USER MANUAL

MULTIPROTOCOL “KEY-C” GATEWAYS SERIES

MODBUS TO CLOUD (MQTT/HTTP) 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
14/02/2025	0	First revision	MM
24/02/2025	1	Added chapter on the meaning of LEDs	MM

TABLE OF CONTENTS

1. DESCRIPTION

The Z-KEY-C, R-KEY-LT-C, Z-KEY-2ETH-C products allow you to acquire data from serial or ethernet buses based on Modbus protocols and send them to clouds with the MQTT(s) or http(s) protocols.
Writing from cloud to Modus is also supported.

1.1. MODBUS, MQTT, HTTP PROTOCOLS

The supported Modbus protocols are:
Modbus RTU Master
Modbus RTU Slave
Modbus ASCII Master
Modbus ASCII Slave
Modbus TCP-IP Server
Modbus TCP-IP Client
For further information on these protocols, see the Modbus specification website:
http://www.modbus.org/specs.php

The MQTT protocol supported is version 3.1.1

The HTTP protocol for tags publication on cloud is based on API Rest

The TLS protocol supported is version 1.2

Keys certifications according to X.509 standard

1.2. FEATURES OF THE "KEY" SERIES COMMUNICATION PORTS

PRODUCT	ETHERNET PORTS No.	SERIAL PORTS NO.	ISOLATED SERIAL PORTS
Z-KEY-C	1	2	Yes, both ports
R-KEY-LT-C	1	1	NO
Z-KEY-2ETH-C	2	2	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"

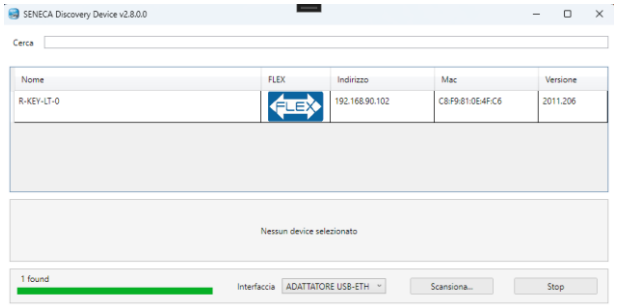
Flex allows you to change the combination of industrial communication protocols supported by the gateways at will from a list of available ones, the development is continuously updated, for a complete list refer to the page: https://www.seneca.it/flex/

Some examples of supported protocols are:

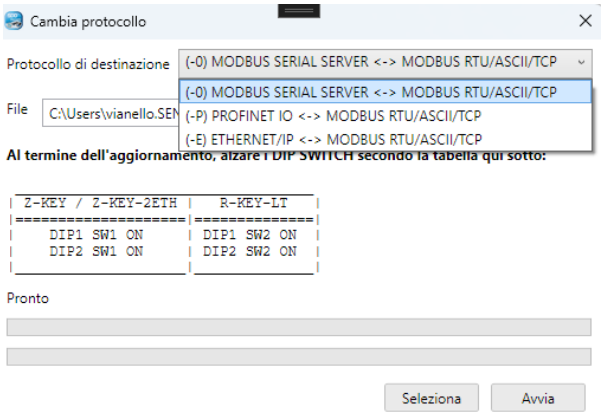
The gateway then becomes "universal" and compatible with Siemens or Rockwell or Schneider systems etc... without the need to purchase different hardware.

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. LED MEANING

The devices are equipped with LEDs whose meaning is as follows:

4.1. LED MODEL Z-KEY-C (CLOUD)

LED	***STATUS***
PWR	***Steady on***: device powered and IP address set ***Flashing***: IP address not yet set ***Off***: device not powered
COM	***Steady on***: No cloud connection error ***Flashing:*** Cloud connection error (for more details on the error, refer to the webserver status page) ***Off***: device not powered
TX1	***Flashing:*** data transmission on serial port #1 ***Off:*** no transmission on serial port #1
RX1	***Flashing:*** data reception on serial port #1 ***Steady on:*** check wiring on serial port #1 ***Off:*** no reception on serial port #1
TX2	***Flashing:*** data transmission on serial port #2 ***Off:*** no transmission on serial port #2
RX2	***Flashing:*** data reception on serial port #2 ***Steady on:*** check wiring on serial port #2 ***Off:*** no reception on serial port #2
ETH ACT (GREEN)	***Flashing:*** presence of data on ethernet port ***Steady on:*** ethernet port connected but no data present ***Off:*** check wiring of the ethernet port

ETH LNK (YELLOW)	***Steady on:*** ethernet cable connected ***Off:*** check the wiring of the ethernet port

LED MODEL R-KEY-LT-C (CLOUD)

LED	***STATUS***
PWR	***Steady on***: device powered and IP address set ***Flashing***: IP address not yet set ***Off***: device not powered
COM	***Steady on***: No cloud connection error ***Flashing:*** Cloud connection error (for more details on the error, refer to the webserver status page) ***Off***: device not powered
TX	***Flashing:*** data transmission on serial port ***Off:*** no transmission on serial port
RX	***Flashing:*** data reception on serial port ***Steady on:*** check wiring on serial port ***Off:*** no reception on serial port
ETH ACT (GREEN)	***Flashing:*** presence of data on ethernet port ***Steady on:*** ethernet port connected but no data present ***Off:*** check wiring of the ethernet port
ETH LNK (YELLOW)	***Steady on:*** ethernet cable connected ***Off:*** check the wiring of the ethernet port

LED MODEL Z-KEY-2ETH-C (CLOUD)

LED	***STATUS***
PWR	***Steady on***: device powered and IP address set ***Flashing***: IP address not yet set ***Off***: device not powered
COM	***Steady on***: No cloud connection error ***Flashing:*** Cloud connection error (for more details on the error, refer to the webserver status page) ***Off***: device not powered
TX1	***Flashing:*** data transmission on serial port #1 ***Off:*** no transmission on serial port #1
RX1	***Flashing:*** data reception on serial port #1 ***Steady on:*** check wiring on serial port #1 ***Off:*** no reception on serial port #1
TX2	***Flashing:*** data transmission on serial port #2 ***Off:*** no transmission on serial port #2
RX2	***Flashing:*** data reception on serial port #2 ***Steady on:*** check wiring on serial port #2 ***Off:*** no reception on serial port #2
ET1	***Flashing:*** presence of data on ethernet port #1 ***Steady on:*** ethernet port #1 connected but no data present ***Off:*** check wiring of ethernet port #1
ET2	***Flashing:*** presence of data on ethernet port #2 ***Steady on:*** ethernet port #2 connected but no data present ***Off:*** check wiring of ethernet port #2

5. 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)

6. 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.

7. OPERATING MODE

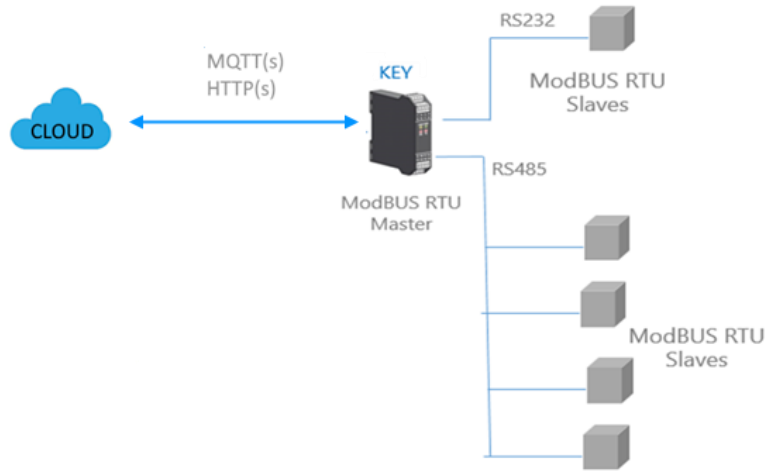
The Gateway operates in the following mode:

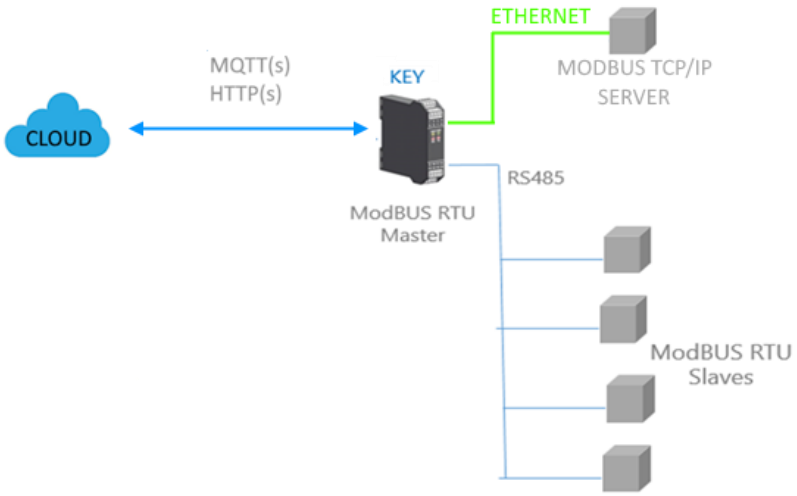
MODBUS SERIAL-ETHERNET MASTER/CLIENT TO CLOUD

7.1. MODBUS MASTER / CLIENT TO CLOUD

This operating mode allows you to load data from Modbus RTU/ASCII Slave and/or remote TCP Server I/Os to a cloud (and vice versa).

Below are some examples of possible connections:





The Gateway, on the field side, works as a Modbus master / Modbus Client device and on the other side as a client to the MQTT broker or HTTP server via Ethernet.
Modbus requests (read or write commands) are configured in the gateway device.

In addition to the serial devices, it is also possible to connect up to 3 remote Modbus TCP-IP servers.
It is also possible to write Modbus registers from the cloud.
The Gateway simultaneously always activates a Modbus TCP-IP server.

7.2. SIMPLIFIED TAG DIAGNOSTICS

Tag diagnostics is only available in Modbus TAGs Gateway mode.
Tag diagnostics can also be viewed via the Modbus serial and Ethernet ports: via special Modbus registers.
The first Modbus address, from which the simplified diagnostics starts, is by default 49001 (Holding Register 9000).
Each bit represents a tag with the following meaning:
1 = TAG OK
0 = TAG FAIL
The least significant bit is the status of tag no. 1
The next is the status of tag no. 2 and so on ...
For example the reading of the following registers:
49001 0 0 0 0 0 0 0 0 0 0 0 1 0 0 1
49002 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1
Means: TAG 1, TAG 4, TAG17, TAG 18 , TAG 19, TAG 20 OK, all the others in FAIL.
At the start, all tags are in a fail state (all 0).

7.3. EXTENDED TAG DIAGNOSTICS

Tag diagnostics is only available in Modbus TAGs Gateway mode.
When a tag is in an error state it is possible to get more information using extended diagnostics.
Extended diagnostics reserves 1 byte for each tag (since the limit is 500 tags, there are 500 bytes = 250 Modbus registers for extended diagnostics).
This diagnostics is found at the end of the simplified diagnostics (default starting Modbus address is 49033, Holding register 32).

Each Modbus register contains 2 tags, so for example:
49033 TAG02_TAG01
49034 TAG04_TAG03
…
49282 TAG500_TAG499
49283 LAST_LOOP_TIME_COM1 [x1 ms]
49284 LAST_LOOP_TIME_COM2 [x1 ms]

The meaning of the advanced diagnostics byte is:

BYTE VALUE	*MEANING*	*NOTE*
0	OK	The tag is read/written correctly
1	TIMEOUT	The response of the tag timed out, but will be queried again
2	DELAYED	Too many fails, tag polling is delayed (tag will be interrogated again after the configured quarantine time)
3	EXCEPTION	Modbus exception response but the tag will be queried again
4	CRC ERROR	CRC Modbus exception response but the tag will be queried again

For example:

49033 0x0000
49034 0x0002

It means that:

TAGs 1 and 2 are OK (0x00 and 0x00)
TAG 03 is in a delayed state (0x02)
TAG 4 is OK (0x00)

LAST_LOOP_TIME_COMx is a register that contains the last interrogation time of all serial tags (in how many of 10 ms) so, for example:

49283 25
49284 42

It means that the serial 1 loop was 250ms, the serial 2 loop was 420ms.

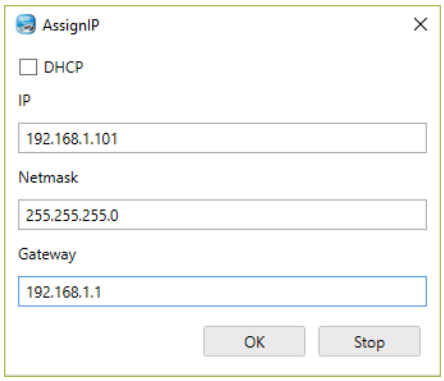
8. "-C" GATEWAY WEBSERVERS

8.1. 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:



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

9. WEBSERVER DEVICE CONFIGURATION

⚠ 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

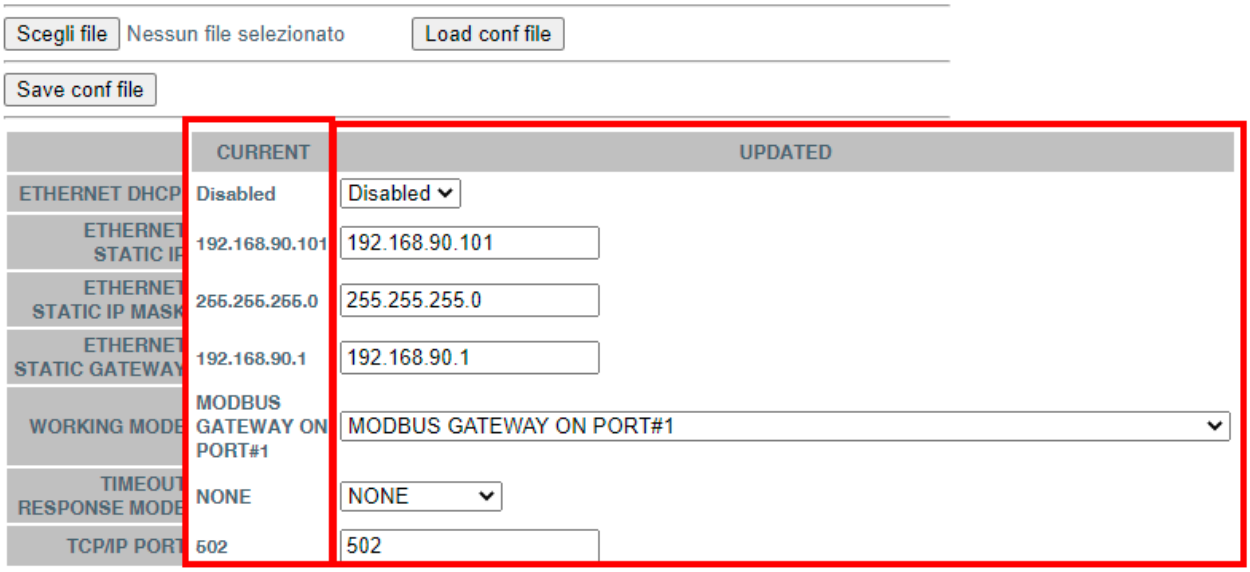
⚠ ATTENTION!

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

9.1. SETUP PAGE



The first column represents the name of the parameter, the second column "current" is the current value of the parameter. The last column "updated" is used to modify the current configuration.

When a configuration has been entered it is necessary to confirm it with the "APPLY" button, at this point the new configuration is operational.
If you want to restore the default parameters, click on the "FACTORY DEFAULT" button.

9.1.1. GENERAL CONFIGURATION PARAMETERS

The general configuration parameters are explained below:

DHCP
Disabled: A static Network Configuration is set up
Enabled: The IP address, IP mask and gateway address are obtained from the DHCP server.
The gateway address can be found by the Seneca Discovery Device software.

ETHERNET STATIC IP
Static IP address when the DHCP is disabled

ETHERNET STATIC IP MASK
Mask when the DHCP is disabled

ETHERNET STATIC GATEWAY
Gateway address when the DHCP is disabled

TCP/IP PORT
TCP-IP port for Modbus TCP-IP Server protocol (Up to a maximum of 8 clients can be connected to the gateway)

PORT#n MODBUS PROTOCOL
Select the Modbus RTU or Modbus ASCII serial protocol

PORT#n BAUDRATE
Select the baudrate of the serial port

PORT#n BIT
Select the number of bits for the serial communication.

PORT#n PARITY
Select the type of parity of the serial port (None, Even or Odd)

PORT#n STOP BITS
Set the number of stop bits of the port (1 or 2), note that if parity is set, only 1 stop bit can be used.

PORT#n TIMEOUT [ms]

Set the waiting time for a response from the Modbus slave serial device, after this time without any response there will be a TIMEOUT.

PORT#n DELAY BETWEEN POLLS [ms]
Set the pause between two successive serial Modbus master requests.

PORT#n WRITING RETRIES (Only for Gateway Tags Modbus mode)
Set the number of attempts to write to the TAG(s) before setting the FAIL status.

PORT#n MAX READ NUM (Only for Gateway Tags Modbus mode)
Set the maximum number of registers that can be read with the multiple reading functions (the gateway will optimize readings with this maximum number of registers). It must be adjusted according to the maximum number of registers that can be read at the same time by the slave device.

PORT#1 MAX WRITE NUM (Only for Gateway Tags Modbus mode)
Set the maximum number of registers that can be written with the multiple writing functions (the gateway will optimize writings with this maximum number of registers).

WEB SERVER PORT
Set the TCP-IP port for the Webserver.

WEB SERVER AUTHENTICATION USERNAME
Set the username for accessing the Webserver (if the user name and password are left blank, no authentication is required to access the Webserver)

WEB SERVER AUTHENTICATION PASSWORD
Set the password for accessing the Webserver (if the username and password are left blank, no authentication is required to access the Webserver)

⚠ ATTENTION!
CHANGE THE DEFAULT USERNAME AND PASSWORD IN THE WEBSERVER TO RESTRICT ACCESS.

⚠ ATTENTION!

IF THE TWO PARAMETER TEXT BOXES ARE LEFT EMPTY, THE AUTHENTICATION FOR ACCESS IS REMOVED.

WEBSERVER HTTPS
It forces the webserver to use the https secure protocol instead of http one
ETHERNET IP CHANGE FROM DISCOVERY
Set whether a user is authorized to change the IP configuration from the "Seneca Discovery Device" software.

DIAGNOSTIC REGISTERS MAPPING

Set the type of register that will contain simplified and advanced diagnostics. It is possible to select between holding registers or input registers.

DIAGNOSTIC REGISTER START ADDRESS

Set the starting address for the diagnostic registers (default offset 9000 -> 49001 in case of holding registers or 39001 in case of input registers)

PORT #n TAGS QUARANTINE [s]

When a TAG is in FAIL it is placed in quarantine and is no longer interrogated for the set time.

MODBUS TCP-IP CLIENT

Enable or not the Modbus TCP-IP clients, the gateway can connect to a maximum of 3 Modbus TCP-IP servers.

TCP-IP PORT SERVER #n (Only if Modbus TCP-IP client is active)

Used to set the TCP-IP server port #n

TCP-IP ADDRESS SERVER #n (Only if Modbus TCP-IP client is active)

Used to set the IP address of the #n server

MODBUS TCP-IP CLIENT TIMEOUT [ms] (Only if Modbus TCP-IP client is active)

Used to set the connection time out for Modbus TCP-IP clients.

MODBUS TCP-IP CLIENT DELAY BETWEEN POLLS [ms] (Only if Modbus TCP-IP client is active)

Set the pause between two successive Modbus TCP-IP client requests.

MODBUS TCP-IP CLIENT WRITING RETRIES (Only if Modbus TCP-IP client is active)

Set the number of attempts to write to the TAG(s) before setting the FAIL status.

MODBUS TCP-IP CLIENT MAX READ NUM (Only if Modbus TCP-IP client is active)

Set the maximum number of registers that can be read with the multiple reading functions (the gateway will optimize readings with this maximum number of registers).

MODBUS TCP-IP CLIENT MAX WRITE NUM (Only if Modbus TCP-IP client is active)

Set the maximum number of registers that can be written with the multiple writing functions (the gateway will optimize writings with this maximum number of registers).

WATCHDOG ENABLE

Enable or disable the time restart of gateway.

WATCHDOG TIMEOUT [hours]

Sets the time in hours after which the gateway will reboot (only if the WATCHDOG ENABLE parameter is enabled).

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

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)

⚠ ATTENTION!

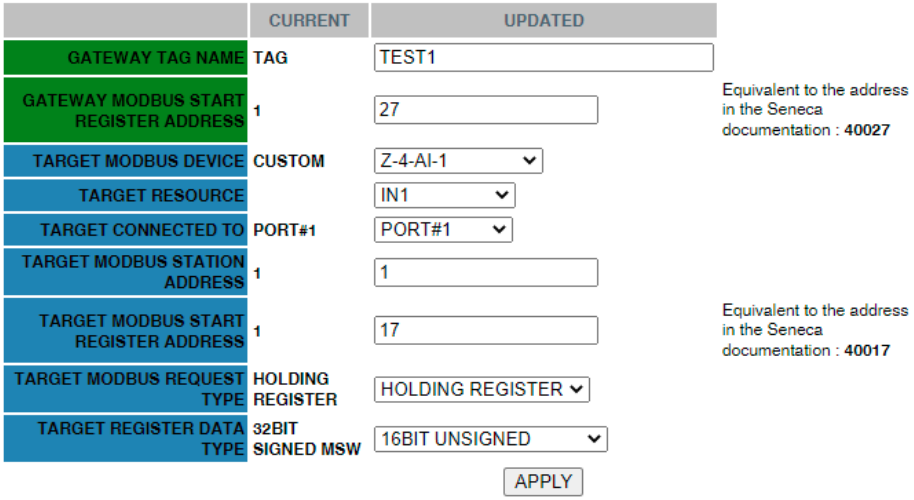
PLEASE REMEMBER THAT NTP SERVERS USE THE UDP 123 PORT (WHICH MUST THEREFORE ALWAYS BE OPEN IN THE CONFIGURATION OF THE NETWORK USED)

9.2. SETUP TAG PAGE

In Modbus Tags Gateway mode it is necessary to define the Modbus tags (i.e. variables), to do this it is possible to use:

- *The webserver*
- *An excel template*

In the case of complex configurations it is easier to use the last two.
In this chapter we will explain the configuration of the tag from the webserver.
To edit the TAGs via webserver, access the "Setup tag" section of the navigation menu:



GATEWAY TAG NAME

Set the mnemonic name of the tag (it will be displayed in the live view)

GATEWAY MODBUS START REGISTER ADDRESS

Set the address of the Gateway memory location where the TAG is saved, these registers are accessible both from Modbus serial and Modbus TCP-IP.

TARGET MODBUS DEVICE

Select the Modbus RTU slave model from the Seneca device database or select "custom" if you are not using a Seneca Modbus RTU slave.

TARGET RESOURCE

If you are using a Seneca Modbus RTU Slave select the resource name from the Seneca database.

TARGET CONNECTED TO PORT#

Select which serial port of the gateway the Modbus RTU slave device is connected to.
(in the case of R-KEY-LT only the COM 1 port is available).

TARGET MODBUS STATION ADDRESS

Defines the Modbus Station Address (also called the Modbus node address) of the slave device.

TARGET MODBUS START REGISTER ADDRESS

Defines the starting register of the TAG to be acquired by the Modbus RTU slave.

TARGET MODBUS REQUEST TYPE

Select the type of Modbus register:

Coil

Discrete Input

Holding Register

Input Register

TARGET REGISTER DATA

Select the type of TAG variable:

16 BIT UNSIGNED: 1 Modbus register, from 0 to 65535

16 BIT SIGNED: 1 Modbus register, from -32768 to +32767

32 BIT UNSIGNED MSW: 2 Modbus registers, whose Modbus register with the lower address contains the most significant word, can assume values from 0 to 4294967295

32 BIT UNSIGNED LSW: 2 Modbus registers, whose Modbus register with the lower address contains the least significant word, can assume values from 0 to 4294967295

32 BIT SIGNED MSW: 2 Modbus registers, whose Modbus register with the lower address contains the most significant word, can assume values from -2147483648 to +2147483647

32 BIT SIGNED LSW: 2 Modbus registers whose Modbus, register with the lower address contains the least significant word, can assume values from -2147483648 to +2147483647

FLOAT MSW: 2 Modbus registers, whose Modbus register with the lower address contains the most significant word, single precision floating point value (IEEE 758-2008)

FLOAT LSW: 2 Modbus registers, whose Modbus register with the lower address contains the least significant word, single precision floating point value (IEEE 758-2008)

BIT: 1 Boolean Coil or Discrete Input, value true or false.

N.B. This field is automatically filled in if a Seneca slave device has been selected in the "TARGET MODBUS DEVICE" field.

⚠ATTENTION!

All 32-bit values are stored in 2 consecutive registers, for example:
The 32-bit unsigned MSW TAG 1 Totalizer is stored in the addresses 40016 and 40017:
The most significant word is 40016, the least significant is 40017.
So the 32bit value is obtained from the following relationship:

$$1 = (40017) + ((40016) \times 65536)$$

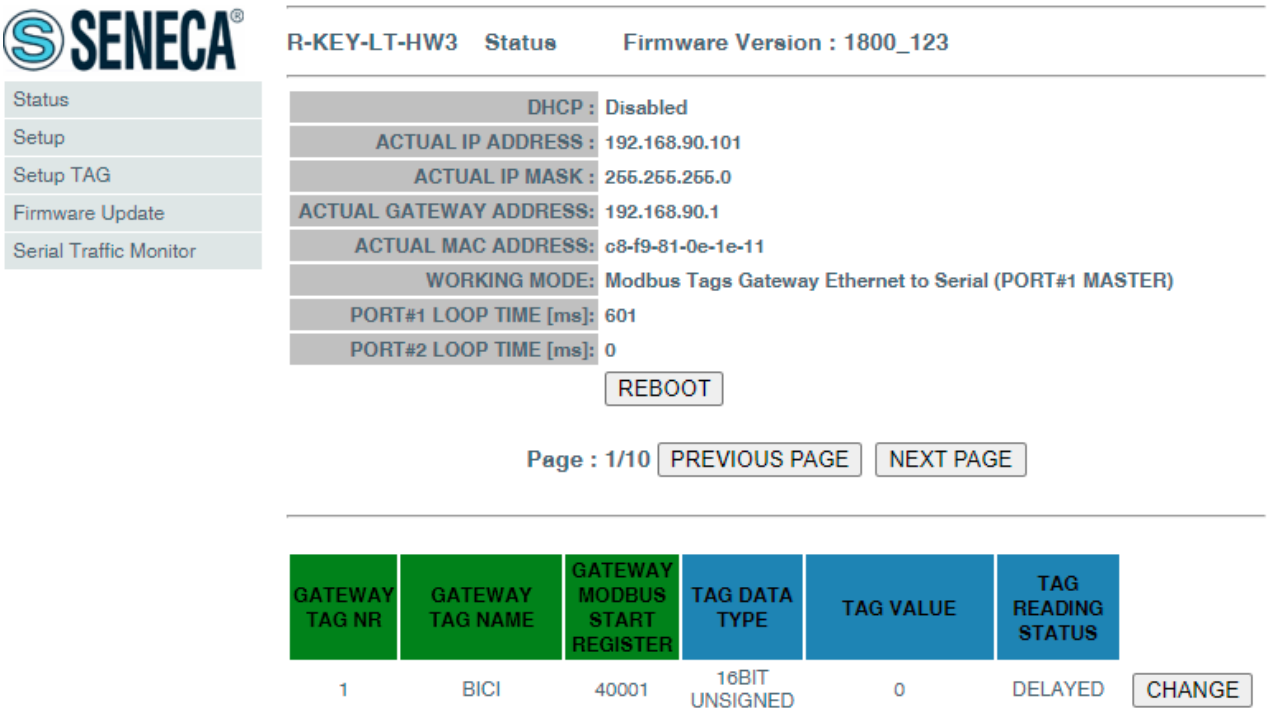
Tag setup can be imported/exported from/to a ".cgi" file:

Note that a .cgi file can also be imported/exported from/to the Excel template.

It is also possible to add, modify, delete or move a tag.

9.2.1. *REAL-TIME VIEW OF THE MODBUS GATEWAY*

Once the TAGs are configured, it is possible to view the status of the Modbus communication in real time, from the Status section of the navigation menu.
The live view will show the current network configuration, operation mode and TAG information.



Tag information includes: The name of the TAG, the Modbus address of the TAG Gateway, the value of the Tag and the status of the TAG:

OK = TAG free of errors
FAIL_TO = TAG reading time out
DELAYED = Once the set retry number has been reached, the polling of the tag is delayed (the tag will be interrogated again after the configured quarantine time)
EXC = Modbus protocol exception response

9.3. CLOUD PAGE (MODBUS TAGS GATEWAY MODE ONLY)

On this page, you can configure the connection to the cloud of the configured Tags.

CLOUD PROTOCOL
Selects the protocol to use between MQTT and http

CLOUD PERIODIC SENDING INTERVAL [s]
Selects the tags sending time to the cloud

CLOUD SERVER ADDRESS
Selects the cloud address to be connected to

CLOUD SERVER PORT
Selects the server port

MQTT CLIENT ID/HTTP PATH
Defines the Client ID used in the MQTT protocol *or the publication path on HTTP server*

MQTT WEBSOCKET
Allows you to activate MQTT communication via Websockets

MQTT KEEP ALIVE INTERVAL [s]
This parameter defines Keep alive which ensures that the connection between the broker and client is still open and that the broker and client are aware that they are connected. When the client establishes a connection to the broker, it tells the broker a time interval in seconds. This interval defines the maximum period of time during which the broker and client may not communicate with each other.

MQTT CLEAN SESSION
This parameter defines the "clean session". When the clean session flag is set to true, the client does not want a persistent session. If the client disconnects for any reason, all information and messages queued from a previous session are lost.

MQTT MESSAGE RETAIN
Usually if a publisher publishes a message on a topic to which no one is subscribed, the message is simply discarded by the broker. However, the publisher can tell the broker to keep the last message of that topic.

MQTT QUALITY OF SERVICE [QOS]
This parameter defines the QOS of the MQTT protocol.
Can be selected from
QOS 0 (once only, without ack)
QOS 1 (at least once, with ack)
QOS 2 (once only, with ack and resend)

CLOUD AUTHENTICATION
This parameter defines whether user/password authentication should be used to access the cloud
CLOUD AUTHENTICATION USER
Broker or server username

CLOUD AUTHENTICATION PASSWORD
Broker or server password

CLOUD SSL/TLS
Defines whether to enable the SSL/TLS 1.2 encrypted security protocol

CLOUD CLIENT CERTIFICATE REQUIRED
Defines whether to manage x.509 certificates for the SSL/TLS connection

CLOUD CLIENT CERTIFICATE VALIDITY CHECK
If activated, it verifies the certificates are valid

CLOUD LOG ON CHANGE
Updates values on broker or server only upon change and no longer over time

CLOUD PUBLISH MULTIPLE TAGS
For MQTT protocol, this parameter defines whether the publish contains multiple tags or whether the device should send a publish for each tag.
For HTTP protocol, this parameter defines whether the post contains multiple tags or whether the device should send a post for each tag.

CLOUD PUBLISH TOPIC FOR LOGS
Selects the topic name for the logs using the following table:

%c	Device Client ID
%m	Device MAC Address
%j[field]	Adds double quotes " to [field]. The double quotes represent a string in JSON

for example:

If:
Device Client ID = Padova13
Publish Topic for Logs = seneca/%c/data

The data logs will be sent to the topic: Seneca/Padova13/data

CLOUD PUBLISH PAYLOAD FOR LOGS
Selects the format to be used for the payload using the following table:

%c	Device Client ID
%m	Device MAC Address
%d	date-time
%t	timestamp (number of seconds from 01/01/1970)
%tms	timestamp (number of milliseconds from 01/01/1970)
%b	bulk (format specified in "Publish Bulk Format")
%n	Tag name (only for "Publish Bulk Format")
%i	Unique ID of the variable
%v	Tag value (only in "Publish Bulk Format")
%j[field]	Adds double quotes " to [field]. The double quotes represent a string in JSON

Note: the %i placeholder adds a unique ID to the variable to be published according to the TAG order (see Tag view page)

CLOUD PUBLISH BULK FORMAT
Selects the format for "bulk mode" according to the following table:

%c	Device Client ID
%m	Device MAC Address
%d	Date/Time
%t	timestamp (number of seconds from 01/01/1970)
%n	Tag name (only for "Publish Bulk Format")
%v	Tag value (only in "Publish Bulk Format")
%j[field]	Adds double quotes " to [field]. The double quotes represent a string in JSON

CUSTOM CLOUD
If the MQTT cloud protocol is selected, you can choose between the clouds:

Direl and ONBOARD

Currently, you can configure:
Generic: Through the device's MQTT configurability, it is possible to connect to virtually any cloud
Direl ADM: Sets up the device to connect to the Direl ADM cloud
On-Board: Sets up the device to connect to the On-Board cloud

To add other clouds to the list, you can make a request to Seneca.

9.3.1. *DIREL ADM4.0*

The parameters for the Direl cloud (https://www.direl.it/) are as follows:

Field	Meaning
Enable	Enables or disables the connection to the Direl ADM4.0 cloud
Username for Commands	This is the username for writing access from the cloud to the device
Password for Commands	It is the password for writing access from the cloud to the device

9.3.2. *ONBOARD*

Onboard is the cloud of innovation system s.r.l., for more information refer to the site:
https://www.onsystem-iot.com/onboard

The parameters for the connection are:

Field	Meaning
Enable	Enables or disables the connection to the Onboard cloud
Username	This is the username for accessing the cloud
Password	This is the password for accessing the cloud

CLOUD SUBSCRIBE TOPIC FOR COMMANDS
To write a tag via MQTT, the device must receive a PUBLISH from the cloud itself with the format indicated in this field.

MQTT CA CERTIFICATE FILE (.pem)
File that represents the Root CA Certificate in .pem format.

MQTT/HTTP SERVER CERTIFICATE FILE (.pem)
File that represents the Client Certificate in .pem format.

MQTT CLIENT PRIVATE KEY FILE (.pem)
File that represents the Client key in .pem format.

9.4. CERTIFICATE/DATABASE UPDATE PAGE

On this page you can upload X.509 certificates for the webserver to the device (if https mode is enabled) and update the Seneca device database.

10. 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-C / Z-KEY-2ETH-C:

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-C:

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

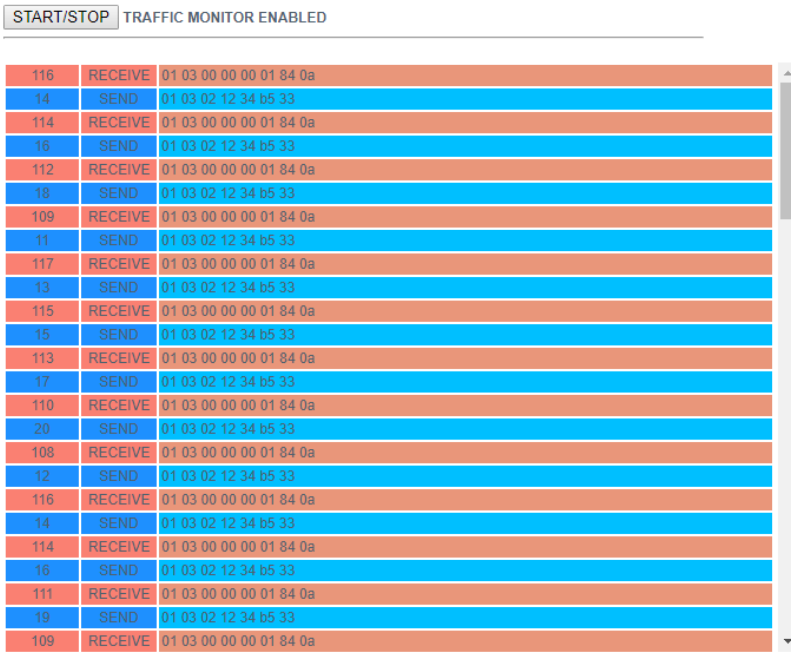
11. TEMPLATE EXCEL

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 or vice versa. The model can be freely downloaded from the Seneca website.

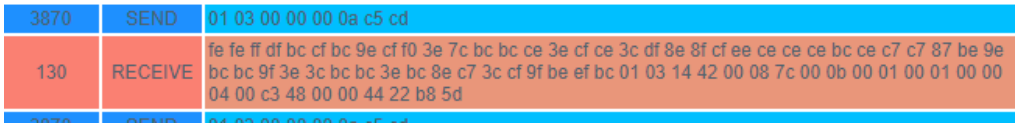
	A	B	C	D	E	F	G	H	I	J	K	L	M
1	MODBUS TCP/IP			SERIAL MODBUS RTU					Export CGI file...		SENECA®		
2	TAG NR	GATEWAY TAG NAME	GATEWAY MODBUS TCP/IP REGISTER ADDRESS	TARGET MODBUS RTU REGISTER TYPE	TARGET MODBUS RTU DATA TYPE	TARGET CONNECTED TO SERIAL PORT NR	TARGET MODBUS RTU START REGISTER	TARGET MODBUS RTU SLAVE ADDRESS	Import CGI file...	SENECA Z-KEY TAGS TEMPLATE FOR GATEWAY MODE. E			
3	1	TAG1	1	HOLDING REGISTER	UINT16	#1	3	2					
4	2	TAG2	2	HOLDING REGISTER	UINT16	#1	4	2					
5	3	TAG3	3	HOLDING REGISTER	UINT16	#1	5	2					
6	4	TAG4	5	HOLDING REGISTER	UINT16	#1	6	2					
7	5	TAG5	7	HOLDING REGISTER	UINT16	#1	7	2					
8	6	TAG6	8	HOLDING REGISTER	UINT16	#1	8	2					
9	7	TAG7	9	HOLDING REGISTER	UINT16	#1	9	2					
10	8	TAG8	10	HOLDING REGISTER	UINT16	#1	10	2					
11	9	TAG9	1	COIL	BIT	#1	1	3					
12	10	TAG10	2	COIL	BIT	#1	2	3					
13	11	TAG11	3	COIL	BIT	#1	3	3					
14	12	TAG12	4	COIL	BIT	#1	4	3					
15	13	TAG13	5	COIL	BIT	#1	5	3					
16	14	TAG14	6	COIL	BIT	#1	6	3					
17	15	TAG15	7	COIL	BIT	#1	7	3					
18	16	TAG16	8	COIL	BIT	#1	8	3					
19	17	TAG17	14	HOLDING REGISTER	INT16	#1	13	4					
20	18	TAG18	15	HOLDING REGISTER	INT16	#1	14	4					
21	19	TAG19	16	HOLDING REGISTER	INT16	#1	15	4					
22	20	TAG20	17	HOLDING REGISTER	INT16	#1	16	4					
23	21	TAG21	1	DISCRETE INPUT	BIT	#1	1	5					
24	22	TAG22	2	DISCRETE INPUT	BIT	#1	2	5					
25	23	TAG23	3	DISCRETE INPUT	BIT	#1	3	5					

12. SERIAL TRAFFIC MONITOR

The Serial Traffic Monitor page of the webserver shows the serial packets that the gateway is receiving and transmitting for line debugging:



The first column is the delay in milliseconds from the last packet, the second column is the direction of the packet (received from or transmitted to), the last column is the contents of the packet in hexadecimal format. Only the serial ModBUS stream is displayed.
The Traffic Monitor shows all packets received from the serial line, for example if it is a serial slave with an incorrect Modbus response:



The Traffic Monitor will also display defective packets in yellow (for example a serial master with wrong baud rate):

13. INSTALLING MULTIPLE DEVICES IN A NETWORK USING THE "DHCP FAIL ADDRESS".

When the Gateway is configured with DHCP enabled but does not receive the DHCP server configuration within 2 minutes then it assumes a fail address.
This fail address is 169.254.x.y where x.y are the last two values from the MAC address.
In this way, if you force all devices to DHCP, you can install on the network even if there is no active DHCP server.
When the fail address has been activated (the relative LED stops flashing), you can launch the "Seneca Discovery Device" software and force the preferred IP address to all devices.

14. THE DB9 RS232 CABLE

The DB9 CABLE RS232 CABLE can be obtained from Seneca (it can also be purchased from the e-commerce website www.seneca.it) for connection with a DB9 RS232 device.

15. SUPPORTED MODBUS COMMUNICATION PROTOCOLS

The Modbus communication protocols supported are:

- Modbus RTU/ASCII master/slave (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.

15.1. 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

16. 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)

16.1. 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

16.2. 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".***

16.3. 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

16.4. 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

16.5. 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							

16.6. 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 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
40064 MOST SIGNIFICANT WORD															

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
40065 LEAST SIGNIFICANT WORD															

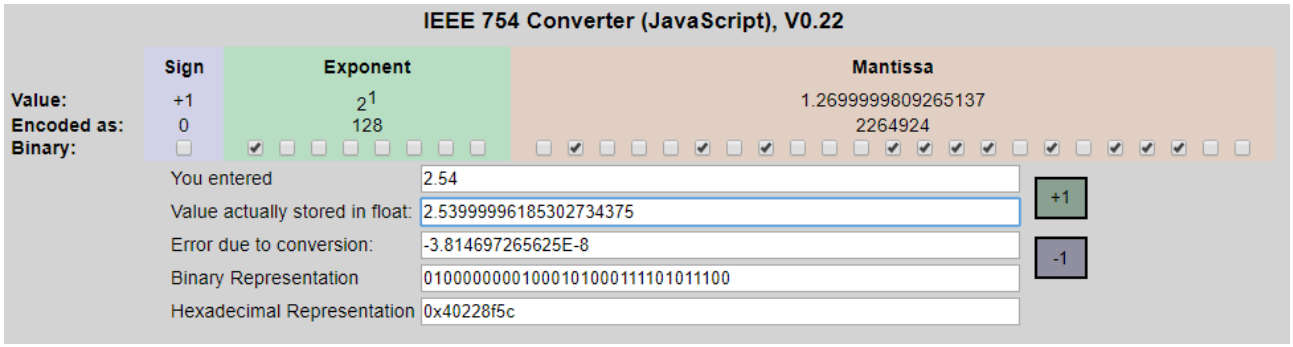
$$Value_{32bit} = Register_{LSW} + (Register_{MSW} * 65536)$$

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.

16.7. 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



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).