

EST-VI

CURRENT AND VOLTAGE INSULATED CONVERTER MODULE



INSTRUCTIONS FOR USE Ver. 01 (EN) – 01/25

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INTRODUCTION



This manual contains the information required for proper installation and the instructions for use and maintenance of the product. It is therefore recommended to read it carefully and preserve it.

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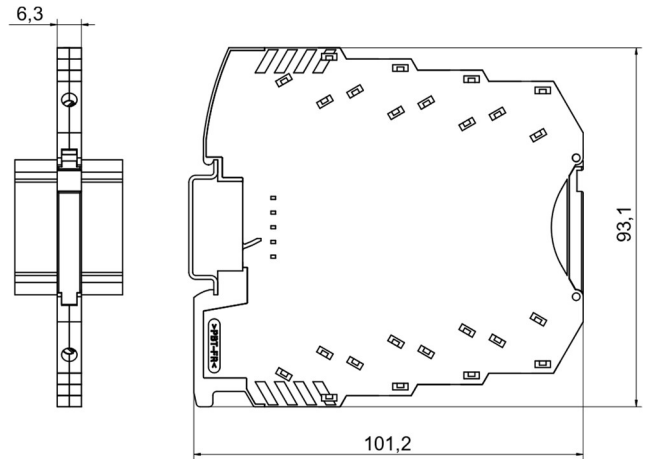
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1 – DIMENSIONS (mm)



2 – DEVICE DESCRIPTION

2.1 – GENERAL DESCRIPTION

The EST-VI is an isolated precision converter for analog current and voltage signals.

This device offers the following features:

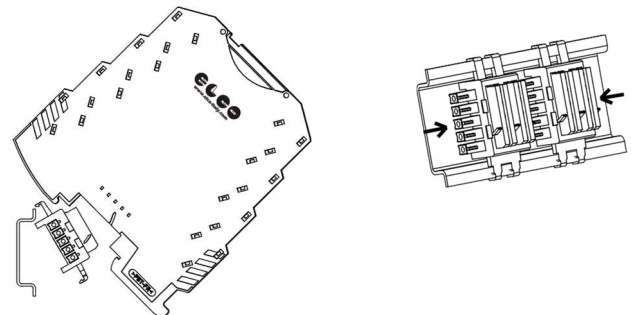
- 3-way galvanic insulation of 1.5kV among power supply, input and output, ensuring protection against interferences found in industrial environments
- Selectable mA/V input and mA/V output, with also the choice for inverted output conversion logic
- Fast and easy device setup via dip-switches
- Device programming and communication available via Modbus RS485 RTU using the bus connector on the DIN rail, accessible with the dedicated accessory (optional)
- Power supply can be provided via the bus connector on the DIN rail, accessible with a dedicated accessory (optional)

3 - SMART-CONNECTION

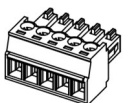
3.1 – DESCRIPTION


The EST-VI is part of the EST device series which includes a variety of converters and dedicated accessories. These accessories enable the usage of various additional features. Most notably, the modules can be connected together as a single batch of modules, reducing occupied space and wiring issues.

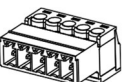
The accessory providing this feature is the **BUS BC-5P2 connector (optional)**, which provides a DIN rail bus with both a Modbus communication line and a power supply line.



To access the Modbus line the dedicated 5-poles connection terminals are **TC-5PL** or **TC-5PR**.



 These terminals are not to be used to access the bus power supply, but only for the RS485 signal.



3.2 – SUPPLYING POWER IN A BATCH CONFIGURATION

When placed together as a batch using the BC-5P2 connector, power can be supplied to the EST modules using the following methods:

- direct power supply of a single module using the 1-2 terminals. The other modules will receive power directly from the connector. Using this configuration the total bus power consumption must not exceed 400mA.

- by using the redundant power supply **EST-PWS** module. Power is supplied only to the EST-PWS module and will then be redistributed to all other modules in the batch. Using this configuration the total bus power consumption must not exceed 1,5A. The EST-PWS module integrates a variety of safety mechanisms to protect the connected modules from possible voltage surges. It's necessary to plan the presence of an appropriately sized fuse.

The option of supplying power (24Vdc) directly to a single module by using the 1-2 terminals is always available, as it does not require the presence of the connector.

3.3 – DEVICE PROGRAMMING THROUGH RS485 MODBUS

3.3.1 – DESCRIPTION

By using the dedicated accessory it's possible to program the device through Modbus RTU RS485.

Device configuration via dip-switches remains as an always available feature.

It's possible to also program the device through the EL.CO ECD converter, giving the option of converting the Modbus RTU protocol used in the EST-VI to a Modbus TCP protocol. The BC-5P accessory used in the ECD converter is compatible with the BC-5P2 connector used in the EST family products.

To maintain the line at rest, the usage of a 120 Ohm termination resistor is required. The device does not mount the resistor. The termination of the RS485 line with the 120 Ohm resistor can be done through the TC-5PL or TC-5PR terminal, provided as an accessory.

The configurable communication speed ranges from 1200 to 38400 baud. This enables the possibility of using a medium quality shielded twisted pair for the line's wiring: it's enough to ensure the total line capacity does not exceed 200 nF.



The poll rate during the programming and use mustn't be under 50ms.

When using 8 or more devices, it's recommended to have a poll rate equal or higher than 80ms.



The maximum distance of a RS485 transmission is 400 meters.



The maximum number of devices in a RS485 batch transmission is 32.

3.3.2 – COMMUNICATION PROTOCOL DESCRIPTION

The used protocol is Modbus RTU. This choice guarantees high compatibility and ease of connection with a large variety of PLCs and most commercial supervision programs.

The MODBUS default address is 100.

The asynchronous communication characteristics are: 8 bit, no parity, one stop bit.

For those wishing to develop their own application software, all the necessary tips and information are available.

These functions (**see Paragraph 7**) allow the supervision program to read and edit any data of the module. Communication is based on messages sent by the master to the device.

The Modbus RTU functions implemented in the EST-VI module are:

function 03(0x03) - reading n words

function 06(0x06) – writing a word

The communication process involves two types of messages:

From the centralizer to the slave:

- Function 03: request to read n words
- Function 06: request to write a word

From the slave to the centralizer:

- Function 03: response containing n words read
- Function 06: confirmation of writing a word

Each message contains four fields:

- slave address: the values between 1 and 255 are valid; address 0 (zero) is reserved by MODBUS RTU for broadcasting messages, **but it is not adopted** in the EST series due to the implicit unreliability of this type of communication;
- function code: it contains 03 or 06 depending on the specified function;
- information field: it contains the addresses or the value of the words, as required by the function used;
- control word: it contains a cyclic redundancy check (CRC) calculated according to the rules envisaged for CRC16.

The functions described for the RS485 protocol are found in Paragraph 7.

3.3.3 – DATA EXCHANGE

The data exchanged consist of a 16-bit word. All readable and writable data appear as 16-bit words allocated in the device's memory.

The operating and configuration parameters of the device can be read and written.

3.4 – PARAMETER READING VIA RS485 MODBUS

3.4.1 – DESCRIPTION

The EST devices have both read and write parameters.

The parameters readable through RS485 are found in **Paragraph 6**.

4 - INSTALLATION AND USE WARNINGS

4.1 - PERMITTED USE

The device has been designed as a measurement and adjustment device in accordance with EN61010 for operation at altitudes up to 2000 m. The use of the device in applications not expressly provided for in the aforementioned standard must include all appropriate protective measures. The device CANNOT be used in hazardous (flammable or explosive) environments without proper protection. It should be remembered that the installer must ensure that the electromagnetic compatibility rules are respected even after the device has been installed, possibly using special filters. If a failure or malfunction of the device can create hazardous or dangerous situations for persons, animals or property, the system must be equipped with additional electromechanical devices to ensure safety.

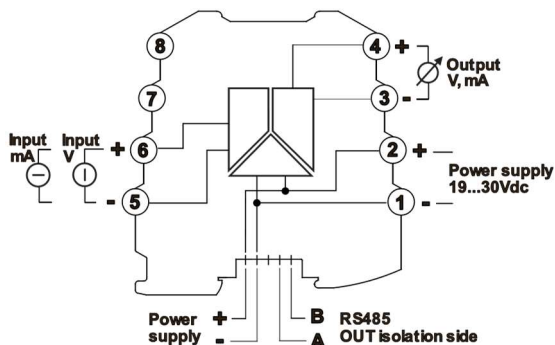
All circuits must be under double insulation from circuits with dangerous voltage.

4.2 - MECHANICAL ASSEMBLY

All EST series models can be mounted vertically on a DIN rail. Avoid placing the device in environments subjected to high humidity or in the presence of polluting elements capable of introducing conductive substances inside the device. Ensure that the device has adequate ventilation and avoid installation in spaces shared with devices that can lead the device to operate outside the declared temperature ratings. Install the device as far as possible from sources that may generate electromagnetic disturbances such as motors, contactors, relays, solenoid valves etc.

An installation that does not comply with the provisions set out in this paragraph could compromise the declared protection levels.

4.3 - WIRING DIAGRAM



Terminals description:

- 1) Power Supply – (GND return)
- 2) Power Supply + : 19...30VDC
- 3) Output – for current or voltage
- 4) Output + for current or voltage
- 5) Input – for current or voltage
- 6) Input + for current or voltage
- 7) Not used
- 8) Not used

Bus description:

- Bus power supply internally reported to terminals 1 and 2
- RS485 input internally reported to the isolated output

4.4 – TERMINAL BLOCK SPECIFICATIONS

- Connection type: screw terminal
- Stripping length: 8 [mm]
- conductor section: 0.2 – 2.5[mm²] / 24 – 12 AWG

5 – OPERATION

5.1 – DESCRIPTION

The EST-VI module enables the isolation or conversion of a voltage and/or current signal. The conversion can be configured via dip-switches or via Modbus.

5.2 – OUT OF SCALE VALUES

- with input > end of scale: output value saturates at the end-scale set value (with dips either 20mA / 5V or 10V)
- with input < start of scale: output values is locked at the start-scale set value (with dips either 0mA or 4mA / 0V or 1V)

5.3 – LED SIGNALING

- blinking: currently converting
- fixed: out of scale

5.4 – SMART DIP

The EST-VI is equipped with the “Smart DIP” technology, which allows an easy product configuration. Thanks to this you can make the product plug-and-play and ready to use.

The dip configuration is acquired every time the product is turned on or every time a new writing via Modbus is performed on the memory.

Dips have priority over Modbus.

LEGEND



Input signal

SW1	1	2	3	
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Default / type stored in memory (ModBus)
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	0...20 mA
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	4...20 mA
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	0...10 Vdc
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	0...5 Vdc
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	2...10 Vdc
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	1...5 Vdc
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	not handled

Input signal filter

SW1	4	
	<input type="checkbox"/>	Disabled
	<input type="checkbox"/>	Enabled

Reverse sul segnale di uscita

SW1	5	
	<input type="checkbox"/>	Disabled
	<input type="checkbox"/>	Enabled

Output signal

SW1	6	7	8	
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Default / type stored in memory (ModBus)
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	0...20 mA
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	4...20 mA
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	0...10 Vdc
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	0...5 Vdc
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	2...10 Vdc
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	1...5 Vdc
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	not handled

The Modbus address is configured using the switches from 1 to 8 of **SW2**. **Modbus default values is 100.**

When configured by hardware it won't be possible to configure the Modbus address via software.

SW2	1	2	3	4	5	6	7	8	
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Default: 100 / address stored in memory (Modbus)
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Binary:00000001--address 1
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Binary:00000010-- address 2
	...								
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Binary:11111111-- address 255

6 – MODBUS PROGRAMMABLE PARAMETERS TABLE

All the parameters available on the device are described below.

RO: Refers to “Read Only”
RW: Refers to “Read and Write”
WO: Refers to “Write Only”

Product code:

Description		Value [hex-ASCII]	Address [hex-dec]
CP1 (RO)	1st field of the product code	0x45 - E	0x01-1
CP2 (RO)	2nd field of the product code	0x53 - S	0x02-2
CP3 (RO)	3rd field of the product code	0x54 - T	0x03-3
CP4 (RO)	4th field of the product code	-	0x04-4
CP5 (RO)	5th field of the product code	0x56 - V	0x05-5
CP6 (RO)	6th field of the product code	0x49 - I	0x06-6

EST-VI parameters:

Description		Values range	Default	Address [hex-dec]
Address (RW)	Modbus Address	1 – 255 [dec]	100	0x21 - 33
Modbus speed (RW)	Modbus speed	1200 2400 9600 19200 38400 [dec]	9600	0x22 - 34
Input (RW)	Input type	V = voltage I = current [ASCII]	V	0x23 - 35
Output (RW)	Output type	V = voltage I = current [ASCII]	V	0x24 - 36
Input filter (RW)	Input filter	U=off F=on [ASCII]	U	0x25 - 37
Reverse Output (RW)	Current (I) output reverse logic	D=off R=on [ASCII]	D	0x26 - 38
Start input (RW)	Minimum input signal value	0÷10 for voltage 0÷20 for current [dec]	0 for voltage 4 for current	0x27 - 39
End input (RW)	Maximum input signal value	0÷10 for voltage 0÷20 for current [dec]	10 for voltage 20 for current	0x28 - 40

Start output (RW)	Minimum output signal value	0÷10 for voltage 0÷20 for current [dec]	0 for voltage 4 for current	0x29 - 41
End output (RW)	Maximum output signal value	0-10 for voltage 0÷20 for current [dec]	10 for voltage 20 for current	0x2A - 42
Status/Err (RO)	Status or out of scale error	0=normal 1=under range 2=over range 3=wrong configuration 9999=reset [dec]	-	0x64 - 100
Input Value (RO)		Voltage in mV Current in µA [dec]	-	0x65 - 101
Output Value (RO)		Voltage in mV Current in µA [dec]	-	0x66 - 102
DIP status (RO)	Dip-switches status on SW1 and SW2	0=off 1=on [binary]	-	0x67 - 103

In the case of simultaneously reading multiple addresses please consider the following limitations:

- for addresses ranging from 33(decimal) to 42(decimal) the sum of the initial and subsequent addresses must be lower than 43
- for addresses higher than 0x65 (100 decimal) only one address can be read at a time

It's possible to perform a **factory reset** of all configuration parameters. To do so write the decimal value 9999 at the 0x64 address (decimal address 100) via Modbus.

7 - FUNCTIONS OF THE RS485 TRANSMISSION PROTOCOL

7.1 – FUNCTION 03 - READING N WORDS

The number of words to read must be less than or equal to 22.

The request has the following structure:

Slave number	Function number	First word address		Number of words		CRC	
		MSB	LSB	MSB	LSB	MSB	LSB
byte 0	byte1= 0x03	byte 2	byte 3	byte 4	byte 5	byte 6	byte 7

The response has the following structure:

Slave number	Function number	NB number of bytes read	First word value		Subsequent words	CRC	
			MSB	LSB		MSB	LSB
byte 0	byte1= 0x03	byte 2	byte 3	byte 4	byte 5	byte NB+2	byte NB+3

7.2 – FUNCTION 06 – WRITING A WORD

The request has the following structure:

Slave number	Function number	First word address		Value to write		CRC	
		MSB	LSB	MSB	LSB	MSB	LSB
byte 0	byte1= 0x06	byte 2	byte 3	byte 4	byte 5	byte 6	byte 7

The normal response is purely an echo of the request message:

Slave number	Function number	First word address		Value to write		CRC	
		MSB	LSB	MSB	LSB	MSB	LSB
byte 0	byte1= 0x06	byte 2	byte 3	byte 4	byte 5	byte 6	byte 7

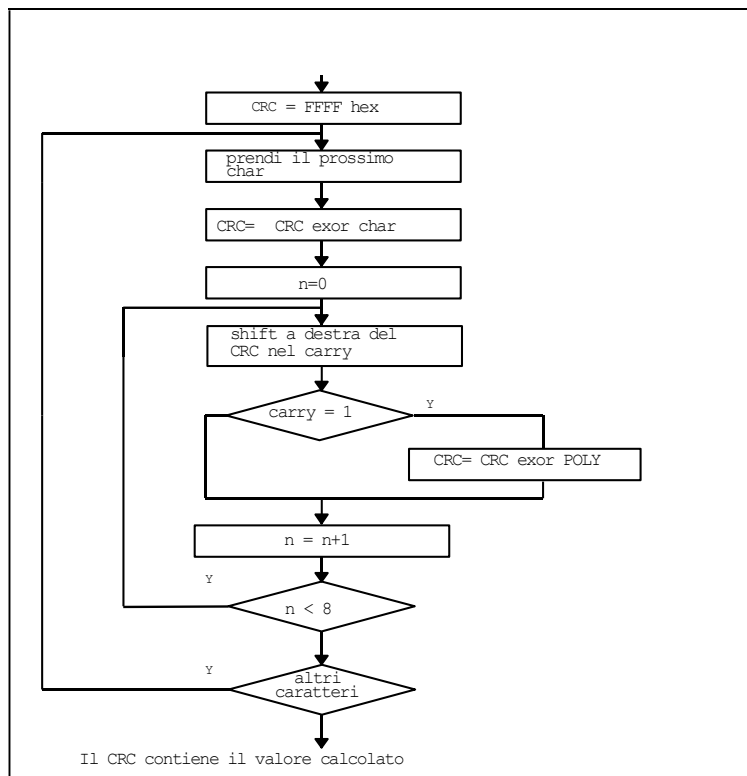
7.3 – CYCLIC REDUNDANCY CHECK (CRC)

The CRC is a check word that allows you to verify the integrity of a message. Each message, sent or received, contains the CRC word in the last two characters.

After receiving a request the controller checks the validity of the message received, thus comparing the CRC contained in the message with the one calculated during reception.

During transmission the controller calculates the CRC and places the two characters at the end of the message. The calculation of the CRC is performed on each character of the message excluding the last two.

Since the EST-VI devices are compatible with the MODBUS RTS (JBUS) protocol, they use the same algorithm for the calculation of the CRC.



The polynomial adopted by MODBUS RTU (JBUS) is 1010 0000 0000 0001.

Note: the first character of the CRC transmitted is the less significant of the two calculated.

8 – TECHNICAL DATA

8.1 – ELECTRICAL CHARACTERISTICS

Power Supply: 19...30 VDC
Insulation: 1.5 KV@1minute
Absorption: 35mA@24VDC, max 45mA
Input: 1 configurable input:
 -voltage: range 0...10Vdc, max 110KΩ impedance
 -current: range 0...20mA, max 35Ω impedance
Output: 1 configurable output:
 - voltage: range 0...10Vdc
 - voltage: range 0...20mA
Conversion: digital, 14 bit
Overvoltage category: 2

8.2 – NORMATIVES

EN61010-1 safety
 EN61000-6-2 EMC immunity, industrial environments
 EN61000-6-4 EMC emissions, industrial environments



8.3 – MECHANICAL CHARACTERISTICS

Case: PTB Plastic, UL 94 V0
Dimensions: 6,3 x 93,1 x 101,2 mm
Weight: 50 gr
Installation: omega DIN guide
Connections: screw terminals and removable bus on DIN rail
Front protection degree: IP 20
Pollution degree: 2
Use environment: indoor.
Working ambient temperature: -10÷65 °C
Working ambient humidity: 30÷95 RH% non-condensing
Temperature for transportation and storage: -30÷80 °C

8.4 – ACCESSORIES (Not included)

BC-5P2: double bus connector for DIN rail connection
TC-5PR: male connector for termination resistor and RS485 line access
TC-5PL: female connector for termination resistor and RS485 line access
EST-PWS: redundant power supply

9 - MAINTENANCE AND WARRANTY

9.1 - CLEANING

It is recommended to clean the device only with a cloth slightly soaked in water or a non-abrasive detergent and not containing solvents.

9.2 - WARRANTY AND REPAIR

The device is guaranteed by manufacture defects or defects in material found within 12 months from the date of delivery. Warranty is limited to repair or replacement of the product. Possible opening of the container, tampering with the device, or improper use and installation of the product will automatically result in the warranty being decayed. In the event of a defective product during the warranty period or outside the warranty period, contact the EL.CO. Sales Dept. to obtain authorization for shipment. The defective product, therefore, accompanied by the indications of the defect found, must be sent to the EL.CO. unless otherwise agreed.