Communication with Gate PN

TECHNICAL NOTE V20200120

It is useful to share information with Pluto controllers, sometimes getting information from it is needed, other times sending information to it. With the use of a gateway, Pluto can communicate with other control systems and form a part of a larger network. In this example, it is explained how to get variables information from an AS-i Pluto and the procedure to send information to it, using the gateway Gete PN.

Material needed

For this example, the material used is the one listed below:

- Gate PN: REF 2TLA020071R9300

  Gateway for 2-way communication between the Pluto bus and Ethernet. Ethernet protocol PROFINET.

Figure 1.- Gate PN

- Pluto AS-i: REF 2TLA020070R1100

  Safety PLC with AS-i bus and Pluto safety bus. Totally 12 I/O: 4 failsafe inputs + 4 non-failsafe outputs/failsafe inputs + 2 individual failsafe relay outputs + 2 individual failsafe transistor outputs.

Figure 2.- Pluto AS-i

- Computer with Pluto Manager software

  Pluto Manager is a software tailored for the safety PLC Pluto. Programming is done in ladder and together with the function block creates the structure of your safety functions. The software comes with predefined function blocks approved by TÜV to facilitate the work on designing the safety functions.

The software can be downloaded from the ABB web, it needs a free license. Contact with technical support to get the license.

Figure 3.- Computer with Pluto Manager

- Pluto cable USB: REF 2TLA020070R5800

Pluto programming and on-line monitoring cable from a PC USB port to the Pluto programming port.

Figure 4.- Pluto USB cable

- IDFIX DATA: REF 2TLA020070R2300

Identifier read/write, for assigning an address to the Pluto it is connected to and for storage of the AS-i safety codes. **Must** be used with Pluto AS-i and Pluto B42 AS-i and can be used for all Pluto types.

Figure 5.- IDFIX DATA

- Power supply 24Vdc (CP-E): REF 1SVR427031R0000

Power supply needed for the AS-i bus and Pluto.

Figure 6.- Power supply

- Controller for getting the information from the gateway AC500. The module CM579 PINIO is needed to integrate the PROFINET protocol.

Figure 7.- AC500

Connection diagram

The connection diagram for this example is the next one:
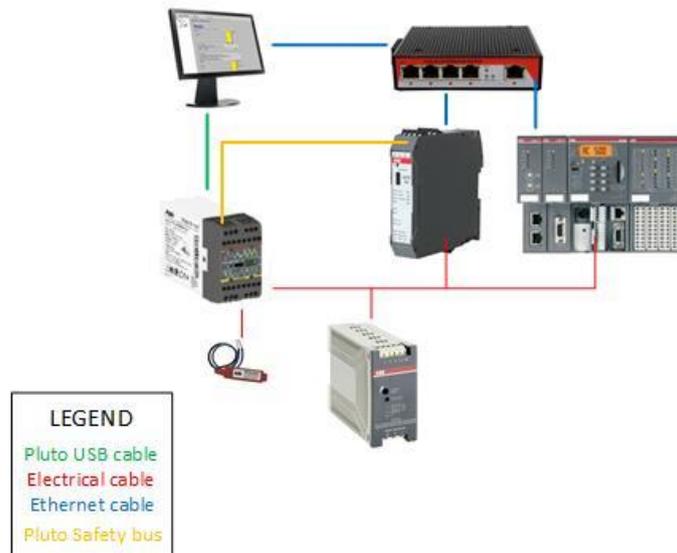
Diagram 1.- Connection diagram example

In the table 1 there are explained connector by connector de electrical connections needed.

Table 1.- Electrical connections

Device 1	Connector 1	Device 2	Connector 2
Pluto AS-i	CH	Gate-PN	CH
Pluto AS-i	CL	Gate-PN	CL
Pluto AS-i	ID	IDFIX-DATA	Black
Pluto AS-i	0 V	IDFIX-DATA	Blue
Pluto AS-i	0 V	CP-E	L-
Pluto AS-i	24 V	CP-E	L+
Gate-PN	1	CP-E	L+
Gate-PN	0 V	CP-E	L-
AC500	L+	CP-E	L+
AC500	M	CP-E	L-

Note that for this example there is a switch for all the ethernet connections instead of following the connection diagram 2:

- computer->AC500   CM-579 PINIO ->Gate-PN
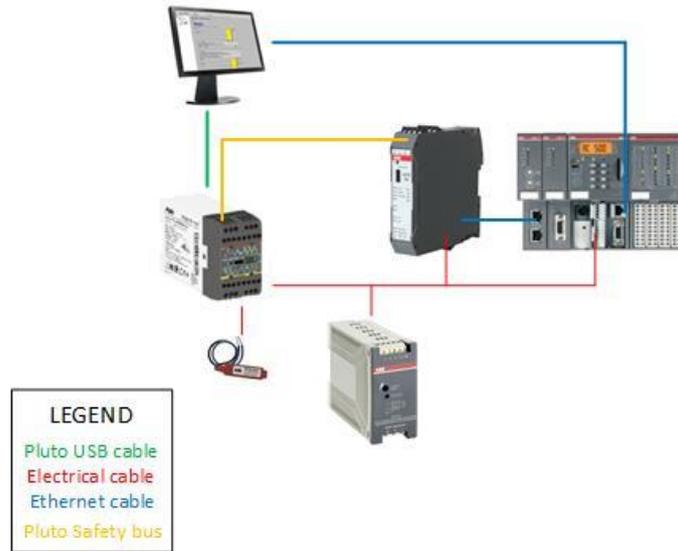
Diagram 2.- Connection diagram 2

This is because with a switch with all the ethernet connections on it, it is possible to apply the ping command to the PINIO module and to the gateway. It is a windows tool that permits checking if the device has got the right IP direction, among other things.

Configuration in Pluto Manager

Before starting with the configuration, it is important to understand how the gateway works. By default, every Pluto PLC shares its global variables with the other devices connected to the Pluto safety bus. In case of the Pluto AS-i, the global variables are the next one:

Table 2.- Pluto global data for Pluto AS-i family (x is Pluto node number and y is the safety node)

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

There are other registers that are filled automatically: There are two registers that contain the information about which Pluto is active in the Pluto safety bus. When a Pluto is active the corresponding bit is set to "1".

Table 3.- Pluto status coding

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

In case other information is needed, there are available 32 registers for additional data from Pluto. These registers can contain different information, depending on the configuration applied to the gateway. This information can be predefined blocks or specific registers or bites that are required by another device.

When sending information to the Pluto is needed, there are 8 registers available. It will be explained how to configure them later.

Reading information

Configuration of the gateway Gate PN in Pluto Manager:

In case of reading global variables, there is no need of any other configuration in the Pluto Manager, since the gateway receives this information when it is connected to the Pluto safety bus.

If extra information is needed, the additional data registers must be configured. For this example, we are going to configure the additional register 0 for receiving information from the Pluto 1 using the function block "ToGateway_User_C".

Table 4.- User defined block type C

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

In order to configure the gateway, connect the PC to the gateway with the Pluto cable USB and follow the next steps:

1. Check the communication port is the right one, it has to contain "(VCP0)" if there is only one Pluto cable connected.
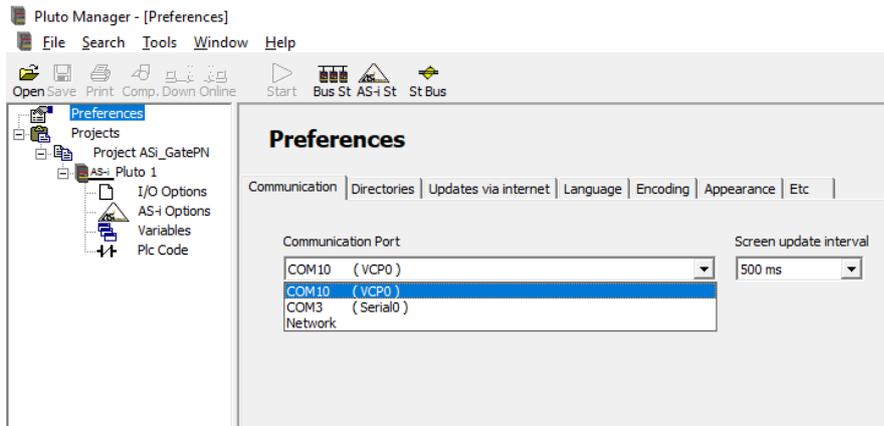

Figure 8.- Configuration communication port

2. The configuration of the gateway is done through the Terminal Window tool, click on it. When it is opened, if the gateway is connected, it will appear "pn_gw>". Indicating that the configuration can start.
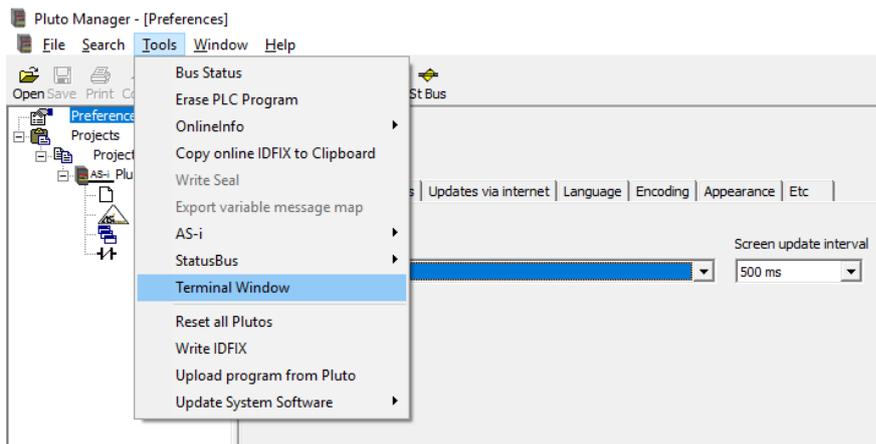

Figure 9.- Terminal window

3. Pressing the "h" key, the help menu will be displayed. There are the most common commands used.
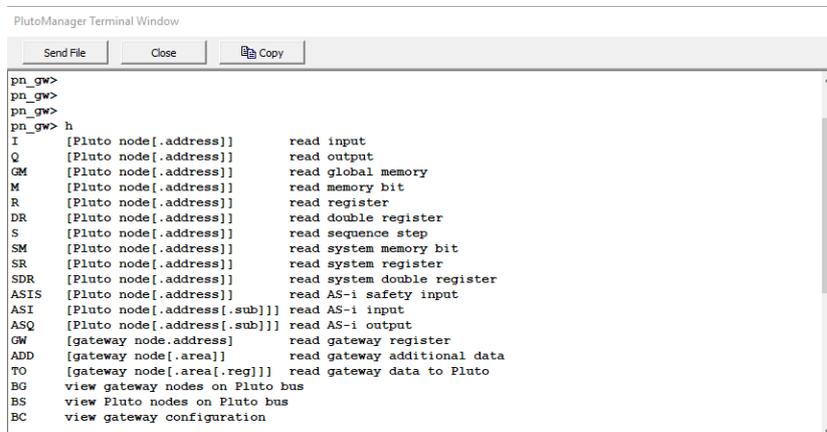
Figure 10.- Help command

4. Using the "BG" and "BS" commands is possible to check the gateways and Plutos connected to the Pluto safety bus respectively.

Figure 11.- Use of BG and BS commands

5. The "BC" (12.1) command is used to check if there is any configuration already stored in the gateway. If there is any configuration, use the "ADDC" (12.2) command to erase it.

Figure 12.- Checking and erasing configuration of the gateway

6. Use the "ADDS" command to configure the additional data. Then select the additional data area desired, the Pluto node that will send the information and the information that will be sent. In this example:

- Additional data 1 (13.1).

- Pluto node 1 (13.2).

- Information sent by user 1 (13.3). This parameter is set in the function block of the PLC code.
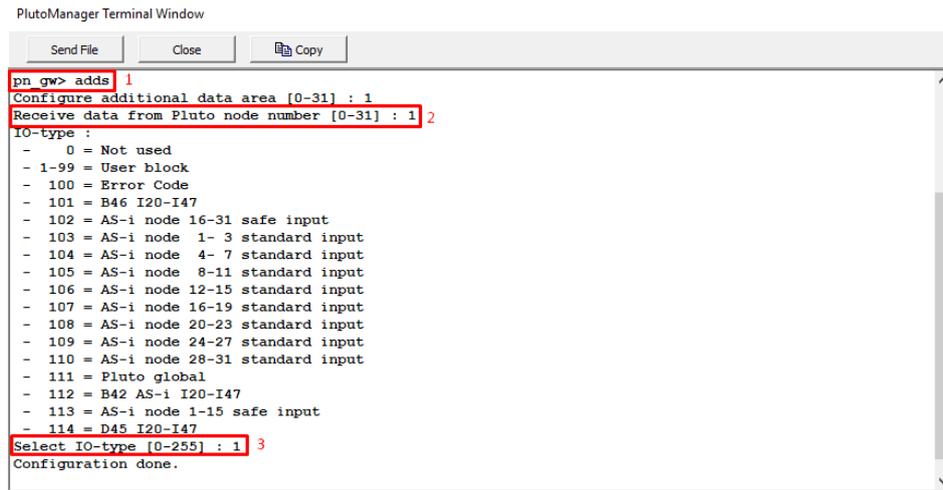
Figure 13.- Configuration of additional data

The terminal window can be closed, the configuration with the Pluto Manager is done. Note that the IP has not been configurated, this is because the IP is set by the PLC controller.

Configuration of AC500 with Automation Builder

Once the controller and extra modules are configurated (PM573 + DC532 + CM572 + CM570-PINIO in this case). The mandatory modules are the PM573 and the CM570-PINIO, the other ones can be installed but will not be used.

The next steps must be followed to configure the gateway:

1. Add the device GATE-PN by loading the GSDML file, the latest version can be downloaded from the "Gate PN webpage". The GSDML file is added to the Automation Builder program by clicking in:

   Tools (14.1)->Device Repository…(14.2)->Install
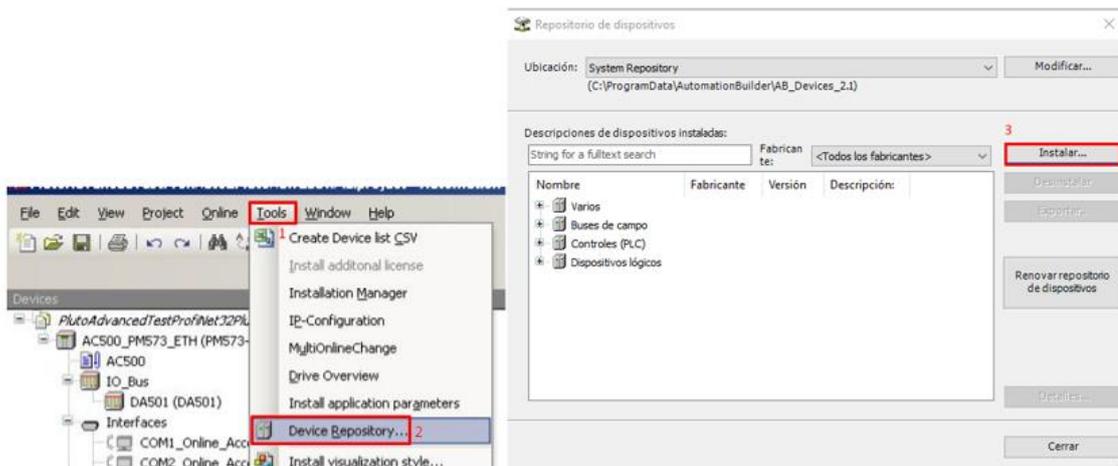
Figure 14.- Adding GSDML file (1)

Then select the file and click in open. Make sure the option "file configuration PROFINET" is selected (Figure 15). Otherwise an error message will appear (Figure 16).
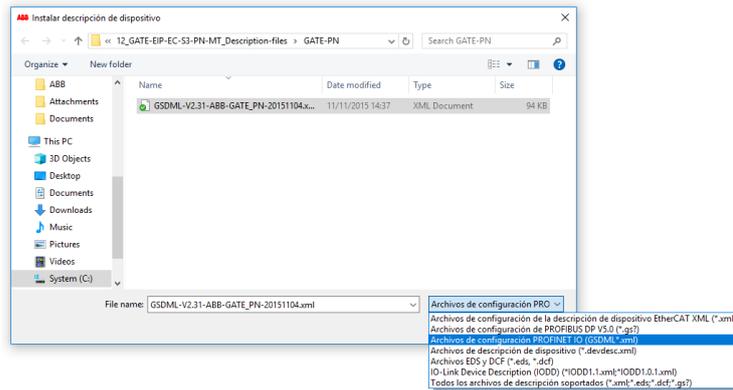
Figure 15.- Adding GSDML file (2)
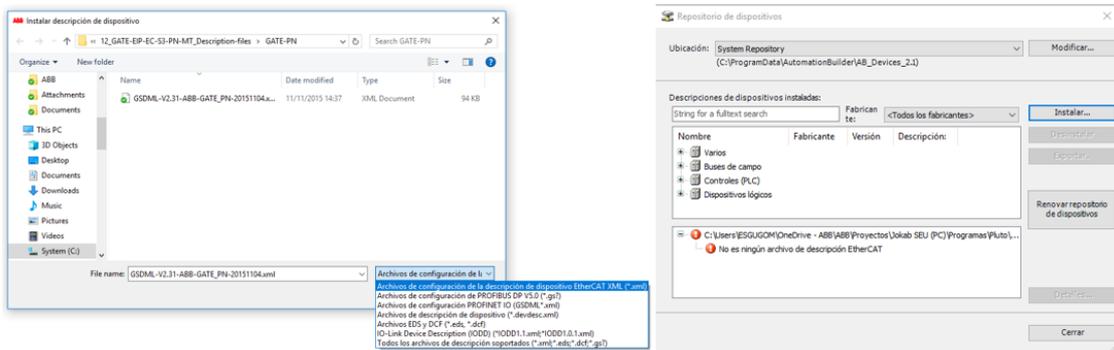
Figure 16.- Adding GSDML file (2)

2. Then, all the modules/objects must be added by doing right click and add aobject. These modules are the registers that let the Pluto send or receive information. When all the modules are added, the object GATE_PN must look like the one in the figure 17.
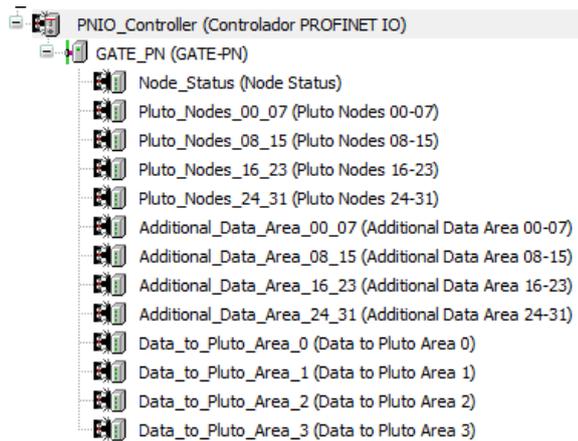

Figure 17.- Configuration GATE_PN objects

3. Configure the gateway also has to be done here. In fact, if the configuration here is different from the one of the Pluto Manager, it will be overwritten by this one. Then, it is important that the information introduced in the Pluto Manager is the same than the one of the Pluto Manager.

The parameters to configure (at least) are the next one:

- Name (18.1).

- IP direction (18.2).

- Gate Node Address: introduce the same than in Pluto Manager (18.3).
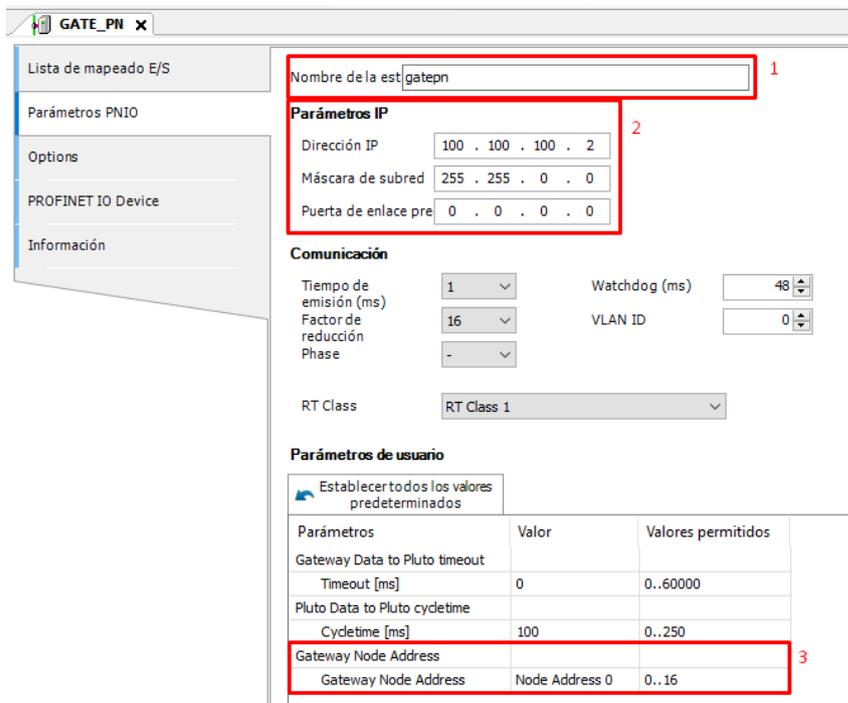
Figure 18.- Configuring GATE_PN

4. After that, configuring the controller is needed. The configuration needed is the next one:

- IP direction (19.1).

- Configuration for slaves: Stablish a compatible range of IP directions (19.2).
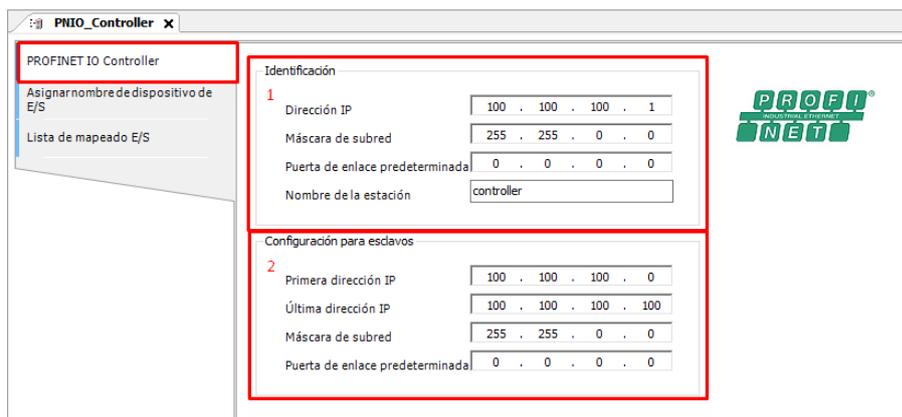
Figure 19.- Configuring profinet controller (1)

- The next steps must be done in order:

  o In the "Assign IO-Device name" menu, press search (20.1), it will appear the slave configurated in the previous step.

  o Click on it (20.2).

o   Select name and IP direction previously configured (20.3).

o   Press "Assign IO-Device name" and "Assign IP configuration" (20.4).
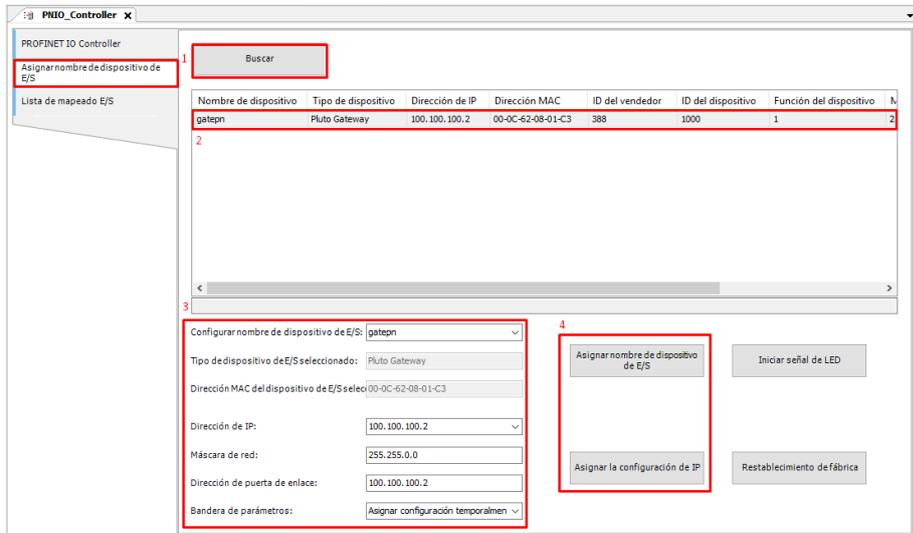
Figure 20.- Configuring profinet controller (2)

With these configurations is possible to read the global variables from the Pluto AS-i (PLC code explained later).
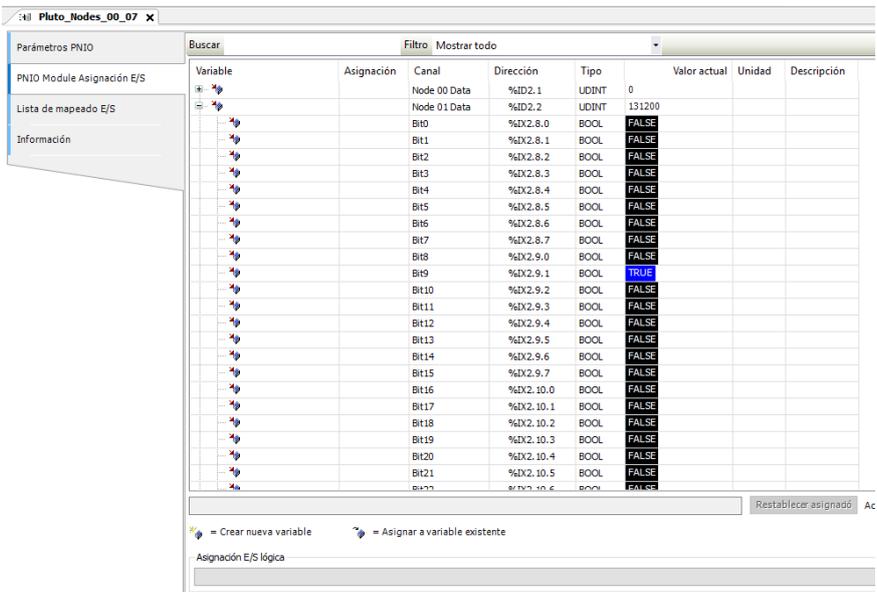

Figure 21.- Reading global variables

5. Configuring the objects can be the next step if reading additional data is needed. For this example, it is configured the additional data area 1 for receiving information from the Pluto1 using the function "ToGateway_UserNumber_1".
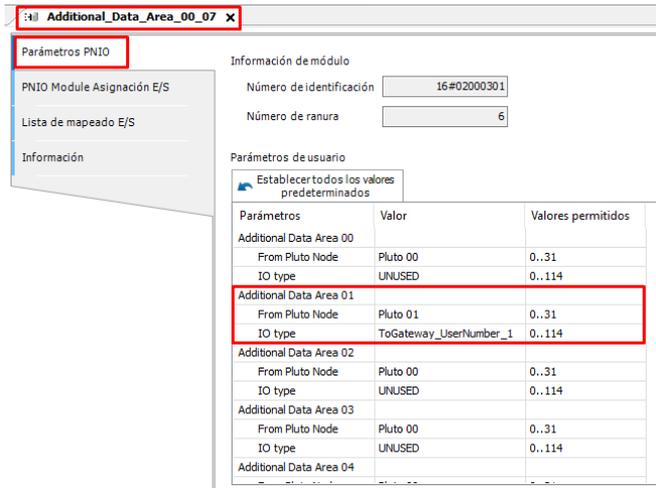
Figure 22.- Configuring objects

Now it is also possible to read information from the additional data 1. The PLC code in Pluto Manager will be explained later.
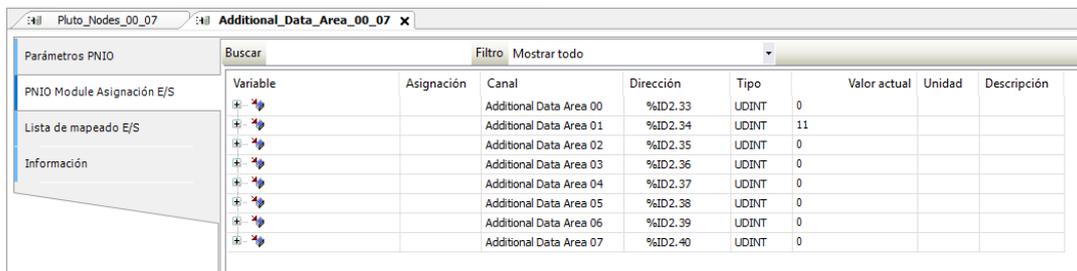

Figure 23.- Reading additional data 1

PLC code – Pluto Manager

- Reading global variables:

  Since the AS-i inputs and the safety outputs are global variables, a basic network is enough to check this communication.


Figure 24.- PLC code Reading global variables

- Reading additional data:

  In order to read the additional data 1 previously configured, the function block used is the block "ToGateway User_A". This block sends two register values to the configured user, in this case, user "No" 1.
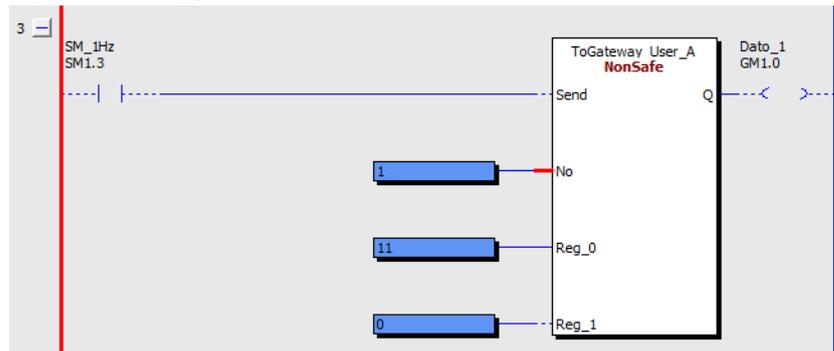
Figure 25.- PLC code Reading additional data

The connectors have the next functions:

- o Send: When enabled, data is transmitted. SM_1Hz is used to reduce the frequency of sending information.

- o No: Number 1..99 to identify the data. This number must be the same that the configured in the gateway.

- o Reg_0 & Reg_1: Input for registers.

If the configuration is right, the PLC controller receives the value from the registers.

Figure 26.- Checking communication additional data

Writing information

In case it is needed to send information from the controller to the Pluto, the procedure needed is as follows.

Configuration of the gateway Gate PN in Pluto Manager:

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 with 16-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

Figure 27.- "Data to Pluto" data allocation

To configure the gateway, press "External Communication" in the Pluto menu, within the Pluto Manager.
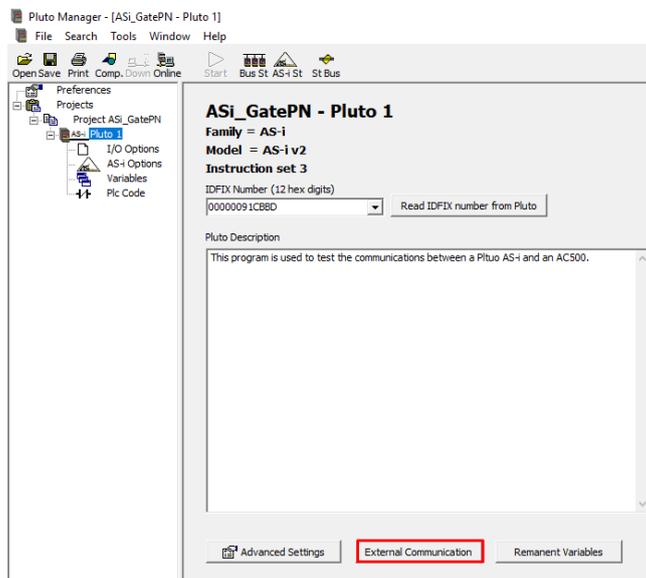

Figure 28.- Clicking external communication

In the new window displayed is needed to select the gateway from which the Pluto will receive data (1) and the packet available (29.2).
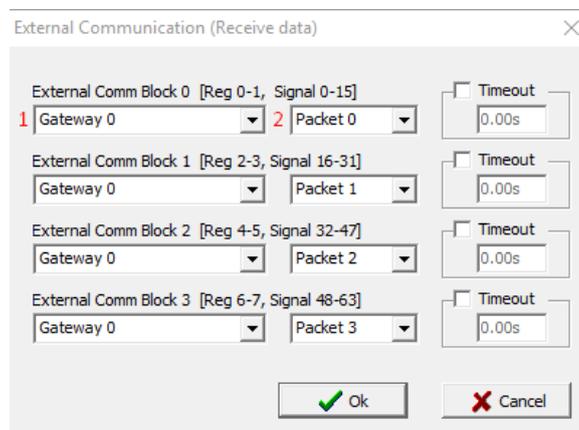

Figure 29.- Configuration Gateway receiving data

The configuration of the gateway is done.

PLC code – Automation Builder (AC500)

To send information to the gateway, the only thing needed is set the value of the configured registers (packet 1-4).

For this example, set names for the registers that are going to be written.

Figure 30.- Setting variables names

Using the "MOVE" command is enough to set the desired value to the selected bit/register.

Figure 31.- Setting value to bits and registers (1)

Figure 32.- Values set to the gateway

PLC code – Pluto Manager

The block used for getting information from the gateway is the block "ExtVarBlock". The only input a configure is the "BlockNo". Use a constant block to introduce the block number needed to be read, in this case the 0. In the outputs the values send from the PLC controller will be displayed. In the bit outputs "output coils" can be used and for the registers outputs "Register results"
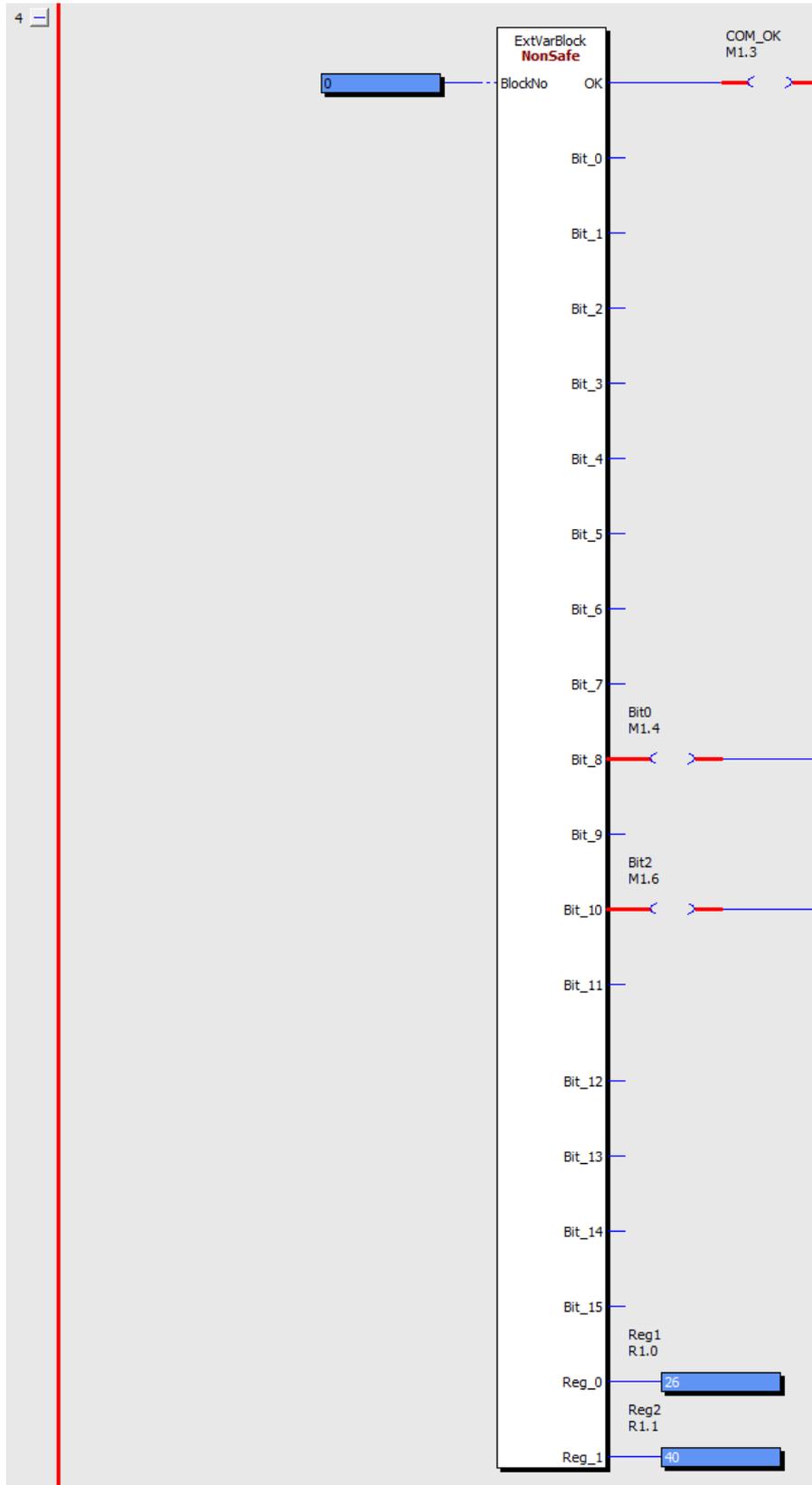
Figure 33.- Information received from AC500

FAQs

Does the information transmitted or received through the gateways can be used in safety functions?

No, the information transmitted by this way can only be used for NON-SAFETY functions, it is only informative.

Are the function blocks explained in this document the only ones able to communicate a Pluto with another PLC/Controller?

No, there are more function blocks depending on the type of information to transmit/receive (number of bits or registers).

How does the communication between devices take place? Directly between PLC?

The communication is always between a PLC/controller-gateway and between Pluto-gateway. The gateway stores all the information and the other devices send information to it or receive information from it.

Useful links:

First Pluto project: https://www.youtube.com/playlist?list=PLf6X6x2ECXPWNvrZ0k-2ePSH6BhWXQCR4

Training videos:
https://www.youtube.com/playlist?list=PLge96zSySnICY9Qgj8RxBWskZaOORrQXc

Pluto programming manual: https://library.e.abb.com/public/336c06f3bb5545fcb8dbbf0452feac90/2TLC172002M0218_A_Pluto_Programming_Manual.pdf

Pluto Hardware manual: https://library.e.abb.com/public/80fe80e7dbd1436c85042fe1223958a6/2TLC172001M0212_A_Pluto_Hardware_Manual.pdf

Gate PN webpage: https://new.abb.com/products/2TLA020071R9300/gate-pn-pluto-gateway-ethernet-profinet

ABB Jokab Safety Main Catalog: http://search.abb.com/library/Download.aspx?DocumentID=2TLC010001C0202&LanguageCode=en&DocumentPartId=&Action=Launch