Instruction manual

CL 3436

RESIDUAL CHLORINE - CHLORINE DIOXIDE
DISSOLVED OZONE

Measuring scales
2.000 ÷ 200.0 ppm
2.000 ÷ 200.0 mg/l

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. 28006341 - Rev 01

INDEX

1 GENERAL WARNINGS AND INFORMATION FOR ALL USERS

1.1 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.

1.2 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.

1.3 CE MARKING

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

- 2011/65/EU "Restriction of the use of certain hazardous substances in electrical and electronic equipment"
-

Until 19/04/2016:

- 2004/108/EC "Electromagnetic compatibility"

From 20/04/2016:

- 2014/30/EU "Electromagnetic compatibility"
- EN 61326-1/2013 "Electromagnetic compatibility"
  - Industrial use
- EN 55011/2009 "Radio-f requency disturbance characteristics"
  - Class A (devices for usage in all establishment other than domestic)
  - Group 1 (Industrial equipment that do not exceed 9kHz)

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

1.4 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 "Instrument's specifications (page 12)", in order to avoid potential damages and a reduction of its operating life.

1.5 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.

2 PRODUCT OVERVIEW

2.1 FUNCTIONAL PURPOSE OF THE DEVICE

The system for the monitoring of free chlorine, combined chlorine, total chlorine, chlorine dioxide, dissolved ozone, and other oxidizers consists of two main parts:

- the transmitter object of this instruction manual;
- the probe/measuring sensor.

The instrument operates in analog and/or digital functionality.

The transmitter performs the following functions:

1 display of the oxidizers values of the aqueous solutions, by using a suitable measuring sensor;

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.

2.2 ACCESSORIES

Sensors and accessories for different applications are available, to be ordered separately.

Our web site contains accessories, upgrades and detailed specifications of each product.

Our staff is always available to help costumers select the most appropriate and suitable solution for their specific needs.

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 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.

3.2 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 23)".

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

- "Instruction for the user (page 23)";

- "Maintenance instruction (page 24)";

- "Warranty (page 50)";

- "Repairs (page 50)".

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.

3.2.1 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.

3.2.2 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.

3.2.3 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:

- LO/HI current of the cell;
- polarization voltage;
- ppm or mg/l measuring unit;
- input scales 2.000 - 20.00 - 200.0;
- current loop enable/disable;
- scale factor 10/100 %;
- 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 8 x1 characters.

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

The messages are alternatively displayed.

Keyboard

The instrument has 4 dual function keys. To use the second function press the key for more than 3 seconds. The combined pressure of keys allows to perform additional functions as described in the manual.

Inputs

The instrument is able to perform the measurement of the oxidizers by using 2 or 3 electrodes specific sensors, by selecting the current value (HI/LO) provided by the cell.

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

Scales

The instrument allows the selection of three measuring scales in each current range obtained from the sensor.

The measuring unit is selectable in ppm or mg/l. See table in section "Instrument's specifications (page 12)".

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 is 20 °C.

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

Calibration

The instruments allows to perform the zero and sensitivity calibration in a wide range, in order to extend the useful life of the sensor.

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

Analog output

The instrument has a 4-20 mA analog output (current loop) 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 isolated 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).

A converter RS485/RS232 or RS485/USB is required.

The operator can use a simple terminal emulation program.

Using Modbus protocol, only the function 03 is implemented.

Software filter

A double software filter operates on the input signal of the measuring sensor.

The user can set the response time relative to signals of small and large variations, in order to obtain a stable reading.

Logic input

The instrument is equipped with a logic input to be connected to a free voltage contact from an external device.

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

The state of the logic input is visible in the record digital broadcast.

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 is powered using the terminals of the current loop (min. 9 Vdc / max. 36 Vdc), the power consumption is minmized.

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 small/large software filter;
- select the unit of measurement of the temperature in °C or °F;
- select the manual temperature compensation value;
- select the parameters of the temperature compensation;
- change the access password.

In case the wrong password is entered, a message will appear and you can view the parameters but not modify them.

Configuration

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

- the HI/LO input current;

- the polarization voltage;
- the measuring unit;
- the measuring scale;
- the current loop enable;
- the scalability factor;
- the baud rate of the RS485 interface;
- the ID for communication protocols Modbus or B&C;
- a new value of the access password.

In case the wrong password is entered, a message will appear and you can view the parameters but not modify them.

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 INSTRUMENT'S SPECIFICATIONS

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
Immunity performance loss	
Conformity EMC/RFI	EN61326
Registered design	002564666-001

4.2.2 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
	Sensor type		2 wires / 3 wires		
C1.1	Sensor current		LO / HI (LO=160 nA/ppm, HI=2000 nA/ppm)		HI
C1.2	Polarization		-1000 ÷ 1000 mV		-200 mV
C1.3	Measuring unit		ppm / mg/l		ppm
C1.4	Scales		2.000 ppm / mg/l 20.00 ppm / mg/l 200.0 ppm / mg/l		20.00
	Scales	Resolution	Measure limits	Reading limits	
	2.000 ppm / mg/l	0.001	-0.100 / 2.100	-0.200 / 2.200	
	20.00 ppm / mg/l	0.01	-1.00 / 21.00	-2.00 / 22.00	
	200.0 ppm / mg/l	0.1	-10.0 / 210.0	-20.0 / 220.0	
S1.2	RT 90 % Large Signal		1 ÷ 20 seconds		2 s
S1.3	RT 90 % Small Signal		1 ÷ 20 seconds		10 s
	Measure update		0.5 seconds		
D1.1	Zero		±20 % of the scale		0 nA
	Calibration		MANUAL manual correction con the selected scale, sensor current off-set		

D1.0	MEAN MEASURE		Default
D1.2	Sensor sensitivity	12.5 ÷ 250 %	100 %

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
	Reference temperature	20 / 25 °C	20 °C
S2.3	Temperature coefficient	0.00 ÷ 4.00 %/°C	2.00 %/°C

	CURRENT LOOP		Default
C5.1	Current loop	enabled / disabled	enabled
	Current loop proportional to measuring	4-20 mA	
C5.2	Scalability factor	10 ÷ 100 %	100 %
	Under range	3.80 mA	
	Over range	20.80 mA	
	ID of the selected scale (current loop enabled)		
	• Scale 2.000	11 mA at switching on for 8"	
	• Scale 20.00	12 mA at switching on for 8"	
	• Scale 200.0	13 mA at switching on for 8"	

	DIGITAL OPERATION		**Default**
	Protocols	B&C protocol ASCII / Modbus RTU The two protocols can coexist	
C8.2	B&C ID protocol	ID=01 ÷ 32 *last s/n digit, if 0 ID=10	01 ÷ 10*
C8.3	Modbus address	ID=01 ÷ 243 *last s/n digit, if 0 ID=10	01 ÷ 10*
	Measures and parameters are provided under interrogation (see protocols B&C ASCII and Modbus RTU function 03)		
	Interface	RS485 isolated not terminated	
C8.1	Baud rate	2400 / 4800 / 9600 / 19200 baud	9600 baud
	Distance of connection	1000 / 500 / 250 / 125 m	
	Use in network	32 transmitters max	

	DIGITAL INPUT		**Default**
	Digital input	Free voltage 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	Off
S1.2	Response time (large signal)	1 ÷ 20 seconds (RT=90 %)	2 s
S1.3	Response time (small signal)	1 ÷ 20 seconds (RT=90 %)	10 s
S2.1	Temperature measuring unit	°C / °F	°C
S2.2	Manual temperature	0 ÷ 100 °C 32 ÷ 212 °F	20 °C
S2.3	Temperature coefficient	0.00 ÷ 4.00 %/°C	2.00 %/°C
S50.0	Password changing	000 ÷ 999	000

D60.0	**CONFIGURATION**		**Default**
60.1	Password to access the configura-tion	000 ÷ 999	000
C1.1	Sensor current	LO / HI	HI
C1.2	Polarization	-1000 ÷ 1000 mV	-220 mV
C1.3	Measurign unit	ppm / mg/l	ppm
C1.4	Measuring scales	2.000 / 20.00 / 200.0	20.00

D60.0	CONFIGURATION		Default
C5.1	Current loop	enabled / disabled	enabled
C5.2	Scalability factor	10 ÷ 100 %	100 %
C8.1	Baud rate	2400 / 4800 / 9600 / 19200 baud	9600 baud
C8.2	B&C ID 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	Password changing	000 ÷ 999	000
I1.0	P/N and firmware release	CL3436 Rev1.xx	
I2.0	Scale / Last calibration date	Scale / XX/XX/XX	
I3.0	Total hours of operation	XXXXXX h	

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

5 INSTALLATION

5.1 PACKING LIST

The instrument package contains:

- the instrument with s/n label;
- the instruction manual in Italian language.

5.2 UNPACKING AND REPACKING OF THE UNIT

1 Remove from the carton box the instruction manual.
2 Remove the instrument wrapped in clear plastic guard.
3 Remove the plastic cap.

If repackaging do the reverse.

5.3 STORAGE AND TRANSPORT

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

5.4 INSTALLATION OF THE TRANSMITTER

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

5.5 INSTALLATION OF THE SENSOR

Follow the specific instructions of the flow-through or immersion sensors for the installation.

The measures of oxidizing agents in water may depend on the sample stream. For this reason the sensors are placed in special overflow cells to keep the flow constant in the vicinity of the sensor.
In case of in-line installation the sample flow should be mantained costant.
The sensors whose measurement is not dependent on flow can also be installed in immersion .

- Protect the cable of the sensor from rain or corrosive agents, for example using a sheath.

Interruptions on the sensor cable may cause interference.
When necessary (for example for cable extension) use high insulation terminal blocks protected from moisture (for example, the derivation accessory SZ 740).

Keep the cable of the sensor away from the power cables.

5.6 ELECTRICAL INSTALLATION

For all electrical connections, refer to the lable on the instruments, also shown and described in chapter "Installation drawings (page 46)".
All the connections to the instrument are made using removable terminal blocks.

⚠ Electronic instruments are subject to accidental failure.
Predict the necessary precautions to avoid any damage caused by their malfunction.

5.6.1 CONNECTION OF THE MEASURING CELL

Two electrodes sensors

- Connect the catode to the terminal 12 marked IN-.
- Connect the anode to the terminal 9 marked CE.
- Installa a jumper between 9-10 terminals marked CE and R.

Three electrodes sensors

- Connect the catode to the terminal 12 marked IN-.
- Connect the anode to the terminal 9 marked CE.
- Connect the third electrode (reference) to the terminal 10 marked R.

Connection of the most popular sensors:

Connection ot the 2-electrodes polarographic cell (CL7901 - CL7902 - OZ7901)
The sensor of the above cells includes the Pt100 temperature sensor and is provided with cable whose wires are identifed by their color.

- Connect the brown wire (cathode) to the terminal 12 marked IN-.
- Connect the white wire (anode) to the terminal 9 marked CE.
- Install a jumper between terminals 9-10.
- Connect the red wire (Pt100) to the terminal 13 marked t1.
- Connect the black wire (Pt100 common) to the terminal 14 marked t2.
- Connect the green wire (Pt100 common) to the terminal 15 marked t0.

Connection of the potentiostatic sensor
The SZ 283 potentiostatic sensor is provided with a shielded cable with two wires identified by their color.

- Connect the black wire (cathode) to the terminal 12 marked IN-.
- Connect the white wire (counter electrode) to the terminal 9 marked CE.
- Connect the shield (reference) to the terminal 10 marked R.

⚠ The connection of the sensors is the most critical part of the whole system.

Application of voltages not related to the process can damage the circuitry of the input amplifier:

- use only the cables supplied with the sensor;

- avoid interruptions in the cables. If necessary use only special blocks at a very high insulation and protection from moisture;

- keep the cell cable far from the power cables also inside the switch board.

5.6.2 CONNECTION OF THE TEMPERATURE SENSOR

To get the display of the temperature value and the automatic compensation of the effect of temperature on the conductivity measurement is necessary to connect the temperature sensor Pt100 RTD as shown in chapter "Installation drawings (page 46)", 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 wire of the Pt100 to terminal 14 and the other common wire to terminal 15 (use two separate wires).

⚠ Do not interrupt the connection cable.

Use extension cable through high isolation junction box;

Keep the cable away from the power cables.

5.6.3 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 3 terminal.
- Connect the return of the loop (-) to the 2 terminal.

If the analog signal must drive more devices, they must be connected in "series" with each other, respecting the maximum value of resistance as a function of the supply voltage.

5.6.4 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.

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

5.6.5 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 31)".

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

5.7 DISPOSAL

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

6 OPERATING PROCEDURE

6.1 OPERATING PRINCIPLE

The measurement method of oxidizing substances dissolved in the water used in this instrument is based on two types of sensors:

1 two or three electrodes immersed in an electrolyte separated from the sample by a membrane selective for the species to be measured;

2 three-electrode amperometric cell, commonly called "potentiostatic sensor".

In the two electrodes cell is applied a suitable bias voltage to the two metal electrodes (anode and cathode) through which flows the electric current proportional to the concentration of the oxidizers present in the solution.

In the three electrodes cell is applied a suitable bias voltage to the two metal electrodes (anode and the counter electrode) in contact with the sample, through which flows the electric current proportional to the concentration of the oxidizers present in the solution.

A reference electrode is used to compensate the internal electrical resistance and the oxidation-reduction potential that occur on the measuring.

The main advantages of the potentiostatic measuring technique are the following:

- a steady and accurate relationship between cell current and concentration of the dissolved oxidizers, especially to very low values;
- the measured value in water without the presence of oxidizers is practically equal to zero;
- the frequency of the instrument calibration in the field is considerably reduced.

In both types of sensor the flow of current makes a chemical reaction of a part of oxidizers, which must be renewed by means of a constant flow of the sample in order to maintain a correct value of the measure.

The constant flow of the sample is obtained by means of special overflow cell whose use is recommended.

In both cases, you can make corrections (zero and sensitivity) to compensate for changes in sensor response due to the conditions of use and pH values, in some cases.

The temperature influences the activity of the ionic solution and with it the signal provided by the sensor. For this reason it is necessary to use the temperature compensation in applications where the temperature of the liquid is significantly different from the reference value of 20 °C.

The user needs to evaluate the installation of a Pt100 in order to perform the automatic compensation in case of significant temperature fluctuations.

6.2 DISPLAY

6.3 KEYS

KEY	FUNCTION
ZERO MODE	Key MODE/ZERO - Visualize 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
v	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) - Access to the secondary menu and parameters

6.4 INSTRUCTION FOR THE USER

6.4.1 CONCENTRATION MEASURING

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

If the values are below/above the limits of reading will be shown respectively the messages -<<<< and >>>> followed by measuring unit.

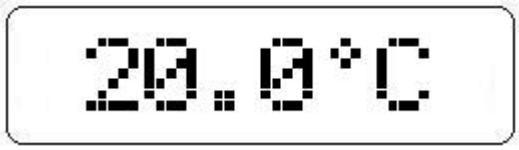
Approaching the limits of measurement will be displayed alternately the reading and the value of the output current.

From 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 to visualize the output current value.

6.4.2 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.



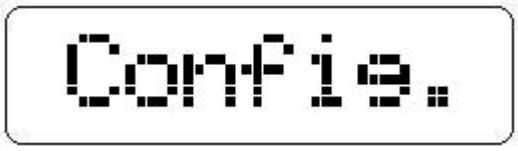
From this display the user can access the calibration procedure of the temperature probe if this has not been reserved to the maintainer.

6.4.3 PARAMETERS RESERVED TO THE PLANT MAINTAINER

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

6.4.4 PARAMETERS RESERVED TO THE PLANT ENGINEER

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



6.4.5 INFORMATION DISPLAY

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

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

MODE to access to the main measurement display.

6.5 MAINTENANCE INSTRUCTION

6.5.1 PRELIMINARY OPERATIONS

Any checking operation must be done with the measuring cell 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 28)".

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.

6.5.2 MAKING MEASUREMENTS

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

- the measuring 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 17)", the system will operate on a regular basis and require only the calibration.

6.5.3 CONCENTRATION CALIBRATION

Install the measuring cell and connect it to the instrument.

On the main measurement can be performed the zero calibration and the sensor's sensitivity calibration.

All the calibration operations must be done after a proper time to permit the polarization of the sensor as described on the sensor's instruction manual.

> *The newly installed chlorine sensors require a few hours of operation before providing a proper measure.*
>
> *During the initial phase of operation the instrument will provide a higher reading than the actual one.*
>
> *It is recommended to keep the sensor polarized in water without chlorine for a few hours before proceeding with the calibration which in any case must be refined after a few days of work.*

If the reservoir of the membrane sensor is empty, it must be filled with the electrolyte provided with the sensor.

Refer to the sensor instructions.

The calibration of the meter in case of temperature compensation requires special precautions:

- set the manual temperature value in the setup menu;
- set the correct value of temperature coefficient in the set up menu;
- install the temperature sensor in case of automatic compensation;
- wait until the sensor has reached a state of thermal equilibrium with the solution itself. This state of equilibrium can be considered achieved when the display marks stable values.

Zero calibration

If necessary the zero calibration is done as follows:

- send a sample to the measuring cell without chlorine or/and other oxidants content and observe the progressive approximation of the extent to values close to zero;
- when the reading is stable you can proceed with the zero calibration procedure described below.

> *Membrane polarographic sensors, never installed or following the replacement of the membrane and/or the electrolyte, can employ long times to reach the stabilization to a minimum value because the electrodes immersed in the electrolyte of the sensor should complete the polarization process.*
>
> *The potentiostatic sensors are faster in response and the zero calibration can be performed with the dry sensor in air.*

MODE (ZERO)	by pressing this button for more than 3 seconds, the message **Zero Cal** appears alternately to the actual value or **Cal lock** if the calibration was inhibited in the setup (Display S1.1).
UP/DOWN	to modify the value.
ENT	to confirm the new value.

If the zero value is outside the acceptable limits described in the technical specifications, the display will show the error message **Zero err**.
The message **Update** indicates that the calibration has been stored.

ENT	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.

Sensitivity calibration

The calibration of the sensor sensitivity can be made only knowing the real value of sample concentration.
Normally the sample concentration is previously measured with a field photometric instrument suitable for the measurement of the sample.
You must select the photometer able to perform the measurement of the sample at the desired scale and with adequate precision.
It' s also important to perform at higher values of sensitivity calibration possible in order to obtain a good precision of the measurement of all the chosen scale.
If it were possible it is not preferable to make the zero calibration (one point calibration).

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

UP/DOWN	to modify the value.
ENT	to confirm the new value.
MODE	to return to the main display without modifying the value.

If the new value exceeds the limits of acceptability shown in the technical specifications of the instrument, the error **Sens err** will appear.
The message **Update** indicates that the calibration has been stored.

ENT	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 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.

One point calibration

In some cases it may be considered sufficient only to calibrate one point. In this case you will have to perform the zero calibration if the process provides measures to close to zero and you will have to calibrate the sensitivity if the process provides the measures to values not less than 10% of full scale.

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, the instrument controls zero deviations of more than +/- 20 % of full scale and minor deviations of the sensor sensitivity of 12.5% or greater than 250% of full scale.

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

6.5.4 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 (ZERO)	press the key 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.

UP/DOWN	to modify the values.

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

UP/DOWN	to modify 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 stored.

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 Zero** and **Last cal** will appear for a few seconds.*

6.5.5 SETUP

MODE	press the key two times from 1.0 display to get the message Set-up (display 50.0).
ENT	to scroll through the setup functions.
UP/DOWN	to change the value or the option visualized on the display.
ENT	to confirm the changings; the message Update will appear.
MODE	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	RT large	Response time of the large filter software	1 ÷ 20 s
S1.3	RT small	Response time of the small filter software	1 ÷ 20 s

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

If the password is incorrect, the message "WRONG PW" will appear for 2 seconds and you can view the parameters but not modify them.

6.5.6 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.

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 and 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.

6.5.7 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 sensor 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.

In case of no use for long periods, store the potentiostatic sensor with the protective cap containing a storage liquid, or tap water.

Do not use distilled water.

Store membrane sensors referring to the sensor's instruction manual.

6.6 INSTALLATION INSTRUCTION

6.6.1 SAFETY REQUIREMENTS

⚠ After performing the installation (chapter "Installation (page 17)"), 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.

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

6.6.2 CONFIGURATION

MODE	press the key three times from 1.0 display to get the message Config. (display 60.0).
ENT	to scroll through the configuration parameters.
UP/DOWN	to change the value or the option visualized on the display.
ENT	to confirm the changings; the message Update will appear.
MODE	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	Current	Current from the sensor	LO/HI
C1.2	Polariz.	Polarization	-1000/1000 mV
C1.3	Measure	Measuring unit	ppm - mg/l
C1.4	Scale	Measuring scale	2.000 - 20.00 - 200.0
C5.1	Loop	Current loop enable/disable	enable disable
C5.2	Scalable	Scale factor	10/100 %
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

If the password is incorrect, the message "WRONG PW" will appear for 2 seconds and you can view the parameters but not modify them.

6.7 OPERATING MODES

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

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

6.8 ANALOG MODE

In analogue mode the transmitter provides a 4-20 mA output current loop isolated from the sample for direct connection to a PLC or to a data logger.

The 4-20 mA output can be set within 10 to 100 % of the measuring scale.

The transmitter can be connected to a PLC or instruments BC 7335 - BC 7635 - BC 7687 - BC 6587 B&C Electronics, which allow the visualization of the measure and have two set point on/off and an alarm window.

The transmitter is supplied with the factory configuration in analogue mode (loop = enable).

When switched on the transmitter will provide for 8 seconds a current value that allow the operator to identify the scale of measurement selected in the configuration:

- 11 mA for 2.000 ppm / mg/l scale;
- 12 mA for 20.00 ppm / mg/l scale;
- 13 mA for 200.0 ppm / mg/l scale.

6.9 DIGITAL OPERATION

In digital mode the transmitter is a slave device that interacts with a master device.

The communication takes place via the RS485 connection with the B&C protocol (ASCII) and Modbus RTU (function 03) protocol described in the following chapters.

In this mode measurements are transmitted and calibration and configuration are possible.

6.9.1 B&C ASCII COMMUNICATION PROTOCOL

Through the RS485 interface the probe can be connected to a PC for data management and calibration.

A RS485/RS232 or RS485/USB converter is required, using a simple terminal emulation program (example Hyperteminal).

The protocol adopted is similar to the protocol of the multiparameter probe with some variations.

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

Commands format

2 bytes of ID transmitter (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 to avoid communication conflicts.

⚠ If the transmitter is set to a different speed is not responding.

The available commands are listed in the following chapters.

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

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
--------------------------------------------------------------------------------
CL3436 CL/O3 TRANSMITTER Rev.fw:1.00  S/N:160589

00H  <cr>  Help menu
00A  <cr>  Acquisition
00Lx <cr>  Current loop:      0001             (0=disable 1=enable)
00Fx <cr>  Sensor current:    0001             (1=LO current 2=HI current)
00Px <cr>  Polarization:     -0200 mV          (-1000/1000 mV)
00Mx <cr>  Measure unit:      0001             (1=ppm 2=mg/l)
00Ox <cr>  Analog out 4/20mA: 0002             (1=2ppm 2=20ppm 3=200ppm)
00Xx <cr>  Scalable output %: 0100             (10-100% full scale)
00RLx<cr>  RT90% large signal 0002 s           (1-20s)
00RSx<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)
00Cx <cr>  TC                 2.00 %/°C        (0.00-4.00%/°C)
00Vx <cr>  Zero cal value:    0.00             (0.000-200.0)
00Tx <cr>  Sens cal value:   20.00             (0.000-200.0)
00Z  <cr>  Zero  calibration: OK        0.01uA (±20% I fs)  (00ZR reset zero)
00S  <cr>  Sens. calibration: not done  100.0% (12.5-250%)  (00SR reset sens)
00Dx <cr>  Last cal date:     00/00/00         (max 8 characters)
00Ix <cr>  ID B&C:     Actual 0009 Config 0009 (01-32)
00Ex <cr>  ID modbus:  Actual 0009 Config 0009 (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
Query commands: 00H?,00Z?,00S?,00J?
--------------------------------------------------------------------------------
```

PARAMETERS QUERY

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

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

By sending the command **H?** displays a record containing the code and the identifier followed by all parameters including the results of calibrations.

The record transmitted uses the "," as separator.

Record format:

```
CL3436- 02,FW:1.00,SN:123456,L:0001,F:0001,P:-0200,M:0001,0:0002,X:010
....+....|....+....|....+....|....+....|....+....|....+....|....+....|....+....|
0,RL:0040,RS:0120,W:0001,J:not done     0.0°C  ,N: 20.0 °C  ,C:2.00,V:
....+....|....+....|....+....|....+....|....+....|....+....|....+....|....+....|
0.020,T:200.0,Z:not done ±  0.00uA  ,S:not done   100.0%   ,D:
....+....|....+....|....+....|....+....|....+....|....+....|....+....|....+....|
,I A:0002,IC:0002,EA:0002,EC:0002,BA:0003,BC:0003,BCC:4BB8,xx
....+....|....+....|....+....|....+....|....+....|....+....|....+....|....+....|
```

CL3436	Transmitter code
02	Transmitter identification number (for ID < 10 visualization with blank/ zero as first character according to the mode used in setting the ID)

Below are transmitted parameter values measured by the transmitter with the format NAME PARAMETER: VALUE.

FW:1.00	Firmware version
SN:123456	Transmitter serial number
L:0001	Current loop enable
F:0001	Sensor current
P:-0200	Polarization
M:0001	Measuring unit
O:0001	Analog output/scale setting
X:0100	Scalable output
RL:0040	Large software filter value
RS:0120	Small software vilter value
W:0001	Temperature measuring unit
J:not done	Temperature calibration outcome (not done, ok, error)
N:20.0 °C	Manual temperature
V:0.000	Zero calibration solution value
T:400.0	Sensitivity calibration solution value
Z:not done	Zero calibration outcome (not done, ok, error)
S:not done	Senstivity calibration outcome (not done, ok, error)
D:	Last calibration date
IA:0002	ID current B&C protocol
IC:0002	ID configurated B&C protocol
EA:0002	ID current Modbus protocol
EC:0002	ID configurated Modbus protocol
BA:0003	Current baud rate
BC:0003	Configurated baud rate
BCC:4BB8	BCC EEPROM check
xx	2 byte BCC of transmitted record

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

EEPROM BCC check use

The EEPROM BCC check is a summary of the transmitter configuration state, the value of the BCC, once set the parameters and carried out the calibration, remains constant until the next change of parameters or calibration. A variation of the BCC value without any change occurred means that an alteration has taken place in transmitter's configuration data.

BCC calculation

The BCC messages sent by the transmitter is calculated as the XOR of all the bytes making up the message (excluding <cr> and <lf>) and divided into 2 nibble.

The two nibbles are then transformed into their ASCII codes.

The BCC transmitted at the end of record is used to check the validity of records received.

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

```
CL3436- 10 0.0 01/01/01 00:00:00 ± 20.00ppm  ±  20.0°C   ±  2.00%/°C ±
....+....|....+....|....+....|....+....|....+....|....+....|....+....|....+....|
     0stat 18/11/10xx
```

CL3436	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 unit with the following format:

Measuring	- Sign of measure (if positive is sent a blank) - Value of measure (6 characters - right alignment)
Measuring unit	- 4 characters - left alignment - 1 blank (ASCII 32)
± 20.00 ppm	Measured value
± 20.0 °C	Temperature
± 2.20 %/°C	Temperature coefficient
± 0stat	State of the logic input (0 = open; 1 = close)

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 calibration
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.

CURRENT LOOP

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

Example: if ID=14 and you want to enable the current loop type 14L0 <cr> or 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

SENSOR CURRENT

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

Example: if ID=14 and the nominal current is 160 nA/ppm (low current) type 14F1 <cr> or 00F1 <cr>

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

The current of the sensor can be set with the following values:

x=1 LO current (160 mA/ppm)

x=2 HI current (2000 nA/ppm)

POLARIZATION VOLTAGE

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

Example: if ID=14 and the polarization voltage is -200 mV type 14P-200 <cr> or 00P-200 <cr>

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

The polarization voltage to use will depend by the sensor type and the application.

MEASURING UNIT

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

Example: if ID=14 and the measuring unit in ppm type 14M1 <cr> or 00M1 <cr>

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

The measuring unit can be set with the following values:

x=1 ppm

x=2 mg/l

ANALOG OUTPUT

Command format: **ID + O + x <cr>**
Example: if ID=14 and analog out = 200.0 ppm type 14O3 <cr> or 00O3 <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 three following scales.
x=1 for 2.000 ppm / mg/l scale
x=2 for 20.00 ppm / mg/l scale
x=3 for 200.0 ppm / mg/l scale

SCALE FACTOR

Command format: **ID + X + x <cr>**
Example: if ID=14 and the scale factor is 50 % type 14X50 <cr> or 00X50 <cr>

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

To verify the receiving of the value type **ID + H**.
Examples of scales factors selection:

Scale factor	full scale
100 %	2/20/200 ppm
50 %	1/10/100 ppm
25 %	0,5/5/50 ppm
10 %	0.2/2/20 ppm

LARGE FILTER

Formato comando: **ID + RL + x <cr>**
Esempio: if ID=14 and the response time is 5 seconds type 14RL5 <cr> or 00RL5 <cr>

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

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

SMALL FILTER

Formato comando: **ID + RS + x <cr>**
Esempio: if ID=14 and the response time is 5 seconds type 14RS5 <cr> oppure 00RS5 <cr>

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

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

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=1 measuring unit °C

x=2 measuring unit °F

TEMPERATURE CALIBRATION

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

Example: if ID=14 and the temperature value 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**.

TEMPERATURE CALIBRATION 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".

TEMPERATURE CALIBRATION TEST

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

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

Response of the unit:	**<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      ±   0.2°C
....+....|....+....|....+....|....+....|....+....|....+....|....+....|....+....|
```

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

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 **ID + H**.

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 **ID + H**.

ZERO CALIBRATION SOLUTION VALUE

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

Example: if ID=14 and the standard solution value is 0.12 ppm type 14V0.12 <cr> or 00V0.12 <cr>

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

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

SENSITIVITY CALIBRATION SOLUTION VALUE

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

Example: if ID=14 and the standard solution value is 18.12 ppm type 14T118.12 <cr> or 00T18.12 <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 **ID + H**.

ZERO CALIBRATION

The zero calibration must be done in a solution without oxidizers or in a known solution.

The value of the zero solution must be inserted into the instrument through the command "Zero cal value".

The zero calibration is carried out in the scale selected and the same offset will be applied to the other scales within the accepted limits.

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 unit:	none	command failed

To verify the results of the zero calibration use the **ID + A**.

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 sensor is perfectly clean.

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

ZERO CALIBRATION 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 unit:	none	command failed

This command allows you to restore the zero value to the default values.

Verify the outcome of the operation with the **ID + H** and check the line "Zero calibration: not done".

ZERO CALIBRATION TEST

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

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

Response of the unit:	**<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       ±  0.12uA
....+....|....+....|....+....|....+....|....+....|....+....|....+....|....+....|
```

Possible results: ok / not done / error.

SENSITIVITY CALIBRATION

The sensitivity calibration is done in a known solution.

The value of the solution should be inserted through the commands "Set standard solution" and "Set stardard measure unit".

The calibration is performed on the selected scale and the new sensitivity value will also be applied to the other scales.

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

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 + H** the user controls line: "Sens calibration: OK/error".

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

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**.

SENSITIVITY CALIBRATION 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".

SENSITIVITY CALIBRATION TEST

Formato comando: **ID + S? <cr>**
Esempio: se ID=14 digitare 14S? <cr> oppure 00S? <cr>

Response of the unit:	**<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       ± 100.0%
....+....|....+....|....+....|....+....|....+....|....+....|....+....|....+....|
```

Possible results: ok / not done / error.

LAST CALIBRATION DATE

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.

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
Response of the unit:	none	command failed

The transmitter activates the new ID to the next power.

ID OF THE MODBUS PROTOCOL

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

Example: if ID=14 and the new ID (identification) to enter is 07 type 14E07 <cr> or 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.

BAUD 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.

Set the parameter:

x=1 for 2400 baud

x=2 for 4800 baud

x=3 for 9600 baud

x=4 for 19200 baud

6.9.2 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

Coding system	8-bit binary
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).

MODBUS FUNCTION 03

Function 03 (MASTER QUERY)

Address	1 byte	01 ÷ 243 (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 ÷ 243 (ID transmitter)
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.
If an error occurs in the request the response takes the following form:

Address	1 byte	01 ÷ 243 (ID transmitter)
Function	1 byte	0x83 (read holding register + error)
Error	1 byte	2 = illegal data address
Error verification	2 bytes	CRC-16

DATA THROUGH MODBUS FUNCTION 03

	Modbus address	Parameter	Range	Unit	Scale
1	0x0000	Measured value	0 ÷ 2000	a	a
2	0x0001	Temperature °C	-100 ÷ 1100	0.1	-10.0 ÷ 110.0 °C
3	0x0002	Temperature °F	140 ÷ 2300	0.1	-14.0 ÷ 230.0 °F
4	0x0003	Measuring unit (ppm - mg/l)	1 ÷ 2	b	
5	0x0004	Scale	1 ÷ 3	b	
6	0x0005	Temp. coeff.	0 ÷ 400	0.01	0.01 ÷ 4.00 %/°C
7	0x0006	Dig. Input State	0 ÷ 1	b	
8	0x0007	BCC EEPROM	0 ÷ 65535	1	0 ÷ 65535

[a] = unit and scale depend on what is set in configuration (see 4 and 5)

[b] = see chapter "Configuration (page 30)"

Data format is integer signed (-32768/+32767).

1 register is 2 bytes.

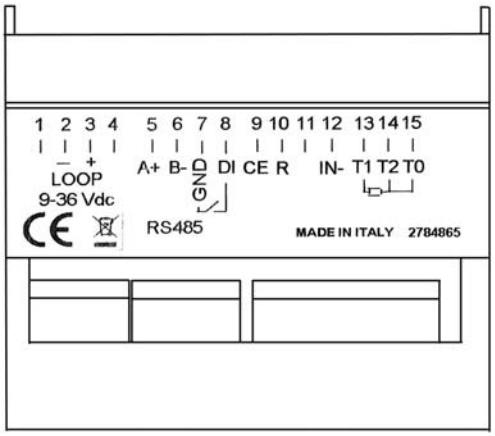
Use of BCC EEPROM

The EEPROM BCC check is the probe configuration state synthesis. After setting the parameters and carry out the calibration the value of the BCC remains constant until the next change of parameters or calibration.

A variation of BCC in the absence of changes warns that an alteration has taken place in the probe configuration data.

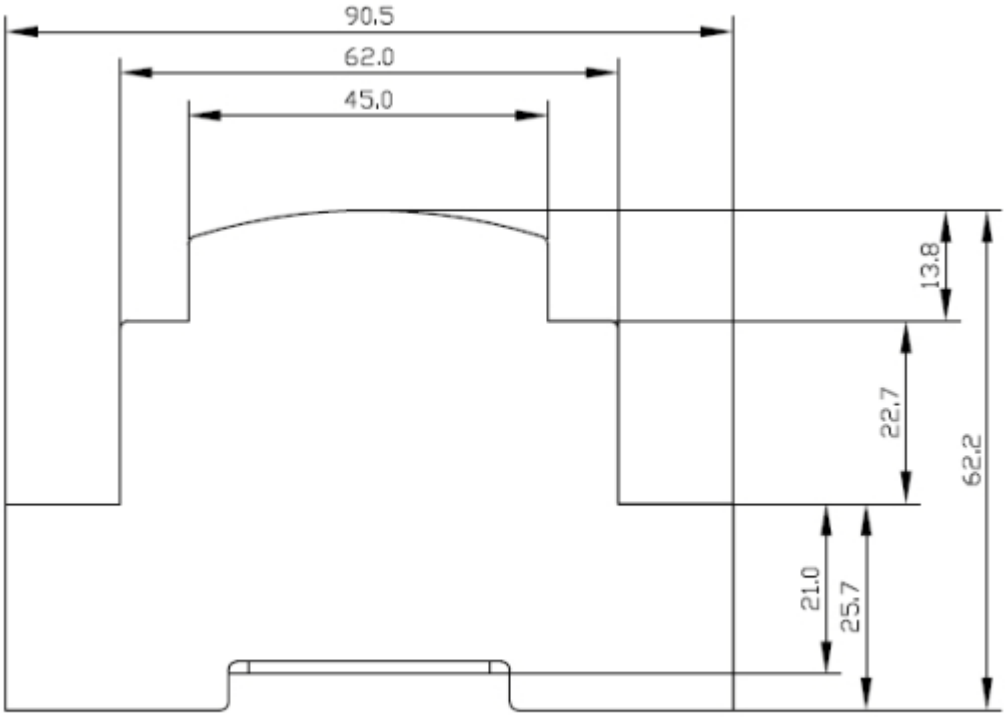
7 INSTALLATION DRAWINGS

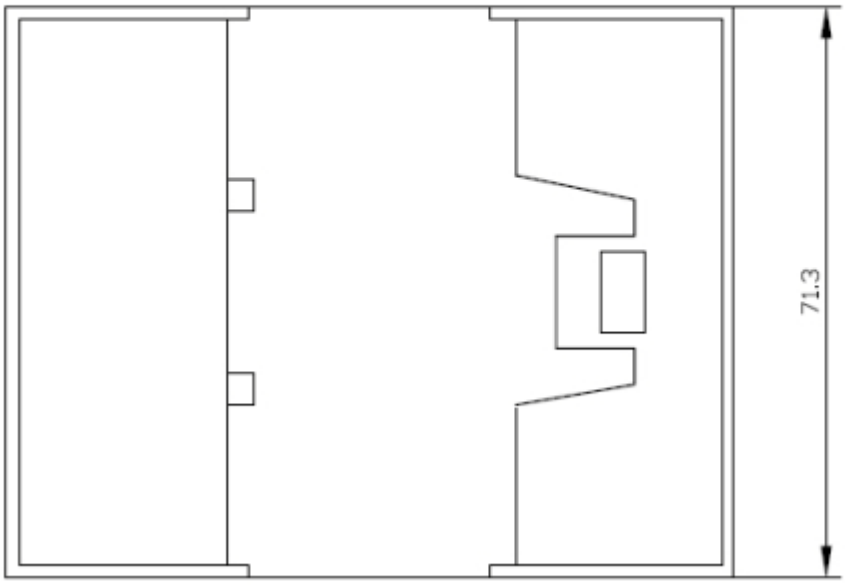
7.1 CONNECTIONS



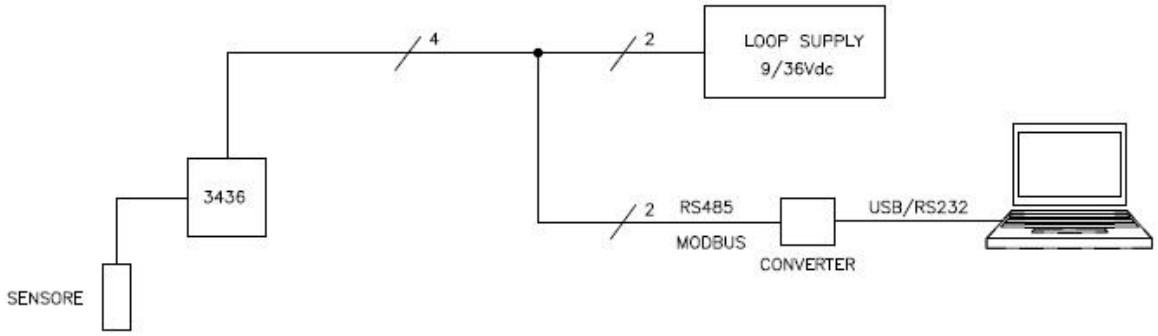
Terminal	Function
2	- Loop
3	+ Loop (9/36 Vdc)
5	RS485 A+
6	RS485 B-
7	RS485 Gnd
7	Digital input
8	Digital input
9	CE (jumper 9 - 10 for two electrodes cell)
10	R (jumper 9 - 10 for two electrodes cell)
11	nc
12	IN -
13	T1 (Pt100) (temperature sensor input)
14	T2 (common Pt100) (temperature sensor input)
15	T0 (common Pt100) (Gnd measure) (temperature sensor input)

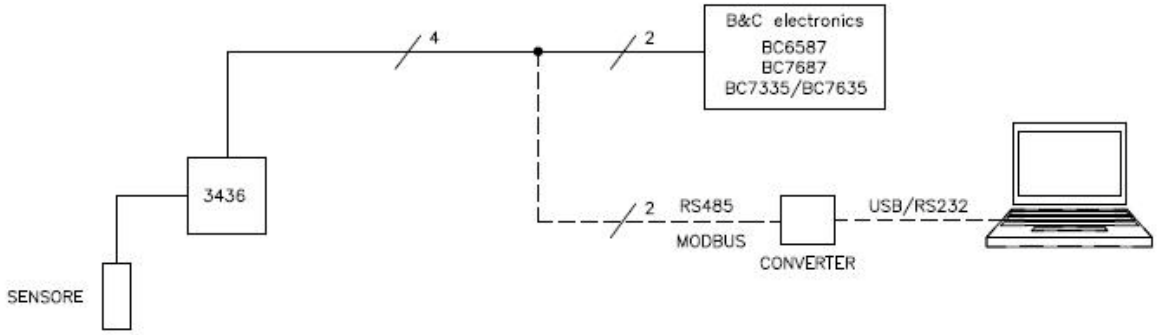
7.2 DIMENSIONS

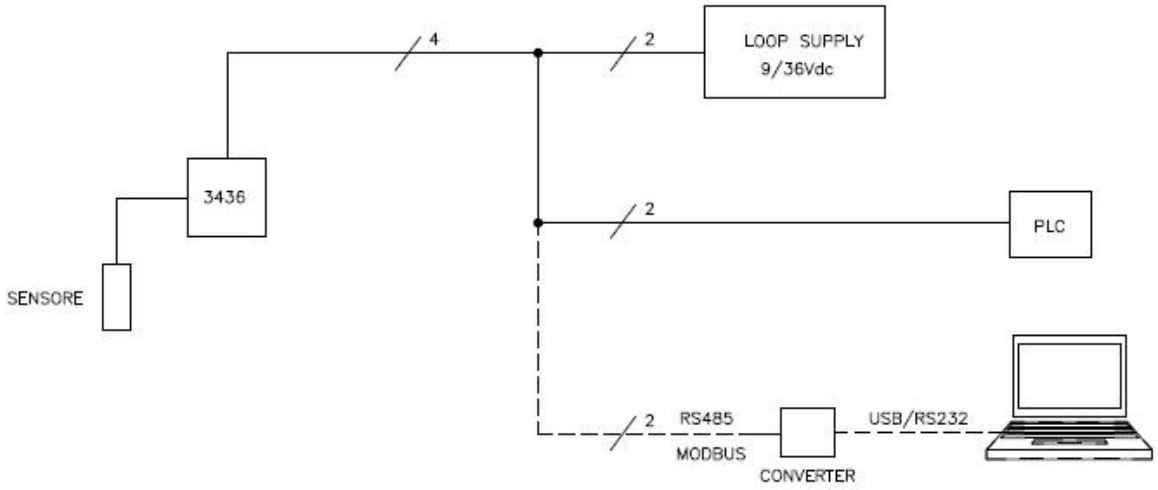




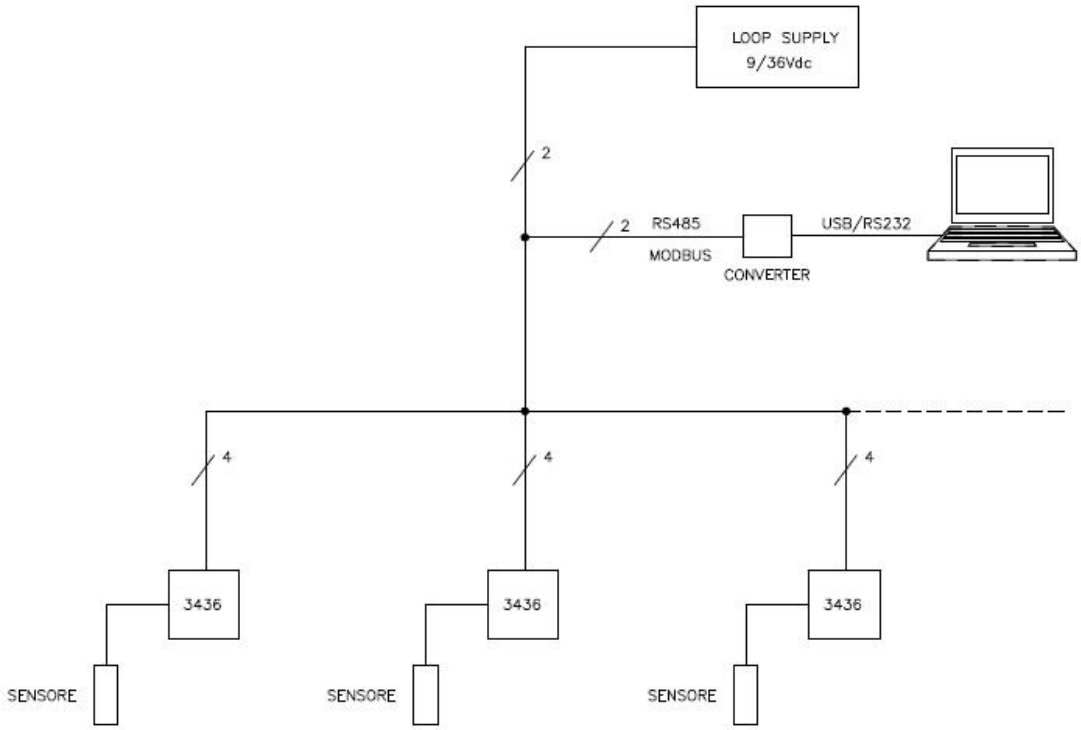
7.3 SINGLE INSTRUMENT CONNECTION

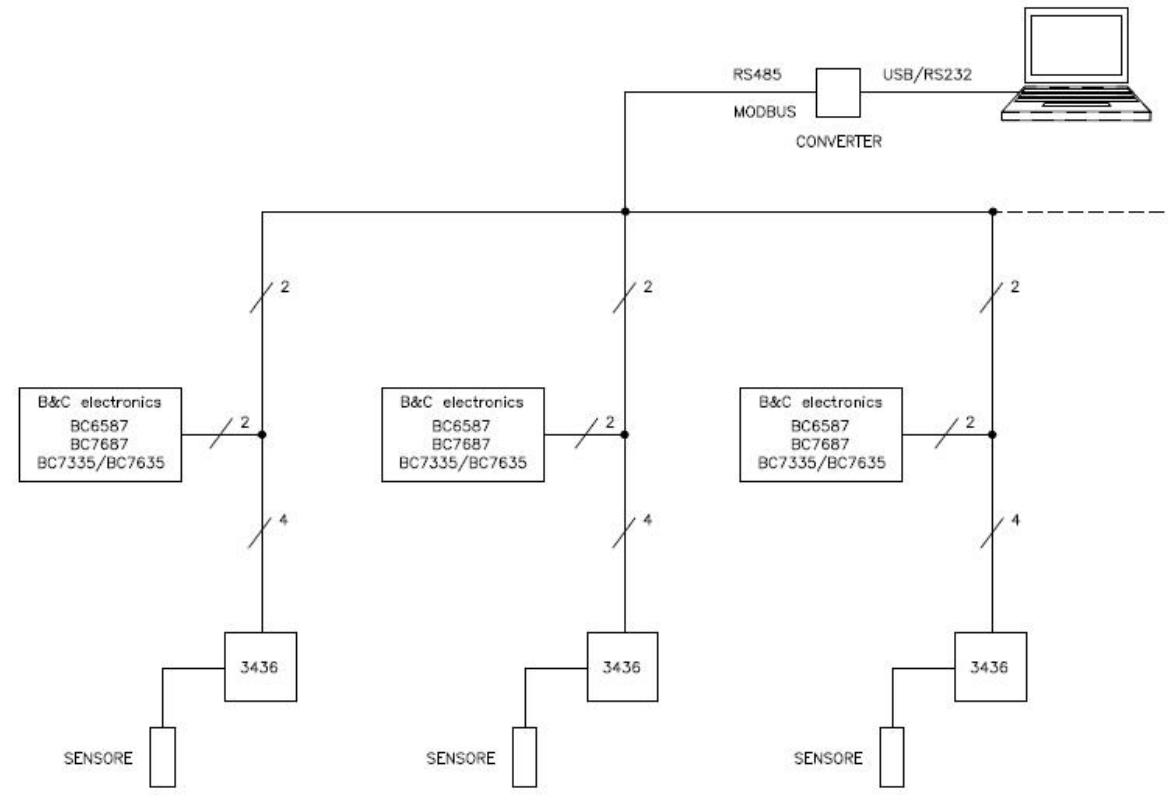






7.4 RS485 NETWORK CONNECTION





8 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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9 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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