UNI EN ISO 9001:2015
CERT. N. 9115 BCEL

INSTRUCTION MANUAL

C 7615 - C 7615.010

DIGITAL CONDUCTIVITY CONTROLLER

C 7615 scales:	0/19.99	0/199.9	0/1999 µS
C 7615.010 scales:	0/1.999	0/19.99	0/199.9 mS
	0/19.99	0/199.9	0/1999 µS
Power supply:	110/220 Vac		

Option _____

S/N _____

REP N° _____

Cod. 28003761 - Rev. C - 03/19 - Valid from S/N 32194

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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"
- 2014/35/EU "Low Voltage" LV
- 2014/30/EU "Electromagnetic compatibility" EMC

- EN 61010-1/2011 "Low Voltage" LV
- EN 61326-1/2013 "Electromagnetic compatibility" EMC
  - Controlled electromagnetic environment
- EN 55011/2009 "Radio-frequency disturbance characteristics"
  - Class A (devices for usage in all establishment other than domestic)
  - Group 1 (Industrial equipment that do not exceed 9kHz)

The marking CE 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 accidents. For this, it is important to take all necessary precautions to avoid damages caused by malfunctions.
All types of operations must be performed by authorized and trained staff.
The use of this controller must respect the parameters described in chapter “Technical specification”, so to avoid potential damages and a reduction of its operating life.

2 GENERAL

This manual applies to the C 7615 and C 7615.010 digital controllers 1/4 DIN housing.
It explains the purpose of the equipment, describes the components of the chain and the procedures for installing the equipment, operating it and calibrating it.
Some suggestions are also given for its maintenance.

3 PRINCIPLE OF OPERATION

The conductivity meter is used to detect specific conductivities of liquids and to control the salt content or the ionic concentrations of liquids.

In the case of low concentrations, all salts break into ions and the measurement of conductivity indicates the salt contents or ionic concentration. There is a linear dependence of the conductivity on the concentration or on the salt contents.

In the case of higher concentrations the linearity is disturbed by incomplete dissociation.
The concentration is achieved by the conductance curve.

The measuring of conductivity is done by measuring the electrical resistance between two electrodes completely surrounded by the liquid.

The electrodes must have definite dimensions and arranged locations.

During the measurement of conductivity the anions and the cations undertake the necessary transport of the current.

In order to prevent polarisation, measuring is done by alternating current. The temperature of the test solution may cause considerable error in this measurement, since, as a result of the rising temperature, the activity of the ions increases, while the contents of the ionic concentration remains constant.

A reference temperature of 20 °C was selected in order to compare various measurements.

4 PHYSICAL DESCRIPTION

The panel mounting instrument's enclosure is designed according to the DIN 43700 standards and it consists of a plastic case with metallic front panel coated with a polycarbonate membrane.

A transparent splashproof front door SZ 7601 can be added to the housing, in order to protect the unit from excessive moisture or corrosive fumes.
However a mounting in a splashproof board is suggested for field applications.
The connections to the unit are made by means of two extractable terminal blocks on the rear side of the instrument.
The package is supplied complete with fixing clamps for panel mounting.

The Fig. 3 shows the physical details, dimensions and drill plan of this case.

5 SPECIFICATIONS

Input:	from conductivity cell and RTD Pt100
C7615 scales:	0/19.99 0/199.9 0/1999 µS
C7615.010 scales:	0/1.999 0/19.99 0/199.9 mS (default)
	0/19.99 0/199.9 0/1999 µS (to be selected by internal switches)
Zero:	adjustment +/- 15%
Slope:	adjustment +/- 20%
Adjustment K:	from 0 to 2
Frequency:	2 KHz
Output:	0/20 mA dc, non isolated, 300 Ω max.
	others on request
Relay contacts:	5 A 220 V resistive load
Regulator hysteresis:	+/- 0.25 % others on request
Switching Time:	< 0.5 s
Temperature:	0/50 °C
Humidity:	95 % without condensate
Voltage:	110/220 Vac +/-10 % 50/60 Hz
Power:	3 VA max
Fuse:	80 mA T internal
Weight:	500 g
Size:	96 x 96 x 154 mm (1/4 DIN housing)

Option 091.311:	output 4/20 mA
Option 091.362:	isolated output
Option 091.203:	0/5 seconds delay and relays action inversion
Option 091.131:	scales 0/1.999 0/19.99 0/199.9 mS
Option 091.532:	automatic temperature compensation with RTD Pt100 for a temperature coefficient 2 % / °C

The model C7615.010 includes 091.203 - 091.131 - 091.532 options as standard

6 DESCRIPTION

A basic conductivity monitoring system consists of two elements: a monitor unit and a conductivity cell.

The instrument provides the measurement of electrical conductivity in industrial plants. In just this one instrument there are all the conductivity ranges necessary to undertake measurements in ultra-pure waters and in solutions with a very high ionic content.

The controller provides two optional features, automatic temperature compensation by means of a RTD Pt100 and scales up to 200 mS.

The system can be expanded by adding accessories for field applications, recorders, secondary regulators, proportional regulators, special temperature probes to suit particular applications.
The instruments contain electronic circuits to control all the operations performed by the system.
These electronic circuits will also action alarms, electric valves and pumps activated directly by the regulator's output relay or by auxiliary remote controls.

The controller provides a digital readout on a 3 1/2 digit display that allows reading even at long distances.

The controller features two on-off regulators A and B.
The set-points are independent and programmed by a front-panel control to trigger at any level within the range of the meter.
A red Led 6's on the panel indicate if the measured value is below the set point A level, or if it is above the set point B level.
A red Led 6's also indicate the switching of corresponding relays.
The set point value is visualized by pushing button 5 on the front panel.

The instrument gives a 0/20 mA output signal (4/20 mA, in volts on request), proportional to the measurement.
The options "isolated output" and "relays" delayed and inverted action" are available on request.

The adjustment of the zero and of the sensitivity is done by means of trimmers mounted on the front panel.
Zero is adjusted by trimmer 3 and slope by trimmer 4.

7 PHYSICAL INSTALLATION

The controller may be installed close to the points being monitored, or it may be located some distance away in a control area.

The enclosure is designed for panel-mounting. It should be mounted on a rigid surface, in a position protected from the possibility of damage or excessive moisture or corrosive fumes.

The conductivity cell must be mounted properly if the system is to operate accurately and efficiently.

It must meet the following requirements:

- the sample in the cell must be representative of the whole solution;
- the solution must circulate continuously through the cell:
- the flow velocity in the cell must not be so high as to cause cavitation;
- the position and orientation of the cell must not trap air-bubbles near the electrode area;
- sediments must not accumulate within the electrode area;
- in all dip cell installations the water must be continuously agitated.

Keep the cable away from power wires on the overall length.

This cable too must not be interrupted on overall length. If interruption is necessary, the extension cable must be fastened to the high insulation terminal strip.

8 ELECTRICAL INSTALLATION

The electrical installation consists of:

- connecting the power supply
- connecting the cell
- connecting alarms, pumps, valves
- connecting the monitor output to the recorder
- connecting other optional devices, RTD Pt100, regulators

All connections within the controller are made on terminal strips located on the rear side.

All power and output-recorder connections are made at the 10 pin terminal strip, while input signal connections are made at the 8 pin terminal strip.

8.1 CONNECTING THE POWER

- connect ground to terminal 4
- connect ac power to 1-2 terminals if power voltage is 110 V
- connect ac power to 1-3 terminals if power voltage is 220 V

WARNINGS

- power the device by means of an isolation transformer;
- avoid mains voltage from an auto-transformer;
- avoid mains voltage from a branch point with heavy inductive loads;
- separate power supply wires from signal ones;
- control the mains voltage value.

8.2 CONNECTING THE CELL

Cell cabling is a critical part of the whole system.

- use a low noise coax cable on overall length between sensor and input terminals of the meter;
- avoid interruption on the cable. If interruption is necessary, the extension cable must be fastened to the high insulation terminal strip.
- keep the cable away from power wires on the overall length.

8.3 CELL CONNECTION TO C7615

- Connect the cell to the terminals 13-14 in order to select the range 0-19.99 µS;
- install a jumper between terminals 14-15 in order to select the range 0-199.9 µS;
- install a jumper between terminals 14-16 in order to select the range 0-1999 µS.

8.4 CELL CONNECTION TO C7615.010

- Connect the cell to the terminals 13-14 in order to select the range 0-1.999 mS;
- install a jumper between terminals 14-15 in order to select the range 0-19.99 mS;
- install a jumper between terminals 14-16 in order to select the range 0-199.9 mS.

8.5 DIP SWITCHES SELECTION

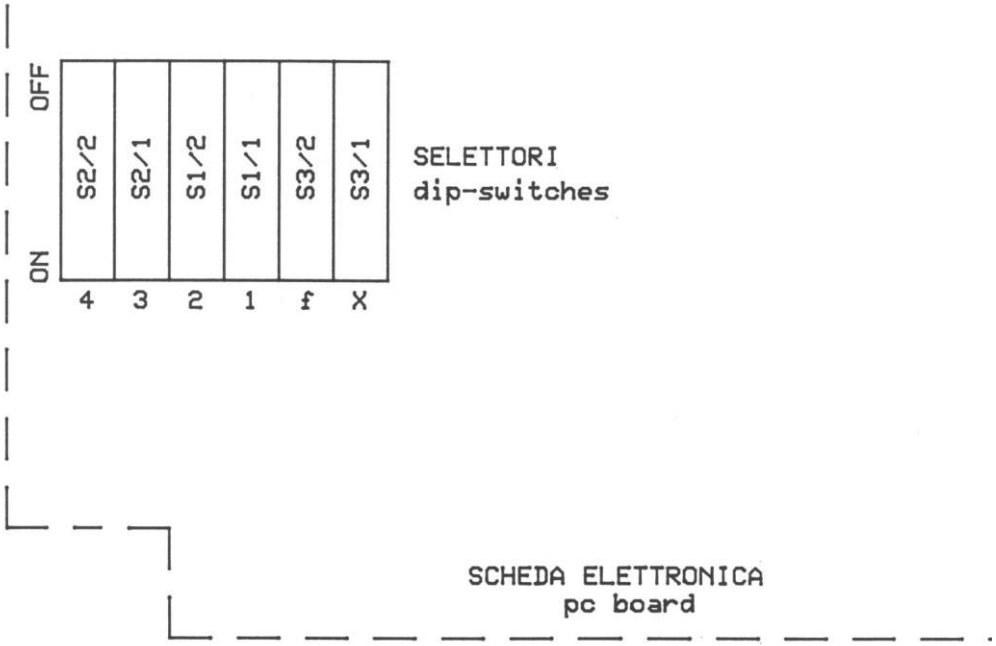
The dip-switches on the rear internal card allows the following set-up:

- the selection of the decimal point position on the display;
- the selection of the operating low/high Frequency;
- the selection of the alight Led µS/mS.

See the following table (Table 1) to set the suitable dip-switches.

DIP-SWITCHES SELECTION

Table 1



FUNZIONE DEI SELETTORI dip-switches function		
RIFERIMENTI reference	OFF	ON
S2/2	mS LED ACCESSO aligth	µS LED ACCESO aligth
S2/1	—	DECIMAL POINT XXX.X
S1/2	—	DECIMAL POINT XX.XX
S1/1	—	DECIMAL POINT X.XXX
S3/2	FREQUENCY = LOW	FREQUENCY = HIGH
S3/1	RANGE µS	RANGE mS

PRESELEZIONE DEI RANGE DI MISURA measuring range set up							
SCALE scales	PONTICELLO external jumper	SELETTORI INTERNI internal dip-switches					
	MORSETTI terminals	S2/2	S2/1	S1/2	S1/1	S3/2	S3/1
19.99 µS	—	ON	OFF	ON	OFF	OFF	OFF
199.9 µS	14 - 15	ON	ON	OFF	OFF	OFF	OFF
1999 µS	14 - 16	ON	OFF	OFF	OFF	OFF	OFF
1.999 mS	—	OFF	OFF	OFF	ON	ON	ON
19.99 mS	14 - 15	OFF	OFF	ON	OFF	ON	ON
199.9 mS	14 - 16	OFF	ON	OFF	OFF	ON	ON

8.6 CONNECTING ALARMS, PUMPS, VALVES

The output connections are made at terminal strip and they consist of two independent relay contacts corresponding to Regulator "A" and Regulator "B".

Regulator "A"

terminal 6 marked C : common contact
terminal 5 marked NO : normal open contact
terminal 7 marked NC : normal closed contact

Regulator "B"

terminal 9 marked C : common contact
terminal 8 marked NO : normal open contact
terminal 10 marked NC : normal closed contact

ATTENTION:

Install a fuse in order to protect the relay contacts.
The device must be powered by an external independent line following the above procedure.

The model C7615.010 is allowed to invert the min/max relays action by means of internal dip-switches on the card connected with terminals 1..10, and to insert a delay action 0/5 seconds by means of the 2 rear trimmers marked DEL A and DEL B.

8.7 CONNECTING A RECORDER

A current output for a remote recorder or P.I.D. regulators is available on terminals 11-12.

Connect the recorder high to terminal "12" and connect the recorder low to terminal "11".

Series connection is required for driving more loads having a total input resistance lower than 300 Ω.
Output drives ground-isolated loads only, unless the isolated output option is installed into the controller.

8.8 CONNECTING THE RTD PT100

When the option 091.532 is included, a 2%/°C automatic temperature compensation operation is available if a RTD Pt100 sensor is connected.

Before connecting RTD Pt100 between terminals 17-18 as per diagram (to put in the automatic temperature compensation), it's necessary to take away the resistance from the same terminals in order to avoid errors in measurement.
Reconnect this resistance when a non compensated operation is necessary.

8.9 CHECKING

Before connecting the system to the power supply:

- check that terminal 4 is connected to ground
- check that all connections are right
- check that all cables are properly fastened to prevent strain on the connections
- check that all terminal-strip connections are mechanically and electrically sound
- check that the fuse value is right

9 OPERATING THE SYSTEM

9.1 PRE-OPERATION CHECK

The system's controls and indicators are all located on the front panel (see Fig.1).

The meter has a digital display 1 that indicates that the unit is on.

Push button 5 and rotate, with a small screwdriver, the corresponding trimmer 7. The display will show the set point values.

The regulators have a set-point check shown by a red Leds 6's which are part of the circuitry that powers the relay.

When the monitored value is below the set-point value, the Led of Reg A is lit up and the corresponding relay is pulled in.

When the monitored value is above the set-point value, the Led of Reg B is lit up and the corresponding relay is pulled in.

Check the correct switching of the relays by rotating the set point control higher or lower than the value simulated, watching the Leds 6.

The cards of the controllers are adjusted at the factory.

If sensors and probes have been connected correctly, as described in the above sections, the system should function correctly needing only the zero calibration to compensate the cable conductivity.

WARNING:

Faults due to bad connections while connecting are not covered by warranty

9.2 ELECTRIC CALIBRATION

The following procedures can be used to verify that the system is operating satisfactorily, and it can be repeated periodically to check that the meter is remaining in calibration:

- connect a conductivity simulator to terminals 13-14 of the controller (14-15 or 14-16 according to the selected scale)
- simulate conductivity values over the entire scale of the meter
- adjust "zero" and "slope" by the trimmer 3 and 4 on the front panel

For the customer's convenience it follows the equivalence table between the Electric resistance (Ω) and the conductivity (Siemens) according to the relation:

$$\textbf{1 Siemens} = \frac{\textbf{1}}{\textbf{1 Ω}}$$

R Ω	1 MΩ	100 kΩ	10 kΩ	1 kΩ	100 Ω	10 Ω
C siemens	1 µS	10 µS	100 µS	1000 µS	10 mS	100 mS

9.3 ELECTRIC CALIBRATION OF THE OUTPUT

When the option 091.311 (4/20 mA output) is not included, it is possible to calibrate the output by means of the trimmers marked "Z" and "S" on the rear panel as follows:

- Connect a mAmeter to terminals 11-12
- Disconnect the probe. The display will indicate 000.0
- Adjust the trimmer "Z" in order to read 4 mA
- Connect a 10 KΩ resistance to the terminals 13-14 (jumper on 14-15) and adjust the trimmer "S" in order to read 12 mA

9.4 FREQUENCY SELECTION

Select the frequency high/low by means of the dip-switch S3/2 marked F on the card.
The dip-switches selection table (Table 1) suggests the Frequency depending of the measuring scales.

10 REGULAR OPERATION

To operate the system it's necessary to feed the meter and observe the measured conductivity of the solution on it.

Adjust the set-point control A and the set-point control B to the setting required for each particular application.

10.1 CELL CONSTANT ADAPTING

If the cell constant value is not exactly K = 1.00 (see the value marked on the cell) the meter must be calibrated in order to adapt the meter to the cell. The calibration is obtained by means of S.C.S. (Standard Conductivity Solution), adjusting the sensitivity trimmer 4 marked "sens".
If necessary adjust the coarse sensitivity trimmer on the rear, marked "K".

10.2 CHEMICAL CALIBRATION

When the cell constant is unknown or is to be checked, it is suggested the following calibration procedure by means of Standard Conductivity Solutions:

- prepare a standard KCl solution (see Table 2)
- operate the meter as for a not temperature compensated measuring
- immerse the cell into solution and adjust the fine sensitivity trimmer 3 or the coarse sensitivity trimmer on the rear
- the accuracy of the calibration depends on the purity of the water and the purity of the dissolved salt

STANDARD CONDUCTIVITY SOLUTIONS

Table 2

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	*

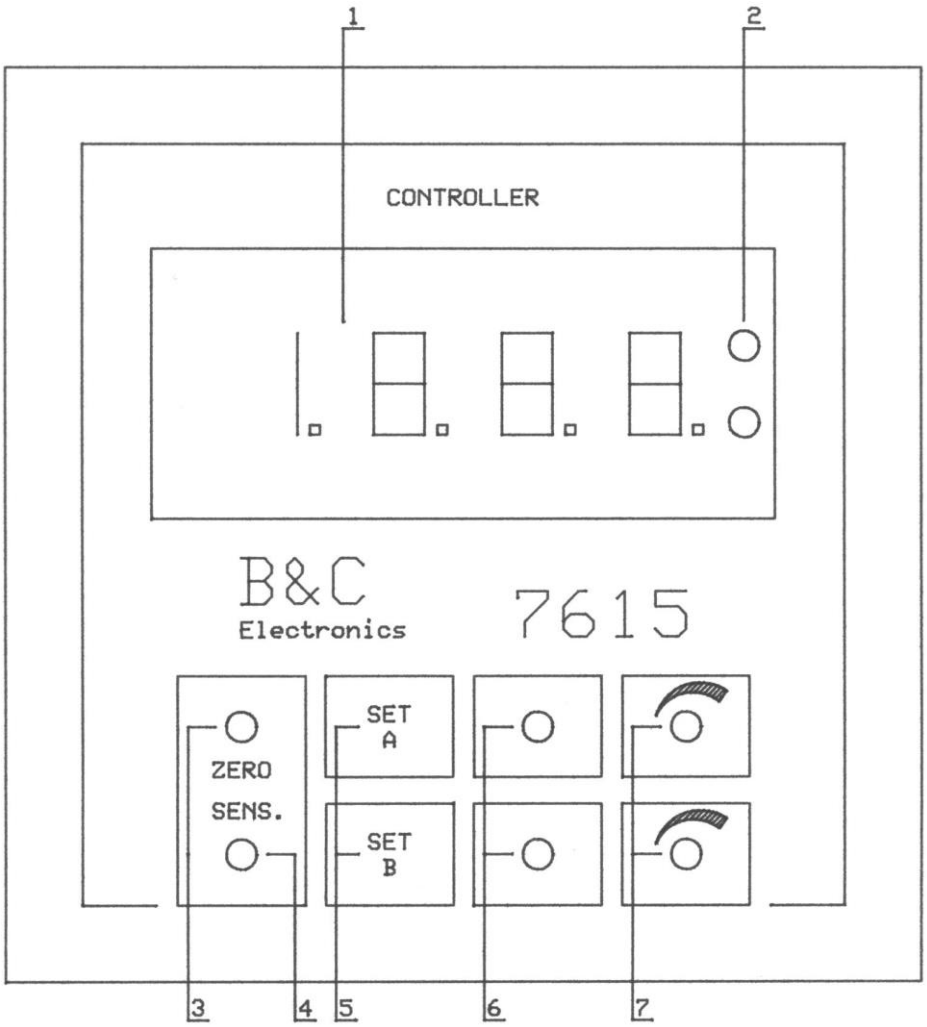
KCl normal solution:

prepared by dissolving 74.59 g of Research Grade Potassium Chloride in 1 liter of distilled water

Values in mS (millimhos/cm).

Low conductivity standard solutions are not steady.

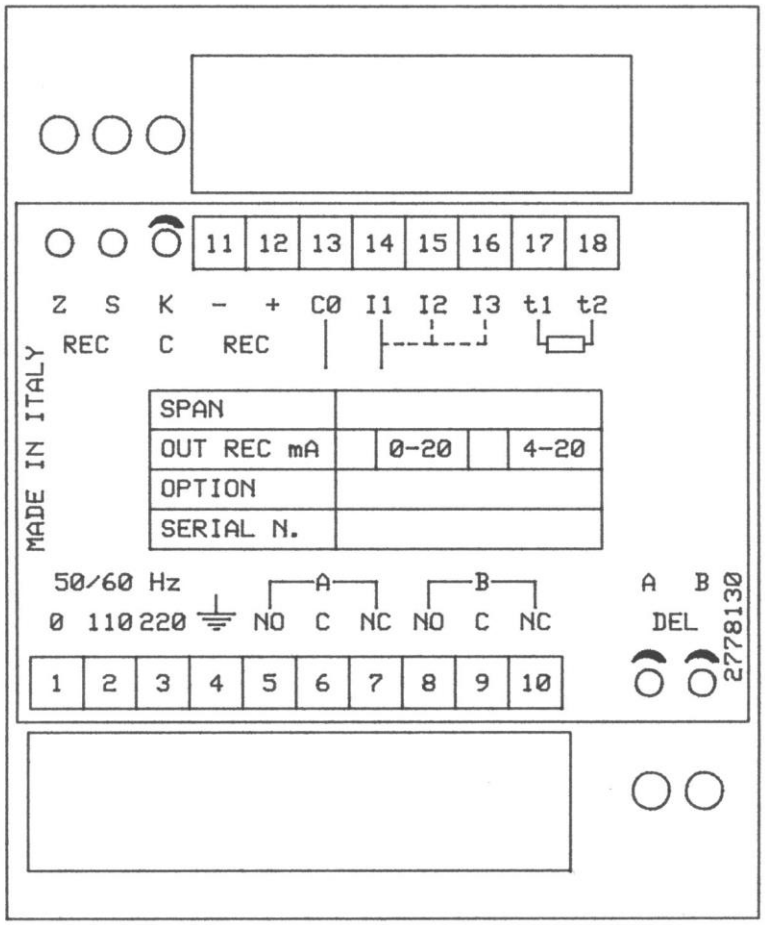
FRONT PANEL



1. Display
2. Scale selector indicator
3. Zero calibration
4. Slope calibration
5. Set point visualization
6. Switched relay light
7. Set point control

Fig. 1

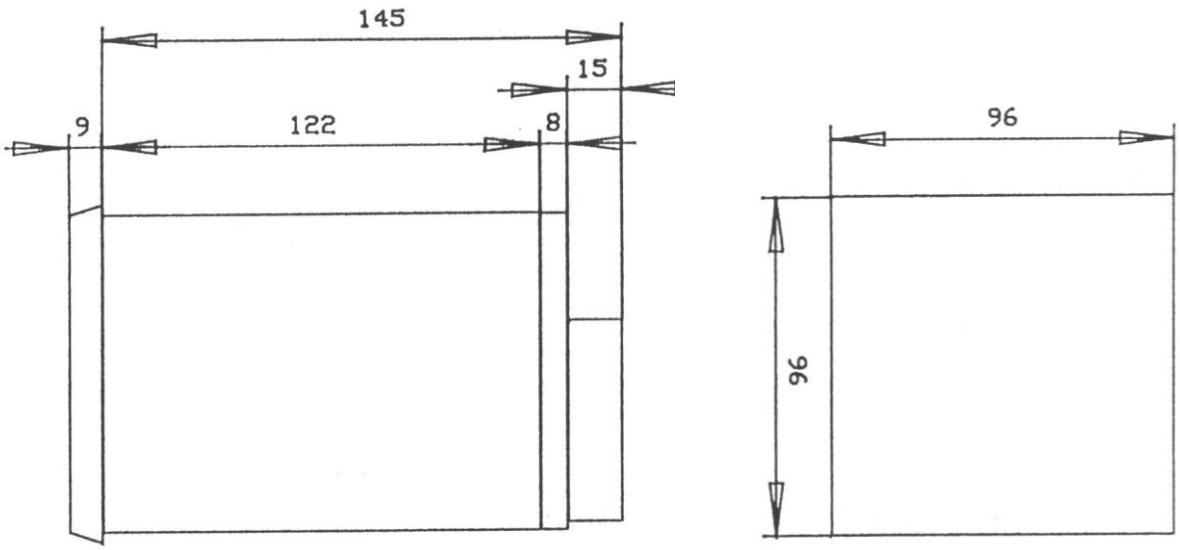
REAR PANEL CONNECTIONS



1. 2	110 V power supply
1. 3	220 V power supply
4.	Ground (power)
5. 6	A relay N.O contacts
6. 7	A relay N.C. contacts
8. 9	B relay N.O. contacts
9.10	B relay N.C. contacts
DEL A	Trimmer for delaying A relay
DEL B	Trimmer for delaying B relay
Z REC	Output Zero calibration
S REC	Output Sens. calibration
K C	Trimmer K cell
11.	Output for recorder (-)
12.	Output for recorder (+)
13. 14	Input cell X 1
14. 15	Jumper scale X 10
14. 16	Jumper scale X 100
17. 18	Input thermocompensation

Fig. 2

DIMENSIONS (measures in mm)



DRILL PLAN (measures in mm)

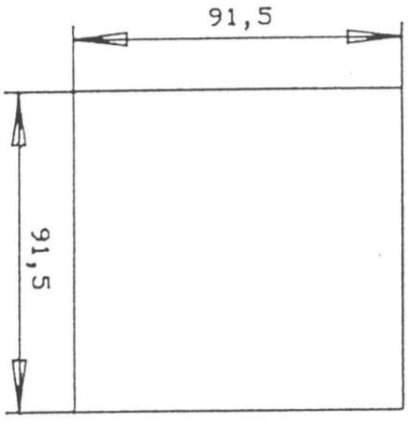


Fig. 3

WARRANTY CERTIFICATE

1) Your product is covered by B&C Electronics Warranty for 5 years from the date of shipment. In order for this Warranty to be valid, the Manufacturer must determine that the instrument failed due to defective materials or workmanship.

2) The Warranty is void if the product has been subject to misuse and abuse, or if the damage is caused by a faulty installation or maintenance.

3) The Warranty includes the repair of the instrument at no charge. All repairs will be completed at the Manufacturer's facilities in Carnate, Italy.

4) B&C Electronics assumes no liability for consequential damages of any kind, and the buyer by accepting this equipment will assume all liability for the consequences of its use by the Customer, his employees, or others.

REPAIRS

1) In order to efficiently solve your problem, we suggest You to ship the instrument along with the Technical Support's Data Sheet (following page) and a Repair Order.

2) The estimate, if requested by the Customer, is free of charge when it is followed by the Customer confirmation for repair. As opposite, if the Customer shall not decide to have the instrument repaired, he will be charged to cover labor and other expenses needed.

3) All instruments that need to be repaired must be shipped pre-paid to B&C Electronics. All other expenses that have not been previously discussed will be charged to Customer.

4) Our Sales Dept. will contact You to inform You about the estimate or to offer you an alternative, in particular when:
   - the repairing cost is too high compared to the cost of a new instrument,
   - the repairing results being technically impossible or unreliable

5) In order to quickly return the repaired instrument, unless differently required by the Customer, the shipment will be freight collect and through the Customer's usual forwarder.

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TECHNICAL SUPPORT

Data sheet

In case of damage, we suggest You to contact our Technical Support by email or phone. If it is necessary for the instrument to be repaired, we recommend to photocopy and fill out this data sheet to be sent along with the instrument, so to help us identifying the problem and therefore accelerate the repairing process.

□ *ESTIMATE* □ *REPAIR*

COMPANY NAME

ADDRESS ZIP CITY

REFER TO MR./MISS. PHONE

MODEL S/N DATE

Please check the operator's manual to better identify the area where the problem seems to be and please provide a brief description of the damage:

□ SENSOR
□ POWER SUPPLY
□ CALIBRATION
□ DISPLAY
□ ANALOG OUTPUT
□ SET POINT
□ RELAY CONTACTS
□ PERIODICAL MALFUNCTIONING

➢ *DESCRIPTION*

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