

General Description
 The Z-8TC instrument is a digital converter for thermocouples, with eight measuring channels, which are insulated from the power supply and from the serial communication line up to 1.5 kV. The same 1.5 kV insulation is present among the input channels belonging to different groups of terminals. The instrument is therefore characterized by a six points global insulation. Furthermore, the module has:

- Facilitated wiring of power supply and serial bus by means of the bus housed in the DIN rail.
- Communication can be configured by DIP-switch or software.
- RS485 serial communication with MODBUS-RTU protocol, 32 nodes maximum.
- Inputs protected against ESD discharges up to 4 kV.
- High acquisition speed.
- Measurement of thermocouples: J, K, E, N, S, R, B, T.
- Measurement of the inputs available in the following formats: floating-point representation, reverse floating-point, fixed dot at 16 bits, in tenths degrees with sign for temperature, tenths of μV for voltage.
- Channels independently activable.
- Programmable value in case of fault or freezing of last reading.

For each pair of inputs belonging to the same group of terminals the following common settings are possible:

- Measurement in temperature or mV.
- Filter programmable at eight levels to stabilise reading.
- Rejection programmable at 50 Hz or 60 Hz.
- Three selectable acquisition speeds (two at 14 bits, one at 15 bits).
- Cold Junction Compensation.

Technical Specifications	
Power Supply:	10...40 Vdc or 19...28 Vac (50...60 Hz), max 0,6 W.
Consumption :	
Serial Communication Ports :	-RS485, 1200...115200 Baud. -RS232, 2400 Baud, Address: 1, Parity: NO, Data bits: 8; Stop bits: 1. MODBUS-RTU.
Inputs	
Inputs :	Thermocouple types: J, K, E, N, S, R, B, T.
Tables :	EN60584-1 (ITS-90).
Temperature Range :	Dependent on the thermocouple type (see Thermocouples Range table).
Span mV:	-10,1...81,4 mV.
Impedance :	10 M Ω .
Total Error:	14 bits ADC and 50 Hz Rejection: "(0,040 % + 13 μV). 15 bits ADC and 50 Hz Rejection: "(0,035 % + 10 μV). 14 bits ADC and 60 Hz Rejection: "(0,045 % + 16 μV). 15 bits ADC and 60 Hz Rejection: "(0,040 % + 12 μV).

Test Current :	<50 nA.
CMRR ⁽¹⁾ :	>155 dB (tested port towards all the other ones at GND).
DMRR ⁽¹⁾⁽²⁾ :	>60 dB.

THERMOCOUPLES RANGE					
TC TYPE	Allowed Range	Linearization Error	TC TYPE	Allowed Range	Linearization Error
J	-210...1200 °C	0,05 °C	S	-50...1768 °C	0,02 °C
K	-200...1372 °C	0,05 °C	R	-50...1768 °C	0,02 °C
E	-200...1000 °C	0,02 °C	B	250...1820 °C ⁽³⁾	0,03 °C
N	-200...1300 °C	0,04 °C	T	-200...400 °C	0,04 °C

Other Features

ADC : Settable to 14 or 15 bits.
 Thermal Drift : < 100 ppm/K.
 Disturbance Rejection : Settable to 50 Hz or 60 Hz.
 Cold Junction Error : <1 °C.
 Insulation Voltage : 1500 Vac among input, power supply and communication ports.
 1500 Vac among channels belonging to different groups of terminals.
 Protection Degree : IP20.
 Environmental conditions : Temperature -10...+65 °C. Saving of parameters in EEPROM guaranteed in range: 0...50 °C.
 Humidity 30...90 % not-condensing.
 Altitude: up to 2000 m a.s.l.
 Storage temperature : -20...+85 °C.
 Signalling by LED : Power Supply, Fail, RS485 Communication.
 Connections : -Removable 4-way screw terminals., max 1.5 mm², 3.5 mm pitch.
 -Rear IDC10 connector for DIN rail.
 -3.5 mm stereophonic front jack for RS232 (COM) connection.

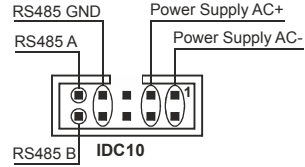
Box : PBT, black.
 Dimensions and weight : 100 x 112 x 17,5 mm, 140 g.
 Standards : EN61000-6-4/2002 (electromagnetic emission, industrial environment)
 EN61000-6-2/2005 (electromagnetic immunity, industrial environment)
 EN61010-1/2001 (safety).
 All circuits must be insulated from the other circuits under dangerous voltage with double insulation. The power supply transformer must comply with EN60742: "Insulated transformers and safety transformers".

⁽¹⁾ The values are valid at the set rejection frequency, with the filter ON.
⁽²⁾ For disturbance values such as the input signal peak does not exceed the limit of acceptability.
⁽³⁾ Up to 250 °C, the input is considered equivalent to a null temperature.

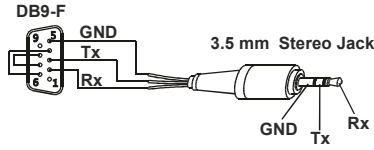
Installation rules
 The module is designed to be installed in vertical position on a DIN 46277 rail. In order to ensure optimum performance and the longest working life, the module(s) must be supplied adequate ventilation and no raceways or other objects that obstruct the ventilation slots.
 Never install modules above sources of heat; we recommend installation in the lower part of the control panel.

Electric Connections

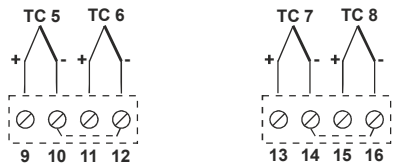
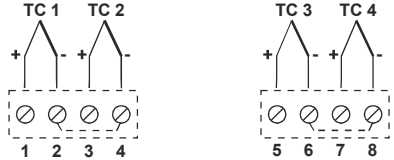
POWER SUPPLY AND RS485 COMMUNICATION PORT
 The electric connections for power supply and RS485 bus can be made only by using the bus for the Seneca DIN rail.
 The connections of the bus connector are described on the following figure.



RS232 SERIAL PORT
 Connection cable DB9 with a 3.5 mm stereo Jack, can be assembled as indicated in the following figure, or can be bought as an accessory.
 We advise you that the GND of the RS232 is the same of RS485.



INPUTS
 The module accepts, at input, the following types of thermocouples: J, K, E, N, S, R, B, T. For the electrical connections, we advise you to use screened cables.



The pairs of channels belonging to the same group of terminals, have the GND terminal internally connected and are not insulated each other.
 Instead a 1.5 kV insulation is present among the input channels belonging to different groups of terminals.

PWR LED (GREEN)	Meaning
Steady	Power Supply is present.
ERR LED (YELLOW)	Meaning
Steady	Fault: insufficient power supply, faulty channel, faulty TC, internal communication error (signalled if the channel has been activated).
RX LED (RED)	Meaning
Steady	Data are being received through the RS485 communication port.

TX LED (RED)	Meaning
Steady	Data are being transmitted through the RS485 communication port.

Serial interface
 For detailed information on RS485 serial interface, consult the documentation provided by the website www.seneca.it, in the section **Prodotti/Serie Z-PC/MODBUS TUTORIAL**.

DIP-SWITCH SETTING

The instrument leaves the factory with all DIP-switches configured in position 0. The settings of the DIP-switches defines the module's communication parameters: address and speed.
 In all the following tables, the indication ● corresponds to a DIP-switch set in 1 (ON); no indication is provided when the DIP-switch is set in 0 (OFF).

SPEED	
SW1	1 2
	● 9600 Baud
	● 19200 Baud
	● 38400 Baud
	● 57600 Baud

ADDRESS	
SW1	3 4 5 6 7 8
	Communication Parameters from EEPROM ⁽⁴⁾
	● Fixed Address: 01
	● Fixed Address: 02
	● Fixed Address: 03
	● Fixed Address: 04
X X X X X X	Fixed Address, as from binary representation.
● ● ● ● ● ●	Fixed Address: 63

NOT USED	
SW1	9
	Not used.
	Leave to OFF position.

RS485 TERMINATOR	
SW1	10
	Terminator OFF.
●	Terminator ON.

⁽⁴⁾ The default configuration is the following: Address 1, 38400, no parity, 1 stop bit.

DEFAULT SETTING OF INPUT CHANNELS
 The default configuration, valid for each pair of channels, belonging to the same group of terminals is the following :

Enabling :	Both channels are enabled.
Type of returned Data :	°C
Cold junction Compensation :	Active
Rejection :	50 Hz
ADC / Filter :	ADC: 15 bit, Filter: average,
Thermocouple Type :	J for both channels.

FILTER SETTING
 The filtering methods can be set for each pair of channels. The filter consists of two independent low-pass filters:
 -FIR Filter, in running average, able to increase the rejection of disturbances to the mains power line frequency and to reduce measuring noise.
 -IIR exponential Filter, with programmable time constant, able to dampen fluctuations.

If an input variation higher than the threshold T is detected, both filters are forced to adapt rapidly to the new value, stabilising it only later on. The value of the threshold in voltage is fixed and equal to 0,75 mV. The filter is set with the three least significant bits of registers MODBUS 40054..57 (refer to section **MODBUS REGISTERS**).
 The following is a table containing all settable filter types. The propagation time (90%) is indicated for each filter, i.e. the maximum time between the step variation of the input and the variation of the number which represents it in the Modbus register, including the interrogation time of the single register (at 115 kbaud). The times indicated are valid if both the following conditions are respected:

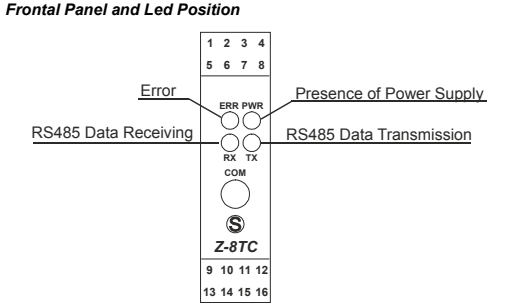
- Rejection set to 50 Hz. For 60 Hz rejection divide the times by 1,2.
- Only one of the two thermocouples of the same group is enabled. If both thermocouples are enabled, the propagation times approximately are doubled.

SET	SAMPLING		FILTER TYPE	PROP. TIME 90%	
	Bits ADC	Hz		<T	>T
000	14	48	Not present	45 ms	45 ms
001	14	20	Average	236 ms	103 ms
010 ⁽⁵⁾	15	11	Average	405 ms	179 ms
011	15	11	Average + exp	1 s	179 ms
100	15	11	Average + exp	3 s	179 ms
101	15	11	Average + exp	8 s	179 ms
110	15	11	Average + exp	24 s	179 ms
111	15	11	Average + exp	72 s	179 ms

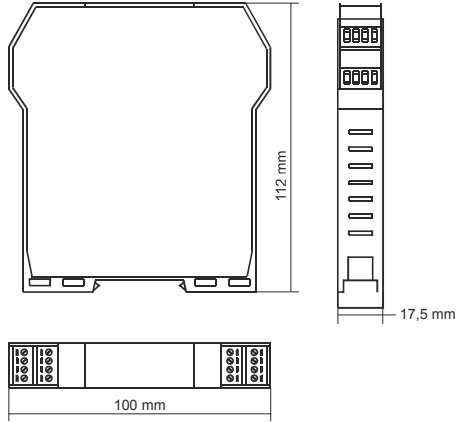
⁽⁵⁾ Default Value.

Programming
 For the product's programming and/or configuration tools, consult the website www.seneca.it.
 During initial programming, the EEPROM (SW3 .8 in OFF position) default setting values originally programmed as follows can be used:
Address = 1, SPEED = 38400 baud, PARITY = none, BIT NUMBER = 8, STOP BIT = 1.

The module can also be programmed through the front connector (COM) while paying attention to the following connection parameters:
Address = 1, Speed = 2400 Baud, PARITY = none, STOP BIT = 1.
 The COM communication port behaves in the same way as the RS485 bus port except for the communication parameters described above. It also has priority over the RS485 serial port and closes after 3 seconds of inactivity.



Dimensions and Overall dimensions



MODBUS REGISTERS

Z-8TC has MODBUS 16 bits (words) registers, accessible by RS485 or RS232 serial communication. In the next paragraphs, we shall describe the supported MODBUS commands, and the functions of the registers.

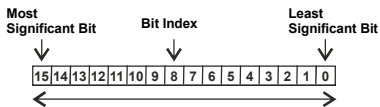
Supported MODBUS Commands

Table with 3 columns: Code, Function, Description. Rows include Read Holding Registers, Read Input Registers, Write Single Register, and Write Multiple Registers.

(*) The two functions have the same effect.

Holding Registers

The 16-bit Holding Registers have the following structure:



In the table the notation Bit [x:y] indicates all bits from x to y. For example Bit [2:1] indicates bit 2 and bit 1, and serves to illustrate the meaning of the various united combinations of the values of the two bits. Remember that MODBUS functions 3, 4, 6 and 16, of single or multiple writing and reading, can be executed in the following registers. Default values are indicated with the * symbol.

Table mapping REGISTER to Description, ADD., and R/W. Includes MACHINER ID, STATUS_INP, and various Bit 15-11 descriptions.

Table for registers CHAN1_TEN through CHAN7_TEN, showing measurement values in tenths of °C or tenths of uV and bit status descriptions.

Table for registers CHAN8_TEN through CHAN5_FLOAT_H, showing measurement values and bit status descriptions.

Table for registers CHAN5_FLOAT_L through CHAN8_FLOAT_L, showing measurement values and bit status descriptions.

Table for registers JUNCT_TEN_IN7_8 through RESET, showing cold junction temperature and module reset functions.

Table for registers ADDR and BAUDR, showing module address/parity control and baudrate/response delay time settings.

Table for registers Bit [10:8], Bit [7:4], Bit [3:0], CONF_CH3_CH4, CONF_CH5_CH6, CONF_CH7_CH8, AUX_SETTINGS, Bit 15, Bit [14:8], Bit 7, Bit 6, Bit 5, Bit 4, Bit 3, Bit 2, Bit 1, and Bit 0, covering filter settings and configuration.

Table for VAL_FAULT_1 through VAL_FAULT_8, showing fault status and response time, and TABLE: THERMOCOUPLE TYPE FOR THE SETTING OF REGISTERS 40054..40057.

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