# S401
# THE NEW STANDARD FOR MODBUS INDICATORS


**Minimum wiring, maximum flexibility.**
**Only 2 wires and**
**20 measures all in one display**

SENECA

# INDEX

# 1.INTRODUCTION

S401 is a product of new generation, extremely small (96x48x40 mm), which became an interesting front panel solution. Thanks to the OLED technology (Organic Light Emitting Diode) it grants advantages such as:

- Low consumption
- Good contrast (also exposed to sunlight)
- backlight unnecessary
- very wide viewing angle

### 1.1 Interfaces and Cabling

S401 works as an operator panel, it has 2 MODBUS RTU ports (1 Master and 1 Slave) and therefore may be associated with any 2-wire device that communicates according to this standard protocol (remote I/O's, PLC, software, field instrumentation).


Fig.1.1. S401, OLED Display with double ModBUS interface

S401 handles Modbus Master and Slave communication. The first is able to perform:

- Measures Reading from Seneca I/O's and/or other Modbus generic devices.
- Data processing
- Writings of measures acquired and/or processed .
- Views of data acquired and processed on the display.

The communication as Modbus Slave involves:
- the information will be available to be read by another Modbus master device
- data will be written (on specific S401 holding registers) through another Modbus master device (this feature must be requested and specified with the order).

### 1.2 Display and Graphics

S401 reaches a brightness of 70 cd/m 2 and a resolution of 128x64 pixels. The device allows to view up to 30 measures freely settable by software through Modbus Slave port and with the following different formats: float, integer, boolean.

### 1.3 Programming and integrated functions

Display configuration may be performed via software (Z-NET3) or via front menu keys: scale, offset, data type, view format and all communication parameters. S401 has also built-in functions then, in addition to simple visualization, also allows alarms setting, average calculation, signals repetition, addition, subtraction etc. Master functions which is fitted include:

- 27 math functions
- 20 readings from slave modules
- 10 records continuous or on event writings to slave devices
- Threshold alarms management

### 1.4 The OLED technology

OLED technology (Organic Light Emitting Diode) is based on a series of layers of organic material that conducts current in one direction, behaving similarly to a diode. Unlike conventional LCD and LED displays, OLED does not require additional components to be enlightened but produce their own light.

# 2. PROGRAMMING AND DISPLAYING

S401 provides configurability of all operating parameters both by key buttons and software (through RS485 Slave port)


Fig.2.1. Start Menù.

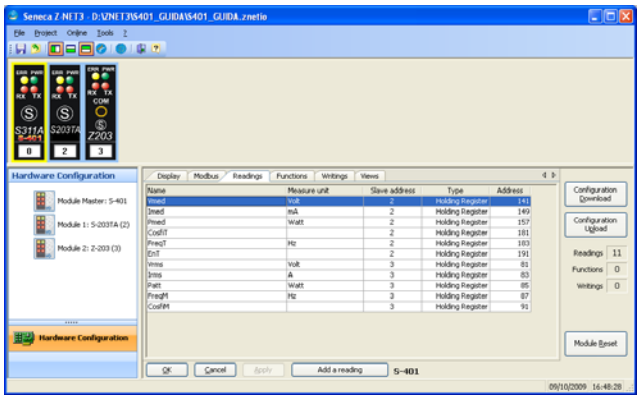


Fig.2.2. Z-NET3 configuration screen shot

### 2.1 Setting of display parameters

Settings of the display parameters includes: number of displayed measures on each line (1,2,3), contrast and language.


Fig.2.3. 1 row view


Fig.2.4. 2 rows view.


Fig.2.5. 3 rows view.

### 2.2 General settings

S401 allows the following settings:

- Change of communication parameters of both Modbus interfaces (Master and Slave)
- Reading and viewing of up to 20 measures, acquired by the slave devices connected to the RS485 port
- Moving average calculation (time window)
- Definition and viewing of up to 10 processed measurement, resulting from the application of mathematical and logical functions.
- Change of the display range (scale)
- Definition and possible viewing of an alarm (high threshold, low threshold and its hysteresis) for each processed variable.
- Definition up to 10 continuous or on event writings, to perform on slave devices connected to the RS485 master port

### 2.3 Display

The display S401 is able of viewing up to a maximum of 30 values, distributed on pages of 1,2,3 rows (by scrolling through the front buttons). These measures include:

- 20 measures acquired directly from the I/O's (scalable values as well). For example, using a Z-4AI is possible to acquire pressure or level measurements (mA or V) and view in the real process scale: namely make the conversion from 0-10000 into the real range (Bar and Meters).
- 10 processed measures representing logic functions, arithmetic or scaling (as above) of the acquired measures or definitions of alarms.For example, if is required a number of temperatures (<=20) can define up to a maximum of 10 alarms (on max threshold and/or min) with respect thereto.

### 2.4 Definition of processed values

It is also possible to define 10 writings which may be:

- REPETITION OF THE SIGNALS _ to transfer signals from one place to another place (by a scale of 0-10000): input from a Z-4AI transferred to the outputs of Z-3AO or the status of the inputs of a Z -10-D-IN to the outputs of Z-10-D-OUT.
- WRITINGS ON EVENT _ that is caused by the occurrence of an alarm, such as required for outputs enabling (Z-D-OUT or Z-10-D-OUT) to which are connected other devices.

# 3. FUNCTIONS MENU'

The menu functions allows you to define the functions, obtained through the processing of one or more parameters defined in reading/writing of one or more processed masures.

Through this menù is possible:

1) Enter a function.
2) Delete a previously defined function
3) Edit a previously defined function and easily modify only the alarm thresholds
4) Determine if the function should be displayed or not and, if so, decide the position in the list view.

For each function you can set the description (defines an identifying name for the function) and the associated operation (sets the operation to be performed).

In the functions table we report the selectable operations of the selectable functions with the type of data on which can be used:

| OPERATION CODE | OPERATION | OPERANDS NUMBER | INPUTS FORMAT | OUTPUTS FORMAT |
|---|---|---|---|---|
| 0 | Identity | 1 | integer/float | integer/float |
| 1 | Sum of 2 | 2 | integer/float | integer/float |
| 2 | Sum of 3 | 3 | integer/float | integer/float |
| 3 | Subtraction | 2 | integer/float | integer/float |
| 4 | Multiplication | 2 | integer/float | integer/float |
| 5 | Division | 2 | integer/float | integer/float |
| 6 | Square | 1 | integer/float | integer/float |
| 7 | Cube | 1 | integer/float | integer/float |
| 8 | Square root | 1 | integer/float | integer/float |
| 9 | Inverse (1/x) | 1 | integer/float | integer/float |
| 10 | Inverse square | 1 | integer/float | integer/float |
| 11 | Inverse root | 1 | integer/float | integer/float |
| 12 | Inverse square root | 1 | integer/float | integer/float |
| 13 | Math average of 2 | 2 | integer/float | integer/float |
| 14 | Math average of 3 | 3 | integer/float | integer/float |
| 15 | Geometric average of 2 | 2 | integer/float | integer/float |
| 16 | Geometric average of 3 | 3 | integer/float | integer/float |
| 17 | Square average of 2 | 2 | integer/float | integer/float |
| 18 | Square average of 3 | 3 | integer/float | integer/float |
| 19 | Logical AND of 2 | 2 | boolean | boolean |
| 20 | Logical AND of 3 | 3 | boolean | boolean |
| 21 | Logical OR of 2 | 2 | boolean | boolean |
| 22 | Logical OR of 3 | 3 | boolean | boolean |
| 23 | Logical XOR of 2 | 2 | boolean | boolean |
| 24 | Normal Volume compensation | 3 | integer/float | integer/float |
| 25 | Standard Volume compensation | 3 | integer/float | integer/float |
| 32 ÷ 47 | Bit extraction 0 ÷ 15 from register | 1 | integer/float | boolean |

Tab.3.1. Table functions

# 4. ALARM MANAGEMENT

S401 offers the opportunity to define for each processed measure an alarm with two thresholds. The warning message will be displayed or written in the variable defined.


Fig. 4.1 Alarm warning

### 4.1 Alarms on processed quantities

You can define and display up to 10 processed quantities, obtained through the application of mathematical or logical functions on the acquired quantities or other processed values. Can be applied functions and mathematical operations on all defined data in the acquisition. The result may be then displayed or not displayed. On the processed quantities is possible to associate an alarm with 2 thresholds (individually). Specifically, on each processed variable (non boolean) may possible associate an alarm.
The alarms may individually settable as:

- High threshold
- Low threshold
- Hysteresis on the high threshold
- Hysteresis on the low threshold

When the value of the variable exceeds the high threshold, the condition will switch to high alarm, it will be de-energized if the variable value is < High threshold - Hysteresis High. When the value of the variable is less than the Low Threshold the condition will switch to low alarm, it will be de-energized if the variable value is > Low Threshold + Low Hysteresis. The alarm conditions are displayed through a warning message that alternates the variable display. It is also possible, when a writing has been setted *(writing on event),* to decide that this occurs in case of an alarm condition.

### 5.2 Writing on event

Through port MODBUS RTU Master can be programmed up to 10 writings (2 types): continuous or on event. The continuous writing type occurs at each cycle of the program (if the value is available). Typically it can be written into the selected I/O registers: the value of one acquired parameters or the processed values.

Writing on event will follow the trend of one of defined processed quantities. I has been defined 1 or 2 alarm threshold, the writing will be enabled only to the occurrence of one of alarm conditions. In the case of:

- single bit writing is also expected the alarm de-energizing

- analog register editing, no writing operating is made when alarm locks

### 5.3 Alarm settings through menu

The menu Function (accessible by software or front buttons) allows to define the functions, obtained through the processing of one or more quantities.
It is possible:

- Enter a function.
- Delete a previously defined function.
- Edit a previously defined function and modify only the alarm thresholds
- Determine if the function shall be displayed or not and if so, decide the position in the list view.

### 5.4 Threshold alarm

Activating this feature *(SI)* you can define alarm thresholds (both low and high) by Float, Long and Short formats. Both can be all enabled, disabled or enabled individually.

- *High threshold:* The value can be either in format that Long Float.
- *Hysteresis on high threshold:* The value can be either in format that Long Float.

- *Low threshold:* The value can be either in format that Long Float
- *Hysteresis on low threshold:* The value can be either in format that Long Float

**5.5 Writing settings mode**

For each writing you can have access to the following settings: "Data Select", "Address Slave", "Address Register", "Activate Trigger", "Alarm threshold", "Data to write."

**Data selection**

Allows you to select the variable to be read or the function that will be involved in the writing operation. This variable can be used in the following ways:

- If you select into the list a *Variable for reading or function without active alarms:* the value of such variable (analog or digital) will be continuously written on the I/O register that will be define in *Register Address*
- If you select in the list a *function with at least one alarm activated will be possible:*
  - the continuous writing of the value of the selected function (as in the previous point)
  - the writing only under alarm conditions (and de-energizing as well). In this last situation (writing on trigger) you can force the writing of a constant (bit/variable value) previous selected.

**Slave address**

The address of the slave module connected to the RS485 master port where make the writing. Values from 1 to 247.

**Address register**

Modbus address register where make the writing

| INDIRIZZI | TIPO DATO | FUNZIONE |
|---|---|---|
| 1..10000 | Boolean | 05 |
| 40001..50000 | Boolean | 06 read-modify-write: scrive il singolo bit nel registro lasciando invariati gli altri. |
| 40001..50000 | Float/Long Int/ Short Int | 06 / 16 |

In order to write an holding register (with address 40003), the parameter Address Register must be set to 40003. In the case of continuous writing please be sure of correspondence between the data type selected in Data Selection and the writing register.

**Enable Trigger (only if in** Data Selection **has been choose a function with at least 1 active threshold)**

This feature is activated only if you choose (in Data Selection) a function with at least one active threshold. By selecting YES, you enable the script on trigger (script only if the selected function is in alarm). Otherwise, proceed with continues script.

**Alarm threshold**

If you have activated the trigger (script on alarm) in Trigger Enabling, you can decide on what threshold to determine the script (it is not possible to determine the script on both simultaneously):
*High alarm*: allows you to enable writing to the overtaking of this threshold (only if for the related function the high threshold had been activated, otherwise the option does not appear). *Low alarm*: allows you to enable the script if the function is below than this threshold (only if the related function associated with the lower threshold had been activated, otherwise the option does not appear).

**Data to be type**

If the trigger has been activated, this mode allows data type setting to be written.
Selectable formats:
- *Boolean 1 (0)*: in case of alarm condition will be imposed on a particular bit the logical value 1 while the return will be imposed on the logical value 0.
- *Boolean 0 (1)*: In case of alarm condition will be imposed on a particular bit the logical value 0 while the return will be imposed on the logical value 1.
- *Word*: Sets the 16-bit integer value that will be written in the event of an alarm condition. When the alarm is cancelled such value will be not written anymore.
-*Data Value*: if an alarm occur the function value set is written into the Select Data. In this case you must select the output format. In the case of long or float you must also specify the data writing order (MSW first or LSW first). When the alarm is cancelled such writing will be interrupted.

# 5. APPLICATIONS

Below we described some of the applications of the S401 display in combination with Z-PC remote I/O's.

### 5.1 Viewing electric variables control

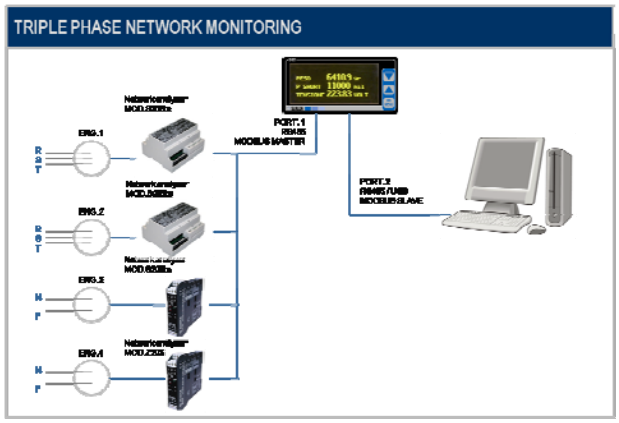



Fig.5.1 Network analisys

The display is used to show electrical parameters related to some and single and three-phase networks. Reading variables happens directly from the registers of the Seneca devices (S203TA and Z203), respectively single and three-phase network analyzers, which are connected to the RS485 master port).. At the same time it is used to make available such data to a PC connected to RS485 slave port.
The following is an display programming example of readings (through ZNET3 software). Before performing the display programming is necessary to configure the I/O network.

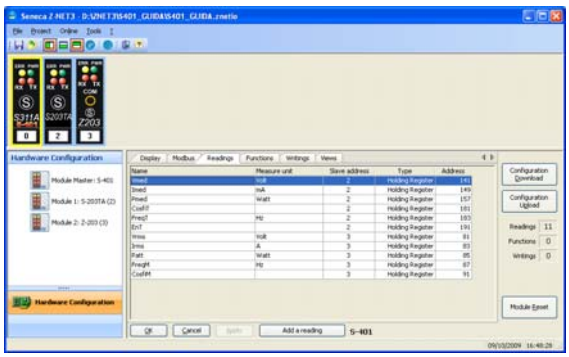


Fig. 5.2. Readings definition from S203TA and Z203

Whenever you want to add a reading must set the following window.

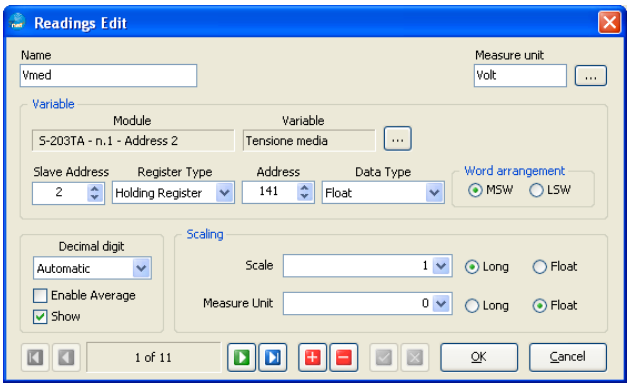



Fig.5.3. Editing of reading parameters

As appear is necessary to indicate:

⇒ *Modbus Address of the slave device* from which to read the variable

⇒ *Modbus Address Register* that stores the data and format of the data of measure

Afterwards you can:

⇒ Enable the viewing on the display and averaging

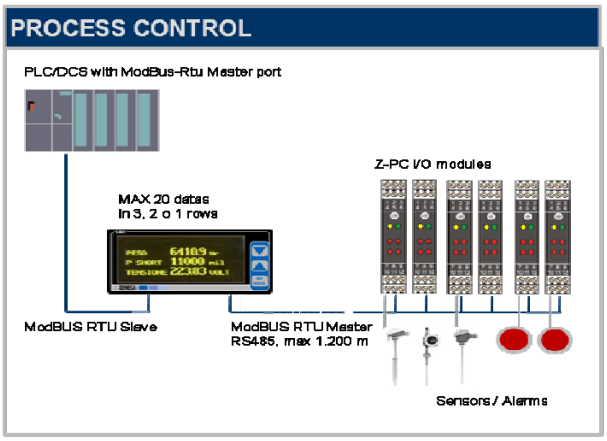
⇒ Set the number of decimal digits to viewing

⇒ Change the viewing scale (scale factor and offset)

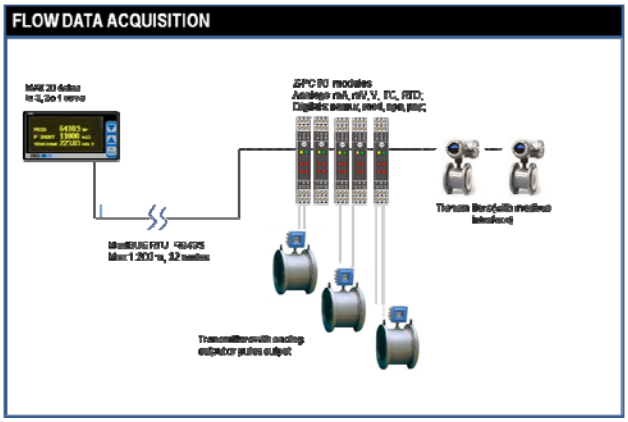
## 5.2 Process Measures

S401 can be used as Master for acquiring, transmitting and displaying process measures:

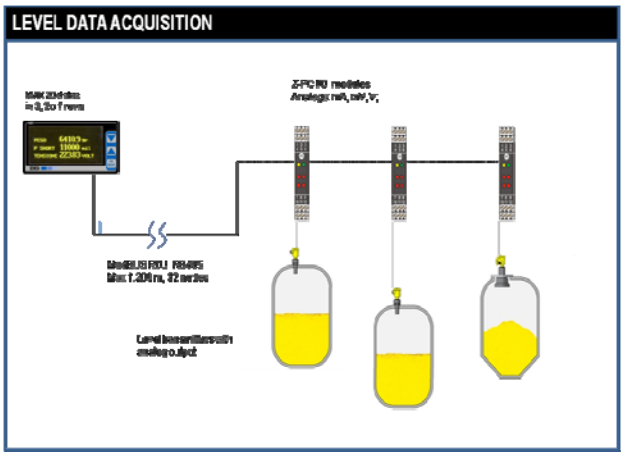
Temperature and pressure




Flow Measurements

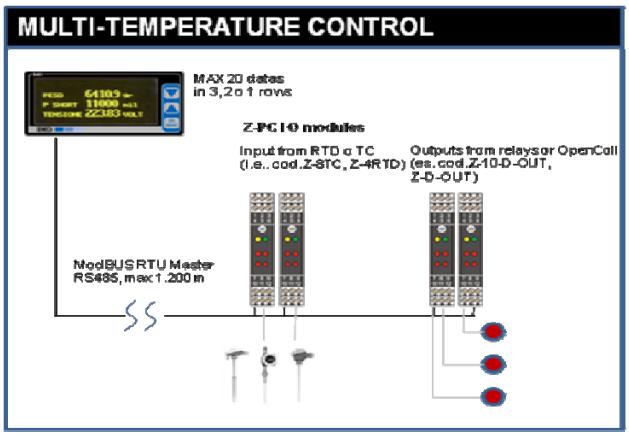



Level Measurements




## 5.3 Alarms Management

In the temperature control applications the S401 display could be used to display the acquired signals from ModBUS, for instance by Seneca modules Z-4RTD2/Z-4TC or Z-8TC (RTD, TC .. converters), and verify the variations.




In particular, the temperature values read by modules Holding Registers will be processed in order to generate an alarm whenever the temperature exceeds the threshold (upper and/or lower). When happens the event the display writes on a module with digital output in order to active the alarm. You can also see the alarm on the display.

Follows a System Configuration by ZNET3 software.

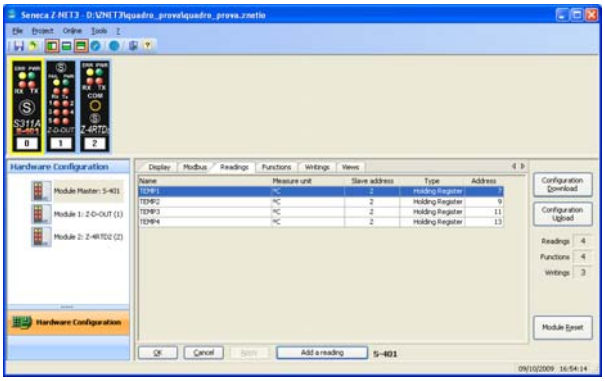


Fig.5.4. Readings definition from RTD

After configuring the slave network composed by a RTD converter Z-4RTD2 and module with 5 digital output Z-D-OUT, the readings to make and to visualize have to be defined (as saw in the previous example).

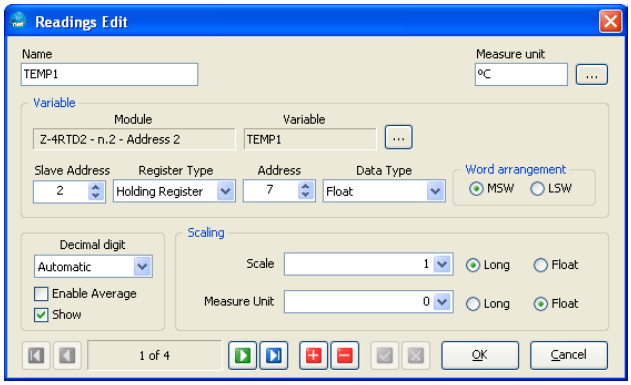



Fig. 5.5 Readings Edit

Subsequently to associate the alarms to the acquired temperature, it's necessary to define a function for each reading.

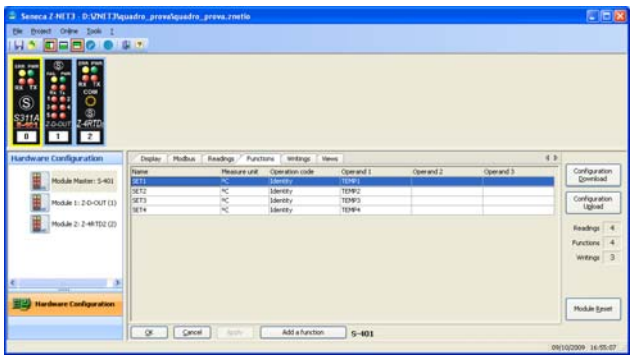


Fig.5.6 Functions definition on acquired temperatures

Every time you want to make a function (or set an alarm) the following window appears

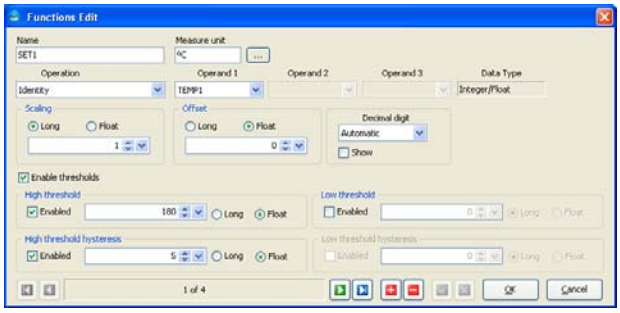



Fig. 5.7 Function edit to set an alarm on High threshold

It's necessary to enter

⇒ Processed value *name*

⇒ *Measure Unit*

⇒ *Operations* to apply and *operands* on which to act ( among own readings):

In the alarm settings, the function on the temperature red is "Identity" (in this way you create a copy of the value acquired on which you'll work)

Moreover you can:

⇒ Change the visualization scale of the value about the variable just defined

⇒ Active an alarm defining the upper and/or lower alarm and the relative histerisys.

⇒ Enable the visualization of the processed value

Once defined all the alarms, a writer will be associated on one of the Z-D-OUT output.

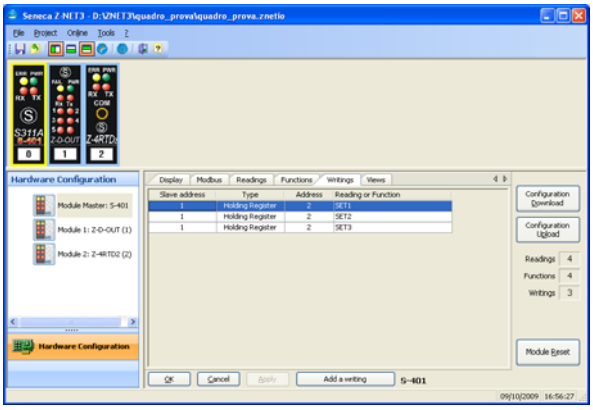


Fig. 5.8 Writings on alarm definition

When you want to add a writing appears the following window

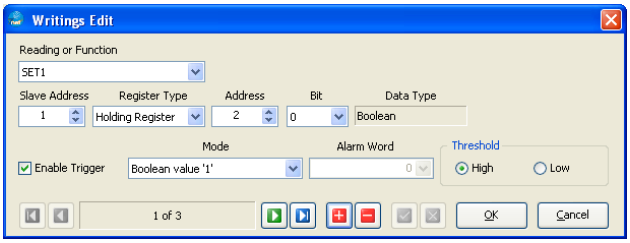



Fig. 5.9 Writing edit

As you can see, it's necessary to enter:

⇒ The *Function* that defines the alarm on which you have to active the writings

⇒ *Modbus slave address* on which the display has to write (Z-D-OUT)

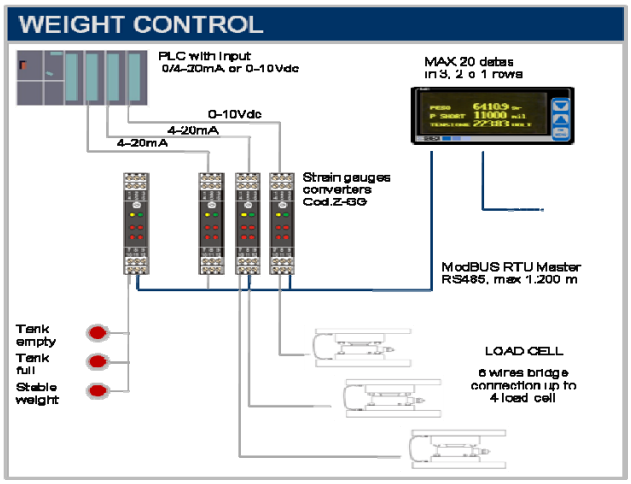
⇒ *Modbus register address* on which you write

Considering the writing to do is a writing on event (or is consequent to the alarm) is necessary to enable the trigger and indicate:

⇒ The value type to write, that in this case is a boolean value 1 (alarm enabled)

⇒ The event on which it is concerned the writing: alarm on upper or lower threshold.

The same procedure can be applied for the control of the weight with a load cell.




## 5.4 Ripetition analogue and digital signals

In the signals repetition the S401 display is utilized to retransmit in a position B, the analogue and digital generated in a position A.
Let's suppose to have a system composed in the following way:

- Position A, you have a Seneca module Z-4AI (it acquires up to 4 input voltage/current), a Seneca module Z-10-D-IN (that has 10 digital input) and a radio modem or Seneca module Z-LINK for the signals transmission. In particular, the Z-4AI accepts in input the output 4…20 mA of a sensor of a level while Z-10-DIN transfers some of status and warning alarms.
- Position B, there is a Seneca module Z-LINK or radio modem for the signal reception, the S401 display, a Seneca module Z-3AO (that has three output in current, of which one convertible in voltage) and a Seneca module Z-10-D-OUT (with 10 digital output) on which the signals received must be repeted.

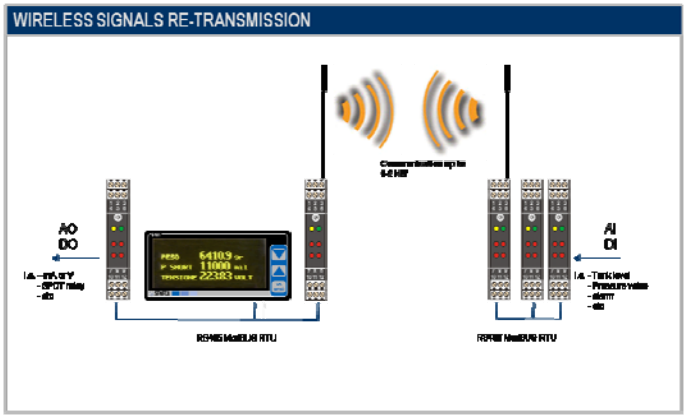



Fig. 5.10 Wireless Retransmission example

The S401 display has to read and visualize, from position A, the measurement of level and the status of the digital input and so render them in the position B through writing

NB. The maximum number of the repeatable signals (analogue values or word 16 bit that contains the status of the digital input) is equal to 10, or to the maximum number of allowed writings.

Following there is a configuration by software ZNET3 of the described system.

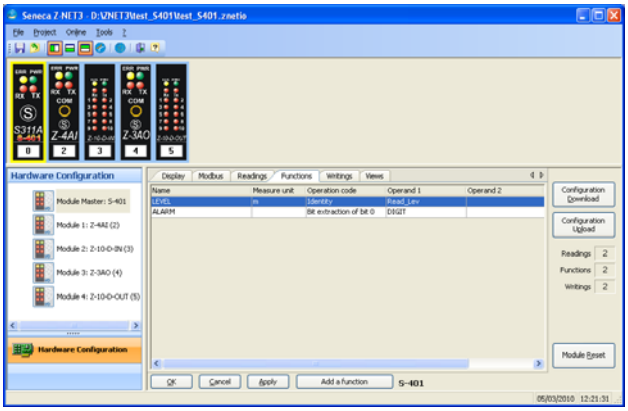


Fig.5.11 Readings definition to repeat

The values to visualize is read by registers of modules Z-4AI and Z-10-DIN and before to be visualized come processed.
In particular:

- The level value read by Z-4AI is scaled to 0…10000, this value is maintained to be repeated, but to visualize the measure included in the range 0..5 metres you need a function on

which the values correspond to the value read in the real scale.


Fig. 5.12 Editing function to scale level measuring.

– from Z-10-DIN come read the word 16 bit that memorizes the input status. This word is necessary to repeat the value but the information to visualize is also present in the bit from 0 to 7. Eight functions will be defined to extract bit interested from the acquired word.


Fig.5.13. Editing functions for bit extraction.

Finally, to define the repetition of signals read, they will be defined the following continue writers

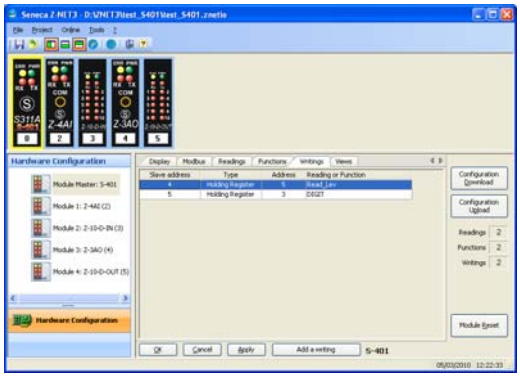


Fig. 5.14. Continuous writings definition.

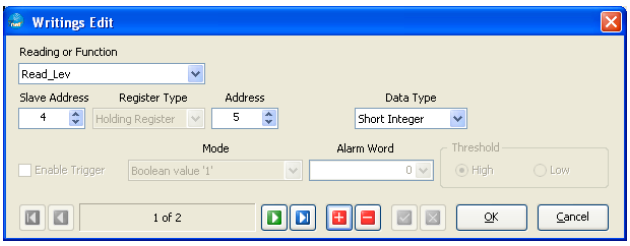



Fig. 5.20. Writings edit.

As you can see, it's necessary to indicate:

⇒ The *Reading* that has to be repeated: level measurement acquired in scale 0-10000 or 16-bit word show the status of alarms or warning (lett_liv and Input_D)

⇒ *Modbus slave address* of the display on which to write (Z-Z-10 and 3AO DOUT) Indirizzo

⇒ *Modbus Register address* on which to write

⇒ *Data Format*

# ANNEX

# A. DATA SHEET AND ORDER CODES

## S-LINE – OLED INDICATOR

### S401

ModBUS RTU indicator with OLED 2,7" display

#### GENERAL DATA

| | |
|---|---|
| Power supply | 10-40 Vdc / 19-28 Vac |
| Power consumption | 1 W |
| Isolation | 1.500 Vac |
| Communication interface | 2 x RS485 ModBUS RTU Master / Slave<br>Speed 1.200..115.200 bps |
| Memory | RAM: 256 byte<br>XRAM: 4kB<br>Flash: 32 kB<br>Scratchpad: 128 byte |

#### VISUALIZATION AND MEASURE

| | |
|---|---|
| Display | OLED 2,7", 128 x 64 pixel |
| Front keys | 3 menu keys |
| Visualization | Up to 20 measures (max 3 per page) free settable |
| Serial communication | Address, parity, baud rate, response delay time, transmission delay time, data receiving timeout |
| Data storage | RAM, 20 x 4 byte |

#### THERMOMECHANICS DATA

| | |
|---|---|
| Operating temperature | -10..+60°C |
| Case | PPO self-exinguished, panel mount, DIN 43700 |
| Front protection | IP65 |
| Connections | Removable terminals |
| Dimension (w x h x d) | 96x48x40 mm |
| Panel dimension | 91x45 mm |
| Weight | 200 g |

#### SETTINGS, NORMS

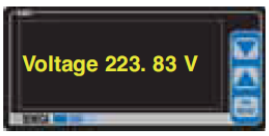
| | |
|---|---|
| Software / query | Max free settings 20 query, data management via Z-NET3 |
| Settings | Communication parameters, language, contrast, brightness, range, offset, measure type |
| Conformity | EN 61000-6-4/2002, EN 61000-6-2/2005, EN 61010-1/2001 |

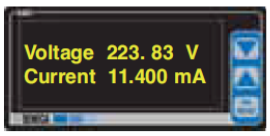
#### ORDER CODES

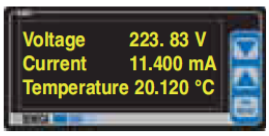
| Code | | Description |
|---|---|---|
| Model | S401 | ModBUS RTU indicator with OLED 2,7" display |
| Power supply | -L | 10-40 Vdc; 19-28 Vac |

### OPERATING VIEW MODE

**In view mode the indicator displays the values of the quantities defined on the display list; it may view 1, 2 or 3 data for screen.**



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