



D1-15 analog module

User's guide

D1-15 analog module
User's guide
Version: 11 February 2003

Information in this document is subject to change without notice and does not represent a commitment on the part of SIELCO.

All trademarks or registered trademarks are property of their respective holders and are hereby acknowledged.

Sielco S.r.l.
via Marcantonio Colonna, 12 – 20149 Milano – Italy
<http://www.sielco.com>

Contents

- 1 Installation1**
 - 1.1 Packaging check 1
 - 1.2 Dimensions2
 - 1.3 Fixing method.....2
 - 1.4 Physical module description 3
 - 1.5 Supply 4
 - 1.6 Inputs 5
 - 1.6.1 Analog inputs for linear sensors 5
 - 1.6.2 Pt100/RTD sensors inputs 6
 - 1.7 Serial communication 7
 - 1.7.1 Serial link..... 7
 - 1.7.2 Communication protocol 8
 - 1.7.3 Device identification..... 8
 - 1.7.4 Serial cable 9
 - 1.8 Earth wiring and shielding..... 9
 - 1.8.1 Earth wiring 9
 - 1.8.2 Pt100 wiring 9

- 2 Operation11**
 - 2.1 Application 11

- A Gates list12**
 - A.1 Numeric Gates (Holding Registers)..... 12

1 Installation

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 D1-15 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.

The models are:

D1-15-I1 6 voltage (0-10V) analog inputs
3 three wires Pt100 inputs (with cable resistance compensation)

D1-15-I2 6 current (0-20mA/4-20mA) analog inputs
3 three wires Pt100 inputs (with cable resistance compensation)

The analog inputs have the following features:

- Precision : $\pm 0,05\%$ full scale
- Resolution : 15 bit
- Input impedance (0-20 mA or 4-20 mA) : 249 ohm

The Pt100/RTD sensor inputs have the following features:

- Temperature range: from -199.9 to +500.0 °C (standard model)

1 Installation

- Precision : $\pm 0,05\%$ full scale
- Resolution : 15 bit
- Max cable resistance: 20 ohm

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 certifies the purchase date.

1.2 Dimensions

The D1-15 modules dimensions are shown in figure 1.1.

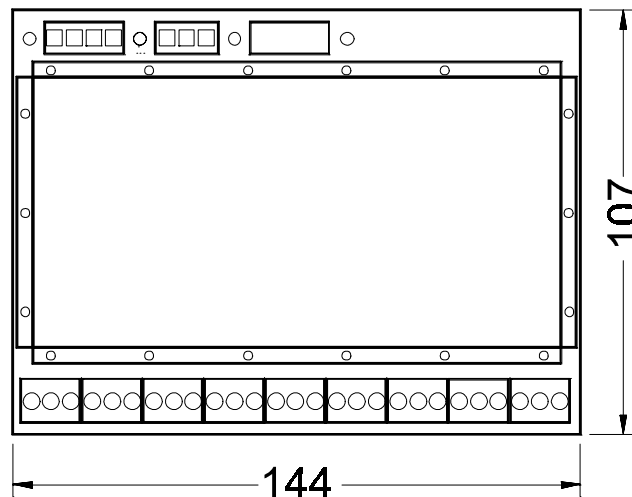


Figure 1.1 - D1-15 module dimensions

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 dismounting the module on the rail. Remember to do these operations with supply voltage switched off or not connected.

1.4 Physical module description

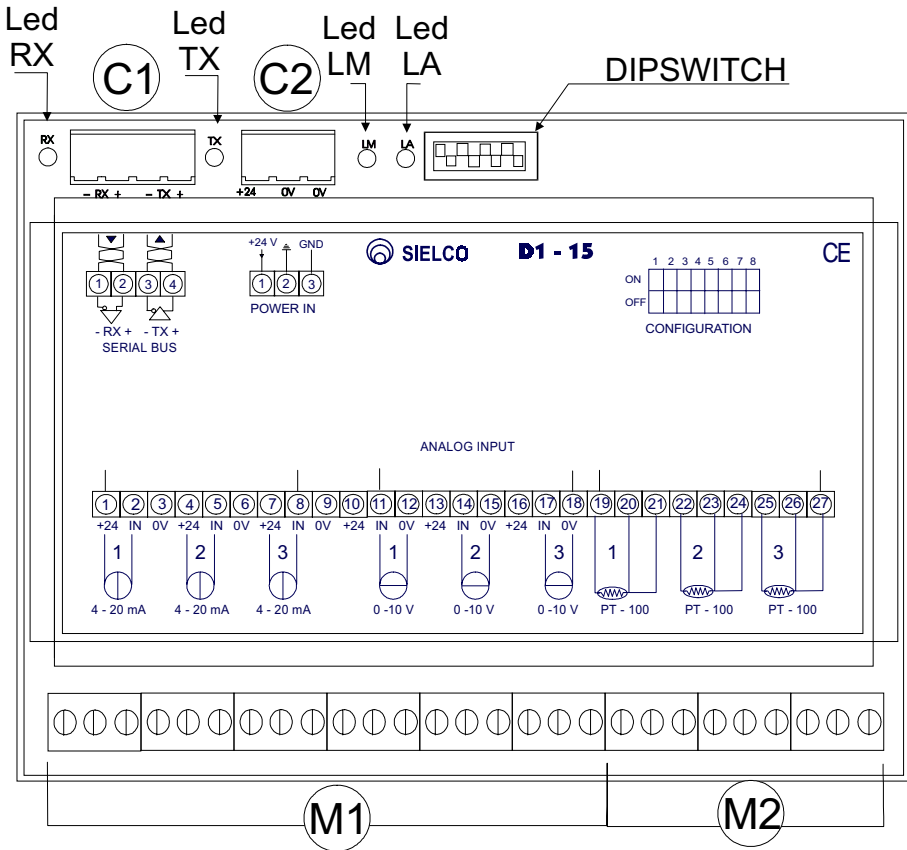


Figure 1.2 - D1-15 scheme

	Description
[C1]	RS422/485 serial channel connector
[C2]	+24 Vdc supply connector
[M1]	Analog inputs screws
[M2]	Pt100/RTD sensors inputs screws
DIPSW	Protocol and device address selection dipswitch
Led LA	Supply led
Led LM	Selftest led (normally blinking)
Led TX	Transmitted data led
Led RX	Received data led

[C1] - RS422/485 serial channel connector

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

[C2] - +24 Vdc supply connector

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

1.5 Supply

The module needs a 24 Vdc ($18V < Vdc < 36V$) supply by [C2] connector and absorb a maximum current $I_{cc}=70$ mA at 24 Vdc.

The negative power supply must be connected to pin #2 of [C2] connector.

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

1.6 Inputs

1.6.1 Analog inputs for linear sensors

To D1-15 series modules can be connected 0-10V or 0-20mA/4-20mA linear sensors.

For a 0-10V output sensor connection connect, for each set of three screws, positive sensor signal to the screw called IN and the negative sensor signal to the 0V one, as shown in figure 1.3.

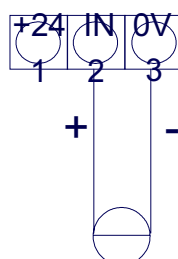


Figure 1.3 - 0-10V linear sensor wiring

For a 0-20mA/4-20mA output sensor connection, it is necessary to distinguish 2 cases:

- A) linear sensor supplied by the D1-15 module; supply the sensor through the screw called +24V and connect the sensor signal to screw called IN (fig. 1.4A);
- B) linear sensor externally supplied; supply the sensor through an external power source and connect its negative to the screw called 0V and connect sensor signal to the screw called IN (fig. 1.4B).

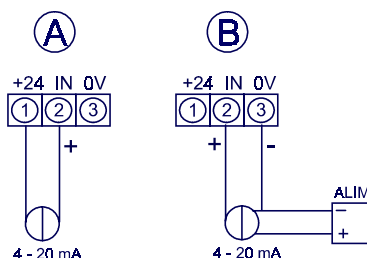


Figure 1.4 - Connection of 4-20 mA linear sensors supplied by the D1-15 module (case A) or by an external power source (case B)

Current input impedance is 249 Ω ; choose sensor compliant with this specification.

Before connecting sensors, verify whether they are compatible with D1-15 model ordered.

In case of disturbance, can be useful to use shielded cable and connect the cable shield to the screw called 0V.

1.6.2 Pt100/RTD sensors inputs

To D1-15 modules can be connected Pt100 sensors.

WARNING! Be sure that the sensors used are in compliance with IEC 751 standard.

Choosing the sensor, be sure that the wires (3) connected to the sensor are electrically isolated from its metallic case. Dispersion currents towards the sensor metallic case can be detrimental to the precision of the reading. Pt100 sensors must be 3 wires type; for connection see figure 1.5.

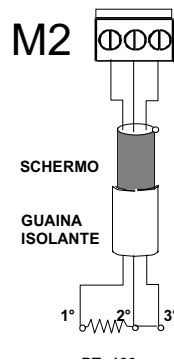


Figure 1.5 – 3 wires Pt100 connections

The cable loop resistance must be less than 20 ohm (measure taken between start loop screw and the end loop screw with a short circuit instead Pt100).

The recommended cable is a twisted pairs conductors cable (the first wire must be twisted with the second) with shielding and self-extinguishing insulating coating.

Do not connect Pt100 using single wires not belonging to the same cable: the outward wire resistance (first wire connected at the first screw of each set of three) must be the same of the inward wire one (second wire connected at the second screw of each set of three).

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 D1-15 [C1] connector as shown in table 1.1.

C1-25			D1-15	
#	RS-422		RS-422	#
1	GND	↔	GND	2 C2
2	RX-	↔	TX-	3 C1
3	RX+	↔	TX+	4 C1
4	TX-	↔	RX-	1 C1
5	TX+	↔	RX+	2 C1
6	0 V			
7	+24 V			

C1-25			D1-15	
#	RS-485		RS-485	#
1	GND	↔	GND	2 C2
2	n.c.		n.c.	1 C1
3	n.c.		n.c.	2 C1
4	TX-/RX-	↔	TX-/RX-	3 C1
5	TX+/RX+	↔	TX+/RX+	4 C1
6	0 V			
7	+24 V			

Table 1.1 - C1-25 - D1-15 (RS 422/485) wiring

D1-15 modules are provided with configurable serial interface RS422/485, normally configured as RS485. To change configuration, remove the shielding cover and move the jumper placed upper and left on the printed circuit board.

1.7.2 Communication protocol

Software communication protocol is realised according to ModBus ASCII or RTU standard: protocol selection is made by #3 selector of dipswitch (ON=RTU, OFF=ASCII).

The baudrate selection is made by #2 selector of dipswitch (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

NOTE

At power on, the device waits 4 seconds to communicate.

1.7.3 Device identification

To D1-15 can be assigned an identification address between 1 and 31 through binary notation, using selector from 4 to 8 of dipswitch (see table 1.2).

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

Table 1.2 - Address configuration using dipswitch

NOTE

Address 0 is reserved.

Dipswitch #1 must be kept in OFF position.

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 (pin #3 of [C2] connector) goes directly to earth;
- the power supply negative signal (pin #2 of [C1] connector) must be connected to a local earth.

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 Pt100 wiring

Temperature reading is based on low intensity signal detection coming from Pt100 sensors.

Parasite currents on the shields can induce disturbances that make reading imprecise.

Follow these shielding rules particularly in environment noise affected by power devices (motor driver , power contact etc.).

- use shielded and twisted cables for Pt100 sensors connection;
- keep connection cables as short as possible;
- it's better to make differents canalizations for Pt100 signals and power signal conductors;

1 Installation

- connect all metal Pt100 connection cables shields only on the D1-15 side, leaving them non connected by the Pt100 sensor side;
- connect all the metal shield at pin 3 of [C2] connector.

2 Operation

2.1 Application

D1-15 module is provided with 9 input channels for 3 temperatures and 6 analog signals acquisition.

Temperature are acquired using three wires Pt100 sensors with automatic cable resistance compensation; acquired temperature values are recorded in tenth degrees on a range from -1990 to +5000; for example, a value of 275 means a temperature of 27.5°C. Recorded values are available through the numeric reading gates TA, TB and TC.

Analog signals can be voltage (0-10 V) or current (0-20 mA); in the first case the acquired value is recorded on a range from 0 to 10000; for example the value of 7500 means 7.50 Volt. In current input case, the acquired value is recorded on a range from 0 to 4980 and for example the value of 2988 means 12.00 mA ($=2988/249$). Recorded values are available through the numeric reading gates J1, ..., J6.

Error gates indicate the presence of an input signals reading allarm; in case of Pt100 error proceede unconnecting Pt100 sensors and checking that there are not any short circuit towards ground.

"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	Range	R/W
00	Restart counter	Rs	1	0: 255	R/W
01	Temperature PT100 A	TA	2	-800:+3000	R
02	Temperature PT100 B	TB	2	-800:+3000	R
03	Temperature PT100 C	TC	2	-800:+3000	R
04	Analog input J1	J1	2	0:10000	R
05	Analog input J2	J2	2	0:10000	R
06	Analog input J3	J3	2	0:10000	R
07	Analog input J4	J4	2	0:10000	R
08	Analog input J5	J5	2	0:10000	R
09	Analog input J6	J6	2	0:10000	R
10	PT100 errors	eT	1	00h:FFh	R
11	J analog errorsJ	eJ	1	00h:FFh	R

PT100 errors - eT

bit - Low sample error

0

bit - High sample error

1

bit - PT100 A resistance error

2

bit - PT100 A line resistance
error

3

bit - PT100 B resistance error

4
bit - PT100 B line resistance
5 error
bit - PT100 C resistance error
6
bit - PT100 C line resistance
7 error

J analog errors - eJ

bit - Analog reference
0 error
bit - Analog error J1
1
bit - Analog error J2
2
bit - Analog error J3
3
bit - Analog error J4
4
bit - Analog error J5
5
bit - Analog error J6
6
bit - Not used
7
