FANOX
Safely protected

RNXtudio

PC software: Configuration program

USER'S MANUAL

1. INTRODUCTION

The **RNXtudio software** is a proprietary and free software with gateway configuration and logic editor, allowing precise customization and integration in the system. In addition, NTP server synchronization is available, ensuring accurate event timing across the system.

The RNXtudio software allows for the following functions:

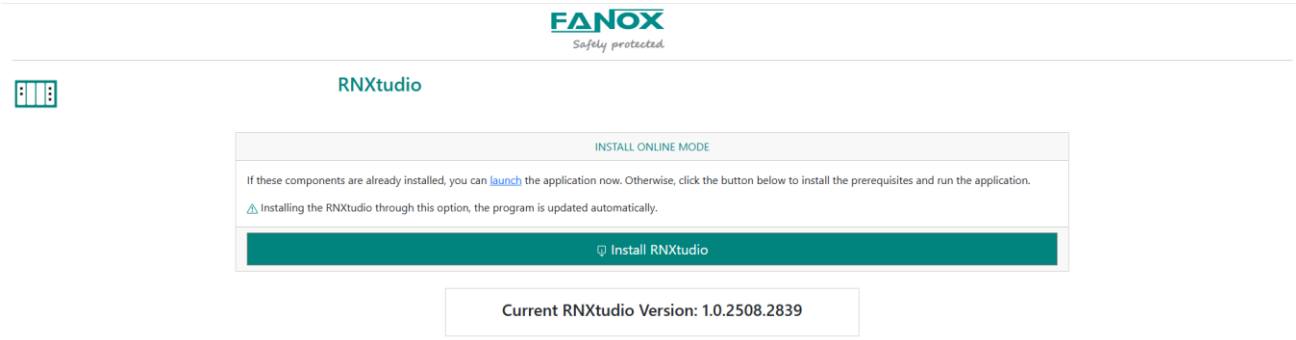
- Installation Management
- Gateways configurations
  - Modbus RTU Master
  - Modbus TCP Master
  - IEC 60870-5-104 Slave
  - IEC 60870-5-101 Slave
  - DNP3 Slave
- Setting configurations
- Logic configuration
- **Exit:** To close the program.

2. INSTALLATION

To install the RNXtudio it is necessary the following link:

https://fanox.blob.core.windows.net/rnxtudio/publish.htm

The link will open the next screen, where key “install” must be pressed:



Once it is pressed INSTALL, the RNXtudio will be installed automatically. Following this advice, the update of the software does not require any user’s action, this is, if the RNXtudio is run being the laptop connected to Internet, The RNXtudio updates itself when it is started. Besides, the necessary drivers depending on the operative system can be downloaded from this page.

Supported operating system is Windows.

3. DESCRIPTION

3.1. Start Page

While no project is open or created, the toolbar submenus options will remain disabled except NEW, Open and import.

RNXtudio as shown as follows:

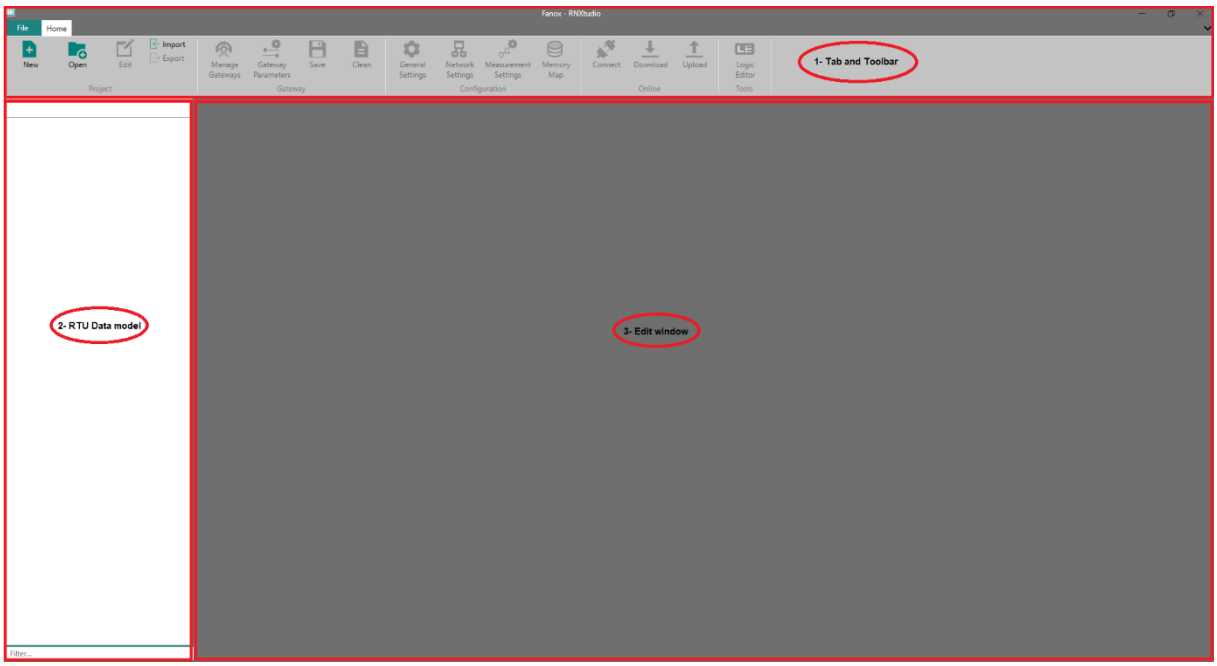


Figure 1: **RNXtudio** Start Page

The main window is divided into 3 areas:

1- Tabs and Toolbar.

2- Browser tree by the RTU data model.

3- Edit window.

3.2. Tabs and Toolbar options

Figure 2: Tabs and Toolbar options

3.2.1. Tabs

3.2.1.1. File Tab

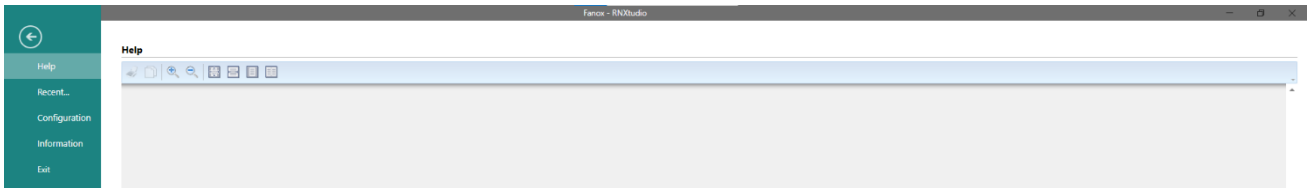


Figure 3: File Tab

The file tab consists of the following menus:

- **Help:** To view help file
- **Recent:** Last project opened
- **Configuration:** Language selection
- **Information:** About RNXtudio Version
- **Exit:** To close the program.

3.2.1.2. Home Tab

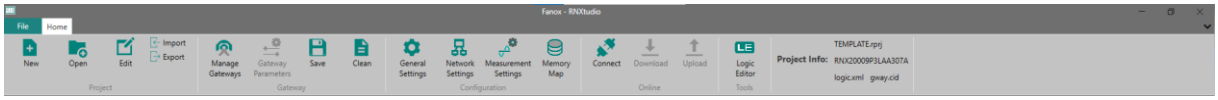


Figure 4: Home Tab

The Home tab consists of the following menus:

- **Project:** Different options for creating and managing project files.
- **Gateway:** Different options to create and manage protocols.
- **Configuration:** Different settings options.
- **Online:** To Download/Upload files.
- **Tools:** Logic Editor tool.

3.2.2. Toolbar options

3.2.2.1. Project Options

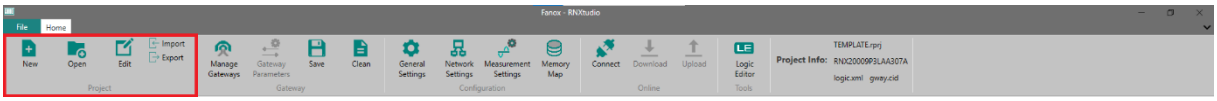


Figure 5: Project Options

The project options menu consists of the following submenus:

- **New:** Allows to create a new Project**.**
- **Open:** Allows to open a Project.
- **Edit:** Edit project options.
- **Export:** Export a backup of a project.
- **Import:** Import a backup of a project.

3.2.2.1.1. New

It allows to create a new project, when selected, the following screen appears:

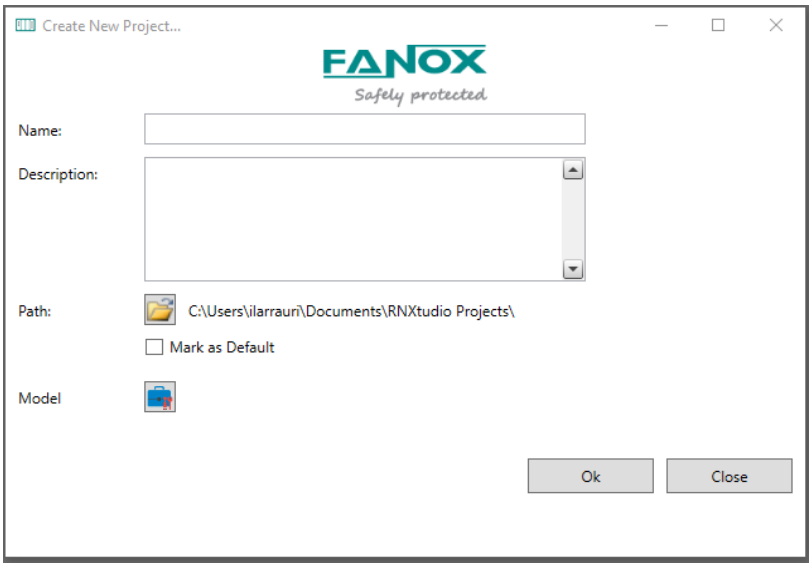


Figure 6: Create New Project

Where:

- **Name:** Project name.
- **Description:** Optional.
- **Path:** Where to save the project files.
- **Model:** Model selection code.

3.2.2.1.2. Open

It allows to open existing project, to open a project, perform the following steps:

- Press Open button.
- On the Open window, select the file to be opened.

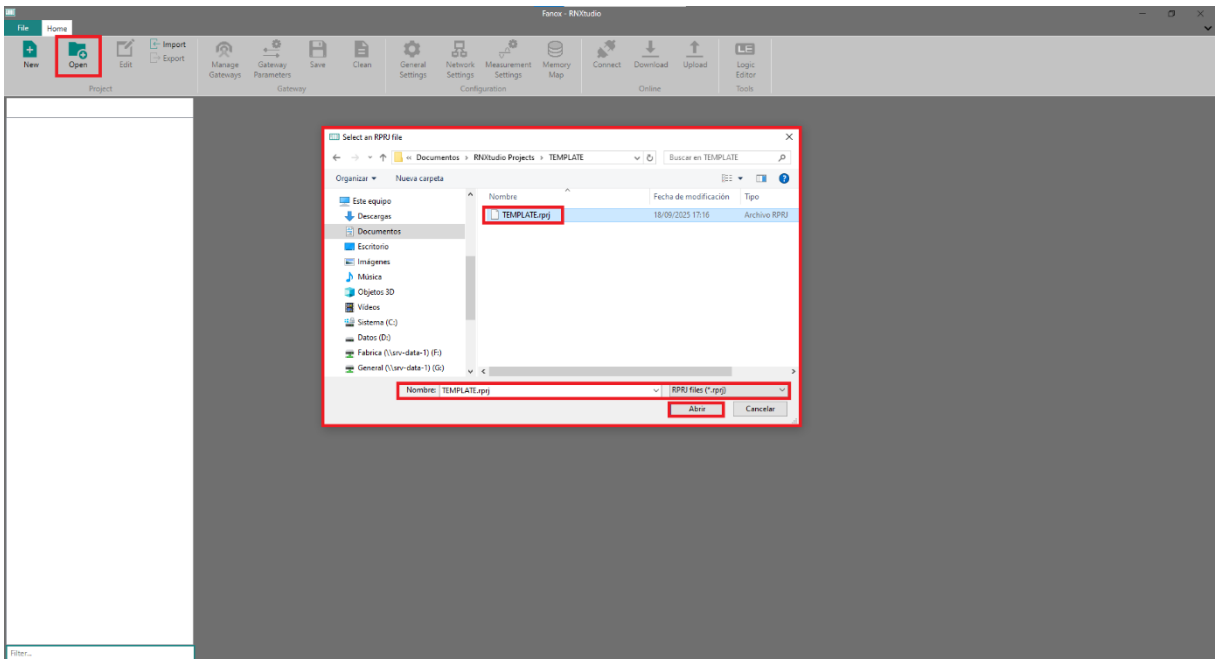


Figure 7: Selecting a Project File

3.2.2.1.3. Edit

It allows to edit an open project, when selected, the following screen appears:

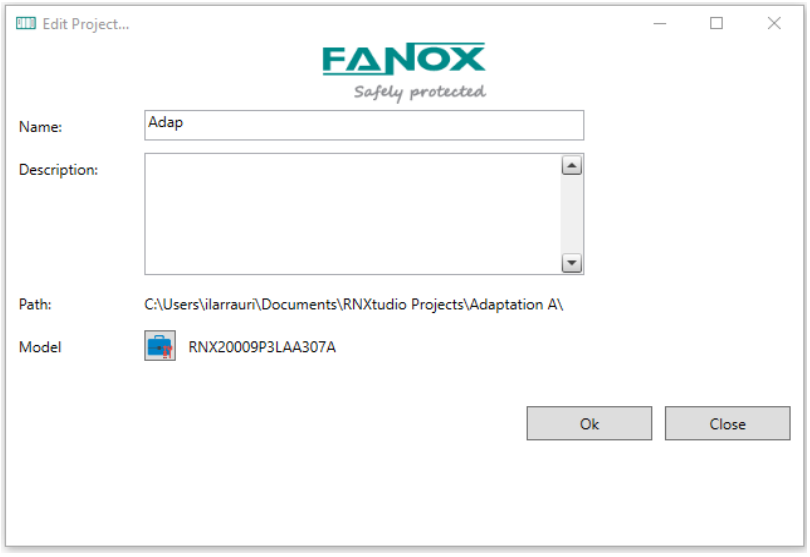


Figure 8: Editing a Project

The following options can be changed:

- Name
- Description
- Model

3.2.2.1.4. Export

It allows to export a back-up of a project, to export a backup, perform the following steps:

- Press Export button.
- On the Open window, select the place to save the backup file to be exported.

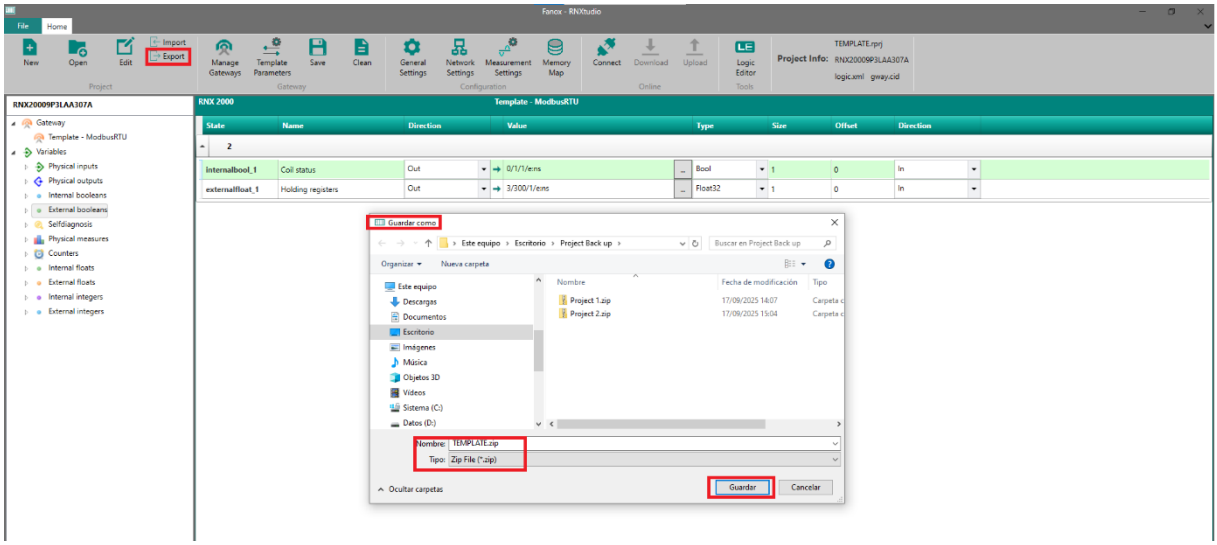


Figure 9: Export a backup of a Project.

3.2.2.1.5. Import

It allows to import a back-up of a project that has been previously exported, to import a backup, perform the following steps:

- Press Import button.
- On the Open window, select the backup file to be imported.

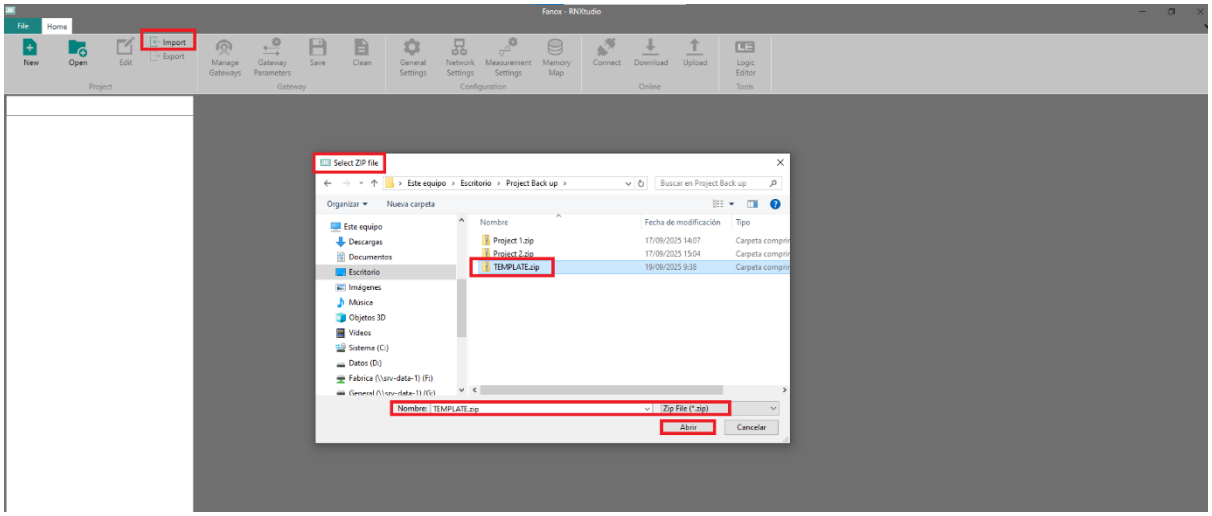


Figure 10: Import a backup of a Project.

3.2.2.2. Gateway

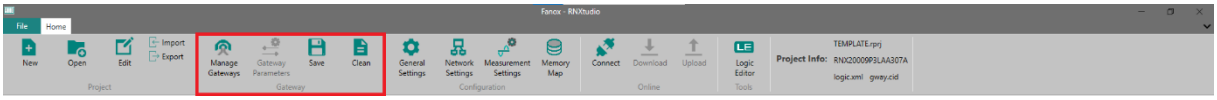


Figure 11: Gateway Options

The Gateway menu consists of the following submenus:

- **Manage Gateways:** To create a new gateway.
- **Parameters:** Parameters of selected protocol.
- **Save:** Save the changes.
- **Clean:** Clears the tables of the selected protocol.

3.2.2.2.1. Manage Gateway

It allows to add different protocols, when selected, the following screen appears:

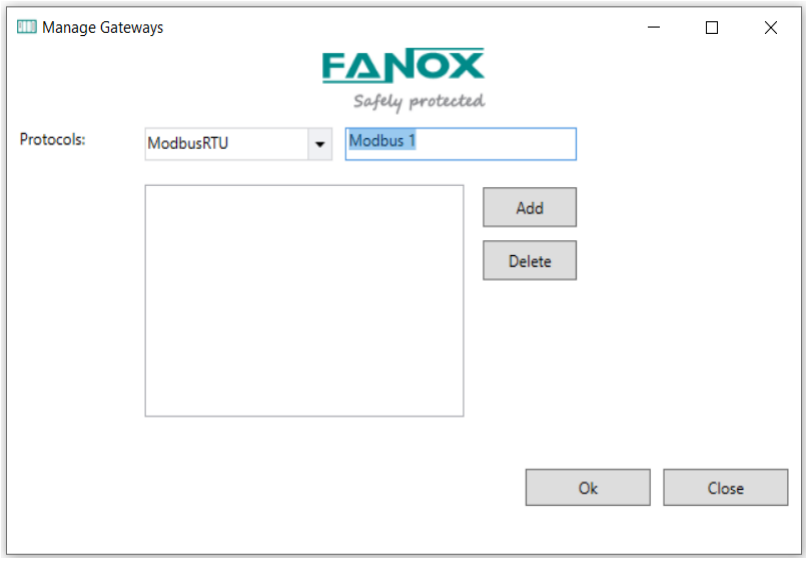


Figure 12: Example of Adding a Protocol

Where:

- **Protocols:** To choose communication protocol. Selectable from a list.
- **Name:** Name of Selected protocol.
- **Add:** To Include in the project.
- **Delete:** To delete created protocol.
- **Ok:** To apply the configuration.

3.2.2.2.2. Protocol Parameters

It allows to change Parameters of selected protocol, when selected, the following screen appears:

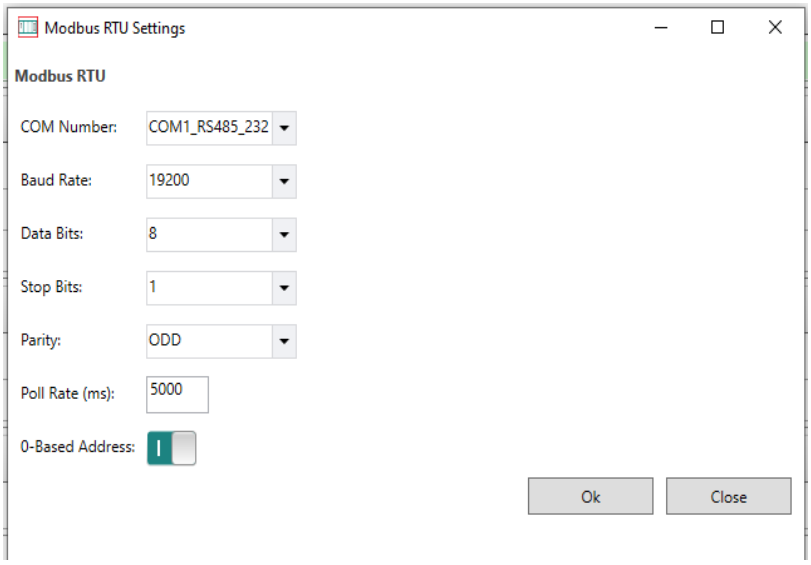


Figure 13: Example of Modbus parameters.

3.2.2.2.3. Save

It saves the signal database configuration.

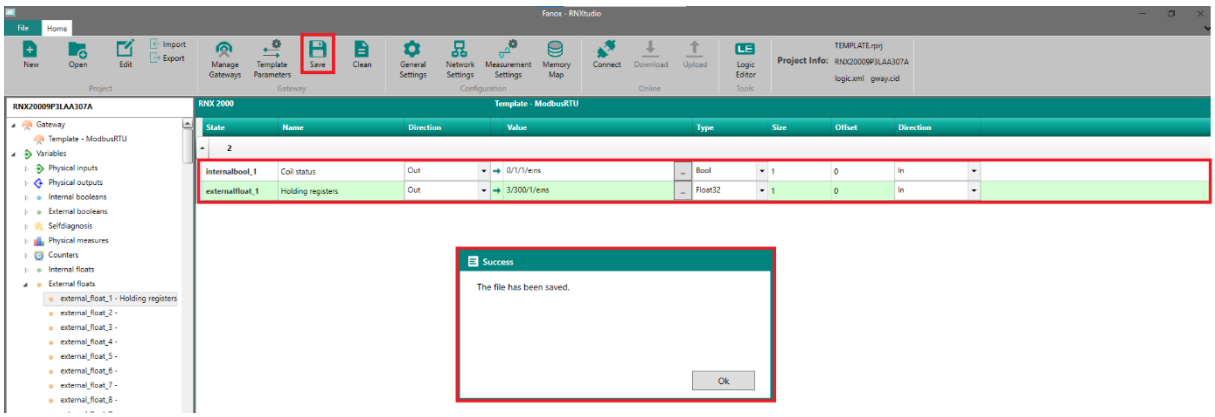


Figure 14: Save database configuration.

3.2.2.2.4. Clean

It deletes the edit window.

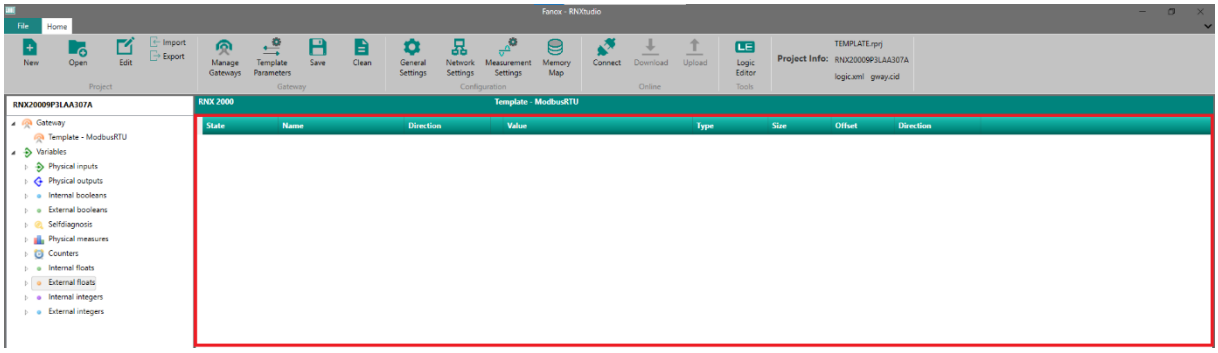


Figure 15: Clean database configuration.

3.2.2.3. Configuracion

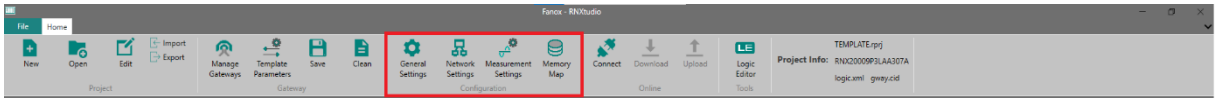


Figure 16: Configuration Options

The Gateway menu consists of the following submenus:

- **General Settings:** To configure Time settings.
- **Network Settings:** To configure parameters of Ethernet ports.
- **Measurement Settings:** To configure measurement settings.
- **Memory Map:** To configure names of variables.

3.2.2.3.1. General Settings

It allows to configure different settings like identifier, time zones, etc. When selected, the following screen appears:

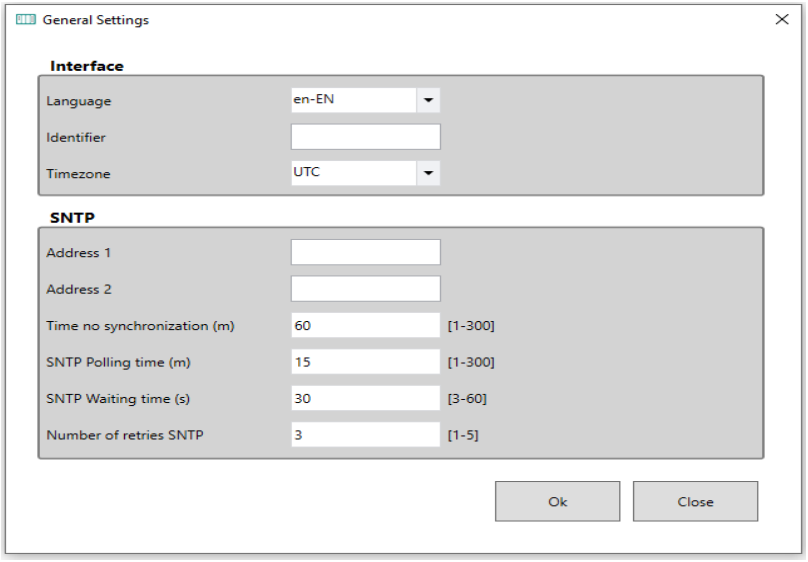


Figure 17: General Settings

It is divided into two parts.

- **Interface**
  - **Languaje:** Configuration language.
  - **Identifier:** Alias name of RTU.
  - **Time zone:** Current time zone

- **SNTP Server**
  - **Address 1:** Ip address of the main NTP server.
  - **Address 2:** Ip address of the secondary NTP server.
  - **Time no synchronization (m):** Synchronization alarm.
  - **SNTP polling time (m):** Time interval between synchronization request to NTP servers.
  - **SNTP waiting time (s):** Waiting time for the response to a unicast synchronization request.
  - **Numbers of retries SNTP:** Number of retries in case there is no response from the NTP server to a request

3.2.2.3.1. Network Settings

It allows to configure the network settings of the different ethernet ports, when selected, the following screen appears:

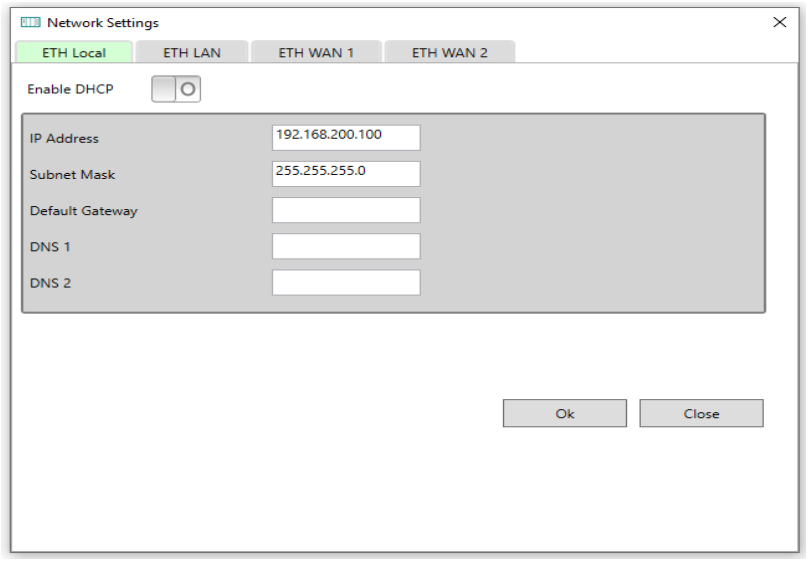


Figure 18: Network Settings

Where:

- **Enable DHCP:** Dynamic Host Configuration Protocol.
- **IP Address:** IP address of selected Ethernet port.
- **Subnet Mask:** Network mask of selected Ethernet port.
- **Default Gateway:** Gateway of selected Ethernet port.
- **DNS 1:** Domain Name System 1.
- **DNS 2:** Domain Name System 2.

3.2.2.3.2. Measurements Settings

It allows to configure the different settings of measurements. When selected, the following screen appears:

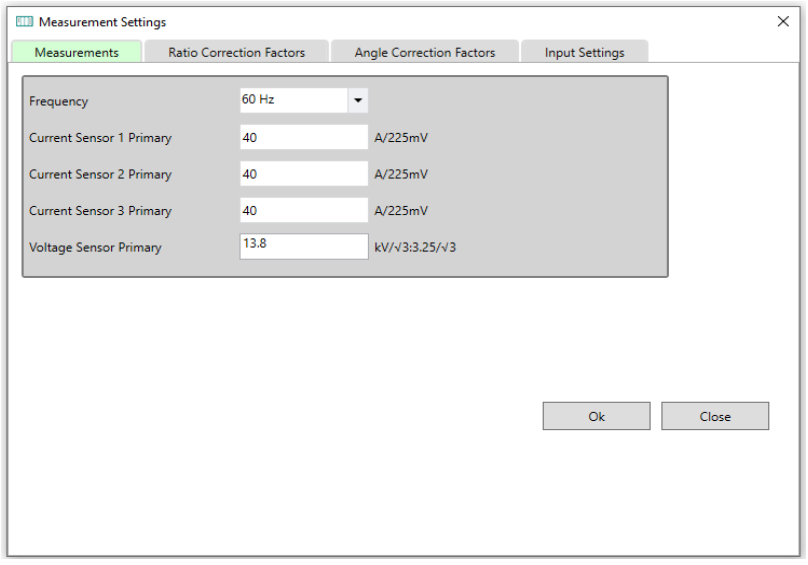


Figure 19: Measurement Settings

It is divided into four parts.

- **Measurement**

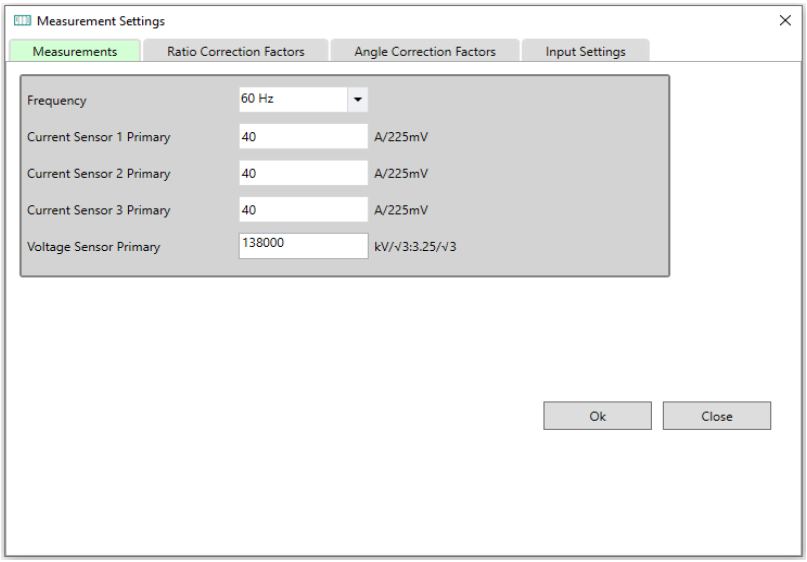


Figure 20: Measurement

Where:

- **Frequency:** Frequency value.
- **Current Sensor 1 Primary:** Current Sensor 1 ratio.
- **Current Sensor 2 Primary:** Current Sensor 2 ratio.
- **Current Sensor 3 Primary:** Current Sensor 3 ratio.
- **Voltage Sensor Primary:** Voltage Sensor ratio.

Values:

Description	Minimum	Maximum	Step	Unit
Frequency	50	60	50/60	Hz
Current Sensor 1	1	1600	0.1	A
Current Sensor 2	1	1600	0.1	A
Current Sensor 3	1	1600	0.1	A
Voltage Sensor	0.001	69	0.001	kV

- **Ratio Corrections Factors**

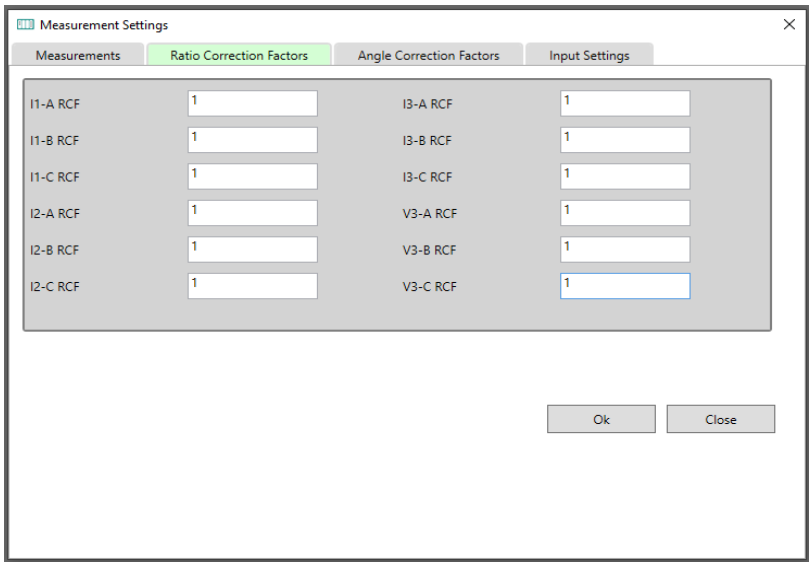


Figure 21: Ratio Correction Factors

Where:

- **I1-A RCF:** First Current Set Phase A Ratio Correction Factor.
- **I1-B RCF:** First Current Set Phase B Ratio Correction Factor.
- **I1-C RCF:** First Current Set Phase C Ratio Correction Factor.
- **I2-A RCF:** Second Current Set Phase A Ratio Correction Factor.
- **I2-B RCF:** Second Current Set Phase B Ratio Correction Factor.
- **I2-C RCF:** Second Current Set Phase C Ratio Correction Factor.
- **I3-A RCF:** Third Current Set Phase A Ratio Correction Factor.
- **I3-B RCF:** Third Current Set Phase B Ratio Correction Factor.
- **I3-C RCF:** Third Current Set Phase C Ratio Correction Factor.
- **V3-A RCF:** Voltage Phase A Ratio Correction Factor.
- **V3-B RCF:** Voltage Phase B Ratio Correction Factor.
- **V3-C RCF:** Voltage Phase C Ratio Correction Factor.

Values:

Description	Minimum	Maximum	Default	Description	Minimum	Maximum	Default
I1-A RCF	0.5	2	1	I3-A RCF	0.5	2	1
I1-B RCF	0.5	2	1	I3-B RCF	0.5	2	1
I1-C RCF	0.5	2	1	I3-C RCF	0.5	2	1
I2-A RCF	0.5	2	1	V3-A RCF	0.5	2	1
I2-B RCF	0.5	2	1	V3-B RCF	0.5	2	1
I2-C RCF	0.5	2	1	V3-C RCF	0.5	2	1

- **Angle Corrections Factors**

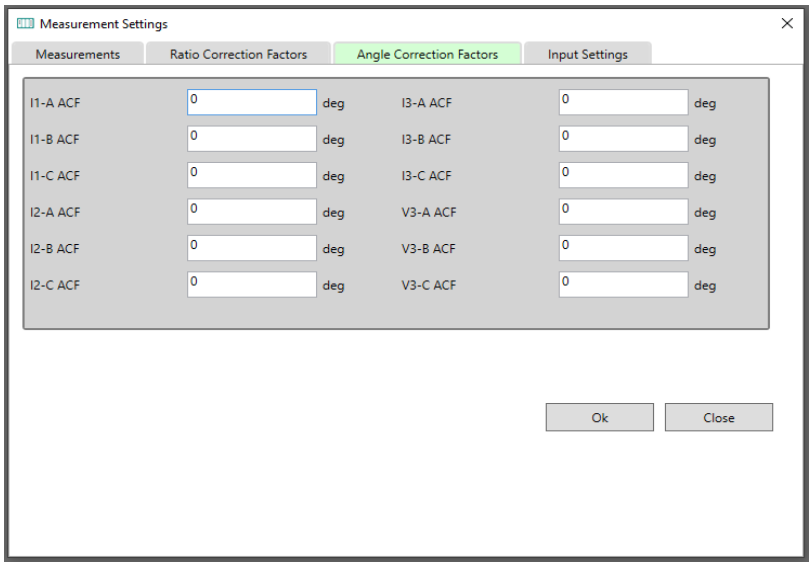


Figure 22: Angle Correction Factors

Where:

- **I1-A ACF:** First Current Set Phase A Angle Correction Factor.
- **I1-B ACF:** First Current Set Phase B Angle Correction Factor.
- **I1-C ACF:** First Current Set Phase C Angle Correction Factor.
- **I2-A ACF:** Second Current Set Phase A Angle Correction Factor.
- **I2-B ACF:** Second Current Set Phase B Angle Correction Factor.
- **I2-C ACF:** Second Current Set Phase C Angle Correction Factor.
- **I3-A ACF:** Third Current Set Phase A Angle Correction Factor.
- **I3-B ACF:** Third Current Set Phase B Angle Correction Factor.
- **I3-C ACF:** Third Current Set Phase C Angle Correction Factor.
- **V3-A ACF:** Voltage Phase A Angle Correction Factor.
- **V3-B ACF:** Voltage Phase B Angle Correction Factor.
- **V3-C ACF:** Voltage Phase C Angle Correction Factor.

Values:

Description	Minimum	Maximum	Default	Description	Minimum	Maximum	Default
I1-A ACF	0	359.9	0	I3-A ACF	0	359.9	0
I1-B ACF	0	359.9	0	I3-B ACF	0	359.9	0
I1-C ACF	0	359.9	0	I3-C ACF	0	359.9	0
I2-A ACF	0	359.9	0	V3-A ACF	0	359.9	0
I2-B ACF	0	359.9	0	V3-B ACF	0	359.9	0
I2-C ACF	0	359.9	0	V3-C ACF	0	359.9	0

- **Input Setting**

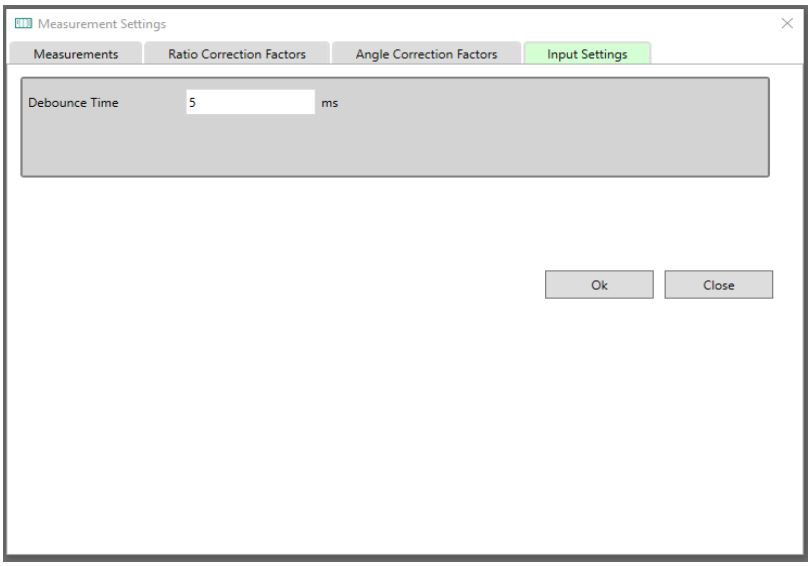


Figure 23: Angle Correction Factors

Where:

- **Debounce time:** Time to consider an input stable.

Values:

Description	Minimum	Maximum	Step	Unit	Default
Debounce time	5	255	1	ms	5

3.2.2.3.3. Memory Map

It allows to configure the names to the different variables. When selected, the following screen appears:

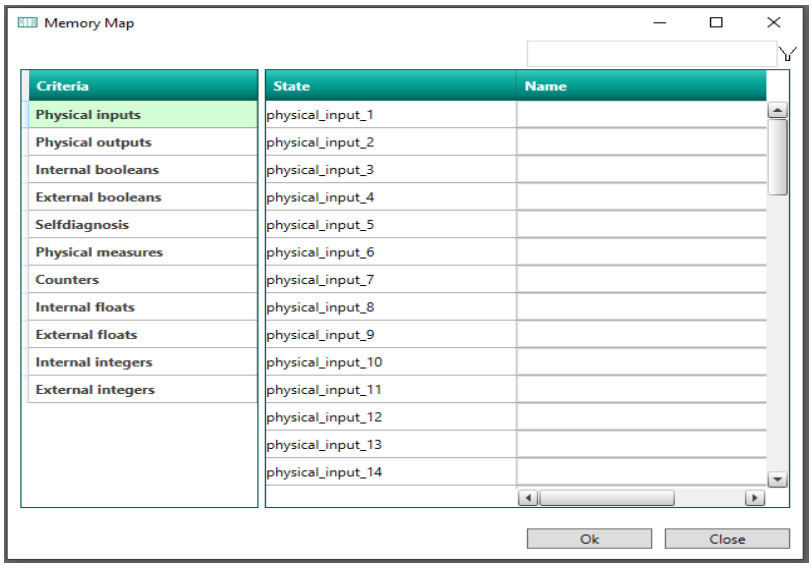


Figure 24: Memory Map

To configure, perform the following steps:

- Select the signal type (Criteria).
- Set the name.
- Press ok to save it.

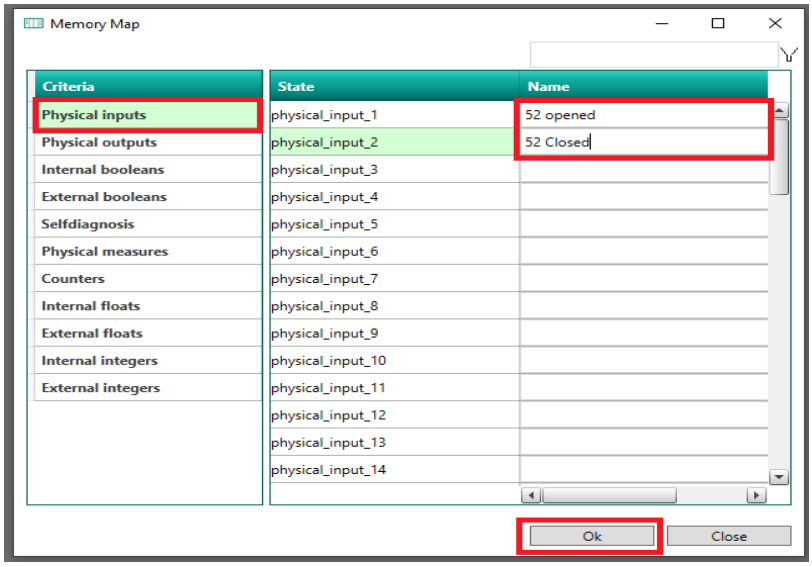


Figure 25: Configuring a name

Once configured, the text will be reflected in the variable:

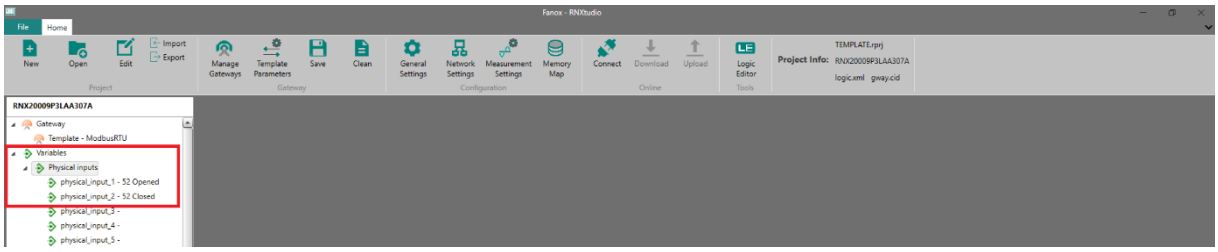


Figure 26: Checking configured name

3.2.2.4. Online

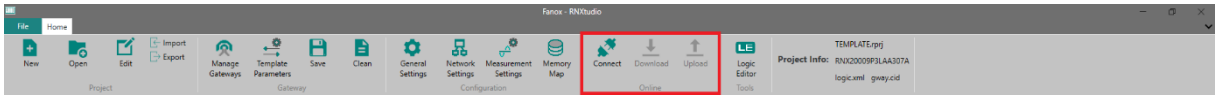


Figure 27: Online options

The online menu consists of the following submenus:

- **Connect:** To connect to the RTU.
- **Download:** To download files from RTU.
- **Upload:** To upload files to RTU.

3.2.2.4.1. Connect to RTU

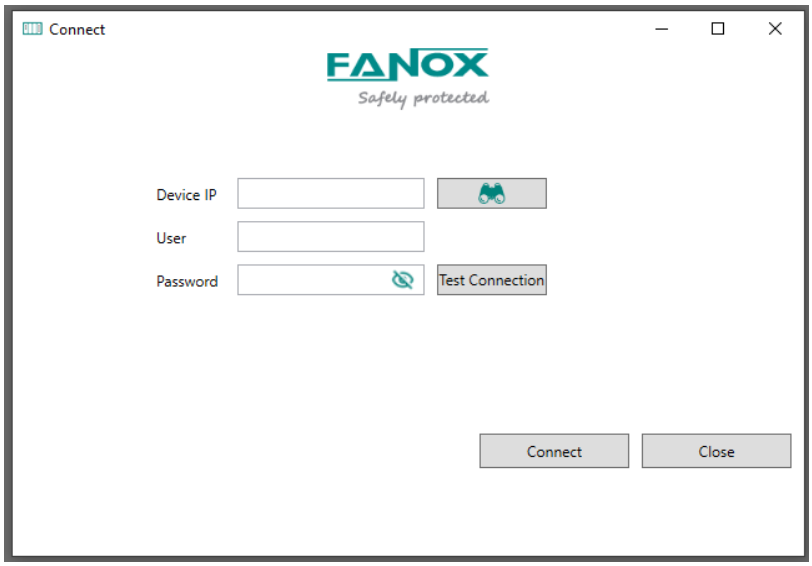


Figure 28: Connect options

Where:

- **Device IP:** IP of the RTU.
- **User:** Super Admin 1
- **Password:** Fanox/5555

The user can be modified form website: Security → User Management.

3.2.2.4.1.1. Discover Device

Figure 29: Device Discovery button

Where

- **Discover Device:** Auto detection of RTU in the nertwork.

It allows for RTU to be auto-detected over the ethernet. When selected, the following screen appears:

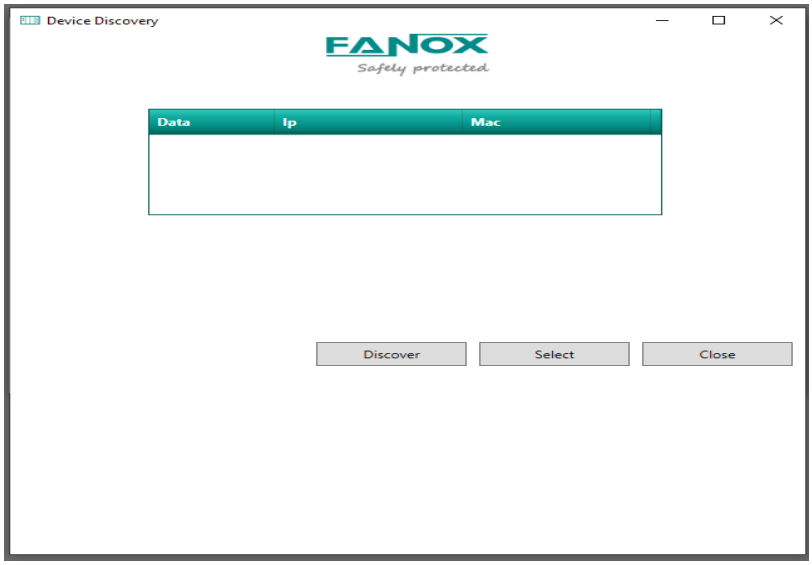


Figure 30: Device Discovery

Where:

- **Discover:** To start searching.
- **Select:** To select the detected IP address
- **Close:** To close window.

To device discovery, perform the following steps:

- Select device discover button.
- Press in Discover button to start searching the IP address on the network.
- A list of the different RTU detected is displayed.
- Select the IP address detected and Press in Select Button.

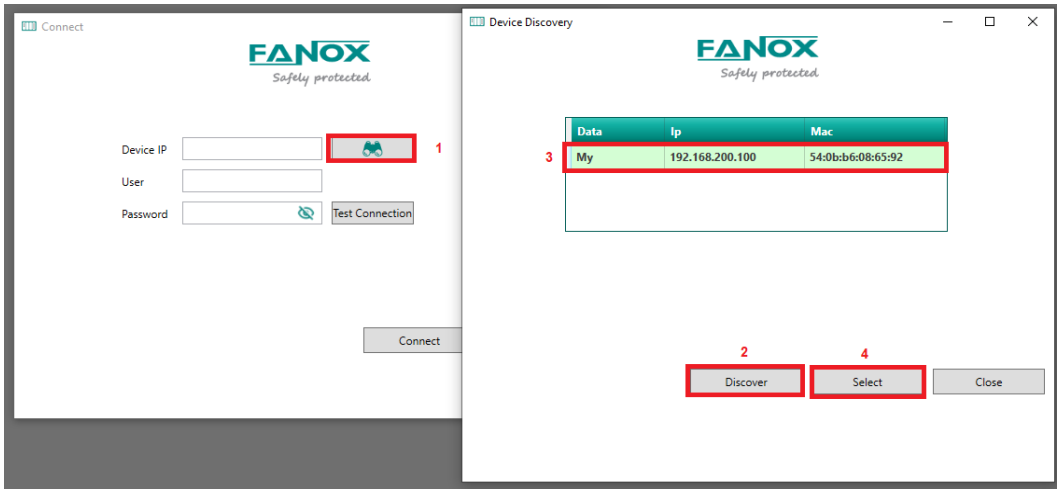


Figure 31: Example of Device Discovery

The IP address of the RTU will automatically be selected:

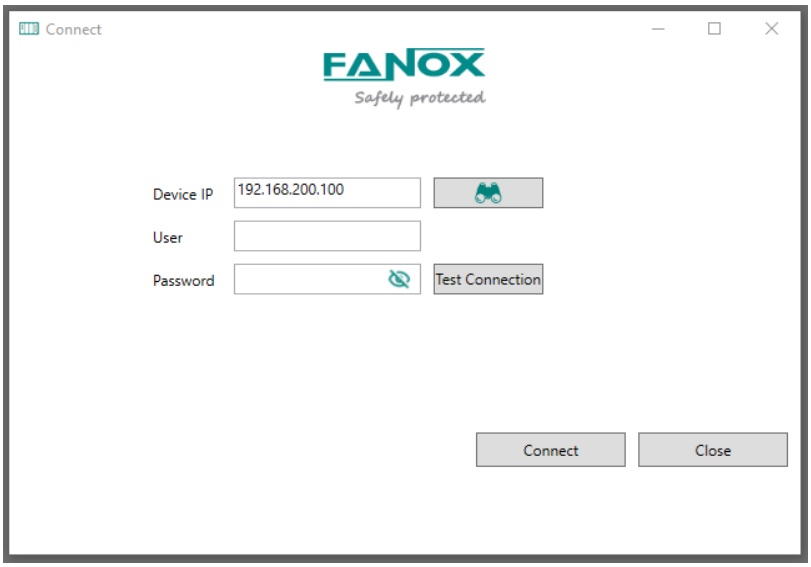


Figure 31: Auto detected IP address

To connect with RTU:

- Set the User.
- Set the password.

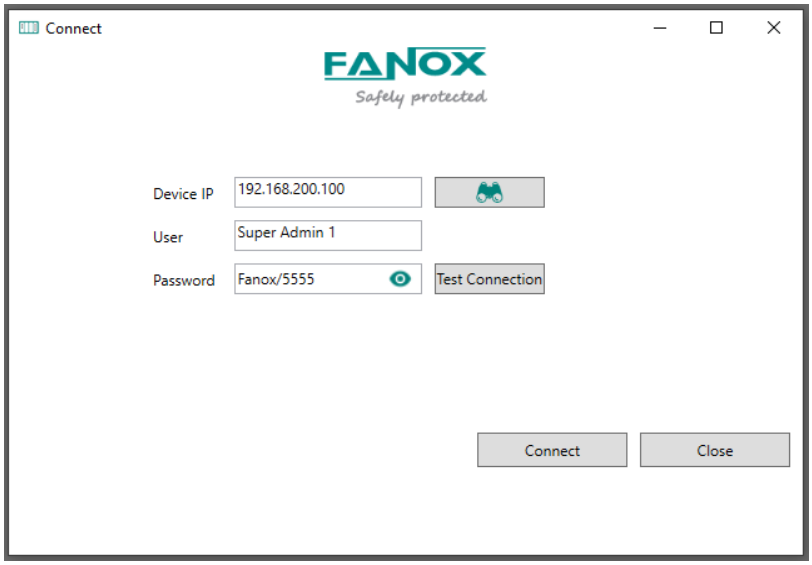


Figure 32: Logging to RTU

Once the connection established, download and Upload button are enabled.

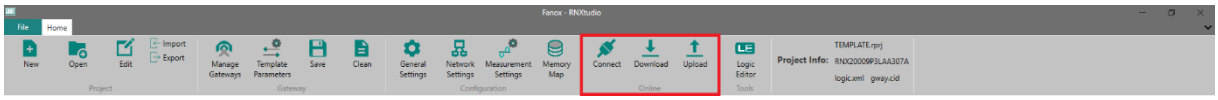


Figure 33: Established Connection

3.2.2.4.2. File management

The RTU handles different files:

- **Program Logic:** Logic Configuration file.
- **Gateway File:** Gateway configuration file.
- **General Setting:** Alias and Time configuration file.
- **Network Setting:** Ethernet configuration file.
- **Measurements Settings:** Measurement configuration file.

It can download or upload all files at once or one at time.

3.2.2.4.2.1. Download Files

It allows to download files from RTU. When selected, the following screen appears:

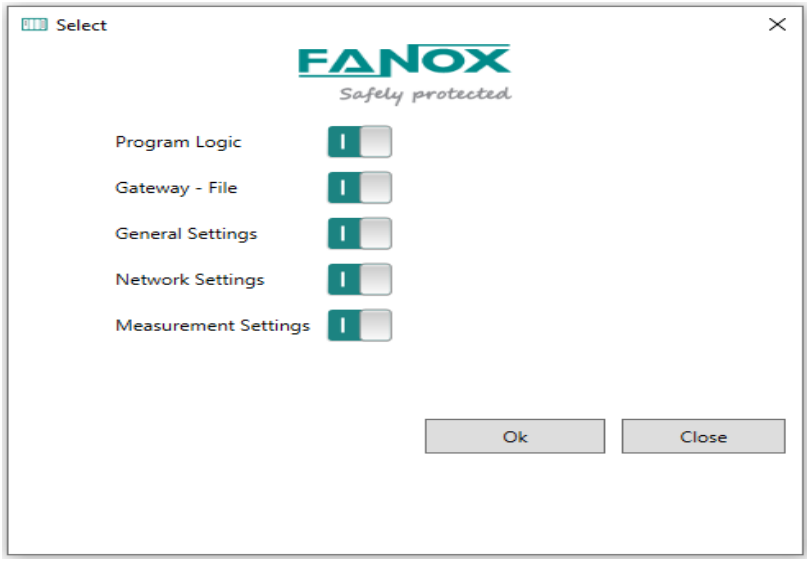


Figure 34: Download Files Selection

It can be send all files or select them from the list.

To upload the files, perform the following steps:

- Connect to RTU.
- Press in download button.
- Select the files to be send.
- Press in Ok Button.

Once the files have been downloaded, the following window is displayed:

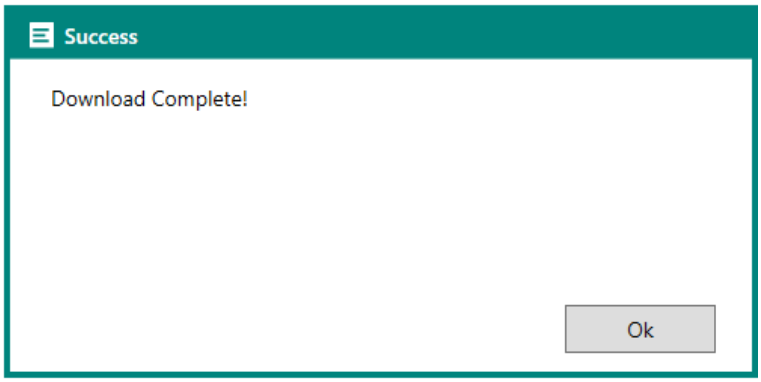


Figure 35: Download complete

3.2.2.4.2.2. Upload Files

It allows to Upload files to RTU. When selected, the following screen appears:

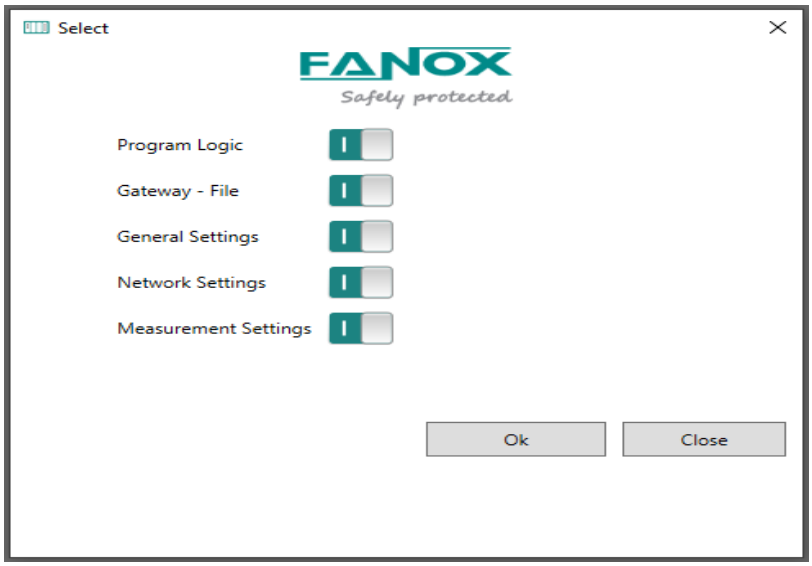


Figure 36: Upload Files Selection

It can be send all files or select them from the list.

To upload the files, perform the following steps:

- Connect to RTU.
- Press in upload button.
- Select the files to be send.
- Press in Ok Button.
- Press Yes in Warning window

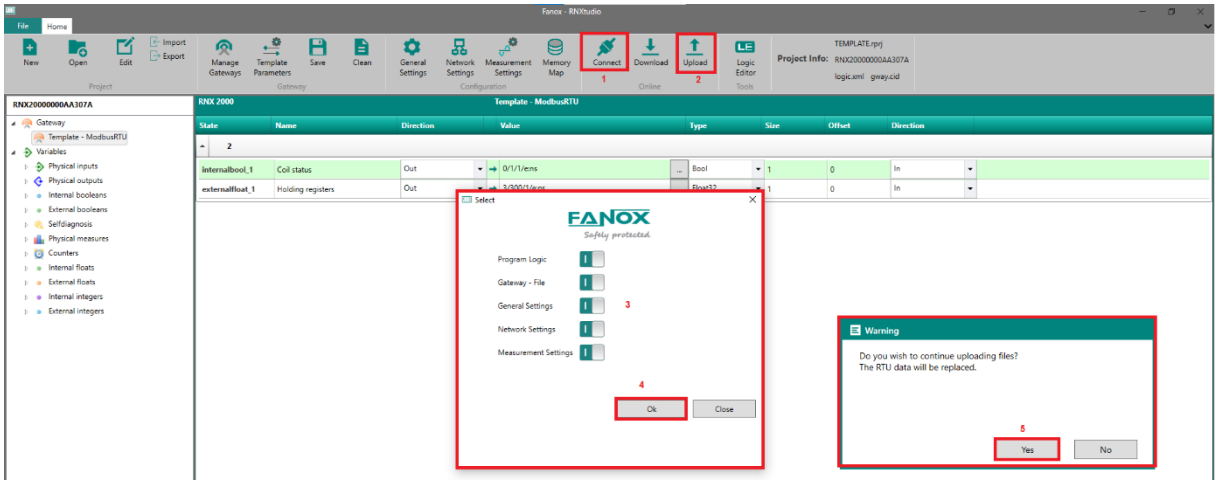


Figure 37: Example of Upload Files

Once the files have been sent, the following window is displayed:

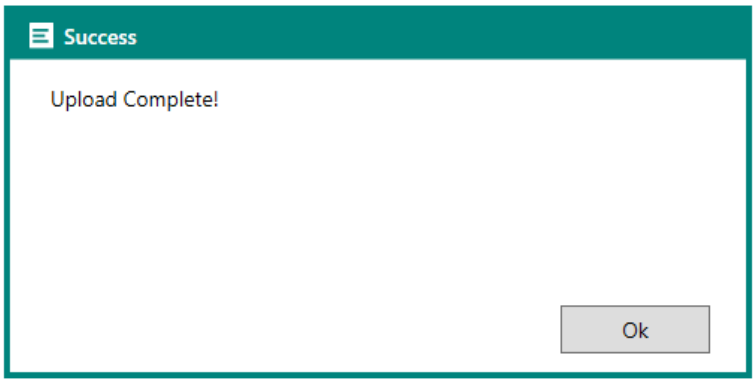


Figure 38: Upload complete

3.2.2.5. Logic Editor

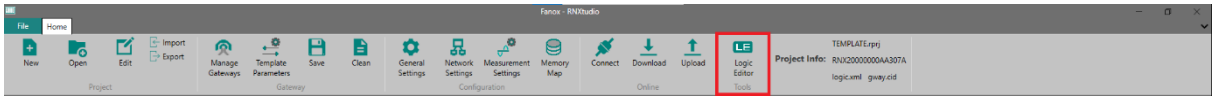


Figure 39: Logic Editor Option

The logic editor for RTU allows for automatisms or logics to be programmed.

The logic configuration program is described in an independent document: **LGGE (Logic Gate Graphic Editor).**

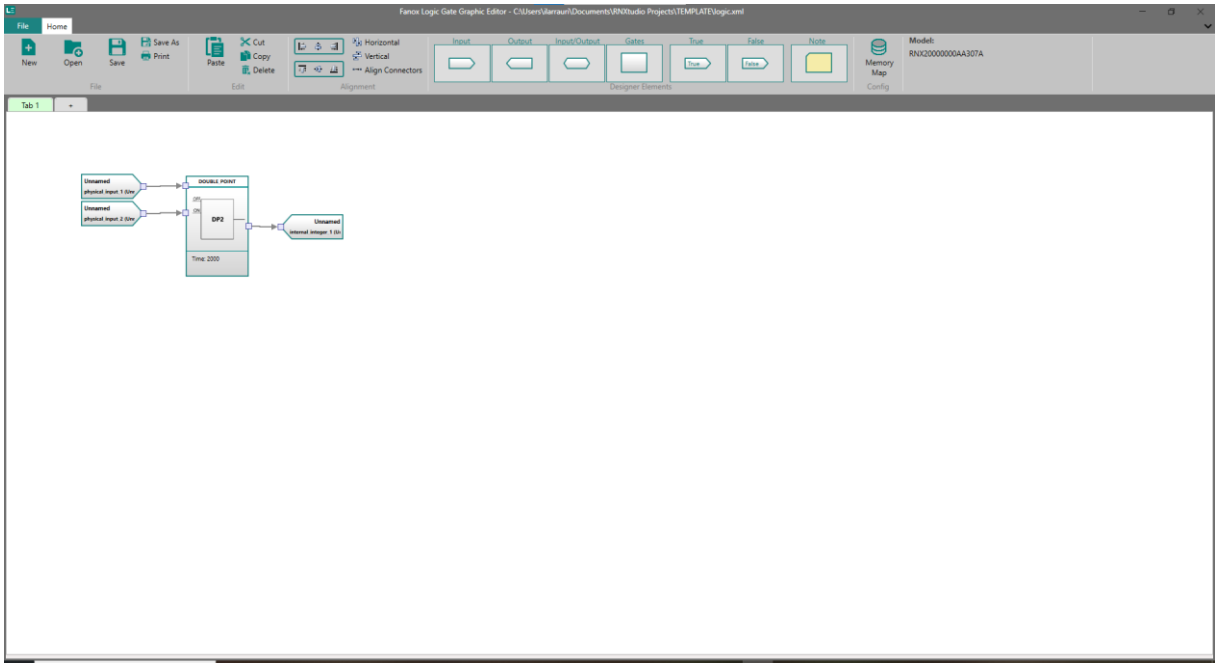


Figure 40: Logic Editor

4. PROTOCOLS CONFIGURATION

4.1. MODBUS MASTER

The Modbus master protocol allows communication with control and/or protection and measuring devices.

The RTU has two types of communication:

- Modbus RTU master: Serial communication.
- Modbus TCP client: TCP/IP network.

The protocol allows the database to update with digital signals, measurements, and commands.

4.1.1. Implemented Functions

The Modbus master functions that may be used for requesting and writing data in the slave devices are the following:

- FC1 (0x01) Read Coils
- FC2 (0x02) Read Discrete Inputs
- FC3 (0x03) Read Holding Registers
- FC4 (0x04) Read Input Registers
- FC5 (0x05) Write Single Coil
- FC6 (0x06) Write Single Holding Register
- FC15 (0x0F) Write Multiple Coils
- FC16 (0x10) Write Multiple Holding Registers

4.1.2. Modbus RTU Gateway

4.1.2.1. Creating a Modbus RTU Gateway

To create a Modbus RTU, perform the following steps:

- Select Manage Gateways from Gateway menu.
- Select ModbusRTU from the list.
- Set a Name.
- Press in ADD button to include in the project.
- Press Ok button to save.

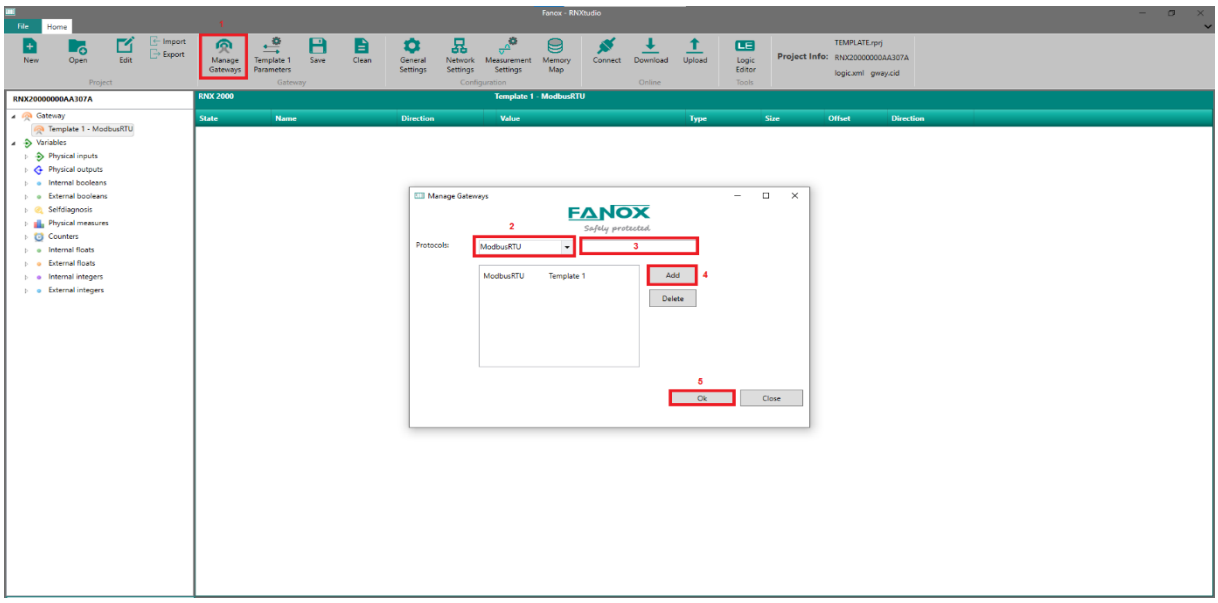


Figure 41: Creating a Modbus RTU

4.1.2.2. Configure a Modbus RTU Setting

To configure a Modbus RTU setting, perform the following steps:

- Select the gateway.
- Select Gateways parameters from Gateway menu.
- Configure the settings.
- Press Ok button to save.

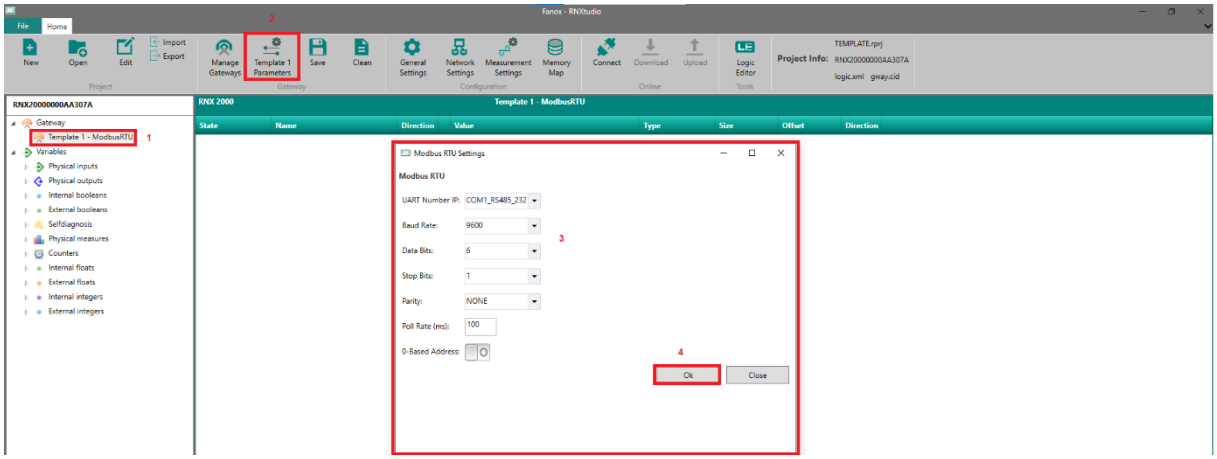


Figure 42: Configuring a Modbus RTU Settings

Where:

- **COM Number:** It allows set the communication channel.
  - COM1_RS485_232
  - COM2_RS485
- **Baud Rate:** It allows to select the serial transmission speed.
  - 9600 Baud
  - 19200 Baud
  - 38400 Baud
  - 57600 Baud
  - 115200 Baud
- **Data Bits:** Number of data bits.
  - 6
  - 7
  - 8
- **Stop Bits:** Number of stop bits.
  - 1
  - 2
- **Parity:** It allows to select the type of the parity to be used in the transmission.
  - None
  - Even
  - Odd
- **Poll Rate (ms):** Time intervals between requests.
- **0-Based Address:** Zero based addressing.
  - not selected Base 0
  - Selected Base 1

4.1.2.3. Configure a Modbus RTU Database

To configure a Modbus RTU database, perform the following steps:

- Select a signal from RTU data model (External variables).
- Drag and drop to edit window.
- Edit signal and configure.
- Press Ok button to include.

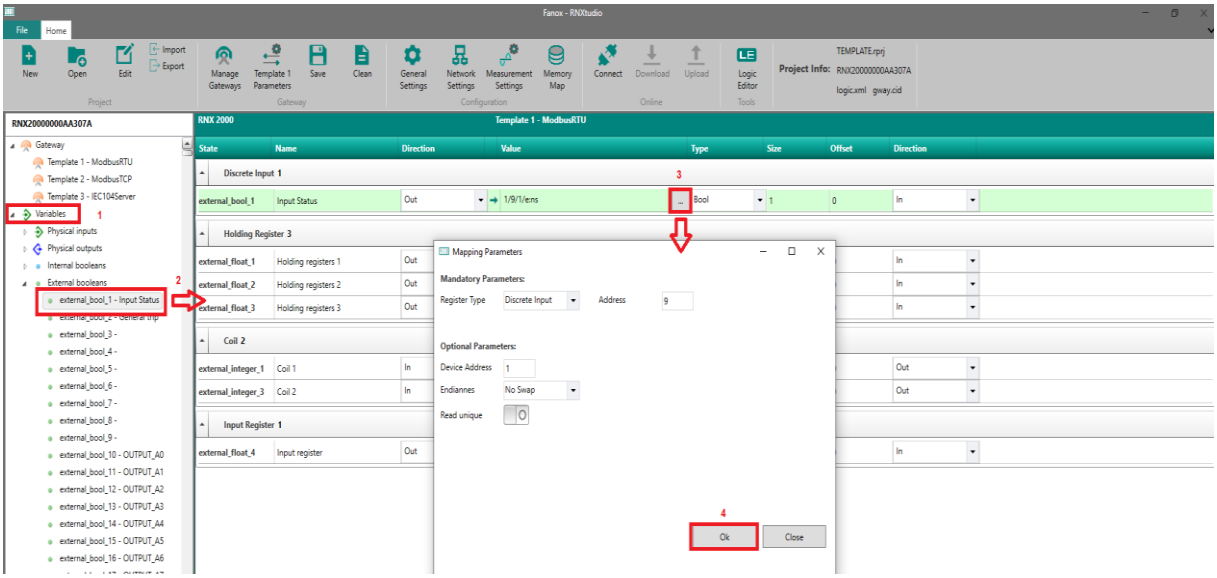


Figure 43: Configuring a Modbus RTU Database

The signals are divided into different columns.

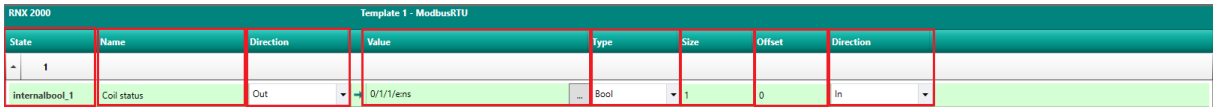


Figure 44: Database Structure

Where:

- **State:** Name of variable used.
- **Name:** Description of the signal, it can be edit.
- **Direction:** where the signal comes from.
- **Value:** Modbus attribute.
  - **Register Type:** Object type, selectable from a list:
    - Coil
    - Discrete input
    - Input register
    - Holding register
  - **Address:** Modbus Address of signal.
  - **Device Address:** Address of Slave device.
  - **Endiannes:** It indicates the order in which the slave sends data, selectable from a list:
    - No Swap
    - Byte Swap (bs).
    - Word Swap (ws).
    - Byte Word Swap (bw).

Endianess Types	Value (HEX)
Default	0x1234 5678
bs	0x3412 7856
bw	0x7856 3412
ws	0x5678 1234

Figure 46: Examples of Endianness types

- **Function:** It is enabled with Coil and Holding register types. It indicated function to use.
  - None (Read).
  - Single (Write).
    - Coils (0x05).
    - Holding Register (0x06).
  - Multiple (Write).
    - Coils (0x0F).
    - Holding Register (0x10).
- **Read unique:** To read configured registers.

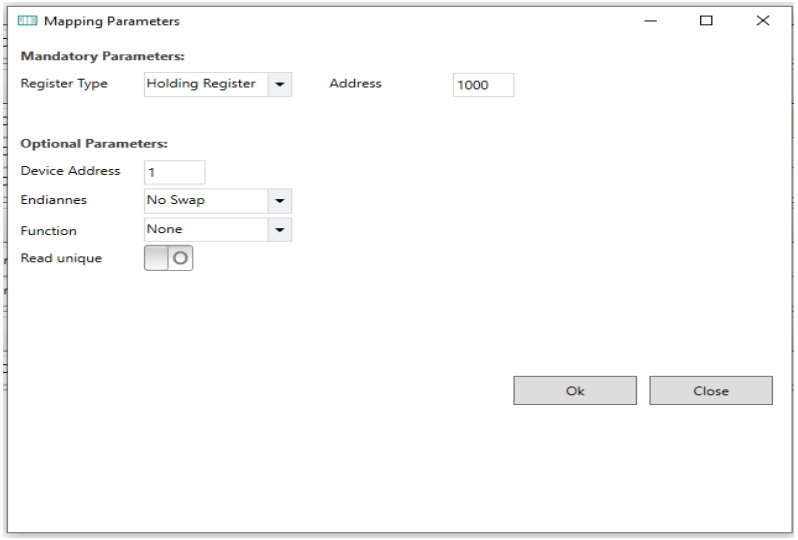


Figure 47: Examples of Modbus Attributes.

- **Type:** Data format types
  - Bool
  - Float 32
  - Int8
  - Int16
  - Int32
  - UInt8
  - UInt16
  - UInt32
  - Codedenum
  - Enumerated
  - String
- **Size:** Number of registers.
- **Offset:** Number of Bit
- **Direction:** where the signal goes.

4.1.2.4. Example of a Modbus RTU configuration

4.1.2.4.1. Input Status

- Signal to be integrated.
  - Input Status (1)
    - Signal type: Discrete input
    - Modbus Address: 9
    - Device Address: 1
    - Endiannes: No swap
    - Fuction: NA

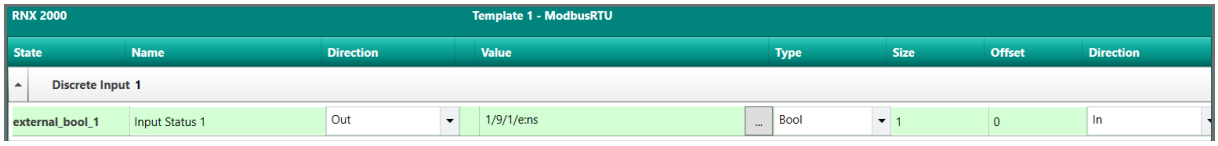


Figure 47: Example of Input Status configuration

For each Input status point, following fields must be configured:

- **State:** Data from RTU model.
- **Name:** Description of the signal.
- **Direction:** From where
- **Value:** 1/9/1/e:ns
  - 1 = Discrete input
  - 9 = Signal Modbus address
  - 1 = Device Address
  - e = Endiannes
- **Type:** Bool
- **Size:** Nº of register
- **Offset:** Bit to be read
- **Direction:** To where

4.1.2.4.2. Holding register

- Signal to be integrated
  - Holding Registers (4)
    - Modbus Address: 1000
    - Device Address: 1
    - Endiannes: No swap
    - Fuction: None

Figure 48: Example of Holding register configuration

For each holding register, following fields must be configured:

- **State:** Data from RTU model.
- **Name:** Description of the signal.
- **Direction:** From where
- **Value:** 4/1000/1/e:ns
  - 4 = Holding register
  - 1000 = Signal Modbus address
  - 1 = Device Address
  - e = Endiannes

- **Type:** UInt16
- **Size:** Nº of register
- **Offset:** Bit to be read
- **Direction:** To where

4.1.2.4.3. Coils status

- Signal to be integrated
  - Coil Status (0)
    - Modbus Address: 2
    - Device Address: 1
    - Endiannes: No swap
    - Fuction: Single
      - Fun:5

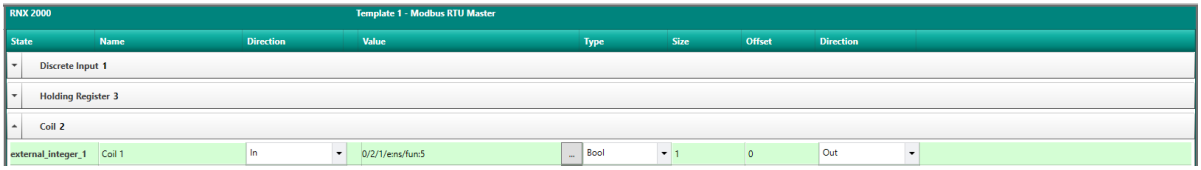


Figure 49: Example of Holding register configuration

For each Coils Status, following fields must be configured:

- **State:** Data from RTU model.
- **Name:** Description of the signal.
- **Direction:** From where
- **Value:** 0/2/1/e:ns/fun:5
  - 0 = Coils
  - 2 = Signal Modbus address
  - 1 = Device Address
  - e = Endiannes
  - fun: 5 = Funcion type
- **Type:** Bool
- **Size:** Nº of register
- **Offset:** Bit to be read
- **Direction:** To where

4.1.2.4.4. Input register

- Signal to be integrated
  - input Registers (3)
    - Modbus Address: 6000
    - Device Address: 1
    - Endiannes: No swap
    - Fuction: NA

Figure 50: Example of Input register configuration

For each Coils Status, following fields must be configured:

- **State:** Data from RTU model.
- **Name:** Description of the signal.
- **Direction:** From where
- **Value:** 0/2/1/e:ns/fun:5
  - 0 = Coils
  - 2 = Signal Modbus address
  - 1 = Device Address
  - e = Endiannes
  - fun: 5 = Funcion type
- **Type:** UInt16
- **Size:** Nº of register
- **Offset:** Bit to be read
- **Direction:** To where

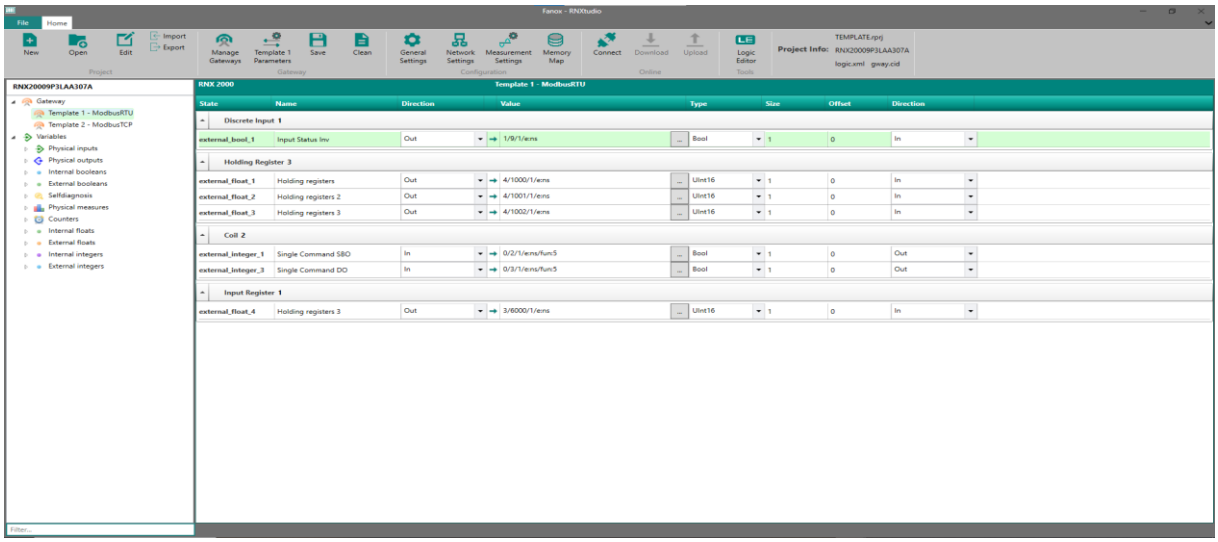


Figure 51: Examples of Modbus RTU Database configuration

4.1.3. Modbus TCP Gateway

4.1.3.1. Creating a Modbus TCP Gateway

To create a Modbus TCP, perform the following steps:

- Select Manage Gateways from Gateway menu.
- Select ModbusTCP from the list.
- Set a Name.
- Press in ADD button to include in the project.
- Press Ok button to save.

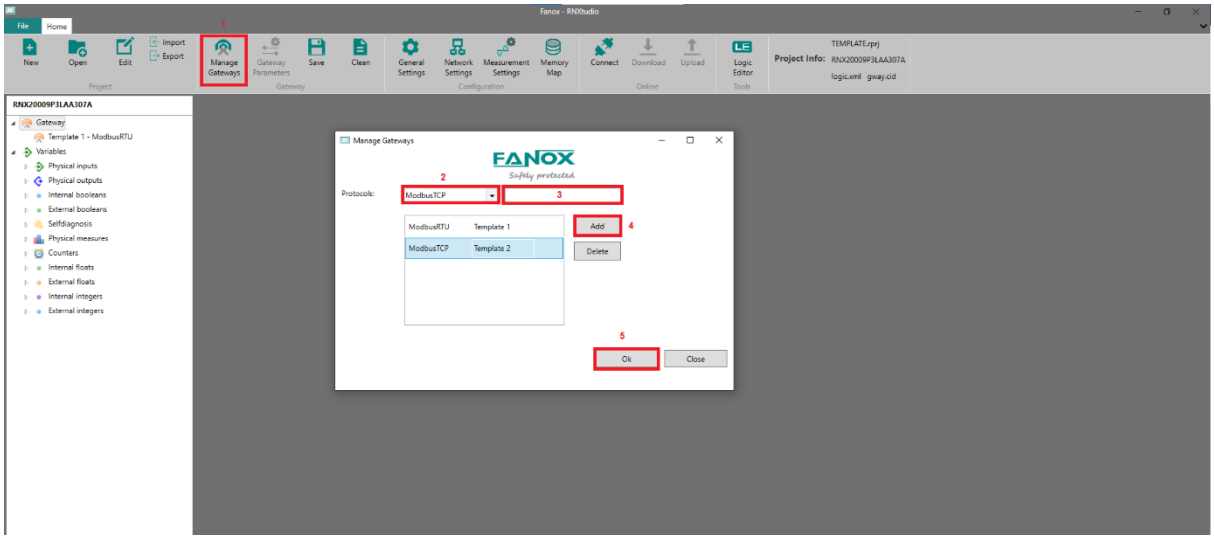


Figure 52: Creating a Modbus RTU

4.1.3.2. Configure a Modbus TCP Setting

To configure a Modbus TCP setting, perform the following steps:

- Select the gateway.
- Select Gateways parameters from Gateway menu.
- Configure the settings.
- Press Ok button to save.

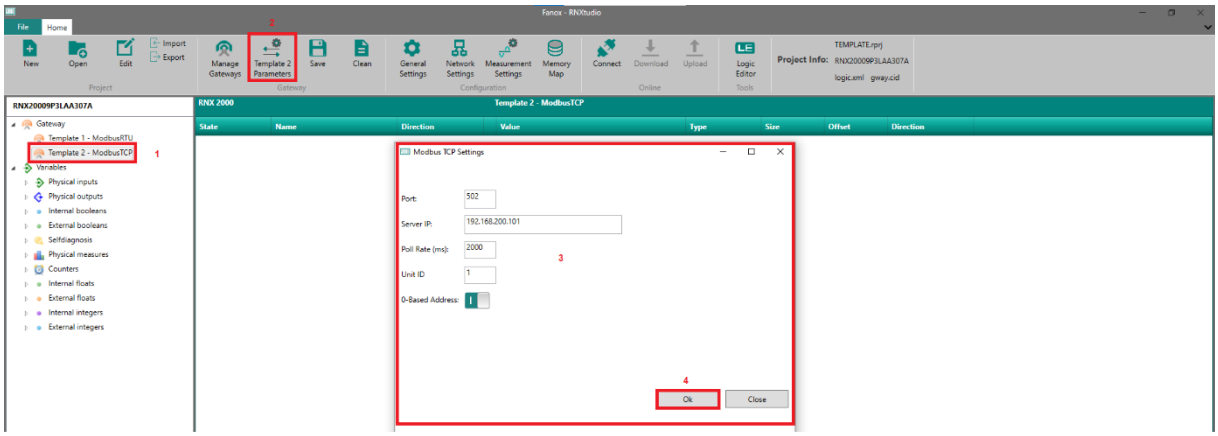


Figure 53: Configuring a Modbus TCP Settings

Where:

- **Port:** Modbus TCP/IP port, by default 502.
- **Server IP:** IP address of Modbus Slave.
- **Poll Rate (ms):** Time intervals between requests.
- **0-Based Address:** Zero based addressing.
  - not selected Base 0
  - Selected Base 1

4.1.3.3. Configure a Modbus TCP Database

To configure a Modbus TCP database, perform the following steps:

- Select a signal from RTU data model (External variables).
- Drag and drop to edit window.
- Edit signal and configure.
- Press Ok button to include.

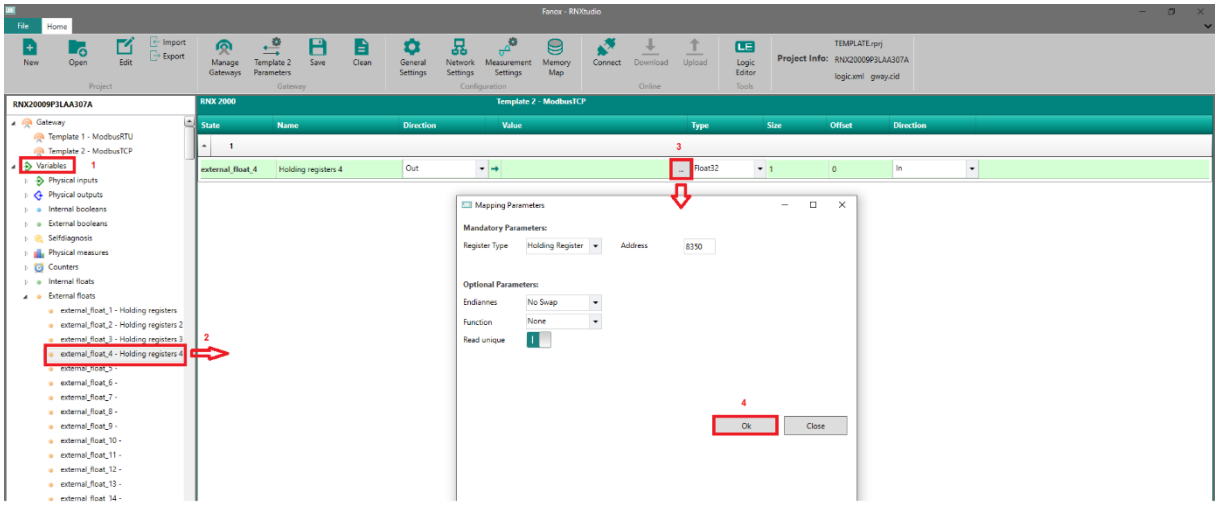


Figure 54: Configuring a Modbus TCP Database

4.1.3.4. Example of a Modbus TCP configuration

4.1.3.4.1. Input Status

- Signal to be integrated.
  - Input Status (1)
    - Modbus Address: 9
    - Endiannes: No swap
    - Fuction: NA

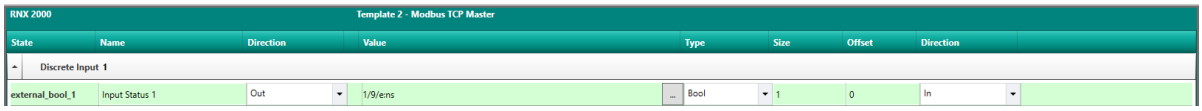


Figure 55: Example of Input Status configuration

For each Input status point, following fields must be configured:

- **State:** Data from RTU model.
- **Name:** Description of the signal.
- **Direction:** From where
- **Value:** 1/9/1/e:ns
  - 1 = Discrete input
  - 9 = Signal Modbus address
  - e = Endiannes
- **Type:**
- **Size:** Nº of register
- **Offset:** Bit to be read
- **Direction:** To where

4.1.3.4.2. Holding register

- Signal to be integrated.
  - Holding Registers (4)
    - Modbus Address: 1000
    - Endiannes: No swap
    - Fuction: None

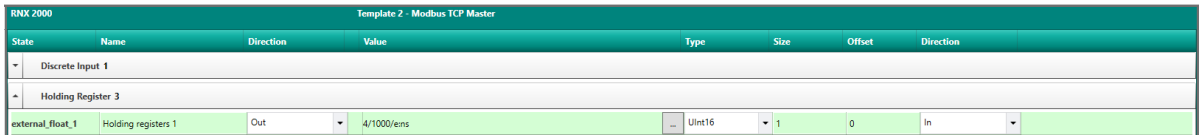


Figure 56: Example of Holding register configuration

For each holding register, following fields must be configured:

- **State:** Data from RTU model.
- **Name:** Description of the signal.
- **Direction:** From where
- **Value:** 4/1000/1/e:ns
  - 4 = Holding register
  - 1000 = Signal Modbus address
  - e = Endiannes
- **Type:**
- **Size:** Nº of register
- **Offset:** Bit to be read
- **Direction:** To where

4.1.3.4.3. Coils status

- Signal to be integrated
  - Coil Status (0)
    - Modbus Address: 2
    - Endiannes: No swap
    - Fuction: Single
      - Fun:5

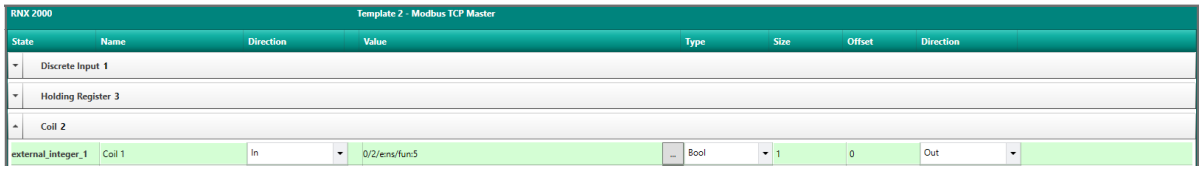


Figure 57: Example of Holding register configuration

For each Coils Status, following fields must be configured:

- **State:** Data from RTU model.
- **Name:** Description of the signal.
- **Direction:** From where
- **Value:** 0/2/1/e:ns/fun:5
  - 0 = Coils
  - 2 = Signal Modbus address
  - e = Endiannes
  - fun: 5 = Funcion type
- **Type:**
- **Size:** Nº of register
- **Offset:** Bit to be read
- **Direction:** To where

4.1.3.4.4. Input register

- Signal to be integrated
  - input Registers (3)
    - Modbus Address: 6000
    - Endiannes: No swap
    - Fuction: NA

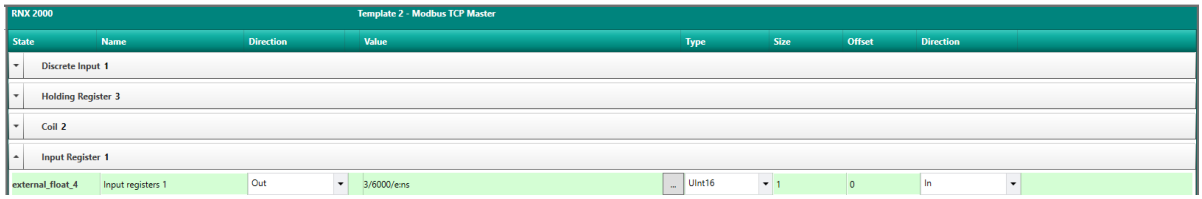


Figure 58: Example of Input register configuration

For each Coils Status, following fields must be configured:

- **State:** Data from RTU model.
- **Name:** Description of the signal.
- **Direction:** From where
- **Value:** 0/2/1/e:ns/fun:5
  - 0 = Coils
  - 2 = Signal Modbus address
  - 1 = Device Address
  - e = Endiannes
  - fun: 5 = Funcion type

- **Type:**
- **Size:** Nº of register
- **Offset:** Bit to be read
- **Direction:** To where

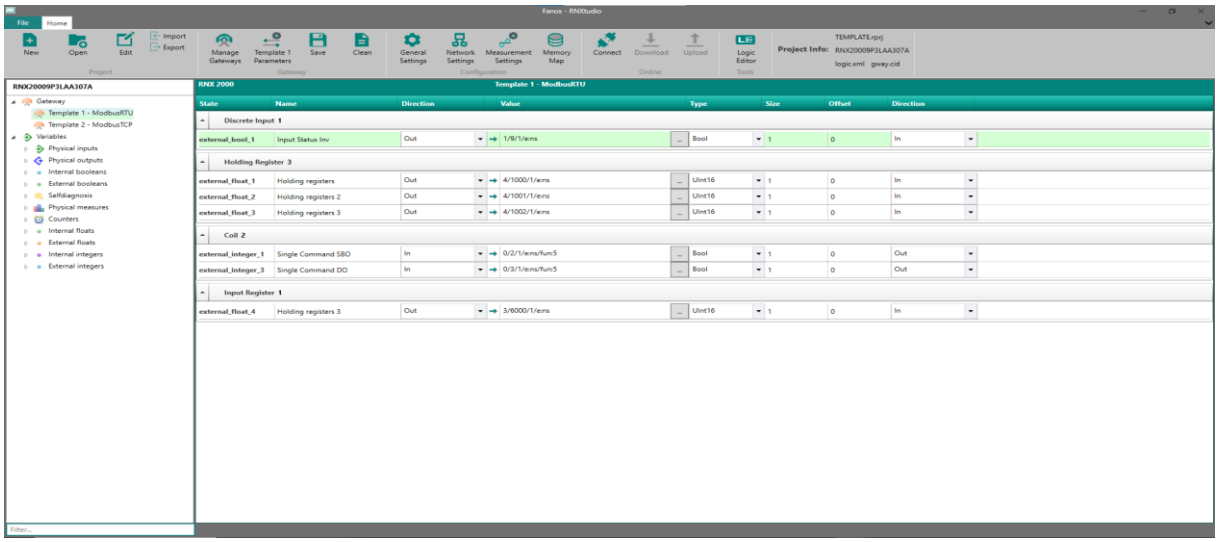


Figure 59: Examples of Modbus TCP Database configuration

4.2. IEC 60870-5-104

IEC60870-5-104 telecontrol protocol is based in a client/server model referring the controlling station as the client and the controlled station as the server. Is the controlling station which establishes each transport connection with all IEC60870-5- 104 servers in the network.

The transport interface (User to TCP interface) is a stream-oriented interface which does not define any start or stop mechanism for the ASDUs of IEC 60870-5-101. In order to detect the start and the end of the ASDUs, each APCI includes the following delimiting elements: a start character, the specification of the length of the ASDU, plus the control field. Either a complete APDU (or, for control purposes, only the APCI fields) may be transferred.

4.2.1. IEC104 Server Gateway

4.2.1.1. Creating an IEC104 Server Gateway

To create an IEC104 Server, perform the following steps:

- Select Manage Gateways from Gateway menu.
- Select IEC104Server from the list.
- Set a Name.
- Press in ADD button to include in the project.
- Press Ok button to save.

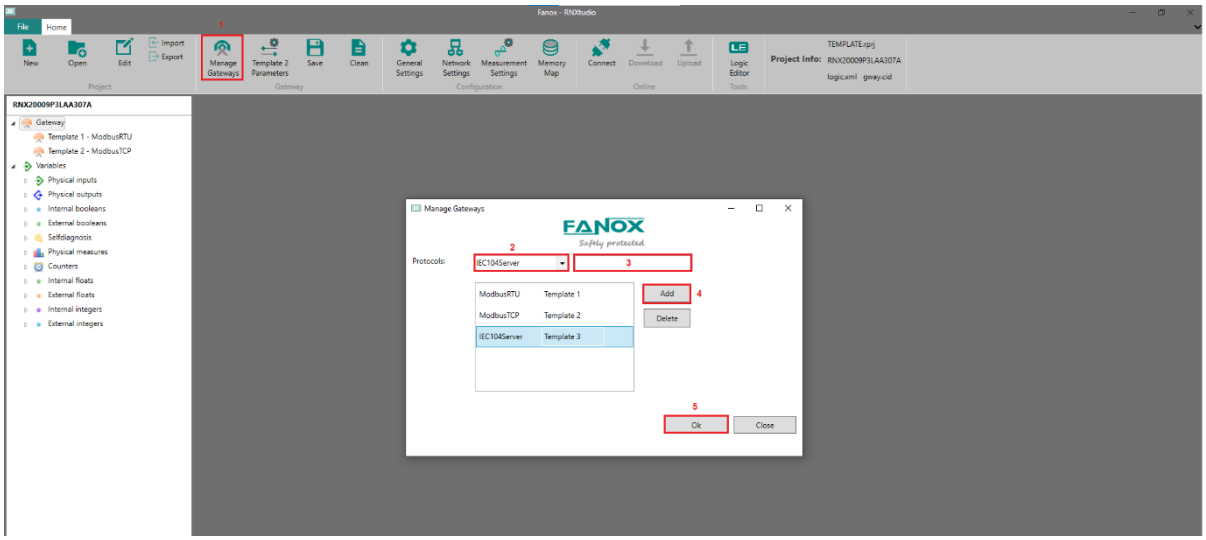


Figure 60: Creating an IEC104Server

4.2.1.2. Configure an IEC104 Server Setting

To configure a IEC104 Server setting, perform the following steps:

- Select the gateway.
- Select Gateways parameters from Gateway menu.
- Configure the settings.
- Press Ok button to save.

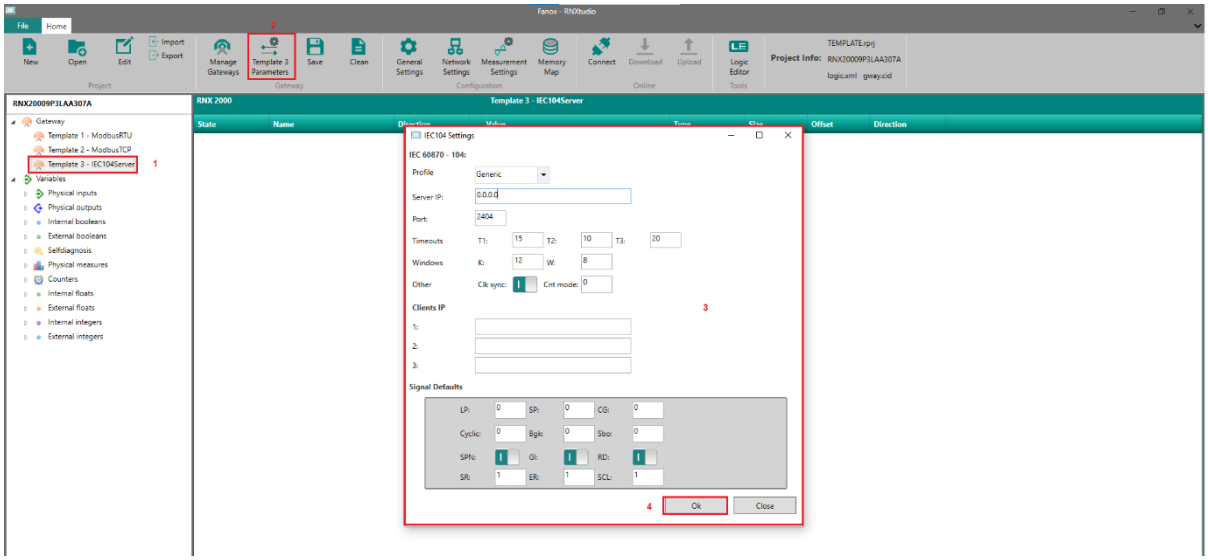


Figure 61: Configuring a IEC104 Server Settings

Where:

- **Profile:** Selectable from a list:
  - Generic: Generic Profile.
  - EVN: EVN Profile.
- **Server IP:** IP address of RTU.
- **Port:** IEC 104 port, by default 2404**.**
- **Timeouts:**
  - T1: Time-out of send or test APDUs.
  - T2: Time-out for acknowledges in case of no data messages t2 < t1.
  - T3: Time-out for sending test frames in case of a long idle state.
- **Window:**
  - k: Maximum difference receive sequence number to send state variable.
  - w: Lasted acknowledge after receiving w I format APDUs.
- **Other:**
  - Clk sync: Synchro enabled by IEC 61850-5-104
  - Cnt Mode: Counter mode.
    - Mode A = Value 0
    - Mode B = Value 1
    - Mode C = Value 2
    - Mode D = Value 3
- **Clients IP:** Allowed IP to connect as a client.
- **Default signals:** Applies to entire database

LP	Lond pulse duration	**SP**	Short pulse Duration	**CG**	Counter group
Cyclic	Cyclic data transmission time	**Sbo**	Select Before operate time		
SPN	Spontaneous	**GI**	General interrogation	**RD**	Read procedure Time

SR	Start range for normalized value	**ER**	End range for normalized value	**SCL**	Scale factor

4.2.1.3. Configure an IEC 104 Server Database

To configure an IEC104 Server database, perform the following steps:

- Select a signal from RTU data model.
- Drag and drop to edit window.
- Edit signal and configure.
- Press Ok button to include.

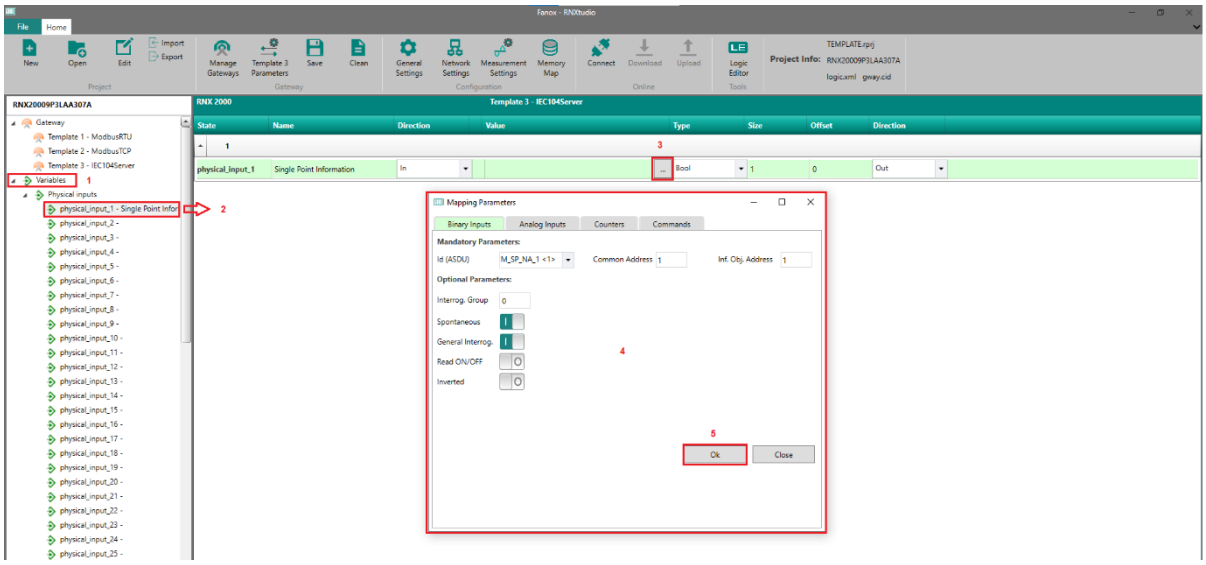


Figure 62: Configuring an IEC104 Server Database

The signals are divided into different columns.

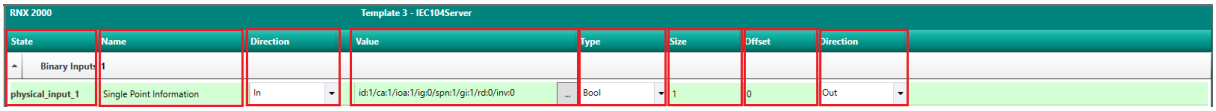


Figure 63: Database Structure

Where:

- **State:** Name of variable used.
- **Name:** Description of the signal, it can be edit.
- **Direction:** where the signal comes from.
- **Value:** IEC 104 attribute, four type of signals:
  - **Binary Inputs:**
    - Mandatory Parameters
      - Id (ASDU)
        - M_SP_NA_1 <1> (Single point information).
        - M_DP_NA_1 <3> (Double point information).
        - M_SP_TB_1 <30> (Single point inf. with time tag).
        - M_DP_TB_1 <31> (Double point inf. with time tag).
      - Common Address
      - IOA: Information Object Address

- Optional Parameters
  - Interrog. Group
  - Spontaneous
  - General interrogation
  - Read ON/OFF
  - Inverted

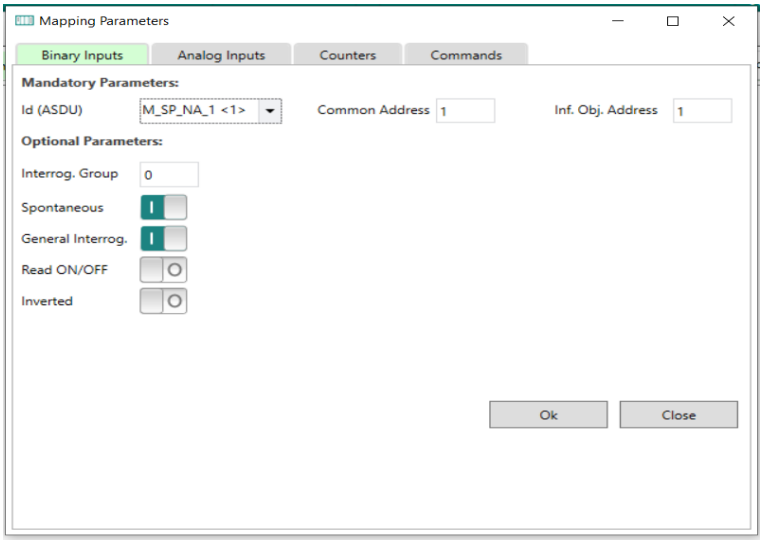


Figure 64: Examples of Binary Inputs Attributes.

- **Analog Inputs:**
  - Mandatory Parameters
    - Id (ASDU)
      - M_ST_NA_1 <5> (Step position information).
      - M_ME_NA_1 <9> (Normalized value).
      - M_ME_NB_1 <11> (Scaled value).
      - M_ME_NC_1 <13> (Short Floating point).
      - M_ST_TB_1 <32> (Step position information with time).
      - M_ME_TD_1 <34> (Normalized value with time).
      - M_ME_TE_1 <35> (Scaled value with time).
      - M_ME_TF_1 <36> (Short Floating point with time).
    - Common Address
    - IOA: Information Object Address

  - Optional Parameters
    - Cyclic time
    - Range Init (Enables with the following types: 9/34)
    - Range End (Enables with the following types: 9/34)
    - Scaled
    - Interrog. Group
    - Spontaneous
    - General interrogation
    - Read ON/OFF
    - Deadband

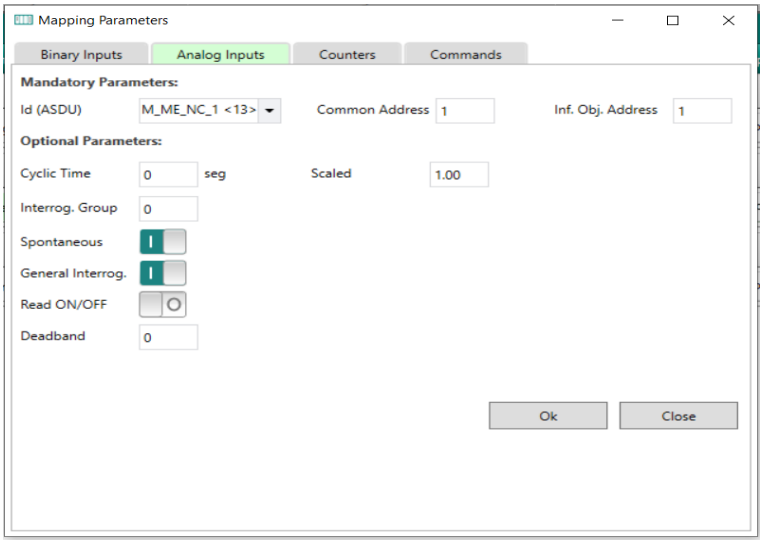


Figure 65: Examples of Analog Inputs Attributes.

- **Counters:**
  - Mandatory Parameters
    - Id (ASDU)
      - M_IT_NA_1 <15> (Integrated total).
      - M_IT_TB_1 <37> (Integrated total with time).
    - Common Address
    - IOA: Information Object Address

  - Optional Parameters
    - Freeze
    - Counter Group

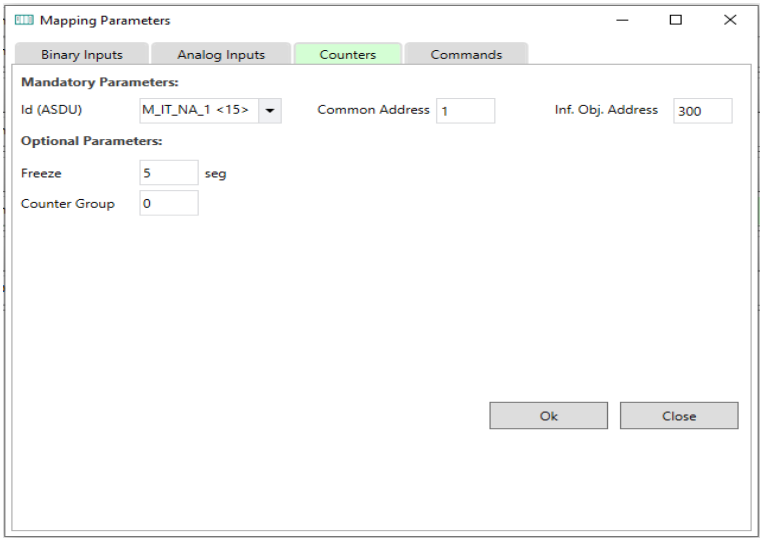


Figure 66: Examples of Counter Attributes.

- **Commands:**
  - Mandatory Parameters
    - Id (ASDU)
      - C_SC_NA_1 <45> (Single command).
      - C_DC_NA_1 <46> (Double command).
      - C_RC_NA_1 <47> (Regulating step command).
      - C_SE_NA_1 <48> (Set point command, normalized value).
      - C_SE_NB_1 <49> (Set point command, scaled value).
      - C_SE_NC_1 <50> (Set point command, short floating-point number).
    - Common Address
    - IOA: Information Object Address

  - Optional Parameters
    - SBO
    - Long Pulse
    - Short Pulse
    - Inverted (Enables with the following types: 45/46/47)

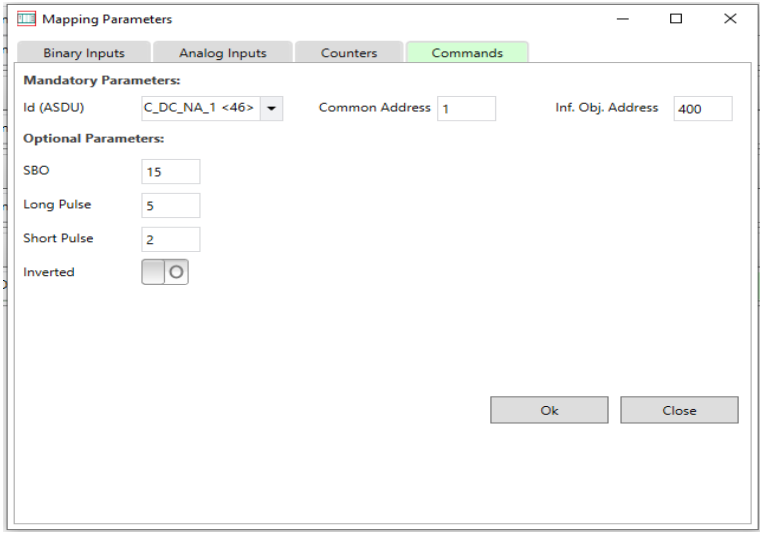


Figure 67: Examples of Command Attributes.

- **Type:** Data format types
  - Bool
  - Float 32
  - Int8
  - Int16
  - Int32
  - UInt8
  - UInt16
  - UInt32
  - Codedenum
  - Enumerated
  - String
- **Size:** Number of registers.
- **Offset:** Number of Bit
- **Direction:** where the signal goes.

4.2.1.4. Example of an IEC 104 Server configuration

Database to be configured:

- Signal to be integrated.
  - Binary Inputs
    - Single point:
      - Type identification: <1>: = Single point information.
      - Common Address: 1
      - IOA (Information Object Address): 1
      - COT (Cause of transmission):
        - Spontaneous
        - General interrogation
    - Double point:
      - Type identification: <3>: = Double point information.
      - Common Address: 1
      - IOA (Information Object Address): 100
      - COT (Cause of transmission):
        - Spontaneous
        - General interrogation
  - Analog Inputs
    - Type identification: <13>: = measured value, short floating point number
    - Common Address: 1
    - IOA (Information Object Address): 200
    - COT (Cause of transmission):
      - Periodic,Cyclic:60 Seg
      - General interrogation
  - Counters
    - Type identification: <15>: = integrated totals
    - Common Address: 1
    - IOA (Information Object Address): 300
    - Freeze: 10 Seg
    - Counter Group: 0 (General Request).
  - Commands
    - Type identification: <46>: = Double commands
    - Common Address: 1
    - IOA (Information Object Address): 400
    - SBO:15
    - Long Pulse: 5 Seg
    - Short Pulse: 2 Seg

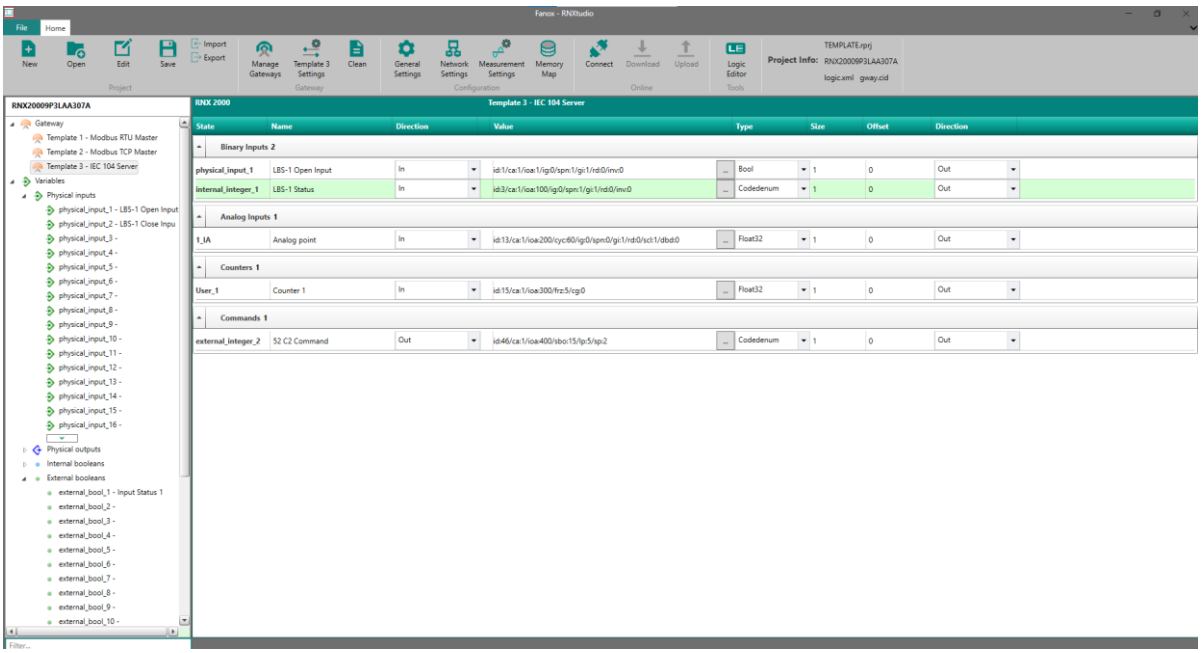


Figure 68: Examples of IEC 104 Server Configuration

5. WEB BROWSER

5.1. Introduction

This document describes the capacity of the web server.

It consists of the following functional features:

- Equipment monitoring.
- Data logging
- Setup
- Security
- Test Menu
- FW Update

5.2. Web server connection

To access the application, open a browser and write the IP address of the device to which you want to connect in the address bar.

E.g.: https://192.168.200.100 connected to ETH Local. A login page will appear to start the session.

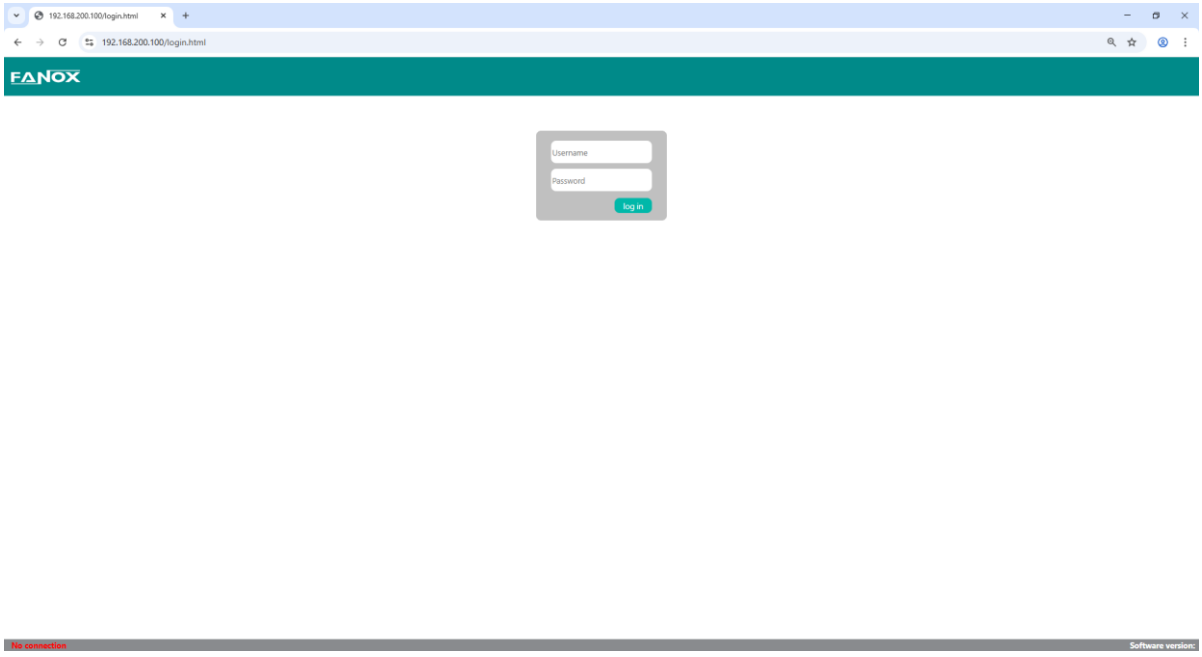


Figure 69: Web Server log in page

The login screen will appear where you will have to enter your username and password.

Authentication is necessary to have access to web.

- User: Super Admin 1
- Password: Fanox/5555

The User and password can be modified from web server.

5.3. Web server options

Web server options consists of the following menus.

- **Monitoring:** It allows to visualize different data.
- **Data logging:** It allows to visualize events and system log.
- **Setup:** It allows to change the settings of RTU.
- **Security:** It allows to change Users and Roles configuration.
- **Test Menu:** It allows to simulate the signals.
- **FW Update:** It allows to send firmware update.

5.3.1. Monitoring

The monitoring options menu consists of the following submenus:

- **Device info:** It provides us with information about equipment.
- **States:** It allows to be monitoring the real state of:
  - Physical Inputs
  - Physical Outputs
  - Internal Booleans
  - External Booleans
  - Internal floats
  - External floats
  - Internal integers
  - External integers
  - Protections
  - Selfdiagnosis
- **Measurements:** It allows to monitoring measurements
- **Counters:** It allows to change the values of counters.

5.3.1.1. Device info

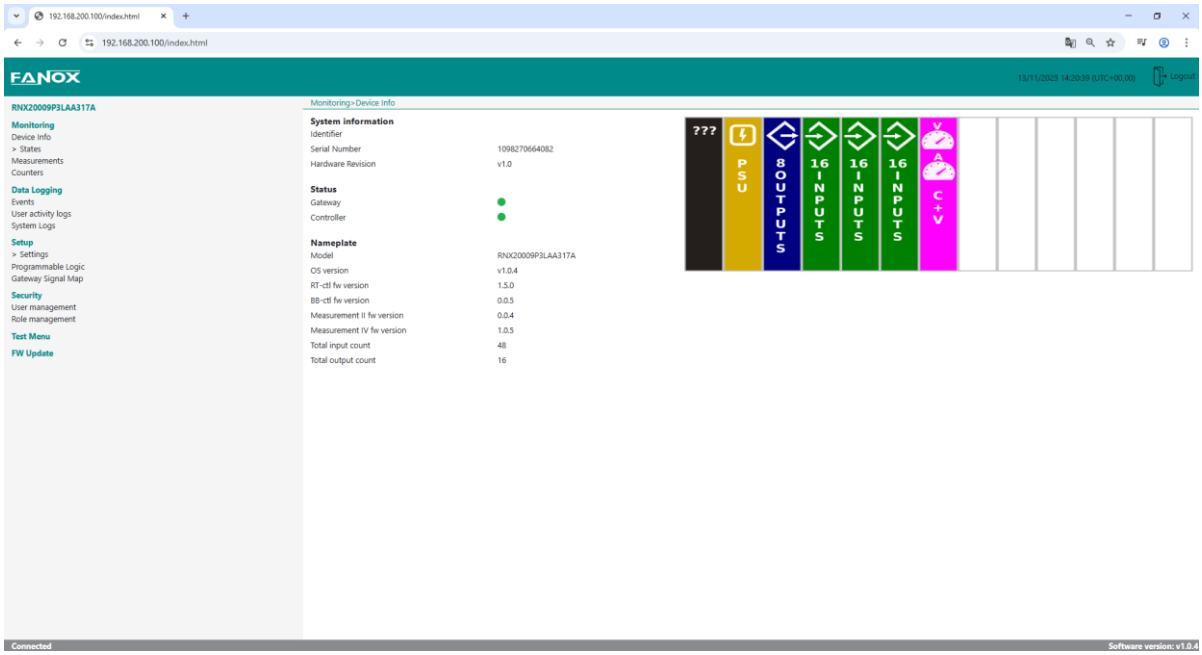


Figure 70: Device info page

5.3.1.2. States

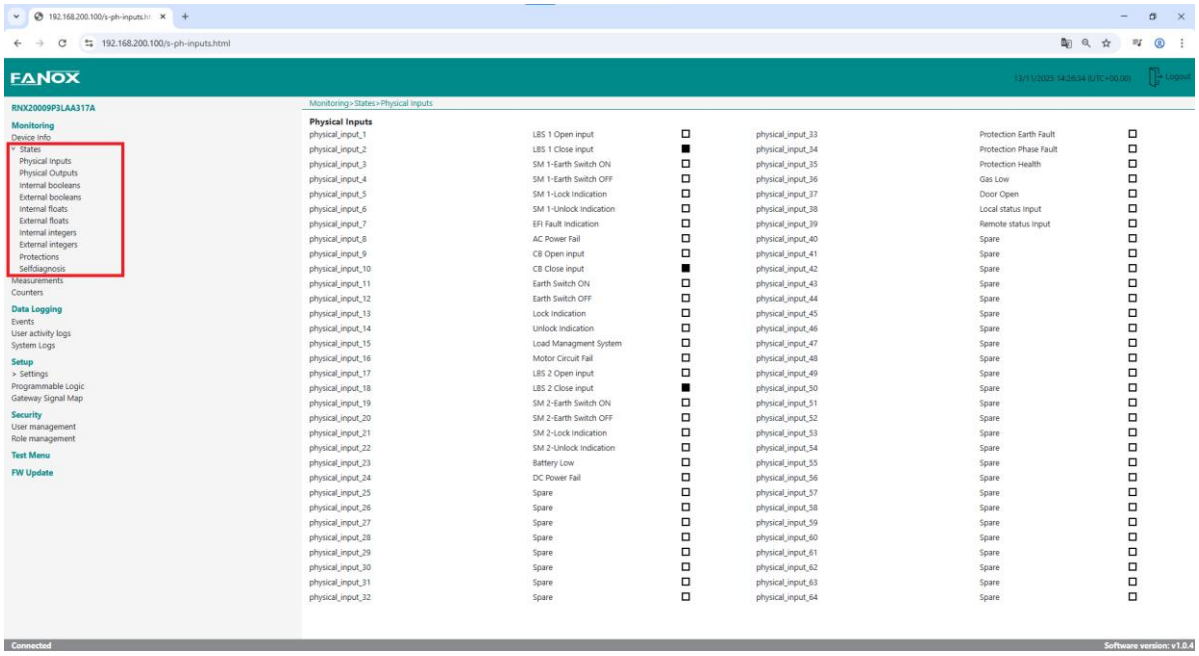


Figure 71: States page

5.3.1.3. Measurements

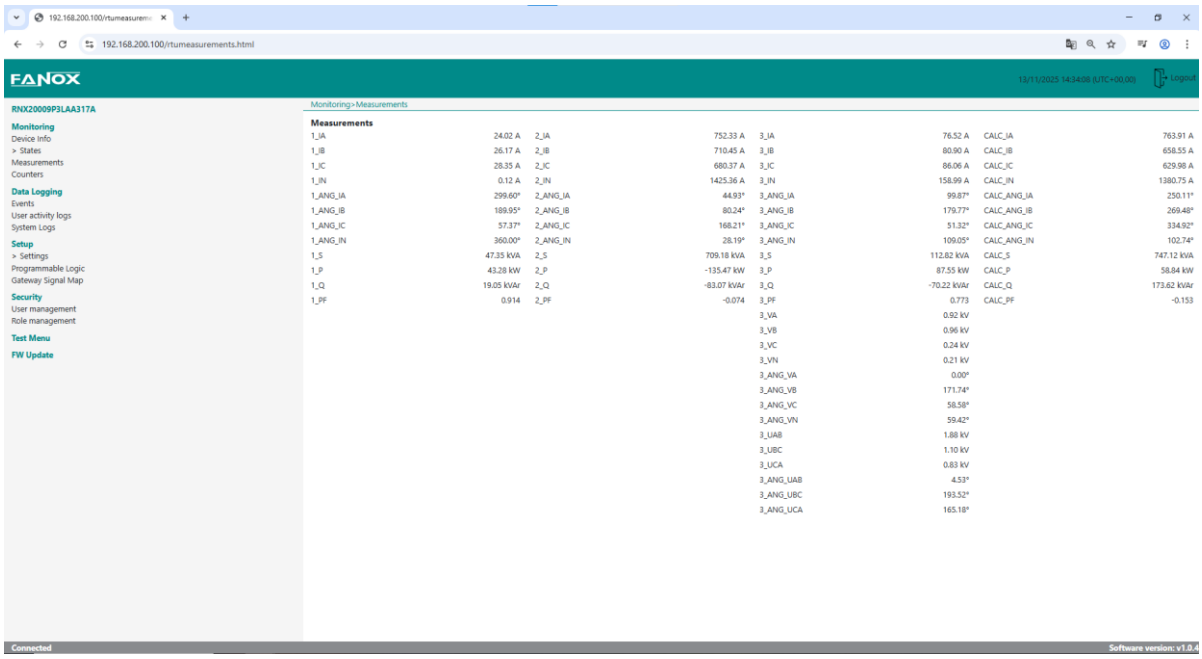


Figure 72: Measurements page

5.3.1.4. Counters

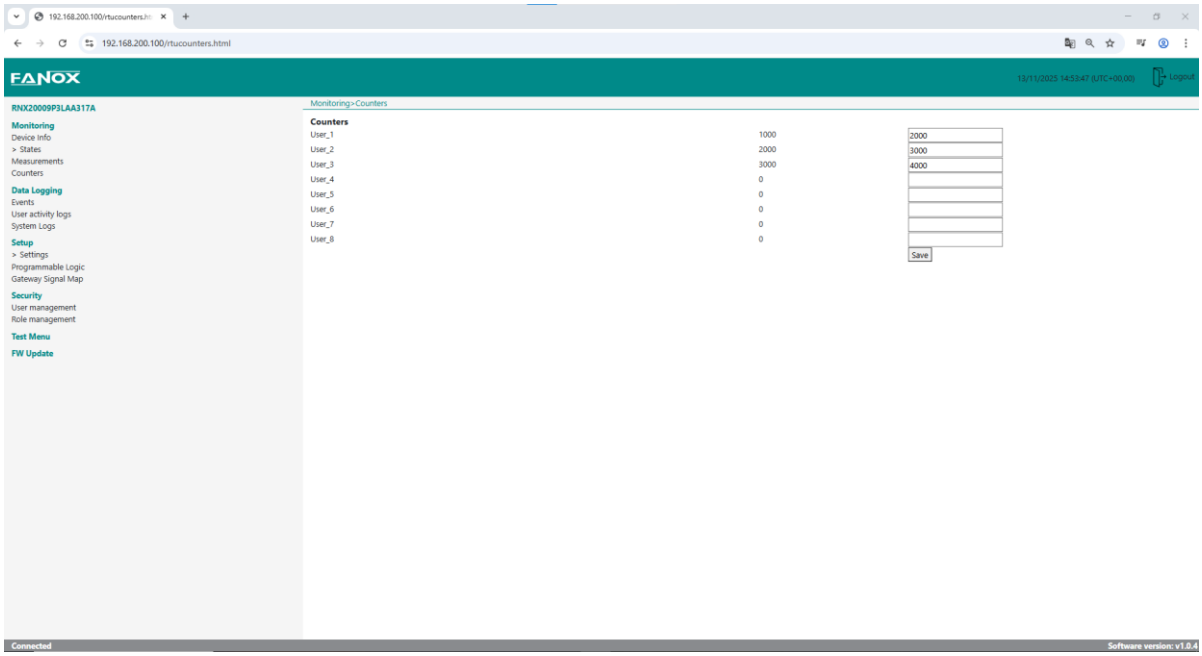


Figure 73: Counters page

5.3.2. Data Logging

The data logging menu consists of the following submenus:

- Events: System variable events
- User activity logs: User Events
- System logs: System event logs

5.3.2.1. Events

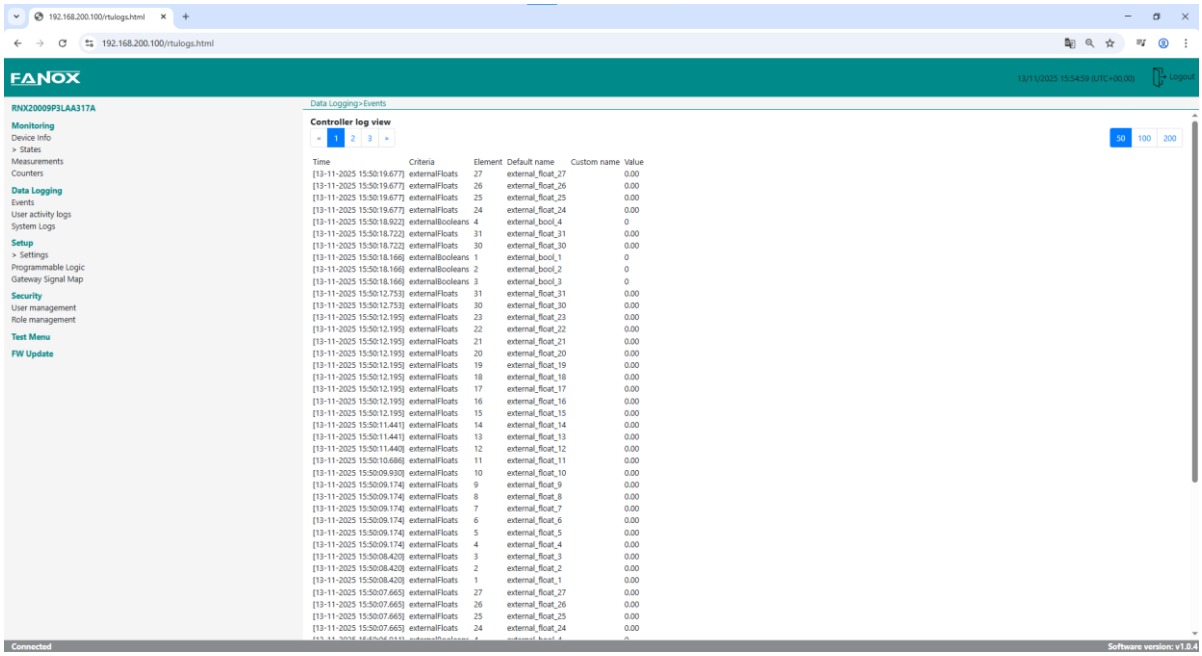


Figure 74: Events page

5.3.2.1. User activity logs

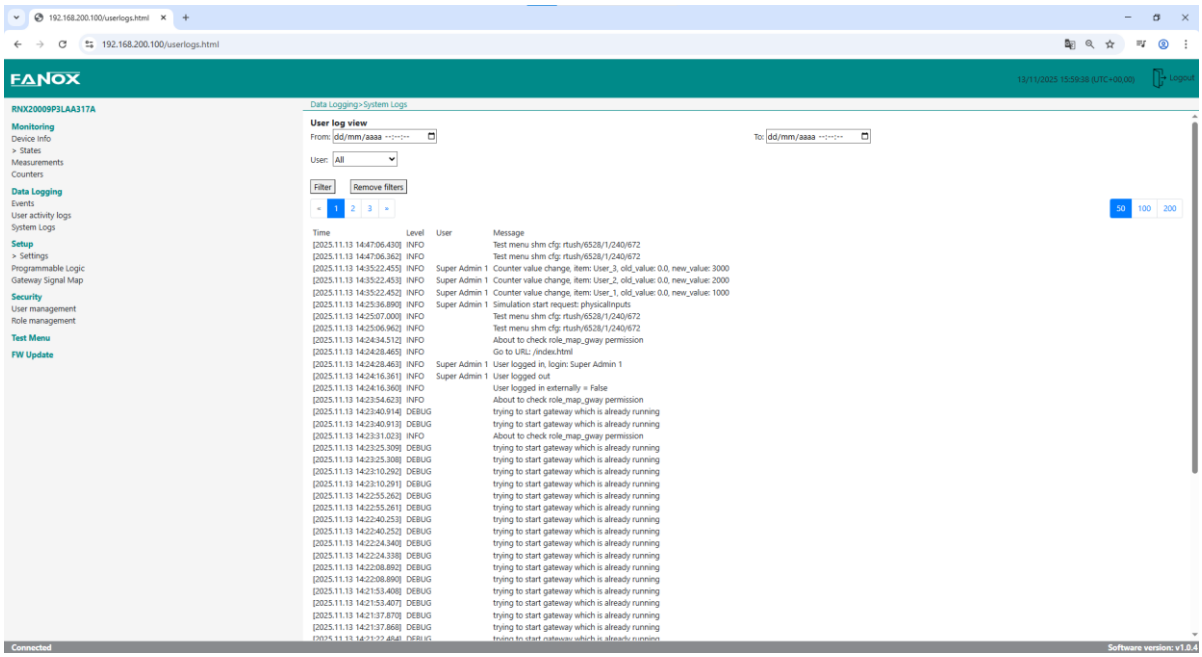


Figure 75: User activity logs page

5.3.2.1. System logs

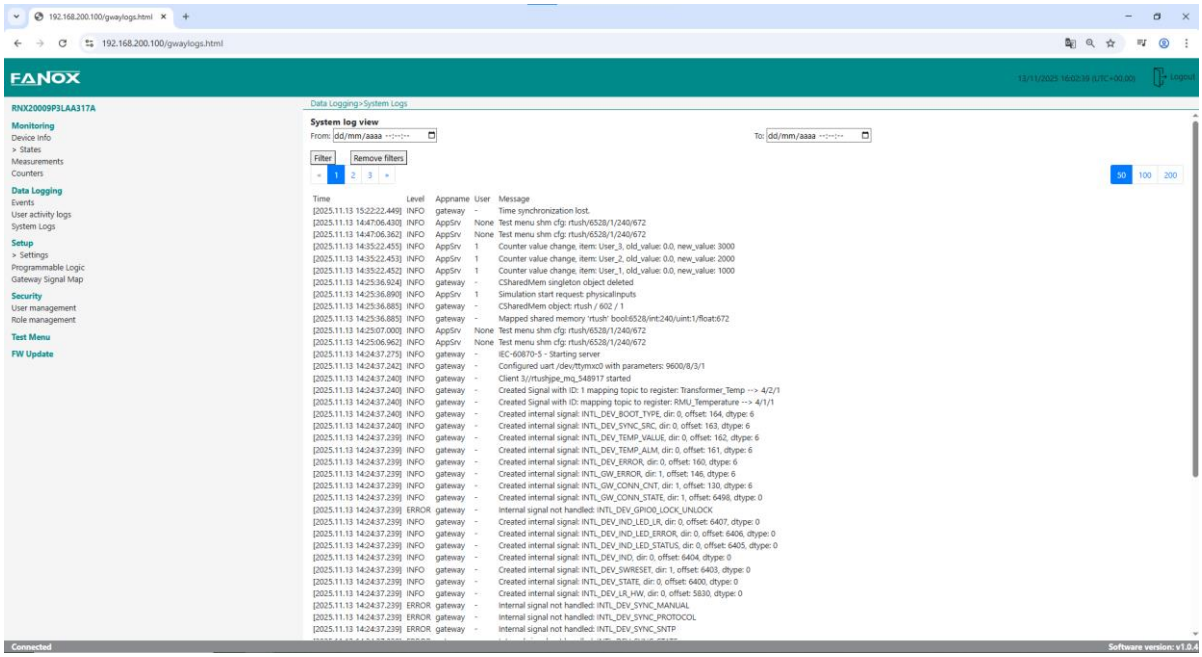


Figure 76: System logs page

5.3.3. Setup

The setup options menu consists of the following submenus:

- Settings:
  - General: It allows to configure time zone and synchronization settings.
  - Measurements
    - Settings Measurements: It allows to configure measurements settings (Ratios, correct factors...).
    - Settings inputs: Debounce time.
  - Serial ports: Serial port settings, cannot be configured.
  - Ethernet ports: Ethernet port setting configuration
- Programmable Logic: It allows the followings:
  - Start: To start the application.
  - Stop: To stop the application.
  - Restart: To restart the application.
  - Send: To send logics configuration file.
  - Get: To download the logics configuration file.
- Gateway Signal Map: It allows the followings:
  - Start All: To start the gateway application.
  - Stop All: To stop the gateway application.
  - Send: To send gateway configuration file.
  - Get: To download gateway configuration file.
-

5.3.3.1. Settings

5.3.3.1.1. General

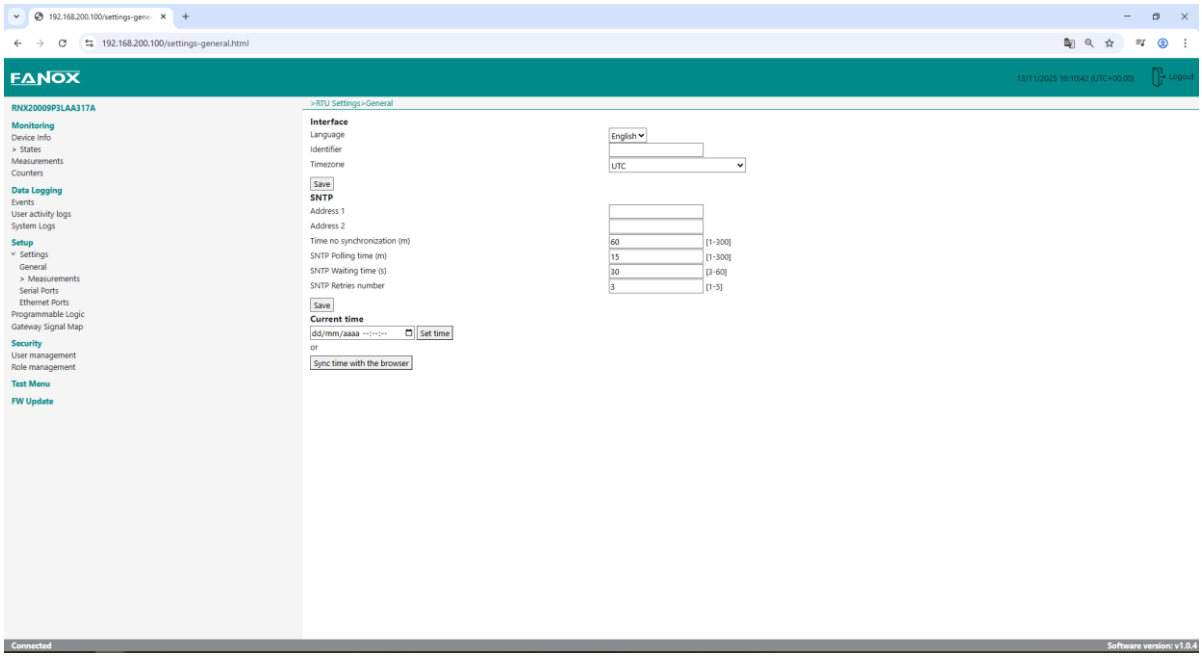


Figure 77: General Settings page

5.3.3.1.2. Settings Measurements

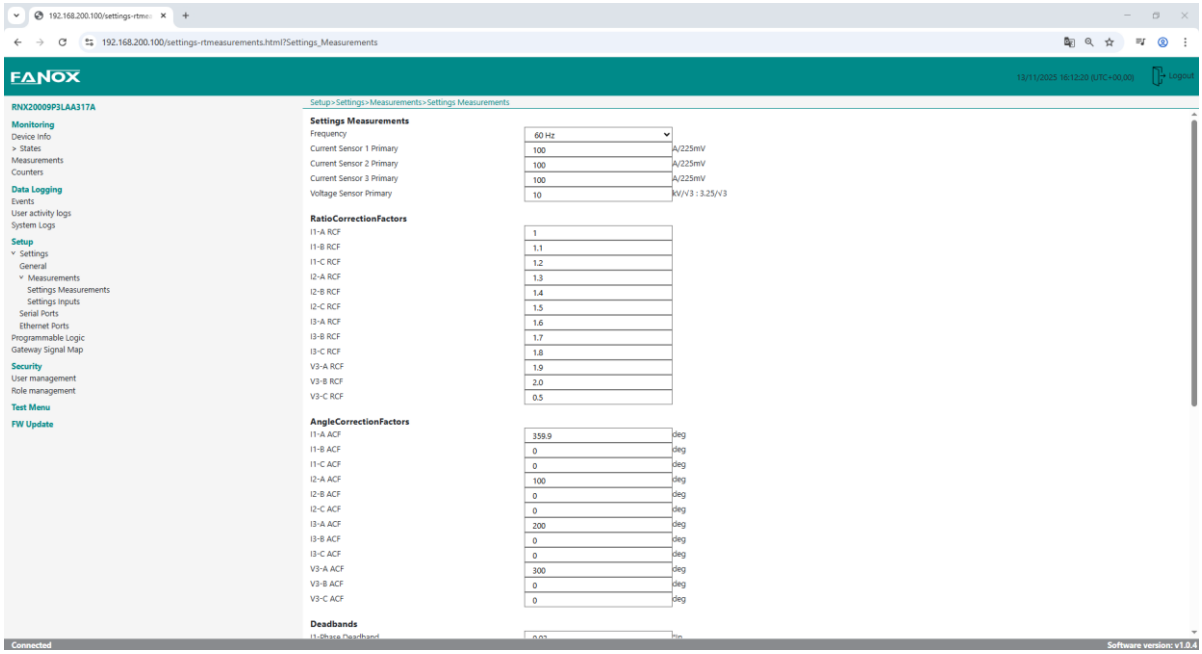


Figure 78: Settings Measurements page 1_2

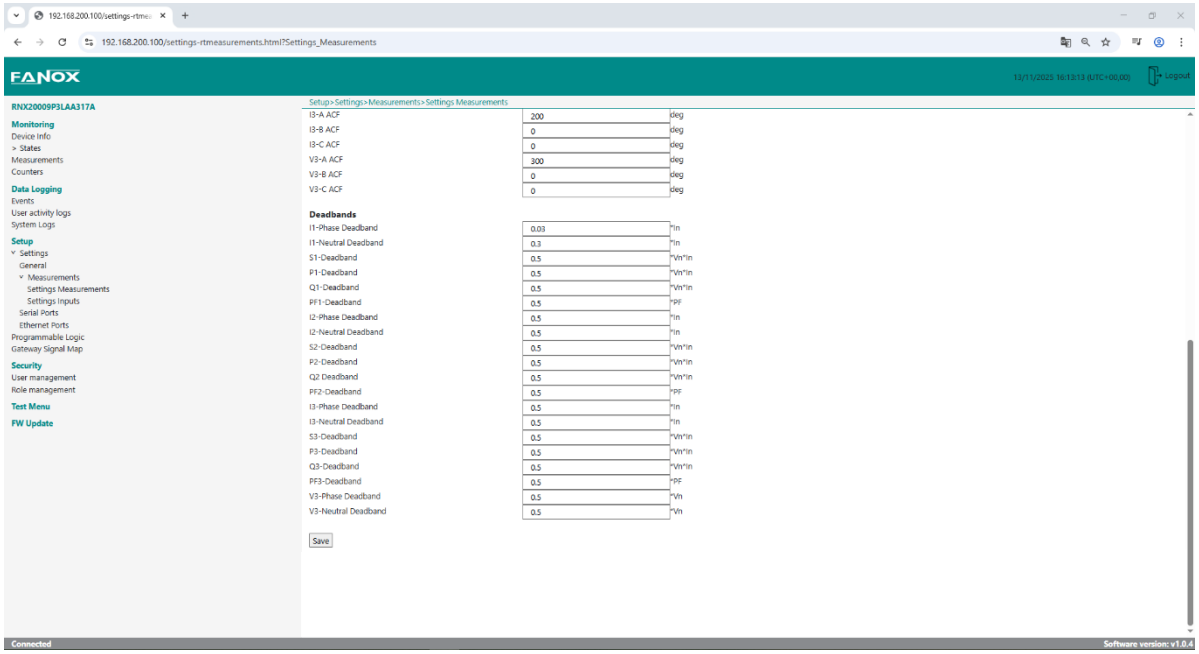


Figure 79: Settings Measurements page 2_2

5.3.3.1.3. Settings Inputs

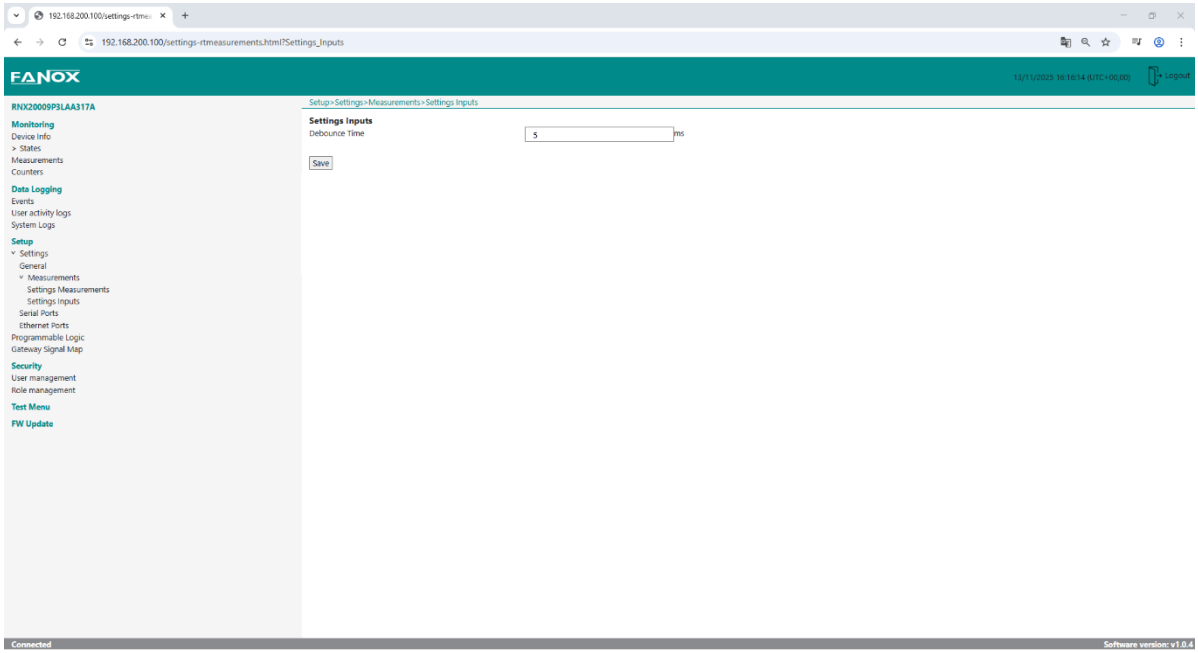


Figure 80: Settings Inputs page

5.3.3.1.4. Serial Ports

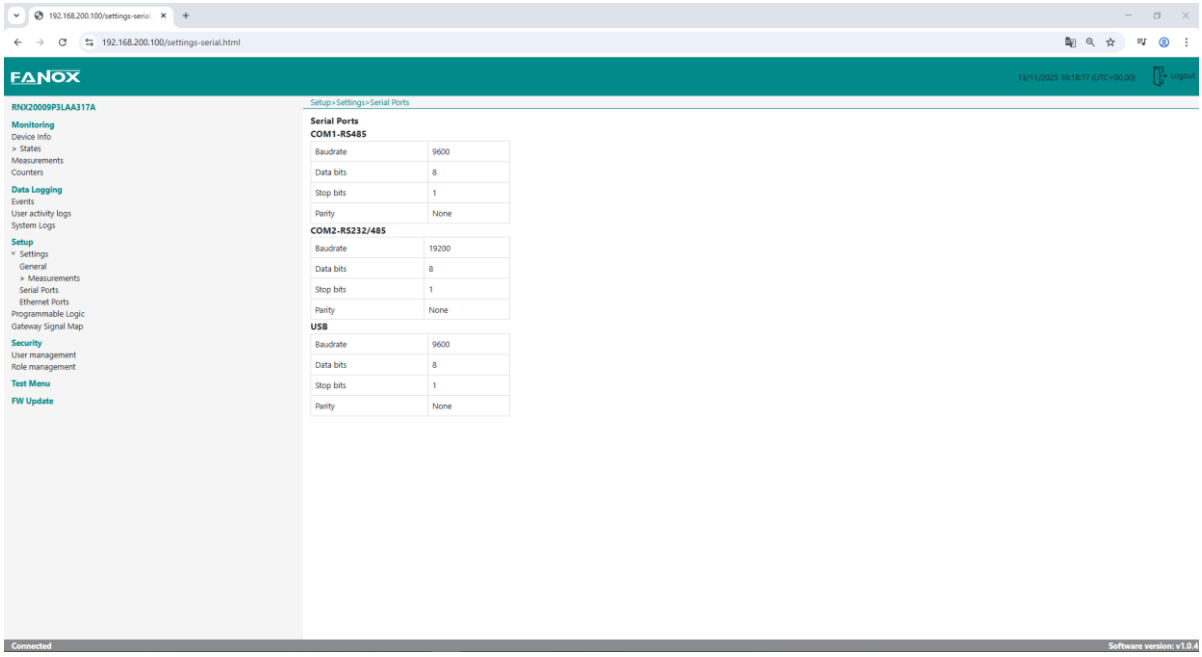


Figure 81: Serial Ports page

5.3.3.1.5. Ethernet Ports

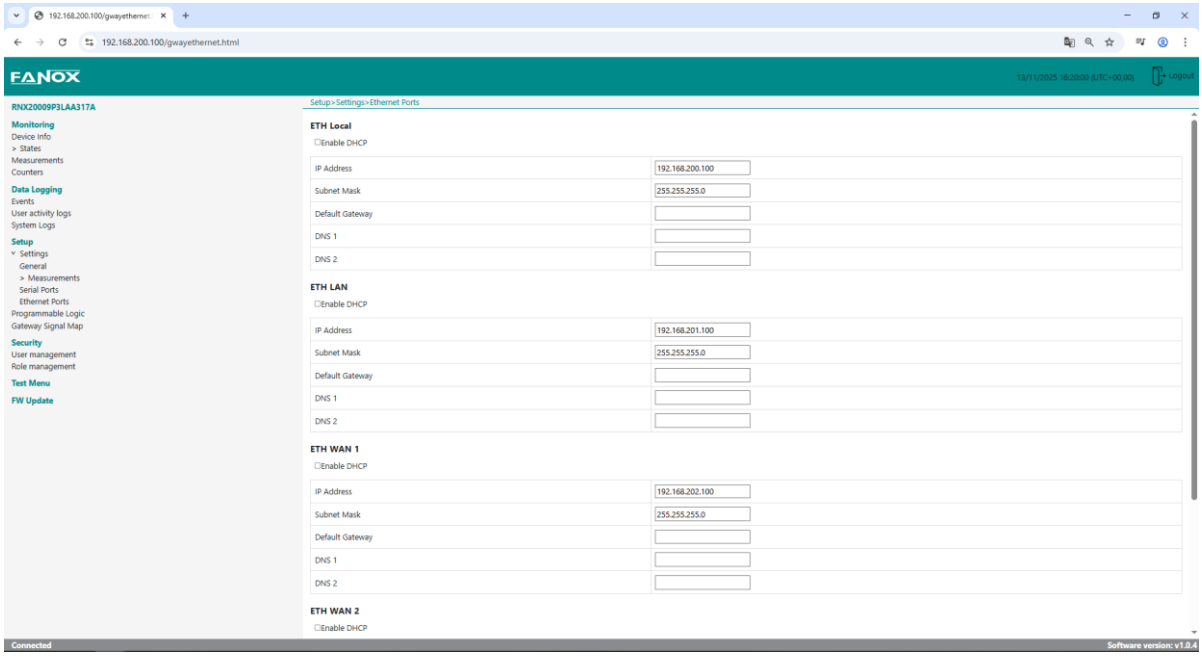


Figure 82: Ethernet Ports page 1_2

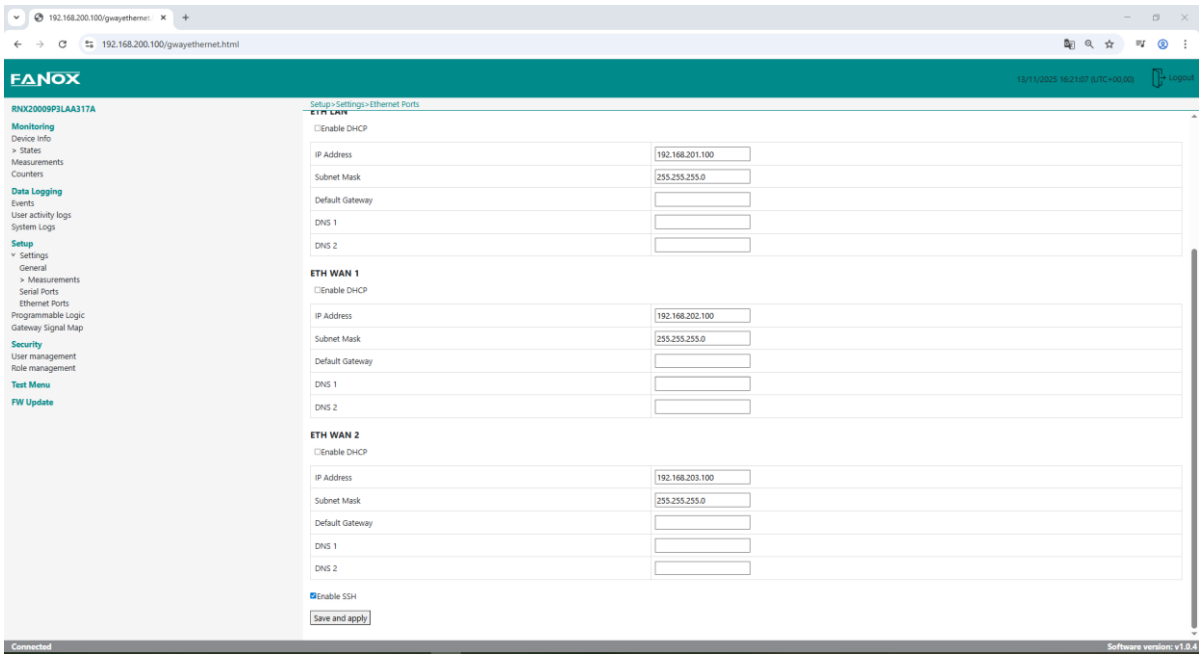


Figure 83: Ethernet Ports page 2_2

5.3.3.2. Programable Logic

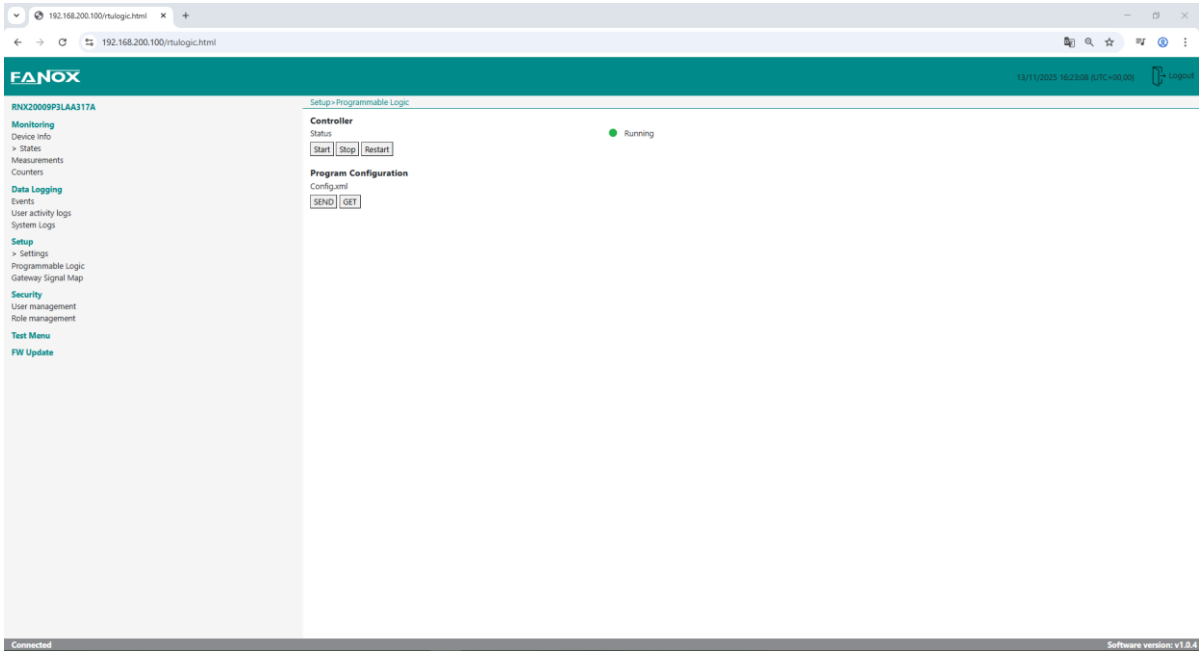


Figure 84: Programable Logic page

5.3.3.3. Gateway Signal Map

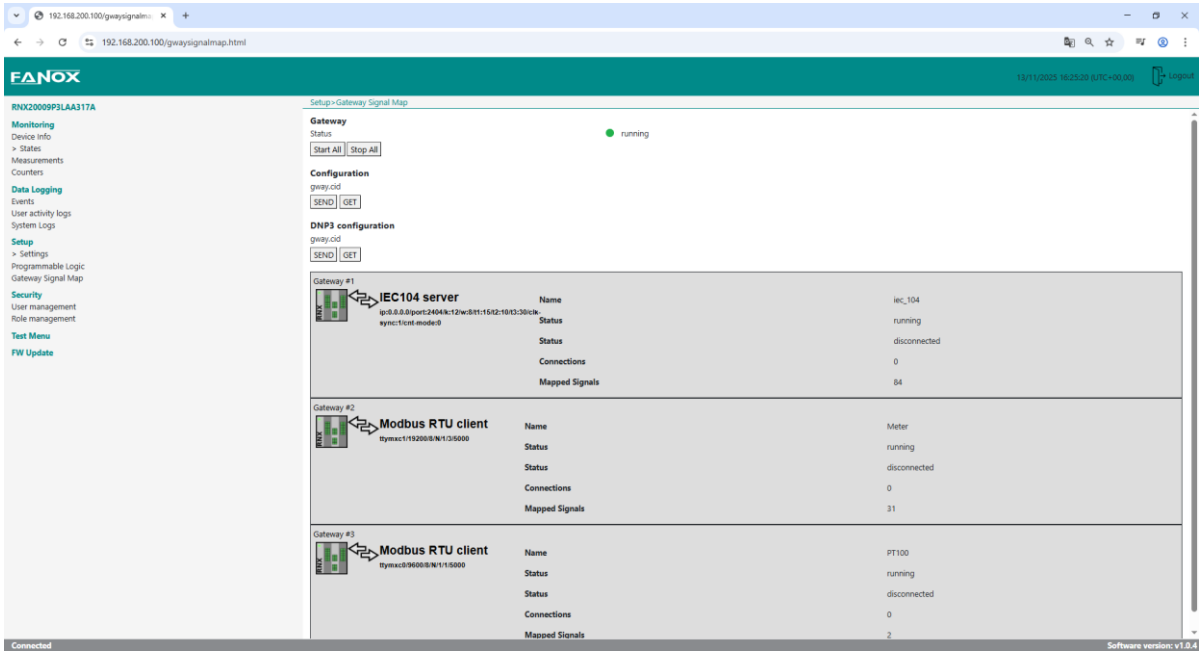


Figure 85: Gateway Signal Map page

5.3.4. Security

The security menu consists of the following submenus:

- **User Management:** It allows to configure the Users.
- **Role Management:** It allows to configure the Roles of the users.

5.3.4.1. User Management

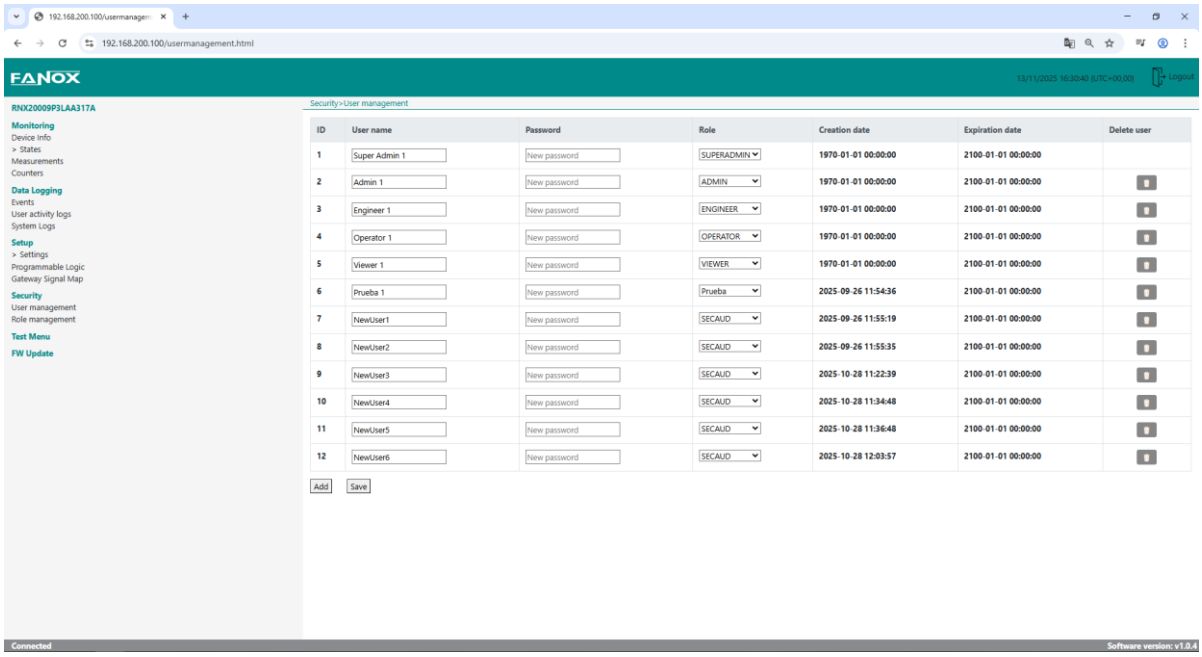


Figure 86: User Management page

5.3.4.2. Role Management

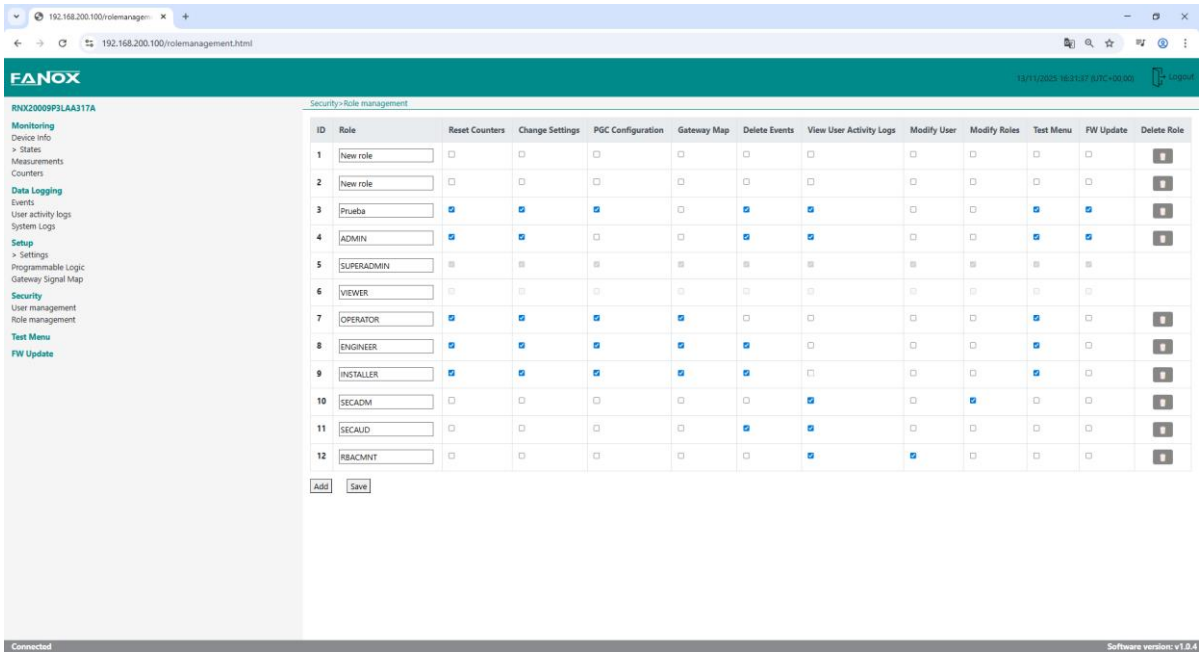


Figure 87: Role Management page

5.3.5. Test Menu

It allows simulation of all available RTU variables.

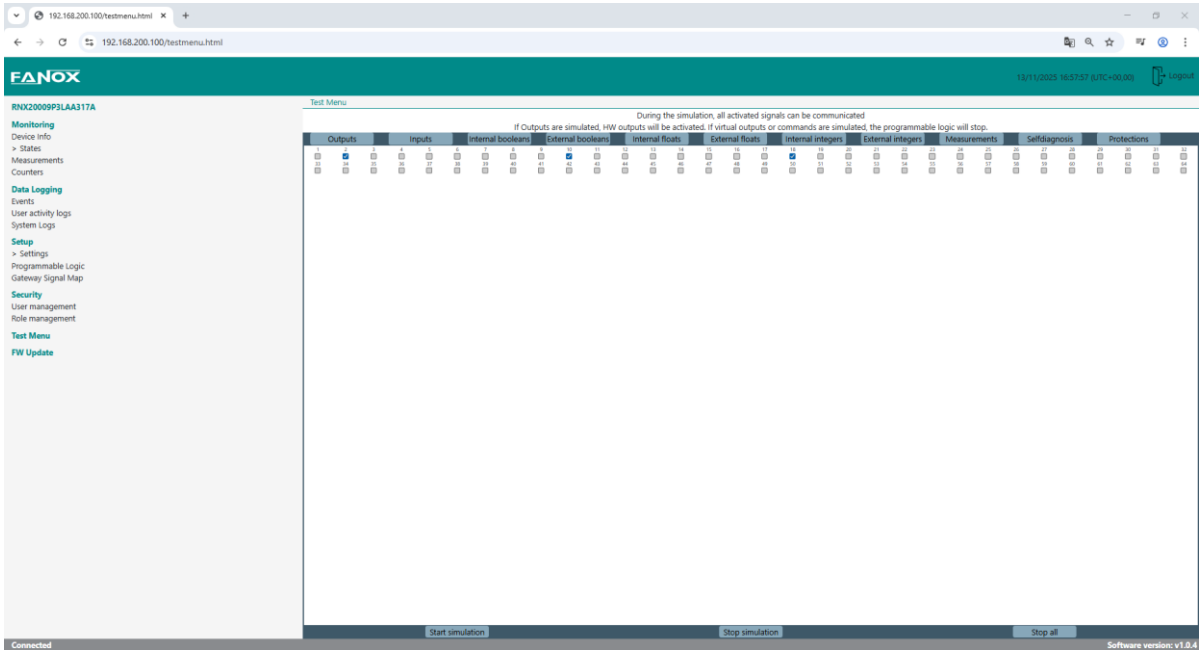


Figure 88: Test Menu page

5.3.6. Firmware Update

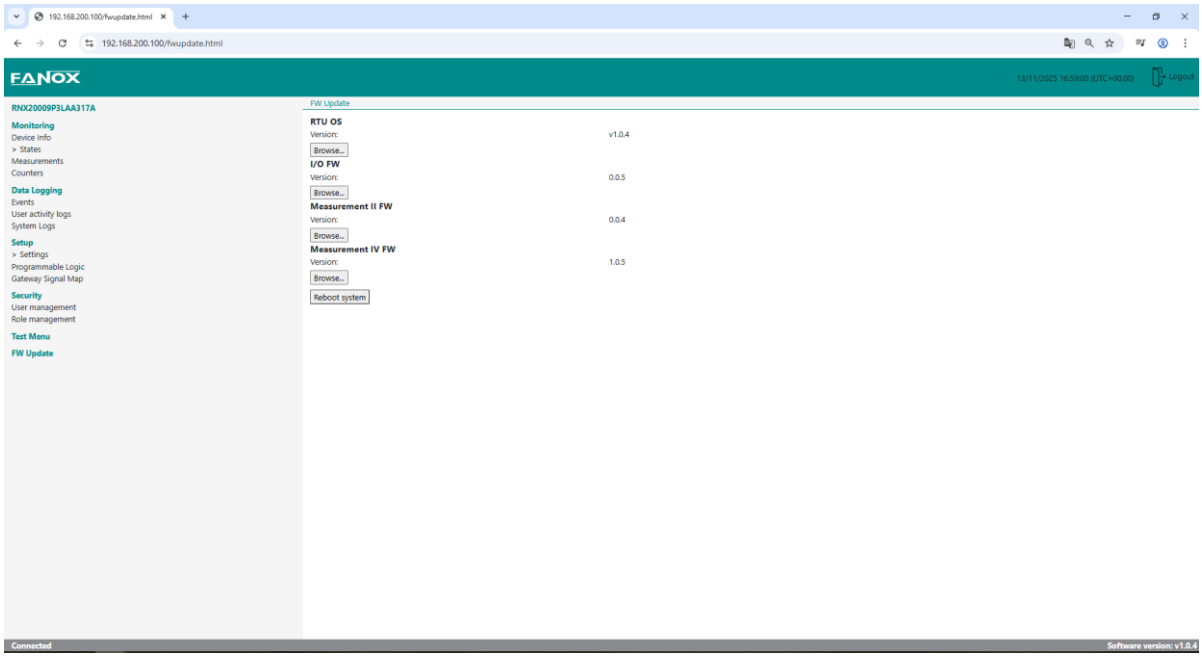


Figure 89: Firmware update page

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