of the gateway. All of the 32 additional data areas available are set to listen to the Pluto node equal to its own designation. This means “Additional data area 00” will listen for data from Pluto node 0, “Additional data area 01” from Pluto node1, and so on. The IO type is set to 1 in all of the areas, which means they’re all listening for a block with user number 1, be it any type of “ToGateway_User_...”, A, B or C, as used in the Pluto project for each Pluto node.

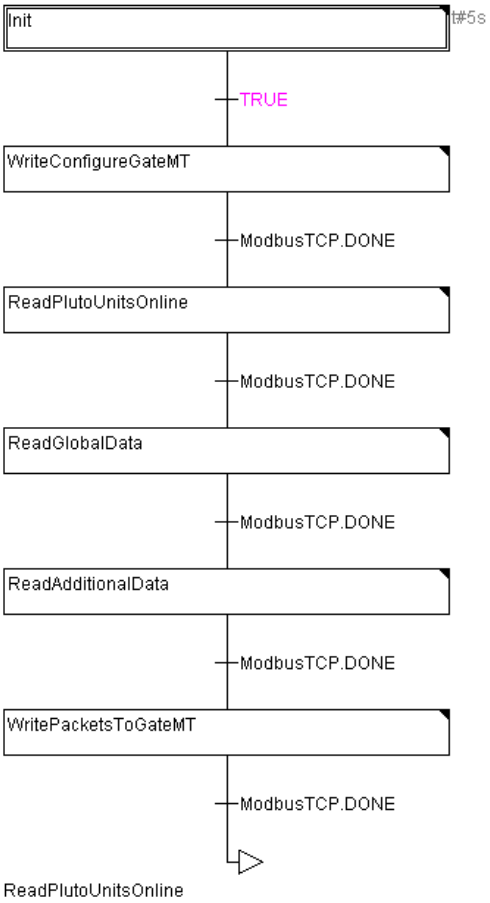
```
PROGRAM ModbusTCP_GateMT

VAR CONSTANT
        IP_Adress_Gate_MT:STRING:='192.168.0.100';(* Chosen by the user *)

        (* See Appendix F, bullet 17.6 for the structure of the configuration telegram. *)

        Length:WORD:=42; (* Length of Modbus TCP configuration telegram, do not change *)
                Enable_Data_To_Pluto_Packets:WORD:=15; (* Enables up to four packets to Pluto, value 0 to 15 decimal,
                                                          0000 (none) - 1111 (all four) binary *)
        Data_To_Pluto_Timeout:WORD:=0; (* Sets the timeout, 0 means no timeout or set to 1000 - 60000 *)
        Expected_Pluto_NodesLSW:WORD:=65535; (* Pluto nodes 0 - 15, 65535 decimal for all 0 to 15, 1111 1111 1111 1111
                                                binary, LSB is Pluto 0, MSB is Pluto 15 *)
        Expected_Pluto_NodesMSW:WORD:=65535; (* Pluto nodes 16 - 31 65535 decimal for all 16 to 31, 1111 1111 1111 1111
                                                binary, LSB is Pluto 16, MSB is Pluto 31 *)
        Additional_Data_Area_0_Pluto_Node_Number:BYTE:=0; (* High Byte is Pluto node number, Low Byte is IO type; for IO type
                                                             see bullet 4.3.3 in the Pluto gateway manual *)
        Additional_Data_Area_0_IO_Type:BYTE:=1; (* This and all 32 additional data areas below are calculated and in the Init step
                                                   and inserted into the CfgData array below *)
        Additional_Data_Area_1_Pluto_Node_Number:BYTE:=1;
        Additional_Data_Area_1_IO_Type:BYTE:=1;
        Additional_Data_Area_2_Pluto_Node_Number:BYTE:=2;
        Additional_Data_Area_2_IO_Type:BYTE:=1;
        Additional_Data_Area_3_Pluto_Node_Number:BYTE:=3;
        Additional_Data_Area_3_IO_Type:BYTE:=1;
```

```
        Additional_Data_Area_4_Pluto_Node_Number:BYTE:=4;
        Additional_Data_Area_4_IO_Type:BYTE:=1;
        Additional_Data_Area_5_Pluto_Node_Number:BYTE:=5;
        Additional_Data_Area_5_IO_Type:BYTE:=1;
        Additional_Data_Area_6_Pluto_Node_Number:BYTE:=6;
        Additional_Data_Area_6_IO_Type:BYTE:=1;
        Additional_Data_Area_7_Pluto_Node_Number:BYTE:=7;
        Additional_Data_Area_7_IO_Type:BYTE:=1;
        Additional_Data_Area_8_Pluto_Node_Number:BYTE:=8;
        Additional_Data_Area_8_IO_Type:BYTE:=1;
        Additional_Data_Area_9_Pluto_Node_Number:BYTE:=9;
        Additional_Data_Area_9_IO_Type:BYTE:=1;
        Additional_Data_Area_10_Pluto_Node_Number:BYTE:=10;
        Additional_Data_Area_10_IO_Type:BYTE:=1;
        Additional_Data_Area_11_Pluto_Node_Number:BYTE:=11;
        Additional_Data_Area_11_IO_Type:BYTE:=1;
        Additional_Data_Area_12_Pluto_Node_Number:BYTE:=12;
        Additional_Data_Area_12_IO_Type:BYTE:=1;
        Additional_Data_Area_13_Pluto_Node_Number:BYTE:=13;
        Additional_Data_Area_13_IO_Type:BYTE:=1;
        Additional_Data_Area_14_Pluto_Node_Number:BYTE:=14;
        Additional_Data_Area_14_IO_Type:BYTE:=1;
        Additional_Data_Area_15_Pluto_Node_Number:BYTE:=15;
        Additional_Data_Area_15_IO_Type:BYTE:=1;
        Additional_Data_Area_16_Pluto_Node_Number:BYTE:=16;
        Additional_Data_Area_16_IO_Type:BYTE:=1;
        Additional_Data_Area_17_Pluto_Node_Number:BYTE:=17;
        Additional_Data_Area_17_IO_Type:BYTE:=1;
        Additional_Data_Area_18_Pluto_Node_Number:BYTE:=18;
        Additional_Data_Area_18_IO_Type:BYTE:=1;
        Additional_Data_Area_19_Pluto_Node_Number:BYTE:=19;
        Additional_Data_Area_19_IO_Type:BYTE:=1;
        Additional_Data_Area_20_Pluto_Node_Number:BYTE:=20;
        Additional_Data_Area_20_IO_Type:BYTE:=1;
        Additional_Data_Area_21_Pluto_Node_Number:BYTE:=21;
        Additional_Data_Area_21_IO_Type:BYTE:=1;
        Additional_Data_Area_22_Pluto_Node_Number:BYTE:=22;
        Additional_Data_Area_22_IO_Type:BYTE:=1;
        Additional_Data_Area_23_Pluto_Node_Number:BYTE:=23;
        Additional_Data_Area_23_IO_Type:BYTE:=1;
        Additional_Data_Area_24_Pluto_Node_Number:BYTE:=24;
        Additional_Data_Area_24_IO_Type:BYTE:=1;
        Additional_Data_Area_25_Pluto_Node_Number:BYTE:=25;
        Additional_Data_Area_25_IO_Type:BYTE:=1;
        Additional_Data_Area_26_Pluto_Node_Number:BYTE:=26;
        Additional_Data_Area_26_IO_Type:BYTE:=1;
        Additional_Data_Area_27_Pluto_Node_Number:BYTE:=27;
        Additional_Data_Area_27_IO_Type:BYTE:=1;
        Additional_Data_Area_28_Pluto_Node_Number:BYTE:=28;
        Additional_Data_Area_28_IO_Type:BYTE:=1;
        Additional_Data_Area_29_Pluto_Node_Number:BYTE:=29;
        Additional_Data_Area_29_IO_Type:BYTE:=1;
        Additional_Data_Area_30_Pluto_Node_Number:BYTE:=30;
        Additional_Data_Area_30_IO_Type:BYTE:=1;
        Additional_Data_Area_31_Pluto_Node_Number:BYTE:=31;
        Additional_Data_Area_31_IO_Type:BYTE:=1;
        Data_To_Pluto_Cycle_Time:WORD:=100; (* How often in ms the value is sent to the Pluto bus, lower value means high bus
                                                load, value 4 - 255 *)
        NotUsed0:WORD:=0;
        NotUsed1:WORD:=0;
        NotUsed2:WORD:=0;
        Gateway_Node_Address:WORD:=0; (* Value between 0-15, can also be set by DIP switch on the gateway *)
END_VAR

VAR
        ModbusTCP: ETH_MOD_MAST;
        CfgData:ARRAY [0..41] OF WORD:=
        Length,
        Enable_Data_To_Pluto_Packets,
        Data_To_Pluto_Timeout,
        Expected_Pluto_NodesMSW,
        Expected_Pluto_NodesLSW,
        0, (* Here and below follows the 32 (0 - 31) additional data areas available in the Gate-MT *)
        0, (* The value is calculated in the Init step and inserted into the CfgData but they need to be initialised, set to zero *)
        0, (* The value depends on the Additional_Data_Area_X_Pluto_Node_Number and
                Additional_Data_Area_X_IO_Type above *)
        0, (* Where X is 0 - 31 *)
        0,
        0,
```

```
        0,
        0,
        0,
        0,
        0,
        0,
        0,
        0,
        0,
        0,
        0,
        0,
        0,
        0,
        0,
        0,
        0,
        0,
        0,
        0,
        0,
        0,
        0,
        0,
        0,
        0,
        0,
        0,
        0,
        Data_To_Pluto_Cycle_Time,
        NotUsed0,
        NotUsed1,
        NotUsed2,
        Gateway_Node_Address;

END_VAR
```

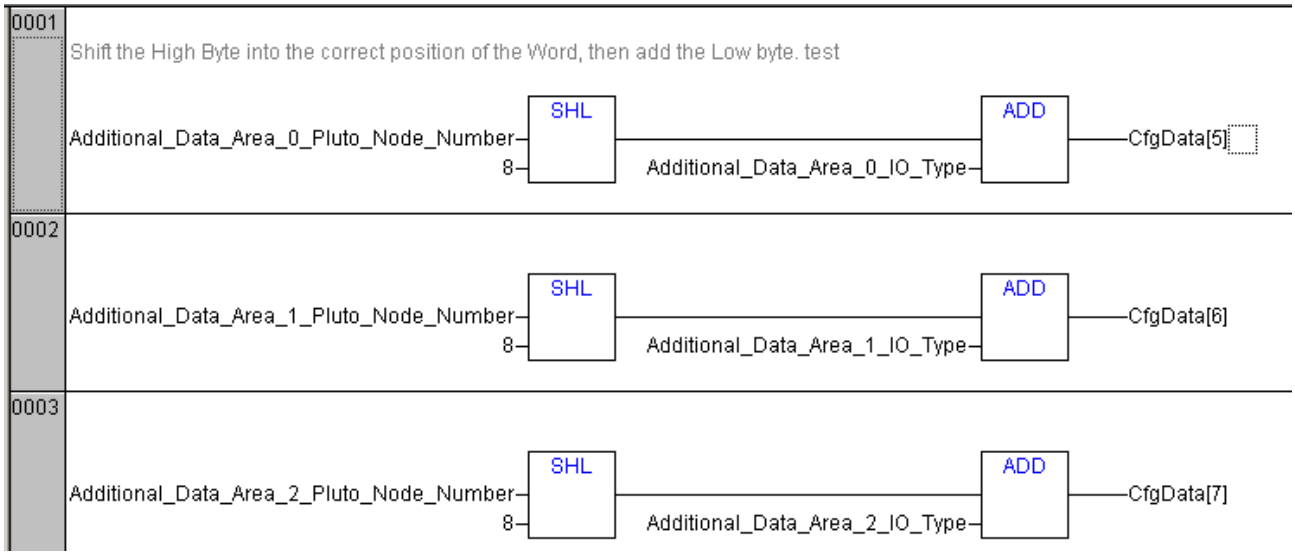
10.6.2.1.2 Structured Flow chart steps

The flow the state-machine works through, the user is advised to remove parts that will not be used as he sees fit. A configuration is always recommended to implement.



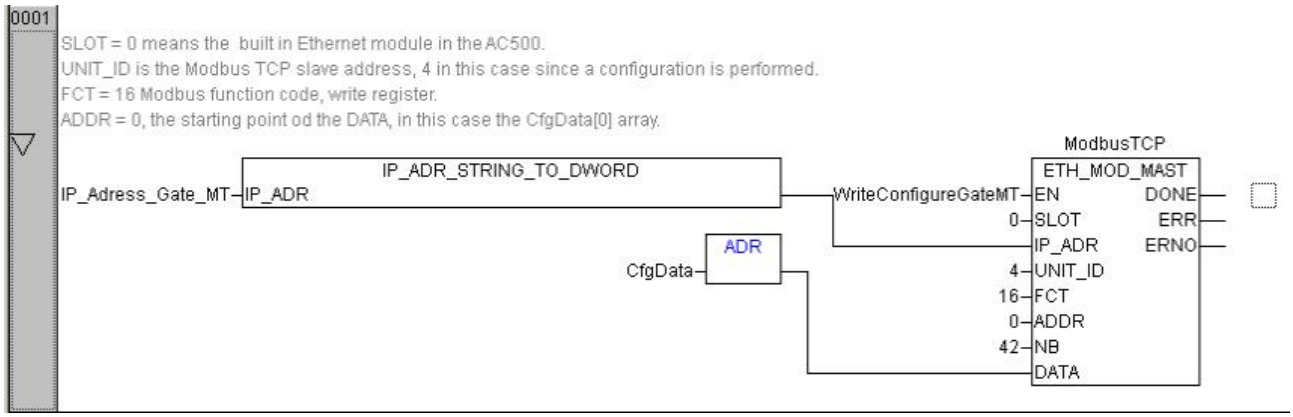
10.6.2.1.3 Init step

This step takes the contents of the variables initialized above and puts in the correct place in the configuration array, CfgData.



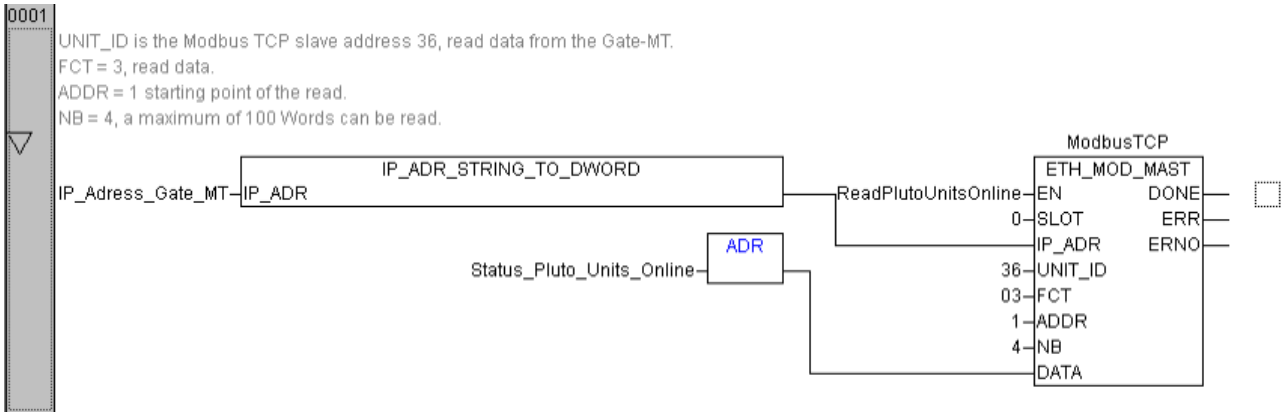
10.6.2.1.4 Configuration step, Write

This step used the “ETH_MOD_MAST” block available in the CoDeSys environment. It is setup according to the rules described in Appendix F, bullet 17.6.



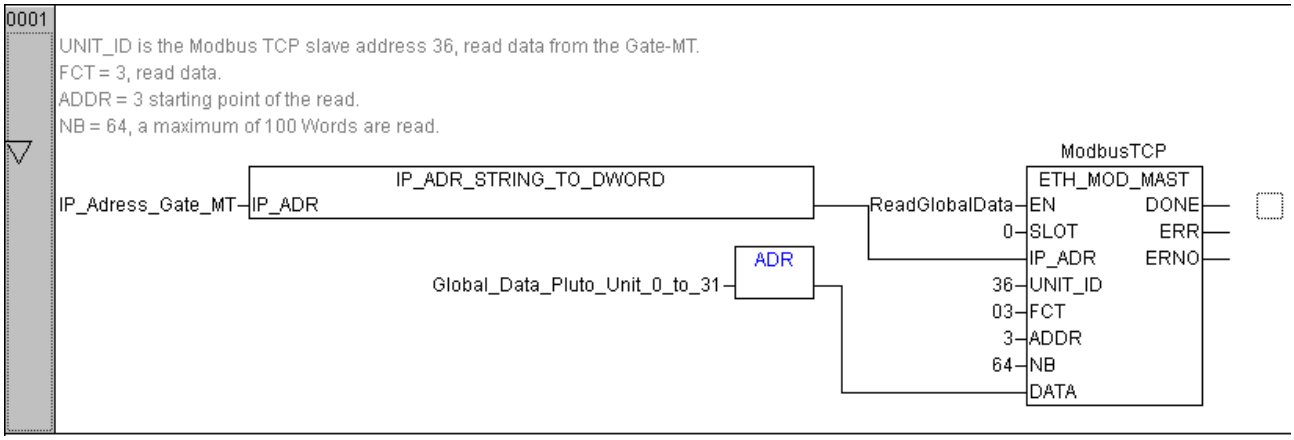
10.6.2.1.5 Pluto units online, Read

Reads which Pluto unit nodes are online on the Pluto bus.



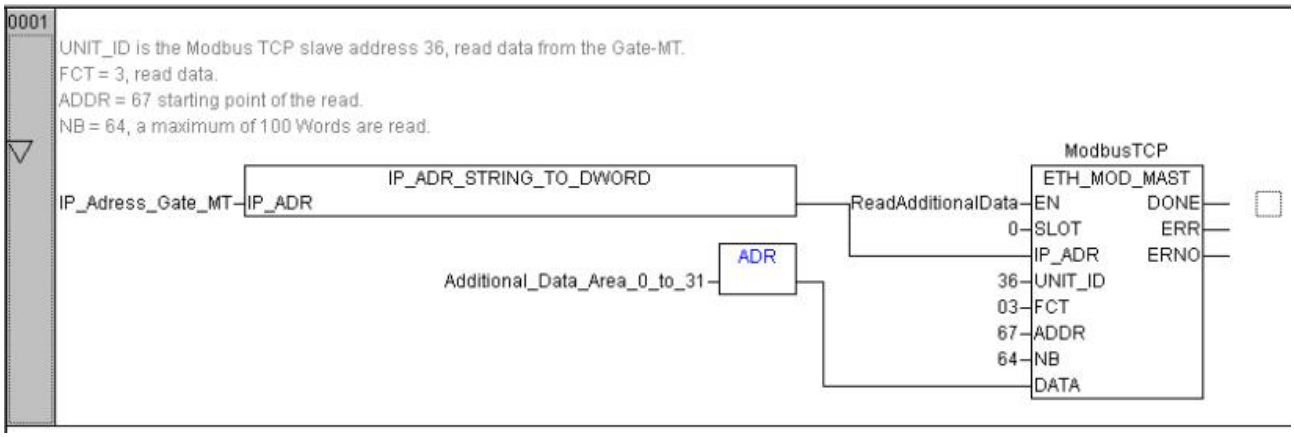
10.6.2.1.6 Global Data, Read

Reads the global data of all Pluto units available on the Pluto bus, the data which all units always transmit. Nothing needs to be configured in the Pluto unit.



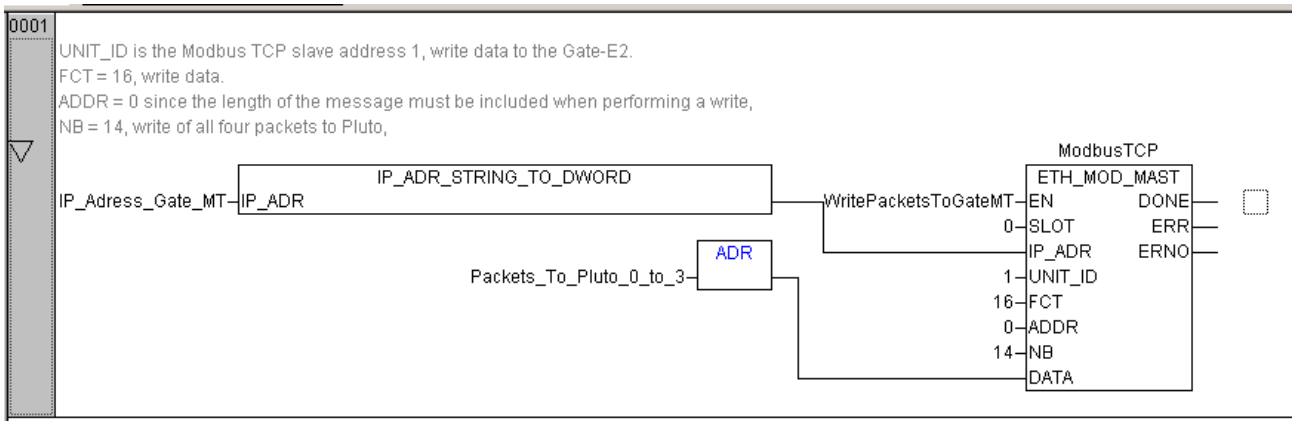
10.6.2.1.7 Additional Data, Read

Reads the additional data that is transmitted on the Pluto bus by the Pluto units. The Pluto project needs to be setup using the “Ext01.fps” block library and use a suitable block from that library.



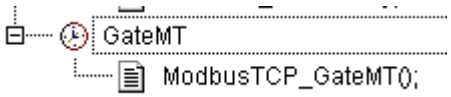
10.6.2.1.8 Packets to Pluto, Write

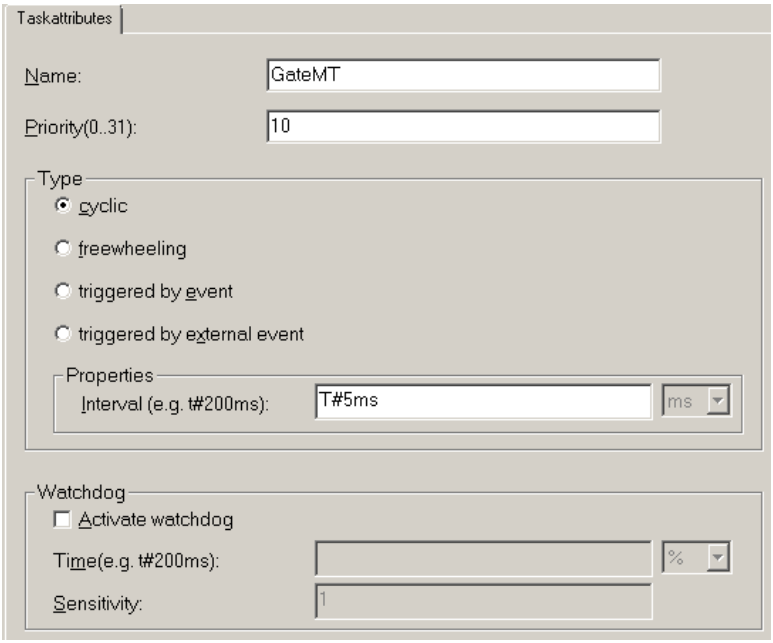
Used to transmit data to the Pluto units, via the gateway onto the Pluto bus. The Pluto unit that wishes to pick up the packet needs to be configured to do so. See the Pluto chapter.

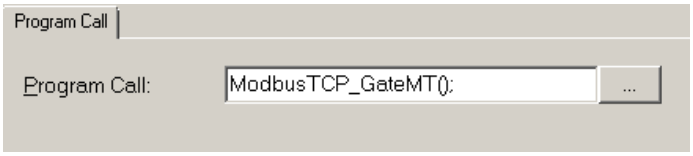


10.6.2.2 Task configuration

Create a task under; Resources – Task configuration, calling the SFC POU at a suitable interval, for example as shown in the pictures.







11 Data to/from Pluto

This chapter will describe the different type of data sent to/from Pluto via the gateway. It will also be the reference chapter regarding encoding of the data.

11.1 Pluto Status

The size of this module is 4 bytes or 2 words. These data contain information about which Pluto units that are active on the Pluto bus. When a Pluto is active the corresponding bit is set to “1”.

The coding of the status data in byte is,

Byte	MSB							LSB
0	Pluto 7	Pluto 6	Pluto 5	Pluto 4	Pluto 3	Pluto 2	Pluto 1	Pluto 0
1	Pluto 15	Pluto 14	Pluto 13	Pluto 12	Pluto 11	Pluto 10	Pluto 9	Pluto 8
2	Pluto 23	Pluto 22	Pluto 21	Pluto 20	Pluto 19	Pluto 18	Pluto 17	Pluto 16
3	Pluto 31	Pluto 30	Pluto 29	Pluto 28	Pluto 27	Pluto 26	Pluto 25	Pluto 24

11.2 Global Data from Pluto

When selected, the global Pluto variables are always transferred. There are 32 global Pluto variables from each Pluto and they are always available on the Pluto bus, 1024 for a full net with 32 Pluto. All variables are bit variables.

The size of this module is 4 bytes or 2 words. Pluto global variables are of different types and are depending on which type of Pluto the data is coming from. The table below list different type of variables and the following tables list the layout of data from different type of Pluto:

Ix.y	Inputs data port y from Pluto x.
Qx.y	Safety outputs port y from Pluto x.
GMx.y	Global memories y from Pluto x.
ASIx.y	Input AS-i safety slave y from Pluto x.

The coding of the Pluto variables for A20 and Double family in byte is,

Byte	MSB							LSB
0	Ix.7	Ix.6	Ix.5	Ix.4	Ix.3	Ix.2	Ix.1	Ix.0
1	Ix.17	Ix.16	Ix.15	Ix.14	Ix.13	Ix.12	Ix.11	Ix.10
2	GMx.3	GMx.2	GMx.1	GMx.0	Qx.3	Qx.2	Qx.1	Qx.0
3	GMx.11	GMx.10	GMx.9	GMx.8	GMx.7	GMx.6	GMx.5	GMx.4

x is Pluto node number.

The coding of the status variables for Pluto AS-i family in byte is,

Byte	MSB							LSB
0	ASIx.7	ASIx.6	ASIx.5	ASIx.4	ASIx.3	ASIx.2	ASIx.1	Ix.0
1	ASIx.15	ASIx.14	ASIx.13	ASIx.12	ASIx.11	ASIx.10	ASIx.9	ASIx.8
2	GMx.3	GMx.2	GMx.1	GMx.0	Qx.3	Qx.2	Qx.1	Qx.0
3	GMx.11	GMx.10	GMx.9	GMx.8	GMx.7	GMx.6	GMx.5	GMx.4

x is Pluto node number and ASIx.y is the safety node y.

The coding of the Pluto variables for Pluto B42 AS-i in byte is,

Byte	MSB							LSB
0	GMx.3	GMx.2	GMx.1	GMx.0	Ix.3	Ix.2	Ix.1	Ix.0
1	GMx.11	GMx.10	GMx.9	GMx.8	GMx.7	GMx.6	GMx.5	GMx.4
2	GMx.19	GMx.18	GMx.17	GMx.16	GMx.15	GMx.14	GMx.13	GMx.12
3	GMx.27	GMx.26	GMx.25	GMx.24	GMx.23	GMx.22	GMx.21	GMx.20

x is Pluto node number.

The coding of the Pluto variables for Pluto O2 in byte is,

Byte	MSB							LSB
0	-	-	-	-	-	-	Ix.1	Ix.0
1	-	-	-	-	-	-	Ix.11	Ix.10
2	GMx.3	GMx.2	GMx.1	GMx.0	-	-	Qx.1	Qx.0
3	GMx.11	GMx.10	GMx.9	GMx.8	GMx.7	GMx.6	GMx.5	GMx.4

x is Pluto node number.

11.3 Additional Data from Pluto

Every Pluto on the Pluto bus can send out additional data blocks where each block has:

- The Pluto node number.
- An IO-type number (for user block a user identity number).
  - 0 (zero) data is not used.
  - 1-99 are user defined numbers used at the additional data blocks in PLC code.
  - ≥100 are standard additional data types (see tables below).
  - 111 are IO-type for Pluto global data.
- 32 bit of data according to IO-type.

The configuration of the additional data is normally done using application objects on the industry protocol from the connected PLC system. It can also be done via the terminal port using commands according to chapter 5.5.

11.3.1 Layout of additional data

All blocks which can be used in the Pluto PLC program for sending additional data are listed below.

> **Note:** For the user defined blocks each block in each Pluto must be allocated a unique number between 1 and 99 (on input “No”) to identify the data block. This number is then used to identify the block in the receiving field bus system.

The standard blocks have defined data.

11.3.1.1 User defined blocks

User defined “ToGateway_User_A” (ToGateway_UserNumber_x),

Byte	MSB							LSB
0	Reg_0.7	Reg_0.6	Reg_0.5	Reg_0.4	Reg_0.3	Reg_0.2	Reg_0.1	Reg_0.0
1	Reg_0.15	Reg_0.14	Reg_0.13	Reg_0.12	Reg_0.11	Reg_0.10	Reg_0.9	Reg_0.8
2	Reg_1.7	Reg_1.6	Reg_1.5	Reg_1.4	Reg_1.3	Reg_1.2	Reg_1.1	Reg_1.0
3	Reg_1.15	Reg_1.14	Reg_1.13	Reg_1.12	Reg_1.11	Reg_1.10	Reg_1.9	Reg_1.8

Unique user number (x) set in block.

User defined “ToGateway_User_B” (ToGateway_UserNumber_x),

Byte	MSB							LSB
0	Reg_0.7	Reg_0.6	Reg_0.5	Reg_0.4	Reg_0.3	Reg_0.2	Reg_0.1	Reg_0.0
1	Reg_0.15	Reg_0.14	Reg_0.13	Reg_0.12	Reg_0.11	Reg_0.10	Reg_0.9	Reg_0.8
2	Bit_7	Bit_6	Bit_5	Bit_4	Bit_3	Bit_2	Bit_1	Bit_0
3	Pluto Error Code							

Unique user number (x) set in block.

User defined “ToGateway_User_C” (ToGateway_UserNumber_x),

Byte	MSB							LSB
0	Reg_0.7	Reg_0.6	Reg_0.5	Reg_0.4	Reg_0.3	Reg_0.2	Reg_0.1	Reg_0.0
1	Reg_0.15	Reg_0.14	Reg_0.13	Reg_0.12	Reg_0.11	Reg_0.10	Reg_0.9	Reg_0.8
2	Bit_7	Bit_6	Bit_5	Bit_4	Bit_3	Bit_2	Bit_1	Bit_0
3	Bit_15	Bit_14	Bit_13	Bit_12	Bit_11	Bit_10	Bit_9	Bit_8

Unique user number (x) set in block.

11.3.1.2 Standard blocks

Standard "ToGateway_ErrorCode" (IO-type number 100, 0x64),

Byte	MSB							LSB
0	-	-	-	-	-	-	-	-
1	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-
3	Pluto Error Code							

The '-' character indicate undefined value.

Standard "ToGateway_B46_I20_I47" (IO-type number 101, 0x65),

Byte	MSB							LSB
0	Ix.27	Ix.26	Ix.25	Ix.24	Ix.23	Ix.22	Ix.21	Ix.20
1	Ix.37	Ix.36	Ix.35	Ix.34	Ix.33	Ix.32	Ix.31	Ix.30
2	Ix.47	Ix.46	Ix.45	Ix.44	Ix.43	Ix.42	Ix.41	Ix.40
3	Pluto Error Code							

Standard "ToGateway_ASi_16_31_Safe" (IO-type number 102, 0x66),

Byte	MSB							LSB
0	Ix.13*	Ix.12*	Ix.11*	Ix.10*	Ix.3*	Ix.2*	Ix.1*	-
1	ASIx.23	ASIx.22	ASIx.21	ASIx.20	ASIx.19	ASIx.18	ASIx.17	ASIx.16
2	ASIx.31	ASIx.30	ASIx.29	ASIx.28	ASIx.27	ASIx.26	ASIx.25	ASIx.24
3	Pluto Error Code							

*For B42 AS-i: Undefined
ASIx.y is safety slave y from Pluto AS-i unit (x is Pluto node number).
The '-' character indicates undefined value.

Standard "ToGateway_ASi_1_3_NonSafe_In" (IO-type number 103, 0x67),

Byte	MSB							LSB
0	-	-	-	-	-	-	-	-
1	Ax.1B.4	Ax.1B.3	Ax.1B.2	Ax.1B.1	Ax.1.4	Ax.1.3	Ax.1.2	Ax.1.1
2	Ax.2B.4	Ax.2B.3	Ax.2B.2	Ax.2B.1	Ax.2.4	Ax.2.3	Ax.2.2	Ax.2.1
3	Ax.3B.4	Ax.3B.3	Ax.3B.2	Ax.3B.1	Ax.3.4	Ax.3.3	Ax.3.2	Ax.3.1

ASIx.<slave>.<bit> from Pluto x.
The '-' character indicate undefined value.

Standard "ToGateway_ASi_4_7_NonSafe_In" (IO-type number 104, 0x68),

Byte	MSB							LSB
0	Ax.4B.4	Ax.4B.3	Ax.4B.2	Ax.4B.1	Ax.4.4	Ax.4.3	Ax.4.2	Ax.4.1
1	Ax.5B.4	Ax.5B.3	Ax.5B.2	Ax.5B.1	Ax.5.4	Ax.5.3	Ax.5.2	Ax.5.1
2	Ax.6B.4	Ax.6B.3	Ax.6B.2	Ax.6B.1	Ax.6.4	Ax.6.3	Ax.6.2	Ax.6.1
3	Ax.7B.4	Ax.7B.3	Ax.7B.2	Ax.7B.1	Ax.7.4	Ax.7.3	Ax.7.2	Ax.7.1

ASIx.<slave>.<bit> from Pluto x.

Standard “ToGateway_ASi_8_11_NonSafe_In” (IO-type number 105, 0x69),

Byte	MSB							LSB
0	Ax.8B.4	Ax.8B.3	Ax.8B.2	Ax.8B.1	Ax.8.4	Ax.8.3	Ax.8.2	Ax.8.1
1	Ax.9B.4	Ax.9B.3	Ax.9B.2	Ax.9B.1	Ax.9.4	Ax.9.3	Ax.9.2	Ax.9.1
2	Ax.10B.4	Ax.10B.3	Ax.10B.2	Ax.10B.1	Ax.10.4	Ax.10.3	Ax.10.2	Ax.10.1
3	Ax.11B.4	Ax.11B.3	Ax.11B.2	Ax.11B.1	Ax.11.4	Ax.11.3	Ax.11.2	Ax.11.1

ASIx.<slave>.<bit> from Pluto x.

Standard “ToGateway_ASi_12_15_NonSafe_In” (IO-type number 106, 0x6A),

Byte	MSB							LSB
0	Ax.12B.4	Ax.12B.3	Ax.12B.2	Ax.12B.1	Ax.12.4	Ax.12.3	Ax.12.2	Ax.12.1
1	Ax.13B.4	Ax.13B.3	Ax.13B.2	Ax.13B.1	Ax.13.4	Ax.13.3	Ax.13.2	Ax.13.1
2	Ax.14B.4	Ax.14B.3	Ax.14B.2	Ax.14B.1	Ax.14.4	Ax.14.3	Ax.14.2	Ax.14.1
3	Ax.15B.4	Ax.15B.3	Ax.15B.2	Ax.15B.1	Ax.15.4	Ax.15.3	Ax.15.2	Ax.15.1

ASIx.<slave>.<bit> from Pluto x.

Standard “ToGateway_ASi_16_19_NonSafe_In” (IO-type number 107, 0x6B),

Byte	MSB							LSB
0	Ax.16B.4	Ax.16B.3	Ax.16B.2	Ax.16B.1	Ax.16.4	Ax.16.3	Ax.16.2	Ax.16.1
1	Ax.17B.4	Ax.17B.3	Ax.17B.2	Ax.17B.1	Ax.17.4	Ax.17.3	Ax.17.2	Ax.17.1
2	Ax.18B.4	Ax.18B.3	Ax.18B.2	Ax.18B.1	Ax.18.4	Ax.18.3	Ax.18.2	Ax.18.1
3	Ax.19B.4	Ax.19B.3	Ax.19B.2	Ax.19B.1	Ax.19.4	Ax.19.3	Ax.19.2	Ax.19.1

ASIx.<slave>.<bit> from Pluto x.

Standard “ToGateway_ASi_20_23_NonSafe_In” (IO-type number 108, 0x6C),

Byte	MSB							LSB
0	Ax.20B.4	Ax.20B.3	Ax.20B.2	Ax.20B.1	Ax.20.4	Ax.20.3	Ax.20.2	Ax.20.1
1	Ax.21B.4	Ax.21B.3	Ax.21B.2	Ax.21B.1	Ax.21.4	Ax.21.3	Ax.21.2	Ax.21.1
2	Ax.22B.4	Ax.22B.3	Ax.22B.2	Ax.22B.1	Ax.22.4	Ax.22.3	Ax.22.2	Ax.22.1
3	Ax.23B.4	Ax.23B.3	Ax.23B.2	Ax.23B.1	Ax.23.4	Ax.23.3	Ax.23.2	Ax.23.1

ASIx.<slave>.<bit> from Pluto x.

Standard “ToGateway_ASi_24_27_NonSafe_In” (IO-type number 109, 0x6D),

Byte	MSB							LSB
0	Ax.24B.4	Ax.24B.3	Ax.24B.2	Ax.24B.1	Ax.24.4	Ax.24.3	Ax.24.2	Ax.24.1
1	Ax.25B.4	Ax.25B.3	Ax.25B.2	Ax.25B.1	Ax.25.4	Ax.25.3	Ax.25.2	Ax.25.1
2	Ax.26B.4	Ax.26B.3	Ax.26B.2	Ax.26B.1	Ax.26.4	Ax.26.3	Ax.26.2	Ax.26.1
3	Ax.27B.4	Ax.27B.3	Ax.27B.2	Ax.27B.1	Ax.27.4	Ax.27.3	Ax.27.2	Ax.27.1

ASIx.<slave>.<bit> from Pluto x.

Standard “ToGateway_ASi_28_31_NonSafe_In” (IO-type number 110, 0x6E),

Byte	MSB							LSB
0	Ax.28B.4	Ax.28B.3	Ax.28B.2	Ax.28B.1	Ax.28.4	Ax.28.3	Ax.28.2	Ax.28.1
1	Ax.29B.4	Ax.29B.3	Ax.29B.2	Ax.29B.1	Ax.29.4	Ax.29.3	Ax.29.2	Ax.29.1
2	Ax.30B.4	Ax.30B.3	Ax.30B.2	Ax.30B.1	Ax.30.4	Ax.30.3	Ax.30.2	Ax.30.1
3	Ax.31B.4	Ax.31B.3	Ax.31B.2	Ax.31B.1	Ax.31.4	Ax.31.3	Ax.31.2	Ax.31.1

ASIx.<slave>.<bit> from Pluto x.

Standard “GLOBAL DATA” (IO-type number 111, 0x6F),

Byte	MSB							LSB
0	See 11.2							
1								
2								
3								

Standard “ToGateway_B42_ASi_I20_I47” (IO-type number 112, 0x70),

Byte	MSB							LSB
0	Ix.27	Ix.26	Ix.25	Ix.24	Ix.23	Ix.22	Ix.21	Ix.20
1	Ix.37	Ix.36	Ix.35	Ix.34	Ix.33	Ix.32	Ix.31	Ix.30
2	Ix.47	Ix.46	Ix.45	Ix.44	Ix.43	Ix.42	Ix.41	Ix.40
3	Pluto Error Code							

Standard “ToGateway_ASi_1_15_Safe” (IO-type number 113, 0x71),

Byte	MSB							LSB
0	Ix.17	Ix.16	Ix.15	Ix.14	Ix.13	Ix.12	Ix.11	Ix.10
1	ASIx.7	ASIx.6	ASIx.5	ASIx.4	ASIx.3	ASIx.2	ASIx.1	0
2	ASIx.15	ASIx.14	ASIx.13	ASIx.12	ASIx.11	ASIx.10	ASIx.9	ASIx.8
3	Pluto Error Code							

ASIx.y is safety slave y from Pluto AS-i unit (x is Pluto node number).

Standard “ToGateway_D45_I20_I47” (IO-type number 114, 0x71),

Byte	MSB							LSB
0	0	Ix.26	Ix.25	Ix.24	Ix.23	Ix.22	Ix.21	Ix.20
1	Ix.37	Ix.36	Ix.35	Ix.34	Ix.33	Ix.32	Ix.31	Ix.30
2	Ix.47	Ix.46	Ix.45	Ix.44	Ix.43	Ix.42	Ix.41	Ix.40
3	Pluto Error Code							

11.3.2 Programming in Pluto PLC

11.3.2.1 Function block library

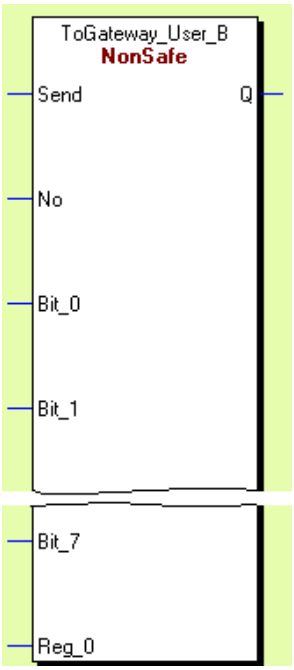
To use the function “Additional data from Pluto” the function block library “Ext01_1.fps” must be selected. The library contains all blocks listed above (11.3.1.1 and11.3.1.2).

11.3.2.2 Use of the function blocks

As described before there are standard blocks and user defined blocks. The standard blocks have a fixed content as for example “ToGateway_B46_I20_I47” transmitting the local inputs and error code of a Pluto B46. The user defined blocks have inputs for bit variables (M, I, Q...) and registers which makes it possible for the user to compose his own telegram.

Example of a standard block. Transmission of AS-i slave inputs 16-31 and error code.

Each block generates a CAN telegram on the Pluto bus. In order to control and limit bus load and execution time all blocks have an input named “Send”. When the input conditions for “Send” are true (1) the block transmits a telegram. All blocks have also an output “Q” which is high (1) by transmission and can for example be used for inhibiting other blocks to transmit.



Example of a user defined block: Transmission of 8 bits and one register.
***Note:** Each block in each Pluto shall have its unique number in input **“**No”.*

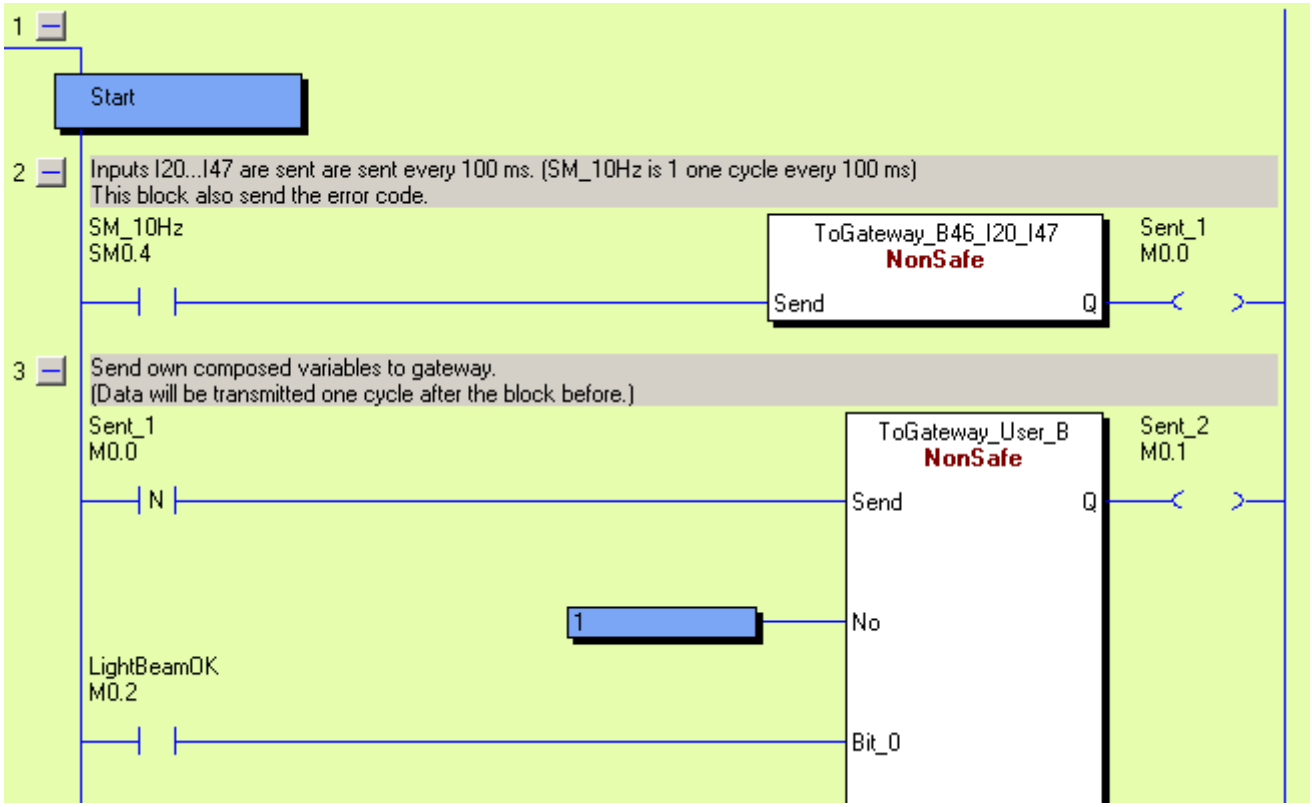
If “Send” is continuously activated a CAN message is transmitted every 10 ms which of course will give the best performance in reaction time. If there is need for limiting the transmission depends on how many Pluto units there are on the bus and how many of these blocks are used.

Note: Pluto can only send 4 telegrams every PLC cycle.

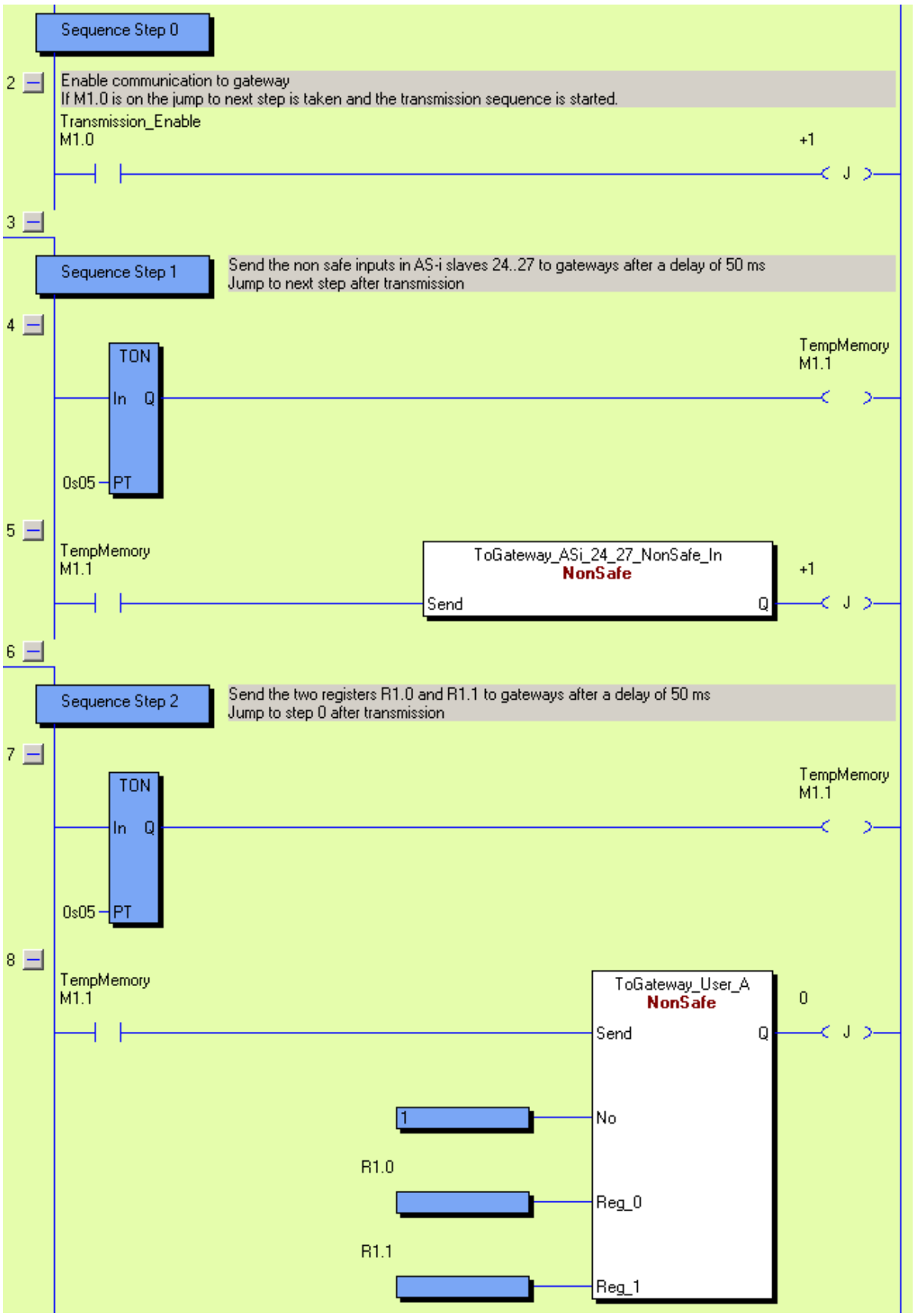
Note: The gateway has **300 ms** timeout on additional data. Therefore data from Pluto shall be sent with maximum 250 ms interval when if for example TON is used (see example below).

11.3.2.3 Example of usage in Pluto program

The following two examples show how transmission rate can be controlled in order to limit the CAN bus load and program execution time in Pluto.



Example 1: Transmission of local IO:s in a Pluto B46 user defined block.
The input "Send" in the first block is connected to the system memory for 10Hz to decrease the CAN bus load to 1 telegram / 100ms.
The second block will be transmitted one PLC cycle after the first because "Send" is connected to negative edge of Sent_1.



Example for transmission from a Pluto AS-i sequence. The transmission can be enabled by memory M0.0 in sequence 0 then a telegram will be transmitted every 50 ms.
This is a recommended method when a lot of blocks are used since it limits the CAN bus load and the Pluto do not need to execute the code in inactive sequence steps.

11.4 Data to Pluto

A gateway can totally transfer 64 bit variables and 8 registers from other field buses to the Pluto bus. The area “Data to Pluto” is divided into four packets each with16 bit variables and two registers and is organized according to the table below.

To Pluto Area Packet	Type	Data
0	Bit (16 bits)	Bit variables 0…15
	Register (16 bits)	Register 0
	Register (16 bits)	Register 1
1	Bit (16 bits)	Bit variables 0…15
	Register (16 bits)	Register 0
	Register (16 bits)	Register 1
2	Bit (16 bits)	Bit variables 0…15
	Register (16 bits)	Register 0
	Register (16 bits)	Register 1
3	Bit (16 bits)	Bit variables 0…15
	Register (16 bits)	Register 0
	Register (16 bits)	Register 1

11.4.1 Enable bit

A PLC system on the field bus can enable the usage of 0 to 4 of the packets for Data to Pluto, for example enable the gateway to transfer the data in packet 0 and 1 to the units on the Pluto bus. The gateway then transmits one packet in one CAN telegram.

11.4.2 Cyclic transmission time

The gateway will transmit each data packet cyclically every 100 ms to the Pluto bus. The time interval is 4 – 255 ms with a default value of 100 ms.

Note: Low cycle time will load the Pluto bus more.
Therefore this value shall not be set lower than needed and with consideration of the load of the Pluto bus.

11.4.3 Timeout time

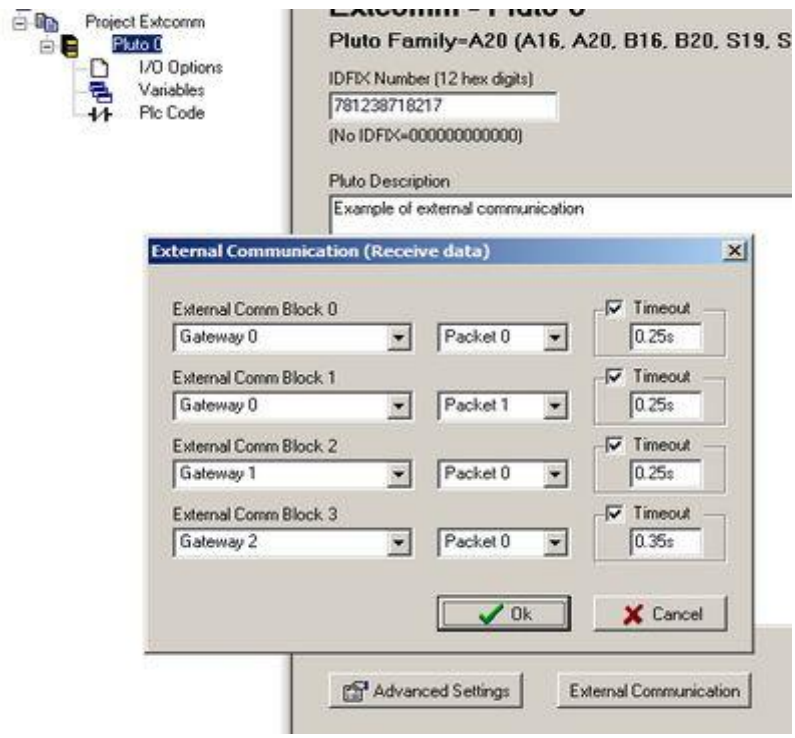
A PLC system on the field bus can also set a timeout value time in the range of 0 – 60000 ms. The default value is **0** which is the same as **no timeout**. If the gateway does not receive data telegrams from the field bus within the timeout time the data will be cleared and the gateway will transmit “0”.

11.5 In PLUTO - Reception of external data from gateway

A PLUTO has a corresponding data area for external communication divided in four data blocks which enables each PLUTO unit to receive four packets of data from different sources e.g. four different gateways. A data block in a PLUTO is programmed to receive data from a certain gateway node number (0 – 15) and a certain packet number (0 – 15).

11.5.1 Set up in PLUTO for reception

For each PLUTO which shall receive data from a gateway, a setup must be made to decide from where the data comes. If the same gateway shall send to more than one block it must send in two different packets. (One packet is one CAN telegram).



Example of setup in Pluto for reception of external data from three different gateways.

Note: The timeout shall be greater than the gateway cycle time which has a default value of 100 ms, see chapter 11.4.2.

11.5.2 Addressing of external data in Pluto

In the PLUTO the variables are numbered according to the following table.

Data block	Data in Pluto
External Comm Block 0	Data bit 0…15
	Reg 0
	Reg 1
External Comm Block 1	Data bit 16…31
	Reg 2
	Reg 3
External Comm Block 2	Data bit 32…47
	Reg 4
	Reg 5
External Comm Block 3	Data bit 48…63
	Reg 6
	Reg 7

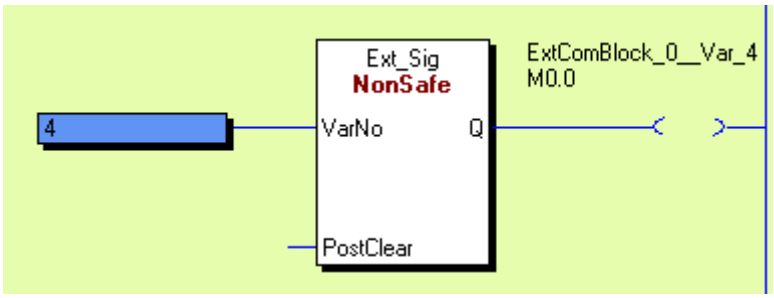
11.5.3 Connection of external variables in PLC code

When the setup in “External Communication” is made the data can be used in the PLC code. Then there are function blocks for linking the variables to the ordinary PLC variables M, Q, GM or R. The blocks are available in the library “Ext01.fps” which must be selected.

The function library Ext01.fps must be selected

11.5.3.1 Function block ”Ext_Sig”

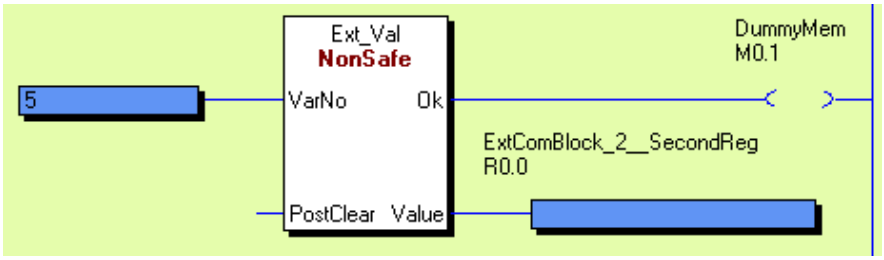
The function block Ext_Sig links the data bits to the PLC code.



Reception of Data bit 4 (located in Data block 0).

11.5.3.2 Function block ”Ext_Val”

The function block Ext_Val links the registers to the PLC code.

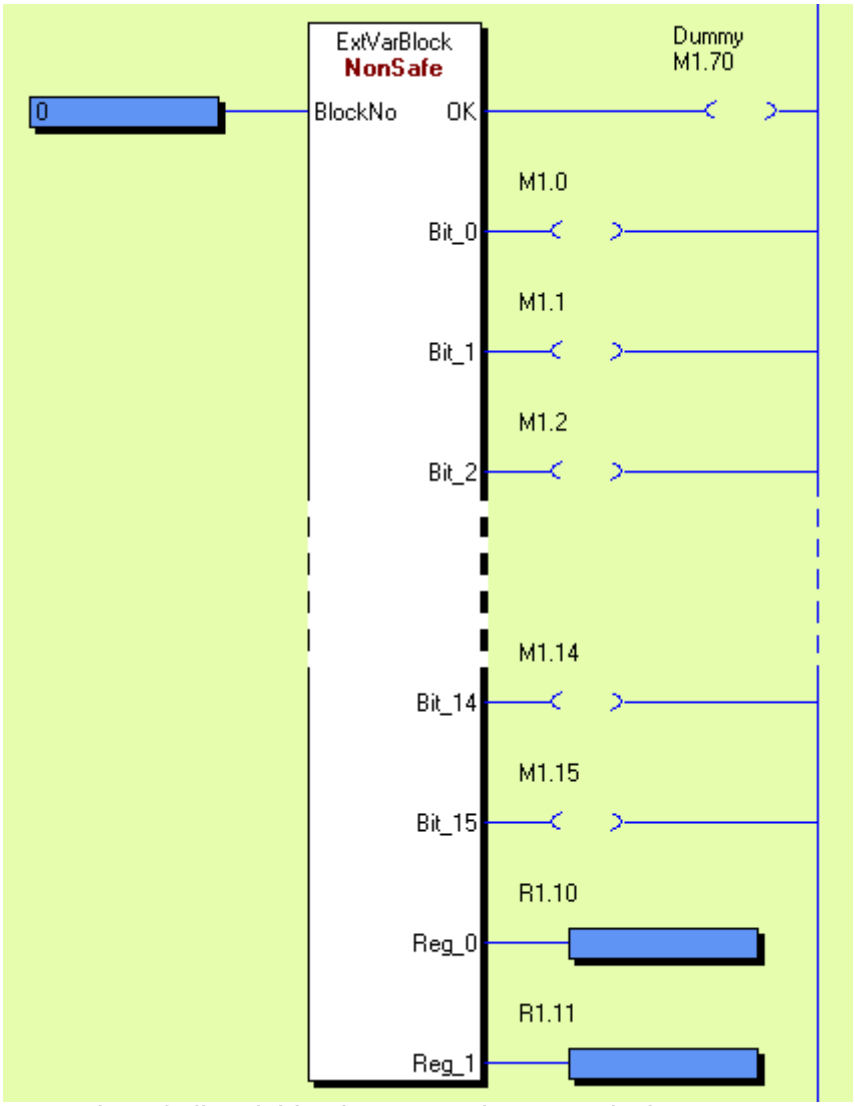


Reception of register 5 (located in Data block 2).

11.5.3.3 Function block ”ExtVarBlock”

The function block ExtVarBlock makes it possible to link all variables in one of the “External comm blocks” to the PLC code. The function block is very big but is easier to use since the only input parameter is the number of the “External comm. Block”.

By setting of BlockNo = 0: Bits 0…15 and Reg 0..1 are given.
By setting of BlockNo = 1: Bits 16…31 and Reg 2..3 are given.
By setting of BlockNo = 2: Bits 32…47 and Reg 4..5 are given.
By setting of BlockNo = 3: Bits 48…63 and Reg 6..7 are given.
(According to table 11.5.2)



Reception of all variables in “External Comm Block” 0,
(16 bits, 2 registers).

12 Technical data

12.1 Protocol specific data

GATE-EIP – EtherNet/IP	
Interface	According to, · ODVA, CIP Volume 1 Edition 3.16 · ODVA, CIP Volume 2 EtherNet/IP Adaption of CIP Edition 1.17 · Minimum RPI value of 10 ms.
Status indication	Mod (Module) status and Net (Network) status.
Default IP address	DHCP.
Service ports	TCP/44818, UDP/2222 and UDP/44818 (see 6.4).

GATE-EC – EtherCAT	
Interface	According to · IEC 61158 Part 2-6 Type 12 documents (ETG.1000 V1.0.3). · EtherCAT Protocol Enhancements (ETG.1020 V1.0.0). · Minimum cycle time is 500 µs. · The device support FoE (firmware update). · The device support EoE (FTP, TFTP, web and telnet server).
Status indication	Run and Error status.
Default IP address	Master configured.
Service ports	-

GATE-S3 – Sercos III	
Interface	According to: · Communication Spec. V1.1.2.1.7 (March 30, 2009). · Sercos Communication Profile V1.1.2.1.1 (March 31, 2009). · Function Specific Profile IO V1.1.2.1.4 (May 11, 2009). · Internet Protocol Services V1.3.1 - 1.2 (February 10, 2011). · Minimum cycle time is 500 µs.
Status indication	S3 status.
Default IP address	192.168.0.100
Service ports	UDP/35021 (see 8.4).

GATE-PN – PROFINET	
Interface	According to: · Specification for PROFINET, Version 2.31. · IRT Top (“Red phase”) will be supported. · Minimum cycle time 2ms for RTC1 and 1ms for RTC3.
Status indication	SF (System Failure) and BF (Bus Failure).
Default IP address	Master configured.
Service ports	UDP/161, UDP/34964 and UDP/49152 (see 9.6).

GATE-MT – Modbus TCP	
Interface	According to: · Modbus Application Protocol Specification, V1.1a. · Modbus Messaging on TCP/IP Implementation Guide, V1.0a. · Minimum 500 request per seconds for one steady open connection with about 1 ms response time. · Maximum of 8 client connections.
Status indication	RUN (Connection) and ERR (Error).
Default IP address	DHCP.
Service ports	TCP/502 (see 10.4).

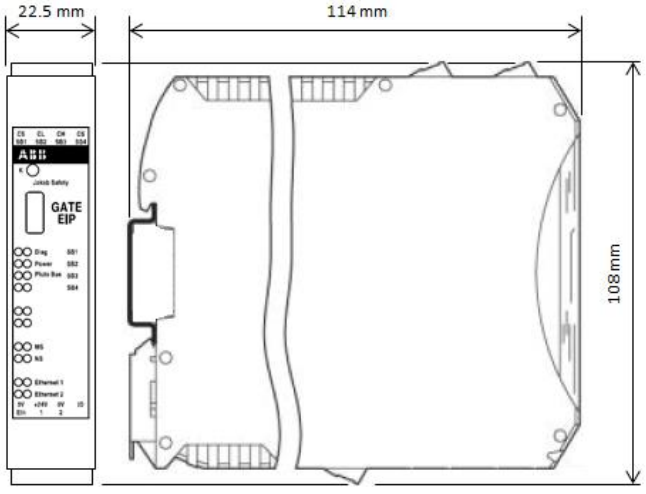
12.2 Common data

Ethernet data and services	
Interface	2 port with 10/100 Mbit/s, half/full duplex.
Status	Link status and traffic status on each port.
IP address	Static, DHCP and BOOTP. Set via terminal (PC port). Not for GATE-EC and GATE-PN.
FTP server	Firmware updates (port 20/21).
TFTP server	Firmware updates (port 69).
Web server	Status, IP address configuration and firmware updates (port 80).
Telnet server	Remote access (port 50100).

Pluto bus	
Pluto bus	CAN (electrical insulation 500 VAC).
Pluto bus speed	100, 125, 200, 250, 400, 500, 800 and 1000 kbit/s (automatic speed detection).
Status indication	Pluto bus status vid LED (Pluto bus).

PC port (front connector)	
Setting	57600 bit/s, 8 bit data, 1 stop bit, no parity and no flow control.
Cable (serial)	Article number 2TLA020070R5600.
Cable (USB)	Article number 2TLA020070R5800.

Common data	
DC power	24 VDC, -15% to +20%.
Power consumption at 24V	< 4.8 W < 0.2 A (recommended external fuse ≤ 6 A).
Electrical insulation	500 VAC for Pluto bus and Ethernet ports to DC power.
Enclosure	Width = 22.5 mm, height = 108 mm and depth = 114 mm.
Mounting	35 mm DIN rail.
Ambient air temperature	-10 °C to + 55 ºC.
Temperature, transportation and storage	-25 °C to + 55 ºC.
Operating altitude	Up to 2000 meter.
Humidity	EN 60 204-1 50% at 40 ºC (ex 90% at 20 ºC).
Degree of protection	Enclosure IP 20 - IEC 60 529. Terminals IP 20 - IEC 60 529.
Approval	CE cULus



13 Appendix A, gateway registers.

With the terminal command “gw” and via Pluto bus request it’s possible to read this information from the gateway. All gateway registers are 32-bit registers.

13.1 Gateway registers 0 - …

Unit information registers.

Register	Data	Read	Write	Note
0	Unit firmware version - Bit 24 – 31, major number - Bit 16 – 23, minor number - Bit 8 – 15, build number - Bit 0 – 7, revision number	X		
1	Unit firmware date - Bit 24 – 31, century - Bit 16 – 23, year - Bit 8 – 15, month - Bit 0 – 7, day	X		
2	Reserved	-		
3	Reserved	-		
4	Reserved	-		
5	Unit name - GATE-EIP, 0x45495000 (EIP) - GATE-EC, 0x45430000 (EC) - GATE-S3, 0x53330000 (S3) - GATE-PN, 0x504E0000 (PN) - GATE-MT, 0x4D540000 (MT)	X		
6	Unit device type	X		Zero (0)
7	Reserved	-		
8	Unit serial number	X		
9	Reserved	-		
10	Unit uptime in seconds	X		
11	Unit gateway node number (0 – 15)	X		
12	Online Pluto bit mask information	X		
13	Active additional data bit mask information	X		
14	-			
15	-			
16	-			
17	-			
18	-			
19	-			
20	CAN speed (0 = speed detection)	X		
21	CAN receive overrun counter	X		
22	CAN error status	X		
23	CAN error passive counter	X		
24	CAN bus off counter	X		
25	CAN restart counter	X		
26	CAN RX counter (CAN controller)	X		
27	CAN TX counter (CAN controller)	X		

13.2 Gateway registers 100 - …

Fieldbus information registers.

Register	Data	Read	Write	Note
100	MAC address (high part, bit 0 - 15)	X		
101	MAC address (low part, bit 0 - 31)	X		
102	TCP/IP address - aaa.bbb.ccc.ddd - bit 0 – 7 is ddd value - bit 8 – 15 is ccc value - bit 16 – 23 is bbb value - bit 24 – 32 is aaa value	X		
103	TCP/IP subnet mask - See coding for register 102	X		
104	TCP/IP gateway address - See coding for register 102	X		
105	TCP/IP address mode - 1 address mode Static - 2 address mode BOOTP - 3 address mode DHCP	X		
106	Number of Ethernet ports	X		
107	Port speed for port 1 - 1 is 10 Mbit/s - 2 is 100 Mbit/s - Else undefined	X		
108	Port speed for port 2 - See coding for register 107	X		
109	Port speed for port 3 - See coding for register 107	X		
110	Port speed for port 4 - See coding for register 107	X		
111	Duplex information for port 1 - 1 is half duplex - 2 is full duplex - Else undefined	X		
112	Duplex information for port 2 - See coding for register 111	X		
113	Duplex information for port 3 - See coding for register 111	X		
114	Duplex information for port 4 - See coding for register 111	X		
115	FTP server active - 1 is active / 0 is not active	X		
116	TFTP server active - 1 is active / 0 is not active	X		
117	web server active - 1 is active / 0 is not active	X		
118	Telnet server active - 1 is active / 0 is not active	X		
119	Telnet server port	X		

GATE-EIP specific registers (EtherNet/IP).

120	Vendor id	X		
121	Product number	X		

122	Profile number	X		
123	Module status	X		
124	Network status	X		

GATE-EC specific registers (EtherCAT).

120	Vendor id	X		
121	Product number	X		

GATE-S3 specific registers (Sercos III).

120	Vendor id	X		
121	Product number	X		

GATE-PN specific registers (PROFINET).

120	Vendor id	X		
121	Product number	X		

GATE-MT specific registers (Modbus TCP).

119	-	-		
120	-	-		

13.3 Gateway register 200 - …

Pluto global data register information.

Register	Data	Read	Write	Note
200	Global data from Pluto 0	X		
201	Global data from Pluto 1	X		
202	Global data from Pluto 2	X		
203	Global data from Pluto 3	X		
204	Global data from Pluto 4	X		
205	Global data from Pluto 5	X		
206	Global data from Pluto 6	X		
207	Global data from Pluto 7	X		
208	Global data from Pluto 8	X		
209	Global data from Pluto 9	X		
210	Global data from Pluto 10	X		
211	Global data from Pluto 11	X		
212	Global data from Pluto 12	X		
213	Global data from Pluto 13	X		
214	Global data from Pluto 14	X		
215	Global data from Pluto 15	X		
216	Global data from Pluto 16	X		
217	Global data from Pluto 17	X		
218	Global data from Pluto 18	X		
219	Global data from Pluto 19	X		
220	Global data from Pluto 20	X		
221	Global data from Pluto 21	X		
222	Global data from Pluto 22	X		
223	Global data from Pluto 23	X		
224	Global data from Pluto 24	X		

225	Global data from Pluto 25	X		
226	Global data from Pluto 26	X		
227	Global data from Pluto 27	X		
228	Global data from Pluto 28	X		
229	Global data from Pluto 29	X		
230	Global data from Pluto 30	X		
231	Global data from Pluto 31	X		

13.4 Gateway register 300 - …

Additional data register information.

Register	Data	Read	Write	Note
300	Additional data for area 0	X		
301	Additional data for area 1	X		
302	Additional data for area 2	X		
303	Additional data for area 3	X		
304	Additional data for area 4	X		
305	Additional data for area 5	X		
306	Additional data for area 6	X		
307	Additional data for area 7	X		
308	Additional data for area 8	X		
309	Additional data for area 9	X		
310	Additional data for area 10	X		
311	Additional data for area 11	X		
312	Additional data for area 12	X		
313	Additional data for area 13	X		
314	Additional data for area 14	X		
315	Additional data for area 15	X		
316	Additional data for area 16	X		
317	Additional data for area 17	X		
318	Additional data for area 18	X		
319	Additional data for area 19	X		
320	Additional data for area 20	X		
321	Additional data for area 21	X		
322	Additional data for area 22	X		
323	Additional data for area 23	X		
324	Additional data for area 24	X		
325	Additional data for area 25	X		
326	Additional data for area 26	X		
327	Additional data for area 27	X		
328	Additional data for area 28	X		
329	Additional data for area 29	X		
330	Additional data for area 30	X		
331	Additional data for area 31	X		

13.5 Gateway register 400 - …

Additional filter register information.

- Bit 0 – 7 coding IO-type
- Bit 8 – 15 coding Pluto number
- Bit 30 set if active on Pluto bus
- Bit 31 set if configuration active (e.g. IO-type not zero)

Register	Data	Read	Write	Note
400	Additional filter for area 0	X		
401	Additional filter for area 1	X		
402	Additional filter for area 2	X		
403	Additional filter for area 3	X		
404	Additional filter for area 4	X		
405	Additional filter for area 5	X		
406	Additional filter for area 6	X		
407	Additional filter for area 7	X		
408	Additional filter for area 8	X		
409	Additional filter for area 9	X		
410	Additional filter for area 10	X		
411	Additional filter for area 11	X		
412	Additional filter for area 12	X		
413	Additional filter for area 13	X		
414	Additional filter for area 14	X		
415	Additional filter for area 15	X		
416	Additional filter for area 16	X		
417	Additional filter for area 17	X		
418	Additional filter for area 18	X		
419	Additional filter for area 19	X		
420	Additional filter for area 20	X		
421	Additional filter for area 21	X		
422	Additional filter for area 22	X		
423	Additional filter for area 23	X		
424	Additional filter for area 24	X		
425	Additional filter for area 25	X		
426	Additional filter for area 26	X		
427	Additional filter for area 27	X		
428	Additional filter for area 28	X		
429	Additional filter for area 29	X		
430	Additional filter for area 30	X		
431	Additional filter for area 31	X		

13.6 Gateway register 500 - …

Data to Pluto data register information.

Register	Data	Read	Write	Note
500	Data to Pluto area 0, bits	X		
501	Data to Pluto area 0, register 1	X		
502	Data to Pluto area 0, register 2	X		
503	Data to Pluto area 1, bits	X		
504	Data to Pluto area 1, register 1	X		
505	Data to Pluto area 1, register 2	X		
506	Data to Pluto area 2, bits	X		
507	Data to Pluto area 2, register 1	X		
508	Data to Pluto area 2, register 2	X		
509	Data to Pluto area 3, bits	X		
510	Data to Pluto area 3, register 1	X		
511	Data to Pluto area 3, register 2	X		

13.7 Gateway register 600 - …

Data to Pluto setting register information.

Register	Data	Read	Write	Note
600	Data to Pluto enable bit mask - Bit 0 enable area 0 - Bit 1 enable area 1 - Bit 2 enable area 2 - Bit 3 enable area 2	X		
601	Data to Pluto update time (ms)	X		
602	Data to Pluto timeout (ms)	X		

14 Appendix B, object description EtherNet/IP

This is a description of the object model used for EtherNet/IP.

14.1 Definitions

The following table has a description of all of the data types used.

USINT	Unsigned Short Integer (8-bit)
UINT	Unsigned Integer (16-bit)
UDINT	Unsigned Double Integer (32-bit)
STRING	Character String (1 byte per character)
BYTE	Bit String (8-bits)
WORD	Bit String (16-bits)
DWORD	Bit String (32-bits)

14.2 Identity Object (01_{HEX} - 1 Instance)

Class Attributes

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

Instance Attributes

Attribute ID	Name	Data Type	Data Value	Access Rule
1	Vendor Number	UINT	950	Get
2	Device Type	UINT	43	Get
3	Product Code Number	UINT	1100	Get
4	Product Major Revision Product Minor Revision	USINT USINT	2 11	Get
5	Status Word (see below for definition)	WORD	See Below	Get
6	Product Serial Number	UDINT	Unique 32 Bit Value	Get
7	Product Name	String of USINT	GATE-EIP	Get

Status Word

Bit	Bit = 0	Bit = 1
0	Not Owned	Owned
1	Unused	Unused
2	No configuration since the last Out of Box reset.	The device has been configured since the last Out of Box reset.
3 – 15	Unused	Unused

Common Services

Service Code	Implemented for		Service Name
	Class Level	Instance Level	
$0E_{HEX}$	Yes	Yes	Get_Attribute_Single
05_{HEX}	No	Yes	Reset

14.3 Message Router Object (02_{HEX})

This object has no supported attributes.

14.4 Assembly Object (04_{HEX} – 5 Instances)

Class Attributes (Instance 0)

Attribute ID	Name	Data Type	Data Value	Access Rule
1	Revision	UINT	2	Get
2	Max Instance	UINT	113	Get

Input Instance Attributes (Instance 100 - 102)

Attribute ID	Name	Data Type	Default Data Value	Access Rule
3	Input Data	USINT [4-132]	0	Get

Input Instance 100 – 4 Bytes (Node Status Only)

For more information about data structure see chapter 11.

Bytes	Class, Instance, Attribute	Description
0 – 3	0x64, 0x00, 0B	Node Status

Input Instance 101 – 256 Bytes (Node Data Only)

For more information about data structure see chapter 11.

Bytes	Class, Instance, Attribute	Description
0 – 3	0x64, 0x01, 0x04	Combined 32 Bit Data – Node 0
4 – 7	0x64, 0x02, 0x04	Combined 32 Bit Data – Node 1
…		
120 – 123	0x64, 0x1F, 0x04	Combined 32 Bit Data – Node 30
124 – 127	0x64, 0x20, 0x04	Combined 32 Bit Data – Node 31
128 – 131	0x64, 0x01, 0x0A	Additional Data 00
132 – 135	0x64, 0x02, 0x0A	Additional Data 01
…		
248 – 251	0x64, 0x1F, 0x0A	Additional Data 30
252 – 255	0x64, 0x20, 0x0A	Additional Data 31

Input Instance 102 – 260 Bytes (Node Status and Data)

For more information about data structure see chapter 11.

Bytes	Class, Instance, Attribute	Description
0 – 3	0x64, 0x00, 0x0B	Node Status
4 – 7	0x64, 0x01, 0x04	Combined 32 Bit Data – Node 0
8 – 11	0x64, 0x02, 0x04	Combined 32 Bit Data – Node 1
…		
124 – 127	0x64, 0x1F, 0x04	Combined 32 Bit Data – Node 30
128 – 131	0x64, 0x20, 0x04	Combined 32 Bit Data – Node 31
132 – 135	0x64, 0x01, 0x0A	Additional Data 00
136 – 139	0x64, 0x02, 0x0A	Additional Data 01
…		
252 – 255	0x64, 0x1F, 0x0A	Additional Data 30
256 – 259	0x64, 0x20, 0x0A	Additional Data 31

Output Instance Attributes (Instance 112)

Attribute ID	Name	Data Type	Default Data Value	Access Rule
3	Output Data	USINT [0-24]	0	Get

Output Instance 112 – 24 Bytes (Data to Pluto)

For more information about data structure see chapter **Error! Reference source not found.**.

Bytes	Class, Instance, Attribute	Description
0 – 5	0x64, 0x00, 0x0C	Data to Pluto area 0
6 – 11	0x64, 0x00, 0x0D	Data to Pluto area 1
12 – 17	0x64, 0x00, 0x0E	Data to Pluto area 2
18 – 23	0x64, 0x00, 0x0F	Data to Pluto area 3

Output Instance 128 (Heartbeat Instance – Input Only)

This instance allows client to monitor input data without providing output data.

Output Instance 129 (Heartbeat Instance – Listen Only)

This instance allows client to monitor input data without providing output data. To utilize this connection type, an owning connection must exist from a second client and the configuration of the connection must match exactly.

Output Instance 130 (Configuration Instance)

This instance allows client to download necessary configuration information to the gateway when the I/O connection is opened. The configuration instance supports 0 – 400 bytes of data. If no configuration data is needed this instance may be omitted.

Common Services

Service Code	Implemented for		Service Name
	Class Level	Instance Level	
$0E_{HEX}$	Yes	Yes	Get_Attribute_Single
10_{HEX}	No	Yes	Set_Attribute_Single

14.5 Connection Manager Object (06_{HEX})

This object has no attributes.

14.6 TCP Object ($F5_{HEX}$ - 1 Instance)

Class Attributes

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

Instance Attributes

Attribute ID	Name	Data Type	Default Data Value	Access Rule
1	Status[1]	DWORD	1	Get
2	Configuration Capability[2]	DWORD	0	Get
3	Configuration Control[3]	DWORD	0	Get
4	Physical Link Object[4] **Structure of:** Path Size Path	 UINT Array Of WORD	 2 0x20F6 0x2401	Get
5	Interface Configuration[5] **Structure of:** IP Address Network Mask Gateway Address Name Server Name Server 2 Domain Name Size Domain Name	 UDINT UDINT UDINT UDINT UDINT UINT STRING	 0 0 0 0 0 0 0	Get
6	Host Name[6] **Structure of:** Host Name Size Host Name	 UINT STRING	 0 0	Get

Common Services

Service Code	Implemented for		Service Name
	Class Level	Instance Level	
$0E_{HEX}$	Yes	Yes	Get_Attribute_Single
10_{HEX}	No	Yes	Set_Attribute_Single
01_{HEX}	No	Yes	Get_Attribute_All

[1] See section 5-3.2.2.1 of “Volume 2: EtherNet/IP Adaptation of CIP” from ODVA for more details on this attribute.
[2] See section 5-3.2.2.2 of “Volume 2: EtherNet/IP Adaptation of CIP” from ODVA for more details on this attribute.
[3] See section 5-3.2.2.3 of “Volume 2: EtherNet/IP Adaptation of CIP” from ODVA for more details on this attribute.
[4] See section 5-3.2.2.4 of “Volume 2: EtherNet/IP Adaptation of CIP” from ODVA for more details on this attribute.
[5] See section 5-3.2.2.5 of “Volume 2: EtherNet/IP Adaptation of CIP” from ODVA for more details on this attribute.
[6] See section 5-3.2.2.6 of “Volume 2: EtherNet/IP Adaptation of CIP” from ODVA for more details on this attribute.

14.7 Ethernet Link Object ($F6_{HEX}$ - 1 Instance)

Class Attributes

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

Instance Attributes

Attribute ID	Name	Data Type	Default Data Value	Access Rule
1	Interface Speed[7]	UDINT	100	Get
2	Interface Flags[8]	DWORD	3	Get
3	Physical Address[9]	USINT Array[6]	0	Get

Common Services

Service Code	Implemented for		Service Name
	Class Level	Instance Level	
$0E_{HEX}$	Yes	Yes	Get_Attribute_Single
01_{HEX}	No	Yes	Get_Attribute_All

[7] See section 5-4.2.2.1 of “Volume 2: EtherNet/IP Adaptation of CIP” from ODVA for more details on this attribute.
[8] See section 5-4.2.2.2 of “Volume 2: EtherNet/IP Adaptation of CIP” from ODVA for more details on this attribute.
[9] See section 5-4.2.2.3 of “Volume 2: EtherNet/IP Adaptation of CIP” from ODVA for more details on this attribute.

14.8 Application Object (64_{HEX} - 32 Instances)

Class Attributes (Instance 0)

For more information about “Data to Pluto” structure see chapter 11.4.

Attribute ID	Name	Data Type	Default Data Value	Access Rule
1	Revision	UINT	1	Get
10	Expected Nodes Bitmap **Not used!**	DWORD	0	Get/Set
11	Node Status Bitmap	DWORD	0	Get
12	Data to Pluto 1	UINT[3]	0,0,0	Get/Set
13	Data to Pluto 2	UINT[3]	0,0,0	Get/Set
14	Data to Pluto 3	UINT[3]	0,0,0	Get/Set
15	Data to Pluto 4	UINT[3]	0,0,0	Get/Set
16	Enable Data to Pluto (0 = Disabled; 1 = Enabled) Bit 0 – Data To Pluto 1 Bit 1 – Data To Pluto 2 Bit 2 – Data To Pluto 3 Bit 3 – Data To Pluto 4	BYTE	0	Get/Set
17	Data to Pluto Timeout (ms) 0 = timeout disabled Valid value ≥ 1000 ms.	UINT16	0	Get/Set
18	Data to Pluto Update Time (ms). Value modulus of 4 e.g. 0, 4, 8, 16… 252.	UINT8	100	Get/Set
19	Set gateway node number 0 = DIP switch setting 1 = Node number 0 2 = Node number 1 … 16 = Node number 15	UINT8	0	Get/Set
20	Read gateway node number 0 = Node number 0 1 = Node number 1 … 15 = Node number 15	UINT8	0	Get

Additional data configuration see chapter 11.3.

Attribute ID	Name	Data Type	Default Data Value	Access Rule
32	Additional Data 00, Node (0-31)	BYTE	0	Get/Set
33	Additional Data 00, IO-type	BYTE	0	Get/Set
34	Additional Data 01, Node (0-31)	BYTE	0	Get/Set
35	Additional Data 01, IO-type	BYTE	0	Get/Set
36	Additional Data 02, Node (0-31)	BYTE	0	Get/Set
37	Additional Data 02, IO-type	BYTE	0	Get/Set
38	Additional Data 03, Node (0-31)	BYTE	0	Get/Set
39	Additional Data 03, IO-type	BYTE	0	Get/Set
40	Additional Data 04, Node (0-31)	BYTE	0	Get/Set
41	Additional Data 04, IO-type	BYTE	0	Get/Set
42	Additional Data 05, Node (0-31)	BYTE	0	Get/Set
43	Additional Data 05, IO-type	BYTE	0	Get/Set

44	Additional Data 06, Node (0-31)	BYTE	0	Get/Set
45	Additional Data 06, IO-type	BYTE	0	Get/Set
46	Additional Data 07, Node (0-31)	BYTE	0	Get/Set
47	Additional Data 07, IO-type	BYTE	0	Get/Set
48	Additional Data 08, Node (0-31)	BYTE	0	Get/Set
49	Additional Data 08, IO-type	BYTE	0	Get/Set
50	Additional Data 09, Node (0-31)	BYTE	0	Get/Set
51	Additional Data 09, IO-type	BYTE	0	Get/Set
52	Additional Data 10, Node (0-31)	BYTE	0	Get/Set
53	Additional Data 10, IO-type	BYTE	0	Get/Set
54	Additional Data 11, Node (0-31)	BYTE	0	Get/Set
55	Additional Data 11, IO-type	BYTE	0	Get/Set
56	Additional Data 12, Node (0-31)	BYTE	0	Get/Set
57	Additional Data 12, IO-type	BYTE	0	Get/Set
58	Additional Data 13, Node (0-31)	BYTE	0	Get/Set
59	Additional Data 13, IO-type	BYTE	0	Get/Set
60	Additional Data 14, Node (0-31)	BYTE	0	Get/Set
61	Additional Data 14, IO-type	BYTE	0	Get/Set
62	Additional Data 15, Node (0-31)	BYTE	0	Get/Set
63	Additional Data 15, IO-type	BYTE	0	Get/Set
64	Additional Data 16, Node (0-31)	BYTE	0	Get/Set
65	Additional Data 16, IO-type	BYTE	0	Get/Set
66	Additional Data 17, Node (0-31)	BYTE	0	Get/Set
67	Additional Data 17, IO-type	BYTE	0	Get/Set
68	Additional Data 18, Node (0-31)	BYTE	0	Get/Set
69	Additional Data 18, IO-type	BYTE	0	Get/Set
70	Additional Data 19, Node (0-31)	BYTE	0	Get/Set
71	Additional Data 19, IO-type	BYTE	0	Get/Set
72	Additional Data 20, Node (0-31)	BYTE	0	Get/Set
73	Additional Data 20, IO-type	BYTE	0	Get/Set
74	Additional Data 21, Node (0-31)	BYTE	0	Get/Set
75	Additional Data 21, IO-type	BYTE	0	Get/Set
76	Additional Data 22, Node (0-31)	BYTE	0	Get/Set
77	Additional Data 22, IO-type	BYTE	0	Get/Set
78	Additional Data 23, Node (0-31)	BYTE	0	Get/Set
79	Additional Data 23, IO-type	BYTE	0	Get/Set
80	Additional Data 24, Node (0-31)	BYTE	0	Get/Set
81	Additional Data 24, IO-type	BYTE	0	Get/Set
82	Additional Data 25, Node (0-31)	BYTE	0	Get/Set
83	Additional Data 25, IO-type	BYTE	0	Get/Set
84	Additional Data 26, Node (0-31)	BYTE	0	Get/Set
85	Additional Data 26, IO-type	BYTE	0	Get/Set
86	Additional Data 27, Node (0-31)	BYTE	0	Get/Set
87	Additional Data 27, IO-type	BYTE	0	Get/Set
88	Additional Data 28, Node (0-31)	BYTE	0	Get/Set
89	Additional Data 28, IO-type	BYTE	0	Get/Set
90	Additional Data 29, Node (0-31)	BYTE	0	Get/Set
91	Additional Data 29, IO-type	BYTE	0	Get/Set
92	Additional Data 30, Node (0-31)	BYTE	0	Get/Set
93	Additional Data 30, IO-type	BYTE	0	Get/Set
94	Additional Data 31, Node (0-31)	BYTE	0	Get/Set
95	Additional Data 31, IO-type	BYTE	0	Get/Set

Instance Attributes (Instances 1-32)

Instance value 1-32 is equal to Pluto station number 0-31.

Attribute ID	Name	Data Type	Default Data Value	Access Rule
1	Input Bits	WORD	0	Get
2	Output Bits	BYTE	0	Get
3	Global Bits	WORD	0	Get
4	Combined 32 Bits	DWORD	0	Get
10	Additional Data 32 Bits	DWORD	0	Get

Common Services

Service Code	Implemented for		Service Name
	Class Level	Instance Level	
$0E_{HEX}$	Yes	Yes	Get Attribute Single
10_{HEX}	Yes	No	Set Attribute Single

15 Appendix C, object description EtherCAT

15.1 PDO mapping

15.1.1 Input mapping

15.1.1.1 Pluto status (0x1A00)

Index: Subindex	Name	Data Type	Default Data Value	Access
0x1A00:1	Pluto status data(0x2120:1)			

15.1.1.2 Pluto global 0 – 7 (0x1A01)

Index: Subindex	Name	Data Type	Default Data Value	Access
0x1A01:1	Pluto global 0 (0x2100:1)			
0x1A01:2	Pluto global 1 (0x2100:2)			
0x1A01:3	Pluto global 2 (0x2100:3)			
0x1A01:4	Pluto global 3 (0x2100:4)			
0x1A01:5	Pluto global 4 (0x2100:5)			
0x1A01:6	Pluto global 5 (0x2100:6)			
0x1A01:7	Pluto global 6 (0x2100:7)			
0x1A01:8	Pluto global 7 (0x2100:8)			

15.1.1.3 Pluto global 8 – 15 (0x1A02)

Index: Subindex	Name	Data Type	Default Data Value	Access
0x1A02:1	Pluto global 8 (0x2100:9)			
0x1A02:2	Pluto global 9 (0x2100:10)			
0x1A02:3	Pluto global 10 (0x2100:11)			
0x1A02:4	Pluto global 11 (0x2100:12)			
0x1A02:5	Pluto global 12 (0x2100:13)			
0x1A02:6	Pluto global 13 (0x2100:14)			
0x1A02:7	Pluto global 14 (0x2100:15)			
0x1A02:8	Pluto global 15 (0x2100:16)			

15.1.1.4 Pluto global 16 – 23 (0x1A03)

Index: Subindex	Name	Data Type	Default Data Value	Access
0x1A03:1	Pluto global 16 (0x2100:17)			
0x1A03:2	Pluto global 17 (0x2100:18)			
0x1A03:3	Pluto global 18 (0x2100:19)			
0x1A03:4	Pluto global 19 (0x2100:20)			

Index: Subindex	Name	Data Type	Default Data Value	Access
0x1A03:5	Pluto global 20 (0x2100:21)			
0x1A03:6	Pluto global 21 (0x2100:22)			
0x1A03:7	Pluto global 22 (0x2100:23)			
0x1A03:8	Pluto global 23 (0x2100:24)			

15.1.1.5 Pluto global 24 – 31 (0x1A04)

Index: Subindex	Name	Data Type	Default Data Value	Access
0x1A04:1	Pluto global 24 (0x2100:25)			
0x1A04:2	Pluto global 25 (0x2100:26)			
0x1A04:3	Pluto global 26 (0x2100:27)			
0x1A04:4	Pluto global 27 (0x2100:28)			
0x1A04:5	Pluto global 28 (0x2100:29)			
0x1A04:6	Pluto global 29 (0x2100:30)			
0x1A04:7	Pluto global 30 (0x2100:31)			
0x1A04:8	Pluto global 31 (0x2100:31)			

15.1.1.6 Additional data 0 – 7 (0x1A05)

Index: Subindex	Name	Data Type	Default Data Value	Access
0x1A05:1	Additional data 0 (0x2101:1)			
0x1A05:2	Additional data 1 (0x2101:2)			
0x1A05:3	Additional data 2 (0x2101:3)			
0x1A05:4	Additional data 3 (0x2101:4)			
0x1A05:5	Additional data 4 (0x2101:5)			
0x1A05:6	Additional data 5 (0x2101:6)			
0x1A05:7	Additional data 6 (0x2101:7)			
0x1A05:8	Additional data 7 (0x2101:8)			

15.1.1.7 Additional data 8 – 15 (0x1A06)

Index: Subindex	Name	Data Type	Default Data Value	Access
0x1A06:1	Additional data 8 (0x2101:9)			
0x1A06:2	Additional data 9 (0x2101:10)			
0x1A06:3	Additional data 10 (0x2101:11)			
0x1A06:4	Additional data 11 (0x2101:12)			
0x1A06:5	Additional data 12 (0x2101:13)			
0x1A06:6	Additional data 13 (0x2101:14)			
0x1A06:7	Additional data 14 (0x2101:15)			

Index: Subindex	Name	Data Type	Default Data Value	Access
0x1A06:8	Additional data 15 (0x2101:16)			

15.1.1.8 Additional data 16 – 23 (0x1A07)

Index: Subindex	Name	Data Type	Default Data Value	Access
0x1A07:1	Additional data 16 (0x2101:17)			
0x1A07:2	Additional data 17 (0x2101:18)			
0x1A07:3	Additional data 18 (0x2101:19)			
0x1A07:4	Additional data 19 (0x2101:20)			
0x1A07:5	Additional data 20 (0x2101:21)			
0x1A07:6	Additional data 21 (0x2101:22)			
0x1A07:7	Additional data 22 (0x2101:23)			
0x1A07:8	Additional data 23 (0x2101:24)			

15.1.1.9 Additional data 24 – 31 (0x1A08)

Index: Subindex	Name	Data Type	Default Data Value	Access
0x1A08:1	Additional data 24 (0x2101:25)			
0x1A08:2	Additional data 25 (0x2101:26)			
0x1A08:3	Additional data 26 (0x2101:27)			
0x1A08:4	Additional data 27 (0x2101:28)			
0x1A08:5	Additional data 28 (0x2101:29)			
0x1A08:6	Additional data 29 (0x2101:30)			
0x1A08:7	Additional data 30 (0x2101:31)			
0x1A08:8	Additional data 31 (0x2101:31)			

15.1.2 Output mapping

15.1.2.1 Data to Pluto packet 1 (0x1600)

Index: Subindex	Name	Data Type	Default Data Value	Access
0x1600:1	Bits 0-15 (0x2200:1)			
0x1600:2	Register 0 (0x2200:2)			
0x1600:3	Register 1 (0x2200:3)			

15.1.2.2 Data to Pluto packet 1 (0x1601)

Index: Subindex	Name	Data Type	Default Data Value	Access
0x1601:1	Bits 0-15 (0x2201:1)			

Index: Subindex	Name	Data Type	Default Data Value	Access
0x1601:2	Register 0 (0x2201:2)			
0x1601:3	Register 1 (0x2201:3)			

15.1.2.3 Data to Pluto packet 3 (0x1602)

Index: Subindex	Name	Data Type	Default Data Value	Access
0x1602:1	Bits 0-15 (0x2202:1)			
0x1602:2	Register 0 (0x2202:2)			
0x1602:3	Register 1 (0x2202:3)			

15.1.2.4 Data to Pluto packet 4 (0x1603)

Index: Subindex	Name	Data Type	Default Data Value	Access
0x1603:1	Bits 0-15 (0x2203:1)			
0x1603:2	Register 0 (0x2203:2)			
0x1603:3	Register 1 (0x2203:3)			

15.2 SDO mapping

15.2.1 Pluto global data (0x2100)

Index: Subindex	Name	Data Type	Default Data Value	Access
0x2100:1	Pluto 0	DWORD	0	Ro
0x2100:2	Pluto 1	DWORD	0	Ro
0x2100:3	Pluto 2	DWORD	0	Ro
0x2100:4	Pluto 3	DWORD	0	Ro
0x2100:5	Pluto 4	DWORD	0	Ro
0x2100:6	Pluto 5	DWORD	0	Ro
0x2100:7	Pluto 6	DWORD	0	Ro
0x2100:8	Pluto 7	DWORD	0	Ro
0x2100:9	Pluto 8	DWORD	0	Ro
0x2100:10	Pluto 9	DWORD	0	Ro
0x2100:11	Pluto 10	DWORD	0	Ro
0x2100:12	Pluto 11	DWORD	0	Ro
0x2100:13	Pluto 12	DWORD	0	Ro
0x2100:14	Pluto 13	DWORD	0	Ro
0x2100:15	Pluto 14	DWORD	0	Ro
0x2100:16	Pluto 15	DWORD	0	Ro
0x2100:17	Pluto 16	DWORD	0	Ro
0x2100:18	Pluto 17	DWORD	0	Ro
0x2100:19	Pluto 18	DWORD	0	Ro
0x2100:20	Pluto 19	DWORD	0	Ro

Index: Subindex	Name	Data Type	Default Data Value	Access
0x2100:21	Pluto 20	DWORD	0	Ro
0x2100:22	Pluto 21	DWORD	0	Ro
0x2100:23	Pluto 22	DWORD	0	Ro
0x2100:24	Pluto 23	DWORD	0	Ro
0x2100:25	Pluto 24	DWORD	0	Ro
0x2100:26	Pluto 25	DWORD	0	Ro
0x2100:27	Pluto 26	DWORD	0	Ro
0x2100:28	Pluto 27	DWORD	0	Ro
0x2100:29	Pluto 28	DWORD	0	Ro
0x2100:30	Pluto 29	DWORD	0	Ro
0x2100:31	Pluto 30	DWORD	0	Ro
0x2100:32	Pluto 31	DWORD	0	Ro

15.2.2 Additional data (0x2101)

Index: Subindex	Name	Data Type	Default Data Value	Access
0x2101:1	Additional area 0	DWORD	0	Ro
0x2101:2	Additional area 1	DWORD	0	Ro
0x2101:3	Additional area 2	DWORD	0	Ro
0x2101:4	Additional area 3	DWORD	0	Ro
0x2101:5	Additional area 4	DWORD	0	Ro
0x2101:6	Additional area 5	DWORD	0	Ro
0x2101:7	Additional area 6	DWORD	0	Ro
0x2101:8	Additional area 7	DWORD	0	Ro
0x2101:9	Additional area 8	DWORD	0	Ro
0x2101:10	Additional area 9	DWORD	0	Ro
0x2101:11	Additional area 10	DWORD	0	Ro
0x2101:12	Additional area 11	DWORD	0	Ro
0x2101:13	Additional area 12	DWORD	0	Ro
0x2101:14	Additional area 13	DWORD	0	Ro
0x2101:15	Additional area 14	DWORD	0	Ro
0x2101:16	Additional area 15	DWORD	0	Ro
0x2101:17	Additional area 16	DWORD	0	Ro
0x2101:18	Additional area 17	DWORD	0	Ro
0x2101:19	Additional area 18	DWORD	0	Ro
0x2101:20	Additional area 19	DWORD	0	Ro
0x2101:21	Additional area 20	DWORD	0	Ro
0x2101:22	Additional area 21	DWORD	0	Ro
0x2101:23	Additional area 22	DWORD	0	Ro
0x2101:24	Additional area 23	DWORD	0	Ro
0x2101:25	Additional area 24	DWORD	0	Ro
0x2101:26	Additional area 25	DWORD	0	Ro
0x2101:27	Additional area 26	DWORD	0	Ro
0x2101:28	Additional area 27	DWORD	0	Ro
0x2101:29	Additional area 28	DWORD	0	Ro

Index: Subindex	Name	Data Type	Default Data Value	Access
0x2101:30	Additional area 29	DWORD	0	Ro
0x2101:31	Additional area 30	DWORD	0	Ro
0x2101:32	Additional area 31	DWORD	0	Ro

15.2.3 Pluto status (0x2120)

Index: Subindex	Name	Data Type	Default Data Value	Access
0x2120	Pluto status data	DWORD	0	Ro

15.2.4 Data to Pluto (0x220y)

There are 4 objects with the Indexes 0x2200 to 0x2203 represents the output data going to Pluto.

Index: Subindex	Name	Data Type	Default Data Value	Access
0x220Y	Data to Pluto Output Pack Y			
0x220Y:1	Py Bits 0-15	WORD	0	RW
0x220Y:2	Py Register 0	WORD	0	RW
0x220Y:3	Py Register 1	WORD	0	RW

15.2.5 Configuration of additional data (0x23zz)

There are 32 objects with the Indexes 0x2300 to 0x231F represents Additional data configuration. The object is only writeable in PREOP mode.

Index: Subindex	Name	Data Type	Default Data Value	Access
0x23ZZ	Config. of additional data			
0x23ZZ:1	ADzz Pluto node	BYTE	0	RW
0x23ZZ:2	ADzz IO-Type	BYTE	0	RW

15.2.6 Configuration of Data to Pluto (0x2320)

Index: Subindex	Name	Data Type	Default Data Value	Access
0x2320	Configuration of data to Pluto			
0x2320:1	Data to Pluto enable	BYTE	1	RW
0x2320:2	Data to Pluto timeout	WORD	1000	RW
0x2320:3	Data to Pluto update time	BYTE	100	RW

15.2.7 Configuration gateway node number (0x2321)

Index: Subindex	Name	Data Type	Default Data Value	Access
0x2321	Gateway node number	BYTE	0	RW

16 Appendix D, object description Sercos III

16.1 Standard Sercos IDN supported by the gateway

IDN	Name	Value	Unit	comment
S-0-0014	Interface Status	-	-	
S-0-0017	IDN list of all operation data	-	-	
S-0-0021	IDN list of invalid operation data for CP2	-	-	
S-0-0022	IDN list of invalid operation data for CP3	-	-	
S-0-0025	IDN list of all procedure commands	-	-	
S-0-0095	Diagnostic message	-	-	
S-0-0099	Reset class 1 diagnostic (Process Command)	-	-	
S-0-0127	CP3 transition check (Process Command)	-	-	
S-0-0128	CP4 transition check (Process Command)	-	-	
S-0-0267	Password	-		
S-0-0279	IDN list of password protected data	-	-	
S-0-0390	Diagnostic number	-	-	
S-0-0398	IDN list of configurable real-time bits as producer	-	-	
S-0-0399	IDN list of configurable real-time bits as consumer	-	-	
S-0-1000	SCP type & version	-	-	
S-0-1002	Communication cycle time (tScyc)	-	us	
S-0-1003	Allowed MST losses in CP3/CP4	10	-	
S-0-1005	Minimum feedback processing time (t5)	-	us	
S-0-1006	AT0 transmission starting time (t1)	-	us	
S-0-1007	Feedback acquisition capture point (t4)	-	us	
S-0-1008	Command value valid time (t3)	-	us	
S-0-1009	Device control (C-Dev) offset in MDT	-	-	
S-0-1010	Length of MDTs	-	-	
S-0-1011	Device status (S-Dev) offset in AT	-	-	
S-0-1012	Length of Ats	-	-	
S-0-1013	SVC offset in MDT	-	-	
S-0-1014	SVC offset in AT	-	-	
S-0-1015	Ring delay	-	us	
S-0-1016	Slave delay	-	us	
S-0-1017	NRT transmission time	-	us	
S-0-1019	MAC address	-	-	
S-0-1020	IP address	192.168.0.100	-	
S-0-1020.0.1	Current IP address	-	-	
S-0-1021	Subnet mask	255.255.255.0	-	

S-0-1021.0.1	Current Subnet mask	-	-	
S-0-1022	Gateway node number	192.168.0.1	-	
S-0-1022.0.1	Current Gateway node number	-	-	
S-0-1023	SYNC jitter	-	us	
S-0-1024	SYNC delay measuring procedure command (Process Command)	-	-	
S-0-1026	Version of communication hardware	-	-	
S-0-1027.0.1	Requested MTU	-	-	
S-0-1027.0.2	Effective MTU	-	-	
S-0-1028	Error counter MST-P/S	-	-	
S-0-1031	Test pin assignment Port 1 and Port 2	-	-	
S-0-1035	Error counter Port1 and Port2	-	-	
S-0-1035.0.1	Error counter P&S	-	-	
S-0-1036	Interframe Gap	-	-	
S-0-1037	Slave Jitter	-	-	
S-0-1040	Sercos address	1	-	
S-0-1041	AT Command value valid time (t9)	-	us	
S-0-1044	Device control	-	-	
S-0-1045	Device status	-	-	
S-0-1047	Maximum consumer activation time (t11)	-	us	
S-0-1048	Procedure Command – Activate IP Settings	-	-	
S-0-1050.x.1	Connection setup	-	-	
S-0-1050.x.2	Connection number	-	-	
S-0-1050.x.3	Telegram assignment	-	-	
S-0-1050.x.4	Max. length of connection	-	-	
S-0-1050.x.5	Current length of connection	-	-	
S-0-1050.x.6	Configuration list	-	-	
S-0-1050.x.8	Connection control	-	-	
S-0-1050.x.10	Producer cycle time	-	us	
S-0-1050.x.11	Allowed data losses	-	-	
S-0-1050.x.12	Error counter data losses	-	-	
S-0-1050.x.20	IDN allocation of real-time bit	-	-	
S-0-1050.x.21	Bit allocation of real-time bit	-	-	
S-0-1051	Image of connection setups	-	-	
S-0-1300.0.1	Component name	-	-	
S-0-1300.0.2	Vendor name	-	-	
S-0-1300.0.3	Vendor code	-	-	
S-0-1300.0.4	Device name	-	-	
S-0-1300.0.5	Device ID	-	-	
S-0-1300.0.7	Function revision	-	-	
S-0-1300.0.8	Hardware revision	-	-	
S-0-1300.0.9	Firmware revision	-	-	
S-0-1300.0.10	Firmware loader revision	-	-	
S-0-1300.0.11	Order number	-	-	

S-0-1300.0.12	Serial number	-	-	
S-0-1300.0.13	Manufacturing date parameter	-	-	
S-0-1300.0.14	QA Date	-	-	
S-0-1300.0.20	Operational hours.	-	h	
S-0-1300.0.21	Service Date	-	-	
S-0-1301	List of GDP classes & version	-	-	
S-0-1302.0.1	FSP type & version	-	-	
S-0-1302.0.2	Function groups	-	-	
S-0-1302.0.3	Application type	-	-	
S-0-1303.0.1[10]	Diagnosis trace configuration	-	-	
S-0-1303.0.2	Diagnosis trace control	-	-	
S-0-1303.0.3	Diagnosis trace state	-	-	
S-0-1303.0.10	Diagnosis trace buffer no1	-	-	
S-0-1303.0.11	Diagnosis trace buffer no2	-	-	
S-0-1305.0.1	Sercos current time	-	-	
S-0-1305.0.2	Sercos current fine time	-		
S-0-1305.0.3	Sercos current coarse time	-		
S-0-1350	Reboot device	-	-	
S-0-1500	IO bus coupler	-	-	
S-0-1500.0.1	IO control	-	-	
S-0-1500.0.2	IO status	-	-	
S-0-1500.0.3	List of module type codes	-	-	
S-0-1500.0.5	Container output data	-	-	
S-0-1500.0.9	Container input data	-	-	
S-0-1500.0.19	Parameter channel receive	-	-	
S-0-1500.0.20	Parameter channel transmit	-	-	
S-0-1500.0.32	IO diagnostic message	-	-	
S-0-1500.0.33	Current IO diagnostic message	-	-	
S-0-1502	IO function group digital output	-	-	
S-0-1502.0.1	Name of IO FG	-	-	
S-0-1502.0.2	Configuration of IO FG	-	-	
S-0-1502.0.3	Channel quantity PDOUT	-	-	
S-0-1502.0.4	Channel width PDOUT	-	-	
S-0-1502.0.5	PDOUT	-	-	
S-0-1502.0.15	Channel Quantity DIAGIN	-	-	
S-0-1502.0.16	Channel width DIAGIN	-	-	
S-0-1502.0.17	DIAGIN	-	-	
S-0-1502.0.22	Fallback Value Output	-	-	
S-0-1502.0.23	Min. Delay time	-	-	
S-0-1502.0.24	Max. Delay time	-	-	
S-0-1503	IO function group digital input	-	-	
S-0-1503.0.1	Name of IO FG	-	-	
S-0-1503.0.2	Configuration of IO FG	-	-	

S-0-1503.0.7	Channel quantity PDIN	-	-	
S-0-1503.0.8	Channel width PDIN	-	-	
S-0-1503.0.9	PDIN	-	-	
S-0-1503.0.15	Channel Quantity DIAGIN	-	-	
S-0-1503.0.16	Channel width DIAGIN	-	-	
S-0-1503.0.17	DIAGIN	-	-	
S-0-1503.0.23	Min. Delay time	-	-	
S-0-1503.0.24	Max. Delay time	-	-	

16.2 IDN for gateway configuration

The following configuration will be transmitted through the IDN S-0-1502.0.20 (Parameter channel transmit)

Byte No.	Description	Value
Gateway configuration		
0	Gateway node number (0-16)	
	DIP switch setting	0
	Gateway node number 0	1
	Gateway node number 1	2
	…	..
	Gateway node number 15	15
Data to Pluto configuration		
1	Data to Pluto Update Time (ms).	
	Value modulus	4 - 250
2 – 3	Data to Pluto Timeout (ms)	
	timeout disabled	0
	Valid value in ms.	1 - 65535
4	Enable Data to Pluto (bit or:ed data)	
	Data to Pluto 1	0x1
	Data to Pluto 2	0x2
	Data to Pluto 3	0x4
	Data to Pluto 4	0x8
Additional Data configuration		
5	Additional Data 00, Pluto node (0-31)	0 – 31
6	Additional Data 00, IO-type	0 – 255
7	Additional Data 01, Pluto node (0-31)	0 – 31
8	Additional Data 01, IO-type	0 – 255
9	Additional Data 02, Pluto node (0-31)	0 – 31
10	Additional Data 02, IO-type	0 – 255
11	Additional Data 03, Pluto node (0-31)	0 – 31
12	Additional Data 03, IO-type	0 – 255
13	Additional Data 04, Pluto node (0-31)	0 – 31
14	Additional Data 04, IO-type	0 – 255
15	Additional Data 05, Pluto node (0-31)	0 – 31
16	Additional Data 05, IO-type	0 – 255
17	Additional Data 06, Pluto node (0-31)	0 – 31

Byte No.	Description	Value
18	Additional Data 06, IO-type	0 – 255
19	Additional Data 07, Pluto node (0-31)	0 – 31
20	Additional Data 07, IO-type	0 – 255
21	Additional Data 08, Pluto node (0-31)	0 – 31
22	Additional Data 08, IO-type	0 – 255
23	Additional Data 09, Pluto node (0-31)	0 – 31
24	Additional Data 09, IO-type	0 – 255
25	Additional Data 10, Pluto node (0-31)	0 – 31
26	Additional Data 10, IO-type	0 – 255
27	Additional Data 11, Pluto node (0-31)	0 – 31
28	Additional Data 11, IO-type	0 – 255
29	Additional Data 12, Pluto node (0-31)	0 – 31
30	Additional Data 12, IO-type	0 – 255
31	Additional Data 13, Pluto node (0-31)	0 – 31
32	Additional Data 13, IO-type	0 – 255
33	Additional Data 14, Pluto node (0-31)	0 – 31
34	Additional Data 14, IO-type	0 – 255
35	Additional Data 15, Pluto node (0-31)	0 – 31
36	Additional Data 15, IO-type	0 – 255
37	Additional Data 16, Pluto node (0-31)	0 – 31
38	Additional Data 16, IO-type	0 – 255
39	Additional Data 17, Pluto node (0-31)	0 – 31
40	Additional Data 17, IO-type	0 – 255
41	Additional Data 18, Pluto node (0-31)	0 – 31
42	Additional Data 18, IO-type	0 – 255
43	Additional Data 19, Pluto node (0-31)	0 – 31
44	Additional Data 19, IO-type	0 – 255
45	Additional Data 20, Pluto node (0-31)	0 – 31
46	Additional Data 20, IO-type	0 – 255
47	Additional Data 21, Pluto node (0-31)	0 – 31
48	Additional Data 21, IO-type	0 – 255
49	Additional Data 22, Pluto node (0-31)	0 – 31
50	Additional Data 22, IO-type	0 – 255
51	Additional Data 23, Pluto node (0-31)	0 – 31
52	Additional Data 23, IO-type	0 – 255
53	Additional Data 24, Pluto node (0-31)	0 – 31
54	Additional Data 24, IO-type	0 – 255
55	Additional Data 25, Pluto node (0-31)	0 – 31
56	Additional Data 25, IO-type	0 – 255
57	Additional Data 26, Pluto node (0-31)	0 – 31
58	Additional Data 26, IO-type	0 – 255
59	Additional Data 27, Pluto node (0-31)	0 – 31
60	Additional Data 27, IO-type	0 – 255
61	Additional Data 28, Pluto node (0-31)	0 – 31
62	Additional Data 28, IO-type	0 – 255
63	Additional Data 29, Pluto node (0-31)	0 – 31
64	Additional Data 29, IO-type	0 – 255
65	Additional Data 30, Pluto node (0-31)	Not used
66	Additional Data 30, IO-type	Not used
67	Additional Data 31, Pluto node (0-31)	Not used
68	Additional Data 31, IO-type	Not used

Element		Value	Note
name		Configuration of Pluto	
attribute	length (octet)	67	
	data type & display format	unsigned integer & binary	
	function	parameter	
	positions after decimal point		
	write protection	never	
	conversion factor		
	unit		
minimum value		n/a	
maximum value		n/a	
scaling		1	
scope of parameter		local	

17 Appendix E, object description PROFINET

Pluto Gateway	
Vendor	ABB AB
Vendor ID	0x0184
Product family	Pluto Gateway
Device-ID	0x03E8
Details	Pluto Gateway PROFINET
Content	
Device Access Points	
Modules	
Parameter of Modules	

Device Access Points

Device Access Point: GATE-E2 (Compatibility Mode)	
Module Ident Number	0x00000100
Details	Pluto Gateway PROFINET (Compatibility Mode)
Vendor Name	ABB AB
Order Number	2TLA020071R8300
Software Version	1.0
Hardware Version	1.0
Maximal Input Length	1440 Bytes
Maximal Output Length	1440 Bytes
Physical Slots	0..15
Minimal Device Interval	8 ms
Based on	RTA ConnectMe
DNS Compliant Name	GATEE2
Supports Extended Assigment of IP Address	No
Fixed in Slots	0
Instance Field of the Object UUID	1
Supports Multiple Write	No
Requires IOPS/IOCS	Yes
IP Address Assignment Methods	DCP
Remote Application Timeout	300 s
Submodule: GATE-E2 (Compatibility Mode)	
Submodule Ident Number	0x00000000
Details	Pluto Gateway PROFINET (Compatibility Mode)
Length of the IO Producer Status	1
Length of the IO Consumer Status	1

Gateway Data to Pluto timeout (Index: 1 -- Length: 2 Byte -- Transfersequence: 0)

Name of Parameter	Data Type	Byte Offset	Bit Offset	Bit Length	Defaultvalue	Value Range	Changeable	Visible
Timeout [ms]	Unsigned16	0			0	0..60000	Yes	Yes

Pluto Data to Pluto cycletime (Index: 2 -- Length: 1 Byte -- Transfersequence: 0)

Name of Parameter	Data Type	Byte Offset	Bit Offset	Bit Length	Defaultvalue	Value Range	Changeable	Visible
Cycletime [ms]	Unsigned8	0			100	0..250	Yes	Yes

Gateway Node Address (Index: 42 -- Length: 1 Byte -- Transfersequence: 0)

Name of Parameter	Data Type	Byte Offset	Bit Offset	Bit Length	Defaultvalue	Value Range	Changeable	Visible

Gateway Node Address	Unsigned8	0			DIP-Switch Setting	0..16	Yes	Yes
Useable Modules								

Name	Information	Allowed in Slots	Used in Slots	Fixed in Slots
Node Status	Show which Pluto units are active on Pluto bus.	1..1		
Pluto Nodes 00-07	Global variables from Pluto 0-7.	2..2		
Pluto Nodes 08-15	Global variables from Pluto 8-15.	3..3		
Pluto Nodes 16-23	Global variables from Pluto 16-23.	4..4		
Pluto Nodes 24-31	Global variables from Pluto 24-31.	5..5		
Additional Data Area 00-07	Additional data from Pluto.	6..6		
Additional Data Area 08-15	Additional data from Pluto.	7..7		
Additional Data Area 16-23	Additional data from Pluto.	8..8		
Additional Data Area 24-31	Additional data from Pluto.	9..9		
Data to Pluto Area 0	Data to Pluto.	10..10		
Data to Pluto Area 1	Data to Pluto.	11..11		
Data to Pluto Area 2	Data to Pluto.	12..12		
Data to Pluto Area 3	Data to Pluto.	13..13		
Local Data Request	Request to Pluto for variable data.	14..14		
Local Data Response	Response from Pluto for variable data.	15..15		

Device Access Point: GATE-PN	
Module Ident Number	0x00200000
Details	Pluto Gateway PROFINET
Vendor Name	ABB AB
Order Number	2TLA020071R9300
Software Version	1.0
Hardware Version	1.0
Maximal Input Length	1440 Bytes
Maximal Output Length	1440 Bytes
Physical Slots	0..15
Minimal Device Interval	1 ms
Based on	netX
DNS Compliant Name	gatepn
Supports Extended Assigment of IP Address	No
Fixed in Slots	0
Instance Field of the Object UUID	1
Supports Multiple Write	Yes
Requires IOPS/IOCS	Yes
IP Address Assignment Methods	DCP
Remote Application Timeout	300 s
Subslots of Module	

Subslot Number	Subslot Label
32768 (0x8000)	X1
32769 (0x8001)	X1 P1
32770 (0x8002)	X1 P2

Submodule: GATE-E2 (Compatibility Mode)	
Submodule Ident	0x00200000

Number	
Details	Pluto Gateway PROFINET (Compatibility Mode)
Writeable IM Records	No
Length of the IO Producer Status	1
Length of the IO Consumer Status	1

Gateway Data to Pluto timeout (Index: 1 -- Length: 2 Byte -- Transfersequence: 0)

Name of Parameter	Data Type	Byte Offset	Bit Offset	Bit Length	Defaultvalue	Value Range	Changeable	Visible
Timeout [ms]	Unsigned16	0			0	0..60000	Yes	Yes

Pluto Data to Pluto cycletime (Index: 2 -- Length: 1 Byte -- Transfersequence: 0)

Name of Parameter	Data Type	Byte Offset	Bit Offset	Bit Length	Defaultvalue	Value Range	Changeable	Visible
Cycletime [ms]	Unsigned8	0			100	0..250	Yes	Yes

Gateway Node Address (Index: 42 -- Length: 1 Byte -- Transfersequence: 0)

Name of Parameter	Data Type	Byte Offset	Bit Offset	Bit Length	Defaultvalue	Value Range	Changeable	Visible
Gateway Node Address	Unsigned8	0			DIP-Switch Setting	0..16	Yes	Yes

Interface: PN-IO	
Submodule Ident Number	0x00200001
Subslot Number	32768 (0x8000)
Supports Realtime Class	Class1
Supports Realtime Classes	RT_CLASS_1;RT_CLASS_3
Supports Isochronous Mode	No
Supported Protocols	SNMP;LLDP
Supported MIBs	MIB2
Supports Network Component Diagnosis	Yes
Maximal Bridge Delay	5500 ns
Maximal Number of IR-Frame Data	256
Synchronisation Mode	SyncSlave
Maximal Local Jitter	50 ns
T_PLL_MAX	1000 ns
Supported Sendclock Factors (Base 31,25µs)	32 64 128
Supported Sendclock Factors for RT Class 3 (Base 31,25µs)	8 16 32 64 128
Supported Reduction Ratios	1 2 4 8 16 32 64 128 256 512
Supported Reduction Ratios for RT Class 3	1 2 4 8 16
Supports RT Media Redundancy	Yes
Supported Role	Client
Port 1: Port 1	
Submodule Ident Number	0x00200002
Subslot Number	32769 (0x8001)
MAU Types	16
MaxPortTxDelay	92 ns
MaxPortRxDelay	340 ns
Port Deactivation Supported	Yes

Link State Diagnosis Capability	No
Is Default Ringport	Yes
Port 2: Port 2	
Submodule Ident Number	0x00200002
Subslot Number	32770 (0x8002)
MAU Types	16
MaxPortTxDelay	92 ns
MaxPortRxDelay	340 ns
Port Deactivation Supported	Yes
Link State Diagnosis Capability	No
Is Default Ringport	Yes

Useable Modules

Name	Information	Allowed in Slots	Used in Slots	Fixed in Slots
Node Status	Show which Pluto units are active on Pluto bus.	1..1		
Pluto Nodes 00-07	Global variables from Pluto 0-7.	2..2		
Pluto Nodes 08-15	Global variables from Pluto 8-15.	3..3		
Pluto Nodes 16-23	Global variables from Pluto 16-23.	4..4		
Pluto Nodes 24-31	Global variables from Pluto 24-31.	5..5		
Additional Data Area 00-07	Additional data from Pluto.	6..6		
Additional Data Area 08-15	Additional data from Pluto.	7..7		
Additional Data Area 16-23	Additional data from Pluto.	8..8		
Additional Data Area 24-31	Additional data from Pluto.	9..9		
Data to Pluto Area 0	Data to Pluto.	10..10		
Data to Pluto Area 1	Data to Pluto.	11..11		
Data to Pluto Area 2	Data to Pluto.	12..12		
Data to Pluto Area 3	Data to Pluto.	13..13		

Modules

Module: Node Status	
Module Ident Number	0x02000101
Details	Show which Pluto units are active on Pluto bus.
Order Number	N/A
Category	01-Status
Software Version	1.0
Hardware Version	1.0
Submodule: Node Status	
Submodule Ident Number	0x02000101
Details	Show which Pluto units are active on Pluto bus.

Cyclic Input Data — Item consistency

Name	Data Type	Display as Bits	Length [Bytes]
Node Status	Unsigned32	Yes	

Status (Index: 3 -- Length: 1 Byte -- Transfersequence: 0)

Name of Parameter	Data Type	Byte Offset	Bit Offset	Bit Length	Defaultvalue	Value Range	Changeable	Visible
Module usage	Bit	0	0		Enable	0..1	Yes	Yes

Module: Pluto Nodes 00-07

Module Ident Number	0x02000201
Details	Global variables from Pluto 0-7.
Order Number	N/A
Category	02-Pluto Nodes
Software Version	1.0
Hardware Version	1.0
Submodule: Pluto Nodes 00-07	
Submodule Ident Number	0x02000201
Details	Global variables from Pluto 0-7.

Cyclic Input Data — Item consistency

Name	Data Type	Display as Bits	Length [Bytes]
Node 00 Data	Unsigned32	Yes	
Node 01 Data	Unsigned32	Yes	
Node 02 Data	Unsigned32	Yes	
Node 03 Data	Unsigned32	Yes	
Node 04 Data	Unsigned32	Yes	
Node 05 Data	Unsigned32	Yes	
Node 06 Data	Unsigned32	Yes	
Node 07 Data	Unsigned32	Yes	

Pluto Nodes 0-7 (Index: 4 -- Length: 1 Byte -- Transfersequence: 0)

Name of Parameter	Data Type	Byte Offset	Bit Offset	Bit Length	Defaultvalue	Value Range	Changeable	Visible
Module usage	Bit	0	0		Enable	0..1	Yes	Yes

Module: Pluto Nodes 08-15	
Module Ident Number	0x02000202
Details	Global variables from Pluto 8-15.
Order Number	N/A
Category	02-Pluto Nodes
Software Version	1.0
Hardware Version	1.0
Submodule: Pluto Nodes 08-15	
Submodule Ident Number	0x02000202
Details	Global variables from Pluto 8-15.

Cyclic Input Data — Item consistency

Name	Data Type	Display as Bits	Length [Bytes]
Node 08 Data	Unsigned32	Yes	
Node 09 Data	Unsigned32	Yes	
Node 10 Data	Unsigned32	Yes	
Node 11 Data	Unsigned32	Yes	
Node 12 Data	Unsigned32	Yes	
Node 13 Data	Unsigned32	Yes	
Node 14 Data	Unsigned32	Yes	
Node 15 Data	Unsigned32	Yes	

Pluto Nodes 8-15 (Index: 5 -- Length: 1 Byte -- Transfersequence: 0)

Name of Parameter	Data Type	Byte Offset	Bit Offset	Bit Length	Defaultvalue	Value Range	Changeable	Visible
Module usage	Bit	0	0		Enable	0..1	Yes	Yes

Module: Pluto Nodes 16-23	
Module Ident Number	0x02000203
Details	Global variables from Pluto 16-23.
Order Number	N/A

Category	02-Pluto Nodes
Software Version	1.0
Hardware Version	1.0
Submodule: Pluto Nodes 16-23	
Submodule Ident Number	0x02000203
Details	Global variables from Pluto 16-23.

Cyclic Input Data — Item consistency

Name	Data Type	Display as Bits	Length [Bytes]
Node 16 Data	Unsigned32	Yes	
Node 17 Data	Unsigned32	Yes	
Node 18 Data	Unsigned32	Yes	
Node 19 Data	Unsigned32	Yes	
Node 20 Data	Unsigned32	Yes	
Node 21 Data	Unsigned32	Yes	
Node 22 Data	Unsigned32	Yes	
Node 23 Data	Unsigned32	Yes	

Pluto Nodes 16-23 (Index: 6 -- Length: 1 Byte -- Transfersequence: 0)

Name of Parameter	Data Type	Byte Offset	Bit Offset	Bit Length	Defaultvalue	Value Range	Changeable	Visible
Module usage	Bit	0	0		Enable	0..1	Yes	Yes

Module: Pluto Nodes 24-31	
Module Ident Number	0x02000204
Details	Global variables from Pluto 24-31.
Order Number	N/A
Category	02-Pluto Nodes
Software Version	1.0
Hardware Version	1.0
Submodule: Pluto Nodes 24-31	
Submodule Ident Number	0x02000204
Details	Global variables from Pluto 24-31.

Cyclic Input Data — Item consistency

Name	Data Type	Display as Bits	Length [Bytes]
Node 24 Data	Unsigned32	Yes	
Node 25 Data	Unsigned32	Yes	
Node 26 Data	Unsigned32	Yes	
Node 27 Data	Unsigned32	Yes	
Node 28 Data	Unsigned32	Yes	
Node 29 Data	Unsigned32	Yes	
Node 30 Data	Unsigned32	Yes	
Node 31 Data	Unsigned32	Yes	

Pluto Nodes 24-31 (Index: 7 -- Length: 1 Byte -- Transfersequence: 0)

Name of Parameter	Data Type	Byte Offset	Bit Offset	Bit Length	Defaultvalue	Value Range	Changeable	Visible
Module usage	Bit	0	0		Enable	0..1	Yes	Yes

Module: Additional Data Area 00-07	
Module Ident Number	0x02000301
Details	Additional data from Pluto.
Order Number	N/A
Category	05-Additional Data
Software Version	1.0
Hardware Version	1.0

Submodule: Additional Data Area 00-07								
Submodule Ident Number	0x02000301							
Details	Additional data from Pluto.							
Cyclic Input Data							Item consistency	
Name	**Data Type**	**Display as Bits**	**Length [Bytes]**					
Additional Data Area 00	Unsigned32	Yes						
Additional Data Area 01	Unsigned32	Yes						
Additional Data Area 02	Unsigned32	Yes						
Additional Data Area 03	Unsigned32	Yes						
Additional Data Area 04	Unsigned32	Yes						
Additional Data Area 05	Unsigned32	Yes						
Additional Data Area 06	Unsigned32	Yes						
Additional Data Area 07	Unsigned32	Yes						
Additional Data Area 00 (Index: 8 -- Length: 2 Byte -- Transfersequence: 0)								
Name of Parameter	**Data Type**	**Byte Offset**	**Bit Offset**	**Bit Length**	**Defaultvalue**	**Value Range**	**Changeable**	**Visible**
From Pluto Node	Unsigned8	0			Pluto 00	0..31	Yes	Yes
IO type	Unsigned8	1			UNUSED	0..114	Yes	Yes
Additional Data Area 01 (Index: 9 -- Length: 2 Byte -- Transfersequence: 0)								
Name of Parameter	**Data Type**	**Byte Offset**	**Bit Offset**	**Bit Length**	**Defaultvalue**	**Value Range**	**Changeable**	**Visible**
From Pluto Node	Unsigned8	0			Pluto 00	0..31	Yes	Yes
IO type	Unsigned8	1			UNUSED	0..114	Yes	Yes
Additional Data Area 02 (Index: 10 -- Length: 2 Byte -- Transfersequence: 0)								
Name of Parameter	**Data Type**	**Byte Offset**	**Bit Offset**	**Bit Length**	**Defaultvalue**	**Value Range**	**Changeable**	**Visible**
From Pluto Node	Unsigned8	0			Pluto 00	0..31	Yes	Yes
IO type	Unsigned8	1			UNUSED	0..114	Yes	Yes
Additional Data Area 03 (Index: 11 -- Length: 2 Byte -- Transfersequence: 0)								
Name of Parameter	**Data Type**	**Byte Offset**	**Bit Offset**	**Bit Length**	**Defaultvalue**	**Value Range**	**Changeable**	**Visible**
From Pluto Node	Unsigned8	0			Pluto 00	0..31	Yes	Yes
IO type	Unsigned8	1			UNUSED	0..114	Yes	Yes
Additional Data Area 04 (Index: 12 -- Length: 2 Byte -- Transfersequence: 0)								
Name of Parameter	**Data Type**	**Byte Offset**	**Bit Offset**	**Bit Length**	**Defaultvalue**	**Value Range**	**Changeable**	**Visible**
From Pluto Node	Unsigned8	0			Pluto 00	0..31	Yes	Yes
IO type	Unsigned8	1			UNUSED	0..114	Yes	Yes
Additional Data Area 05 (Index: 13 -- Length: 2 Byte -- Transfersequence: 0)								
Name of Parameter	**Data Type**	**Byte Offset**	**Bit Offset**	**Bit Length**	**Defaultvalue**	**Value Range**	**Changeable**	**Visible**
From Pluto Node	Unsigned8	0			Pluto 00	0..31	Yes	Yes
IO type	Unsigned8	1			UNUSED	0..114	Yes	Yes
Additional Data Area 06 (Index: 14 -- Length: 2 Byte -- Transfersequence: 0)								
Name of Parameter	**Data Type**	**Byte Offset**	**Bit Offset**	**Bit Length**	**Defaultvalue**	**Value Range**	**Changeable**	**Visible**
From Pluto Node	Unsigned8	0			Pluto 00	0..31	Yes	Yes
IO type	Unsigned8	1			UNUSED	0..114	Yes	Yes
Additional Data Area 07 (Index: 15 -- Length: 2 Byte -- Transfersequence: 0)								
Name of Parameter	**Data Type**	**Byte Offset**	**Bit Offset**	**Bit Length**	**Defaultvalue**	**Value Range**	**Changeable**	**Visible**
From Pluto Node	Unsigned8	0			Pluto 00	0..31	Yes	Yes

IO type	Unsigned8	1			UNUSED	0..114	Yes	Yes

Module: Additional Data Area 08-15								
Module Ident Number	0x02000302							
Details	Additional data from Pluto.							
Order Number	N/A							
Category	05-Additional Data							
Software Version	1.0							
Hardware Version	1.0							
Submodule: Additional Data Area 08-15								
Submodule Ident Number	0x02000302							
Details	Additional data from Pluto.							
Cyclic Input Data							Item consistency	
Name	**Data Type**	**Display as Bits**	**Length [Bytes]**					
Additional Data Area 08	Unsigned32	Yes						
Additional Data Area 09	Unsigned32	Yes						
Additional Data Area 10	Unsigned32	Yes						
Additional Data Area 11	Unsigned32	Yes						
Additional Data Area 12	Unsigned32	Yes						
Additional Data Area 13	Unsigned32	Yes						
Additional Data Area 14	Unsigned32	Yes						
Additional Data Area 15	Unsigned32	Yes						
Additional Data Area 08 (Index: 16 -- Length: 2 Byte -- Transfersequence: 0)								
Name of Parameter	**Data Type**	**Byte Offset**	**Bit Offset**	**Bit Length**	**Defaultvalue**	**Value Range**	**Changeable**	**Visible**
From Pluto Node	Unsigned8	0			Pluto 00	0..31	Yes	Yes
IO type	Unsigned8	1			UNUSED	0..114	Yes	Yes
Additional Data Area 09 (Index: 17 -- Length: 2 Byte -- Transfersequence: 0)								
Name of Parameter	**Data Type**	**Byte Offset**	**Bit Offset**	**Bit Length**	**Defaultvalue**	**Value Range**	**Changeable**	**Visible**
From Pluto Node	Unsigned8	0			Pluto 00	0..31	Yes	Yes
IO type	Unsigned8	1			UNUSED	0..114	Yes	Yes
Additional Data Area 10 (Index: 18 -- Length: 2 Byte -- Transfersequence: 0)								
Name of Parameter	**Data Type**	**Byte Offset**	**Bit Offset**	**Bit Length**	**Defaultvalue**	**Value Range**	**Changeable**	**Visible**
From Pluto Node	Unsigned8	0			Pluto 00	0..31	Yes	Yes
IO type	Unsigned8	1			UNUSED	0..114	Yes	Yes
Additional Data Area 11 (Index: 19 -- Length: 2 Byte -- Transfersequence: 0)								
Name of Parameter	**Data Type**	**Byte Offset**	**Bit Offset**	**Bit Length**	**Defaultvalue**	**Value Range**	**Changeable**	**Visible**
From Pluto Node	Unsigned8	0			Pluto 00	0..31	Yes	Yes
IO type	Unsigned8	1			UNUSED	0..114	Yes	Yes
Additional Data Area 12 (Index: 20 -- Length: 2 Byte -- Transfersequence: 0)								
Name of Parameter	**Data Type**	**Byte Offset**	**Bit Offset**	**Bit Length**	**Defaultvalue**	**Value Range**	**Changeable**	**Visible**
From Pluto Node	Unsigned8	0			Pluto 00	0..31	Yes	Yes
IO type	Unsigned8	1			UNUSED	0..114	Yes	Yes
Additional Data Area 13 (Index: 21 -- Length: 2 Byte -- Transfersequence: 0)								
Name of Parameter	**Data Type**	**Byte Offset**	**Bit Offset**	**Bit Length**	**Defaultvalue**	**Value Range**	**Changeable**	**Visible**

From Pluto Node	Unsigned8	0			Pluto 00	0..31	Yes	Yes
IO type	Unsigned8	1			UNUSED	0..114	Yes	Yes
Additional Data Area 14 (Index: 22 -- Length: 2 Byte -- Transfersequence: 0)								
Name of Parameter	**Data Type**	**Byte Offset**	**Bit Offset**	**Bit Length**	**Defaultvalue**	**Value Range**	**Changeable**	**Visible**
From Pluto Node	Unsigned8	0			Pluto 00	0..31	Yes	Yes
IO type	Unsigned8	1			UNUSED	0..114	Yes	Yes
Additional Data Area 15 (Index: 23 -- Length: 2 Byte -- Transfersequence: 0)								
Name of Parameter	**Data Type**	**Byte Offset**	**Bit Offset**	**Bit Length**	**Defaultvalue**	**Value Range**	**Changeable**	**Visible**
From Pluto Node	Unsigned8	0			Pluto 00	0..31	Yes	Yes
IO type	Unsigned8	1			UNUSED	0..114	Yes	Yes

Module: Additional Data Area 16-23								
Module Ident Number	0x02000303							
Details	Additional data from Pluto.							
Order Number	N/A							
Category	05-Additional Data							
Software Version	1.0							
Hardware Version	1.0							
Submodule: Additional Data Area 16-23								
Submodule Ident Number	0x02000303							
Details	Additional data from Pluto.							
Cyclic Input Data							Item consistency	
Name	**Data Type**	**Display as Bits**	**Length [Bytes]**					
Additional Data Area 16	Unsigned32	Yes						
Additional Data Area 17	Unsigned32	Yes						
Additional Data Area 18	Unsigned32	Yes						
Additional Data Area 19	Unsigned32	Yes						
Additional Data Area 20	Unsigned32	Yes						
Additional Data Area 21	Unsigned32	Yes						
Additional Data Area 22	Unsigned32	Yes						
Additional Data Area 23	Unsigned32	Yes						
Additional Data Area 16 (Index: 24 -- Length: 2 Byte -- Transfersequence: 0)								
Name of Parameter	**Data Type**	**Byte Offset**	**Bit Offset**	**Bit Length**	**Defaultvalue**	**Value Range**	**Changeable**	**Visible**
From Pluto Node	Unsigned8	0			Pluto 00	0..31	Yes	Yes
IO type	Unsigned8	1			UNUSED	0..114	Yes	Yes
Additional Data Area 17 (Index: 25 -- Length: 2 Byte -- Transfersequence: 0)								
Name of Parameter	**Data Type**	**Byte Offset**	**Bit Offset**	**Bit Length**	**Defaultvalue**	**Value Range**	**Changeable**	**Visible**
From Pluto Node	Unsigned8	0			Pluto 00	0..31	Yes	Yes
IO type	Unsigned8	1			UNUSED	0..114	Yes	Yes
Additional Data Area 18 (Index: 26 -- Length: 2 Byte -- Transfersequence: 0)								
Name of Parameter	**Data Type**	**Byte Offset**	**Bit Offset**	**Bit Length**	**Defaultvalue**	**Value Range**	**Changeable**	**Visible**
From Pluto Node	Unsigned8	0			Pluto 00	0..31	Yes	Yes
IO type	Unsigned8	1			UNUSED	0..114	Yes	Yes
Additional Data Area 19 (Index: 27 -- Length: 2 Byte -- Transfersequence: 0)								
Name of Parameter	**Data Type**	**Byte**	**Bit Offset**	**Bit**	**Defaultvalue**	**Value**	**Changeable**	**Visible**

		Offset		Length		Range		
From Pluto Node	Unsigned8	0			Pluto 00	0..31	Yes	Yes
IO type	Unsigned8	1			UNUSED	0..114	Yes	Yes
Additional Data Area 20 (Index: 28 -- Length: 2 Byte -- Transfersequence: 0)								
Name of Parameter	**Data Type**	**Byte Offset**	**Bit Offset**	**Bit Length**	**Defaultvalue**	**Value Range**	**Changeable**	**Visible**
From Pluto Node	Unsigned8	0			Pluto 00	0..31	Yes	Yes
IO type	Unsigned8	1			UNUSED	0..114	Yes	Yes
Additional Data Area 21 (Index: 29 -- Length: 2 Byte -- Transfersequence: 0)								
Name of Parameter	**Data Type**	**Byte Offset**	**Bit Offset**	**Bit Length**	**Defaultvalue**	**Value Range**	**Changeable**	**Visible**
From Pluto Node	Unsigned8	0			Pluto 00	0..31	Yes	Yes
IO type	Unsigned8	1			UNUSED	0..114	Yes	Yes
Additional Data Area 22 (Index: 30 -- Length: 2 Byte -- Transfersequence: 0)								
Name of Parameter	**Data Type**	**Byte Offset**	**Bit Offset**	**Bit Length**	**Defaultvalue**	**Value Range**	**Changeable**	**Visible**
From Pluto Node	Unsigned8	0			Pluto 00	0..31	Yes	Yes
IO type	Unsigned8	1			UNUSED	0..114	Yes	Yes
Additional Data Area 23 (Index: 31 -- Length: 2 Byte -- Transfersequence: 0)								
Name of Parameter	**Data Type**	**Byte Offset**	**Bit Offset**	**Bit Length**	**Defaultvalue**	**Value Range**	**Changeable**	**Visible**
From Pluto Node	Unsigned8	0			Pluto 00	0..31	Yes	Yes
IO type	Unsigned8	1			UNUSED	0..114	Yes	Yes

Module: Additional Data Area 24-31								
Module Ident Number	0x02000304							
Details	Additional data from Pluto.							
Order Number	N/A							
Category	05-Additional Data							
Software Version	1.0							
Hardware Version	1.0							
Submodule: Additional Data Area 24-31								
Submodule Ident Number	0x02000304							
Details	Additional data from Pluto.							
Cyclic Input Data							Item consistency	
Name	**Data Type**	**Display as Bits**	**Length [Bytes]**					
Additional Data Area 24	Unsigned32	Yes						
Additional Data Area 25	Unsigned32	Yes						
Additional Data Area 26	Unsigned32	Yes						
Additional Data Area 27	Unsigned32	Yes						
Additional Data Area 28	Unsigned32	Yes						
Additional Data Area 29	Unsigned32	Yes						
Additional Data Area 30	Unsigned32	Yes						
Additional Data Area 31	Unsigned32	Yes						
Additional Data Area 24 (Index: 32 -- Length: 2 Byte -- Transfersequence: 0)								
Name of Parameter	**Data Type**	**Byte Offset**	**Bit Offset**	**Bit Length**	**Defaultvalue**	**Value Range**	**Changeable**	**Visible**
From Pluto Node	Unsigned8	0			Pluto 00	0..31	Yes	Yes
IO type	Unsigned8	1			UNUSED	0..114	Yes	Yes
Additional Data Area 25 (Index: 33 -- Length: 2 Byte -- Transfersequence: 0)								

Name of Parameter	Data Type	Byte Offset	Bit Offset	Bit Length	Defaultvalue	Value Range	Changeable	Visible
From Pluto Node	Unsigned8	0			Pluto 00	0..31	Yes	Yes
IO type	Unsigned8	1			UNUSED	0..114	Yes	Yes
Additional Data Area 26 (Index: 34 -- Length: 2 Byte -- Transfersequence: 0)								
Name of Parameter	Data Type	Byte Offset	Bit Offset	Bit Length	Defaultvalue	Value Range	Changeable	Visible
From Pluto Node	Unsigned8	0			Pluto 00	0..31	Yes	Yes
IO type	Unsigned8	1			UNUSED	0..114	Yes	Yes
Additional Data Area 27 (Index: 35 -- Length: 2 Byte -- Transfersequence: 0)								
Name of Parameter	Data Type	Byte Offset	Bit Offset	Bit Length	Defaultvalue	Value Range	Changeable	Visible
From Pluto Node	Unsigned8	0			Pluto 00	0..31	Yes	Yes
IO type	Unsigned8	1			UNUSED	0..114	Yes	Yes
Additional Data Area 28 (Index: 36 -- Length: 2 Byte -- Transfersequence: 0)								
Name of Parameter	Data Type	Byte Offset	Bit Offset	Bit Length	Defaultvalue	Value Range	Changeable	Visible
From Pluto Node	Unsigned8	0			Pluto 00	0..31	Yes	Yes
IO type	Unsigned8	1			UNUSED	0..114	Yes	Yes
Additional Data Area 29 (Index: 37 -- Length: 2 Byte -- Transfersequence: 0)								
Name of Parameter	Data Type	Byte Offset	Bit Offset	Bit Length	Defaultvalue	Value Range	Changeable	Visible
From Pluto Node	Unsigned8	0			Pluto 00	0..31	Yes	Yes
IO type	Unsigned8	1			UNUSED	0..114	Yes	Yes
Additional Data Area 30 (Index: 38 -- Length: 2 Byte -- Transfersequence: 0)								
Name of Parameter	Data Type	Byte Offset	Bit Offset	Bit Length	Defaultvalue	Value Range	Changeable	Visible
From Pluto Node	Unsigned8	0			Pluto 00	0..31	Yes	Yes
IO type	Unsigned8	1			UNUSED	0..114	Yes	Yes
Additional Data Area 31 (Index: 39 -- Length: 2 Byte -- Transfersequence: 0)								
Name of Parameter	Data Type	Byte Offset	Bit Offset	Bit Length	Defaultvalue	Value Range	Changeable	Visible
From Pluto Node	Unsigned8	0			Pluto 00	0..31	Yes	Yes
IO type	Unsigned8	1			UNUSED	0..114	Yes	Yes

Module: Data to Pluto Area 0								
Module Ident Number	0x02000401							
Details	Data to Pluto.							
Order Number	N/A							
Category	03-Data to Pluto							
Software Version	1.0							
Hardware Version	1.0							
Submodule: Data to Pluto Area 0								
Submodule Ident Number	0x02000401							
Details	Data to Pluto.							
Cyclic Output Data							Item consistency	
Name	Data Type	Display as Bits	Length [Bytes]					
Area 0 Bits	Unsigned16	Yes						
Area 0 Register 0	Unsigned16	Yes						
Area 0 Register 1	Unsigned16	Yes						
Enable Area 0 (Index: 40 -- Length: 1 Byte -- Transfersequence: 0)								
Name of Parameter	Data Type	Byte Offset	Bit Offset	Bit Length	Defaultvalue	Value Range	Changeable	Visible
Module usage	Bit	0	0		Enable	0..1	Yes	Yes

Module: Data to Pluto Area 1

Module Ident Number	0x02000402							
Details	Data to Pluto.							
Order Number	N/A							
Category	03-Data to Pluto							
Software Version	1.0							
Hardware Version	1.0							
Submodule: Data to Pluto Area 1								
Submodule Ident Number	0x02000402							
Details	Data to Pluto.							
Cyclic Output Data							Item consistency	
Name	**Data Type**	**Display as Bits**	**Length [Bytes]**					
Area 1 Bits	Unsigned16	Yes						
Area 1 Register 0	Unsigned16	Yes						
Area 1 Register 1	Unsigned16	Yes						
Enable Area 1 (Index: 40 -- Length: 1 Byte -- Transfersequence: 0)								
Name of Parameter	**Data Type**	**Byte Offset**	**Bit Offset**	**Bit Length**	**Defaultvalue**	**Value Range**	**Changeable**	**Visible**
Module usage	Bit	0	1		Enable	0..1	Yes	Yes

Module: Data to Pluto Area 2								
Module Ident Number	0x02000403							
Details	Data to Pluto.							
Order Number	N/A							
Category	03-Data to Pluto							
Software Version	1.0							
Hardware Version	1.0							
Submodule: Data to Pluto Area 2								
Submodule Ident Number	0x02000403							
Details	Data to Pluto.							
Cyclic Output Data							Item consistency	
Name	**Data Type**	**Display as Bits**	**Length [Bytes]**					
Area 2 Bits	Unsigned16	Yes						
Area 2 Register 0	Unsigned16	Yes						
Area 2 Register 1	Unsigned16	Yes						
Enable Area 2 (Index: 40 -- Length: 1 Byte -- Transfersequence: 0)								
Name of Parameter	**Data Type**	**Byte Offset**	**Bit Offset**	**Bit Length**	**Defaultvalue**	**Value Range**	**Changeable**	**Visible**
Module usage	Bit	0	2		Enable	0..1	Yes	Yes

Module: Data to Pluto Area 3								
Module Ident Number	0x02000404							
Details	Data to Pluto.							
Order Number	N/A							
Category	03-Data to Pluto							
Software Version	1.0							
Hardware Version	1.0							
Submodule: Data to Pluto Area 3								
Submodule Ident Number	0x02000404							
Details	Data to Pluto.							
Cyclic Output Data							Item consistency	
Name	**Data Type**	**Display as Bits**	**Length [Bytes]**					
Area 3 Bits	Unsigned16	Yes						

Area 3 Register 0	Unsigned16	Yes						
Area 3 Register 1	Unsigned16	Yes						
Enable Area 3 (Index: 40 -- Length: 1 Byte -- Transfersequence: 0)								
Name of Parameter	**Data Type**	**Byte Offset**	**Bit Offset**	**Bit Length**	**Defaultvalue**	**Value Range**	**Changeable**	**Visible**
Module usage	Bit	0	3		Enable	0..1	Yes	Yes

Module: Local Data Request								
Module Ident Number	0x00000501							
Details	Request to Pluto for variable data.							
Order Number	N/A							
Category	04-Local Data Req/Rsp							
Software Version	1.0							
Hardware Version	1.0							
Submodule: Local Data Request								
Submodule Ident Number	0x00000000							
Details	Request to Pluto for variable data.							
Cyclic Output Data							Item consistency	
Name	**Data Type**	**Display as Bits**	**Length [Bytes]**					
Sequence Number	Unsigned16	Yes						
Pluto Node	Unsigned16	Yes						
Data Type	Unsigned16	Yes						
Address	Unsigned16	Yes						
Local Data Request Enable (Index: 41 -- Length: 1 Byte -- Transfersequence: 0)								
Name of Parameter	**Data Type**	**Byte Offset**	**Bit Offset**	**Bit Length**	**Defaultvalue**	**Value Range**	**Changeable**	**Visible**
Module usage	Bit	0	0		Enable	0..1	Yes	Yes

Module: Local Data Response								
Module Ident Number	0x00000502							
Details	Response from Pluto for variable data.							
Order Number	N/A							
Category	04-Local Data Req/Rsp							
Software Version	1.0							
Hardware Version	1.0							
Submodule: Local Data Response								
Submodule Ident Number	0x00000000							
Details	Response from Pluto for variable data.							
Cyclic Input Data							Item consistency	
Name	**Data Type**	**Display as Bits**	**Length [Bytes]**					
Sequence Number	Unsigned16	Yes						
Pluto Node	Unsigned16	Yes						
Data Type	Unsigned16	Yes						
Address	Unsigned16	Yes						
Error Code	Unsigned16	Yes						
Data MSW	Unsigned16	Yes						
Data LSW	Unsigned16	Yes						
Local Data Response Enable (Index: 41 -- Length: 1 Byte -- Transfersequence: 0)								
Name of Parameter	**Data Type**	**Byte Offset**	**Bit Offset**	**Bit Length**	**Defaultvalue**	**Value Range**	**Changeable**	**Visible**
Module usage	Bit	0	1		Enable	0..1	Yes	Yes

Parameter of Modules

Parameter-ID: IDV_Enable	
Value	**Content**
0	Disable
1	Enable

Parameter-ID: IDV_GatewayNodeAddress	
Value	**Content**
0	DIP-Switch Setting
1	Node Address 0
2	Node Address 1
3	Node Address 2
4	Node Address 3
5	Node Address 4
6	Node Address 5
7	Node Address 6
8	Node Address 7
9	Node Address 8
10	Node Address 9
11	Node Address 10
12	Node Address 11
13	Node Address 12
14	Node Address 13
15	Node Address 14
16	Node Address 15

Parameter-ID: IDV_IOPluto	
Value	**Content**
0	Pluto 00
1	Pluto 01
2	Pluto 02
3	Pluto 03
4	Pluto 04
5	Pluto 05
6	Pluto 06
7	Pluto 07
8	Pluto 08
9	Pluto 09
10	Pluto 10
11	Pluto 11
12	Pluto 12
13	Pluto 13
14	Pluto 14
15	Pluto 15
16	Pluto 16
17	Pluto 17
18	Pluto 18
19	Pluto 19
20	Pluto 20
21	Pluto 21
22	Pluto 22
23	Pluto 23
24	Pluto 24
25	Pluto 25

26	Pluto 26
27	Pluto 27
28	Pluto 28
29	Pluto 29
30	Pluto 30
31	Pluto 31

Parameter-ID: IDV_IOType	
Value	**Content**
0	UNUSED
1	ToGateway_UserNumber_1
2	ToGateway_UserNumber_2
3	ToGateway_UserNumber_3
4	ToGateway_UserNumber_4
5	ToGateway_UserNumber_5
6	ToGateway_UserNumber_6
7	ToGateway_UserNumber_7
8	ToGateway_UserNumber_8
9	ToGateway_UserNumber_9
10	ToGateway_UserNumber_10
11	ToGateway_UserNumber_11
12	ToGateway_UserNumber_12
13	ToGateway_UserNumber_13
14	ToGateway_UserNumber_14
15	ToGateway_UserNumber_15
16	ToGateway_UserNumber_16
17	ToGateway_UserNumber_17
18	ToGateway_UserNumber_18
19	ToGateway_UserNumber_19
20	ToGateway_UserNumber_20
21	ToGateway_UserNumber_21
22	ToGateway_UserNumber_22
23	ToGateway_UserNumber_23
24	ToGateway_UserNumber_24
25	ToGateway_UserNumber_25
26	ToGateway_UserNumber_26
27	ToGateway_UserNumber_27
28	ToGateway_UserNumber_28
29	ToGateway_UserNumber_29
30	ToGateway_UserNumber_30
31	ToGateway_UserNumber_31
32	ToGateway_UserNumber_32
33	ToGateway_UserNumber_33
34	ToGateway_UserNumber_34
35	ToGateway_UserNumber_35
36	ToGateway_UserNumber_36
37	ToGateway_UserNumber_37
38	ToGateway_UserNumber_38
39	ToGateway_UserNumber_39
40	ToGateway_UserNumber_40
41	ToGateway_UserNumber_41
42	ToGateway_UserNumber_42
43	ToGateway_UserNumber_43
44	ToGateway_UserNumber_44
45	ToGateway_UserNumber_45
46	ToGateway_UserNumber_46
47	ToGateway_UserNumber_47
48	ToGateway_UserNumber_48

49	ToGateway_UserNumber_49
50	ToGateway_UserNumber_50
51	ToGateway_UserNumber_51
52	ToGateway_UserNumber_52
53	ToGateway_UserNumber_53
54	ToGateway_UserNumber_54
55	ToGateway_UserNumber_55
56	ToGateway_UserNumber_56
57	ToGateway_UserNumber_57
58	ToGateway_UserNumber_58
59	ToGateway_UserNumber_59
60	ToGateway_UserNumber_60
61	ToGateway_UserNumber_61
62	ToGateway_UserNumber_62
63	ToGateway_UserNumber_63
64	ToGateway_UserNumber_64
65	ToGateway_UserNumber_65
66	ToGateway_UserNumber_66
67	ToGateway_UserNumber_67
68	ToGateway_UserNumber_68
69	ToGateway_UserNumber_69
70	ToGateway_UserNumber_70
71	ToGateway_UserNumber_71
72	ToGateway_UserNumber_72
73	ToGateway_UserNumber_73
74	ToGateway_UserNumber_74
75	ToGateway_UserNumber_75
76	ToGateway_UserNumber_76
77	ToGateway_UserNumber_77
78	ToGateway_UserNumber_78
79	ToGateway_UserNumber_79
80	ToGateway_UserNumber_80
81	ToGateway_UserNumber_81
82	ToGateway_UserNumber_82
83	ToGateway_UserNumber_83
84	ToGateway_UserNumber_84
85	ToGateway_UserNumber_85
86	ToGateway_UserNumber_86
87	ToGateway_UserNumber_87
88	ToGateway_UserNumber_88
89	ToGateway_UserNumber_89
90	ToGateway_UserNumber_90
91	ToGateway_UserNumber_91
92	ToGateway_UserNumber_92
93	ToGateway_UserNumber_93
94	ToGateway_UserNumber_94
95	ToGateway_UserNumber_95
96	ToGateway_UserNumber_96
97	ToGateway_UserNumber_97
98	ToGateway_UserNumber_98
99	ToGateway_UserNumber_99
100	ToGateway_ErrorCode
101	ToGateway_B46_I20_I47
102	ToGateway_ASi_16_31_Safe
103	ToGateway_ASi_1_3_NonSafe_In
104	ToGateway_ASi_4_7_NonSafe_In
105	ToGateway_ASi_8_11_NonSafe_In
106	ToGateway_ASi_12_15_NonSafe_In
107	ToGateway_ASi_16_19_NonSafe_In

	ToGateway_ASi_20_23_NonSafe_In
109	ToGateway_ASi_24_27_NonSafe_In
110	ToGateway_ASi_28_31_NonSafe_In
111	ToGateway_Global
112	ToGateway_ASi_B42_I20_I47
113	ToGateway_ASi_1_15_Safe
114	ToGateway_D45_I20_I47

Note: This page shows the content of a GSD file transformed into HTML format. In the case of disparity between this and the XML view, the content of the XML file takes precedence.

18 Appendix F, object description Modbus TCP

18.1 Port number

The Modbus TCP server is running on the standard port number 502.

18.2 Unit Identifier

The server will respond on the following "**Unit Identifier number**" (UI) of "**slave address**".

UI	Data	Access function	Access Rule
1 (0x01)	Data to Pluto.	FC01, FC03, FC05, FC06, FC15 and FC16	RW
4 (0x04)	Gateway Configuration.	FC03 and FC16	RW
10 (0x0A)	Data to/from Pluto.	FC23	RW
33 (0x21)	(Data from Pluto, see note below).	FC03	RO
36 (0x24)	Data from Pluto, see note below.	FC01 and FC03	RO

RW is Read/Write access.
RO is Read only access.

Note: The **UI 33** and **UI 36** is the same information but used differnet type if encoding of 32 bit data.

18.3 Access functions

Each UI can be accessed via different access function codes,

FC	Description	Access Rule
01 (0x01)	Read Coils	Read
03 (0x03)	Read Holding Register	Read
05 (0x05)	Write Coils	Write
06 (0x06)	Write Single Register	Write
15 (0x0E)	Force Multiple Coils	Write
16 (0x10)	Preset Multiple Registers	Write
23 (0x17)	Read/Write Registers	Read/Write

18.4 Data format

An UINT data types occupy one Modbus registers, the data is ordered in the following way:

UINT															
Byte 1								Byte 0							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0

An UDINT data type occupies two Modbus registers, the data is ordered in the following way:

UDINT															
First UINT															
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Second UINT															
31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16

UDINT data for **UI 33**, the data is ordered in the following way:

UDINT															
First UINT															
31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
Second UINT															
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

18.5 Data to Pluto

Unit Identifier 1: for read/write data to Pluto system.

Modbus register	Data Name	Data Type	Access	Note
0	Reserved – will not be used	UINT	RW	
1	Reserved – will not be used	UINT	RW	
2	Area 0, Bits	UINT	RW	
3	Area 0, Register 0	UINT	RW	
4	Area 0, Register 1	UINT	RW	
5	Area 1, Bits	UINT	RW	
6	Area 1, Register 0	UINT	RW	
7	Area 1, Register 1	UINT	RW	
8	Area 2, Bits	UINT	RW	
9	Area 2, Register 0	UINT	RW	
10	Area 2, Register 1	UINT	RW	
11	Area 3, Bits	UINT	RW	
12	Area 3, Register 0	UINT	RW	
13	Area 3, Register 1	UINT	RW	

18.6 Gateway Configuration

Unit Identifier 4: to write configuration to the gateway.

Note: This data is common for all connected clients. E.g. valid configuration will be the data written by the last client writing data to this slave address.

Note: For additional data Pluto number and IO-type shall be set to zero if data area is not used.

Modbus register	Data Name	Data Type	Access	Note
0	Reserved – will not be used	UNIT	RW	
1	Enable Data to Pluto (0 = Disabled; 1 = Enabled) - bit 0 – Data To Pluto Area 0 - bit 1 – Data To Pluto Area 1 - bit 2 – Data To Pluto Area 2 - bit 3 – Data To Pluto Area 3	UINT	RW	UINT read/write data is truncated to byte size.
2	Data to Pluto Timeout (ms) 0 = Timeout disabled (default). 1 – 65535 ms.	UINT	RW	
3	Reserved – will not be used	UDINT	RW	
5	Additional Data Area 0	UINT	RW	Format see note below.
6	Additional Data Area 1	UINT	RW	Format see note below.

Modbus register	Data Name	Data Type	Access	Note
7	Additional Data Area 2	UINT	RW	Format see note below.
8	Additional Data Area 3	UINT	RW	Format see note below.
9	Additional Data Area 4	UINT	RW	Format see note below.
10	Additional Data Area 5	UINT	RW	Format see note below.
11	Additional Data Area 6	UINT	RW	Format see note below.
12	Additional Data Area 7	UINT	RW	Format see note below.
13	Additional Data Area 8	UINT	RW	Format see note below.
14	Additional Data Area 9	UINT	RW	Format see note below.
15	Additional Data Area 10	UINT	RW	Format see note below.
16	Additional Data Area 11	UINT	RW	Format see note below.
17	Additional Data Area 12	UINT	RW	Format see note below.
18	Additional Data Area 13	UINT	RW	Format see note below.
19	Additional Data Area 14	UINT	RW	Format see note below.
20	Additional Data Area 15	UINT	RW	Format see note below.
21	Additional Data Area 16	UINT	RW	Format see note below.
22	Additional Data Area 17	UINT	RW	Format see note below.
23	Additional Data Area 18	UINT	RW	Format see note below.
24	Additional Data Area 19	UINT	RW	Format see note below.
25	Additional Data Area 20	UINT	RW	Format see note below.
26	Additional Data Area 21	UINT	RW	Format see note below.
27	Additional Data Area 22	UINT	RW	Format see note below.
28	Additional Data Area 23	UINT	RW	Format see note below.
29	Additional Data Area 24	UINT	RW	Format see note below.
30	Additional Data Area 25	UINT	RW	Format see note below.
31	Additional Data Area 26	UINT	RW	Format see note below.
32	Additional Data Area 27	UINT	RW	Format see note below.
33	Additional Data Area 28	UINT	RW	Format see note below.
34	Additional Data Area 29	UINT	RW	Format see note below.
35	Additional Data Area 30	UINT	RW	Format see note below.
36	Additional Data Area 31	UINT	RW	Format see note below.
37	Data to Pluto Cycle time (ms) 0 – 255 ms, default 100 ms	UINT	RW	UINT read/write data is truncated to byte size.
38	Reserved – will not be used	UINT	RW	
39	Reserved – will not be used	UINT	RW	
40	Reserved – will not be used	UINT	RW	
41	Gateway Node number (0-16) 0 = Read from DIP switch 1 = Gateway node number 0 2 = Gateway node number 1 … 16 = Gateway node number 15 For more see chapter 5.1.4.1.	UINT	RW	UINT read/write data is truncated to byte size.

The UINT configuration data is allocated as following:

UINT	
Byte 1 (high byte)	Byte 0 (low byte)
Pluto node number, range 0 – 31.	IO-typ, range 0 – 255.

18.7 Data to/from Pluto

Unit Identifier 10: Read global data from Pluto and write data to Pluto

Modbus register	Data Name	Data Type	Access	Note
0	Pluto node status	UDINT	RO	
2	Global data Pluto 0	UDINT	RO	
4	Global data Pluto 1	UDINT	RO	
6	Global data Pluto 2	UDINT	RO	
8	Global data Pluto 3	UDINT	RO	
10	Global data Pluto 4	UDINT	RO	
12	Global data Pluto 5	UDINT	RO	
14	Global data Pluto 6	UDINT	RO	
16	Global data Pluto 7	UDINT	RO	
18	Global data Pluto 8	UDINT	RO	
20	Global data Pluto 9	UDINT	RO	
22	Global data Pluto 10	UDINT	RO	
24	Global data Pluto 11	UDINT	RO	
26	Global data Pluto 12	UDINT	RO	
28	Global data Pluto 13	UDINT	RO	
30	Global data Pluto 14	UDINT	RO	
32	Global data Pluto 15	UDINT	RO	
34	Global data Pluto 16	UDINT	RO	
36	Global data Pluto 17	UDINT	RO	
38	Global data Pluto 18	UDINT	RO	
40	Global data Pluto 19	UDINT	RO	
42	Global data Pluto 20	UDINT	RO	
44	Global data Pluto 21	UDINT	RO	
46	Global data Pluto 22	UDINT	RO	
48	Global data Pluto 23	UDINT	RO	
50	Global data Pluto 24	UDINT	RO	
52	Global data Pluto 25	UDINT	RO	
54	Global data Pluto 26	UDINT	RO	
56	Global data Pluto 27	UDINT	RO	
58	Global data Pluto 28	UDINT	RO	
60	Global data Pluto 29	UDINT	RO	
62	Global data Pluto 30	UDINT	RO	
64	Global data Pluto 31	UDINT	RO	
66	Additional data 0	UDINT	RO	
68	Additional data 1	UDINT	RO	
70	Additional data 2	UDINT	RO	
72	Additional data 3	UDINT	RO	
74	Additional data 4	UDINT	RO	
76	Additional data 5	UDINT	RO	
78	Additional data 6	UDINT	RO	
80	Additional data 7	UDINT	RO	
82	Additional data 8	UDINT	RO	
84	Additional data 9	UDINT	RO	
86	Additional data 10	UDINT	RO	
88	Additional data 11	UDINT	RO	
90	Additional data 12	UDINT	RO	
92	Additional data 13	UDINT	RO	
94	Additional data 14	UDINT	RO	
96	Additional data 15	UDINT	RO	

Modbus register	Data Name	Data Type	Access	Note
98	Additional data 16	UDINT	RO	
100	Additional data 17	UDINT	RO	
102	Additional data 18	UDINT	RO	
104	Additional data 19	UDINT	RO	
106	Additional data 20	UDINT	RO	
108	Additional data 21	UDINT	RO	
110	Additional data 22	UDINT	RO	
112	Additional data 23	UDINT	RO	
114	Additional data 24	UDINT	RO	
116	Additional data 25	UDINT	RO	
118	Additional data 26	UDINT	RO	
120	Additional data 27	UDINT	RO	
122	Additional data 28	UDINT	RO	
124	Additional data 29	UDINT	RO	
126	Additional data 30	UDINT	RO	
128	Additional data 31	UDINT	RO	
130-198	Not used	UDINT		Not mapped
200	Area 0, Bits	UINT	RW	
201	Area 0, Register 0	UINT	RW	
202	Area 0, Register 1	UINT	RW	
203	Area 1, Bits	UINT	RW	
204	Area 1, Register 0	UINT	RW	
205	Area 1, Register 1	UINT	RW	
206	Area 2, Bits	UINT	RW	
207	Area 2, Register 0	UINT	RW	
208	Area 2, Register 1	UINT	RW	
209	Area 3, Bits	UINT	RW	
210	Area 3, Register 0	UINT	RW	
211	Area 3, Register 1	UINT	RW	

18.8 Data from Pluto

Unit Identifier 33 and 36: for read Pluto node status, global data from each Pluto and also additional data from the Pluto system.

Note: Note that **UI 33** and **UI36** has different layout of the UDINT (see 18.4). The **UI33** is implemented for compatibility with the GATE-E2 and new usage shall use the **UI36** with the standard format of UDINT for Modbus TCP (see 18.2).

Note: Only 100 words can be read in one request!

If more data is needed divide them in two or more request with selected start/end address in the request. For example a request with start 1 and end 66 will give node status and Pluto global data. A request with start 67 and end 130 will give additional data.

Modbus register	Data Name	Data Type	Access	Note
0	Reserved – will not be used	UINT	RO	
1	Pluto node status	UDINT	RO	
3	Global data Pluto 0	UDINT	RO	

Modbus register	Data Name	Data Type	Access	Note
5	Global data Pluto 1	UDINT	RO	
7	Global data Pluto 2	UDINT	RO	
9	Global data Pluto 3	UDINT	RO	
11	Global data Pluto 4	UDINT	RO	
13	Global data Pluto 5	UDINT	RO	
15	Global data Pluto 6	UDINT	RO	
17	Global data Pluto 7	UDINT	RO	
19	Global data Pluto 8	UDINT	RO	
21	Global data Pluto 9	UDINT	RO	
23	Global data Pluto 10	UDINT	RO	
25	Global data Pluto 11	UDINT	RO	
27	Global data Pluto 12	UDINT	RO	
29	Global data Pluto 13	UDINT	RO	
31	Global data Pluto 14	UDINT	RO	
33	Global data Pluto 15	UDINT	RO	
35	Global data Pluto 16	UDINT	RO	
37	Global data Pluto 17	UDINT	RO	
39	Global data Pluto 18	UDINT	RO	
41	Global data Pluto 19	UDINT	RO	
43	Global data Pluto 20	UDINT	RO	
45	Global data Pluto 21	UDINT	RO	
47	Global data Pluto 22	UDINT	RO	
49	Global data Pluto 23	UDINT	RO	
51	Global data Pluto 24	UDINT	RO	
53	Global data Pluto 25	UDINT	RO	
55	Global data Pluto 26	UDINT	RO	
57	Global data Pluto 27	UDINT	RO	
59	Global data Pluto 28	UDINT	RO	
61	Global data Pluto 29	UDINT	RO	
63	Global data Pluto 30	UDINT	RO	
65	Global data Pluto 31	UDINT	RO	
67	Additional data 0	UDINT	RO	
69	Additional data 1	UDINT	RO	
71	Additional data 2	UDINT	RO	
73	Additional data 3	UDINT	RO	
75	Additional data 4	UDINT	RO	
77	Additional data 5	UDINT	RO	
79	Additional data 6	UDINT	RO	
81	Additional data 7	UDINT	RO	
83	Additional data 8	UDINT	RO	
85	Additional data 9	UDINT	RO	
87	Additional data 10	UDINT	RO	
89	Additional data 11	UDINT	RO	
91	Additional data 12	UDINT	RO	
93	Additional data 13	UDINT	RO	
95	Additional data 14	UDINT	RO	
97	Additional data 15	UDINT	RO	
99	Additional data 16	UDINT	RO	
101	Additional data 17	UDINT	RO	
103	Additional data 18	UDINT	RO	
105	Additional data 19	UDINT	RO	
107	Additional data 20	UDINT	RO	
109	Additional data 21	UDINT	RO	

Modbus register	Data Name	Data Type	Access	Note
111	Additional data 22	UDINT	RO	
113	Additional data 23	UDINT	RO	
115	Additional data 24	UDINT	RO	
117	Additional data 25	UDINT	RO	
119	Additional data 26	UDINT	RO	
121	Additional data 27	UDINT	RO	
123	Additional data 28	UDINT	RO	
125	Additional data 29	UDINT	RO	
127	Additional data 30	UDINT	RO	
129	Additional data 31	UDINT	RO	

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