

USER MANUAL

MULTIPROTOCOL “KEY” GATEWAYS SERIES

OPC-UA / MODBUS RTU&TCP GATEWAYS



SENECA S.r.l.

Via Austria 26 – 35127 – Z.I. - PADOVA (PD) - ITALY

Tel. +39.049.8705355 – 8705355 Fax +39 049.8706287

www.seneca.it

ORIGINAL INSTRUCTIONS

CAUTION

SENECA does not guarantee that all specifications and/or aspects of the product and firmware, included in them, will meet the requirements of the actual final application even if the product referred to in this documentation is in compliance with the technological state of the art.

The user assumes full responsibility and/or risk with regard to the configuration of the product to achieve the intended results in relation to the specific installation and/or end application.

SENECA may, with prior agreement, provide consultancy services for the successful completion of the final application, but under no circumstances can it be held responsible for its proper functioning.

The SENECA product is an advanced product, the operation of which is specified in the technical documentation supplied with the product itself and/or can be downloaded, if desired prior to purchase, from the www.seneca.it website.

SENECA has a policy of continuous development and accordingly reserves the right to make and/or introduce - without prior notice - changes and/or improvements to any product described in this documentation.

The product described in this documentation may solely and exclusively be used by personnel qualified for the specific activity and in accordance with the relevant technical documentation, with particular attention being paid to the safety instructions.

Qualified personnel means personnel who, on the basis of their training, competence and experience, are able to identify risks and avoid potential hazards that could occur during the use of this product.

SENECA products may only be used for the applications and in the manner described in the technical documentation relating to the products themselves.

To ensure proper operation and prevent the occurrence of malfunctions, the transport, storage, installation, assembly, maintenance of SENECA products must comply with the safety instructions and environmental conditions specified in this documentation.

SENECA's liability in relation to its products is governed by the general conditions of sale, which can be downloaded from www.seneca.it.

Neither SENECA nor its employees, within the limits of applicable law, will in any case be liable for any lost profits and/or sales, loss of data and/or information, higher costs incurred for goods and/or replacement services, damage to property and/or persons, interruption of activities and/or provision of services, any direct, indirect, incidental, pecuniary and non-pecuniary, consequential damages in any way caused and/or caused, due to negligence, carelessness, incompetence and/or other liabilities arising from the installation, use and/or inability to use the product.

CONTACT US

Technical support	supporto@seneca.it
Product information	commerciale@seneca.it

Document revisions

DATE	REVISION	NOTES	AUTHOR
02/10/2024	0	First revision	MM
24/10/2024	1	fix project name in title Added only 1 client supported Fix various -I instead of -U Fix parameter STOP MODBUS READING WHEN NO OPC-UA CONNECTION Added Modbus TCP-IP server info	MM
11/11/2024	2	Added max 50 TAG	MM
22/11/2024	3	New limits from firmware rev 107: max 100 TAG, 3 remote server modbus tcp-ip, 1 remote client modbus tcp-ip. New connection with User/Password authentication from fw rev 107	MM

This document is the property of SENECA srl.
Copies and reproduction are prohibited unless authorised.

TABLE OF CONTENTS

1. PRELIMINARY WARNINGS.....	6
1.1. DESCRIPTION.....	6
1.2. OPC- UA PROTOCOL.....	7
1.3. FEATURES OF THE “KEY” SERIES COMMUNICATION PORTS.....	8
2. DEVICE HARDWARE REVISION.....	8
3. FLEX TECHNOLOGY FOR PROTOCOL CHANGE.....	9
3.1. CHANGING PROTOCOLS WITH THE SENECA DISCOVERY DEVICE SOFTWARE	10
4. ETHERNET PORT	11
5. FIRMWARE UPDATE.....	11
6. OPERATING MODE	12
6.1. OPC-UA SERVER / MODBUS MASTER	12
6.2. OPC-UA SERVER / MODBUS MASTER / CLIENT MODBUS TCP-IP	13
7. GATEWAY CONFIGURATION.....	14
7.1. CONFIGURATION OF THE UAEXPERT™ CLIENT FOR BASIC CONNECTION .	14
8. GATEWAY WEBSERVERS	18
8.1. “-U” GATEWAY WEBSERVER	18
8.1.1. WEBSERVER MODE AND OPC-UA MODE	18
8.1.2. WEB/OPCUA WORKING STATUS.....	18
8.1.2.1. LED SD/COM	18
8.1.2.2. SENECA DISCOVERY DEVICE	18
8.1.3. CHANGE OF WEB/OPC-UA OPERATING MODE.....	19
8.1.3.1. MANUAL PROCEDURE FOR SWITCHING FROM OPC-UA MODE TO WEBSERVER MODE AND VICE VERSA ..	19
8.1.3.2. SENECA DISCOVERY DEVICE	19
8.1.3.3. WEB SERVER.....	20
8.1.4. STEP BY STEP GUIDE FOR THE FIRST ACCESS TO THE WEBSERVER	20
8.1.5. WEBSERVER DEVICE CONFIGURATION	21
8.1.5.1. WEBSERVER SECTIONS	22
8.1.5.2. “STATUS” SECTION	23
8.1.5.3. “SETUP” SECTION	24
8.1.5.4. “SETUP TAGS” SECTION”	29
8.1.5.1. “FIRMWARE UPDATE” SECTION.....	30
8.1.5.1. UTC TIME SETUP.....	30
8.1.5.1. “DATABASE UPDATE” SECTION	30
8.1.5.2. SERIAL “SERIAL TRAFFIC MONITOR”	30

9.	RESETTING THE DEVICE TO ITS FACTORY CONFIGURATION	31
10.	TEMPLATE EXCEL.....	32
11.	SUPPORTED MODBUS COMMUNICATION PROTOCOLS	33
11.1.	SUPPORTED MODBUS FUNCTION CODES.....	33
12.	SENECA DISCOVERY DEVICE.....	33
13.	INFORMATION ABOUT MODBUS REGISTERS	34
13.1.	NUMBERING OF "0-BASED" OR "1-BASED" MODBUS ADDRESSES	34
13.2.	NUMBERING OF MODBUS ADDRESSES WITH "0-BASED" CONVENTION	34
13.3.	NUMBERING OF MODBUS ADDRESSES WITH "1 BASED" CONVENTION (STANDARD)	35
13.4.	BIT CONVENTION WITHIN A MODBUS HOLDING REGISTER	36
13.5.	MSB and LSB BYTE CONVENTION WITHIN A MODBUS HOLDING REGISTER.....	36
13.6.	REPRESENTATION OF A 32-BIT VALUE IN TWO CONSECUTIVE MODBUS HOLDING REGISTERS	37
13.7.	TYPE OF 32-BIT FLOATING POINT DATA (IEEE 754)	37

1. PRELIMINARY WARNINGS

 **ATTENTION!**

This user manual extends the information from the installation manual to the configuration of the device. Use the installation manual for more information.

 **ATTENTION!**

In any case, SENECA s.r.l. or its suppliers will not be responsible for the loss of data/revenue or consequential or incidental damages due to negligence or bad/improper management of the device, even if SENECA is well aware of these possible damages.

SENECA, its subsidiaries, affiliates, group companies, suppliers and distributors do not guarantee that the functions fully meet the customer's expectations or that the device, firmware and software should have no errors or operate continuously.

1.1. DESCRIPTION

The Z-KEY-U, R-KEY-LT-U, Z-KEY-2ETH-U products allow to convert data coming from the Modbus serial bus or Modbus TCP-IP Ethernet into the OPC-UA server protocol.

1.2. OPC- UA PROTOCOL

OPC Unified Architecture (OPC UA) is a cross-platform, open source IEC62541 standard for exchanging data from sensors to cloud and SCADA applications developed by the OPC Foundation.

PROTOCOL	
Type of protocol	OPC- UA Protocol OPC-UA server (IEC 62541 server) TLS 1.2 connection, X.509 certificate management 1 remote supported Client OPC- UA Modbus protocols: Modbus TCP-IP Modbus RTU Modbus ASCII Max 3 remote Modbus TCP- IP servers Max 128 serial Modbus slave devices (for serial port) Max 1 remote supported Client Modbus TCP- IP
MEMORY	
Memory size of variables	Max 100 Tag

1.3. FEATURES OF THE “KEY” SERIES COMMUNICATION PORTS

PRODUCT	ETHERNET PORTS	SERIAL PORT # 1 RS232/RS485 CONFIGURABLE	RS485 SERIAL PORT # 2	ISOLATED SERIAL PORTS
Z-KEY-U	1	1	1	Yes, both ports
R-KEY-LT-U	1	1	NO	NO
Z-KEY-2ETH-U	2	1	1	Yes, both ports

2. DEVICE HARDWARE REVISION

With a view to continuous improvement, Seneca updates and makes the hardware of its devices increasingly more sophisticated. It is possible to know the hardware revision of a product via the label on the side of the device.

An example of an R-KEY-LT product label is the following:



The label also shows the firmware revision present in the device (in this case 2.0.1.0) at the time of sale, the hardware revision (in this case) is E00.

To improve performance or extend functionality, Seneca recommends updating the firmware to the latest available version (see the section dedicated to the product on www.seneca.it).

3. FLEX TECHNOLOGY FOR PROTOCOL CHANGE



Starting from the hardware revision indicated in the following table, the KEY series devices include Flex technology.

GATEWAY	FLEX TECHNOLOGY SUPPORTED BY HARDWARE REVISION
Z-KEY	"G00"
R-KEY-LT	"E00"
Z-KEY-2ETH	"C00"

Flex allows you to change the combination of industrial communication protocols supported by the gateways at will from a list of available ones, the development is continuously updated, for a complete list refer to the page: <https://www.seneca.it/flex/>

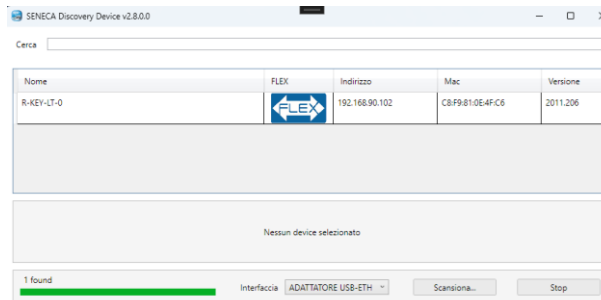
Some examples of supported protocols are:



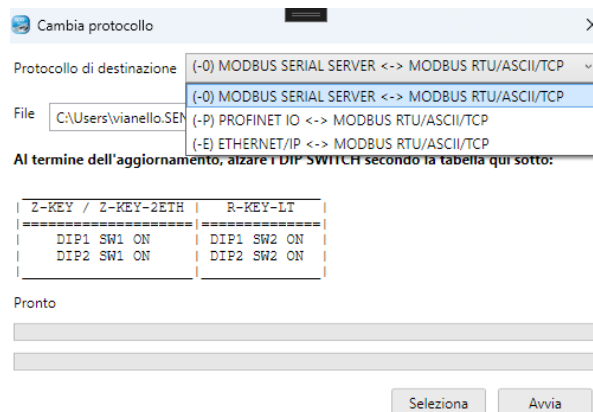
The gateway then becomes "universal" and compatible with Siemens or Rockwell or Schneider systems etc. without the need to purchase different hardware.

3.1. CHANGING PROTOCOLS WITH THE SENECA DISCOVERY DEVICE SOFTWARE

From revision 2.8 the Seneca Discovery Device software identifies the devices that support the “Flex” technology:



For example, in the case in the figure it is possible to press the “Change Protocol” button and select the destination protocol from those in the list:



At the end of the operation, bring (only at the first power-on) the dip switches 1 and 2 to “ON” to force the device to default (see also the chapter “RESETTING THE DEVICE TO ITS FACTORY CONFIGURATION”).

Always refer to the user manual of the communication protocol installed in the device by downloading it from the Seneca website.

4. ETHERNET PORT

The factory configuration of the Ethernet port is:

STATIC IP: 192.168.90.101

SUBNET MASK: 255.255.255.0

GATEWAY: 192.168.90.1

Multiple devices must not be inserted on the same network with the same static IP.

 **ATTENTION!**

***DO NOT CONNECT 2 OR MORE FACTORY-CONFIGURED DEVICES ON THE SAME NETWORK, OR THE
DEVICE WILL NOT WORK
(CONFLICT OF IP ADDRESSES 192.168.90.101)***

5. FIRMWARE UPDATE

In order to improve, add or optimize the functions of the product, Seneca releases firmware updates on the device section on the www.seneca.it website

The firmware update is performed using Seneca tools or the webserver.

 **ATTENTION!**

**NOT TO DAMAGE THE DEVICE DO NOT REMOVE THE POWER SUPPLY DURING THE FIRMWARE
UPDATE OPERATION.**

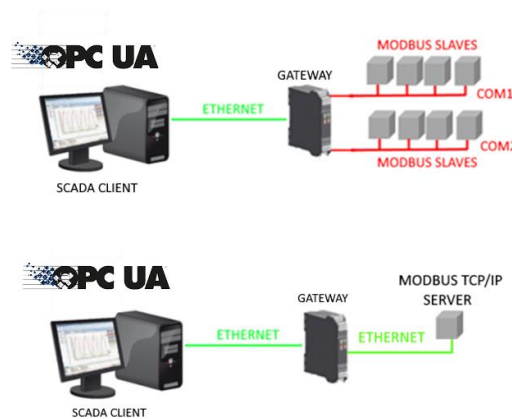
6. OPERATING MODE

The Gateway allows you to operate in the following mode:

OPC-UA SERVER / MODBUS SERIALE-ETHERNET MASTER/CLIENT

6.1. OPC-UA SERVER / MODBUS MASTER

This operating mode allows to connect an OPC-UA SCADA client with Modbus RTU/ASCII Slave and/or remote TCP Server I/O devices



The Gateway, on the field side, works as a Modbus master / Modbus Client device and on the other side as an IEC 61850 server via Ethernet.

The Modbus requests (read or write commands) are configured in the gateway device and an ICD file is automatically generated according to the SCL standard.

Once this file is imported into the SCADA (it is also possible to search for the node) all the configured IO will be accessible without any other configuration.

In addition to the serial devices, it is also possible to connect up to 3 remote Modbus TCP-IP servers.

6.2. OPC-UA SERVER / MODBUS MASTER / CLIENT MODBUS TCP-IP

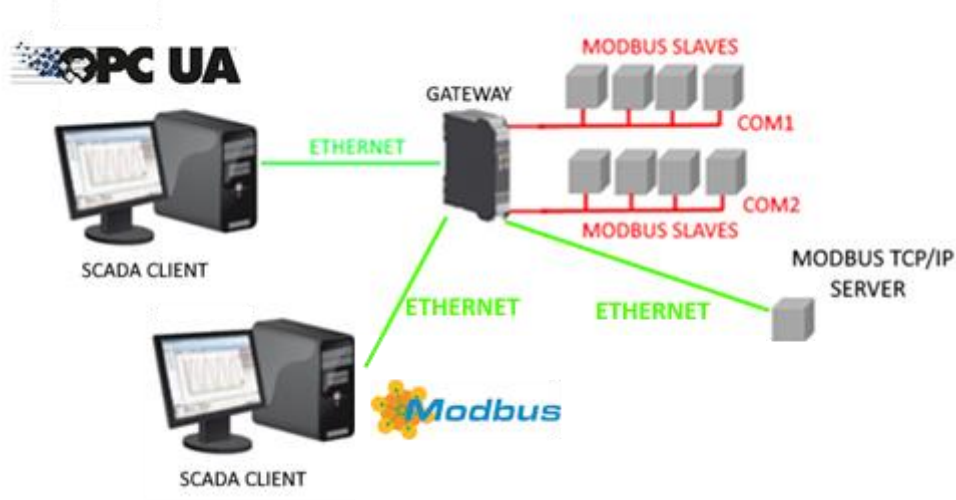
In addition to the OPC-UA server, the Gateway also provides a Modbus TCP-IP server with the support for 1 remote client.



ATTENTION!

IN ADDITION TO OPC-UA SERVER, THE DEVICE ALSO ACTIVATE A MODBUS TCP-IP SERVER

It is therefore possible to obtain connections of the type:



7. GATEWAY CONFIGURATION

7.1. CONFIGURATION OF THE UaEXPERT™ CLIENT FOR BASIC CONNECTION

To perform a test connection, use the UaExpert™ software.

UaExpert™ is a complete OPC UA client capable of supporting different OPC UA profiles and features.

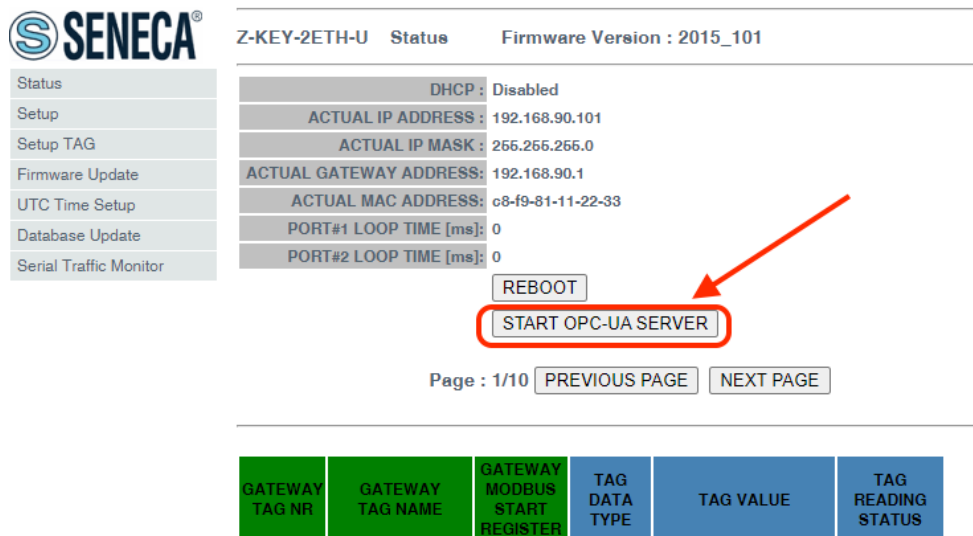
The free version can be downloaded from the link:

<https://www.unified-automation.com/downloads.html>

First, we bring the device into WEB mode (see the relevant chapter of this manual) and configure the OPC-UA server parameters in the device's web server (setup section):

OPC-UA SERVER PORT	4840	<input type="text" value="4840"/>
OPC-UA SERVER URI NAME	ZR-KEY	<input type="text" value="ZR-KEY"/>
OPC-UA SERVER SECURITY POLICY	NONE	<input type="text" value="NONE"/>
OPC-UA SERVER MESSAGE SECURITY MODE	NONE	<input type="text" value="NONE"/>

Now we need to activate the OPC-UA protocol in the gateway, from the “Status” web page:



SENECA Z-KEY-2ETH-U Status Firmware Version : 2015_101

Status	DHCP :	Disabled
Setup	ACTUAL IP ADDRESS :	192.168.90.101
Setup TAG	ACTUAL IP MASK :	255.255.255.0
Firmware Update	ACTUAL GATEWAY ADDRESS:	192.168.90.1
UTC Time Setup	ACTUAL MAC ADDRESS:	c8-f9-81-11-22-33
Database Update	PORT#1 LOOP TIME [ms]:	0
Serial Traffic Monitor	PORT#2 LOOP TIME [ms]:	0

REBOOT

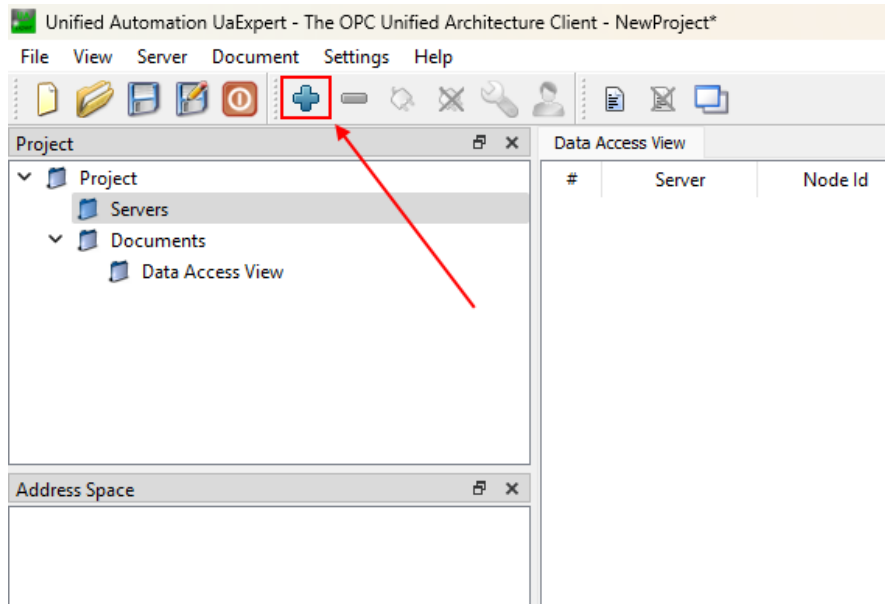
START OPC-UA SERVER

Page : 1/10 PREVIOUS PAGE NEXT PAGE

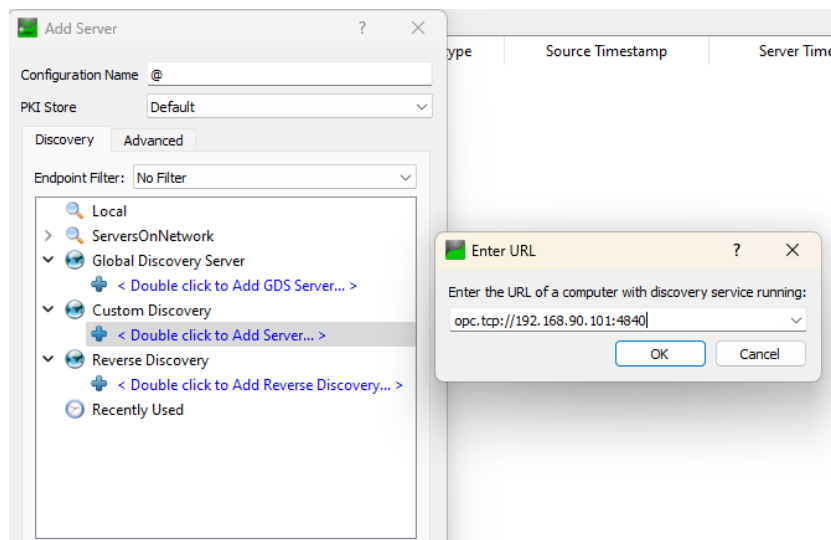
GATEWAY TAG NR	GATEWAY TAG NAME	GATEWAY MODBUS START REGISTER	TAG DATA TYPE	TAG VALUE	TAG READING STATUS
----------------	------------------	-------------------------------	---------------	-----------	--------------------

At this point, the web server is disabled and the OPC-UA server is enabled.

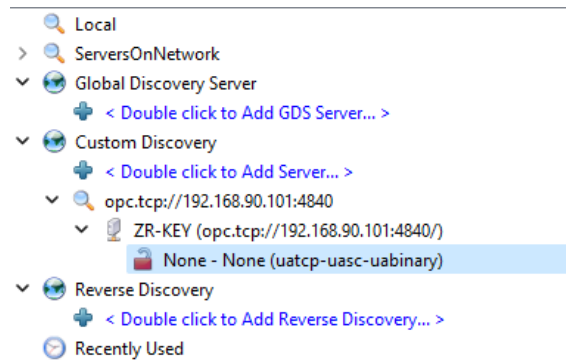
Now open the OPC-UA client and press the “+” icon to add an OPC-UA server:



At this point under "Custom directory" we enter the IP address of the Z-KEY-U device (192.168.90.101 in the example) and the configured port (4840 in the example):



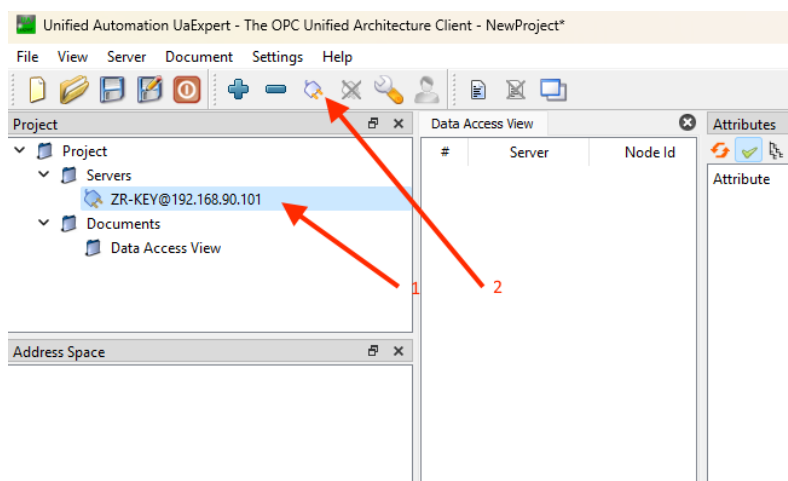
By pressing OK the server is added to the list, select the desired encryption (None in this example):



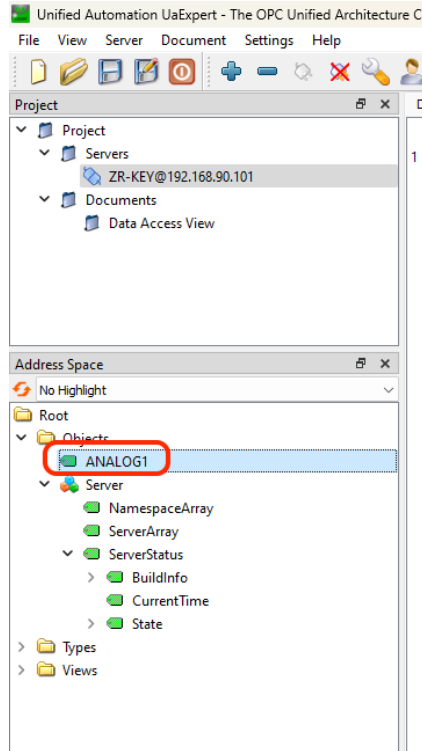
Press OK

Now the server is added.

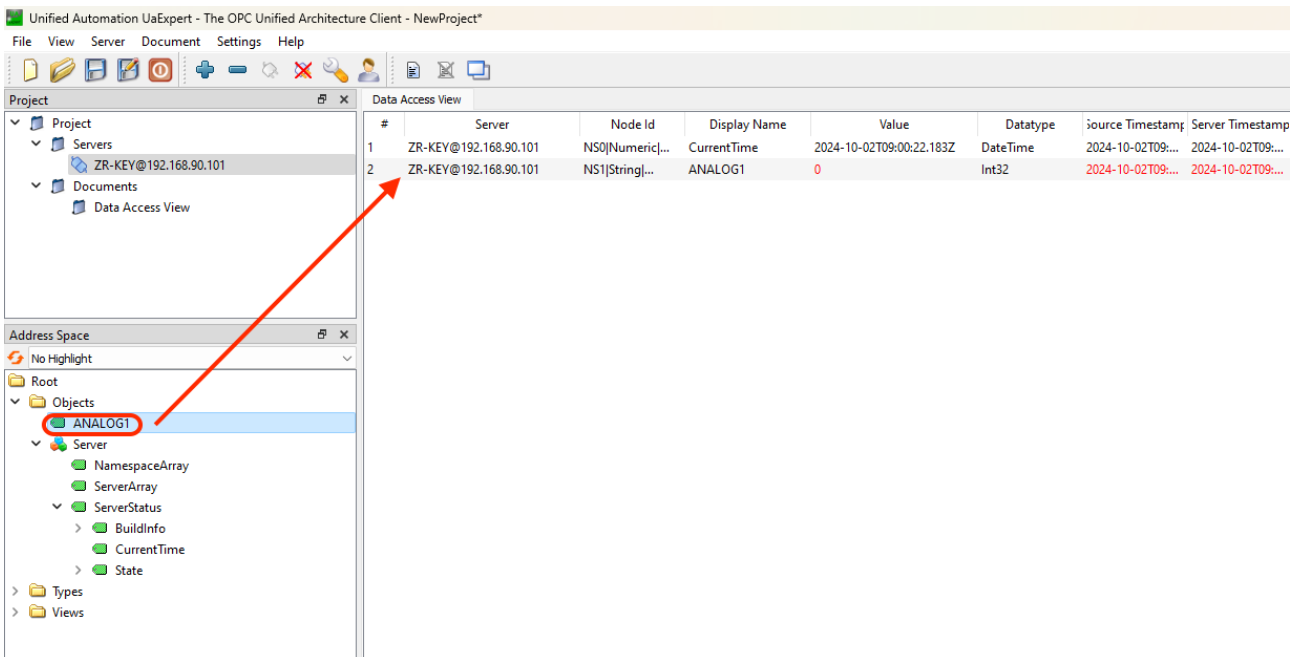
First select the server and then press the connection icon:



Now the connection is established and the configured list of variables appears:



Now you can drag the variables you want to view:



It is also possible to write to read/write variables.

8. GATEWAY WEBSERVERS

8.1. “-U” GATEWAY WEBSERVER

8.1.1. WEBSERVER MODE AND OPC-UA MODE

To access the internal webserver, you must put the device in Webserver mode.
To make the OPC-UA server work, you need to disable the webserver.

8.1.2. WEB/OPCUA WORKING STATUS

To know the current working state (OPC-UA or WEBSERVER):

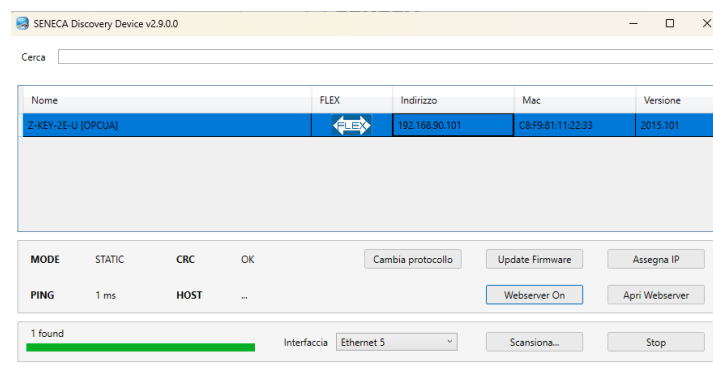
8.1.2.1. LED SD/COM

If the device is in Webserver mode the SD/COM LEDs flash slowly.

If the device is in OPC-UA server mode the SD/COM LEDs are on.

8.1.2.2. SENECA DISCOVERY DEVICE

The gateway status can be read also by the Seneca Discovery Device software:



8.1.3. CHANGE OF WEB/OPC-UA OPERATING MODE

8.1.3.1. MANUAL PROCEDURE FOR SWITCHING FROM OPC-UA MODE TO WEBSERVER MODE AND VICE VERSA

To force webserver mode:

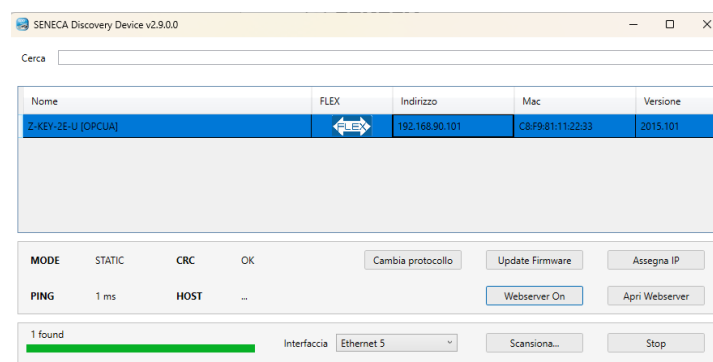
- 1) Turn on the device
- 2) Keep the PS1 button pressed until all LEDs turn off
- 3) Release the button
- 4) The device restarts and the LEDs
 On Z-KEY-U: PWR and SD/COM
 On Z-KEY-2ETH-U: PWR and COM
 On R-KEY-LT-U: PWR and COM
 flash slowly to show webserver mode

To force OPC-UA mode

- 1) Turn on the device
- 2) Keep the PS1 button pressed until all LEDs turn off
- 3) Release the button
- 4) The device restarts and the LEDs
 On Z-KEY-U: PWR and SD/COM
 On Z-KEY-2ETH-U: PWR and COM
 On R-KEY-LT-U: PWR and COM
 end flashing slowly to show OPC-UA mode.

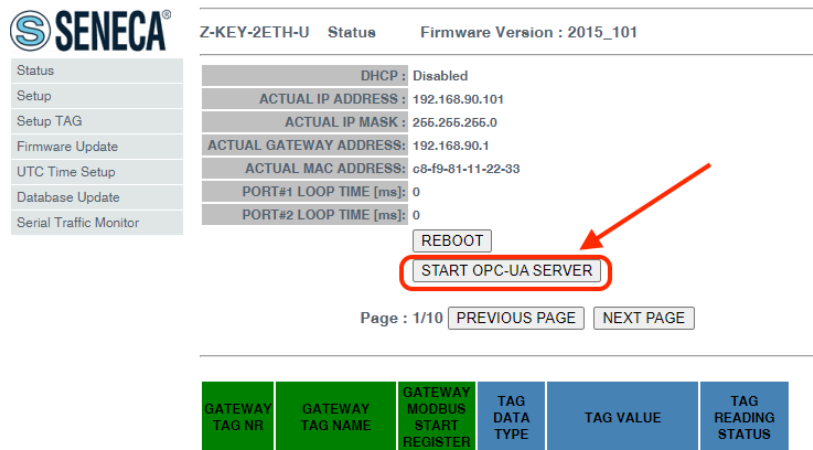
8.1.3.2. SENECA DISCOVERY DEVICE

It is possible to change the Webserver/OPC-UA mode from the Seneca Discovery Device software



8.1.3.3. WEB SERVER

You can switch from Webserver only to OPC-UA mode via the Status web page:



The screenshot shows the SENECA web interface for device Z-KEY-2ETH-U. The 'Status' page displays the following information:

- DHCP: Disabled
- ACTUAL IP ADDRESS: 192.168.90.101
- ACTUAL IP MASK: 255.255.255.0
- ACTUAL GATEWAY ADDRESS: 192.168.90.1
- ACTUAL MAC ADDRESS: c8-f9-81-11-22-33
- PORT#1 LOOP TIME [ms]: 0
- PORT#2 LOOP TIME [ms]: 0

Below the status information, there are two buttons: 'REBOOT' and 'START OPC-UA SERVER'. The 'START OPC-UA SERVER' button is highlighted with a red circle, and a red arrow points to it from the right. At the bottom of the page, there is a table header with the following columns:

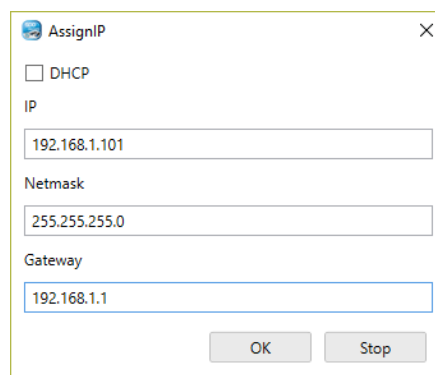
GATEWAY TAG NR	GATEWAY TAG NAME	GATEWAY MODBUS START REGISTER	TAG DATA TYPE	TAG VALUE	TAG READING STATUS
----------------	------------------	-------------------------------	---------------	-----------	--------------------

8.1.4. STEP BY STEP GUIDE FOR THE FIRST ACCESS TO THE WEBSERVER

STEP 1: POWER THE DEVICE AND CONNECT THE ETHERNET PORT, PUT THE DEVICE IN WEBSERVER MODE

SENECA DISCOVERY DEVICE SOFTWARE STEP 2

If you need to change the IP address of the device (default 192.168.90.101), launch the Seneca Discovery Device software and perform the SCAN, select the device and press the "Assign IP" button, set a configuration compatible with your PC, for example:



The 'AssignIP' dialog box contains the following fields and buttons:

- DHCP
- IP: 192.168.1.101
- Netmask: 255.255.255.0
- Gateway: 192.168.1.1
- Buttons: OK, Stop

Confirm with OK. Now the device can be reached via Ethernet from your PC.

STEP 3 ACCESS TO THE CONFIGURATION WEBSERVER

ENTER your access credentials:

user: admin

password: admin

 **ATTENTION!**

**THE WEB BROWSERS WHICH HAVE BEEN TESTED FOR COMPATIBILITY WITH THE DEVICE
WEBSERVER ARE:
MOZILLA FIREFOX AND GOOGLE CHROME.
THEREFORE, THE OPERATION WITH OTHER BROWSERS IS NOT GUARANTEED**

8.1.5. WEBSERVER DEVICE CONFIGURATION

For further information on the access to the webservice of a new device, please refer to chapter 8.1.4.

 **ATTENTION!**

**THE WEB BROWSERS WHICH HAVE BEEN TESTED FOR COMPATIBILITY WITH THE DEVICE
WEBSERVER ARE:
MOZILLA FIREFOX AND GOOGLE CHROME.
THEREFORE, THE OPERATION WITH OTHER BROWSERS IS NOT GUARANTEED**

 **ATTENTION!**

**AFTER THE FIRST ACCESS CHANGE USER NAME AND PASSWORD IN ORDER TO PREVENT
ACCESS TO THE DEVICE TO UNAUTHORIZED PEOPLE.**

 **ATTENTION!**

**IF THE PARAMETERS TO ACCESS THE WEBSERVER HAVE BEEN LOST, TO ACCESS IT, IT IS
NECESSARY TO GO THROUGH THE PROCEDURE TO RESET THE FACTORY-SET CONFIGURATION**

8.1.5.1. WEBSERVER SECTIONS

The Webserver is divided into pages (sections) representing the various gateway functions:

Status

It is the section that displays the values of Modbus requests in real time.

Setup

This is the section that allows the basic configuration of the device, it also allows you to export or import a configuration.

Setup Tag

It is the section that allows you to add/modify the Modbus device TAGs connected to the gateway.

Firmware Update

This is the section that allows you to update the device firmware.

UTC Time Setup

This allows you to set the device date/time

Database Update

This allows you to update the TAG list of Seneca devices

Serial Traffic Monitor

It allows to analyse the ModBUS frames of the serials.

8.1.5.2. "STATUS" SECTION

The Status section displays the status of the values acquired from modbus:

Z-KEY-2ETH-U Status Firmware Version : 2015_101

DHCP :	Disabled
ACTUAL IP ADDRESS :	192.168.00.101
ACTUAL IP MASK :	255.255.255.0
ACTUAL GATEWAY ADDRESS:	192.168.00.1
ACTUAL MAC ADDRESS:	c8-f0-81-11-22-33
PORT#1 LOOP TIME [ms]:	100
PORT#2 LOOP TIME [ms]:	0

REBOOT

START OPC-UA SERVER

Page : 1/10 PREVIOUS PAGE NEXT PAGE

GATEWAY TAG NR	GATEWAY TAG NAME	GATEWAY MODBUS START REGISTER	TAG DATA TYPE	TAG VALUE	TAG READING STATUS	
1	ANALOG1	40001	16BIT SIGNED	0	DELAYED	CHANGE

It is also possible to force tag writing with the "CHANGE" button.

The START OPC-UA SERVER button allows you to restart the device by activating the OPC-UA server instead of the web server (see the relevant chapter in this manual).

The REBOOT button restarts the device.

8.1.5.3. "SETUP" SECTION

At the top of the web page you can load a configuration or save one with the buttons "Load conf file" and "Save conf file".

A configuration includes the configured tags.

<input type="button" value="Scegli file"/>	Nessun file selezionato	<input type="button" value="Load conf file"/>
<input type="button" value="Save conf file"/>		

DHCP (ETH) (default: Disabled)

Sets the DHCP client to get an IP address automatically.

STATIC IP (default: 192.168.90.101)

Sets the device static address. Careful not to enter devices with the same IP address into the same network.

STATIC IP MASK (default: 255.255.255.0)

Sets the mask for the IP network.

STATIC GATEWAY (default: 192.168.90.1)

Sets the gateway address.

TCP-IP PORT (default: 502)

Sets the communication port for the Modbus TCP-IP client protocol.

TCP-IP TIMEOUT [ms] (default 512 ms)

Sets the waiting time for a request to be considered in timeout.

PORT #1 MODBUS PROTOCOL (default RTU)

Sets the protocol on the serial between Modbus RTU or Modbus ASCII

PORT #2 MODBUS PROTOCOL (default RTU)

Sets the protocol on the serial between Modbus RTU or Modbus ASCII

PORT #1 BAUDRATE (default: 38400 baud)

Selects the communication speed of the COM #1 serial port

PORT #1 DATA BITS (default: 38400 baud)

Selects the communication speed of the COM #1 serial port

PORT #1 PARITY (default: None)

Sets the parity for the COM #1 serial communication port.

PORT #1 STOP BIT (default: 1)

Sets the number of stop bits for the COM #1 serial communication port.

PORT #1 TIMEOUT [ms]

Sets the wait time before defining fail.

PORT #1 WRITING RETRIES (default: 3)

Selects the number of writing attempts to be made on a serial slave before returning an error.

PORT #1 MAX READ NUM

Sets the maximum number of simultaneous serial reading ModBUS registers, the firmware will use this value to optimize the ModBUS readings.

PORT #1 MAX WRITE NUM

Sets the maximum number of simultaneous writing ModBUS registers of the serial, the firmware will use this value to optimize the ModBUS writings.

PORT #2 BAUDRATE (default: 38400 baud) (only for Z-KEY-U and Z-KEY-2ETH-U)

Selects the communication speed of the COM #2 serial port

PORT #2 DATA BITS (default: 38400 baud) (only for Z-KEY-U and Z-KEY-2ETH-U)

Selects the communication speed of the COM #2 serial port

PORT #2 PARITY (default: None) (only for Z-KEY-U and Z-KEY-2ETH-U)

Sets the parity for the COM #2 serial communication port.

PORT #2 STOP BIT (default: 1) (only for Z-KEY-U and Z-KEY-2ETH-U)

Sets the number of stop bits for the COM #2 serial communication port.

PORT# 2 TIMEOUT [ms] (only for Z-KEY-U and Z-KEY-2ETH-U)

Sets the wait time before defining fail.

PORT #2 WRITING RETRIES (default: 3) (only for Z-KEY-U and Z-KEY-2ETH-U)

Selects the number of writing attempts to be made on a serial slave before returning an error.

PORT #2 MAX READ NUM (only for Z-KEY-U and Z-KEY-2ETH-U)

Sets the maximum number of simultaneous reading ModBUS registers of the remote TCP-IP Modbus server, the firmware will use this value to optimize the ModBUS readings.

PORT #2 MAX WRITE NUM (only for Z-KEY-U and Z-KEY-2ETH-U)

Sets the maximum number of simultaneous writing ModBUS registers of the serial, the firmware will use this value to optimize the ModBUS writings.

WEB SERVER PORT (default: 80)

Sets the communication port for the web server.

WEB SERVER AUTHENTICATION USER NAME (default: admin)

Sets the username to access the webserver.

WEB SERVER PASSWORD (default: admin)

Sets the password to access the webserver and to read/write the configuration (if enabled).

IP CHANGE FROM DISCOVERY (default: Enabled)

Selects whether or not the device accepts the IP address change from the Seneca Discovery Device software.

DIAGNOSTIC REGISTERS MAPPING

You can choose whether the diagnostic registers are placed on Holding registers or Input Registers.

DIAGNOSTIC REGISTERS START ADDRESS

It is the starting address of the diagnostic registers

PORT#1 TAGS QUARATINE [s]

Sets the number of quarantine seconds after a tag has been declared in fail (i.e. these tags are no longer considered) before being interrogated again.

PORT TAGS QUARATINE [s] (only for Z-KEY-U and Z-KEY-2ETH-U)

Sets the number of quarantine seconds after a tag has been declared in fail (i.e. these tags are no longer considered) before being interrogated again.

MODBUS TCP-IP CLIENT

Enables or not the TCP-IP client Modbus

MODBUS TCP-IP SERVER#1...10 PORT

Sets the port for the max 10 remote TCP-IP Modbus servers

MODBUS TCP-IP SERVER#1...10 ADDRESS

Sets the IP address for the max 10 remote TCP-IP Modbus servers

MODBUS TCP-IP CLIENT TIMEOUT [ms]

Sets the timeout for remote TCP-IP Modbus servers

MODBUS TCP-IP CLIENT DELAY BETWEEN POLLS [ms]

Sets the time between requests for remote Modbus TCP-IP servers

MODBUS TCP-IP CLIENT WRITING RETRIES

Selects the number of writing attempts to be made on a remote TCP-IP Modbus server before returning an error and activating the quarantine.

MODBUS TCP-IP CLIENT MAX READ NUM

Sets the maximum number of simultaneous reading ModBUS registers of the remote TCP-IP Modbus server, the firmware will use this value to optimize the ModBUS readings.

MODBUS TCP-IP CLIENT MAX WRITE NUM

Sets the maximum number of simultaneous writing ModBUS registers of the remote TCP-IP Modbus server, the firmware will use this value to optimize the ModBUS writings.

STOP MODBUS READING WHEN NO OPC-UA CONNECTION

If active, it allows to stop the modbus communication when the communication with the OPC-UA client is lost. This allows to trigger any timeouts present in the modbus slave/server devices.

SYNC CLOCK WITH INTERNET TIME

Allows you to enable date/time updating via connection to NTP servers (RFC 5905).

 **ATTENTION!**

AT EACH SWITCHING OFF THE DEVICE MUST BE ABLE TO RETRIEVE THE DATE/TIME FROM AN NTP SERVER OTHERWISE THIS WILL BE SET TO 1/1/1970 0:00

 **ATTENTION!**

PLEASE REMEMBER THAT NTP SERVERS USE THE UDP 123 PORT (WHICH MUST THEREFORE ALWAYS BE OPEN IN THE CONFIGURATION OF THE NETWORK USED)

NTP SERVER 1 ADDRESS

This is the IP address of the first NTP server (for example 193.204.114.232 for INRIM's NTP)

NTP SERVER 2 ADDRESS

This is the IP address of the second NTP server (in case the first one does not respond)

WATCHDOG

Enables or disables automatic device reboot with adjustable cycle time

WATCHDOG TIMEOUT [min]

Sets the device auto-reboot time

OPC-UA SERVER PORT

Sets the port for the OPC-UA server.

OPC-UA SERVER URI NAME

Sets the URI (Uniform Resource Identifier) of the OPC-UA server

OPC-UA SERVER SECURITY POLICY

Selects whether the connection should be secure (encrypted) or not. In this case, you can choose the crypto algorithm to use.

OPC-UA SERVER MESSAGE SECURITY MODE

OPC UA supports the selection of different security modes: "None", "Sign", "SignAndEncrypt". The "None" security mode can only be used with the None security profile.

The choice of "Sign" or "SignAndEncrypt" depends on the CSMS (Cyber Security Management System), in some applications where data confidentiality is not required, "Sign" may be sufficient.

OPC-UA AUTHENTICATION

Sets whether the connection is to be 'Anonymous' or with 'User/Password'

OPC-UA AUTHENTICATION. USER

If authentication is set to 'User/Password' this represents the user name

OPC-UA AUTHENTICATION. PASSWORD

If authentication is set to 'User/Password' this represents the password

8.1.5.4. "SETUP TAGS" SECTION

In this section you can add, modify or delete a modbus TAG, a TAG represents a variable that will then be displayed on the OPC-UA server. A TAG consists of one or more modbus registers depending on the type.

It is also possible to compose and import the list of TAGs from the Excel template available on the Seneca website on the device page.

Using the ADD button you can add a new TAG.

Using the MODIFY button it is possible to modify an existing TAG.

Using the DEL button it is possible to delete an existing TAG.

GATEWAY TAG NAME

This is the identifying name of the TAG as it will appear in the OPC-UA server.

GATEWAY MODBUS START REGISTER ADDRESS

This is the register in which to store the value of the TAG, it must be a progressive number.

TARGET MODBUS DEVICE

It represents the Seneca Modbus device selected from those available in the database.

In the case of a non-Seneca device or for advanced configurations, select CUSTOM.

TARGET RESOURCE

It represents the Seneca device variable you want to add.

TARGET CONNECTED TO

It selects the serial or server to be used to acquire the specified TAG.

TARGET MODBUS STATION ADDRESS

It selects the station address to use for the TAG.

TARGET MODBUS START REGISTER

It represents the starting Modbus address of the command (in the case of a Seneca device it is filled in automatically).

TARGET MODBUS REQUEST TYPE

It represents the type of Modbus command to use (Read Holding Register, Coil etc.).

In the case of a Seneca device it is filled in automatically.

TARGET REGISTER DATA TYPE

It selects the type of data associated with the TAG, you can choose between:

various types of data from 1 to 64 bit with or without sign.

8.1.5.1. "FIRMWARE UPDATE" SECTION

In order to improve, add, optimize the functions of the product, Seneca releases firmware updates on the device section on the www.seneca.it website

**ATTENTION!**

NOT TO DAMAGE THE DEVICE DO NOT REMOVE THE POWER SUPPLY DURING THE FIRMWARE UPDATE OPERATION.

8.1.5.1. UTC TIME SETUP

It allows you to manually set the date/time in CUT (Coordinated Universal Time) format.

**ATTENTION!**

IF AN NTP SERVER IS NOT SET, THE DEVICE WILL HAVE THE DATE/TIME 1/1/1970 0:00 WHEN IT RESTARTS

8.1.5.1. "DATABASE UPDATE" SECTION

This section allows you to send or delete a certificate and/or the private key of the device.

The used format is PEM.

It is also possible to update the database with Seneca device registers.

8.1.5.2. SERIAL "SERIAL TRAFFIC MONITOR"

Allows you to view the serial packets that are in transit.

9. RESETTING THE DEVICE TO ITS FACTORY CONFIGURATION

The factory configuration resets all parameters to default.

To reset the device to the factory configuration it is necessary to follow the procedure below:

Z-KEY-U/ Z-KEY-2ETH-U:

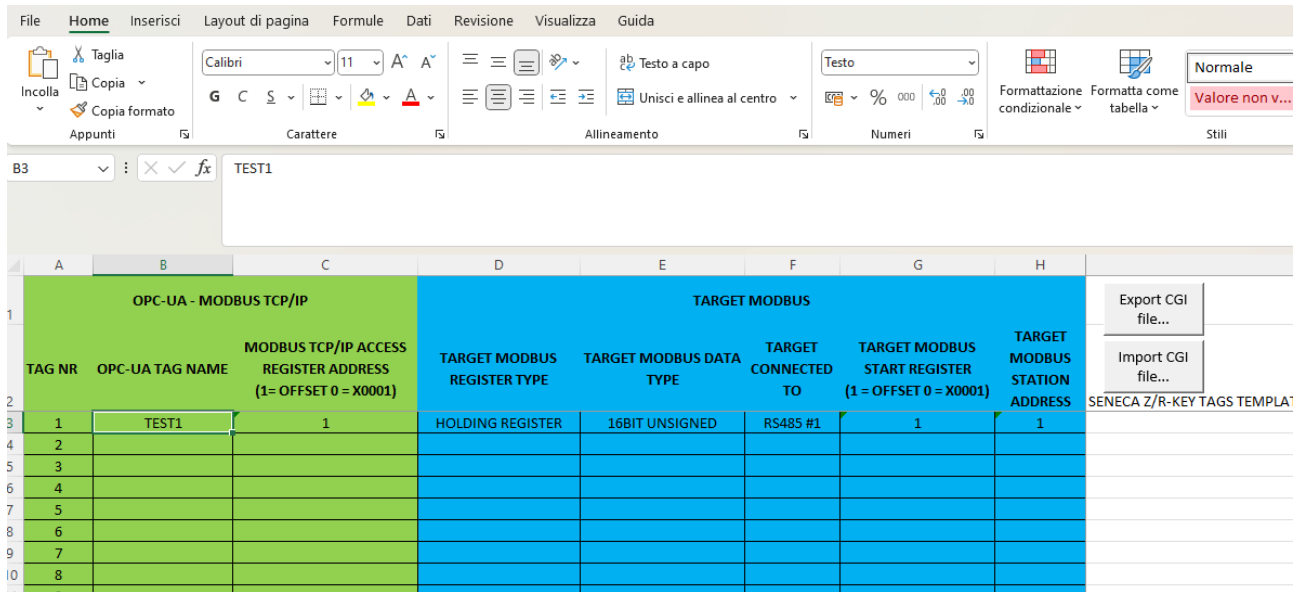
- 1) Remove power from the device
- 2) Turn dip switches 1 and 2 to ON
- 3) Power up the device and wait at least 10 seconds
- 4) Remove power from the device
- 5) Turn dip switches 1 and 2 to OFF
- 6) At the next restart the device will have loaded the factory configuration

R-KEY-LT-U:

- 1) Remove power from the device
- 2) Set dip switches 1 and 2 of SW2 to ON
- 3) Power up the device and wait at least 10 seconds
- 4) Remove power from the device
- 5) Turn 2 SW2 dip switches to OFF.
- 6) At the next restart the device will have loaded the factory configuration

10. TEMPLATE EXCEL

The preparation of the Tag configuration can be a frustrating operation if done with the webserver, so a software and a Microsoft Excel™ Template are available to create a .bin file to import into the gateway. The model can be freely downloaded from the Seneca website.



OPC-UA - MODBUS TCP/IP			TARGET MODBUS				
TAG NR	OPC-UA TAG NAME	MODBUS TCP/IP ACCESS REGISTER ADDRESS (1= OFFSET 0 = X0001)	TARGET MODBUS REGISTER TYPE	TARGET MODBUS DATA TYPE	TARGET CONNECTED TO	TARGET MODBUS START REGISTER (1 = OFFSET 0 = X0001)	TARGET MODBUS STATION ADDRESS
1	TEST1	1	HOLDING REGISTER	16BIT UNSIGNED	RS485 #1	1	1
2							
3							
4							
5							
6							
7							
8							

11. SUPPORTED MODBUS COMMUNICATION PROTOCOLS

The Modbus communication protocols supported are:

- Modbus RTU/ASCII master (from #1 and #2 serial ports)
- Modbus TCP-IP Client (from the Ethernet port) up to 10 remote TCP-IP Modbus Servers

For more information on these protocols, see the website:

<http://www.modbus.org/specs.php>.

11.1. SUPPORTED MODBUS FUNCTION CODES

The following Modbus functions are supported:

- Read Coils (function 1)
- Read Discrete Inputs (function 2)
- Read Holding Registers (function 3)
- Read Input Registers (function 4)
- Write Single Coil (function 5)
- Write Single Register (function 6)
- Write multiple Coils (function 15)
- Write Multiple Registers (function 16)

 **ATTENTION!**

All 32-bit variables are contained in 2 consecutive Modbus registers

All 64-bit variables are contained in 4 consecutive Modbus registers

12. SENECA DISCOVERY DEVICE

The Seneca Discovery Device Tool is available free of charge from the Seneca website.

With this software it is possible to search for Seneca devices via the Ethernet port and change the current IP configuration even if the PC has a different subnet.

13. INFORMATION ABOUT MODBUS REGISTERS


The following abbreviations are used in the following chapter:

MS	Most Significant
LS	Least Significant
MSBIT	Most Significant Bit
LSBIT	Least Significant Bit
MMSW	“Most” Most Significant Word (16bit)
MSW	Most Significant Word (16bit)
LSW	Least Significant Word (16bit)
LLSW	“Least” Least Significant Word (16bit)
RO	Read Only
RW*	Read-Write: REGISTERS CONTAINED IN FLASH MEMORY: WRITABLE ABOUT 10,000 TIMES MAXIMUM
RW**	Read-Write: REGISTERS THAT CAN BE WRITTEN ONLY AFTER WRITING THE COMMAND "ENABLE WRITE CUSTOM ENERGIES = 49616"
UNSIGNED 16 BIT	Unsigned integer register that can assume values from 0 to 65535
SIGNED 16 BIT	Signed integer register that can take values from -32768 to +32767
UNSIGNED 32 BIT	Unsigned integer register that can assume values from 0 to 4294967296
SIGNED 32 BIT	Signed integer register that can take values from -2147483648 to 2147483647
UNSIGNED 64 BIT	Unsigned integer register that can assume values from 0 to 18446744073709551615
SIGNED 64 BIT	Signed integer register that can assume values from -2 ⁶³ to 2 ⁶³ -1
FLOAT 32 BIT	32-bit, single-precision floating-point register (IEEE 754) https://en.wikipedia.org/wiki/IEEE_754
BIT	Boolean register, which can take the values 0 (false) or 1 (true)

13.1. NUMBERING OF "0-BASED" OR "1-BASED" MODBUS ADDRESSES

According to the Modbus standard the Holding Registers are addressable from 0 to 65535, there are 2 different conventions for numbering the addresses: "0-BASED" and "1-BASED".

For greater clarity, Seneca shows its register tables in both conventions.



ATTENTION!

**CAREFULLY READ THE DOCUMENTATION OF THE MODBUS MASTER DEVICE
IN ORDER TO UNDERSTAND WHICH OF THE TWO CONVENTIONS THE MANUFACTURER HAS
DECIDED TO USE**

SENECA USES THE "1 BASED" CONVENTION FOR ITS PRODUCTS

13.2. NUMBERING OF MODBUS ADDRESSES WITH "0-BASED" CONVENTION

The numbering is:

HOLDING REGISTER MODBUS ADDRESS (OFFSET)	MEANING
0	FIRST REGISTER
1	SECOND REGISTER
2	THIRD REGISTER
3	FOURTH REGISTER
4	FIFTH REGISTER

Therefore, the first register is at address 0.

In the following tables, this convention is indicated with **“ADDRESS OFFSET”**.

13.3. NUMBERING OF MODBUS ADDRESSES WITH "1 BASED" CONVENTION (STANDARD)

The numbering is that established by the Modbus consortium and is of the type:

HOLDING REGISTER MODBUS ADDRESS 4x	MEANING
40001	FIRST REGISTER
40002	SECOND REGISTER
40003	THIRD REGISTER
40004	FOURTH REGISTER
40005	FIFTH REGISTER

This convention is indicated with **“ADDRESS 4x”** since a 40000 is added to the address so that the first Modbus register is 40001.

A further convention is also possible where the number 4 is omitted in front of the register address:

HOLDING MODBUS ADDRESS WITHOUT 4x	MEANING
1	FIRST REGISTER
2	SECOND REGISTER
3	THIRD REGISTER
4	FOURTH REGISTER
5	FIFTH REGISTER

13.4. BIT CONVENTION WITHIN A MODBUS HOLDING REGISTER

A Modbus Holding Register consists of 16 bits with the following convention:

BIT 15	BIT 14	BIT 13	BIT 12	BIT 11	BIT 10	BIT 9	BIT 8	BIT 7	BIT 6	BIT 5	BIT 4	BIT 3	BIT 2	BIT 1	BIT 0
-----------	-----------	-----------	-----------	-----------	-----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------

For instance, if the value of the register in decimal is
12300

the value 12300 in hexadecimal is:

0x300C

the hexadecimal 0x300C in binary value is:

11 0000 0000 1100

So, using the above convention, we get:

BIT 15	BIT 14	BIT 13	BIT 12	BIT 11	BIT 10	BIT 9	BIT 8	BIT 7	BIT 6	BIT 5	BIT 4	BIT 3	BIT 2	BIT 1	BIT 0
0	0	1	1	0	0	0	0	0	0	0	0	1	1	0	0

13.5. MSB and LSB BYTE CONVENTION WITHIN A MODBUS HOLDING REGISTER

A Modbus Holding Register consists of 16 bits with the following convention:

BIT 15	BIT 14	BIT 13	BIT 12	BIT 11	BIT 10	BIT 9	BIT 8	BIT 7	BIT 6	BIT 5	BIT 4	BIT 3	BIT 2	BIT 1	BIT 0
-----------	-----------	-----------	-----------	-----------	-----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------

LSB Byte (Least Significant Byte) defines the 8 bits ranging from Bit 0 to Bit 7 included, we define MSB Byte (Most Significant Byte) the 8 bits ranging from Bit 8 to Bit 15 inclusive:

BIT 15	BIT 14	BIT 13	BIT 12	BIT 11	BIT 10	BIT 9	BIT 8	BIT 7	BIT 6	BIT 5	BIT 4	BIT 3	BIT 2	BIT 1	BIT 0
BYTE MSB								BYTE LSB							

13.6. REPRESENTATION OF A 32-BIT VALUE IN TWO CONSECUTIVE MODBUS HOLDING REGISTERS

The representation of a 32-bit value in the Modbus Holding Registers is made using 2 consecutive Holding Registers (a Holding Register is a 16-bit register). To obtain the 32-bit value it is therefore necessary to read two consecutive registers:

For example, if register 40064 contains the 16 most significant bits (MSW) while register 40065 contains the least significant 16 bits (LSW), the 32-bit value is obtained by composing the 2 registers:

BIT	BIT	BIT	BIT	BIT	BIT	BIT	BIT	BIT	BIT	BIT	BIT	BIT	BIT	BIT	BIT
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
40064 MOST SIGNIFICANT WORD															

BIT	BIT	BIT	BIT	BIT	BIT	BIT	BIT	BIT	BIT	BIT	BIT	BIT	BIT	BIT	BIT
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
40065 LEAST SIGNIFICANT WORD															

$$Value_{32bit} = Register_{LSW} + (Register_{MSW} * 65536)$$

In the reading registers it is possible to swap the most significant word with the least significant word, therefore it is possible to obtain 40064 as LSW and 40065 as MSW.

13.7. TYPE OF 32-BIT FLOATING POINT DATA (IEEE 754)

The IEEE 754 standard (https://en.wikipedia.org/wiki/IEEE_754) defines the format for representing floating point numbers.

As already mentioned, since it is a 32-bit data type, its representation occupies two 16-bit holding registers. To obtain a binary/hexadecimal conversion of a floating point value it is possible to refer to an online converter at this address:

<http://www.h-schmidt.net/FloatConverter/IEEE754.html>

IEEE 754 Converter (JavaScript), V0.22

	Sign	Exponent	Mantissa
Value:	+1	2^1	1.2699999809265137
Encoded as:	0	128	2264924
Binary:	<input type="checkbox"/>	<input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/>

You entered

Value actually stored in float: +1

Error due to conversion: -1

Binary Representation

Hexadecimal Representation

Using the last representation the value 2.54 is represented at 32 bits as:

0x4022 8F5C

Since we have 16-bit registers available, the value must be divided into MSW and LSW:

0x4022 (16418 decimal) are the 16 most significant bits (MSW) while 0x8F5C (36700 decimal) are the 16 least significant bits (LSW).