EVO SER

EvoSer-T

EvoSer-U

Instruction manual

italcoppie
SENSORI

Before installing the device, read and scrupulously follow the instructions given in this manual.

¤ Read the installation instruction given in this manual before hooking up the device or network of devices.
¤ The device must be cabled with wiring suited to the limit voltage and current specifications given in the technical data: we recommend using the appropriate Italcoppie 4 pole + shield cable (see 'Evo ser options'); The cable can be used to install a network of up to 32 devices.
¤ The RS485 serial interface is NOT galvanically isolated: if the network is controlled by a master unit equipped with RS232 interface, we recommend using an isolated converter; if the network is controlled by a master unit equipped with an RS485 interface, we recommend using a galvanic separator (see 'Evo ser options').
¤ Incorrect connection (e.g.: connecting the power to the serial interface's A and B signals) can cause the device to fail: the Evoser device is protected against inverted power polarity.
¤ The device is not equipped with an ON/OFF switch, and powers up immediately as soon as power is supplied to it
¤ The device or network must be powered with a DC voltage in the range 12 to 30V: power supply in excess of 30 V DC will cause the entire network to fail. We recommend powering the device(or network) with the appropriate power supply (see 'Evo ser options'): this will power up to 32 devices. It is already provided with an input fuse.
¤ If the network is composed of more than 32 devices, use more than one power supply (1 per group of 32 devices) and several serial repeaters (1 each 32 devices) (see 'Evo ser options')
¤ Make sure that the working environment falls within the range specified in 1.1 'Technical specifications'
¤ The device is not designed for operation in hazardous atmospheres (flammable or explosive): its use in such conditions is <u>prohibited</u>.

This controller has been designed with compliance to 'Regulations on electrical apparatus (appliance, systems and installations) according to the European Community directive 73/23/EEC amended by the European Comunity directive 93/68/EEC and the Regulations on the essential protection requirements in electrical apparatus EN61010- 1 : 93 + A2:95.
It is important to understand that it's responsibility of the installer to ensure the compliance of the regulations on safety requirements and EMC.

The products meet the requirements for the European WEEE.

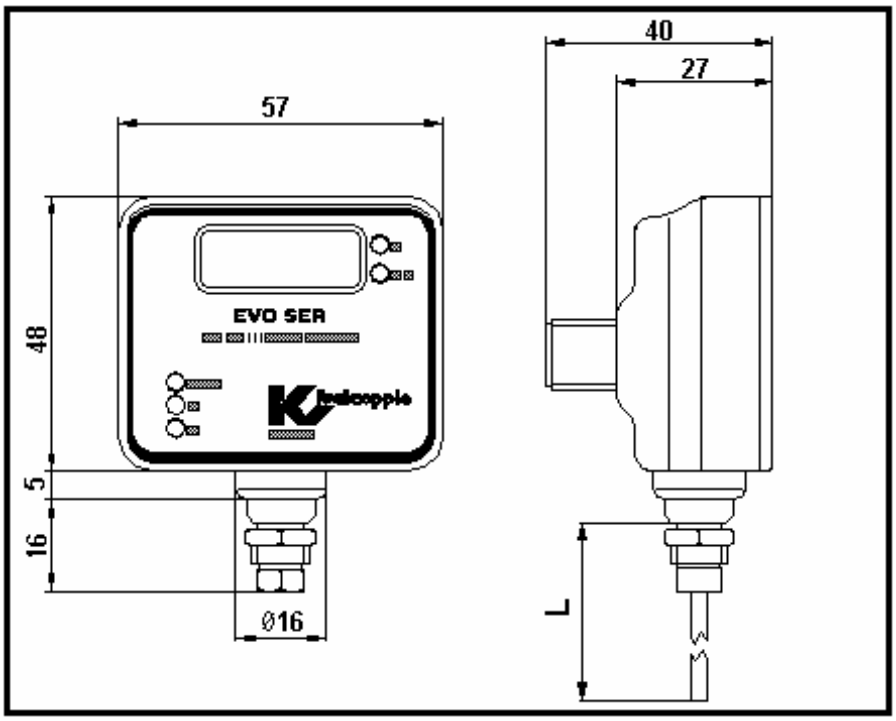
Italcoppie sensori s.r.l. is not liable in any way for damage or injury caused by tampering or incorrect or improper use of the device.

1 Introduction

Evo Ser is the new series of field sensors with serial output (Modbus RTU) conceived and designed by Italcoppie sensori: together with the Evo-Stop and Evo-Tra series, it provides a complete range of advanced temperature sensors.
Sophisticated design, small footprint, IP67 protection rating, low cost, ease of cabling and use – these are the features which make the device the perfect choice for a wide range of industrial and residential (home-automation) applications.
The two M12 connectors on the rear of its housing make the Evo-Ser system quick and easy to hookup.
The Evo Ser range of devices is designed for modular system installations: it is easy to expand an installation at any time without supplementary design costs.

The MODBUS (RTU or ASCII) protocol is a very popular standard for field bus applications: it is ideal for reliably and efficiently handling large data flows with numerous variables. Thanks to this standard, the Evo Ser series can be hooked up directly to the majority of commercially available PLC's and SCADA packages, with the option to connect these modules together with other devices (PLC's, operator panels, CNC equipment, etc...) over a single network.

1.1 Mechanical dimensions

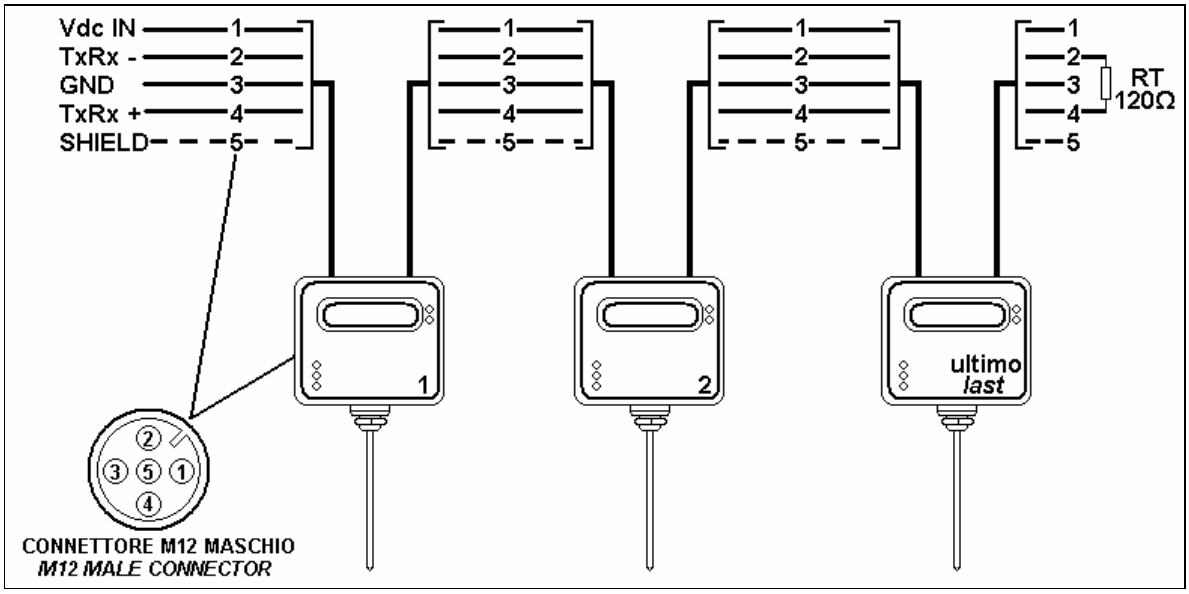


italcoppie
SENSORI

2 EVO SER installation

2.1 Electrical connections between EVO SER devices

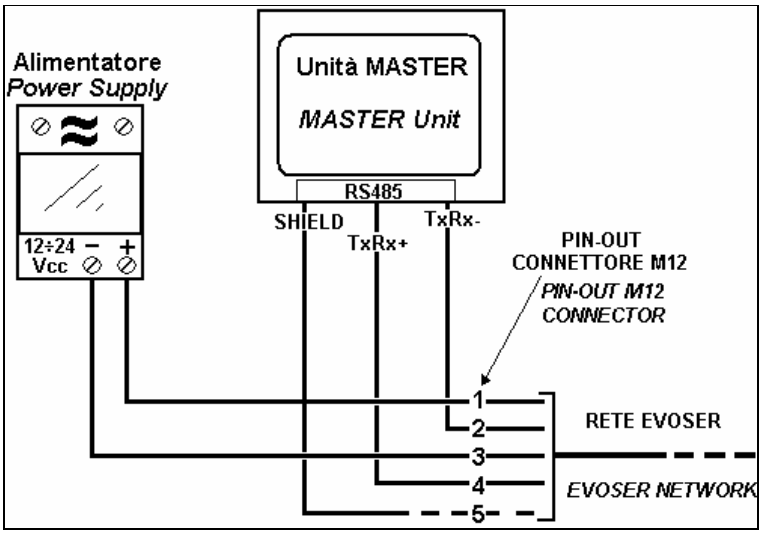
Follow the hookup schematic given below:



Fit a 120 ohm ¼ Watt terminal resistance to the last device in the chain to reduce serial signal reflections to a minimum: an M12 connector equipped with this resistance (see 'Evoser options') is available for this purpose. Make sure that the master unit (control unit which handles the RS485 network) is equipped with this resistance between the RS485 RxTx+ and RxTx- signals: if it is not so equipped, install one.
The connection between Evoser devices can be made with the appropriate Italcoppie extensions with co-moulded connector: this considerably simplifies and speeds up the cabling process. If you wish to use another type of cable, to obtain the performance ratings given in this manual we recommend using a cable with the closest possible specifications to those given in '*EvoSer device cable*' in '*Evo ser options*'.

SENSORI

2.2 Powering the EVO SER network and connection to the master unit

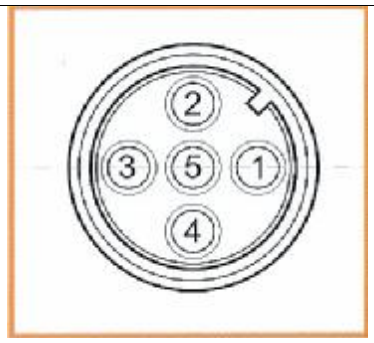


Power the Evoser network with a stabilised power supply with output voltage in the range 12 to 30V DC: voltage in excess of this maximum will cause the entire chain of devices connected to the power supply to fail.
Note: The device is not equipped with an ON/OFF switch, and powers up immediately as soon as power is supplied to it
We recommend using the switching power supply indicated in 'Evo Ser options'; this unit can power up to 32 Evoser devices.

2.3 RS485 serial interface

Evo Ser devices are equipped with an RS-485 serial port with 2 wire connection; The two M12 5-pole connectors on the device simplify cabling by integrating the serial signal with power to the device.
The RS485 serial interface is not galvanically isolated: if the master unit is equipped with an RS232 serial interface, we recommend using an isolated converter. If the master unit is equipped with an RS485 port, we recommend using an RS485 galvanic separator (see 'Evo Ser options').

2.4 M12 connector Pin-OUT



1: +V (+24V DC power)
2: TxRx- (B)
3: GND
4: TxRx+(A)
5: SHIELD

2.5 Communication cable layout

To prevent external interference with the serial signal and obtain the highest efficiency between the master and the Evo Ser devices, a number of small precautions must be observed.
The most important (and simplest) is to physically separate the power and communications cables and route them as far as possible from contactors, electromagnets, powerful motors, etc.
The type of cable used is essential to the operation of the system as a whole. The most important specification is capacitance per metre (pF/m); the lower the capacitance of the cable the longer the line may be. In this regard, the power cable and generic ducting cables are absolutely to be avoided inasmuch as they have a very high capacitance per metre. Furthermore, to obtain high resistance to disturbances, the cables must be twisted together and equipped with a metal shield connected to a good ground plant (at one end only), with a characteristic impedance of around 120 ohm.
If these simple precautions are observed, the line will operate at its highest possible speed over a distance of up to 1,200 metres.
The two devices (master and last slave) at each end of the line must be terminated; star type connections are not allowed, since each wire would be terminated, thus significantly lowering the impedance of the line and blocking communications completely.
Extensions with co-moulded M12 connectors are available as accessories, as described below.

3 GUIDE TO RS-485 NETWORK

The RS485 serial interface is based on a balanced differential communications line with typical impedance of 120 ohm. The maximum cable run is not defined, but depends on the speed of communications, the signal noise ratio and the quality of the cable used. The line is generally guaranteed to operate up to 1,200 m.
The cable can be unshielded if the run is of a few metres in an electrically only slightly noisy area. For distances from 15 to 100 m, you can use a shielded and twisted cable without special characteristics, while for connections over 100 metres, we recommend using a category 5 cable.
The ends of the line must be terminated in parallel with a 120 ohm resistance.
The shield of the cable must be connected to pin Nr.5 (Shield) on the M12 connector, and grounded at one end only; if the other end must be grounded to reduce disturbance, fit a 10nF capacitor.

3.1 Capacitive load of the line

With very long cables, the capacitance of the cable starts to be the dominant factor in power consumption. For this reason, it is not usually possible to achieve maximum cable run and highest transmission speed in a single installation.
The following table is a rough guide to the compromise between distance and speed.

Baud rate	Total max. capacitance of cable (pF)
2,400	200,000
4,800	100,000
9,600	50,000
19,200	25,000
38,400	12,000

The capacitance of the cable (in pF/m) can be obtained from the manufacturer, and is typically between 50pF/m (for high quality cables, e.g. category 5) and 100pF/m.
Naturally, the resistance and inductance of the cable, which may be neglected for short cable runs, influence the signal level if the cable run is very long. It is hard to give general rules, since he minimum section depends on the line termination, number of connected devices and spacing between them. In case of doubt, always choose the larger section cable.

3.2 Line polarity

As per the RS485/422 standard, the line connections are indicated as A and B: the line may however be marked differently, for example HI/LO or +/-. It is usually assumed that A/B correspond respectively to HI/LO, or +/-, but this is not always the case. In case of malfunction, try swapping the connections even if everything seems to be OK.

4 Modbus RTU

4.1.1 Preliminary notions

MODBUS was used primarily in industrial applications, thanks to the dominating presence of Modicon in the PLC market, which developed the standard for its own equipment.
When the specifications became public and open, the Modbus protocol was adopted in numerous automation applications and subsequently in all sectors.
For many years it has been a *de facto* standard, and the Modbus protocol can be found on any "intelligent" equipment (IFD - Intelligent Field Device): programmable controllers, NC, drivers, man/machine terminals, measurement equipment, etc.

4.1.2 Communications model

The connection is made over an RS-485 multipoint network, typically by means of a twisted two-wire cable with shielding.
The communications technique is of the Master-Slave type, multipoint half-duplex, in which only the Master (typically a Host PC) can initiate communications with a request ("Query"), while the Slaves respond with a message ("Response") only to the queries addressed directly to themselves.
One master can control up to 247 slaves on a single line; note that this is a logical limit of the protocol, however the physical interface may further limit the number of devices, for example, the standard RS-485 interface supports a maximum of 31 slaves on a single line. If we replace the last device on the line with a bridge or repeater, a further 31 slaves can be installed, an so on up to the logical limit.
The Modbus protocol establishes the format of the query, which contains the address of the slave being queried, a function code for the requested action, various fields for exchanging data (registries, coils, etc...), and a field to check for communications errors (CRC).
The slaves respond with messages which are structured in the same way; if a slave is unable to complete the requested action, it sends an error code in the response.

4.1.3 Transmission

The Evo Ser devices employ the RTU Modbus protocol; the serial mode and setup must be the same for all devices on the Modbus network.

In RTU (Remote Terminal Unit) mode, the messages, which are composed of single bytes, are sent in the form of two 4 bit hexadecimal characters. The advantage of this is that the quality of data exchange is better than that provided by the ASCII mode for a given transmission speed. Each communications packet must be transmitted in a continuous cycle.

The format for each RTU mode byte is:

Coding system: 8 binary bits, from 00 to FF
Two hexadecimal characters are contained in each 8 bit field of the message.
Each 8 bit character of the message corresponds to one data byte.

Character format:
1 start bit ,
8 data bits,
the 1st bit is the least significant,
no parity bit (None),
1 stop bit.

Address: Modbus transactions always involve the master, which controls the line, and one slave at a time (except for broadcast messages, but these are not implemented in the Evo Ser firmware). To identify the target of the query, the first byte contains the numerical address of the desired slave. Each slave has a unique address number which uniquely identifies it. Legal addresses run from 1 to 247, while 0, which cannot be assigned to a slave, at the head of a message identifies the message as "broadcast", directed at all slaves at the same time. Only messages which do not require a response to complete may be transmitted as broadcast, in other words, only assignments.

Function code:
The second character of the message identifies the function to be executed, to which the slave responds with the same code to indicate that the functionhas been executed. The Evo Ser system implements a subset of Modbus functions, including:

Modbus function code	*Function*
01	Read Coil status
02	Read Input Status
03	Read Holding register
04	Read Input register
05	Force single Coil

06	Preset single register
07	Read Status
16	Preset multiple Registers

In the Evo Ser system, functions 01 and 02 are operatively identical and interchangeable, as are functions 03 and 04.

4.1.4 CRC16

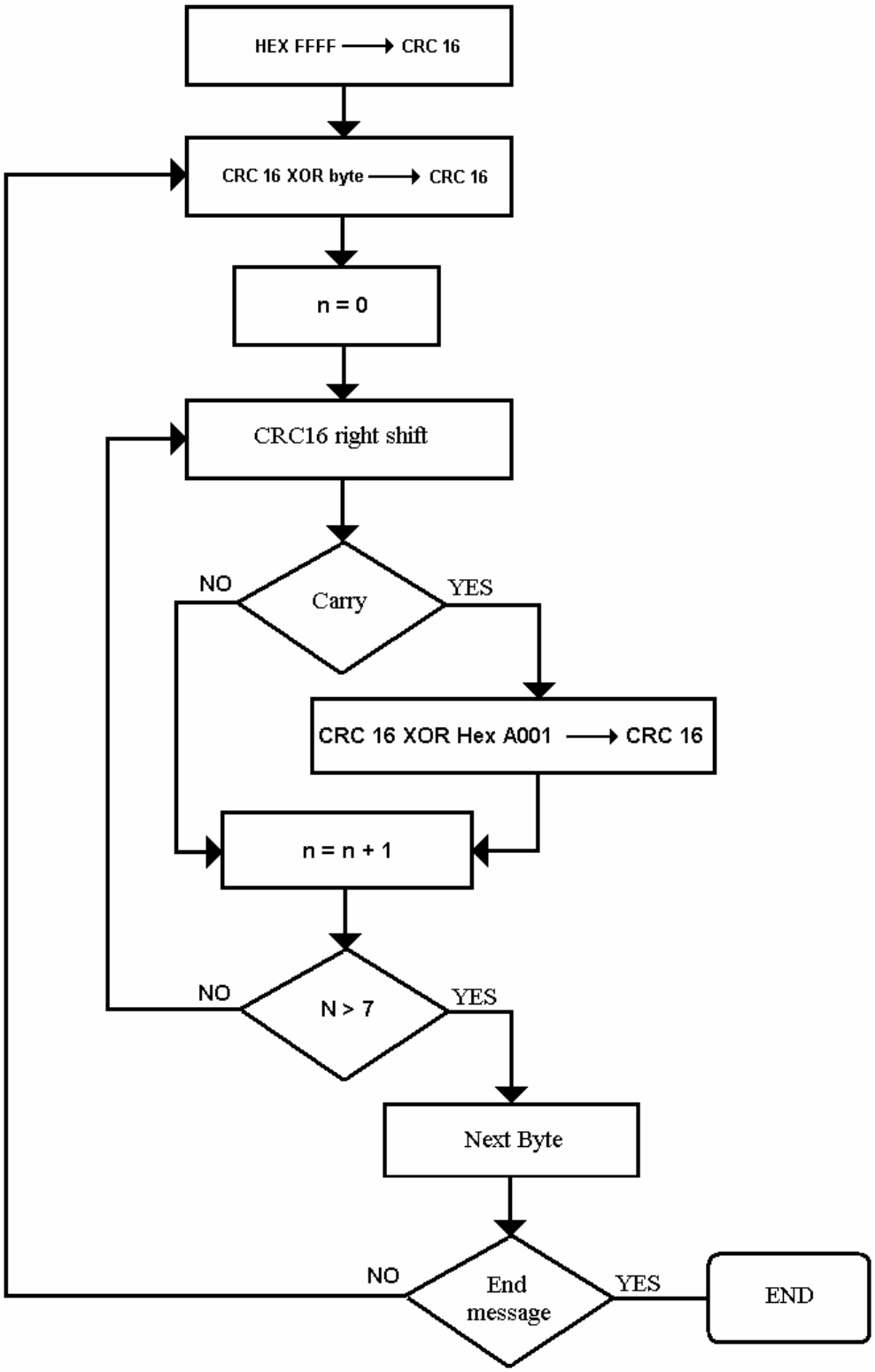
The last two characters of the message contain the Cyclical Redundancy Check (CRC) code calculated with the CRC16 algorithm. In order to calculate these two characters, the message (address, function code and data, excluding the start, stop and parity bit) is considered as a single binary number of which the most significant bit (MSB) is the first to be transmitted. The message is first multiplied by 2^{16} (moved to the left by 16 bits) and then divided by $2^{16} + 2^{15} + 2^2 + 1$ expressed as a binary number (1100000000000101). The entire quotient is then discarded and the 16 bit remainder (initialised to FFFFh at the beginning to avoid the case of messages consisting of only zeroes) is added to the transmitted message. The resulting message, when it is divided by the receiving device in the same way ($2^{16} + 2^{15} + 2^2 + 1$) will give zero as remainder if no errors have occurred (the receiving device recalculates the CRC).
Since the device serialising the data to be transmitted (UART) transmits first the least significant bit (LSB) rather than the MSB as would be the case for calculating the CRC, this is done by inverting the function. Furthermore, since the MSB of the function only influences the quotient and not the remainder, it is eliminated, thus making it 1010000000000001.
The step by step procedure for calculating the CRC16 is as follows:

1) **Load a 16 bit register with FFFFh (all bits set to 1)**
2) **Run an exclusive OR of the first character with the top byte of the register, and write the result to the register.**
3) **Move the register to the right by one bit.**
4) **If the bit which drops out of the right side of the register (flag) is 1, run an exclusive OR on the generator function 1010000000000001 with the register.**
5) **Repeat steps 3 and 4 8 times.**
6) **Run an exclusive OR of the next character with the top byte of the register, and write the result to the register.**
7) **Repeat steps 3 to 6 for all characters in the message.**
8) **The contents of the 16 but register is the CRC code which must be added to the message.**

4.1.5 Calculating CRC16 in Visual Basic

```
        Function CRC16(String As String) As String

                Dim N As Integer, I As Integer, NByte As Integer
                Dim CRC As Long, a As Byte
Dim Buffer As String

NByte = Len(String)
CRC = 65535


        For i = 1 To NByte
            a = Asc(Mid$(String, I, 1)) 'C(I)
          CRC = (CRC Xor a) And &HFFFF

            For N = 0 To 7

               If CRC And 1 Then
                     CRC = (CRC \ 2)
                  CRC = (CRC Xor 40961)
               Else
                  CRC = CRC \ 2
               End if

         Next

        Next

        Buffer = Right$("0000" + Hex$(CRC And &HFFFF), 4)
CRC16 = Chr$ ("&H"+ Right$(Buffer, 2)) + Chr$("&H" + Left$(Buffer,2))
        End Function
```

4.1.6 CRC16 calculation flowchart



italcoppie
SENSORI

4.1.7 Message synchronisation

The message between the transmitter and receiver is synchronised by inserting a pause between messages of at least 3.5 times the time it takes to transmit a character; this pause therefore depends on the baud rate.
If the receiver does not receive for a period of 3.5 characters, it assumes the previous message to be complete and considers the subsequent byte to be the first of a new message, and thus an address.
The network devices constantly monitor the bus, including the silent pause. The admissible characters transmitted for all fields are 8 bit numbers, hence in the range 0 to 255.
The first transmitted field is the address of the device.
When the first field (address) has been received, each device decodes it to determine whether the message is addressed to itself.
After the last transmitted character, an interval of 3.5 characters follows to indicate the end of the current message. A new message can start immediately after expiry of this delay. The entire message frame must be transmitted continuously.
If a new message starts before the delay of 3.5 characters has expired, the receiver will consider it to be the continuation of the previous message; this generates an error, since the value of the last field (CRC) will not be valid for the combined messages.

START	ADDRESS	FUNCTION	DATA	CRC CHECK	END
T1-T2-T3-T4	1 CHAR (8 bits)	1 CHAR (8 bits)	N CHARS (n x 8 bits)	2 CHARS (16 bits)	T1-T2-T3-T4

4.2 Modbus functions

We describe in detail the modbus functions implemented on Evo Ser devices.

4.2.1 Read N bits (Function code 01 or 02)

This function allows the user to read the logical value (ON/OFF) of the bits of the addressed device. The returned data are packaged in bytes, so that the first requested bit occupies the least significant bit of the first byte of data. The others follow in such a way that if the number of bits requested is not a multiple of 8, the last byte in the response will be completed with zeroes.

Master – device package:

Device address	Function code (01 or 02)	Address of first bit		Number of bits to read (max 255)		CRC	
1 byte	1 byte	MSB	LSB	MSB	LSB	MSB	LSB

Device – master package

Device address	Function code	Number of bytes read	First byte of data	.....	Last byte of data	CRC	
1 byte	1 byte	1 byte	1 byte	.....	1 byte	MSB	LSB

Example: Read 2 bits starting from the bit with address 0, device address 2.

Master – device:

Device address	Function code	Address of first bit		Number of bits to read		CRC	
02	01	00	00	00	02	BD	F8

Device – master:

Device address	Function code	Number of bytes read	Number of bytes of data	CRC	
02	01	01	03	xx	xx

The response tells us that bits 0 and 1 (Enable Watchdog Event and Watchdog Event) are equal to 1. The response assigns zeroes to addresses which are not requested by the master; this does not mean that their real values are zero.

4.2.2 Read N registers (function code 03 or 04)

This function allows the user to read the values of the registers of the addressed device.

Master – device package:

Device address	Function code (03 or 04)	Address of register number		Number of registers to read (max 16)		CRC	
1 byte	1 byte	MSB	LSB	MSB	LSB	MSB	LSB

Device – master package:

Device address	Function code	Number of bytes read	Value of first register		.....	Value of last register		CRC	
1 byte	1 byte	1 byte	MSB	LSB	.....	MSB	LSB	MSB	LSB

Example: Read 2 registers starting with register address 13 (device name), device address 1.

Master – device:

Device address	Function code	Address of register number		Number of registers to read		CRC	
01	03	00	0D	00	02	55	C8

Device – master:

Device address	Function code	Number of bytes read	Value of first register		Value of last register		CRC	
01	03	04	45	56	4F	54	3A	E0

The response tells us that registers 13 and 14 have the values 0x4556 and 0x4F54 respectively, or 'EV' 'OT' in ASCII.
Up to 16 registers can be read at a time; a request for more than 16 registers generates an error frame.

4.2.3 Assign a bit (function code 05)

This function allows the user to assign the logical values (ON/OFF) of the bits of the addressed device. To deactivate a bit, send 00h, to activate it, send 01h or FFh. This value must be written in the most significant byte.

Master – device package:

Device address	Function code (05)	Address of bit		Value of bit		CRC	
1 byte	1 byte	MSB	LSB	MSB	LSB	MSB	LSB

Device – master package:

Device address	Function code (05)	Address of bit		Value of bit		CRC	
1 byte	1 byte	MSB	LSB	MSB	LSB	MSB	LSB

Example: Assign activate to the bit with address 0, device address 2.

Master – device:

Device address	Function code	Address of bit		Value of bit		CRC	
02	05	00	00	01	00	CC	69

Device – master:

Device address	Function code	Address of bit		Value of bit		CRC	
02	05	00	00	01	00	xx	xx

The response tells us that bit 0 (Enable Watchdog Event) has been activated.

4.2.4 Assign a register (function code 06)

This function allows the user to set the values of the parameters of the addressed device.

Master – device package:

Device address	Function code (06)	Address of register		Value of register		CRC	
1 byte	1 byte	MSB	LSB	MSB	LSB	MSB	LSB

Device – master package:

Device address	Function code (06)	Address of register		Value of register		CRC	
1 byte	1 byte	MSB	LSB	MSB	LSB	MSB	LSB

Example: Assign the value 15 (000Fh) to the register with address 01, device address 2.

Master – device:

Device address	Function code	Address of register		Value of register		CRC	
02	06	00	01	00	0F	98	3D

Device – master:

Device address	Function code	Address of register		Value of register		CRC	
02	06	00	01	00	0F	xx	xx

The response tells us that register 1 (temperature bias) has been set to 15 (1.5°C).

4.2.5 Assign multiple registers (function code 16)

This function allows the user to set the value of a block of consecutive 16 bit registers.
In the Evo Ser implementation, while this function is available for reasons of compatibility, it does not allow more than 15 register to be set.
Master – device package:

Device address	Function code (16)	Address of first register		Number of WORDS		Number of BYTES	...DATA...		CRC	
1 byte	1 byte	MSB	LSB	MSB	LSB	1 byte	MSB	LSB	MSB	LSB

Device – master package:

Device address	Function code (16)	Address of first register		Number of WORDS		CRC	
1 byte	1 byte	MSB	LSB	MSB	LSB	MSB	LSB

Example: Write two registers at the same time. Assign the value 4556h to the register with address 13, and 4F54h to the register with address 14, device address 1. [Device name 'EVOT']

Master – device:

Device address	Function code	Address of first register		Number of WORDS		Number of BYTES	DATA				CRC	
01	10	00	0D	00	02	04	45	56	4F	54	F2	E5

Device – master:

Device address	Function code (16)	Address of first register		Number of WORDS		CRC	
01	10	00	0D	00	02	D0	0B

4.3 Modbus error codes

The Modbus protocol provides for two types of error, which are handled in different ways: transmission errors and operational errors. Transmission errors are errors which change the message in terms of format, parity (if used) or CRC16. A device which detects this type of error considers the message to be invalid and does not respond. If, on the other hand, the message format is correct but the requested function cannot be executed for any reason, this is an operational error. The device responds to this type of error with an exception message. Such a message is composed of the address, code of the requested function, error code and CRC. To indicate that the response is an error, the function code is returned with its most significant bit set to '1'.
Although the Modbus standard provides for 8 different exception codes, the Evo Ser implementation only has 3:

Error code	Name	Description
01	ILLEGAL FUNCTION	Invalid function
02	ILLEGAL DATA ADDRESS	the address of the data is invalid
03	ILLEGAL DATA VALUE	the data field/s are invalid

4.4 Communications times

The messages, as described above, must be exchanged without internal pauses of more than 3.5 times the transmission time of a character, since a pause of this duration indicates the end of a message. Between a master query and the response from the addressed Evo Ser device, a latency time passes which can be set from 0 to 0.51 seconds, set in steps of 2 ms with the parameter '*Modbus delay*' (register address 10).

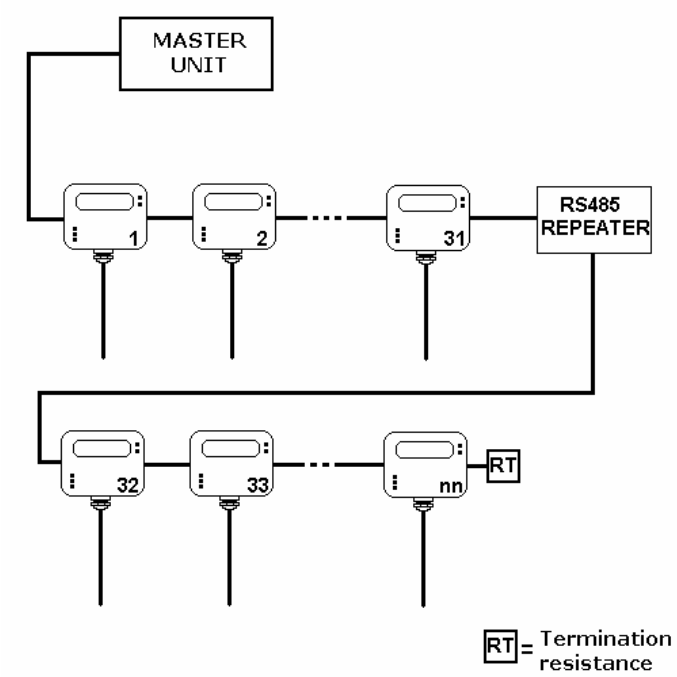
5 Evo Ser options

5.1 Serial repeater

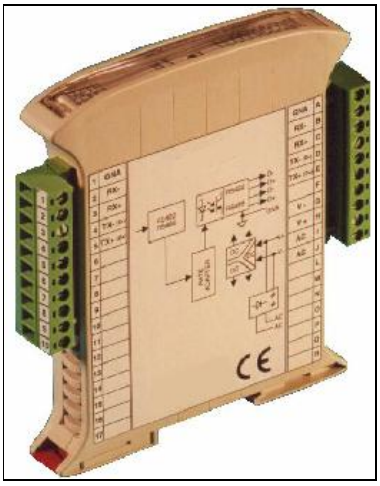
Order code: EVO005

As described above, when it is necessary to create a network with more than 31 devices or you need to cover very long distances (over 1,000 metres), you must fit a serial repeater between the last Evo Ser in the network and the first of the subsequent network.

Example:



The termination resistances (RT = 120 ohm) are installed at the beginning and end of each segment of network.



italcoppie SENSORI

Technical characteristics

Power	**10-30V DC 9-18V AC**
Transmission speed	**From 75 to 115,200 baud**
Typical line impedance	**100 ohm**
Isolation between the 2 lines	**2,000V AC, 50Hz, 1min.**
Distance up to:	**1,200 metres**
Consumption	**25mA @ 24V DC**
RX/TX switching time	**150µS**
Operating temperature	**-20 - 70°C**
Storage temperature	**-40 - 100°C**
Relative humidity without condensation	**0 - 90%**
Dimensions (WxHxT) in mm	**101 x 119 x 22.5**
Adapted to installation with DIN bar	
Automatic speed adaptation	
Serial connection on removable terminals	

5.2 RS232 /RS485 isolated serial converter

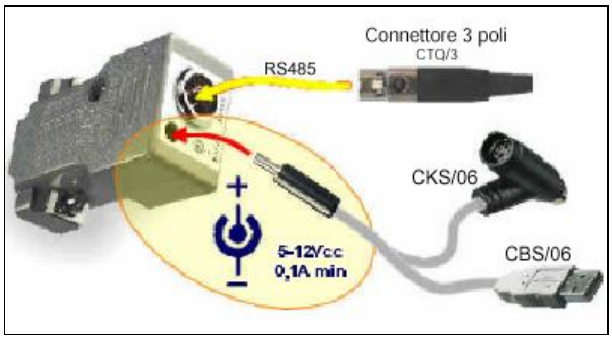
Order code: EVO006

The serial interface of Evo Ser devices is of the RS485 type: if you need to display the data on a PC or any other type of master unit equipped only with an RS232/RS485 converter.

Technical characteristics

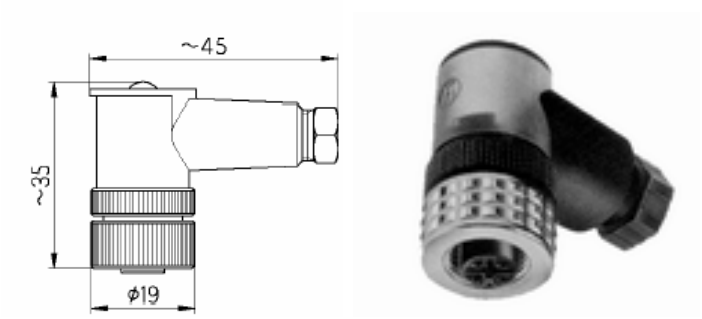
Power	**5-12V DC (DC socket 1.35 x 3.5mm)**
Max. transmission speed	**115,200 bps**
ESD protection	**±15KV**
RS232/RS485 isolation	**±50V**
Automatic data direction	
Limited slew rate for transmission without errors	
Integrated standard termination resistance	

Since this is an isolated serial converter, it requires a separate power supply: its low power consumption means that it can be powered via the USB/PS2 ports of the PC using the special optional cables.



5.3 M12 5-pole IP67 90° connector

Order code: CONV109



This connector (5 female poles) can be used to cable the Evo Ser network: for further information, see '*Electrical connections*'.

5.4 M12 connector with integrated termination resistance

Order code: EVO001

As described in '*Electrical connections*' , the last device on the RS485 network must be fitted with a 120 ohm termination resistance between the A and B signals to reduce serial signal reflection.
This M12-5 pole connector is equipped with a 120 ohm resistance between pins 2 and 4, in other words, between the A and B signals of the RS485 line.

5.5 Connection cable between Evo Ser devices

As described above, the connectors on the Evo Ser devices are 5-pole units, of which 2 poles give the RS485 serial signals, 2 poles are power and 1 pole is the shield.
The cable indicated below is designed for this type of network, since it is composed of two pairs of copper wires, of which one is a twisted pair for the RS485 signals (greater rejetion of disturbance) and one pair has a slightly greater section for the power supply.
The two pairs of cables are shielded with an aluminium cover with foil wire for easier connection to the M12 connector: the entire assembly being covered with an external oil and fire resistant polyurethane sheath.

Technical characteristics:

CONDUCTOR	
Nr. of conductors	**1x2x24AWG + 1x2x22AWG**
Composition	**1 AWG24 twisted pair (0.24 mm^2)** **1 AWG22 pair (0.33 mm^2)**
Material	**Tinned copper**

ISOLATION	
Material	**Polyurethane**
Colour	**AWG24 twisted pair: WHITE-BLUE** **AWG22 pair: BLACK-RED**

SHIELD	
Material	Aluminium with foil wire
Coverage	>85%

EXTERNAL SHEATH	
Material	Polyurethane
Colour	GREY Opaque
Section	5 ± 0,15mm

ELECTRICAL AND MECHNICAL SPECIFICATIONS			
FIXED ROUTING cable			
Characteristic impedance at 1 MHz			120ohm ± 15%
Maximum capacitance			<45pF/mt
Ohmic resistance of the wires at 20°			88.58 ohm/km max
Minimum radius of curvature			15 times diameter of cable
Operating temperature			- 20°C +80°C
Operating voltage			30V max
COLOUR CODING			
+VIN	1	RED	AWG22 (0.33 mm^2)
GND	3	BLACK	
-RxTx	2	BLUE	AWG24 (0.24 mm^2) twisted
+RxTx	4	WHITE	
SHIELD	5	-	-

5.6 IP67 connection extensions

Order code: PRV#

As options, extensions of various lengths are available, constructed with the cable described above and with co-moulded female M12 5-pole connectors. They are available in a range of lengths.

5.7 Power supply

Order code: STR129

The device must be powered with a DC voltage in the range 12 to 30V. This unit can power a network of up to 32 Evo Ser devices.

Technical specifications:

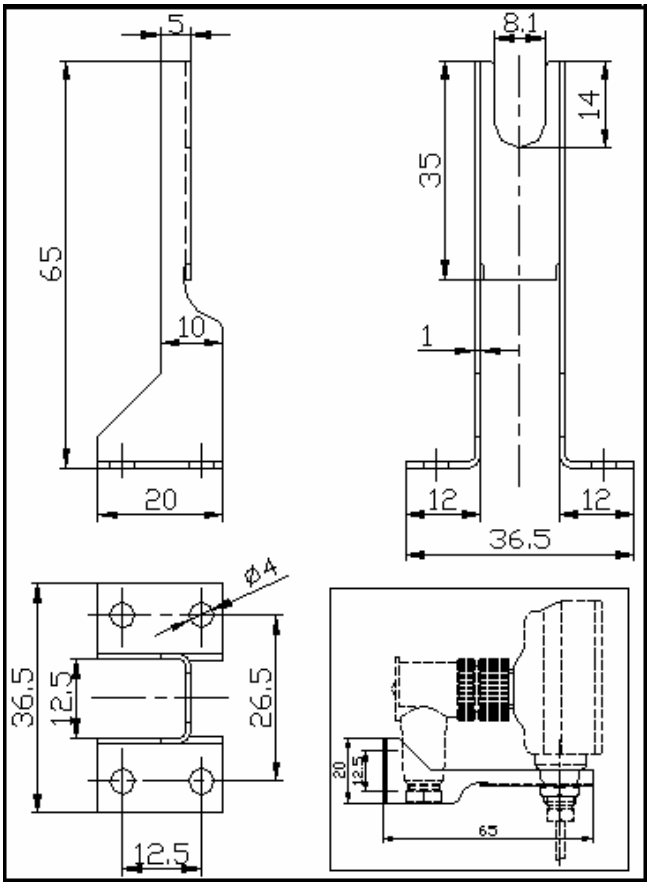
Type of power supply	**Switching**
Mains power	**90 ÷ 264 V AC**
Frequency	**47 - 63 Hz**
Output voltage	**24V DC ±10%**
Nominal current	**2.5A (continuous service)**
Ripple with nominal IO	**150mVpp**
Over-voltage threshold	**27-6 - 30V DC**
Efficiency	**Min.75%**
Maintenance at switch off	**16mS**
Operating temperature	**0÷50°C**
Isolated output	
Short circuit protection on output	
Equipped for installation to DIN bar	
Certificate UL-CSA (file ref. E159228)	

5.8 Wall mounting bracket

Order code: STR129

This bracket makes it quick and easy to mount the Evo Ser device to the wall.

Mechanical dimensions



italcoppie
SENSORI

5.9 Evo Ser configuration kit

This kit is designed for configuring the Evo Ser device and includes:

- **1 Rs485 à to PC (Rs232) serial converter (isolated)**
- **1 connection cable, length 1.5m.**
- **1 stabilised power supply, 12V DC 0.5Amp**
- **1 CD containing the '*EvoSerConf*' software and pdf instruction manual.**

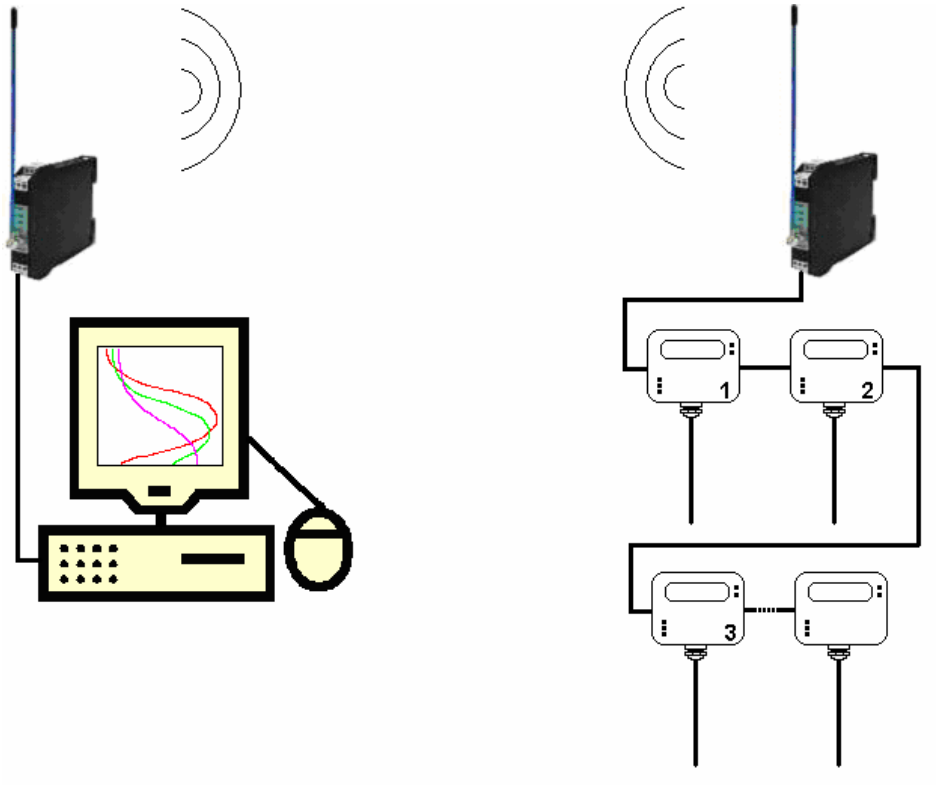
(For further information, see 'Evo Ser configuration software').

italcoppie
SENSORI

5.10 Wireless communications module

Order code: EVO002

This module makes it possible to implement a wireless network of Evoser devices. A typical application would be as follows:



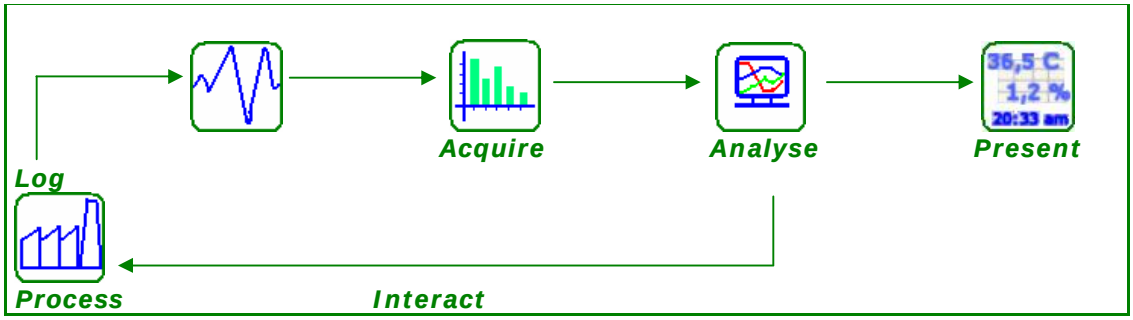
Technical characteristics:

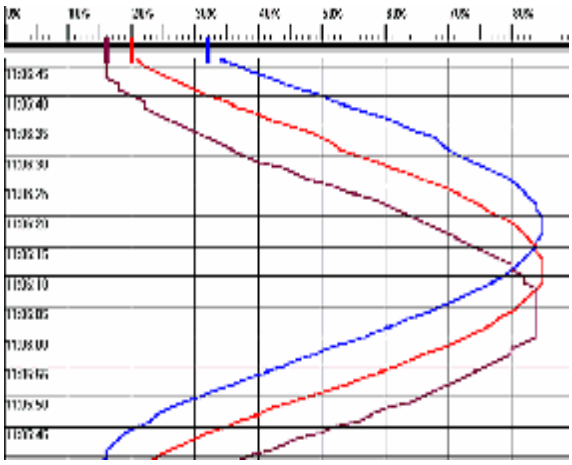
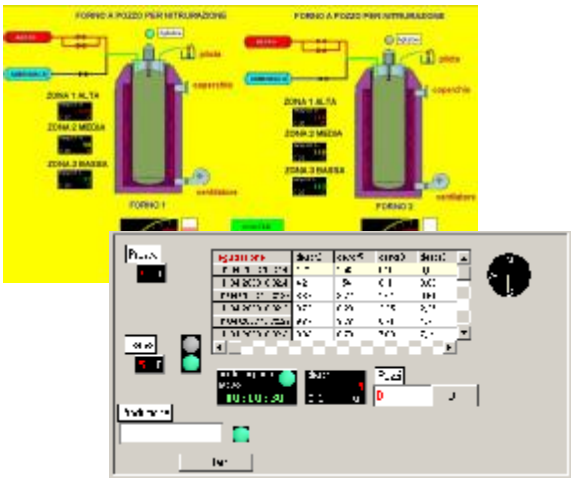
Transmission frequency	**868MHz**
Irradiated power	**10mW**
Max speed	**100Kbps**
Recommended distance in free air	**100m**
Power	**10-18V DC or 21.5-28V DC**
Operating temperature	**0 - 55°C**
Maximum humidity	**90% at +40°C**
Connections	**Removable screw down terminal clamps**
Antenna connection	**Standard SMA connector**
Installation	**For DIN 35 mm guide**
Battery or solar panel powered	

Accessories	**Directional antenna (requires license) for connection to over 1 Km** ***Order code: EVO003***

5.11 SCADA EVORECORDER software

EvoRecorder is the most simple and intuitive platform for acquiring and graphing EVOSER field sensor data. It runs on PC's with the Windows® OS and allows for acquiring and graphing up to 256 channels. It can integrate GSM functions via modem for receiving alarms by email and sms or for querying the system; the mathematics package allows for calculating mathematical functions on the acquired data, including integrals; the acquired data can be encrypted if required for reasons of internal security or regulations. If the EVOSER modbus network is amplified with digital I/O modules, you can also generate alarm thresholds on the basis of the acquired data.



PEN DISPLAY	SYNOPTIC DISPLAY AND SUPERVISION
	

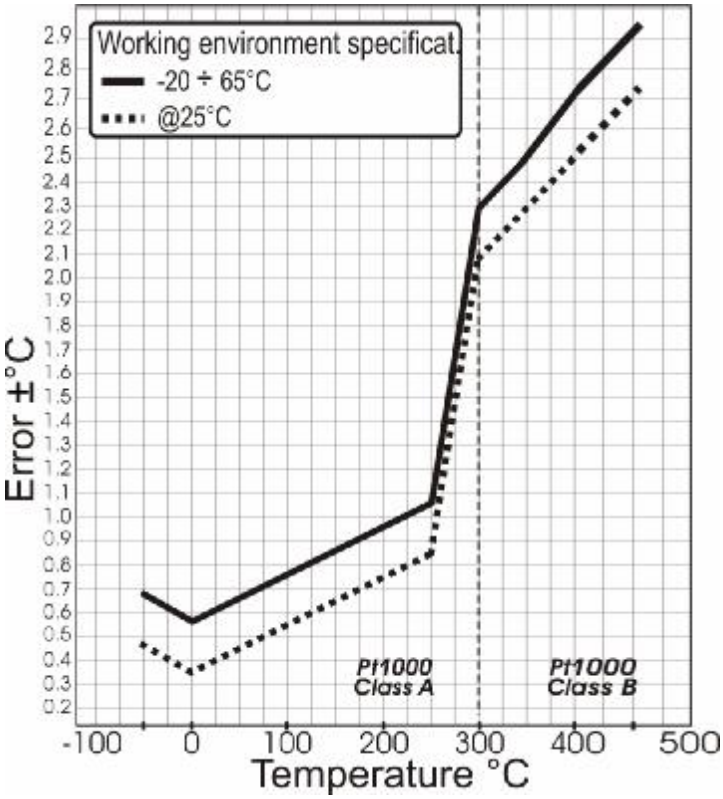
italcoppie
SENSORI

6 EVO SER-T (Temperature)

6.1 Technical specifications

Operating conditions	
Temperature	-20°C ÷ 65°C
Humidity	0 ÷ 100% RH
Tightness	IP67
Housing material	Nylon grey
Probe material	AISI 316 S.S.
General specifications	
Power voltage	12 ÷ 30 V DC
Internal consumption	0.25Watt 0.50 Watt (with display option)
AD converter	15 bit
Temperature resolution	±0.1°C
Accuracy	See graphic below
Input	
Sensor: RTD Pt1000	Minimum bending radius: three-times the outer diameter (except the sensing of length is ≈30mm)
Current injected to thermo-resistor	120 µA
Measurement range	-50.0 - 450.0°C
Serial interface	
RS485 serial	Settable speed: 2,400 - 4,800 - 9,600 - 19,200 - 38,400 baud
ESD protection	±15KV
Communications protocol	Modicon MODBUS-RTU
Maximum number of nodes	32
Connection distance	Up to 1,200 metres
Display	
Display (optional)	4 digits 7 red segments h. 8mm Red led for °C indication
Led indicators	Green: Power (power on) Red: Tx (transmission in progress) Red: Rx (reception in progress)
Standards:	
EMC 89/336/EEC	
Emission EN 50 081-1, EN 50 081-2	
Immunity EN 50 082-1, EN 50 082-2, EN 61326-1	

6.2 Accuracy



Note: in the range -50°C to 300°C the accuracy of the Pt1000 sensor is class A; above 300°C the accuracy of the sensor is class B

7 Table of registries

All the data shared by a module communicating with the Modbus protocol are mapped into tables, in which each datum is given an address.
Each datum can be of two types:
- "COIL", composed of a single bit: in the Evo Ser implementation, these bits are logical states.
- "REGISTER", composed of 2 bytes (16 bit): the variables and parameters are coded as signed integers (notation in complement of 2) without decimal point (for example: a temperature displayed as "25.0" is transmitted as 250). Assignment is only possible to the field admitted for each parameter; if you attempt to assign a value outside the admitted field, the Evo Ser device will return an error message with exception code 3 and will not execute the assignment.
Assigning word values with functions 06 and 16 is only allowed for addresses in which this is possible (parameters marked "R/W" in the table).

Modbus address	Parameter name	Range	Notes	E^2P
0[0x00]	Temperature	-50.0 - 450.0°C	Read Only	
1[0x01]	Temperature bias	-12.5 - 12.5°C	R/W	X
2[0x02]	Max Temperature peak	--	Read Only	X
3[0x03]	Min Temperature peak	--	Read Only	X
4[0x04]	Reset peaks	1	R/W	
5[0x05]	Modbus address	0÷255	R/W	X
6[0x06]	Baud Rate modbus 0 – 2,400 bps 1 – 4,800 bps 2 – 9,600 bps 3 – 19,200 bps 4 – 38,400 bps	0÷7	R/W	X
7[0x07]	Parity 0 – none 1 – even 2 – odd	0÷2	R/W	X
8[0x08]	Number of data bits 0 – 8 bits 1 – 7 bits	0÷1	R/W	X
9[0x09]	Number of stop bits 0 – 1 Stop bit 1 – 2 Stop bits	0÷1	R/W	X
10[0x0A]	Modbus delay	0÷255	R/W (x2mS)	X
11[0x0B]	System errors 0 – OK 1 – Sensor failure 2 – EEprom Error 3 – Over Range 4 – Under Range	0÷4	Read Only	
12[0x0C]	Show zeroes on display 0- No zeroes 1- Yes zeroes	0÷1	R/W	X
13[0x0D]	Device name	2 ASCII characters	R/W	X
14[0x0E]	Device 1 name	2 ASCII characters	R/W	X
15[0x0F]	Watchdog time	0÷250	R/W (*0.5sec)	X
16[0x10]	Software version	0.0÷99.9	Read Only	
17[0x11]	Hardware version	0.0÷99.9	Read Only	
18[0x12]	Serial Number	0-65535	Read Only	X
19[0x13]	Production lot	0-65535	Read Only	X
20[0x14]	Reserved	--	--	
21[0x15]	Default Parameters	0xAAAA	Write Only	
22[0x16]	Reserved	----	--	
23[0x17]	Reserved	----	--	

24[0x18]	Reserved	----	--	

8 Table of coils

Modbus address	Parameter name	Range	Notes	E2P
0	Enable Watchdog Event	0÷1	R/W	
1	Watch dog Event	0÷1	R/W	
2	Power-UP Event	0÷1	R/W	

- Writing values outside the allowed range will result in an error message.
- The registries and coils marked in the column "E^2P", are written to EEprom (permanent memory).

9 Registries

Address 0: Temperature [R]
Sensor temperature in tenths of degrees: a value of 100 thus corresponds to 10.0°C

Address 1: Temperature bias [R/W]
Default: 0.0
This parameter adds a positive/negative bias to the sensor temperature, which applies to the sensor's entire range.

Address 2: Max temperature peak [R]
This parameter identifies the maximum temperature read by the Evo Ser device; this is stored in EEprom and is thus not erased by a power off. This value can be reset with registry 4, described below.

Address 3: Min temperature peak [R]
This parameter identifies the minimum temperature read by the Evo Ser device; this is stored in EEprom and is thus not erased by a power off. This value can be reset with registry 4, described below.

Address 4: Reset Peaks [R/W]
To reset the minimum and maximum temperature peaks read by the device (modbus registries 2 and 3), write a 1 to this registry.

Address 5: Modbus address [R/W]
Default:1
This parameter identifies the device on the Modbus serial network.
Changes to this parameter only take effect when the device is next powered on.

Note: no two or more devices may have the same address on the modbus network.

Address 6: Baud rate[R/W]
Default: 2 (9,600 bps)
This parameter sets the serial communications rate in bits per second.
Changes to this parameter only take effect when the device is next powered on.
Note: all devices must have the same baud rate on the modbus network.

Address 7: Parity [R/W]
Default: 0 (none)
This parameter sets the serial protocol to include or exclude a parity bit.
Changes to this parameter only take effect when the device is next powered on.
Note: all devices must have the same serial criteria on the modbus network.

Address 8: Number of data bits [R/W]
Default: 0 (8 data bits)
This sets the number of bits making up a byte in serial communications.
Changes to this parameter only take effect when the device is next powered on.

Address 9: Number of stop bits [R/W]
Default: 0 (1 Stop bit)
This sets the number of stop bits in the serial frame.

Address 10: Modbus Tx/Rx delay [R/W]
Default: 1 (2 mS)
This is the delay between reception of a query and the transmission of a response, specified with a 2 ms resolution.
0x0000 = 0 ms
0x0001 = 2 ms
0x00FF = 255x10 = 0.51 sec.

Address 11: System errors [R]
This registry identifies system errors, as follows:
0: Normal operation: no error.
1: Sensor failure: also indicated by the power led flashing slowly.
2: Eeprom error. A system error occurred while data was being written to the microprocessor's eeprom: the power and TX leds flash. This requires technical service: however, you can try resetting the EEPROM default values with modbus registry 21.
3: Over Range. The sensor temperature is over 450.0°C; the power led flashes fast.

4: Under Range. The sensor temperature is less than -50.0°C; also indicated by the power led flashing fast.

Except for the Eeprom error, the registry is reset when normal operation is restored.

Address 12: Show zeroes on display [R/W]

Default: 0 (No zeroes)

This parameter is significant only if the Evo Ser device is equipped with a display if this register is set to 1, the zeroes of the most significant digits are displayed.
Example: 25.0 displays as 025.0 if the register is set to 1, and 25.0 if it is set to 0.

Address 13-14: Device name [R/W]

Default: 'EVOS'

This is a 32 bit (4 byte or 4 ASCII character) field, which is user-settable, and may contain the name of the device or a coding of its function in the plant. Each of the 4 available bytes can be set to any value.

Address 15: Watchdog time [R/W]

Default: 1 (0.5 seconds)

This is the value of the Watchdog timer, in steps of 0.5 seconds. If the Watchdog is enabled (see the Coils table) and the module does not receive commands for a time equivalent to that set in the registry, the watchdog alarm is generated.
0x0001 = 0.5 seconds
0x00FF = 127.5 seconds.

Address 16: Software version [R]

This read only register gives the version of the software on the processor: 10 corresponds to software version 1.0.

Address 17: Hardware version [R]

This read only register gives the hardware version of the device: 10 corresponds to hardware version 1.0.

Address 18: Production number [R]

This read-only registry identifies the production number, which is also printed on the device's case.

Address 19: Production lot [R]

This read-only registry identifies the production lot (year and week of production), which is also printed on the device's case.

Address 21: Default Parameters
This write-only registry resets the default values with which the device was delivered.
To reset the default values, write 0xAAAA to the registry. The default values are given below:

Registry name	Default value
Temperature bias	0.0°C
Modbus address	1
Baud rate	9,600 bps
Parity	None
Number of data bits	8 bits
Number of stop bits	1 Stop bit
Modbus delay	2mS
Show zeroes on display	Yes
Device name	EVOS
Watchdog time	0.5 sec.

Addresses 20, 22, 23, 24: Reserved
These registers are reserved.

10 Coils

Address 0: Enable Watchdog Event
Default value: 0 (serial communications Watchdog disabled)
This coil enables the Watchdog alarm. If the alarm is disabled and the module does not receive commands for a period in excess of that specified in registry 15, the Watchdog alarm trips.

Address 0: Watchdog Event
Indicates the status of the watchdog alarm. If the alarm is disabled and the module does not receive commands for a period in excess of that specified in registry 15, this coil is forced to 1. To reset the alarm, set this coil to 0. If the coil is forced to 1 by a host command, a watchdog event is simulated and an alarm condition is generated.
1 = Alarm condition
0 = Normal status

Address 1: Power-UP Event
Indicates that the device has been switched off and on again or reset.
Forced to 1 at every power up. Write the coil to 0 and monitor its status to be informed of when the module has been reset.
1 = Reset executed
0 = The device has not been reset.

11 Error display

LED ERROR MESSAGES	
 Power	**Fast flashing: temperature over/under range** **Slow flashing: Temperature sensor failure (technical service required)**
 Power Tx Rx	**Power + Tx leds flashing: EEprom write error (technical service required)**
 Power Tx Rx	**Power + Rx leds flashing: System ready for firmware update**

DISPLAY ERROR MESSAGES	
	**Temperature over-range (temperature over 450°)**
	**Temperature under-range (temperature below -50°)**
	**Temperature sensor failure (technical service required)**
	**System error: Corrupted Eeprom (technical service required)**

12 EVO SER-U (Relative humidity/Temperature)

12.1 Notes on using the sensor

- **DO NOT use the device's sensor at temperatures over 120° or below -40°C: use for an extended period of time outside these limits can cause the sensor to fail.**
- **In case of condensation on the sensor (for example, following a sudden drop in the system temperature), the value reading is around 100%; the sensor automatically resets when the condensation is removed.**
- **If the sensor is completely immersed in water, it will temporarily indicate an RH below 90%. The sensor resets itself when the water is completely removed.**
- **The sensor does not require cleaning.**
- **The humidity sensor is not affected by pressure variations; the maximum admissible pressure is 8 bar.**
- **Do not use the sensor without its filter if the air flow is greater than 3 m/sec.**

12.2 Selecting the installation position

The location of the device must be selected in view of the circulation of air since the location of the sensor must be representative of the area in which the relative humidity measurements are to be made.
Avoid the following conditions:

- **all sources of heat and cold**
- **all IR sources**
- **direct exposure to sunlight**
- **corners of walls and any areas in which there is insufficient air circulation.**

We recommend selecting a filter which meets the requirements of the application, and keeping it clean.

12.3 Wall mounting

The device can be wall mounted with the special bracket (see 'Evo Ser options'); in this case, the device must always be installed with the measurement head downmost so as to minimise the propagation of heat from the housing to the sensor itself.

12.4 Duct mounting

In duct mounting applications, make sure that the end of the probe (filter) is invested perpendicularly by the flow of air of which the relative humidity is to be measured. We recommend installing a secondary access to the duct, near to that of the sensor itself, so as to permit field inspections.
Using compression fittings (see Italcoppie catalogue) greatly simplifies this type of installation.

12.5 Filter

The filter provides essential protection against dust, high air flows and resistance to damaging chemical agents.
The filter allows the sensor to "breathe" the humidity in the measurement area and it is therefore essential to keep it clean.
Clean the filter by blowing dry air through it from the inside outwards; if necessary, rinse it with clean distilled water and thoroughly dry it off.

This should be done as frequently as possible, and in any case in response to the amount of dust in the area.
To remove the filter from the sensor, simply unscrew it with the appropriate wrench.



13 Technical specifications

Operating conditions	
Temperature	-20°C ÷ 65°C
Humidity	0 ÷ 100% RH
Tightness	IP67
Housing material	Nylon grey

General specifications	
Power voltage	12 - 30 V DC
Internal conumption	0,25Watt 0.50 Watt (with display option)
AD converter resolution	Temperature: 14 bit Relative humidity: 12 bit
Temperature resolution	±0.1°C
Humidity resolution	±0,1 %
Temperature precision	±0.3°C @25°C (see '*Temperature precision*' graph)
Relative humidity precision	±1.8% UR (20÷80%) ±4%UR (< 20%UR, >80%UR) (see '*Humidity precision*' graph)
Temperature-compensated, linearised humidity measurement	
Dewpoint calculation	
Temperature/relative humidity sensor, removable and interchangeable without the need for calibration	

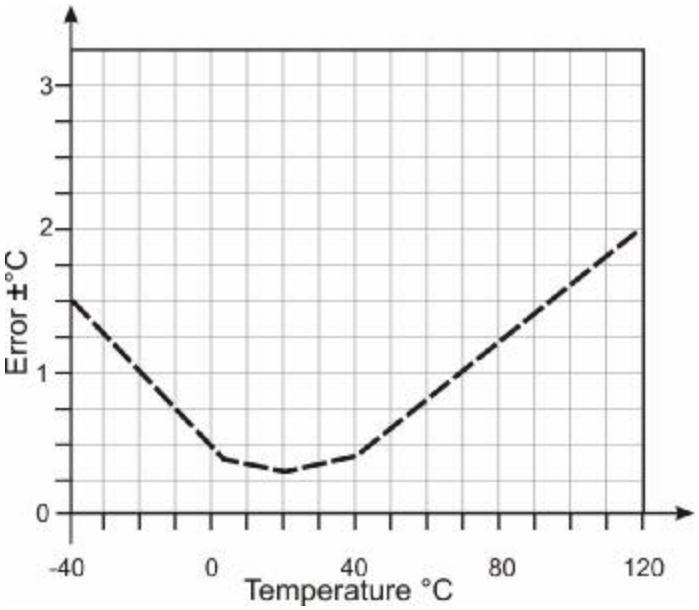
Input	
-Capacitive relative humidity sensor -Resistive temperature sensor	Mounted on mineral oxide probe, ø6 mm curvable, with minimum radius of curvature 3 times diameter (excluding terminal section for around ≈40mm)
Relative humidity measurement range	0 ÷ 100.0%
Temperature measurement range	-40.0 ÷ 120.0°C
Response time	Typically 10 seconds RH (without filter and slow air flow)

Serial interface	
RS485 serial	Settable speed: 2,400 - 4,800 - 9,600 - 19,200 - 38,400 baud
ESD protection	±15KV
Communications protocol	Modicon MODBUS-RTU
Maximum number of nodes	32
Connection distance	Up to 1,200 metres

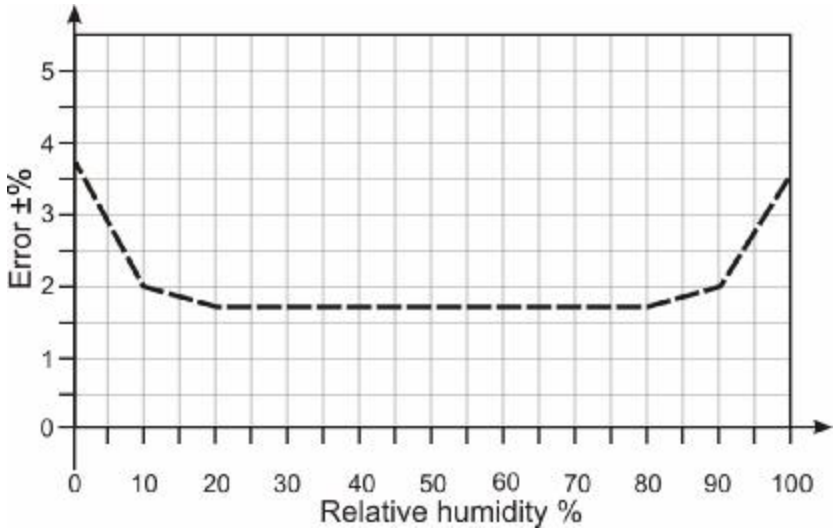
Display	
Display (optional.)	4 digits 7 red segments h. 8mm Red led for °C indication Red led for %RH indication
Led indicators	Green: Power (power on) Red: Tx (transmission in progress) Red: Rx (reception in progress)

Standards:
EMC 89/336/EEC
Emission EN 50 081-1, EN 50 081-2
Immunity EN 50 082-1, EN 50 082-2, EN 61326-1

14 Temperature accuracy



15 Relative humidity accuracy



16 Table of registries

Modbus address	Parameter name	Range	Notes	E^2P
0[0x00]	Temperature peak	-40.0- 120.0°C	Read only	
1[0x01]	Relative humidity	0.0-100.0%	Read only	
2[0x02]	Dewpoint	-40.0- 120.0°C	Read only	
3[0x03]	Temperature bias	-12.5- 12.5°C	R/W	X
4[0x04]	Relative humidity bias	-12.5÷12.5°%	R/W	X
5[0x05]	Max Relative humidity peak	--	R	X
6[0x06]	Min Relative humidity peak	--	R	X
7[0x07]	Max Temperature peak	--	R	X
8[0x08]	Min Temperature peak	--	R	X
9[0x09]	Reset peaks	1	R/W	
10[0x0A]	Modbus address	0÷255	R/W	X
11[0x0B]	Baud rate 0 – 2,400 bps 1 – 4,800 bps 2 – 9,600 bps 3 – 19,200 bps 4 – 38,400 bps	0÷4	R/W	X
12[0x0C]	Parity 0 – none 1 – even 2 – odd	0÷2	R/W	X

13[0x0D]	Number of data bits 0 – 8 bits 1 – 7 bits	0÷1	R/W	X
14[0x0E]	Number of stop bits 0 – 1 Stop bit 1 – 2 Stop bits	0÷1	R/W	X
15[0x0F]	Modbus delay	0÷255	R/W (x2mS)	X
16[0x10]	System errors: 0 – OK 1 – sensor failure 2 – EEprom Error	0÷2	Read Only	
17[0x11]	Show zeroes on display 2- No zeroes 3- Yes zeroes	0÷1		X
18[0x12]	Display mode 0- Temperature 1- Relative humidity 2- Temperature/humidity	0÷3	R/W	X
19[0x13]	Display time in temperature/humidity scan mode	1÷10sec	R/W	X
20[0x14]	Device name	2 ASCII characters	R/W	X
21[0x15]	Device 1 name	2 ASCII characters	R/W	X
22[0x16]	Watchdog time	0÷250	R/W (*0,5sec)	X
23[0x17]	Software version	0.0÷99.9	Read Only	
24[0x18]	Hardware version	0.0÷99.9	Read Only	
25[0x19]	Serial Number	0-65535	Read Only	X
26[0x1A]	Production lot	0-65535	Read Only	X
27[0x1B]	Reserved	--	--	
28[0x1C]	Default Parameters	0xAAAA	Write only	
29[0x1D]	Reserved	--	--	
30[0x1E]	Reserved	--	--	

17 Table of coils

Modbus address	Parameter name	Range	Notes	E2P
0	Enable Watchdog Event	0÷1	R/W	
1	Watchdog Event	0÷1	R/W	
2	Power-UP Event	0÷1	R/W	

- Writing values outside the allowed range will result in an error message.

- The registries and coils marked in the column "E^2P", are written to EEprom (permanent memory).

18 Registries

Address 0: Temperature [R]
Sensor temperature in tenths of degrees: a value of 100 thus corresponds to 10.0°C

Address 1: Relative humidity [R]
Sensor relative humidity in tenths: a value of 100 corresponds to a relative humidity of 10.0 %.

Address 2: Dewpoint [R]
Dewpoint in tenths: a value of 100 corresponds to a dewpoint of 10.0 °C.

Address 3: Temperature bias [R/W]
Default:0.0
This parameter adds a positive/negative bias to the sensor temperature, which applies to the sensor's entire range.

Address 4: Relative humidity bias [R/W]
Default:0.0
This parameter adds a positive/negative bias to the sensor relative humidity, which applies to the sensor's entire range.

Address 5: Max relative humidity peak [R]
This parameter identifies the maximum relative humidity read by the sensor; this is stored in EEprom and is thus not erased by a power off. This value can be reset with registry 9, described below.

Address 6: Min relative humidity peak [R]
This parameter identifies the minimum relative humidity read by the sensor; this is stored in EEprom and is thus not erased by a power off. This value can be reset with registry 9, described below.

Address 7: Max temperature peak [R]
This parameter identifies the maximum temperature read by the sensor; this is stored in EEprom and is thus not erased by a power off. This value can be reset with registry 9, described below.

Address 8: Min temperature peak [R]
This parameter identifies the minimum temperature read by the sensor; this is stored in EEprom and is thus not erased by a power off. This value can be reset with registry 9, described below.

Address 9: Reset Peaks [R/W]
This parameter is used to reset the minimum and maximum relative humidity and temperature readings of the device (modbus registers 5,6,7, and 8). To reset the peaks, write 1 to the register.

Address 10: Modbus address [R/W]
Default:1
This parameter identifies the device on the Modbus serial network.
Changes to this parameter only take effect when the device is next powered on.
Note: no two or more devices may have the same address on the modbus network.

Address 11: Baud rate[R/W]
Default: 2 (9,600 bps)
This parameter sets the serial communications rate in bits per second.
Changes to this parameter only take effect when the device is next powered on.
Note: all devices must have the same baud rate on the modbus network.

Address 12: Parity [R/W]
Default: 0 (none)
This parameter sets the serial protocol to include or exclude a parity bit.
Changes to this parameter only take effect when the device is next powered on.
Note: all devices must have the same serial criteria on the modbus network.

Address 13: Number of data bits [R/W]
Default: 0 (8 data bits)
This sets the number of bits making up a byte in serial communications.
Changes to this parameter only take effect when the device is next powered on.

Address 14: Number of stop bits [R/W]
Default: 0 (1 Stop bit)
This sets the number of stop bits in the serial frame.

Address 15: Modbus Tx/Rx delay [R/W]
Default: 1 (2 mS)
This is the delay between reception of a query and the transmission of a response, specified with a 2 ms resolution.
0x0000 = 0 ms
0x0001 = 2 ms
0x00FF = 255x10 = 0.51 sec.

Address 16: System errors [R]
This registry identifies system errors, as follows:

0: Normal operation: no error.
1: Sensor failure: also indicated by the power led flashing fast.
2: Eeprom error. A system error occurred while data was being written to the microprocessor's Eeprom: the power and TX leds flash.
This requires technical service: however, you can try resetting the EEPROM default values with modbus registry 28.

Except for the Eeprom error, the registry is reset when normal operation is restored.

Address 17: Show zeroes on display [R/W]
Default: 0 (No zeroes)
This parameter is significant only when the Evo Ser device is equipped with a display; when the registry is set to 1, the zeroes of the most significant digits are displayed.
Example: 25.0 displays as 025.0 if the register is set to 1, and 25.0 if it is set to 0.

Address 18: Display mode [R/W]
Default: 2 (Temperature/relative humidity)
This parameter is significant only when the Evo Ser device is equipped with a display; if the registry is set to 0, only the temperature is displayed, if it is set to 1 only the relative humidity is displayed, and if it is set to 2 both the temperature and relative humidity are displayed, with a scan time set in registry 19.

Address 19: Sensor reading display time [R/W]
Default: 8 sec.
This parameter is significant only when the Evo Ser device is equipped with a display and the registry with address 18 is set to 2.
The registry defines the time that lapses between the temperature and relative humidity displays: this time is independent of the relative humidity and temperature acquisition times.

Address 20-21: Device name [R/W]
Default: 'EVOU'
This is a 32 bit (4 byte or 4 ASCII character) field, which is user-settable, and may contain the name of the device or a coding of its function in the plant. Each of the 4 available bytes can be set to any value.

Address 22: Watchdog time [R/W]
Default: 1 (0.5 seconds)

This is the value of the Watchdog timer, in steps of 0.5 seconds. If the Watchdog is enabled (see the Coils table) and the module does not receive commands for a time equivalent to that set in the registry, the watchdog alarm is generated.
0x0001 = 0.5 seconds
0x00FF = 127.5 seconds.

Address 23: Software version [R]
This read only register gives the version of the software on the processor: 10 corresponds to software version 1.0.

Address 24: Hardware version [R]
This read only register gives the hardware version of the device: 10 corresponds to hardware version 1.0.

Address 25: Production number [R]
This read-only registry identifies the production number, which is also printed on the device's case.

Address 26: Production lot [R]
This read-only registry identifies the production lot (year and week of production), which is also printed on the device's case.

Address 28: Default parameters [W]
This write-only registry resets the default values with which the device was delivered.
To reset the default values, write 0xAAAA to the registry. The default values are given below:

Registry name	Default value
Temperature bias	0.0°C
Humidity bias	0.0%
Modbus address	1
Baud rate	9,600 bps
Parity	None
Number of data bits	8 bits
Number of Stop Bits	1 Stop bit
Modbus delay	2mS
Show zeroes on display	Yes
Display mode	Temperature/relative humidity
Alternance delay	8 sec.
Device name	EVOU
Watchdog time	0.5 sec.

Addresses 27, 29, 30: Reserved
These registers are reserved.

19 Coils

Address 0: Enable Watchdog Event
Default value: 0 (serial communications Watchdog disabled)
This coil enables the Watchdog alarm. If the alarm is disabled and the module does not receive commands for a period in excess of that specified in registry 22, the watchdog alarm trips.

Address 0: Watchdog Event
Indicates the status of the watchdog alarm. If the alarm is disabled and the module does not receive commands for a period in excess of that specified in registry 22, this coil is forced to 1. To reset the alarm, set this coil to 0. If the coil is forced to 1 by a host command, a watchdog event is simulated and an alarm condition is generated.
1 = Alarm condition
0 = Normal status

Address 1: Power-UP Event
Indicates that the device has been switched off and on again or reset.
Forced to 1 at every power up. Write the coil to 0 and monitor its status to be informed of when the module has been reset.
1 = Reset executed
0 = The device has not been reset.

Error display

LED ERROR MESSAGES	
 Power	**Fast flashing: Sensor failure (technical service required)**
 Power  Tx  Rx	**Power + Tx led flashing: EEprom write error (technical service required)**
 Power  Tx  Rx	**Power + Rx leds flashing: System ready for firmware update**

DISPLAY ERROR MESSAGES	
	**Temperature/relative humidity sensor failure (technical service required)**
	**System error: Corrupted Eeprom (technical service required)**

Notes on relative humidity and dewpoint

19.1 Relative humidity

The air we breathe, however dry it may seem, always contains a certain amount of water vapour. The maximum amount of water vapour which the air contains depends on the temperature and pressure: the warmer the air, the more water vapour it can contain.
The relative humidity expresses the ratio between the actual water vapour content and the maximum amount of vapour a given mass of air can contain for a given temperature and pressure. The relative humidity is expressed as a percentage.
The relative humidity does not give us an indication of the amount of water vapour actually contained by the air; for this we need another datum: the dewpoint.

19.2 Dewpoint

The dewpoint gives the temperature (in °C) to which the air must be cooled (at constant pressure) to reach 100% relative humidity – in other words, to be saturated with vapour.
Given that the amount of vapour which can be contained in the air diminishes as temperature drops, it is clear that as the temperature falls, the relative humidity will rise: the drier the air at the starting point, the lower the respective dewpoint.
If the air reaches the dewpoint temperature, the air is saturated and the vapour condenses out; if the dewpoint is greater than 0 °C, liquid condenses out of the air (mist, dew), while if the value is below zero, ice (frost) forms. This consideration is particularly important for agriculture, given that frost can destroy the work of an entire year.

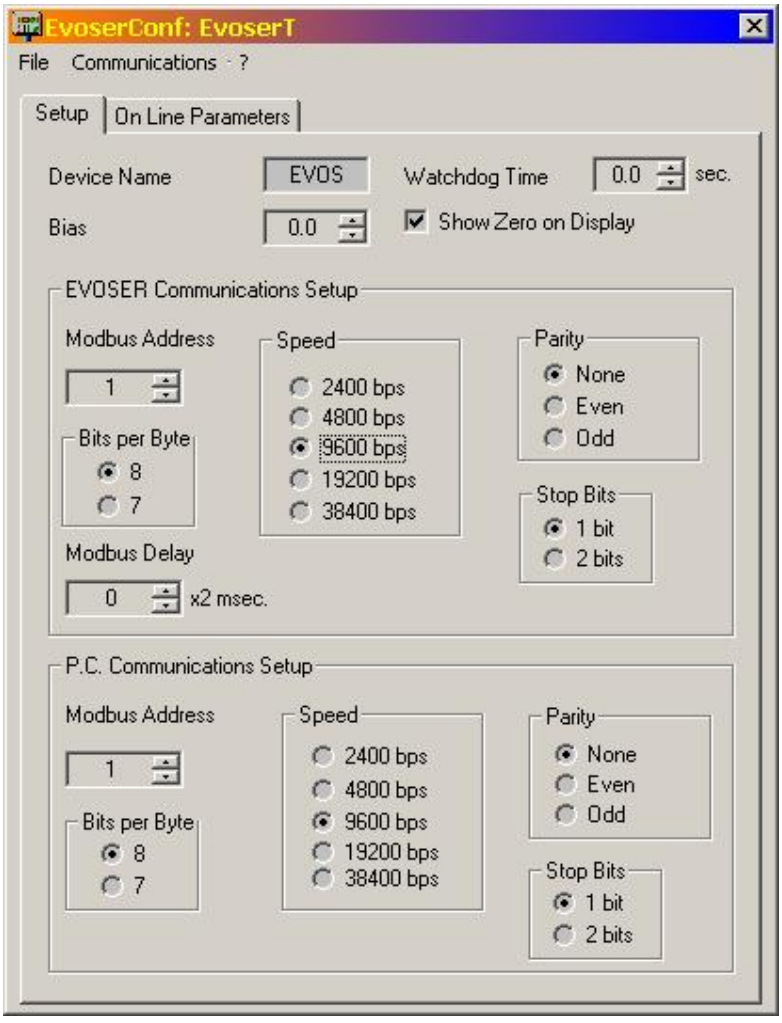
The dewpoint calculated by the Evo Ser-U device is extremely precise due to the sensor used, in which the temperature reading is effected at the same point as the relative humidity reading.

20 EVO SER configuration software

The '*EvoSerConf*' software sets up the Modbus serial address and serial communications criteria and enables you to test the functions of all Evo Ser series devices.
The software was developed for Windows ®; the connection between the PC and the EvoSer series instruments must be made via the RS232/RS485 converter supplied with the *Evo Ser SET* programming kit, called '*Evo Ser-Conv*', the comms cable, power supply and the '*EvoSerConf*'. installation CD.

20.1 Introduction

Insert the CD, run 'Setup.exe' and follow the instructions. On completion, run the '*Evo SerConf*' from the applications bar: the following window will appear:



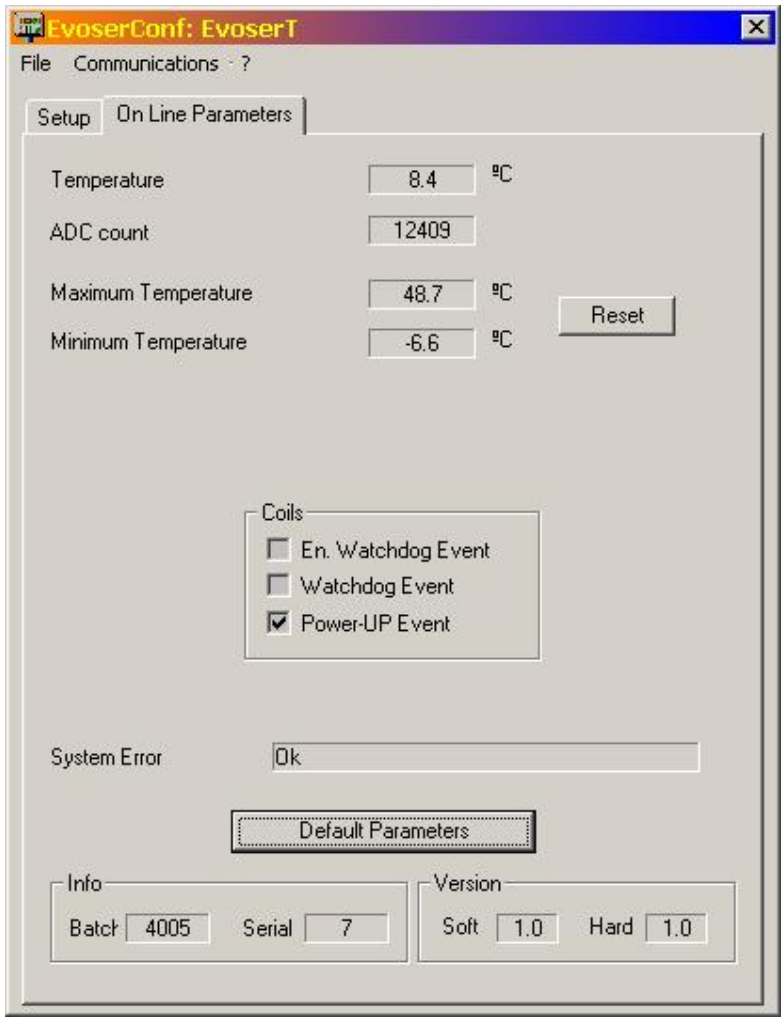
italcoppie
SENSORI

20.2 'Setup' window

This window sets all Evo Ser series device programming parameters.
Refer to '*Registries*' for the meanings of the parameters.

20.3 'On Line Parameters' window

This window displays the temperature (and humidity for the EvoserU device) measured by the device in real time, along with the status of the 'Coils', the max/min temperature readings and the production lot.
See '*Registries* ' and '*Coils*' for the meanings of the parameters.



italcoppie
SENSORI

20.4 'Default parameters' key

Click on this key to restore the default settings to the Evoser device: these are the factory settings with which the device is delivered to the client.

This completely resets the device and quits the EvoSerConf 'On line' menu.

EVOSER-T default values

Registry name	Default value
Temperature bias	0.0°C
Modbus address	1
Baud rate	9,600 bps
Parity	None
Number of data bits	8 bits
Number of stop bits	1 Stop bit
Modbus delay	2mS
Show zeroes on display	Yes
Device name	EVOS
Watchdog time	0.5 sec.

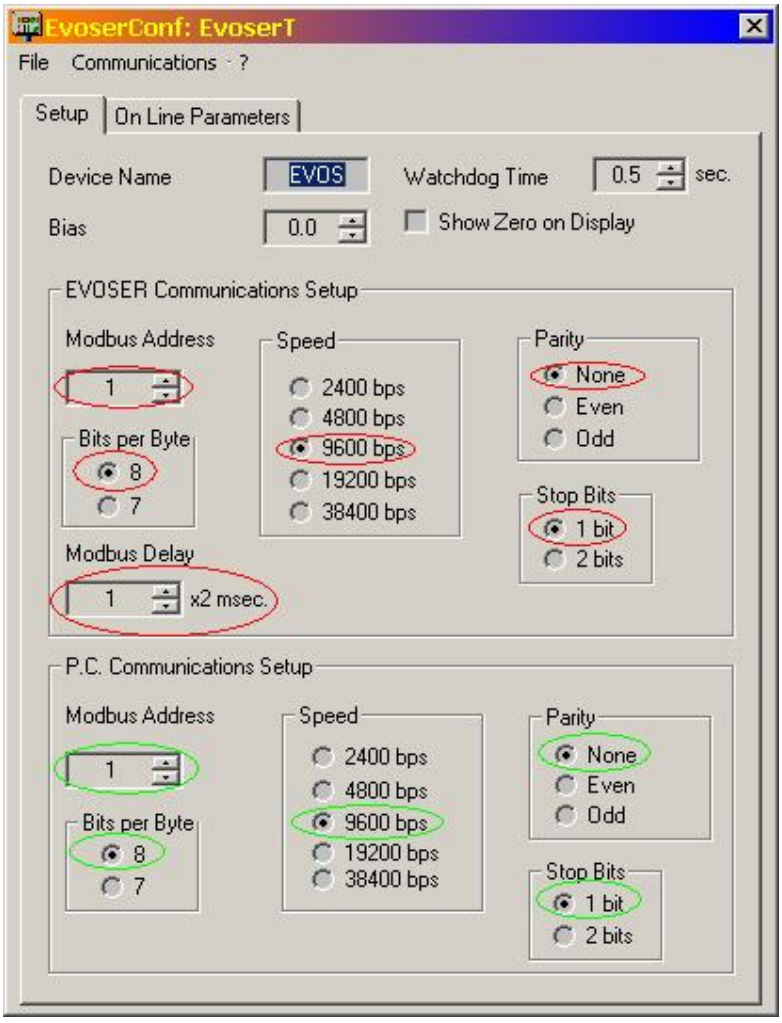
EVOSER-U default values

Registry name	Default value
Temperature bias	0.0°C
Humidity bias	0.0%
Modbus address	1
Baud rate	9,600 bps
Parity	None
Number of data bits	8 bits
Number of Stop Bits	1 Stop bit
Modbus delay	2mS
Show zeroes on display	Yes
Display mode	Temperature/relative humidity
Alternance delay	8 sec.
Device name	EVOU
Watchdog time	0.5 sec.

20.5 'Plug & Play'

If the device has never been configured, it will have the following default values: Modbus address = 1, Baud rate = 9,600, Bits per byte = 8, Parity= None, Stop bits = 8, Modbus delay = 1.

To configure the device at once, simply set the PC's serial port to which it is connected (using the Communications à Interface menu), and the 'Setup' menu:



Click on the 'On Line Parameters' tab to display the temperature (and the humidity, for EvoserU devices) in real time.

20.6 'File' menu

Submenu 'Open'
Loads a setup file previously saved to the hard disk.

Submenu 'Save'
Writes a file to the hard disk containing the configuration of the Evo Ser device connected to the PC.

Submenu 'Import'
Imports the configuration of the connected device directly from the device itself:, in other words the values of all programmable parameters: use the Save option to store the configuration on the hard drive.

Submenu 'Export'
Writes a configuration file opened with the command 'Open' to the connected Evo Ser device.

Submenu 'EVOSERT'
Opens a window which displays the parameters for the EvoSerT (Temperature) device.

Submenu 'EVOSERUT'
Opens a window which displays the parameters for the EvoSerUT (Temperature and Humidity) device.

Submenu 'Change Language'
Changes the EvoSerConf software display language.

Submenu 'Exit'
Quits Evo SerConf.

20.7 'Setup' menu

Submenu 'Interface'
Selects the PC's port (COMxx) to which the Evo Ser device is connected.

Submenu 'Address detection'
Finds the modbus address of the Evo Ser device connected to the PC, depending on the parameters set in '*Settings à PC communications setup*'.
This feature is valuable inasmuch as it establishes the serial connection between the EvoSerConf software and the connected device: only after this connection has been established can the device's configuration be changed.
You must first know the communications criteria of the Evo Ser device (baud rate, parity, bits per byte and stop bits): you can then set them in the box

called *'PC communications setup '* after which, the software can find the device's serial address.
If you do not know the serial communications parameters of the Evo Ser device connected to the PC, use the submenu '*Device detection*' described below.

Submenu 'Device detection'
This submenu automatically finds the serial address, baud rate and communications criteria of the Evo Ser device connected to the PC. After the system has found the device, its configuration can be changed.
This feature is helpful if you do not know the communications parameters for the Evo Ser device whose configuration you wish to change.
The find procedure may take a few seconds to a few minutes.

20.8 Sample setup

Let us suppose we want to setup an Evo Ser-T device with serial address 3, baud rate 19,200 bps, 8 bits per byte, no parity and 1 stop bit (19200 N 8 1).

Step 1: using the Evoser Set setup kit, connect the Evo Ser-T device to the PC's port (or to the first available port), and power up the system.

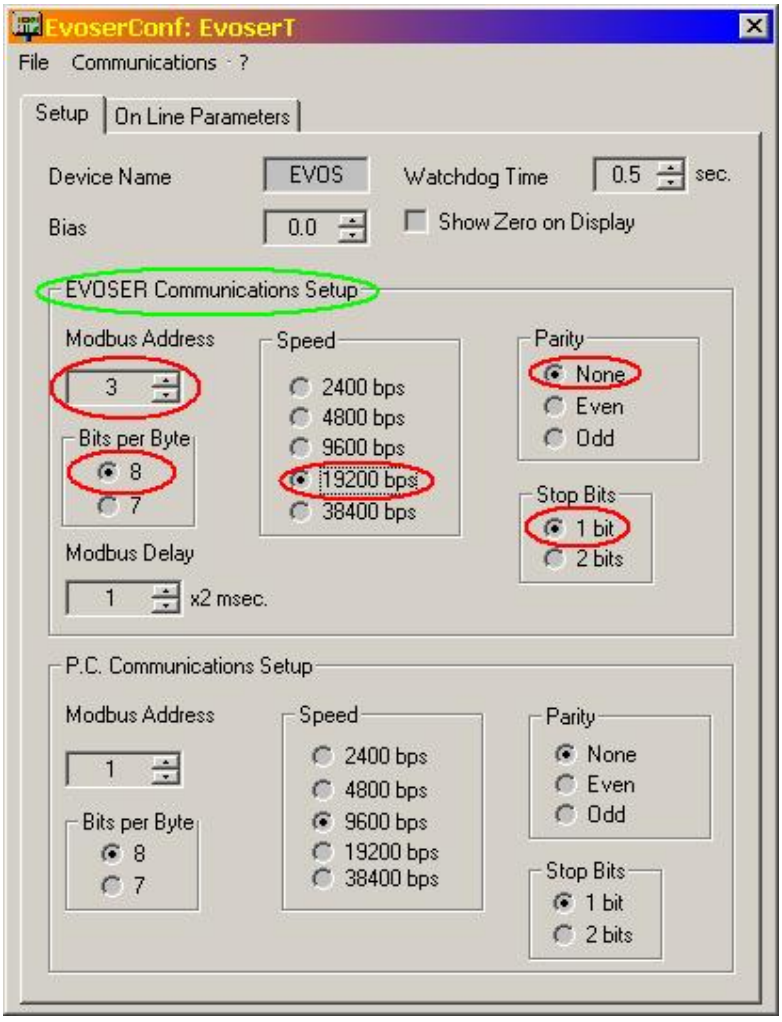
Step 2: from the applications bar, run the EvoserConf software.

Step 3: select the menu '*Communications à Interface à COM1*' (or the COM port to which the device is connected).

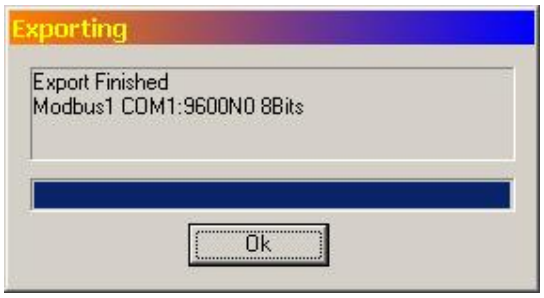
Step 4: Select '*Communications à Device detection*'. At the end of the procedure, the following window will appear:

Now click on OK.

Step 5: in '*EVOSER communications setup'* set the baud rate to 19,200bps, the Modbus address to 3, 8 bits per byte, no parity, 1 stop bit.



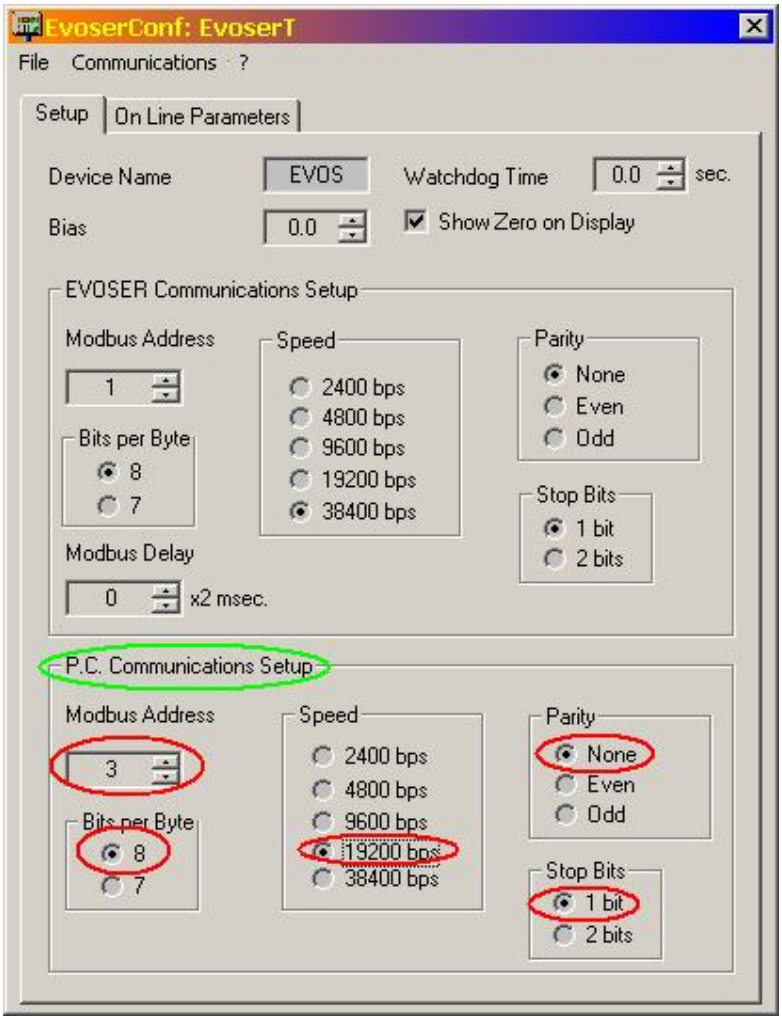
Step 6: Select '*File à Export*' to store the new configuration on the Evo Ser. The following window will now display:



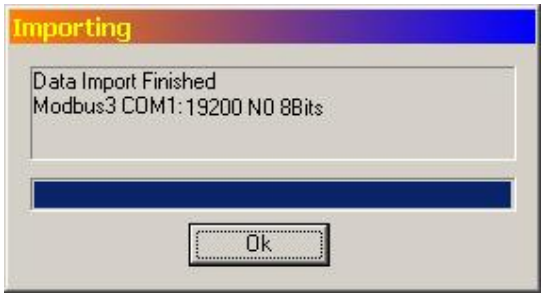
As described in '*Registries*', to activate the new settings, you must switch the device off and on again.
When it powers-on the Evo Ser device will be setup with baud rate 19,200bps and modbus address 3.

To check that the new configuration has been written correctly, proceed as follows::

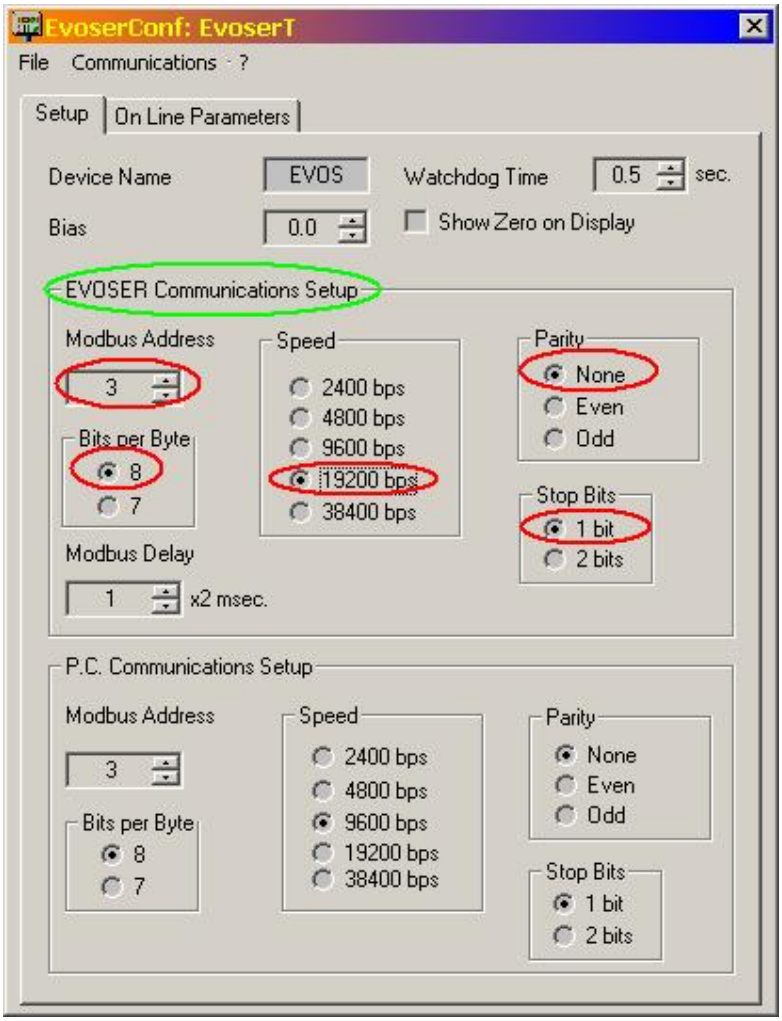
In 'PC *communications setup*' set the modbus address to 3 and the communications criteria to 19,200 N 8 1:



Under File, select '*Import*'. When the data have been imported, the following window will display:



Click on OK, and the '*EVOSER communications setup*' box will show that the stored data coincide with those desired.



italcoppie
SENSORI

21 EVO SER FIRMWARE UPDATE

The firmware of the Evo Ser devices can be updated at any time quickly and easily: given the simplicity of the procedure, even the end user can do this.
Updating the firmware makes the devices highly versatile, since they can be improved at any time, as well as making it possible to install custom software.
The Evo Ser standard series implements the Modbus RTU slave protocol, but other protocols can be implemented, including Omron, S7200 PPI, Allen bradley, custom specified, etc: this makes it possible to connect the Evo Ser device directly to supervision systems or PLC's.

21.1 Updating the firmware

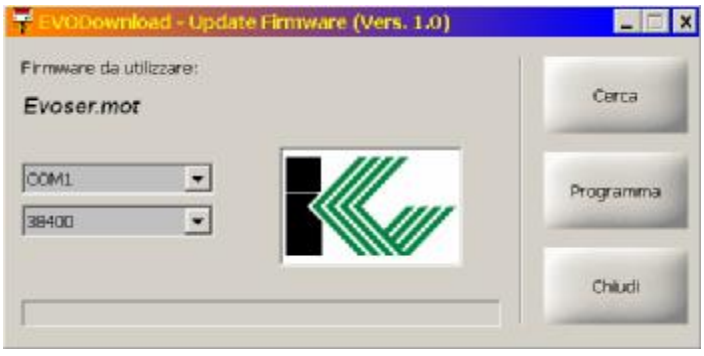
To update the firmware of the Evo Ser device, you need the *Evo SerConf-Kit* and '*EvoDownload*' software.
Firmware updates are password protected, and must be done as described below:

Evo Ser-T:
- **In register address 23 (reserved register), write the decimal value 1324**
- **In register address 20 (reserved register), write the decimal value 29**

Evo Ser-U:
- **In register address 29 (reserved register), write the decimal value 1324**
- **In register address 27 (reserved register), write the decimal value 29**

On completion of the procedure, the power and Rx leds will flash to indicate that the system is ready for the firmware update.

Launch the Evodownload software:



Click on '*Find*' to open the new firmware file (*.mot) to be written to the Evo Ser device; select the serial port to which the device is connected, and click on '*Program*'.
When programming is completed, the Evo Ser device will be updated with the new firmware: the power led will flash to confirm.

CONTENTS

Warranty: We warrant that the products will be free from defects in material and workmanship for 1 years from the installation date with a max of 18 months from delivery date. The warranty above shall not apply for any failure caused by the use of the product not in line with the instructions reported on this manual.

Product return: the instrument can be returned under warranty only after Italcoppie sensori authorization.

ITALCOPPIE SENSORI s.r.l.
Via A. Tonani, 10
26030 Malagnino (Cremona) ITALY
Tel. +39 0372-441220
Fax. +39 0372-441238
http:www.italcoppie.it
evo@italcoppie.it