USER MANUAL

Z113-1

Double threshold with universal analog input

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Date	Revision	Notes
29/08/2013	0	First revision

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Seneca **Z113-1**

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1. Introduction

The Z113-1 model is a double threshold with an universal analog input and 2 relays.
An USB port it's also available for configuration and real time data acquisition (Modbus RTU protocol supported).

1.1. Features

- Two alarms configurable on Maximum, Minimum or Window.
- Two SPST relays (3A, 250V ac), Normally open/close configurable from software.
- Universal analog input (DC current 0-20mA, DC voltage 0-10V, Potentiometer, Thermocouples and Thermoresistances).
- Thermoresistances measure in 2, 3 or 4 wires mode for best measure accuracy.
- Thermocouple measure with internal Cold Junction compensation.
- Optional Input Range Analysis.
- Optional Temperature sensor Burn / Broken detection.
- USB communication with Modbus RTU protocol for real time measure and configuration.
- Active current input mode (Z113-1 can power an external sensor max 17V, 25mA).
- Configurable into 50/60 Hz Measure Rejection.
- Easy and Free configuration and real time data visualization software from www.seneca.it
- Alarms with Hysteresis, Shoot Delay and Recovery Delay configurable parameters.

2. Technical Specifications

2.1. Universal Analog input specifications

Analog Universal Inputs number	1
ADC Sampling Time	20 ms for 50 Hz Rejection 16,66 ms for 60 Hz Rejection
Filter	Yes, Configurable from level 0 to 19
Response Time	5 ms + ADC Sampling Time (Typical, with Filter = 0, no USB Communication)
Current Input mode	Configurable in Active (The external sensor is powered by Z113-1, MAX 25mA and 17V) or Passive mode (the external sensor is external powered). Range from 0 to 20mA. Internal 50 Ohm shunt. Short circuit protected.
Voltage input mode	Range from 0 to 10 V. Input impedence: 120Kohm.
Potentiometer input mode	Potentiometers supported from 1Kohm to 100Kohm. A 330 Ohm external resistance must be connected in parallel mode. Current excitation 1mA. Input Impedence: > 5 MOhm
Thermocouple input mode	Supported types: J, K, R, S, T, B, E and N. Input Impedence: > 5 MOhm. Sensor Burn-out/ Broken automatic detection. Cold Junction compensation.
Thermoresistance (RTD) input mode	Supported types: PT100, NI100, PT500, PT1000. Measure mode: 2, 3 or 4 wires. Excitation current: 1,1 mA (PT100, NI100), 0,11 mA

	(PT1000, PT500). Sensor Burn-out / Broken automatic detection.

2.2. Accuracy, Thermal stability and Linearity Errors

Errors max measuring range	***Accuracy***	***Thermal stability***	***Linearity error***	***EMI***
Voltage or current input type	0.1%	0.01%/°K	0.05%	<1% (1)
TC-input type: J, K, E, T, N	0.1%	0.01%/°K	0.2°C	<1% (1)
TC-input type: R, S	0.1%	0.01%/°K	0.5°C	<1% (1)
TC-input type: B (2)	0.1%	0.01%/°K	1.5°C	<1% (1)
Cold junction compensation (only for TC-input type)	2°C between 0-50°C	/	/	/
POTENTIOMETER-input type	0.1%	0.01%/°K	0.1%	<1%
RTD-input type (3)	0.1%	0.01%/°K	0.02%(if t>0°C) 0.05%(if t<0°C)	<1% (4)

(1)Influence of wire resistance: 0.1 uV/Ohm
(2) for t < 250°C the temperature is always 250°C
(3)For RTD type: PT100, PT500, PT1000, NI100. All the errors have to be calculated with reference to resistive value
(4) 0.005 %/Ohm, max 20 Ohm

2.3. Digital Output Relays specifications

Digital Outputs number	2
Type	Relays SPST normally open
Max current	3 A
Max voltage	250 V ac

2.4. Power supply specifications

Power supply	10-40 VDC 19-28 VAC 50/60 Hz
Power consumption	Typical 2,5W, MAX 3W

2.5. Environmental specifications

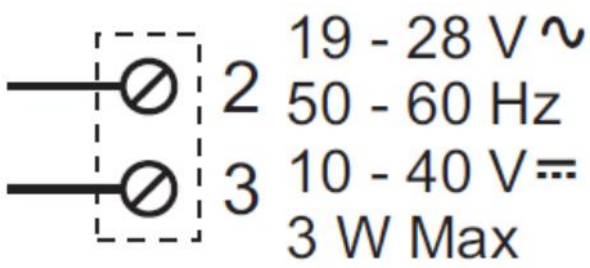
Operating temperature	-10°C ... +65°C
Humidity	30 ... 90% to 40°C not condensing (during operation)
Max environment pollution degree	2 (during operation)
Storage temperature	-20°C ... +85°C

3. Z113-1 Electrical Connections

WARNING!

Power on the module with < 40 Vdc or < 28 Vac voltage supply. These upper limits must not be exceeded to avoid serious damage to the module.

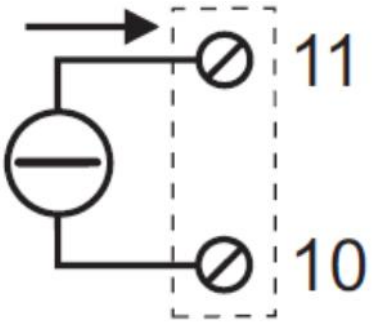
3.1. Power connections



Seneca recommend to connect a fuse on the Power Supply for Z113-1 protection.

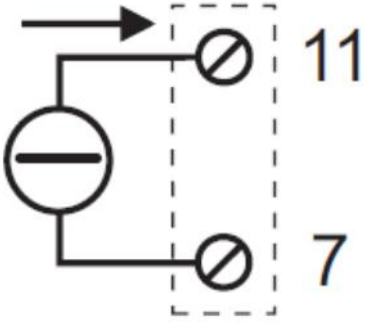
3.1. Input connections

3.1.1. Passive DC Current mode input



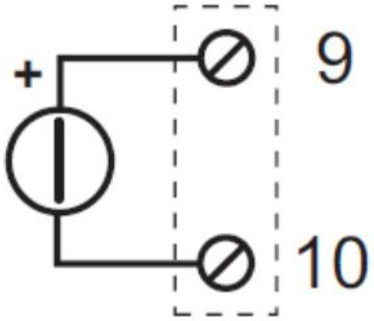
In the passive current mode the external sensor must be powered by an external source.

3.1.1. Active DC Current mode input

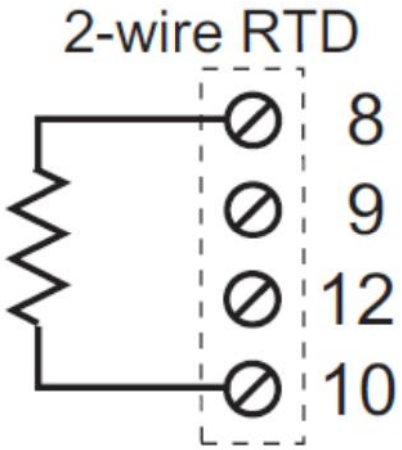


In the active current mode the external sensor it's powered by the Z113-1 (MAX current 25mA, MAX voltage 17 V).

3.1.1. Voltage DC mode input



3.1.1. 2-Wire Thermoresistance (RTD) mode input

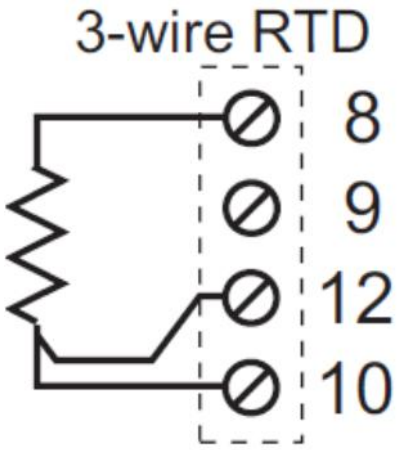


The 2-wire connection mode for measuring a thermoresistance it's the fastest mode but the measured value is:

$$Rmeasured = Rrtd + Rwire1 + Rwire2$$

So in this connection the wires length is very important if you must obtain a good measure.

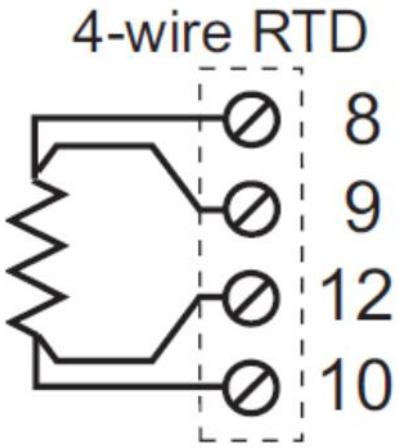
3.1.1. 3-Wire Thermoresistance (RTD) mode input



The 3-wire connection mode it's a technique for measuring the Resistance without the error introduced by the Wires resistance.

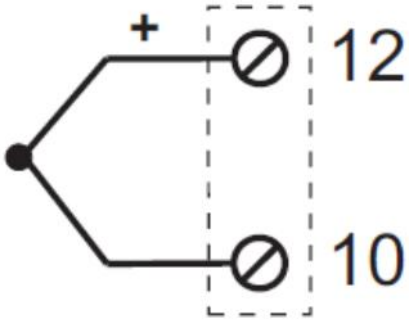
WARNING
The Value measured with the 3-wire connection mode it's not effected by the Wire resistance only if the 3 wires have the same resistance. So the 3 wires must have the same length and must be of the same type.

3.1.1. 4-Wire Thermoresistance (RTD) mode input



The 4-wire connection mode it's a technique for measuring the Resistance without the error introduced by the Wires resistance, in this case the wires can be of different length or type.

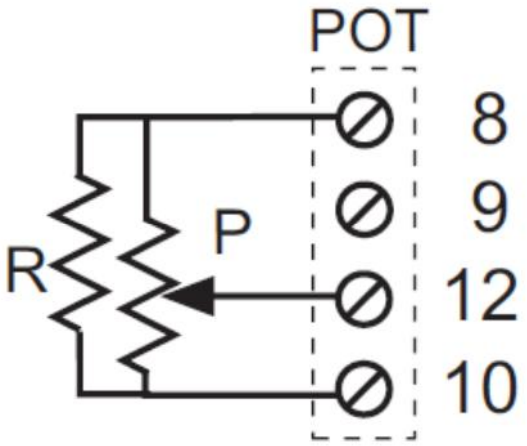
3.1.1. Thermocouple mode input



In the thermocouple mode input the (+) wire must be connected to screw terminal 12.

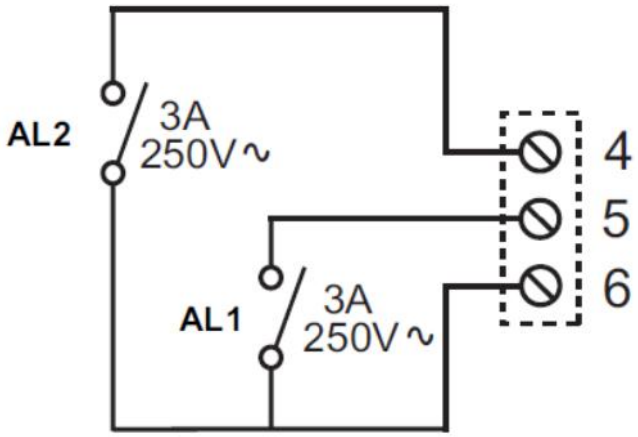
Note
By using the USB communication it's possible to read a mV input using this input mode, the value it's expressed in mV and the range is from -10mV to +70mV (see Modbus Registers chapter for more info).

3.1.2. Potentiometer mode input



NOTE
An external Resistance (R = 330 Ohm) must be connected by the 8 and 10 terminal screw.

3.1. Outputs connections



4. USB Communication

The communication protocol supported from the USB ports is Modbus RTU slave, for more information about this protocol please refer to Modbus specification website:

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

The default configuration for the USB port is:

- Modbus station address: 1
- baud rate: 9600 baud

- parity: none
- data bit: 8
- stop bit: 1

4.1. Modbus RTU protocol

All registers are “Holding register” (Read Modbus function 3) with the convention that the first register is the 40001 address.

The following Modbus functions are supported:

Read Multiple Modbus Register (function 3)

Write Single Modbus Register (function 6)

Write Multiple Modbus Registers (function 16)

All values in 32bits are stored into 2 consecutive registers, for example:

uA Value in floating point 32 bits is stored into registers 40122 and 40123, the Most significant word is the register 40122, the less significant word is the 40123.

So the 32bits value is obtained by the following relation:

$$uA\ value = Reg40123 + (Reg40122 \times 2^{16}) = Reg40123 + (Reg40122 \times 65536)$$

4.1.1. Abbreviation used

In the following table this abbreviations are used:

Glossary
“MS” = Most significant
“LS” = Less significant
“MSB” = Most significant Byte
“LSB” = Less significant Byte
“MSW” = Most significant Word (16 bits)
“LSW” = Less significant Word (16 bits)

“R” = Read only register
“RW” = Read and write register
“Unsigned 16 bits” = Unsigned 16 bits register
“Signed 16 bits” = 16 bits register with sign
“Float 32 bits” = Floating point single precision 32 bits (IEEE 754) register
“0x” = Hexadecimal Value
“Bit[0]” = first bit (less significant bit) of a 16 bits register for example a 16 bits register value: 11111111 11111110 The Bit[0] value is “0”
“Bit[1]” = the second bit of a 16 bits register for example a 16 bits register value: 11111111 11111101 The Bit[1] value is “0”
“Bit[n]” = the n-bit of a 16 bits register

4.1.2. Modbus Register Addresses

Modbus Address	Register Name	Comment	Register Type	R/W	Default value or Start Value
40001	MACH_ID_EXT_REV	Module ID code	16 bit unsigned	R	0x5900
40002	FW REV	Firmware code revision	16 bit unsigned	R	-
40003	INPUT TYPE	This register configure the input that it’s connected : 0 = current 1 = voltage 2 = potentiometer 3 = TC J 4 = TC K	16 bit unsigned	R/W	0

		5 = TC R 6 =TC S 7 = TC T 8 = TC B 9 = TC E 10 = TC N 11 = PT100 -2 wire 12 = PT100 -3 wire 13 = PT100 -4 wire 14 = NI100 -2 wire 15 = NI100 -3 wire 16 = NI100 -4 wire 17 = PT500 -2 wire 18 = PT500-3 wire 19 = PT500 -4 wire 20 = PT1000 -2 wire 21 = PT1000 -3 wire 22 = PT1000 -4 wire			
40004	OUT1_OUT2_TYPE	This register it's used for configure the NO/NC for the digital outputs: MSB=0 OUT1 Normally open MSB=1 OUT1 Normally close LSB=0 OUT2 Normally open LSB=1 OUT2 Normally close	16 bit unsigned	R/W	0
40005	COLDJUNCTION_FILTER	MSB = 1 Cold Junction compensation activated	16 bit unsigned	R/W	0x0100

		MSB = 0 Cold Junction compensation not activated LSB = Filter level from 0 to 19			
40006	REJECTION_BURN_FAIL	This register configure the Rejection, the burn-out and the Range check behavior Bit [9..8]= 00 50Hz Rejection Bit [9..8]= 01 60 Hz Rejection Bit [3] = 0 Burn-out to full scale Bit [3] = 1 Burn-out to start scale Bit[2] = 0 Burn-out disabled Bit[2] =1 Burn-out enabled Bit[1] = 0 Fail range to full scale Bit[1]= 1 Fail range to start scale Bit[0] = 0 Fail range check not enabled Bit[0] = 1 Fail range check	16 bit unsigned	R/W	0

		enabled			
40007	ALARM1_ALARM2_TYPE	Alarm 1 / 2 Type configuration: MSB = 0 ALARM 1 ON MAXIMUM MSB = 1 ALARM 1 ON MINUMUM MSB = 2 ALARM 1 ON WINDOW MSB = 3 ALARM 1 DISABLE LSB = 0 ALARM 2 ON MAXIMUM LSB = 1 ALARM 2 ON MINUMUM LSB = 2 ALARM 2 ON WINDOW LSB = 3 ALARM 2 DISABLE	16 bit unsigned	R/W	0
40008 (MS) 40009 (LS)	ALARM1_HIGH_THRESHOLD	Alarm 1 High Threshold	Float	R/W	12000.0
40010 (MS) 40011 (LS)	ALARM1_LOW_THRESHOLD	Alarm 1 Low Threshold	Float	R/W	0.0
40012 (MS) 40013 (LS)	ALARM2_HIGH_THRESHOLD	Alarm 2 High Threshold	Float	R/W	16000.0
40014 (MS) 40015 (LS)	ALARM2_LOW_THRESHOLD	Alarm 2 Low Threshold	Float	R/W	0.0

40016 (MS) 40017 (LS)	HYSTERESYS_ALARM1	Alarm 1 hysteresis Value	Float	R/W	100.0
40018 (MS) 40019 (LS)	HYSTERESYS_ALARM2	Alarm 2 hysteresis Value	Float	R/W	100.0
40020	DELAY_SHOOTING_ALARM1	Alarm 1 Shooting Delay [Seconds/10]	unsigned 16	R/W	10 = 1 Second
40021	DELAY_RECOVERY_ALARM1	Alarm 1 Recovery Delay [Seconds/10]	unsigned 16	R/W	10 = 1 Second
40022	DELAY_SHOOTING_ALARM2	Alarm 2 Shooting Delay [Seconds/10]	unsigned 16	R/W	10 = 1 Second
40023	DELAY_RECOVERY_ALARM2	Alarm 2 Recovery Delay [Seconds/10]	unsigned 16	R/W	10 = 1 Second
40024 (MS) 40025 (LS)	CHECK_START_RANGE	Start Input Range for Range Check error	Float	R/W	20500.0
40026 (MS) 40027 (LS)	CHECK_STOP_RANGE	Stop Input Range for Range Check error	Float	R/W	3500.0
40100	Command	Command Register. Commands available are: 49568 = Module Reset 41217 = Close relays 1 41216 = Open relays 1 41473 = Close relays 2 41472 = Open relays 2 0 = normal operation	unsigned 16	R/W	0
40101	Status	Bit [10] = 1 input < Threshold 1 Low Bit [10] = 0 input >= Threshold 1 Low	unsigned 16	R	0

		Bit [9] = 1 input < threshold 2 Low Bit [9] = 1 input >= threshold 2 Low Bit [8] = 1 input < Threshold 2 High Bit [8] = 0 input >= Threshold 2 High Bit[7] =1 input > threshold 1 High Bit[7] =0 input <= threshold 1 High Bit [6] =1 Alarm 2 is set Bit [6] =0 Alarm 2 is not set Bit [5] = 1 Alarm 1 is set Bit [5] = 0 Alarm 1 is not set Bit [4]= 1 Input is under range Bit [3] = 1 Input is over range Bit [2] = 1 Temperature sensor Broken or Burned-out Bit [1] = 1 Cold Junction error Bit [0] = 1 EEprom error			
40112 (MS) 40113 (LS)	TC_mV_NC	Thermocouple equivalent voltage without the Cold junction compensation. These registers can be used also for read an	Float	R	0

		input from -10 mV to +70 mV			
40114 (MS) 40115 (LS)	TC_mV_C	Thermocouple equivalent voltage with the Cold junction compensation [mV]	Float	R	0
40116 (MS) 40117 (LS)	TC_value	Thermocouple measure value [°C] (with or without cold junction compensation)	Float	R	0
40118 (MS) 40119 (LS)	Rx_value	RTD Resistance value [Ohm] These registers can also be used for read a resistance value	Float	R	0
40120 (MS) 40121 (LS)	RTD_value	RTD Temperature value [°C]	Float	R	0
40122 (MS) 40123 (LS)	Current_value	Current measure value [uA = mA/1000] 1000 uA = 1 mA 20000 uA = 20 mA	Float	R	0
40124 (MS) 40125 (LS)	Voltage_value	Voltage measure value [mV]	Float	R	0
40126 (MS) 40127 (LS)	Rx_Wire1	Wire 1 Resistance measure [Ohm] (only for RTD measure at 3 or 4 wires). For Measure at 3 wires must be Rwire1=Rwire2=Rwire3 For Measure at 4 wires the value it's the wire resistance connected to the terminal screw 9.	Float	R	0
40128 (MS) 40129 (LS)	Rx_Wire2	Wire 2 Resistance measure [Ohm] (only for RTD measure at 4 wires). It's the resistance of the wire connected to the terminal screw 12.	Float	R	0

40130 (MS) 40131 (LS)	Potentiometer_value	Cursor % position on the Potentiometer [%]	Float	R	0
40134 (MS) 40135 (SL)	Measure_Value	Input Measure [uA, mV, %, °C] The measure unit depends from the input selected	Float	R	0

5. DEBUG LEDs

Three leds are available:

LED	LED status	Meaning
PWR	ON	Z113-1 is powered
PWR	OFF	Z113-1 is not powered
PWR	BLINKING	Input Out of Range or Burn Error
AL1	ON	The Alarm1 is shoot
AL1	OFF	The Alarm1 is Rearmed
AL2	ON	The Alarm2 is shoot
AL2	OFF	The Alarm2 is Rearmed

6. THE KIT-USB

The KIT-USB can be obtained from Seneca (Can be bought also from the E-commorce Website www.seneca.it)

The kit contain:

- A CD with the USB drivers for Windows and the Easy Setup software
- A standard mini-B USB Cable
- A standard micro USB Cable

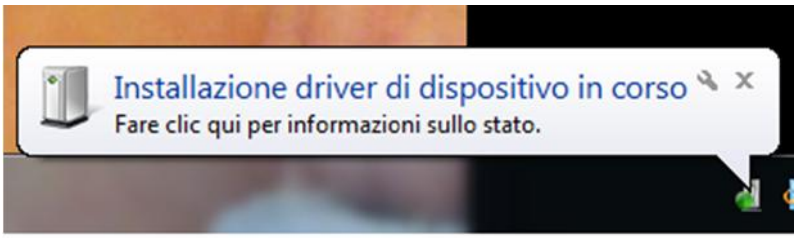
  The USB drivers can also be freely downloaded from the website:
  http://www.ftdichip.com/Drivers/VCP.htm

  The Easy Setup software can also be freely downloaded from the website:
  www.seneca.it

7. WINDOWS USB DRIVERS INSTALLATION

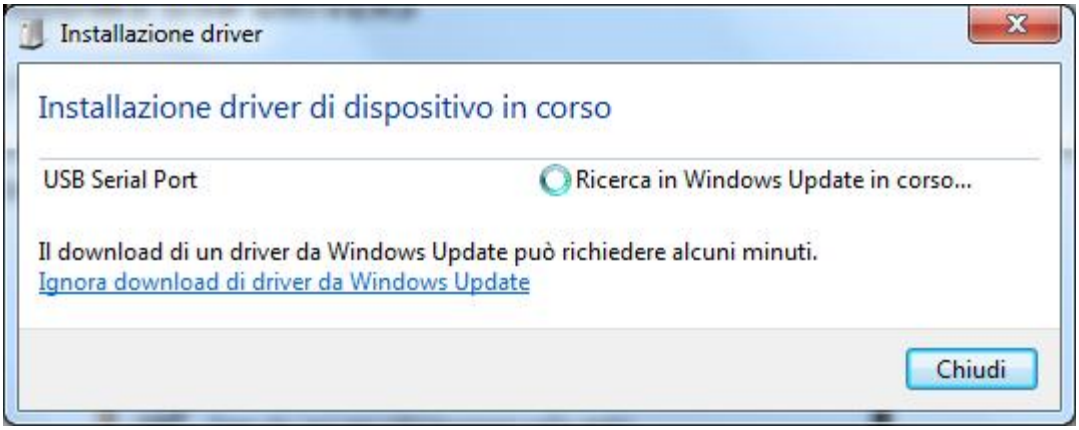
For installing the USB drivers follow this procedure:

- Power up the Z113-1 and then connect the USB to the PC, the new hardware it's detected:

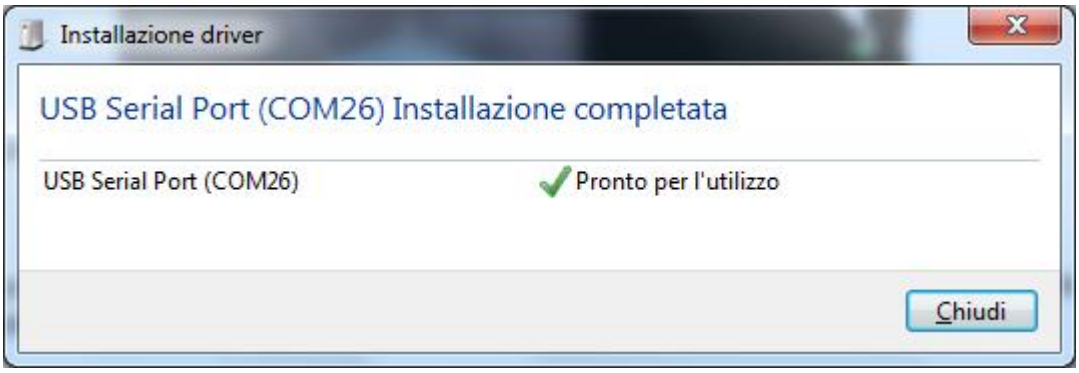


- If you don't have an internet connection insert the CD and install the FTDI driver or download the drivers from the website http://www.ftdichip.com/Drivers/VCP.htm

- If you have an internet connection the driver is automatically searched into the Windows Update database:



- After 3-4 minutes the driver is installed and the USB (USB Serial Port) is ready to use :



8. OTHERS OPERATING SYSTEM DRIVERS:

From the website:

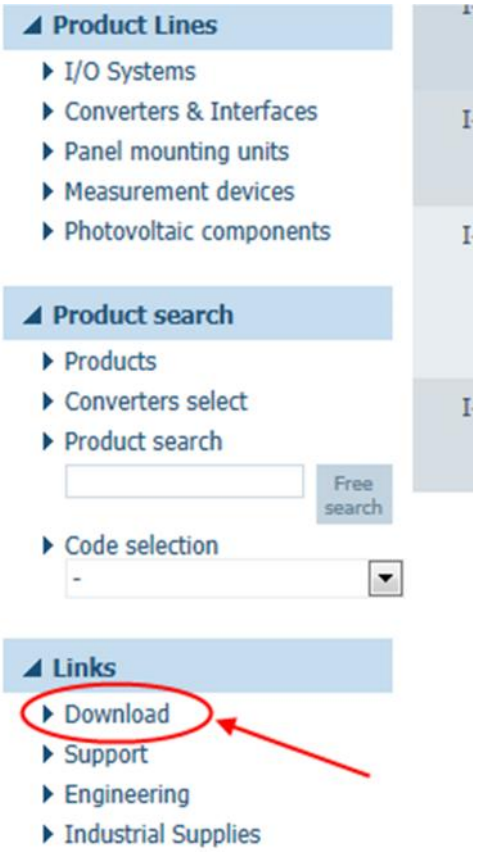
http://www.ftdichip.com/Drivers/VCP.htm

it's possible to download the USB drivers for :

Windows Xp, Vista, Windows 8, Windows 7
Linux
MAC OS
Windows CE

9. DOWNLOADING AND INSTALLING EASY SETUP SOFTWARE for Windows

From the Website www.seneca.it can be downloaded free of charge the Easy Setup suite software, select Download from the Links section:



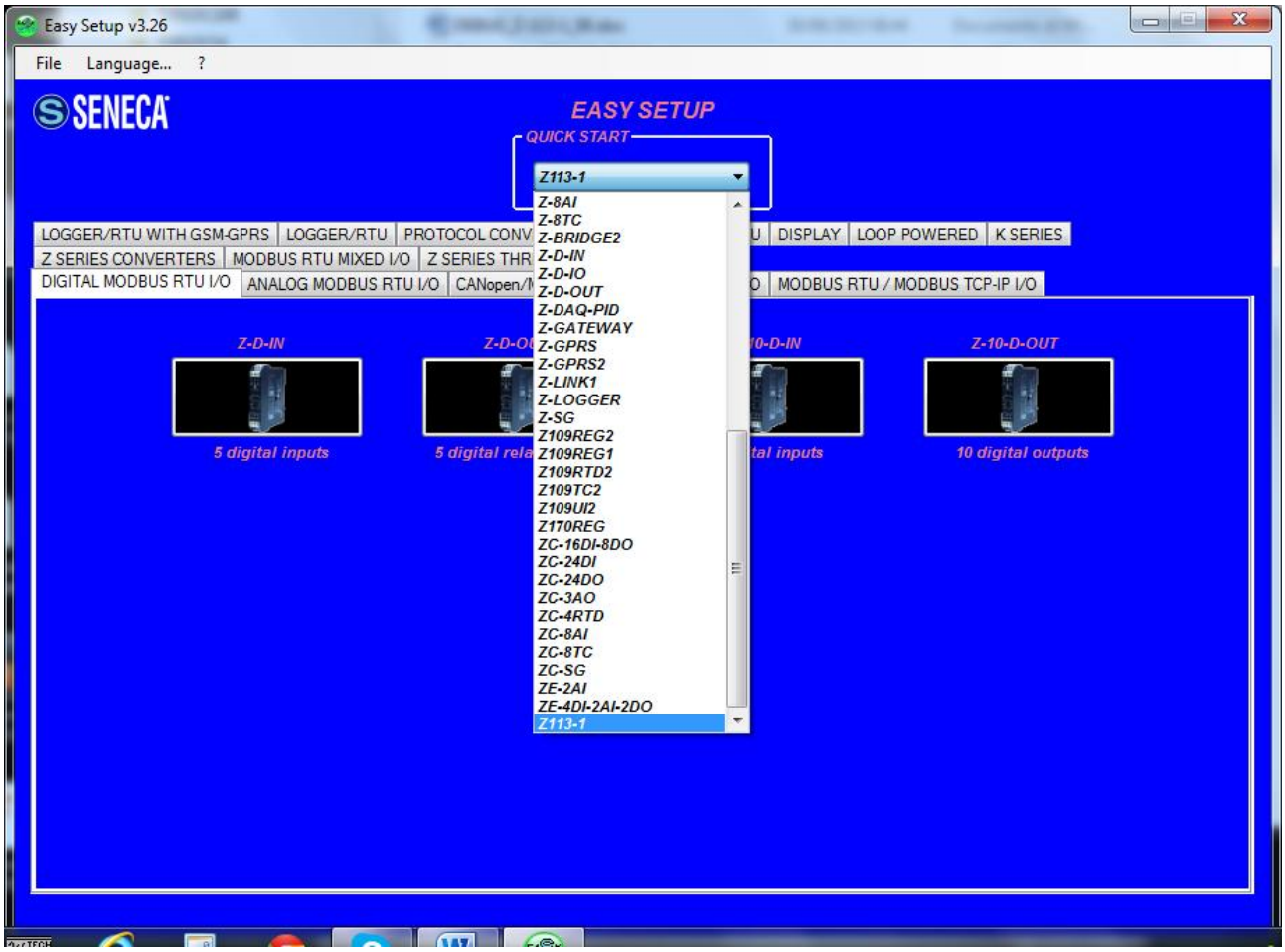
Then download the last Easy Setup version:

Easy Setup works on Windows XP 32/64 bits, Windows Vista 32/64 bits and Windows 7 32/64 bits.

Note that If you want to configure the Z113-1 you must FIRST install the USB drivers (see chapter 7).

Extract the zip file and double click on the Setup file for install the software.

From the Quick Start menu select the Z113-1 model (you can also click on the tab “Z-SERIES THRESHOLD” and select the Z113-1 button).



Now the configuration software “Easy Z113-1” starts.

10. Z113-1 CONFIGURATION

The Easy Setup software will configure the Z113-1 module in a fast and easy way. A test section is also available for debug.

Press next to start the configuration process:

The connection page will be displayed:

Now you can connect the PC with the Z113-1 (online configuration, automatic search) or create an offline configuration (no search).

Note that for connect to the PC you must first power up the Z113-1.

10.1. AUTOMATIC SEARCH

By clicking the “automatic search” button the software will search on all serials connect to the PC the Z113-1 module.

This phase take from seconds to 2-3 minutes depending from the numbers of serial available on the PC:

When Z113-1 is found the configuration menu will be displayed with the firmware revision code to lower left corner:

10.2. NO SEARCH

Select this mode if you don’t have a Z113-1 module connected to the PC but you want to save to file a configuration that can be used in the future.

10.3. CONFIGURATION MENU

In this menu you can:

Create a new configuration, reading an existing configuration from file o from the z113-1 or using the test configuration page (available only on online mode).

10.4. NEW CONFIGURATION

10.4.1. INPUT CONFIGURATION

In the first configuration page all the input settings can be configured:

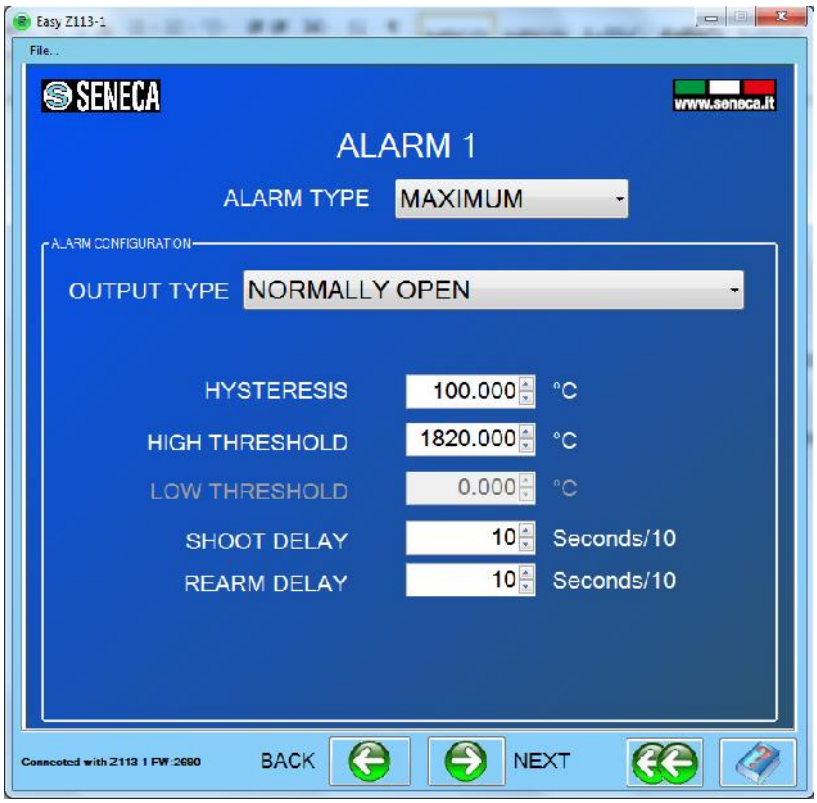
Select the ***Input Type*** from: Current, Voltage, Potentiometer, Thermocouple, PT100, Ni100, PT500 or PT1000.

If you have select a Thermocouple it's possible to activate the internal ***Cold Junction Compensation*** to obtain a best measure.

Rejection can be set to 50 Hz (Europe) or 60 Hz (America).

The input ***Filter Level*** can be set from 0 (no filter) to 19 (max filter).

10.4.2. ALARM 1 / 2 CONFIGURATION



Select the ***Alarm Type*** from:

Maximum (the alarm is set if the input is higher than the high threshold)

Minimum (the alarm is set if the input is lower than the low threshold)

Window (the alarm is set if the value is higher than the high threshold or lower than the low threshold)

Disable (the alarm is disabled).

The ***Output Type*** relays can be configured on normally open or normally close.

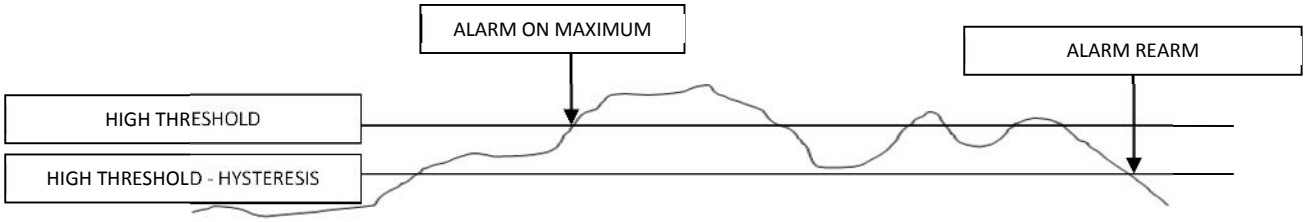
Note

You can change the alarm logic by changing the normally open/ normally close output mode.

Hysteresis can be used for deleting the glitch input effect on the alarm:

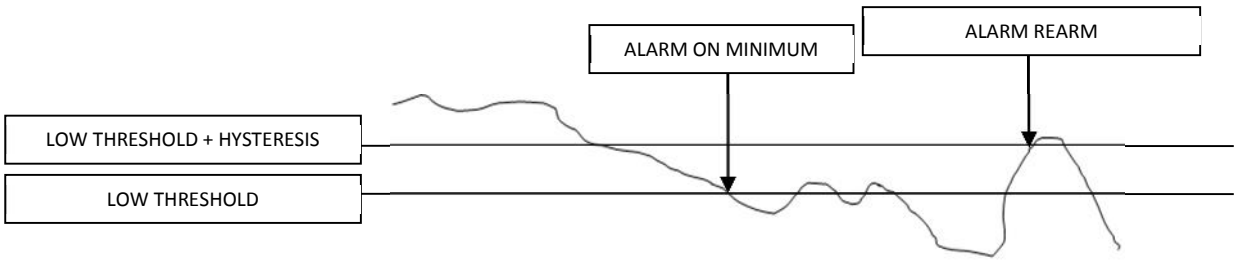
When the alarm is set on **MAXIMUM** the alarm will shoot at an higher value than the High Threshold but the Recovery will be at:

$$RearmValue = HighThreshold - Hysteresis$$



When the alarm is set on **MINIMUM** the alarm will shoot at a lower value than the Low Threshold but the Recovery will be at:

$$RearmValue = LowThreshold + Hysteresis$$

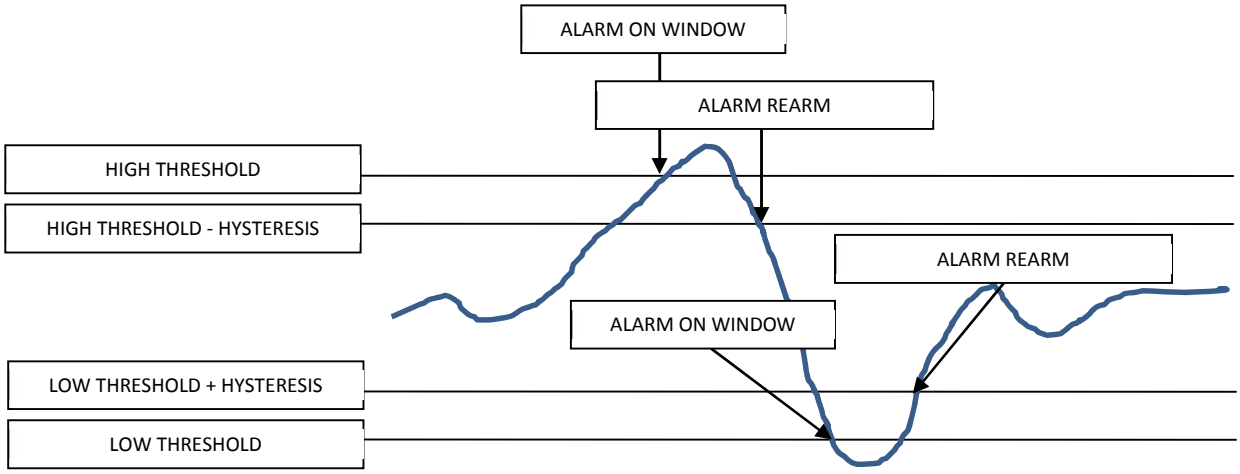


When the alarm is set on **WINDOW** the alarm will shoot at the low Threshold Value or at high Threshold Value but the Recovery will be from:

$$RearmValueHigh = HighThreshold - Hysteresis$$

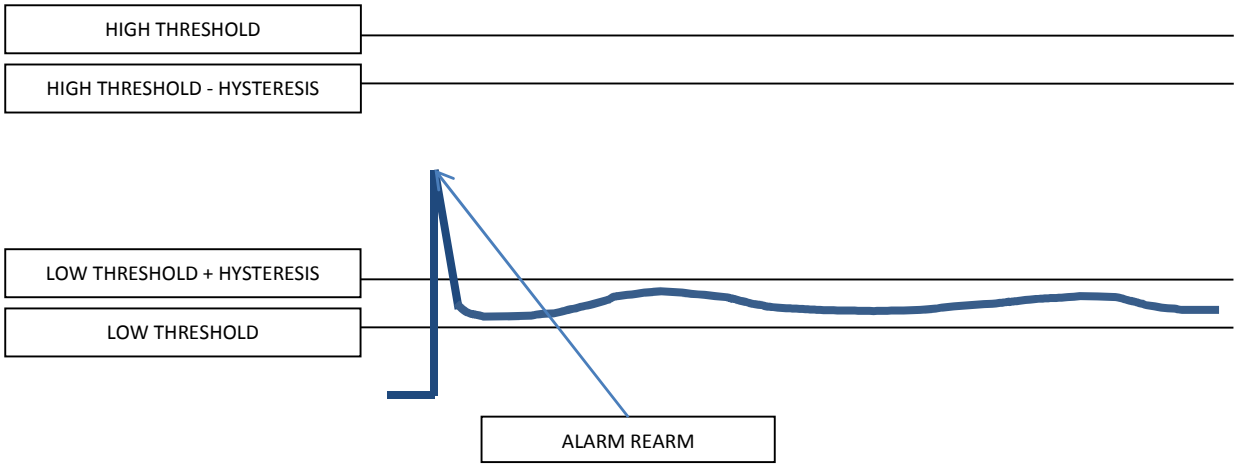
To

$$RearmValueLow = LowThreshold + Hysteresis$$



NOTE

In the Window alarm a fast input change value into the (High Threshold-Hysteresis) and (Low Threshold-Hysteresis) rearm the Alarm:



In this case you can activate the filter for bypass the input glitch effect.

Shoot Delay is used for obtain a temporal hysteresis, the alarm is shoot only if the Alarm is set for more than Shoot Delay time. When the alarm is not set The shoot delay time is always recharged. The value must be entered in seconds/10 so if you want to enter 1 second you must enter a value of 10, if you want enter 60 seconds write 600 etc.. (max value 100 minutes).

Recovery Delay is used for obtain a temporal hysteresis, the alarm is Rearmed only if the Alarm is not set for more than Recovery Delay time. When the alarm is Set The Recovery delay time is always recharged. The value must be entered in seconds/10 so if you want to enter 1 second you must enter a value of 10, if you want enter 60 seconds write 600 etc.. (max value 100 minutes).

Shoot Delay is used for obtain a temporal hysteresis, the alarm is shoot only if the Alarm is set for more than Shoot Delay time. When the alarm is not set The shoot delay time is always recharged. The value must be entered in seconds/10 so if you want to enter 1 second you must enter a value of 10, if you want enter 60 seconds write 600 etc… (max value 100 minutes).

Recovery Delay is used for obtain a temporal hysteresis, the alarm is Rearmed only if the Alarm is not set for more than Recovery Delay time. When the alarm is Set The Recovery delay time is always recharged. The value must be entered in seconds/10 so if you want to enter 1 second you must enter a value of 10, if you want enter 60 seconds write 600 etc... (max value 100 minutes).

10.4.3. BEHAVIOUR ON SENSOR FAIL

In this page you can set the sensor behavior:

Fail check on temperature sensor is used for checking if the temperature sensor is burned or broken. In this case the input value can be written with the start or the end sensor scale (see the table below), note that the new input value is used for the alarms:

SENSOR TYPE	START SCALE [°C]	STOP SCALE [°C]
TC J	-210	1200
TC K	-200	1370
TC R	-50	1760
TC S	-50	1760
TC T	-200	400
TC B	0	1820
TC E	-200	1000
TC N	-200	1300
NI100	-60	250

PT100	-200	660
PT500	-200	660
PT1000	-200	660

Input Range Check is used for checking the input range, select a start input input range and a stop input range. When the input is out of the configured range the input value can be written the start or the end input scale (see the table below), note that the new input value is used for the alarms:

INPUT TYPE	**START SCALE**	**STOP SCALE**
VOLTAGE[mV]	-500	11000
CURRENT[uA]	-500	21000
POTENTIOMETER[%]	-5	105
TC J [°C]	-210	1200
TC K [°C]	-200	1370
TC R [°C]	-50	1760
TC S [°C]	-50	1760
TC T [°C]	-200	400
TC B [°C]	0	1820
TC E [°C]	-200	1000
TC N [°C]	-200	1300
NI100 [°C]	-60	250
PT100 [°C]	-200	660
PT500 [°C]	-200	660
PT1000 [°C]	-200	660

10.5. CONFIGURATION COMPLETED MENU

Now you can send the configuration to the Z113-1 connected (only if you are in online mode), save the configuration to a file or return to the Configuration Menu

10.6. TEST CONFIGURATION

In the configuration Menu select the Configuration test (only if you are in online mode):

In this page the realtime value is displayed in the upper of the page, you can also check the alarms or the various fail mode in the lower of the page.