USER MANUAL

Z-8TC

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MI002613-E

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Seneca Z-PC Line module: **Z-8TC**

The Z-8TC module acquires up to 8 single-ended signals (voltage-type, from the: signal generator or thermocouple) and it converts them to a digital format (normalized measure).

General characteristics

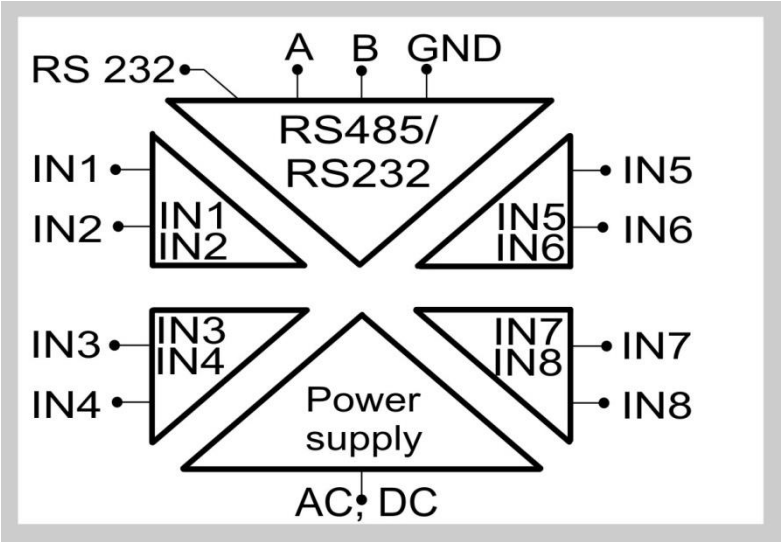
- It is possible to choose if measure is voltage (mV) or temperature (°C) type, for each couple of input signals: IN1 and IN2, IN3 and IN4, IN5 and IN6, IN7 and IN8
- It is possible to enable/disable each input
- Configuration of a filter applied to each couple of input signals
- It is possible to enable/disable cold-junction compensation, for each couple of input signals
- It is possible to configure module (node) address and baud-rate by Dip-Switches
- It is possible to add/remove the module to/from RS485-bus without disconnecting the communication or power supply
- It is possible to switch automatically from RS485 to USB or vice versa

Features

INPUT	
Number	8
Resolution	14bits (if filter=0-1); 15 bits (if filter=2-7)
Sampling frequency	Configurable between: 48Hz (if the filter is deactivated), 20Hz (if filter=1), 11Hz (if filter=2-7)
Rejection	50Hz or 60 Hz
Filter (0-7)	IIR and FIR; configurable between: 0 (deactivated), from 1(min) to 7(max)
Accuracy	Initial: 0.1% of E.E.S. (Electrical End Scale)
	Thermal stability: < 100 ppm/°K
	EMI: < 1%
Protection	This module provides inputs protection against the ESD (up to 4kV)
Voltage-type IN (from the thermocouple)	Bipolar with E.S.S./E.E.S. (Electrical Start/End Scale) unchangeable between: -10.1mV..+81.4mV. TC-type: J, K, R, S, T, B, E, N. Automatic detection if a TC interruption occurs: if this option is enabled, test current:<50nA. Input impedance: > 10 MΩ

CONNECTIONS	
RS485 interface	IDC10 connector for DIN 46277 rail (back-side panel)
USB interface	Micro USB connector
1500 Vac ISOLATIONS	
	Between: power supply, RS485/USB, inputs 1/2, inputs 3/4, inputs 5/6, inputs 7/8

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POWER SUPPLY	
Supply voltage	10 – 40 Vdc or 19 – 28 Vac (50Hz - 60Hz)
Power consumption	Max: 0.6W

The power supply transformer necessary to supply the module must comply with EN60742 (Isolated transformers and safety transformers requirements). To protect the power supply, it is recommended to install a fuse.

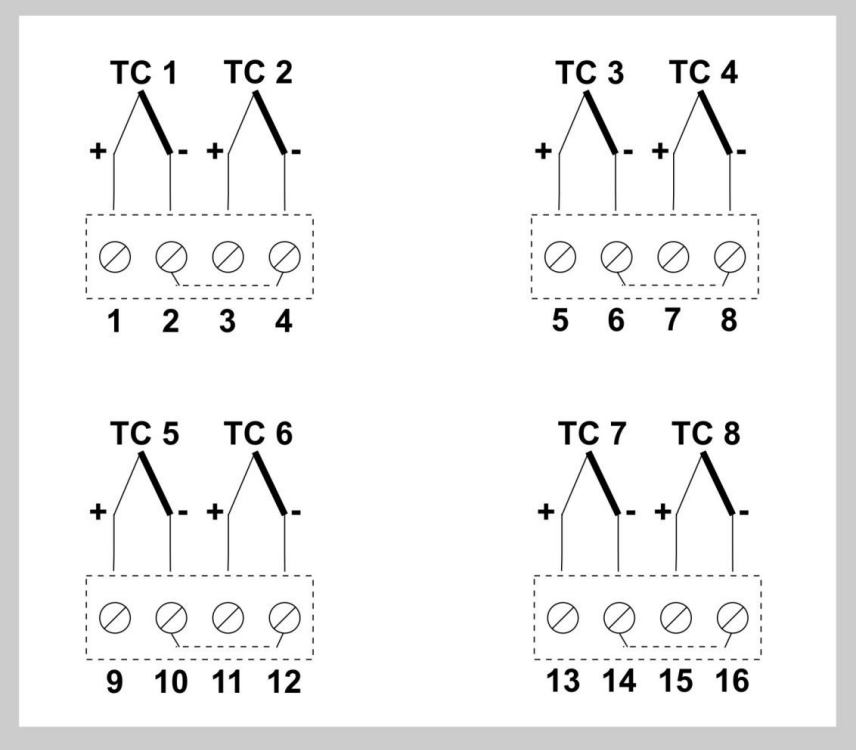
Input connections

The Z-8TC module has a digital thermometer (DT sensor) internally to compensate the cold-junction effect, if a thermocouple is connected to input.

To decrease the signal-acquisition errors due to noise effects, short-circuit each unused TC-type input to the GND, for each couple of inputs. In particular:

- unused screw terminal 1 and/or 3 to the screw terminal 2 or 4 (GND for input 1 and input 2);
- unused screw terminal 5 and/or 7 to the screw terminal 6 or 8 (GND for input 3 and input 4);
- unused screw terminal 9 and/or 11 to the screw terminal 10 or 12 (GND for input 5 and input 6);
- unused screw terminal 13 and/or 15 to the screw terminal 14 or 16 (GND for input 7 and input 8).

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In the following figure are shown the cable colors for each type of thermocouple.

THERMOCOUPLE	ALLOY	ANSI MC96.1 (USA)		DIN43710 (D)		IEC 584-3 (EUROPE)	
		-	+	-	+	-	+
TC J	Fe-Co	red	white	blue	red	white	black
TC K	Cr-Al	red	yellow	green	red	white	green
TC R	Pt13%Rh-Pt	red	black	white	red	white	orange
TC S	Pt10%Rh-Pt	red	black	white	red	white	orange
TC T	Cu-Co	red	blue	brown	red	white	brown
TC E	Cr-Co	red	purple	black	red	white	purple
TC B	Pt30%Rh-Pt6%Rh	red	grey	red	grey	white	grey
TC N	Nicrosil-Nisil	red	brown	/	/	white	pink

The input scale range values, for selected thermocouple-type input, are shown in the following table.

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TC-type	Scale range	TC-type	Scale range
J	-210°C..1200°C	S	-50°C..1768°C
K	-200°C..1372°C	R	-50°C..1768°C
E	-200°C..1000°C	B	250°C..1820°C
N	-210°C..1300°C	T	-200°C..400°C

Dip-switches table

In the following tables: box without circle means Dip-Switch=0 (OFF state); box with circle means Dip-Switch=1 (ON state).

BAUD-RATE (Dip-Switches: DIP-SWITCH STATUS)		
1	2	Meaning
		Baud-rate=9600 Baud
	●	Baud-rate=19200 Baud
●		Baud-rate=38400 Baud
●	●	Baud-rate=57600 Baud

ADDRESS (Dip-Switches: DIP-SWITCH STATUS)						
3	4	5	6	7	8	Meaning
						Address and Baud-Rate are acquired from memory(EEPROM)
					●	Address=1
				●		Address=2
				●	●	Address=3
			●			Address=4
X	X	X	X	X	X	……
●	●	●	●	●	●	Address=63

RS485 TERMINATOR (Dip-Switches: DIP-SWITCH STATUS)		
9	10	Meaning
		RS485 terminator disabled
	●	RS485 terminator enabled

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Modbus RTU Register table

Name	Range	Interpretation of register	R/W	Default	Address
MachineID	/	MSB, LSB	R		40001
	Id_Code (Module ID)			0x18 (24 decimal)	Bit [15:8]
	Ext_Rev (Module version)				Bit [7:0]
Errors	/	Bit	R		40002
	Input 1 and input 2 error: 0=there isn't; 1=there is			/	Bit 15
	Input 3 and input 4 error: 0=there isn't; 1=there is			/	Bit 14
	Input 5 and input 6 error: 0=there isn't; 1=there is			/	Bit 13
	Input 7 and input 8 error: 0=there isn't; 1=there is			/	Bit 12
	Input 1 burn-out error (if TC-type input): 0=there isn't; 1=there is			/	Bit 11
	Input 2 burn-out error (if TC-type input): 0=there isn't; 1=there is			/	Bit 10
	Input 3 burn-out error (if TC-type input): 0=there isn't; 1=there is			/	Bit 9
	Input 4 burn-out error (if TC-type input): 0=there isn't; 1=there is			/	Bit 8
	Input 5 burn-out error (if TC-type input): 0=there isn't; 1=there is			/	Bit 7
	Input 6 burn-out error (if TC-type input): 0=there isn't; 1=there is			/	Bit 6
	Input 7 burn-out error (if TC-type input): 0=there isn't; 1=there is			/	Bit 5
	Input 8 burn-out error (if TC-type input): 0=there isn't; 1=there is			/	Bit 4
	Input 1 and input 2 communication error: 0=there isn't; 1=there is			/	Bit 3
	Input 3 and input 4 communication error: 0=there isn't; 1=there is			/	Bit 2
	Input 5 and input 6 communication error: 0=there isn't; 1=there is			/	Bit 1
	Input 7 and input 8 communication error: 0=there isn't; 1=there is			/	Bit 0
Errors IN1-2 IN3-4	/	Bit	R		40037
	Supply-voltage error for input 1 and input 2: 0=there isn't; 1=there is			/	Bit 15
	RS485-reception error for input 1 and input 2: 0=there isn't; 1=there is			/	Bit 14
	Memory error (EEPROM) for input 1 and input 2: 0=there isn't; 1=there is			/	Bit 13
	These bits aren't used			/	Bit [12:9]

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	CRC EEPROM error for input 1 and input 2: 0=there isn't; 1=there is. If "1", it is not possible to save in memory (EEPROM)			/	Bit 8
	Supply-voltage error for input 3 and input 4: 0=there isn't; 1=there is			/	Bit 7
	RS485-reception error for input 3 and input 4: 0=there isn't; 1=there is			/	Bit 6
	Memory error (EEPROM) for input 3 and input 4: 0=there isn't; 1=there is			/	Bit 5
	These bits aren't used			/	Bit [4:1]
	CRC EEPROM error for input 3 and input 4: 0=there isn't; 1=there is. If "1", it is not possible to save in memory (EEPROM)			/	Bit 0
Errors IN5-6 IN7-8	/	Bit	R		40038
	Supply-voltage error for input 5 and input 6: 0=there isn't; 1=there is			/	Bit 15
	RS485-reception error for input 5 and input 6: 0=there isn't; 1=there is			/	Bit 14
	Memory error (EEPROM) for input 5 and input 6: 0=there isn't; 1=there is			/	Bit 13
	These bits aren't used			/	Bit [12:9]
	CRC EEPROM error for input 5 and input 6: 0=there isn't; 1=there is. If "1", it is not possible to save in memory (EEPROM)			/	Bit 8
	Supply-voltage error for input 7 and input 8: 0=there isn't; 1=there is			/	Bit 7
	RS485-reception error for input 7 and input 8: 0=there isn't; 1=there is			/	Bit 6
	Memory error (EEPROM) for input 7 and input 8: 0=there isn't; 1=there is			/	Bit 5
	These bits aren't used			/	Bit [4:1]
	CRC EEPROM error for input 7 and input 8: 0=there isn't; 1=there is. If "1", it is not possible to save in memory (EEPROM)			/	Bit 0
Config IN1-2	/	Bit	R/W		40054
	Input1 enabling: 0=deactivated; 1=activated			1	Bit 15
	Input2 enabling: 0=deactivated; 1=activated			1	Bit 14
	Input1 and input 2 measure type: 1=voltage [mV]; 0=temperature [°C]			0	Bit 13
	Cold-junction compensation for input 1 and input2: 0=deactivated; 1=activated			1	Bit 12
	Rejection: 0=50Hz; 1=60Hz			0	Bit 11
	Filter applied to acquired input1 and input2. To know the configurations of bit40054.[10:8], see table1			0b010	Bit [10:8]
	Thermocouple type of input 1. To know the configurations of bit40054.[7:4], see table 2			0b0000 (TC J)	Bit [7:4]
	Thermocouple type of input 2. To know the configurations of bit40054.[3:0], see table 2			0b0000 (TC J)	Bit [3:0]
Config IN3-4	/	Bit	R/W		40055
	Input3 enabling: 0=deactivated; 1=activated			1	Bit 15
	Input4 enabling: 0=deactivated; 1=activated			1	Bit 14
	Input3 and input 4 measure type: 1=voltage [mV]; 0=temperature [°C]			0	Bit 13
	Cold-junction compensation for input 3 and input4: 0=deactivated; 1=activated			1	Bit 12
	Rejection: 0=50Hz; 1=60Hz			0	Bit 11

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	Filter applied to acquired input3 and input4. To know the configurations of bit40055.[10:8], see table1			0b010	Bit [10:8]
	Thermocouple type of input 3. To know the configurations of bit40055.[7:4], see table 2			0b0000 (TC J)	Bit [7:4]
	Thermocouple type of input 4. To know the configurations of bit40055.[3:0], see table 2			0b0000 (TC J)	Bit [3:0]
Config IN5-6	/	Bit	R/W		40056
	Input5 enabling: 0=deactivated; 1=activated			1	Bit 15
	Input6 enabling: 0=deactivated; 1=activated			1	Bit 14
	Input5 and input 6 measure type: 1=voltage [mV]; 0=temperature [°C]			0	Bit 13
	Cold-junction compensation for input 5 and input6: 0=deactivated; 1=activated			1	Bit 12
	Rejection: 0=50Hz; 1=60Hz			0	Bit 11
	Filter applied to acquired input5 and input6. To know the configurations of bit40055.[10:8], see table1			0b010	Bit [10:8]
	Thermocouple type of input 5. To know the configurations of bit40056.[7:4], see table 2			0b0000 (TC J)	Bit [7:4]
	Thermocouple type of input 6. To know the configurations of bit40056.[3:0], see table 2			0b0000 (TC J)	Bit [3:0]
Config IN7-8	/	Bit	R/W		40057
	Input7 enabling: 0=deactivated; 1=activated			1	Bit 15
	Input8 enabling: 0=deactivated; 1=activated			1	Bit 14
	Input7 and input 8 measure type: 1=voltage [mV]; 0=temperature [°C]			0	Bit 13
	Cold-junction compensation for input 7 and input8: 0=deactivated; 1=activated			1	Bit 12
	Rejection: 0=50Hz; 1=60Hz			0	Bit 11
	Filter applied to acquired input7 and input8. To know the configurations of bit40057.[10:8], see table1			0b010	Bit [10:8]
	Thermocouple type of input 7. To know the configurations of bit40057.[7:4], see table 2			0b0000 (TC J)	Bit [7:4]
	Thermocouple type of input 8. To know the configurations of bit40057.[3:0], see table 2			0b0000 (TC J)	Bit [3:0]
Configuration aux	/	Bit	R/W		40058
	Floating point (32bits) registers interpretation. If bit 40058.15=0, FP32bit_MSW is most significant word of 32bits registers and FP32bit_LSW is less significant word of 32bit registers; if bit40058.15=1, FP32bit_LSW is most significant word of 32bits registers and FP32bit_MSW is less significant word of 32bit registers			0	Bit 15
	These bits aren't used			/	Bit [14:8]
	Module behavior if there is input 1 error: 0=register 40059 is overwritten in 40003 (word register) and in 40011,40012(floating point register); 1= content of register 40003 (word) and 40011, 40012 (FP) is the last measure acquired through input 1 correctly			0	Bit 7
	Module behavior if there is input 2 error: 0=register 40060 is overwritten in 40004 (word register) and in 40013,40014(floating point register); 1= content of register 40004 (word) and 40013, 40014 (FP) is the last measure acquired through input 2 correctly			0	Bit 6
	Module behavior if there is input 3 error: 0=register 40061 is overwritten in 40005 (word register) and in 40015,40016(floating point register); 1= content of register			0	Bit 5

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	40005 (word) and 40015, 40016 (FP) is the last measure acquired through input 3 correctly				
	Module behavior if there is input 4 error: 0=register 40062 is overwritten in 40006 (word register) and in 40017,40018(floating point register); 1= content of register 40006 (word) and 40017, 40018 (FP) is the last measure acquired through input 4 correctly			0	Bit 4
	Module behavior if there is input 5 error: 0=register 40063 is overwritten in 40007 (word register) and in 40019,40020(floating point register); 1= content of register 40007 (word) and 40019, 40020 (FP) is the last measure acquired through input 5 correctly			0	Bit 3
	Module behavior if there is input 6 error: 0=register 40064 is overwritten in 40008 (word register) and in 40021,40022(floating point register); 1= content of register 40008 (word) and 40021,40022(FP) is the last measure acquired through input 6 correctly			0	Bit 2
	Module behavior if there is input 7 error: 0=register 40065 is overwritten in 40009 (word register) and in 40023,40024(floating point register); 1= content of register 40009 (word) and 40023,40024(FP) is the last measure acquired through input 7 correctly			0	Bit 1
	Module behavior if there is input 8 error: 0=register 40066 is overwritten in 40010 (word register) and in 40025,40026(floating point register); 1= content of register 40010 (word) and 40025,40026(FP) is the last measure acquired through input 8 correctly			0	Bit 0
Baudrate Delay	Delay: from 0x00=0 to 0xFF=255	MSB, LSB	R/W		40053
	Baud-rate for RS485 (baud-rate of module/node if parameters are configurated by memory modality): 0=4800; 1=9600; 2=19200; 3=38400; 4=57600; 5=115200; 6=1200; 7=2400			38400	Bit [15:8]
	Delay for RS485 (delay of communication response: pauses between the end of Rx message and the start of Tx message). 1 pause=6 characters			0	Bit [7:0]
Address Parity	Address: from 0x01=1 to 0xFF=255	MSB, LSB	R/W		40052
	Address for RS485 (baud-rate of module/node if parameters are configurated by memory modality)			1	Bit [15:8]
	Parity for RS485: 0=there isn't; 1=even parity; 2=odd parity			0	Bit [7:0]
Reset	0xCCCC	Word	R/W		40041
	Reset of module, if reg.40041=0xCCCC			/	
INPUT 1					
IN1	/	Bit	R/W		40003
	Measure of input 1 [°C/10] (if bit 40054.13=0), [10·mV] (if bit 40054.13=1)			/	
IN1 MSW		FP32bit_MSW	R		40011
IN1 LSW		FP32bit_LSW	R		40012
	Floating point measure of input 1 [°C] (if bit40054.13=0), [mV] (if bit40054.13=1). To interpret the FP32bit register, see bit40058.15			/	
IN1 Fault	Between: -32000, 32000	Word	R/W		40059
	Fault value of input 1 [°C/10] (if bit40054.13=0), [mV/100] (if bit40054.13=1)			20000	

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INPUT 2					
IN2	/	Bit	R/W		40004
	Measure of input 1 [°C/10] (if bit 40054.13=0), [10·mV] (if bit 40054.13=1)			/	
IN2 MSW		FP32bit_MSW	R		40013
IN2 LSW		FP32bit_LSW	R		40014
	Floating point measure of input 2 [°C] (if bit40054.13=0), [mV] (if bit40054.13=1). To interpret the FP32bit register, see bit40058.15			/	
IN2 Fault	Between: -32000, 32000	Word	R/W		40060
	Fault value of input 1 [°C/10] (if bit40054.13=0), [mV/100] (if bit40054.13=1)			20000	
IN1-2 ColdJunction		Word	R		40028
	Input 1-2 cold junction temperature [°C/10]			/	
INPUT 3					
IN3	/	Bit	R/W		40005
	Measure of input 3 [°C/10] (if bit 40055.13=0), [10·mV] (if bit 40055.13=1)			/	
IN3 MSW		FP32bit_MSW	R		40015
IN3 LSW		FP32bit_LSW	R		40016
	Floating point measure of input 1 [°C] (if bit40055.13=0), [mV] (if bit40055.13=1). To interpret the FP32bit register, see bit40058.15			/	
IN3 Fault	Between: -32000, 32000	Word	R/W		40061
	Fault value of input 3 [°C/10] (if bit40055.13=0), [mV/100] (if bit40055.13=1)			20000	
INPUT 4					
IN4	/	Bit	R/W		40006
	Measure of input 4 [°C/10] (if bit 40055.13=0), [10·mV] (if bit 40055.13=1)			/	
IN4 MSW		FP32bit_MSW	R		40017
IN4 LSW		FP32bit_LSW	R		40018
	Floating point measure of input 4 [°C] (if bit40055.13=0), [mV] (if bit40055.13=1). To interpret the FP32bit register, see bit40058.15			/	
IN4 Fault	Between: -32000, 32000	Word	R/W		40062
	Fault value of input 4 [°C/10] (if bit40055.13=0), [mV/100] (if bit40055.13=1)			20000	
IN3-4 ColdJunction		Word	R		40029
	Input 3-4 cold junction temperature [°C/10]			/	
INPUT 5					
IN5	/	Bit	R/W		40007
	Measure of input 5 [°C/10] (if bit 40056.13=0), [10·mV] (if bit 40056.13=1)			/	
IN5 MSW		FP32bit_MSW	R		40019
IN5 LSW		FP32bit_LSW	R		40020
	Floating point measure of input 5 [°C] (if bit40056.13=0), [mV] (if bit40056.13=1). To interpret the FP32bit register, see bit40058.15			/	
IN5 Fault	Between: -32000, 32000	Word	R/W		40063

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	Fault value of input 5 [°C/10] (if bit40056.13=0), [mV/100] (if bit40056.13=1)			20000	
INPUT 6					
IN6	/	Bit	R/W		40008
	Measure of input 6 [°C/10] (if bit 40056.13=0), [10·mV] (if bit 40056.13=1)			/	
IN6 MSW		FP32bit_MSW	R		40021
IN6 LSW		FP32bit_LSW	R		40022
	Floating point measure of input 6 [°C] (if bit40056.13=0), [mV] (if bit40056.13=1). To interpret the FP32bit register, see bit40058.15			/	
IN6 Fault	Between: -32000, 32000	Word	R/W		40064
	Fault value of input 6 [°C/10] (if bit40056.13=0), [mV/100] (if bit40056.13=1)			20000	
IN5-6ColdJunction		Word	R		40030
	Input 5-6 cold junction temperature [°C/10]			/	
INPUT 7					
IN7	/	Bit	R/W		40009
	Measure of input 7 [°C/10] (if bit 40057.13=0), [10·mV] (if bit 40057.13=1)			/	
IN7 MSW		FP32bit_MSW	R		40023
IN7 LSW		FP32bit_LSW	R		40024
	Floating point measure of input 7 [°C] (if bit40057.13=0), [mV] (if bit40057.13=1). To interpret the FP32bit register, see bit40058.15			/	
IN7 Fault	Between: -32000, 32000	Word	R/W		40065
	Fault value of input 7 [°C/10] (if bit40057.13=0), [mV/100] (if bit40057.13=1)			20000	
INPUT 8					
IN8	/	Bit	R/W		40010
	Measure of input 8 [°C/10] (if bit 40057.13=0), [10·mV] (if bit 40057.13=1)			/	
IN8 MSW		FP32bit_MSW	R		40025
IN8 LSW		FP32bit_LSW	R		40026
	Floating point measure of input 8 [°C] (if bit40057.13=0), [mV] (if bit40057.13=1). To interpret the FP32bit register, see bit40058.15			/	
IN8 Fault	Between: -32000, 32000	Word	R/W		40066
	Fault value of input 8 [°C/10] (if bit40057.13=0), [mV/100] (if bit40057.13=1)			20000	
IN7-8 ColdJunction		Word	R		40031
	Input 7-8 cold junction temperature [°C/10]			/	

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TABLE 1 – CONFIGURATIONS FOR FILTER APPLIED TO ACQUIRED INPUTS IN1 and IN2 (bit40054.[10:8]), IN3 and IN4 (bit40055.[10:8]), IN5 and IN6 (bit40056.[10:8]), IN7 and IN8 (bit40057.[10:8])					
Bit[10:8]	***Filter type***	***BIT ADC***	***SAMPLING Hz***	***Propagation time (if IN<T)***	***Propagation time (if IN>T)***
0b000	Deactivated	14	48	45ms	45ms
0b001	Average	14	20	236ms	103ms
0b010	Average	15	11	405ms	179ms
0b011	Average + exp	15	11	1s	179ms
0b100	Average + exp	15	11	3s	179ms
0b101	Average + exp	15	11	8s	179ms
0b110	Average + exp	15	11	24s	179ms
0b111	Average + exp	15	11	72s	179ms


Threshold value: T=0.75mV


Propagation time: interval time between a step change of input electrical signal and corresponding change of measure in register (at 115kBaud). The propagation times shown in table 1 refer to 50Hz rejection; to obtain the propagation times refer to 60Hz rejection, divide them for 1.2.

TABLE 2 – THERMOCOUPLE TYPE OF INPUT IN 1 (bit40054.[7:4]), IN 2 (bit40054.[3:0]), IN 3 (bit40055.[7:4]), IN 4 (bit40055.[3:0]) IN 5 (bit40056.[7:4]), IN 6 (bit40056.[3:0]), IN 7 (bit40057.[7:4]), IN 8 (bit40057.[3:0])			
Bit [7:4]	TC for IN1, IN3, IN5, IN7	Bit [3:0]	TC for IN2, IN4, IN6, IN8
0b0000	TC J	0b0000	TC J
0b0001	TC K	0b0001	TC K
0b0010	TC R	0b0010	TC R
0b0011	TC S	0b0011	TC S
0b0100	TC T	0b0100	TC T
0b0101	TC B	0b0101	TC B
0b0110	TC E	0b0110	TC E
0b0111	TC N	0b0111	TC N

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LEDs for signalling

In the front-side panel there are 4 LEDs and their state refers to important operating conditions of the module.

LED	LED status	Meaning
PWR	Constant light	The module power is on
ERR	Constant light	The module has at least one of the errors described in RS485 Registers table
	Blinking light	Module failure
RX	Constant light	Verify if the bus connection is corrected
	Blinking light	The module received a data packet
TX	Blinking light	The module sent a data packet
	Constant light	Module failure

CONFIGURATION SOFTWARE

To configure Z-8TC with a PC please download the Easy Setup suite or Z-NET suite.

The softwares are free-downloadable from www.seneca.it.

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