Instruction manual

C 3436

CONDUCTIVITY TRASMITTER
4-20 mA – RS485

Conductivity scales
2 µS ÷ 2000 mS

Temperature scales
-10.0 ÷ 110.0 °C
14.0 ÷ 230.0 °F

Option
S/N
REP N°

Power supply: 9/36 Vdc
Installed firmware: R 1.0x

Cod. 27363341 Revisione 01

INDEX

1 PRODUCT OVERVIEW

1.1 FUNCTIONAL PURPOSE OF THE DEVICE

The system for the monitoring of conductivity consists of two main parts:

- the transmitter object of this instruction manual;
- the conductivity cell.

The instrument operates in analog and/or digital functionality.

Analog operation

In analog mode the transmitter provides an isolated 4-20 mA current loop for direct connection to a PLC or a data logger.

The transmitter can be connected to the B&C Electronics instruments BC7635 - BC7335 - BC7687 - BC6587 which provide the power and perform the functions of display and control.

When operating in analog mode the instrument maintains the operation in digital mode.

Digital operation

In digital mode the transmitter interacts with a master device via the RS485 connection with the protocol B&C (ASCII) or Modbus (function 03) described later in this manual.

In this mode the user transmits the measurements and perform the calibration and the configuration.

The keys of the instrument remain active and have priority over the remote commands.

In order to reduce the power consumption, the user can disable the current loop and operate only in digital mode.

The transmitter performs the following functions:

1 display of the conductivity values of the aqueous solutions, by using a suitable measuring electrode;

2 display of the temperature values, by using a Pt100 temperature sensor;

3 perform the manual or automatic temperature compensation;

4 operate in analog or digital mode;

5 activate the hold function of the current loop through an external free voltage contact.

1.2 OPERATING PRINCIPLES

The instrument is used for measuring the electrical conductivity of a liquid that depends on the ionic concentration in solution.

The conductivity measurement is carried out using a cell with 2 or 4 electrodes featuring defined geometric dimensions, completely surrounded by the liquid, to which is applied an alternating voltage of suitable frequency to avoid polarization of the same caused by electrochemical effects.

The method of measurement used in the cell with 4 electrodes minimizes the polarization of the electrodes and the measuring error for electrodes dirty.

The geometry of the electrodes defines the cell constant, normally indicated with "K".

Normally are used cells having the value K=1, but this transmitter can be operated with conductivity cells having values of K=0.1 - K=0.5 - K=1 - K=10 to obtain measurement scales in a very wide range.

The type of material used for the construction of the electrodes limits the choice of the measuring scale normally declared in the specification of the cell itself.

The temperature of the solution has a major influence on the measure because it depends on the activity of ionic substances dissolved in the sample.

There is therefore an increase in conductivity with increasing temperature even if the content of the sample remains unchanged.

In many cases it is important to have a measurement of conductivity independent of temperature and referred to a conventional temperature (20 °C or 25 °C); in this case it is necessary to use the automatic compensation of the effect of temperature, by detecting the temperature with a sensor immersed in the sample for the electronic correction of the conductivity value detected.

1.3 ACCESSORIES

The items listed below are the ones most commonly used and are to be ordered separately.

Sensors and accessories suitable for different uses and heavy aplications are available.

Ask our staff for the best solutions to your needs.

2 electrodes conductivity cells

SI 301

SI 3013

SZ 3252

SZ 3271

SZ 3273.1

SZ 3320.1
SZ 3330.1
SZ 3300.1

SZ 3350.1
SZ 3360.1

4 electrodes conductivity cells

SI 311

SZ 3134.1

SI31011

SI31012

Holders

SZ 810	for use in immersion in PVC, L=210 mm
SZ 820	for use in immersion in PVC, L=400 mm
SZ 821	for use in immersion in PVDF, L=400 mm
SZ 860	for use in immersion in PVC, L=720 mm
SZ 880	for use in immersion in PVC, L=1170 mm

SZ 7101	for use in line up to 40 °C, PVC body
SZ 7105	for use in line up to 100 °C, PVDF body
SZ 7108	for use in line up to 110 °C, s.steel body

SZ 7231	for use in flow, for sensor D=12 mm and temperature sensor
SZ 7233	for use in flow, for 3 sensors D=12 mm and temperature sensor

SZ 7261	for use in flow, for sensor D=12 mm and temperature sensor
SZ 7263	for use in flow, for 3 sensors D=12 mm and temperature sensor

Temperature sensors

SI 520	Pt100 in line
SI 540	Pt100 immersion
SP 514	Pt100 in flow
SP51501	Pt1000 in flow, s.steel body, cable 1,5 m
SP51511	Pt1000 in flow, epoxy body, cable 1,5 m

Other accessories

BC 9408 IP65 enclosure for 1 or 2 instruments
BC 9412 IP65 enclosure for 3 instruments

SZ 740 IP65 junction box
SZ 911 stopper

SZ 927.1 multiwired shielded special cable

2 GENERAL WARNINGS AND INFORMATION FOR ALL USERS

2.1 WARRANTY

This product is guaranteed for all manufacturing defects.

Please take a look at the terms and conditions described on the warranty certificate at the end of the manual.

2.2 AFTER SALES SERVICE

B&C Electronics offers to all of its customers the following services:

- a free of charge technical assistance over the phone for problems regarding installation, calibration and regular maintenance;
- a repairing service in our Carnate (Italy) headquarter for all types of damages, calibration or for a scheduled maintenance.

Please take a look at the technical support data sheet at the end of the manual for more details.

2.3 CE MARKING

This instrument is manufactured according to the following european community directives:

- 72/23/EEC "Electrical safety – low tension" amended in 93/68/EEC.
- 2004/108/CEE (previously 89/336/EEC) "Electromagnetic compatibility".

The CE marking is placed on the packaging and on the S/N label of the instrument.

2.4 SAFETY WARNINGS

It is important to underline the fact that electronic instruments are subject to accidental failure. For this, it is important to take all necessary precautions to avoid damages caused by malfunctions.

Any operation must be performed by authorized and trained staff.

The use of this transmitter must comply with the parameters described in chapter "Technical specifications (page 17)", in order to avoid potential damages and a reduction of its operating life.

3 INSTRUCTION MANUAL CONTENTS

This chapter describes the manual and gives suggestions to all users on how to read it and use it.

The manual is written according to the following norms:

- UNI 10893 "Instructions for use";
- UNI 10653 "Quality of product technical documentation".

3.1 MANUAL REVISIONS

This chapter shortly describes the differences between previously released versions of the same manual, so to help users that are already familiar with the product.

Rev. A: first release.

3.2 SYMBOLS

Throughout the manual you may find the following symbols, which are both dictated by a norm or that are simply conventional.

WARNINGS: this symbol is used to warn users that if the instructions are ignored or not correctly followed, damage to the instrument can be caused.

NOTE: this symbol is to invite the user to pay particular attention to a specific section of the manual.

3.3 HOW TO READ THE INSTRUCTION MANUAL

The manual contains all the information needed to acquire full knowledge of the product, to ensure a proper installation, proper use and maintenance in order to achieve the desired result at the time of its choice.

The manual is aimed at staff with appropriate knowledge and experience in the field of measurement and control through the use of sensors and transmitters in the context of industrial plants.

The index of the manual refers the reader to the chapters on aspects that want to learn and develop.

In particular, the first chapters show general topics and allow the user to become familiar with the product, with its functional purpose and with the necessary accessories or options for its use.

The user can then check whether he knows all the elements necessary for the use of the instrument and of the measuring/control.

The instrument has been designed keeping in mind three different types of use: generic use (end user), control (maintenance staff), installation (plant engineer).

The user is normally interested on the display and will have to refer to the chapter:

- "Instruction for the user (page 24)".

The maintainer of the system, will be more interested in the chapters of the manual concerning:

- "Instruction for the user (page 24)";

- "Maintenance instruction (page 25)";

- "Warranty (page 51)";

- "Repairs (page 51)".

The plant engineer will have to make a complete reading of the chapters and consulting explanatory drawings in order to:

- verify that the technical and functional characteristics are conformed with the plants requirements;

- verify that the environmental and climatic conditions required by the instruments are respected;

- make the correct electronic connections;

- become familiar with the instrument's firmware;

- configure the instrument according to the application;

- run all of the necessary tests before starting the instrument;

- calibrate the instrument once the sensor is connected.

3.3.1 USING THE INSTRUMENT ON THE PLANT

For the generic use, the end user can operate with a locked keyboard (suggested mode and to be set by maintenance staff). By this, he can check the set point parameters without the possibility of changing the configured set points values and the zero/sensitivity calibration.

3.3.2 PLANT MAINTENANCE STAFF

Maintenance staff can select the operating values, by setting the desired parameters of the setup menu and after inserting the password. He can also enable the user's access to calibration, set point and alarm settings.

The location of this set parameters can be seen in the left column of the technical specifications table and they are identified by a letter "S" followed by a number.

The operations that need to be done during the start-up and the periodical tests are the following:

- to allow only the visualization of the measures during the normal use;
- to calibrate the sensors by means of ZERO and SENS keys;
- to set the following parameters:
  - temperature measuring unit in °C or °F;
  - manual temperature compensation;
  - reference temperature for the temperature compensation;
  - temperature coefficient;

  - response time of the filter software;
- to modify the password to access the setup.

3.3.3 INSTRUMENT INSTALLATION

The plant engineer, by inserting the access password and by setting and modifying the configuration parameters, will be able to select the necessary functions required by the plant.

The location of this set parameters can be seen in the left column of the technical specifications table and they are identified by a letter "C" followed by a number.

The operations that need to be done during the instrument installation are the following:

- K cell constant;
- measuring scale in function of the K cell;
- enable TDS scales and conversion factor;
- baude rate of the RS485 interface;
- B&C or Modbus protocol ID;
- password to access the configuration.

4 SPECIFICATIONS

4.1 FUNCTIONAL SPECIFICATION

Display

The instrument is equipped with an alphanumeric LCD display 8x1 characters.

The display shows the measured values and messages which guide the operator in the use of the instrument.

The message scrolls across the display and begin with the identification number reported to the technical specifications.

Keyboard

The instrument has a 4 keys keyboard, who perform a dual function when pressed for more than 3 seconds, which allows access to all functions available.

Inputs

The instrument is able to perform the measurement of the conductivity and temperature.

The conductivity is measured by means of a cell with two or four electrodes.

The temperature in °C or °F is measured by a 3-wire RTD Pt100.

Scale

The instrument allows the selection of four values of K cell.

For each value of K the user can choose 5 scales of conductivity as shown in the table in section "Technical specifications (page 17)".

For each scale, the instrument can display the measure in terms of TDS by applying a conversion factor selectable from 0,450 to 1,000.

Temperature compensation

The instrument displays the temperature value in the field -10.0 ÷ 100.0 °C or 14.0 ÷ 230.0 °F and it performs the manual or automatic temperature compensation.

For absence or malfunction of the temperature sensor it automatically switches to manual compensation, by displaying the value of the compensation temperature.

The reference temperature can be chosen between two values (20 °C or 25 °C) commonly used by users.

The temperature coefficient can be set in function of the specific applications.

Calibration

In the calibration of conductivity are automatically recognized the standard solutions whose values are stored in the instrument.

If you use solutions other than standard, the instrument proposes the closer stored value allowing manual editing.

At the end of the calibration it possible to save the date of calibration.

Analog output

The instrument operates in the current loop 4-20 mA proportional to the value of the principal measure.

The output is galvanically isolated, so to be interfaced directly to a PLC or data acquisition cards.

Serial interface

Through the RS485 interface, the user can connect the transmitter to a PC or a terminal to receive the measures and to perform the sensor calibration (only B&C protocol).

It needs a converter RS485/RS232 or RS485/USB.

The operator can use a simple terminal emulation program.

Using Modbus protocol the function 03 is implemented.

Software filter

On the input signal of the measuring sensor operates a software filter.

The user can set the response time relative to signals of small variation, in order to obtain good stability of reading.

Logic input

The instrument is equipped with a logic input which connects a free voltage contact from an external device.

The function of this input is to maintain in hold the current loop.

Power supply

The instrument is powered (min. 9 Vdc / max. 36 Vdc) through the current loop, directly from a PLC or data acquisition boards that provide the power, or by a power supply in series between the analog output and the apparatus of acquisition.

When operating in digital mode the instrument will be equally fed to the terminals of the current loop (min. 9 Vdc / max. 36 Vdc) minimizing power consumption.

Setup

The instrument is provided with a setup menu protected by a specific password where you can:

- disable the calibration functions;
- choose the response time for the software filter;
- select the unit of measurement of the temperature in °C or °F;
- select the parameters of the temperature compensation;
- change the access password.

Configuration

The instrument is provided with a configuration menu protected by a specific password where you can select:

- the cell constant K;
- the measuring scale;

- the TDS enable and the conversion factor EC/TDS;
- the current loop enable;
- the baud rate of the RS485 interface;
- the ID for communication protocols Modbus or B&C;
- a new value of the access password.

Information menu

The instrument is provided with an information menu to show:

- p/n and firmware release;
- last calibration date;
- total operating hours.

4.2 TECHNICAL SPECIFICATIONS

In the left column indicates the number of the display concerned:
- SETUP parameters are indicated by "S xy"
- CONFIGURATION parameters are indicated with "C xy" where
  x = paragraph y = sequential 1..2..3..4..ecc

D1.0	**MEAN MEASURE**				**Default**
D1.0 D0.5	Measure	Conductivity TDS+Conductivity			Conductivity
	Input	cell 2 / 4 wires			
C1.1	K cell	0.1 / 0.5 / 1.0 / 10			1.0
C1.2	Conductivity scales				
	K=0.1	2.000 / 20.00 / 200.0 / 2000 µS 20.00 mS			
	K=0.5	10.00 / 100.0 / 1000 µS 10.00 / 100.0 mS			
	K=1.0	20.00 / 200.0 / 2000 µS 20.00 / 200.0 mS			2000 µS
	K=10	200.0 / 2000 µS 20.00 / 200.0 / 2000 mS			
	Scales	Resolution	Under range	Over range	
	2.000 µS	0.001	-0.200	2.200	
	10.00 µS	0.01	-1.00	11.00	
	20.00 µS	0.01	-2.00	22.00	
	100.0 µS	0.1	-10.0	110.0	
	200.0 µS	0.1	-20.0	220.0	
	1000 µS	1	-100	1100	
	2000 µS	1	-200	2200	
	10.00 mS	0.01	-1.00	11.00	
	20.00 mS	0.01	-2.00	22.00	
	100.0 mS	0.1	-10.0	110.0	
	200.0 mS	0.1	-20.0	220.0	
	2000 mS	1	-200	2200	
	Under range	-<<<< µS / mS			
	Over range	>>>> µS / mS			

D1.0	MEAN MEASURE				Default
S1.2	RT 90 % Large Signal RT 90 % Small Signal	2 s 1 ÷ 20 s			 10 s
	Measure update	0.5 s			
D1.1	Zero	±10 % of the scale			0 %
	Calibration	the zero calibration is done automatically on all scales from the lowest one			
D1.2	Sensitivity	60 ÷ 160 %			100 %
	Calibration	Man / auto with KCl standard solutions			
	Solutions KCl standard	0.01 N	0.1 N	1 N	
	Tref 20 °C	1278 µS	11.67 mS	102.1 mS	
	Tref 25 °C	1413 µS	12.88 mS	111.8 mS	
	TC during calibration	TC of the standard solution			
C1.3	Scales TDS	On / Off			Off
C1.4	Conversion factor TDS/EC	0.450 / 1.000 1/S			0.500
		Scale EC	TDS scale	Resolution	
		2.000 µS	1.000 ppm	0.001 ppm	
		10.00 µS	5.00 ppm	0.01 ppm	
		20.00 µS	10.00 ppm	0.01 ppm	
		100.0 µS	50.0 ppm	0.1 ppm	
		200.0 µS	100.0 ppm	0.1 ppm	
		1000 µS	500 ppm	1 ppm	
		2000 µS	1000 ppm	1 ppm	
		10.00 mS	5.00 ppt	0.01 ppt	
		20.00 mS	10.00 ppt	0.01 ppt	
		100.0 mS	50.0 ppt	0.1 ppt	
		200.0 mS	100.0 ppt	0.1 ppt	

D1.0	MEAN MEASURE				Default
		2000 mS	1000 ppt	1 ppt	
	Under range	-<<<< ppm / ppt			
	Over range	>>>> ppm / ppt			

D2.0	SECONDARY MEASURE		Default
D2.0	Measure	Temperature	
	Input	RTD Pt100 3 wires	
S2.1	Measuring unit	°C / °F	°C
	Temperature compensation	manual without RTD automatic with RTD	
	Scales	-10.0 ÷ 110.0 °C 14.0 ÷ 230.0 °F	
	Resolution	0.1 °C / °F	
	Zero	± 5.0 °C ± 9.0 °F	0.0 °C 0.0 °F
S2.2	Manual temperature	0.0 ÷ 100.0 °C 32.0 ÷ 212.0 °F	20.0 °C 68.0 °F
S2.3	Reference temperature	20 / 25 °C	20 °C
S2.4	Temperature coefficient	0.00 ÷ 3.50 %/°C	2.20 %/°C

	CURRENT LOOP		Default
C5.1	Current loop	Enabled / Disabled	Enabled
	Current loop proportional to main measuring	4-20 mA	
	Under range	3.80 mA	
	Over range	20.80 mA	
	ID of the selected scale		
	• Scale 1	11 mA at switching on for 8"	
	• Scale 2	12 mA at switching on for 8"	
	• Scale 3	13 mA at switching on for 8"	

	CURRENT LOOP		Default
	• Scale 4	14 mA at switching on for 8"	
	• Scale 5	15 mA at switching on for 8"	

	DIGITAL OPERATION		Default
	Protocols	B&C protocol ASCII / Modbus RTU The two protocols can coexist	
C8.2	ID B&C protocol	ID=01 ÷ 32 last s/n figure, if 0 ID=10	01 ÷ 10
C8.3	Modbus address	ID=01 ÷ 32 last s/n figure, if 0 ID=10	01 ÷ 10
	Measures and parameters are provided under interrogation (see protocols B&C ASCII and Modbus RTU function 03)		

	SERIAL INTERFACE		Default
	Interface	RS485 isolated not terminated	
C8.1	Baud rate	2400 / 4800 / 9600 / 19200 bit/s	9600 bit/s
	Distance of connection	1000 / 500 / 250 / 125 m	
	Use in network	32 trasmettersi max	

	DIGITAL INPUT		Default
	Digital input	free voltaghe contacts in closure	
	Digital function	hold of the loop 4-20 mA (The input state is visible on the digital protocols)	

D50.0	SETUP		Default
50.1	Password to access the setup	000 ÷ 999	000
S1.1	Calibration inhibition	On / Off	
S1.2	Response time (small signal)	1 ÷ 20 seconds (RT=90 %)	10 s
S2.1	Temperature measuring unit	°C / °F	°C
S2.2	Manual temperatura	0 ÷ 100 °C 32 ÷ 212 °F	20 °C
S2.3	Reference temperatura	20 / 25 °C	20 °C
S2.4	Temperature coefficient	0.00 ÷ 3.50 %/°C	2.20 %/°C
S50.0	Pssword changing	000 ÷ 999	000

D60.0	CONFIGURATION		Default
60.1	Password to access the configuration	000 ÷ 999	000
C1.1	K of cell	0.1 / 0.5 / 1.0 / 10	1.0
C1.2	Conductivity scales		
	K=0.1	2.000 / 20.00 / 200.0 / 2000 µS 20.00 mS	
	K=0.5	10.00 / 100.0 / 1000 µS 10.00 / 100.0 mS	
	K=1.0	20.00 / 200.0 / 2000 µS 20.00 / 200.0 mS	2000 µS
	K=10	200.0 / 2000 µS 20.00 / 200.0 / 2000 mS	
C1.3	TDS scales	On / Off	Off
C1.4	Conversion factor TDS/EC	0.450 ÷ 1.000	0.500
C5.1	Current loop	Enabled / Disabled	Enabled
C8.1	Baud rate	2400 / 4800 / 9600 / 19200 bit/s	9600 bit/s
C8.2	ID B&C protocol	ID=01 ÷ 32 last figure of the s/n, if 0 ID=10	01 ÷ 10
C8.3	Modbus address	ID=0 ÷ 243 last figure of the s/n, if 0 ID=10	01 ÷ 10
C60.0	Pasword changing	000 ÷ 999	000

D70.0	INFO MENU		Default
I1.0	P/N and firmware release	C3436 Rev1.xx	
I2.0	Scale / Last calibration date	Scala / XX/XX/XX	
I3.0	Total hours of operation	XXXXXX h	

	POWER SUPPLY		Default
	Voltage	min 9 Vdc / max 36 Vdc	
	Current with current loop disabled	< 4 mA a 9 Vdc (in absence of communication)	
	Current with current look enabled	4-20 mA, 21 mA max	
	The current can be higher during the communication		

4.2.1 GENERAL SPECIFICATIONS

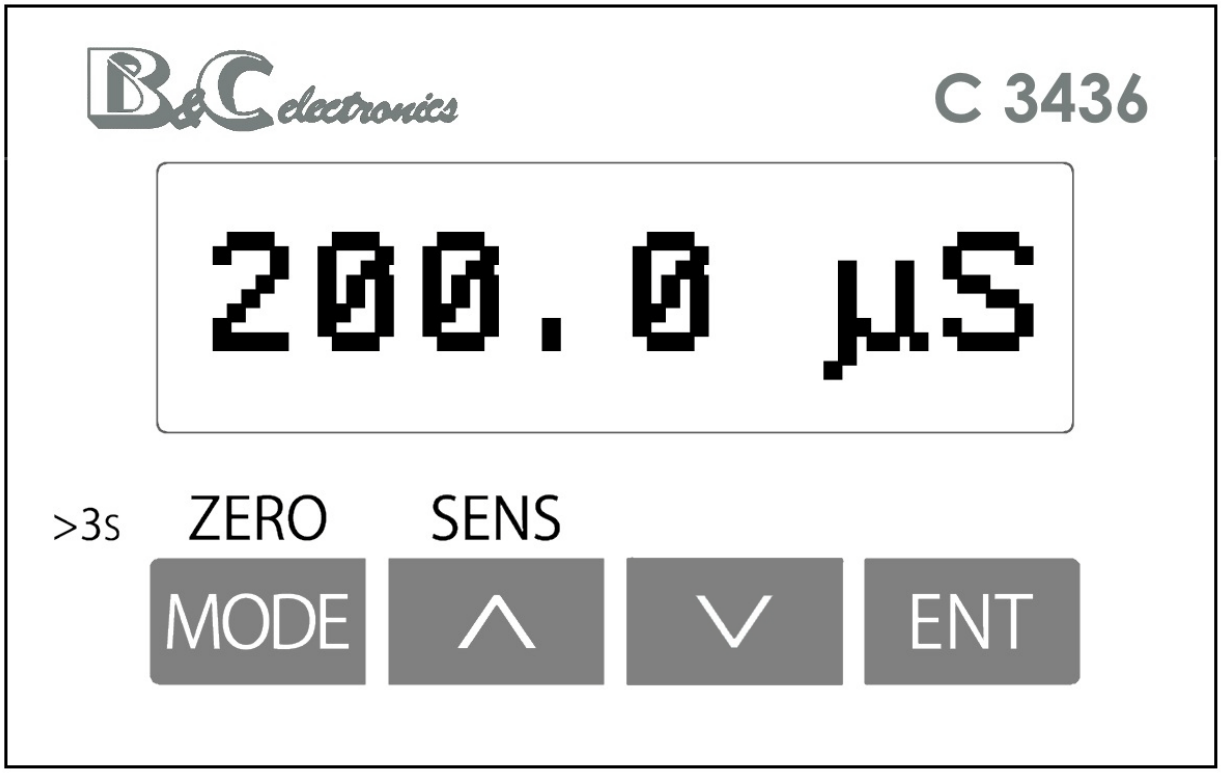
Room temperature	0 °C ÷ +50 °C
Relative humidity	up to 95 % without condensation
Protection of transmitter	IP40
Weight	250 g
Dimensions	71 x 95 x 58 mm
Mounting	Rail din 4 modules
Display	LCD COG 8x1 characters
Characters dimensions	11.97 x 4.97 mm
Long messages	sent alternately (title + variable)
Connections	removable terminal blocks 3.5 mm pitch
Isolation in/out	500 Vdc
Conformity EMC/RFI	EN61326

4.2.2 CONNECTIONS

Terminal	**Function**
2	+ Loop
3	- Loop (9/36 Vdc)
5	RS485 A+
6	RS485 B-
7	RS485 Gnd
7	Digital input
8	Digital input
9	A (EC)
10	B (EC)
11	C (EC)
12	D (EC)
13	T1 (Pt100)
14	T2 (common Pt100)
15	T0 (common Pt100) (Gnd measure)

5 OPERATING PROCEDURE

5.1 DISPLAY



5.2 KEYS

KEY	FUNCTION
ZERO MODE	Key MODE/ZERO - Visualise the sequence of the functions - Exit without changing the visualized value - >3s Start the zero calibration
SENS ∧	Key UP/SENS - Increase the value - Access to the parameter changing - >3s Start the sensitivity calibration
∨	Key DOWN - Decrease the value - Access to the parameter changing
ENT	Key ENTER - Conferm the visualized value - Go to the next parameter (in setup and configuration) - Accss to the secondary parameters

5.3 OPERATING MODES

The transmitter can be configured to operate in analog mode (current loop 4-20 mA = Enable). The digital mode is always active.

The transmitter in the analog mode (current loop) can be connected to a PLC or B&C Electronics instruments BC 7335 - BC7635 - BC7687 - BC6587, which provide power to the transmitter and allow the display of the measurement.

In digital mode the transmitter is a slave device and can be interrogated by a master device with B&C (ASCII) protocol or Modbus protocol.

For digital mode operation, see chapter "Digital operation (page 32)".

5.4 INSTRUCTION FOR THE USER

5.4.1 TDS MEASURING

If the TDS measuring has been configured, the display will show the ppm or ppt values.

ENT press to visualize the output current

5.4.2 CONDUCTIVITY MEASURING

The display shows the conductivity values as selected in the configuration menu.

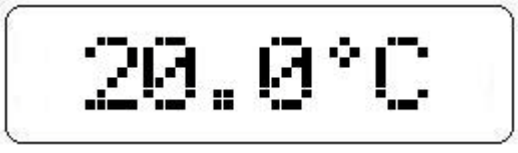
The following are under range and over range messages: -<<<< and >>>>.

From the main measurement display 1.0 the user can access the calibration procedures of the measuring chain, if they have not been reserved to the maintainer.

ENT press the key to visualize the output current value.

5.4.3 TEMPERATURE MEASURING

The display shows the value of the temperature measurement (real or set), the measuring unit (°C or °F) and M in case of absence of the temperature probe.



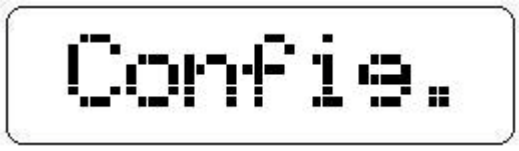
From this display the user can access the calibration procedure of the temperature probe if this has not been reserved to the maintainer.

5.4.4 PARAMETERS RESERVED TO THE PLANT MAINTAINER

From this display the user can access the maintenance menu of the instrument (setup) via password.

5.4.5 PARAMETER RESERVED TO THE PLANT ENGINEER

From this display the user can access the installation menu of the instrument (configuration) via password.



5.4.6 INFORMATION DISPLAY

From this display the user can access the information of the instrument.

ENT	to acces to the functioning informations the last calibration date and the total hours of operation

5.5 MAINTENANCE INSTRUCTION

5.5.1 PRELIMINARY OPERATIONS

Any checking operation must be done with the cell or an adequate resistance connected to the input of the device.

In particular, check that the instrument has been properly configured for the type of use.

To verify the parameters without modifying them follow the operating procedures described in paragraph "Setup (page 29)".

The display provides all the information necessary for the preliminary checks of operation.

The lighting of the display indicates that the unit has power and power circuits are working properly.

5.5.2 MAKING MEASUREMENTS

To operate the system installed, verify the connection of the following components:

- the conductivity cell and the eventual RTD in contact with the liquid under test;
- the logic input if necessary;

provide the power to the current loop and read the conductivity value of the liquid under test.

If the sensors are connected properly, as described in chapter "Installation (page 44)", the system will operate on a regular basis and require only the calibration.

5.5.3 CONDUCTIVITY CALIBRATION

Install the conductivity cell and connect to the same instrument.

The zero calibration if necessary is done as follows:

- remove the cell from the liquid, and verify that the dispaly value is zero;
- if the value is different from zero, adjust to zero the display by means of the calibration procedure described below.

MODE by pressing this button for more than 3 seconds, the message **Zero Cal** appears alternately to the actual conductivityvalue or **Cal lock** if the calibration was inhibited in the setup (Display S1.1).

ENT starts the automatic calibration, the display shows **Zeroing** alternating with **Scale x** where **x** will assume the values o f 5 to 1 to indicate the zeroing of the five scales.

If the zero value is proposed outside the acceptable limits described in the technical specifications, the display will show the error message **Zero err**, press the ENT key to delete the message and return to the main display.

If the new value is accepted, the display will show for a few seconds the message **Last cal** and propose the recording of the calibration date.

UP / DOWN to modify the value.

ENT to confirm the new value.

MODE to return to the main display without entering the date.

This date will be shown in the information menu of the instrument and at the end of the next calibration of zero or sensitivity so that it can be changed by the new date to be inserted.

> *The reset to zero factory in the main display is done as follows:*
>
> *start the calibration of zero, simultaneously press the UP, DOWN and ENT; the messages **RES Zero** and **Last cal** will appear for a few seconds.*
>
> *Proceed to the insertion or modification of date as in the previous case.*

The sensitivity calibration is carried out through the use of standard solutions, considering the temperature value (see attached table). Operate in the following way:

- prepare a standard solution of KCl (see table) or use solutions at known conductivity;
- immerse the cell in the solution and follow the procedure for calibrating the sensitivity described below.

UP (SENS) by pressing this button for more than 3 seconds, the message **Sens Cal** will appear alternately to the actual conductivity value or **Cal lock** if the calibration was inhibited in the setup (Display S1.1).

Wait for the stabilization of the value.

ENT to access the conductivity value changing.

If the measured value is close to that of the standard solution, the value stored will be proposed.

The display will show the measured value **xx.xx pH**.

UP / DOWN to modify the value.

ENT to confirm the entered value.

MODE to return to the main display without entering the sensitivity.

If the new value exceeds the limits of acceptability shown in the technical specifications of the instrument, the error **Sens err** will appear; press the ENT key to delete the error message and return to the main display.

If the new value is accepted, the display will show for a few seconds the message **Last cal** and propose recording the date of calibration.

UP / DOWN to modify the value.

ENT to confirm the entered value.

MODE to return to the main display without entering the date.

This date will be shown in the information menu of the instrument and at the end of the next calibration of zero or sensitivity so that it can be changed by the new date to be inserted.

> *The reset to sensitivity factory in the main display is done as follows:*
>
> *start the calibration of sensitivity, simultaneously press the UP, DOWN and ENT; the messages **RES Sens** and **Last cal** will appear for a few seconds.*
>
> *Proceed to the insertion or modification of date as in the previous case.*

If the value is different from that expected may mean that:

- the real value of the solution used is very different from the nominal one (the solution is polluted or altered);
- the conductivity cell is not operating properly;
- the configuration of the cell K is not correct.

In many applications, it is sufficient to perform only the sensitivity calibration using standard solution value closest to the conductivity of the sample to be measured, periodically checking the zero value with the sensor dry in air.

The two error messages provided by the instrument during the calibration indicate that the cell is in unacceptable operating condition (and therefore risky for the plant).

In fact, a zero deviation > 10 % Zero Err is an indication of excessive electrodes pollution or problems on the cable.

A deviation of sensitivity < 60 % or > 160 % Sens Err indicates a wrong K of the cell, damages or other.

In the case of these reports is advisable to replace the cell or the cable and check the connections.

CONDUCTIVITY STANDARD SOLUTIONS			
KCL CONCENTRATION	1 N	0,1 N	0,01 N
Temperature °C			
0	65.410	7.150	0.776
5	74.140	8.220	0.896
10	83.190	9.330	1.020
15	92.520	10.480	1.147
16	94.410	10.720	1.173
17	96.310	10.950	1.199
18	98.220	11.190	1.225
19	100.140	11.430	1.251
20	102.070	11.670	1.278
21	104.000	11.910	1.305
22	105.940	12.150	1.332
23	107.890	12.390	1.359
24	109.840	12.640	1.386
25	111.800	12.880	1.413
26	113.770	13.130	*
27	115.740	13.370	*
28	*	13.620	*
29	*	13.870	*
30	*	14.120	*

5.5.4 TDS CALIBRATION

The calibration of the TDS is made by choosing the appropriate conversion coefficient EC/TDS in order to obtain on the display the value in ppm or ppt concentration.

t is suggested to set the value of the conversion coefficient after the calibration of the conductivity.

5.5.5 TEMPERATURE CALIBRATION

It can be made when the Pt100 sensor is connected.

Immerse the Pt100 in a liquid or keep the sensor in the air knowing the value of the temperature.

MODE	press the key from the main display to go to D2.0 display
MODE	press the key (ZERO) for more than 3 seconds

The message **Zero cal** will appear alternately with the temperature value.

Wait for the stabilization of the temperature value on the display.

ENT press to access the values changing.

The display will show the actual value **XXX.X °C** o **°F**.

UP / DOWN to change the value.

ENT to confirm the entered value.

MODE to return to the main display without modify the values.

The message **Update** indicates the calibration is memorized.

If the new value exceeds the limits shown in the specification, the message **Zero err** will appear.

*The reset to zero factory in the main display is done as follows: start the calibration of sensitivity, simultaneously press the UP, DOWN and ENT; the messages **RES Sens** and **Last cal** will appear for a few seconds.*

5.5.6 SETUP

MODE	press the key two times from 1.0 display to get the message Set-up (display 50.0).
ENT	press the key to scroll through the setup functions
UP e DOWN	press the key to change the value or the option visualized on the display.
ENT	press the key to confirm the changings; the message Update will appear.
MODE	press the key to exit form the procedure and to turn to the 50.0 display.

Display	Contenuto	Meaning	Possible values
50.1	PASS 000	Password to access the setup menu	000 ÷ 999
S1.1	Cal lock	Inhibition of the zero and sensitivity calibration	On Off
S1.2	RespTime	Response time of the filter software	1 ÷ 20 s
S2.1	T Unit	Measuring unit of the temperature	°C °F
S2.2	T man	Manual temperature values	0.0 ÷ 100.0 °C 32.0 ÷ 212.0 °F
S2.3	Temp.Ref	Reference temperature setting	20 / 25 °C

Display	Contenuto	Meaning	Possible values
S2.4	Temp. Co	Temperature coeffcient	0.00 ÷ 3.50 %/ °C
S50.0	Set-up	Password setting	000 ÷ 999

5.5.7 MAINTENANCE OF THE TRANSMITTER

The use of electronic components of high quality gives the instrument characteristics of great reliability.

The frequency of any maintenance depends on the particular use of the instrument.

⚠ WARNING: Disconnect the power supply to the unit before performing the following procedures:

- dust removal from the terminal;
- operations on the wires connecting the terminal;
- mounting of the instrument in the switch board.

As with any electronic device mechanical components such as buttons, relays, terminal blocks, are the most prone to failure.

- Periodically check that the device is not subject to excessive moisture.
- Check that the connections to the terminal are free of dust and corrosion.
- Check that the terminal screws are tight.

5.5.8 MAINTENANCE OF THE SENSOR

The instrument can provide incorrect measurements due to the sensor which must be carried out proper maintenance by following the instructions in its specific manual.

The cell must be inspected and cleaned regularly, most frequently in the case of applications in alkaline liquids or fat-containing or organic substances.

Periodically, according to the needs of the application, it is suggested to perform the calibration operations.

5.6 INSTALLATION INSTRUCTION

5.6.1 SAFETY REQUIREMENTS

⚠ After performing the installation (chapter "Installation (page 44)"), before switching on and configurating the instrument do the following operations:

- check that all connections are correct;
- check that all connections are fastened on the terminal;
- check that the mechanical attachment of the cables does not cause any twisting or bending on the terminal blocks.

⚠ WARNINGS: The damage due to incorrect connections during installation are not covered by warranty.

5.6.2 CONFIGURATION

MODE	press the key three times from 1.0 display to get the message Config. (display 50.0).
ENT	press the key to scroll through the configuration parameters
UP e DOWN	press the key to change the value or the option visualized on the display.
ENT	press the key to confirm the changings; the message Update will appear.
MODE	press the key to exit form the procedure and to turn to the 60.0 display.

Depending on the configuration of the instrument configuration parameters may not be displayed

Display	Contents	Meaning	Possible values
60.1	PASS 000	Password to access the configuration menu	000 ÷ 999
C1.1	K CELL	K cell selection	0.1/0.5 1.0/10
C1.2	EC scale	Scale selection	Variabile
C1.3	TDS meas	TDS scale activation	On Off
C1.4	TDS fact	TDS/EC conversion factor	0.450 ÷ 1.00
C5.1	Loop	Current loop enable/disable	Enable Disable
C8.1	BaudRate	Baud rate (bit/s) selection	2400/4800 9600/19200
C8.2	B&C ID	ID for the B&C protocol	01 ÷ 32
C8.3	ModbusID	ID for the modbus protocol	01 ÷ 243
C60.0	Config.	Password setting	000 ÷ 999

6 DIGITAL OPERATION

Two protocol types are available:

- B&C (ASCII) protocol;
- Modbus RTU protocol (only function 03).

6.1 B&C ASCII COMMUNICATION PROTOCOL

Transmission mode

Code set	ASCII
Number of bits per character:	
- start bits	1
- data bits	8
- parity	no parity
- stop bits	1
Error check (only A command)	BCC

Format of the commands

2 bytes of ID probe (01 ÷ 32)

1 byte of command

n bytes of data to insert if requested by the command

1 byte <cr> (carriage return), end of the command

The transmitter responds only under the correct received ID or 00.

Do not use the 00 ID if the transmitter is in network, so to avoid communication conflicts.

Beware if the transmitter is set to a different speed is not responding.

6.2 COMMANDS

The list of commands implemented in the transmitter is always available by sending the command Help.

6.2.1 HELP

Command format: **ID + H <cr>**

Example: if ID=14 type 14H <cr> or 00H <cr>

By sending the command **H** displays the list of available commands with a brief description of their meaning.

```
-------------------------------------------------------------------------------
HELP MENU, COMMAND LIST       B&C ELECTRONICS
-------------------------------------------------------------------------------
C3436 CONDUCTIVITY TRANSMITTER Rev.fw:1.00  S/N:160589

00H  <cr>  Help menu
00A  <cr>  Acquisition
00Lx <cr>  Current loop:      0001             (0=disable 1=enable)
00Kx <cr>  K cell:            0003             (1=K0.1 2=K0.5 3=K1 4=K10)
00Ox <cr>  Analog out 4/20mA: 0003             (scale=1-5 for K=1 20uS-200mS)
00Fx <cr>  TDS/EC factor      0.500            (0.450-1.000)
00Rx <cr>  RT90% small signal 0010  s          (1-20s)
00Wx <cr>  Temp. unit         0001             (1=°C 2=°F)
00Jx <cr>  Temp. adjust       not done    0.0  (5.0°C/9.0°F max) (00JR reset)
00Nx <cr>  Tman               20.0  °C         (0.0-100.0°C / 32.0-212.0°F)
00Gx <cr>  Tref               0001             (1=20°C 2=25°C)
00Cx <cr>  TC                 2.20 %/°C        (0.00-3.50%/°C)
00Tx <cr>  Standard solution: 1413             (0.000-2000)
00Ux <cr>  Std. measure unit: 0001             (1=uS 2=mS)
00Z  <cr>  Zero  calibration: OK         0.12  (10% fs max) (00ZR reset zero)
00S  <cr>  Sens. calibration: not done  100.0% (60-160%)    (00SR reset sens)
00Dx <cr>  Last cal date:                      (max 8 characters)
00Ix <cr>  ID B&C:     Actual 0002 Config 0002 (01-32)
00Ex <cr>  ID modbus:  Actual 0002 Config 0002 (01-243)
00Bx <cr>  Baud rate:  Actual 0003 Config 0003 (1=2400 2=4800 3=9600 4=19200)

Type ID number or 00 before command. Example, if ID=15 type 15A or 00A <cr>
Use 00A <cr> if only one probe is connected
-------------------------------------------------------------------------------
```

6.2.2 ACQUISITION

Command format: ID + A <cr>

]Example: if ID=14 type 14A <cr> or 00A <cr>

By sending the command **A**, the transmitter responds by sending a record containing the code, the ID, date, time, and the value of all the measures.

Record format

```
 C3436- 10 0.0 01/01/01 00:00:00 ±  1000uS   ±   500ppm  ±  20.0°C   ±
....+....|....+....|....+....|....+....|....+....|....+....|....+....|....+....|
 0.500     ±    20°C   ±  2.20%/°C ±     0stat 18/11/10xx
```

C3436	p/n of the transmitter
10	ID
0.0	Power voltage (not implemented)
01/01/01	Date (not implemented)
00:00:00	Hour (not implemented)

Below are transmitted the parameter values measured by the transmitter with the following format:

Measuring	- Sign of measure (if positive is sent a blank) - Value of measure (6 characters - right alignment)
Campo U. di m	- 4 characters - left alignment - 1 blank (ASCII 32)
± 1000 uS	Conductivity value
± 500 ppm	TDS value
± 20.0 °C	Temperature
± 0.500	TDS/EC conversion factor
± 20 °C	Reference temperature
± 2.20 %/°C	Temperature coefficient
± 0stat	State of the logic input (0 = aperto; 1 = chiuso)

At the end of the record the transmitter sends the last calibration date, then 2 bytes containing the BCC of the string sent.

18/11/10	Date of the last calibrazion
xx	2 byte BCC

The record transmission is ended by <cr> <lf>.

BCC calculation

The BCC messages sent by the transmitter is calculated as the XOR of all the bytes of the message (excluding <cr> and <lf>) and divided into two nibbles.
The two nibbles are then transformed into their ASCII codes.

6.2.3 CURRENT LOOP

Formato comando: **ID + L + x <cr>**
Esempio: se ID=14 e si vuole abilitare il current loop digitare 14L0 <cr> oppure 00L0 <cr>

Response of the unit:	**<lf> ID + L + x <cr> <lf>**	command executed correctly
Response of the unit:	none	command failed

It is possible to enable or disable the current loop in the configuration menu by selecting:
x=0 current loop disabled
x=1 current loop enabled

6.2.4 K CELL

Command format: **ID + K + x <cr>**
Example: if ID=14 and K cell = 1, type 14K3 <cr> or 00K3 <cr>

Response of the unit:	**<lf> ID + K + x <cr> <lf>**	comando eseguito correttamente
Response of the unit:	none	command failed

The K cell can be set with the following values:
x=1 K cella = 0.1
x=2 K cella = 0.5
x=3 K cella = 1.0
x=4 K cella = 10

6.2.5 4-20 MA ANALOG OUTPUT

Command format: **ID + O + x <cr>**
Example: if ID=14 and analog out = 1 scale (range 0 to 1000 mV) type 14O1 <cr> or 00O1 <cr>

Response of the unit:	**<lf> ID + O + x <cr> <lf>**	command executed correctly
Response of the unit:	none	command failed

The 4-20 mA analog output can be assigned to one of the five EC scales.
According to the K cell selected the five scales take on a different value:

	K=0.1	K=0.5	K=1.0	K=10
x=1 for scale 1	2.000 µS	10.00 µS	20.00 µS	200.0 µS
x=2 for scale 2	20.00 µS	100.0 µS	200.0 µS	2000 µS
x=3 for scale 3	200.0 µS	1000 µS	2000 µS	20.00 mS
x=4 for scale 4	2000 µS	10.00 mS	20.00 mS	200.0 mS
x=5 for scale 5	20.00 mS	100.0 mS	200.0 mS	2000 mS

6.2.6 TDS / EC CONVERSION FACTOR

Command format: **ID + F + x <cr>**
Example: if ID=14 and the factor TDS/EC to select is 0.550, type 14F0.550 <cr> or 00F0.550 <cr>

Response of the unit:	**<lf> ID + F + x <cr> <lf>**	command executed correctly
Response of the unit:	none	command failed

To check whether the entered value has been received, type command **H**.

6.2.7 SMALL SIGNAL RESPONSE TIME

Formato comando: **ID + R + x <cr>**
Esempio: se ID=14 e il tempo di risposta al 90 % per piccole variazioni di segnale è 5 secondi digitare 14R5 <cr> oppure 00R5 <cr>

Response of the unit:	**<lf> ID + R + x <cr> <lf>**	command executed correctly
Response of the unit:	none	command failed

To check whether the entered value has been received, type command **H**.

6.2.8 TEMPERATURE MEASURING UNIT

Command format: **ID + W + x <cr>**

Example: if ID=14 and the unit of measurement of the temperature is °C type 14W0 <cr> or 00W0 <cr>

Response of the unit:	**<lf> ID + W + x <cr> <lf>**	command executed correctly
Response of the unit:	none	command failed

The temperature measuring unit can be configured with the following values:

x=0 measuring unit °C

x=1 measuring unit °F

6.2.9 TEMPERATURE ADJUSTMENT

Command format: **ID + J + x <cr>**

Example: if ID=14 and the temperature value to be taken is 23.2 °C type 14J23.2 <cr> or 00J23.2 <cr>

Response of the unit:	**<lf> ID + J + x <cr> <lf>**	command executed correctly
Response of the unit:	none	command failed

Zero adjustment of the temperature measure.

To verify the results of the temperature correction use the **ID + A**, the temperature reading should be approx same as the adjusted value.

With the command **ID + H** control the line "Temp. adjust: ok / error".

With the command **ID + J?** you can read the result directly.

If the operation has failed (error) the previous zero value is retained.

The "Temp. adjust: not done" message indicates that the parameter has been restored to the default value with the command **ID + JR**.

6.2.10 TEMPERATURE RESET

Command format: **ID + JR <cr>**

Example: if ID=14 type 14JR <cr> or 00JR <cr>

Response of the unit:	**<lf> ID + JR <cr> <lf>**	command executed correctly
Response of the unit:	none	command failed

This command allows you to return the value of the zero temperature to the default value.

Verify the outcome of the operation with the command **ID + H** and check the line "Temp. adjust: not done".

6.2.11 TEST OF THE TEMPERATURE ADJUSTMENT

Command format: **ID + J? <cr>**
Example: if ID=14 type 14J? <cr> or 00J? <cr>

Response of the unit:	**<lf> <8 characters outcome> <blank> <7 digit value> <4 characters unit> <cr> <lf>**
Response of the unit:	none

Record format

```
ok       ±   0.2°C
....+....|....+....|....+....|....+....|....+....|....+....|....+....|....+....|
```

The possible results are: ok / not done / error.

6.2.12 MANUAL TEMPERATURE

Command format: **ID + N + x <cr>**
Example: if ID=14 and the manual temperature is 28.3 °C type 14N28.3 <cr> or 00N28.3 <cr>

Response of the unit:	**<lf> ID + N + x <cr> <lf>**	command executed correctly
Response of the unit:	none	command failed

To check whether the entered value has been received, type command **H**.

6.2.13 REFERENCE TEMPERATURE

Command format: **ID + G + x <cr>**
Example: if ID=14 and the reference temperature is 25 °C, type 14G2 <cr> or 00G2 <cr>

Response of the unit:	**<lf> ID + G + x <cr> <lf>**	command executed correctly
Response of the unit:	none	Command failed

The reference temperature can be selected as follows;
x=1 TRef=20 °C
x=2 TRef=25 °C
To check whether the entered value has been received, type command **H**.

6.2.14 TEMPERATURE COEFFICIENT

Command format: **ID + C + x <cr>**
Example: if ID=14 and the TC is 2.10 %/°C type 14C2.10 <cr> or 00C2.10 <cr>

Response of the unit:	**<lf> ID + C + x <cr> <lf>**	command executed correctly

Response of the unit:	none	command failed

To check whether the entered value has been received, type command **H**.

6.2.15 STANDARD SOLUTION

Command format: **ID + T + x <cr>**

Example: if ID=14 and the standard solution value is 1413 µS type 14T1413 <cr> or 00T1413 <cr>

Response of the unit:	**<lf> ID + T + x <cr> <lf>**	command executed correctly
Response of the unit:	none	command failed

To check whether the entered value has been received, type command **H**.

6.2.16 UNIT OF THE STANDARD SOLUTION

Formato comando: **ID + U + x <cr>**

Esempio: se ID=14 e l'unità di misura della soluzione standard è µS digitare 14U1 <cr> oppure 00U1 <cr>

Response of the unit:	**<lf> ID + U + x <cr> <lf>**	command executed correctly
Response of the unit;	none	command failed

The unit of measure of the standard solution can be set with the following values:

x=1 µS

x=2 mS

To check whether the entered value has been received, type command **H**.

6.2.17 ZERO CALIBRATION

Command format: **ID + Z <cr>**

Example: if ID=14 type 14Z <cr> or 00Z <cr>

Response of the unit:	**<lf> ID + Z <cr> <lf>**	command executed correctly
Response of the:	none	command failed

The zero calibration must be done with the dry cell connected to the transmitter.

The transmitter resets the value of the conductivity on all 5 scales automatically starting from the lower scale.

The zero calibration is to be carried out preferably at the first installation before calibration the sensitivity.

To verify the results of the zero calibration use the **ID + A**; the conductivity reading should be around 0 µS/mS.

With the command **ID + H** control the line "Zero calibration: ok / error ".

With the command **ID + Z ?** you can read the result directly.

If the operation has failed (error), the previuos zero value is retained.

Check if the cell is perfectly clean and dry.

The message "Zero calibration: not done" indicates that the parameter has been restored to the default value with the command **ID + ZR**.

6.2.18 ZERO RESET

Command format: **ID + ZR <cr>**
Example: if ID=14 type 14ZR <cr> or 00ZR <cr>

Response of the unit:	**<lf> ID + ZR <cr> <lf>**	command executed correctly
Response of the unti:	none	command failed

This command allows you to restore the zero value of 5 scales to the default values.
Verify the outcome of the operation with the **ID + H** and check the line "Zero calibration: not done".

6.2.19 ZERO CALIBRATION TEST

Command format: **ID + Z? <cr>**
Example: if ID=14 type 14Z? <cr> or 00Z? <cr>

Response of the unit:	**<lf> <8 characters outcome> <blank> <7 digit value> <4 characters unit> <cr> <lf>**	command executed correctly
Response of the unit:	none	command failed

Record format

```
ok       ±    10uS
....+....|....+....|....+....|....+....|....+....|....+....|....+....|....+....|
```

Possible results: ok / not done / error.

6.2.20 SENSITIVITY CALIBRATION

Command format: **ID + S <cr>**
Example: if ID=14 type 14S <cr> or 00S <cr>

Response of the unit:	**<lf> ID + S <cr> <lf>**	Command executed correctly
Response of the unit:	none	Coomad failed

Tthe sensitivity calibration is done in a standard solution or in solution in known conductivity.
The value of the standard solution should be inserted through the commands "Set standard solution" and "Set stardard measure unit ".
The TC (temperature coefficient) used by the unit during the calibration is that of KCl.
The calibration is performed on the selected scale and the new sensitivity value will also be applied to the other scales.
To verify the results of the calibration, use the **ID + A**; the conductivity reading should be about the value of the calibration solution.

Through the command **ID + S?** the user can read the result directly.

Through the command **ID + H** the user controls the lines lines:

"Zero. calibration: ok / error";

"Sens. calibration: ok / error".

If the calibration has failed (error) check that the conductivity cell is properly immersed in the standard solution.

Iinspect the state of the surfaces of the measuring cell, if necessary, clean the surfaces with a soft cloth.

In case of failure the transmitter resets its previous sensitivity.

The message "Sens. calibration: not done" indicates that the parameter has been restored to the default value through the command **ID + SR**.

6.2.21 SENSITIVITY RESET

Command format: **ID + SR <cr>**

Example: if ID=14 type 14SR <cr> or 00SR <cr>

Response of the unit:	**<lf> ID + SR <cr> <lf>**	command executed correctly
Response of the unit:	none	command failed

This command allows to return to the default sensitivity value of 100.0 %.

Verify the outcome of the operation through the command **ID + H** and check the line "Sens. calibration: not done".

6.2.22 SENSITIVITY CALIBRATION TEST

Formato comando: **ID + S? <cr>**

Esempio: se ID=14 digitare 14S? <cr> oppure 00S? <cr>

Response of the unit:	**<lf> <8 characters outcome> <blank> <7 digit value> <4 characters unit> <cr> <lf>**
Response of the unit:	none

Record format

```
ok       ± 100.0%
....+....|....+....|....+....|....+....|....+....|....+....|....+....|....+....|
```

Possible results: ok / not done / error.

6.2.23 POSSIBLE RESULTS: OK / NOT DONE / ERROR.

Command format: **ID + D + cccccccc <cr>**

Example: if ID=14 and the date to be inserted is 13/11/10 type 14D13/11/10 <cr> or 00D13/11/10 <cr>

Response of the unit:	**<lf> ID + cccccccc <cr> <lf>**	command executed correctly
Response of the unit:	none	command failed

This command allows to store the last calibration date.
The date field is 8 characters to be written in any format and syntax.

6.2.24 ID OF THE B&C PROTOCOL

Command format: **ID + I + x <cr>**
Example: if ID=14 and the new ID (identification) to enter is 07 type 14I07 <cr> or 00I07 <cr>

Response of the unit:	**<lf> ID + I + x <cr> <lf>**	command executed correctly
Reponse of the unit:	none	command failed

The transmitter activates the new ID to the next power.

6.2.25 ID OF THE MODBUS PROTOCOL

Formato comando: **ID + E + x <cr>**
Esempio: se ID=14 e il nuovo ID (identificativo) da inserire è 07 digitare 14E07 <cr> oppure 00E07 <cr>

Response of the unit:	**<lf> ID + E + x <cr> <lf>**	command executed correctly
Response of the unit:	none	command failed

The transmitter activates the new ID to the next power.

6.2.26 BAUDE RATE

Command format: **ID + B + x <cr>**
Example: if ID=14 and the new speed is 2=4800 baud type 14B2 <cr> or 00B2 <cr>

Response of the unit:	**<lf> ID + B + x <cr> <lf>**	command executed correctly
Response of the unit:	none	command failed

The transmitter activates the new baud rate to the next power.

6.3 MODBUS PROTOCOL

On the transmitter, in addition to the ASCII B&C protocol, is implemented the Modbus RTU protocol limited to the function 03.
In Modbus communication network the transmitter operates as a slave device.

RTU transmission mode

Number of bits per character:	
- start bits	1
- data bits (menus sign before)	8
- parity	no parity
- stop bits	1
Errors verification	CRC-16

RTU messages format

Pause transmission	duration 3,5 bytes
Address	1 byte (8 bits)
Function	1 byte (8 bits)
Data	N bytes (N x 8 bits)
Errors verification	2 bytes (16 bits)
Pause transmission	duration 3,5 bytes

For a correct synchronization of the transmission the receiving unit interprets the end of a message when it doesn't receive any characters (bytes) for a time equivalent to the transmission of 3.5 characters (bytes).

6.3.1 MODBUS FUNCTION 03

Function 03 (MASTER QUERY)

Address	1 byte	01 ÷ 32 (ID transmitter)
Function	1 byte	03 (read holding register)
Start address data HI	1 byte	Start address of registers
Start address data LO	1 byte	
Number of registers HI	1 byte	Number of registers (2 byte x register)
Number of registers LO	1 byte	
Errors verification	2 bytes	CRC-16

The transmitter considers valid the message if CRC-16 valid, ID valid and function=03.

Address	1 byte	01 ÷ 32 (ID trasmitter)
Function	1 byte	03 (read holding register)
Number of byte of sent data	1 byte	2x number of sent registers
N byte of data	N byte	Values of registers
Error verification	2 bytes	CRC-16

Time between the end of the query and the beginning of the response about 100 ms.

6.3.2 DATA THROUGH MODBUS FUNCTION 03

	Name	Measure unit	Range	Data type	Size	R/W	Modbus addr
1	Conductivity	In function to scale, see specifications	-100 ÷ 2100	Sign int	2 byte	R	0x0000
2	TDS	In function to scale, see specification	-50 ÷ 1050	Sign int	2 byte	R	0x0001
3	Temperature °C	0.1 °C	-100 ÷ 1100	Sign int	2 byte	R	0x0002
4	Temperature °F	0.1 °F	140 ÷ 2300	Sign int	2 byte	R	0x0003
5	K cell	0.1	1/5/10/100	Sign int	2 byte	R	0x0004
6	Scale	1	1 ÷ 5	Sign int	2 byte	R	0x0005
7	Factor TDS/EC	0.001	450 ÷ 1000	Sign int	2 byte	R	0x0006
8	Ref. temperature	1 °C	20/25	Sign int	2 byte	R	0x0007
9	Coeff. temp.	0.01 %/°C	0 ÷ 350	Sign int	2 byte	R	0x0008
10	Digital input state	1	0 ÷ 1	Sign int	2 byte	R	0x0009

7 INSTALLATION

7.1 PACKING LIST

The instrument package contains:
- The instrument with s/n label;
- The instruction manual in Italian language.

7.2 UNPACKING AND REPACKING OF THE UNIT

1 Remove from the carton box the instruction manual.
2 Open the box and remove the instrument wrapped in clear plastic guard.
3 Remove the plastic cap and keep the two fastening rods.
If repackaging do the reverse.

7.3 STORAGE AND TRANSPORT

For prolonged storage, keep the product in dry places.
In the case of transportation, pack the product in the carton box.

7.4 INSTALLATION OF THE TRANSMITTER

The instrument can be installed in a special watertight box or DIN rail in an electrical control panel.

7.5 INSTALLATION OF THE SENSOR

The conductivity cell must be mounted correctly if you want the system to work accurately and efficiently.
In particular, note the following:
- the sample in contact with the cell must be representative of the solution to be measured;
- the liquid must flow continuously through the cell; if the cell is submersed, the liquid should be shaken;
- the assembly of the cell must be such as to prevent stagnation of air bubbles on the electrodes; typically a 45 ° or installation in a pipe with the electrodes invested by the flow does not create problems;
- sediment or deposits must not accumulate in the electrodes area;
- verify that the limitations of temperature and pressure of the cell met by the fluid under measurement.

Check that the type of cell is appropriate for the selected range, and that the cable is adequate for the distance between the cell and the instrument.

Low conductivity values may require the use of a special cable (eg . the model SZ 927.1) and special connection with the instruments installed at large distances from the cell. (contact our sales department for advice and assistance in special applications).

7.6 ELECTRICAL INSTALLATION

For all electrical connections, refer to the drawing printing on the back of the instruments, also shown and described in chapter "Installation drawings (page 47)".

All the connections to the instrument are made using removable terminal blocks.

⚠ It should be remembered that the electronic instruments are subject to accidental failure.

Predict the necessary precautions to avoid any damage caused by their dysfunction.

7.6.1 CONNECTION OF THE MEASURING CELL

The connection of the cell is the most critical part of the whole system.

The application also accidental voltages can damage the circuitry of the input amplifier.

- Use low loss cables over the entire length between the cell and the input terminals of the instrument.
- Avoid interruptions of the cable. If necessary use junction box with very high insulation and protect from moisture.
- Keep the cell cable from the power cables also inside the electrical panel.
- Very long connections may require compensation of the "zero" when measuring low values o f conductivity.
- Connect the two electrodes cell between terminals 9 and 12 marked A and D verifying the presence of a jumper between terminals 9 and 10 and one of the terminals 11 and 12.
- In the case of cells with coaxial electrodes, connect the central to terminal 9 marked A and the shield to terminal 12 marked D verifying the presence of a jumper between terminals 9 and 10 and one of the terminals 11 and 12.
- Connect the 4-electrode cell between terminals 9 , 10 , 11 and 12.

7.6.2 CONNECTION OF THE TEMPERATURE SENSOR

To get the display of the temperature value and the automatic compensation of the effect of temperature on the pH measurement is necessary to connect the temperature sensor Pt100 RTD as shown in chapter "Installation drawings (page 47)", using the appropriate wire gauge.

If the temperature sensor is not connected, or is interrupted or in short circuit, the instrument automatically switches to the manual temperature compensation.

Two-wire PT100 connection for short distances

- Connect the Pt100 to terminals 13-14 and short terminals 14-15.

Three wire Pt100 connection for great distances

- Connect a Pt100 wire to the 13 instrument terminal.
- Connect one common wirel of the Pt100 to terminal 14 and the other common wire to terminal 15 (use two separate wires).

Warnings:

- do not interrupt the connection cable. Use extension cable through high isolation junction box;
- keep the cable away from the power cables;
- in case of interference use shielded cable with the shield connected to the ground terminal 3.

7.6.3 CONNECTION OF THE CURRENT LOOP

The instrument provides an output current proportional to the primary measure to drive an external recorder, PLC or other similar devices.

- Connect the (+) terminal of the power supply to the 2 terminal.
- Connect the return of the loop (-) to the 3 terminal.

If the analog signal must drive more devices, they must be connected in "series" between them. The sum of their input resistance must not be greater than 600 Ω.

7.6.4 CONNECTION OF THE LOGIC INPUT

The free voltage contacts in closure from an external device must be applied to the logic input terminals 7 and 8.

⚠ WARNINGS
Do not give any power to the logic input terminals.

7.6.5 CONNECTION TO THE RS485 SERIAL PORT

The instrument can be configured as a slave device and communicate via the serial port. There are two types of protocol as described in chapter "Digital operation (page 32)".

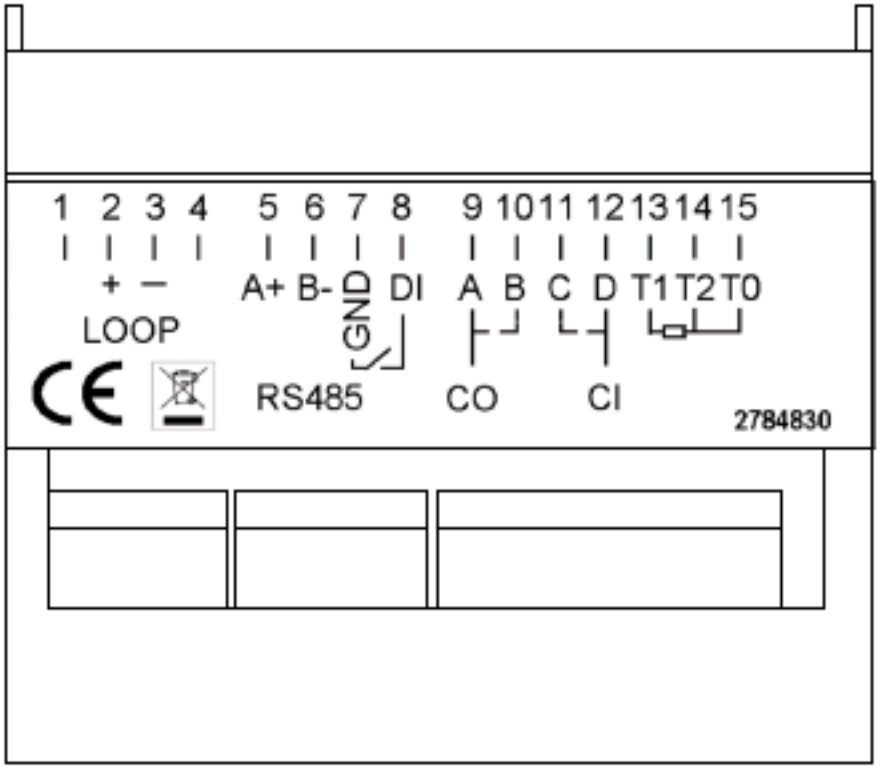
- Connect the (+) or channel A of the RS485 interface to terminal 5.
- Connect the (-) or channel B of the RS485 interface to terminal 6.
- Connect the eventual ground (GND) of the RS485 interface to terminal 7.

7.7 DISPOSAL

In the case of disposal of the instrument, apply the terms of the law provided for the disposal of electronic devices.

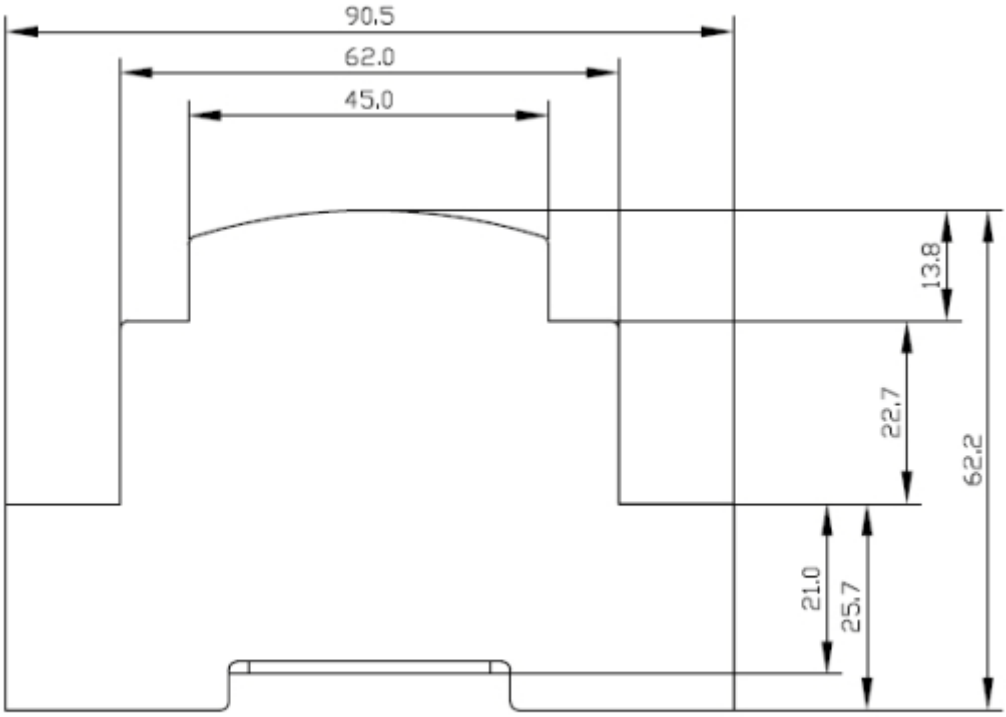
8 INSTALLATION DRAWINGS

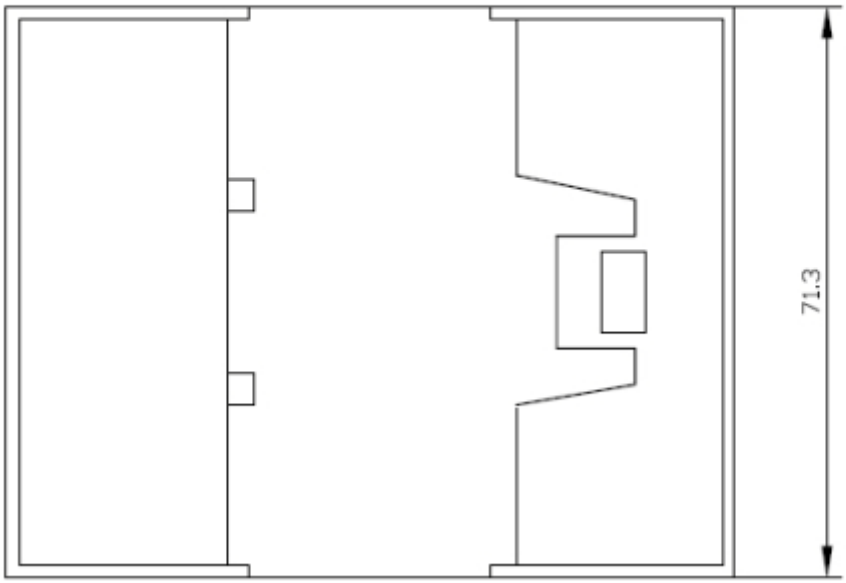
8.1 CONNECTIONS



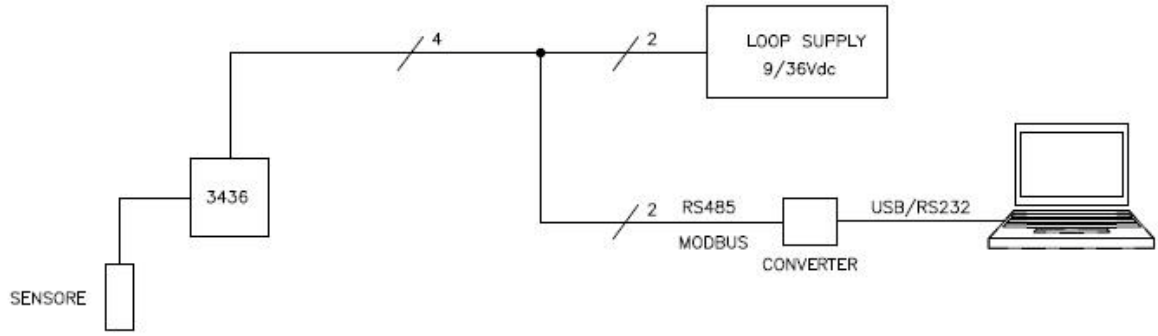
Terminal	Function
2	+ Loop
3	- Loop (9/36 Vdc)
5	RS485 A+
6	RS485 B-
7	RS485 Gnd
7	Digital input
8	Digital input
9	A (EC)
10	B (EC)
11	C (EC)
12	D (EC)
13	T1 (Pt100)
14	T2 (common Pt100)
15	T0 (common Pt100) (Gnd measure)

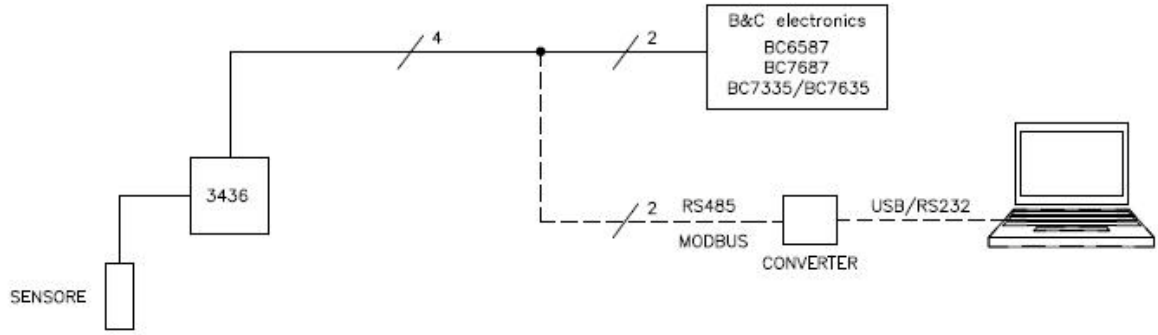
8.2 DIMENSIONS

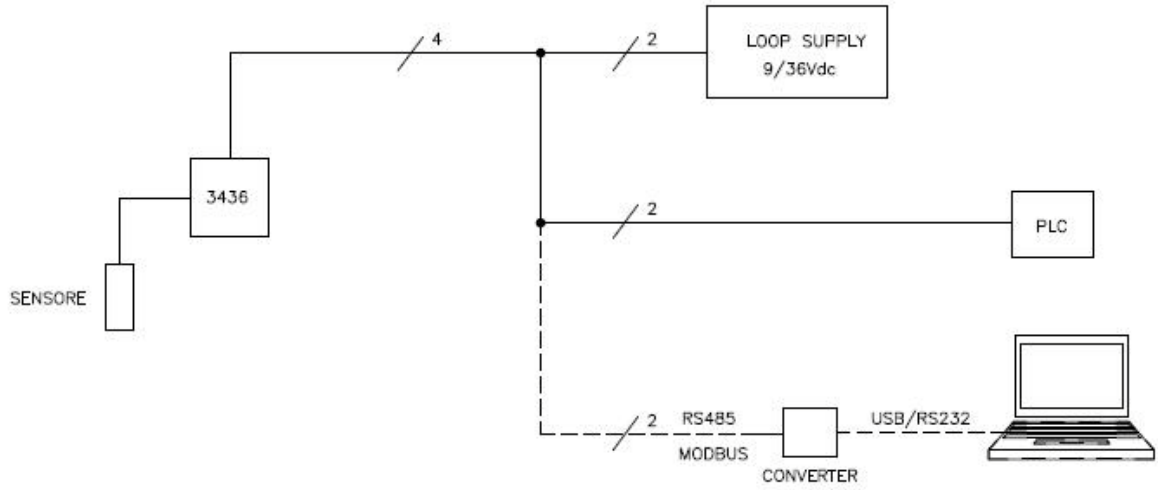




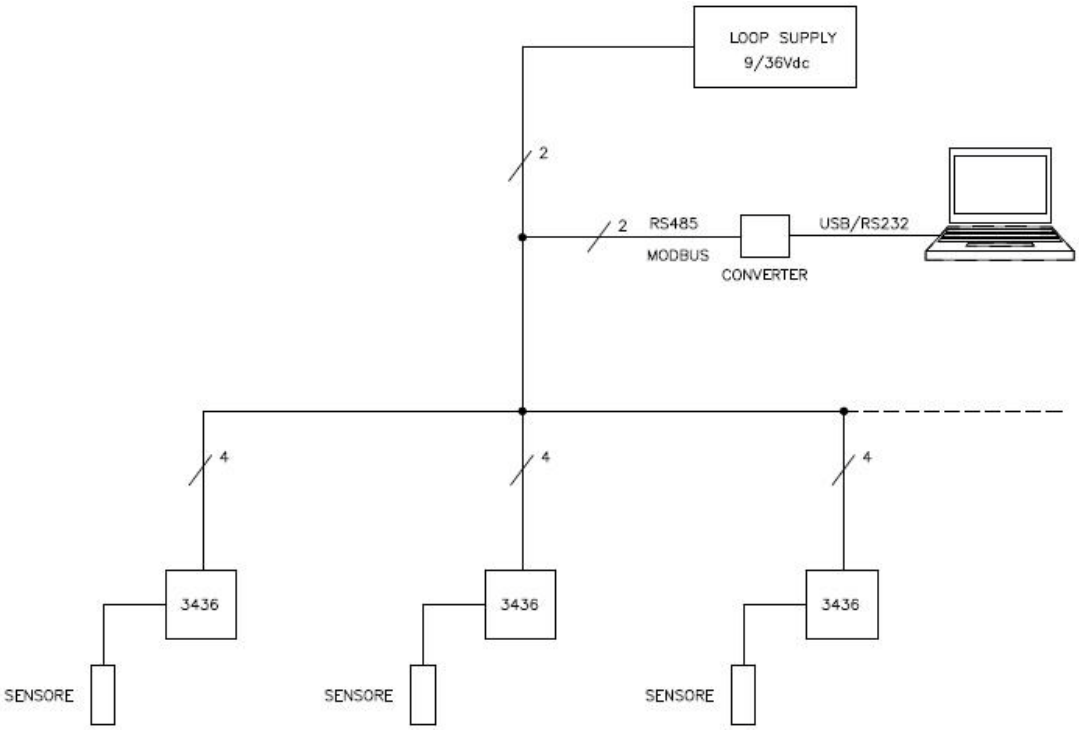
8.3 SINGLE INSTRUMENT CONNECTION

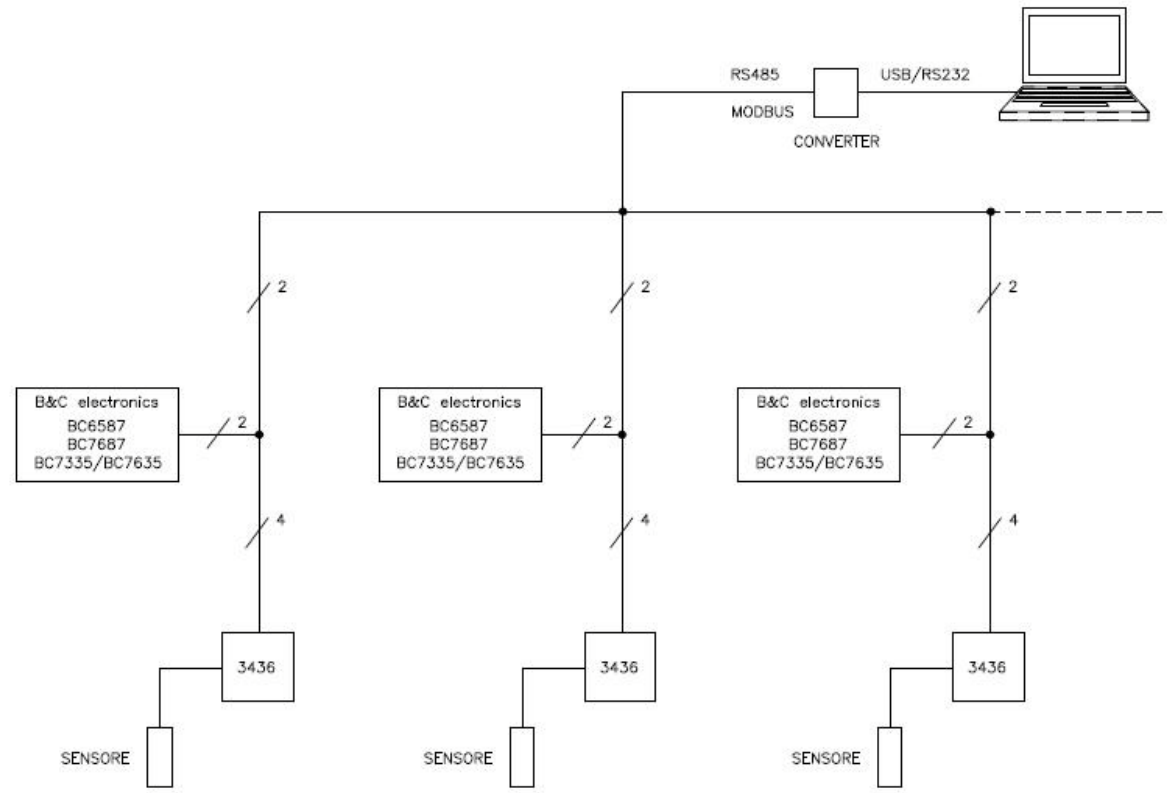






8.4 RS485 NETWORK CONNECTION





9 WARRANTY

1 Your product is guaranteed for 5 years from the date of purchase, for failure due to manufacturing defects.

2 The warranty is void in case of tampering or deterioration due to improper installation or maintenance.

3 The warranty covers only free repair at the laboratories of the manufacturer.

4 B&C Electronics is not liable for any damage arising from the use of its tools.

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10 REPAIRS

For faster and efficient service it is recommended to fill in the "Information card" for the repair service and attach it to a "Repair order".

1 The estimated cost, if required by the customer, is free if the repair is confirmed. Otherwise flat rate results in a charge for the analytical work performed and expenses incurred.

2 The products to be repaired must be sent to B&C Electronics with freight prepaid. Any expenses incurred on behalf of the client and not previously agreed will be charged.

3 Our sales department will submit to the customer the repair estimate or offer a replacement in the following cases:

- repair cost is considered excessive in relation to the cost of the product;
- the repair is technically impossible or unreliable.

4 In order to reduce the time of delivery of the repaired products, unless otherwise offered or arranged by the customer, the shipment will be made with ex-factory, prepaid carriage by a courier.

INFORMATION SHEET

for service repairs

In the event of a fault, we recommend you contact our repair service, to photocopy and complete this information sheet to be attached to the product to be repaired.

□ ESTIMATE □ REPAIR

COMPANY NAME

ADDRESS ZIP TOWN

REFER TO MR/MRS TELEPHONE

MODEL S/N DATE

Consult the instruction manual to identify the area of the defect and/or describe it:

□ SENSOR
□ POWER SUPPLY
□ CALIBRATION
□ DISPLAY
□ ANALOG OUTPT
□ SET POINT
□ RELAYS CONTACTS
□ INTERMITTENT PROBLEM

DESCRIPTION OF THE DEFECT

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