



SIELCO
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D1-40TC thermocouple acquisition module

User's guide

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1 Installation

1.1 Packaging check

Before starting installation, it is necessary to check that the packaging contents is in compliance with your order. In the packaging there must be:

- # 1 D1-40TC series module
- # 1 instruction manual

Check that the model code is in compliance with the ordered code and verify that the manual edition correspond to the purchase year.

D1-40TC module provides 6 J, K, N, R, S, T thermocouple or 0–50mV inputs with the following features:

- Resolution: 16 bit
- Precision: $\pm 0,05\%$ full scale

D1 series modules are covered by 1 year of warranty except for damages caused by tampering or wrong wiring.

The label on the modules backside certificates the purchase date.

1.2 Dimensions

The D1-40TC modules dimensions are shown in figure 1.1.

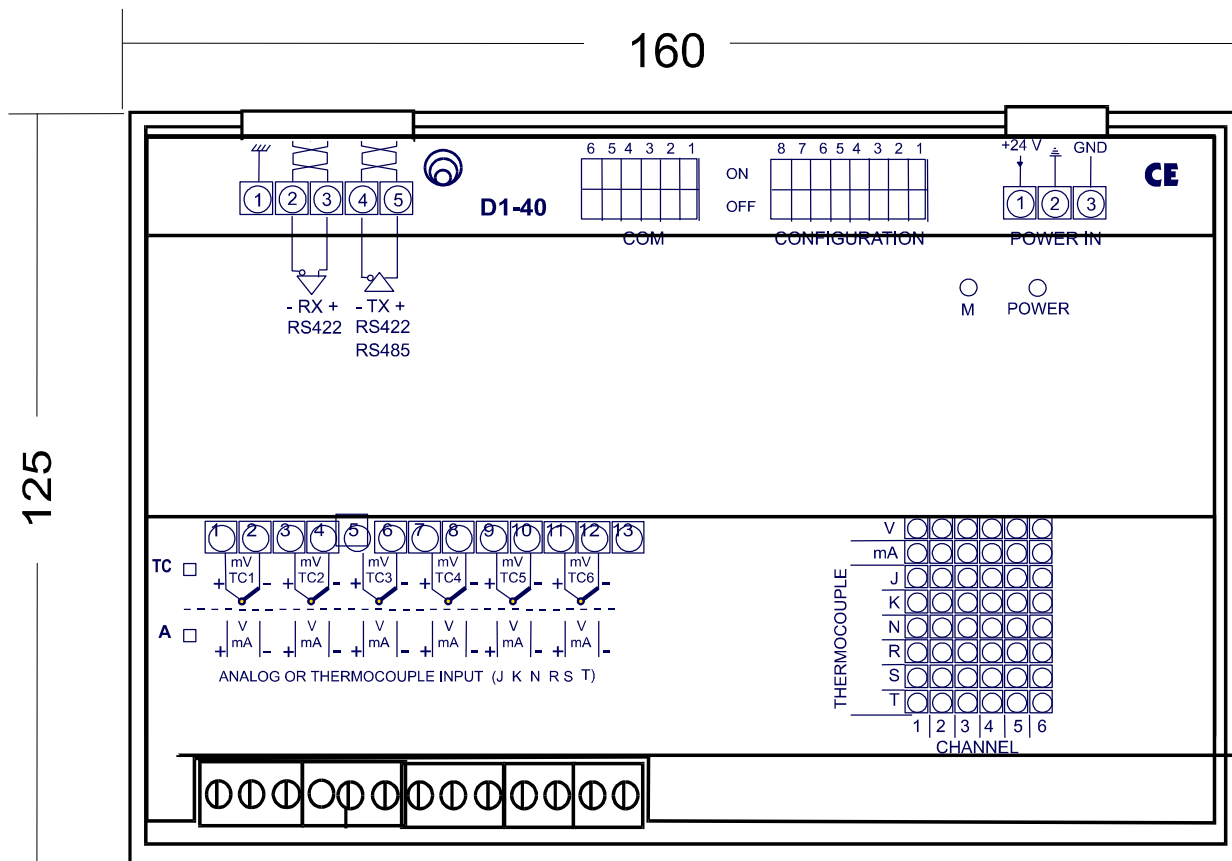


Figure 1.1 - D1-40TC module dimensions

1.3 Fixing method

All D1 series products are provided by a plastic support for fixing on normalized DIN EN rail and by a shielding serigraphed cover.

On the cover there are schematic mounting indications; in grey areas are shown the interface circuits that are inside the module, in yellow areas common use sensors and actuators to be connected externally.

The cover serigraph provides only a general wiring diagram and cannot show every possible connection cases; for this reason it is necessary to read carefully this manual before starting module installation.

Do not use excessive pressure on the cover, mounting or dismantling the module on the rail. Remember to do these operations with supply voltage switched off or not connected.

1.4 Physical module description

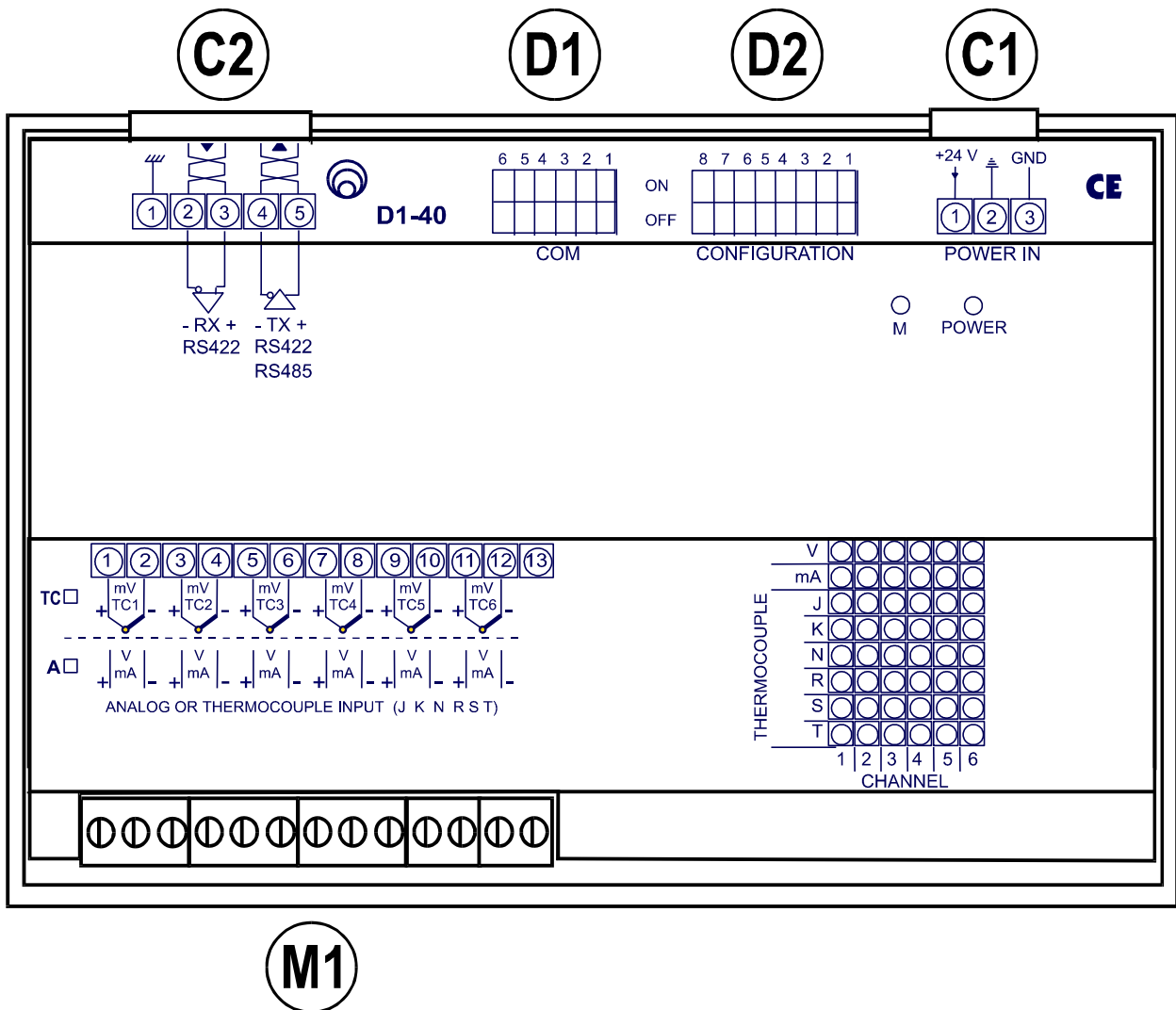


Figure 1.2 - D1-40TC scheme

Description	
[C1]	+24 Vdc supply connector
[C2]	RS422/485 serial channel connector
[M1]	Input screws
[D1]	RS422 or RS485 line selection dipswitch
[D2]	Protocol and device address selection dipswitch
Power	Supply led
Led M	Selftest led (normally blinking)
Led TX	Transmitted data led
Led RX	Received data led

[M1] - Inputs screws

THERMOCOUPLE INPUTS			
1	Channel 1 positive	7	Channel 4 positive
2	Channel 1 negative	8	Channel 4 negative
3	Channel 2 positive	9	Channel 5 positive
4	Channel 2 negative	10	Channel 5 negative
5	Channel 3 positive	11	Channel 6 positive
6	Channel 3 negative	12	Channel 6 negative

Screw #13 contains the cold junction sensor (Pt100).

[C1] - +24 Vdc supply connector

	POWER
1	+24 Vdc
2	FIELD GND
3	MECH. GND

[C2] - RS422/485 serial channel connector

	RS422		RS485
1	SERIAL GND	1	SERIAL GND
2	RX-	2	N.C.
3	RX+	3	N.C.
4	TX-	4	TX-/RX-
5	TX+	5	TX+/RX+

1.5 Supply

The D1-40TC module needs a 24 Vdc ($9V < Vdc < 36V$) supply [C1] connector and absorb a maximum current $I_{cc}=100$ mA at 24 Vdc.

The negative power supply must be connected to pin #2 [C1 connector].

After power is turned on, check that Power led is on.

1.6 Analog inputs

D1-40TC module provides 6 input for thermocouples or 0-50mV low voltage signals ([M1] screws). If you are using thermocouples, connect only J, K, N, R, S, T type sensors in compliance with IEC 584 standard. The controller make automatically the cold junction compensation.

Connect “positive” and “negative” sensors wires respectively to “positive” and “negative” module screws (respectively #1 and #2 for first input) see figure 1.2.

1.7 Serial communication

1.7.1 Serial link

To connect to D1 modules, it is necessary to use a RS422/485 serial interface that usually are not standard equipment in personal computers.

SIELCO produces C1-25 model, a RS232-RS422/485 serial interface converter with triple optical isolation that can be connected to PC serial port (COM) and to D1-40TC [C2] connector as shown in table 1.1.

C1-25			D1-40TC		
#	RS-422		RS-422	#	
1	GND	↔	SERIAL GND	1	C2
2	RX-	↔	TX-	4	C2
3	RX+	↔	TX+	5	C2
4	TX-	↔	RX-	2	C2
5	TX+	↔	RX+	3	C2
6	0 V				
7	+24 V				

C1-25			D1-40TC		
#	RS-485		RS-485	#	
1	GND	↔	SERIAL GND	1	C2
2	n.c.		n.c.	2	C2
3	n.c.		n.c.	3	C2
4	TX-/RX-	↔	TX-/RX-	4	C2
5	TX+/RX+	↔	TX+/RX+	5	C2
6	0 V				
7	+24 V				

Table 1.1 - C1-25 - D1-40TC (RS 422/485) wiring

D1-40TC serial communication must be set in RS422 or RS485 mode using [D1] dipswitch (table 1.2).

RS422							RS485						
	6	5	4	3	2	1		6	5	4	3	2	1
ON		■					ON	■					
OFF	■		■	■	■	■	OFF		■	■	■	■	■

Table 1.2 - Line type (RS422/RS485) configuration using dipswitch [D1]

WARNING! Configurations in which both selectors #5 and #6 are simultaneously ON or OFF, are not permitted.

Selector from #1 to #4 are reserved and they must be kept in OFF position.

1.7.2 Communication protocol

Software communication protocol is realised according to Modbus ASCII or RTU standard: protocol selection is made by #7 selector of dipswitch [D2] (ON=RTU, OFF=ASCII).

The baudrate selection is made by #8 selector of dipswitch [D2] (ON=19200, OFF=9600).

ASCII protocol features

Baud rate	9600 / 19200
Data bits	7
Parity bit	even
Stop bit	1

RTU protocol features

Baud rate	9600 / 19200
Data bits	8
Parity bit	none
Stop bit	1

1.7.3 Device identification

To D1-40TC module can be assigned an identification address between 1 and 63 through binary notation, using selector from 1 to 6 of dipswitch [D2] (see table 1.3).

		ADDRESS							
		8	7	6	5	4	3	2	1
		<i>BAUD</i>	<i>PROT.</i>	2^5	2^4	2^3	2^2	2^1	2^0
ON	19200	RTU							
OFF	9600	ASCII							

Table1.3 - Address configuration using [D2] dipswitch

NOTE

Address 0 is reserved.

1.7.4 Serial cable

Use shielded cable with one (RS-485) or two (RS-422) twisted pair in compliance with EIA RS-485 or EIA RS-422; using the shield for ground.

Recommended cable: *Belden 9841 (RS-485); 9842 (RS-422)*

Maximum signal loss: *6 dB*

Maximum line capacitance: *100 nf*

Maximum line length: *1200 m*

Line impedance: *tra 100 e 120 ohm*

1.8 Earth wiring and shielding

1.8.1 Earth wiring

It is suggested to make the following earth:

- device mechanical ground (connector [C1] pin #3) goes directly to earth;
- the power supply negative signal (connector [C1] pin #2) must be connected to a local earth;
- in case of long or disturbed serial lines, connect serial ground (connector [C2] pin #1) to earth by a 100 Ω resistance.

It is important that device grounds are connected to earth independently; it is also important to avoid to share the same wire path with power devices as inverter, drives etc.

1.8.2 Inputs shielding

Temperature reading is based on low intensity signal detection (TC, 0–50mV).

To improve the sensors reading particularly in environment noise affected by power devices (motor driver, power contact etc.), follow these shielding rules:

- use shielded and twisted cables for sensors connection;
- keep connection cables as short as possible;
- it is a good thing to avoid to share the same wire path with power devices as inverter, drives etc.;
- connect all sensor cable metal shields to the controller negative screw leaving them non connected by the sensor side (parasite currents on the shields can induce disturbances that can affect sensor reading);
- connect all sensor cable metal shields to connector C1 pin #3.

2 Operation

2.1 Application

D1-40TC module is provided with 6 input channels for temperature or analog signals acquisition.

Temperature are acquired using thermocouple sensors with automatic cold junction compensation; acquired temperature values are recorded in tenth degrees on a range from -2000 to $+30000$; for example, a value of 275 means a temperature of 27.5 °C. Recorded values are available through the numeric reading gates from T1 to T6.

Analog voltage signals range is between 0 and 65 mV; the acquired value is recorded on a range from 0 to 65000 and for example the value of 7582 means 7.582 mV. Recorded values are available through the numeric reading gates from T1 to T6.

The gate «sensor type» defines the sensor type connected to each input:

0	none
1	0-50 mV sensor
2	thermocouple J
3	thermocouple K
4	thermocouple N
5	thermocouple R
6	thermocouple S
7	thermocouple T

2 Operation

In case of sensor type «none», a fixed zero temperature is shown.

The gate «reading options» define inputs reading options.

Bit 0 = 1 Active 8 samples filter

Bit 1 = 1 Active a 1°C measure rounding

The gate «offset» allows to apply a correction to the acquired temperature. The value in this gate must be set in tenth degrees. This offset is only applied to thermocouple sensors and it is useful to balance possible sensor imperfection o particular system geometry.

"Restart number" gate is only for diagnostic use and gives an indication of the electrical disturbances presence.

A Gates list

A.1 Numeric gates (Holding Registers)

Address	Description	ID	Byte	Limits	R/W
00	Identification 0	Id0	2	0:65535	R
01	Identification 1	Id1	2	0:65535	R
02	Firmware version	Vers	2	0:65535	R
03	Zero value	Zero	2	0	R
04	AAAA value	AAAA	2	43690	R
05	Restart number	Rs	1	0:255	RW
06	Channel 1 - Sensor type	Type1	1	0:7	RW
07	Channel 2 - Sensor type	Type2	1	0:7	RW
08	Channel 3 - Sensor type	Type3	1	0:7	RW
09	Channel 4 - Sensor type	Type4	1	0:7	RW
10	Channel 5 - Sensor type	Type5	1	0:7	RW
11	Channel 6 - Sensor type	Type6	1	0:7	RW
12	Channel 1 - Input options	Opt1	1	0:3	RW
13	Channel 2 - Input options	Opt2	1	0:3	RW
14	Channel 3 - Input options	Opt3	1	0:3	RW
15	Channel 4 - Input options	Opt4	1	0:3	RW
16	Channel 5 - Input options	Opt5	1	0:3	RW
17	Channel 6 - Input options	Opt6	1	0:3	RW
18	Channel 1 - Temperature offset	Off1	2	-999:+999	RW
19	Channel 2 - Temperature offset	Off2	2	-999:+999	RW
20	Channel 3 - Temperature offset	Off3	2	-999:+999	RW
21	Channel 4 - Temperature offset	Off4	2	-999:+999	RW
22	Channel 5 - Temperature offset	Off5	2	-999:+999	RW
23	Channel 6 - Temperature offset	Off6	2	-999:+999	RW
24	Ramp offset binary	OR	2	0:65535	R
25	Voltage sample binary	CV	2	0:65535	R
26	PT100 sample binary	CP	2	0:65535	R

A Gates list

27	Cold junction temperature	Cold	2	-500:+1000	R
28	Channel 1 - Temperature	T1	2	-2000:+30000	R
29	Channel 2 - Temperature	T2	2	-2000:+30000	R
30	Channel 3 - Temperature	T3	2	-2000:+30000	R
31	Channel 4 - Temperature	T4	2	-2000:+30000	R
32	Channel 5 - Temperature	T5	2	-2000:+30000	R
33	Channel 6 - Temperature	T6	2	-2000:+30000	R