Instruction manual

OD 8325 - OD 8525

OPTICAL DISSOLVED OXYGEN PROBE
4-20 mA – RS485 – Modbus RTU

Scales
0 ÷ 20 ppm
0 ÷ 200 % sat

Option
S/N
REP N°

Power supply: 9 ÷ 36 Vdc
Installed firmware: R 3.0x

Valid also for models:
OD8625

OD 8325

OD 8525

Cod. 280168325 - Rev. C

INDEX

1 GENERAL WARNINGS AND INFORMATION FOR ALL USERS

1.1 WARRANTY

This product is guaranteed for 5 years from the date of purchase 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 and email 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"
- 2014/30/EU "Electromagnetic compatibility" EMC

- EN 61326-2-3/2013 "Electromagnetic compatibility" EMC
  - Industrial 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 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 must comply with the parameters described in chapter "Technical data (page 10)", in order to avoid potential damages and a reduction of its operating life.

1.5 SPECIAL WARNINGS

In order to ensure a reliable operation and to prevent irreversible damage, it is important to avoid all of the following:

- prolonged exposure to direct sunlight;
- cleaning too frequently and excessive air pressure;
- leaving the compressed air input device open if not used;
- screwing the cable gland or the probe body.

1.6 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. C	Modbus RTU function 06 and 16 ID+SN commands Bootloader function
Rev. B	New layout Scalable output Software filter Modbus protocol Addition of OD 8525 and OD 8625
Rev. A	Emission

2 PRODUCT OVERVIEW

2.1 FUNCTIONAL PURPOSE OF THE DEVICE

This unique submersible probe has been designed to measure dissolved oxygen based on fluorescent technology.

Applications

The main applications include the monitoring of water quality, the treatment of civil and industrial water and fish farming.

For use in salt water, contact the Sales Office of the B&C Electronics.

Models

OD 8325	for submersible applications, provided with an autoclean nozzle for external pressure air.
OD 8525	for in flow application into flow cell or in pipe.
OD 8625	for submersible applications, Body with 1.5" thread.

Probe composition

The measuring system consists of:

- optical device complete with a layer of fluorescent material;
- electronic circuit with an exciting beam and fluorescence detection;
- built-in 2-wire 4-20 mA transmitter;
- RS 485 output with B&C protocol for data transmission, calibration and configuration procedures.

The automatic temperature compensation is done internally by means of a built-in sensor.

The probe can operate in analog or digital mode (see chapter "Operating procedure (page 19)").

The OD 8325 probe is equipped with a device for automatic cleaning consisting of a conduit and by an injector which directs a jet of compressed air on the sensitive part, keeping it clean from incrustations and deposits of organic substances.

The probe can work connected as a slave to the MC 6587 and MC 7687 instruments that function as master.

2.2 ACCESSORIES

Sensors and accessories for different applications are available, to be ordered separately.
Our staff is always available to help costumers select the most appropriate and suitable solution for their specific needs.

Accessories

BC 8701 RS485/USB converter with Vdc output

Accessories for OD 8325

0012.450043 adapter for extension pipe

0012.000624 swivel mounting for extension pipe (0012.450043 is included)

0012.440040 PVC tubing for pressure air, L = 33 m

Accessories for OD 8525

TU 910 flow cell
TU 920 flow cell

1892702 adapter for installation in pipe
2713118 O ring for 1892702

SZ 7521 adapter for extension pipe

Spare parts

OD 8391 Optical element replacement kit

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".

The terminologies indicated in the international metrology vocabulary (VIM) are respected as far as possible.

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.

4 SPECIFICATIONS AND TECHNICAL DATA

4.1 FUNCTIONAL SPECIFICATION

Inputs

The probe is able to perform the measurement of the dissolved oxygen and temperature.

Scale

The instrument allows the selection of two different scales: ppm or % saturation.

For all it is possible to set the scalability factor to obtain different full scale values on the analogue output.

Secondary parameters

The dissolved oxygen measurement is affected by atmospheric pressure, salinity and relative humidity.

Setting the values of these parameters avoids the use of conversion tables.

Temperature compensation

The probe is designed to automatically compensate the effect of temperature.

The probe contains the relation to that effect response table.

Analog output

The probe operates in 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, data acquisition cards or B&C Electronics instruments with 4-20 mA input.

Serial interface

Through the isolated RS485 interface, the user can connect the probe to a terminal or to a PC using a simple terminal emulation program. A RS485/RS232 or RS485/USB converter can be necessary.

Using B&C protocol, is possible measurements receiving, parameters setting and to calibration management.

Using Modbus protocol, functions 03, 06 and 16 are implemented for reading the measurements, changing the operating parameters and calibrating.

The MC 6587 and MC 7687 controllers from B&C Electronics allow complete management of the probe.

The bootloader function allows the firmware's update via serial port.

Filter software

The input signal has a filter with two selectable response time.

The user can separately set the response time relative to signals of small or large variation in order to obtain good reading stability and fast response to the variations of the measurement in the process.

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.

Configuration and calibration of the probe

Configuration and calibration of the probe are made via serial interface (see chapter "Digital mode (page 20)") or by using MC 6587 and MC 7687 controllers.

4.2 TECHNICAL DATA

4.2.1 GENERAL SPECIFICATIONS

Common specification

Cable	5 x 0.25 mmq, L= 10 m, sheath in PVC
Temperature	-5 °C ÷ +50 °C
Storage temperature	-5 °C ÷ +50 °C
Operating pressure	0 ÷ 6 bar at 25°C | 0 ÷ 3 bar at 50°C
Protection	IP68
Body	PVC, silicone
Average lifetime sensing element	3 years without exposure to sunlight
Immunity performance loss	< 1 % full scale

OD 8325 specification

Diameter	60 mm
Length	165 mm
Thread	2"NPT
Autoclean	built-in nozzle
Air inlet fitting	1/4" internal, 3/8" external
Air pressure	3 bar max (for max 10 seconds)
Weight	body 420 g, cable 640 g

OD 8525 specification

Diameter	39.50 mm
Length	143 mm
Weight	body 160 g, cable 640 g

OD 8625 specification

Diameter	39.50 mm
Length	135 mm
Weight	body 160 g, cable 640 g

4.2.2 TECHNICAL SPECIFICATIONS

MAIN MEASURING		**Default**
Measuring type	Dissolved oxygen, optical method	

SENSOR TYPE	**Default**
Optical sensor composed by:	
• Sensing replaceable element	
• Led	
• Photodiode	

SCALES		**Default**
Scales	200.0 % sat 20.00 ppm	20.00 ppm
% sat scale	0.0 ÷ 200.0 % sat	
Reading limit	320.0 % sat	
Identification of % sat scale	12 mA at switching for 8 seconds	
Resolution	0.1 % sat	
Accuracy	± 1.0 % sat at < 10.0 % sat ± 2.0 % sat at > 10.0 % sat	
ppm scale	0.00 ÷ 20.00 ppm	
Reading limit	32.00 ppm	
Identification of ppm scale	10 mA at switching for 8 seconds	
Resolution	0.01 ppm	
Accuracy	± 0.1 ppm at < 1.00 ppm ± 0.2 ppm at > 1.00 ppm	
Repeatability	± 0.5 % of scale	
Drift	< 1 % year (typical value)	
Response time	95 % < 60 seconds	
Automatic temperature compensation	B&C table linked to the lot of the sensing element ppm/% conversion table	
Measuring update	every 8 seconds	
Filter software		

SCALES		Default
Response time 90 % small signal	8 ÷ 220 seconds	120 s
Response time 90 % large signal	8 ÷ 220 seconds	40 s

SECONDARY PARAMETERS		Default
Salinity (chloride)	0 ÷ 600 x 100 ppm (100 ppm step)	0 ppm
Pressure	500 ÷ 800 mmHg	760 mmHg
Relative humidity	0 ÷ 100 %	50 %

TEMPERATURE		Default
Sensor for thermocompensation	RTD Pt100 (built-in)	
Compensation range	0.0 ÷ 50.0 °C	
Temperature comp. coefficient	internal table	

CURRENT LOOP (DIGITAL MODE = 0)		Default
Current loop proportional to the measuring	4-20 mA	
Scale factor	10 ÷ 150 %	100%
Under/over range	3.80 / 20.80 mA	
	3.80 / 21.00 mA every 8 seconds	

DIGITAL FUNCTION		Default
Protocols	B&C protocol ASCII Modbus RTU The two protocols can coexist	
B&C ID protocol	ID = 01 ÷ 99 * last s/n digit, if 0 ID=10	01 ÷ 10 *
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)		

SERIAL INTERFACE		Default
Interface	RS485 non terminated	
	Isolated from the sample	
	Non isolated from the loop/power supply	
Baud rate	2400 / 4800 / 9600 / 19200 baud	9600 baud
Distance of connection	1000 / 500 / 250 / 125 m	

SERIAL INTERFACE		Default
Network	32 probes max	

POWER SUPPLY		Default
Power supply	9/36 Vdc	
Absorptions		
• Digital mode = 0 • Digital mode = 1 • Digital mode = 2	Typical 4-20 mA, max 22 mA 10/12 mA according to the scale 7 mA	
	The absorption may be higher during transmission	

5 INSTALLATION

5.1 PACKING LIST

The instrument package contains:
- N° 1 dissolved oxygen probe;
- N° 1 instruction manual.

5.2 UNPACKING AND REPACKING OF THE UNIT

1 Open the carton box and keep it.
2 Remove the probe wrapped in clear plastic guard.
3 Remove the plastic cap.

⚠ Handle the probe with care.

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 OD 8325

Use with autoclean system

The probe should be submerged preferably with an inclination relative to the vertical that favors the cleaning air escape upwards.

The swivel mounting 0012.000624 described in chapter "Accessories (page 6)" allows this type of installation.

Before the immersion of the probe it is necessary to make the following:
- provide an extension pipe with suitable length;
- provide the PVC tubing 0012.440040 with suitable length;
- prepare the 0012.450043 adapter;
- insert the flexible tubing in the air connector;
- insert the cable and the tubing in the adapter 0012.450043 and screw it on the probe;
- insert the extension pipe and screw it on the adapter.

⚠ The pressure air provided by the customer must be a clean air at 3 bar max.

The typical cleaning time is 10 seconds and the typical cleaning frequency is 2 times/day, but it is depending of the application and the actual efficiency of the cleaning action.

Higher cleaning frequency could reduce the lifetime of the DO sensing element.

Avoid a long exposure to sun light, which will reduce the life of the DO sensing element.

Use without autoclean system

Before the immersion of the probe, follow the above procedure but:

- do not install the flexible tubing;
- install a stopper on the air line connector in order to avoid the water entering into the room between the adapter and the probe when the probe is submersed.

⚠ Without the stopper the water will damage the cable and it may leak inside the probe.

⚠ The probe cable can be submerged but must check the compatibility of its PVC jacket with the sample liquid.

In any case it is necessary to periodically check that the cable is in good condition.

5.5 INSTALLATION OF OD 8625

The probe should be submerged preferably with an inclination relative to the vertical that favors the cleaning air escape upwards.

Before the immersion of the probe it is necessary to make the following:

- provide an extension pipe with suitable length;
- insert the cable in the extension pipe and screw it on the probe.

⚠ The probe cable can be submerged but must check the compatibility of its PVC jacket with the sample liquid.

In any case it is necessary to periodically check that the cable is in good condition.

5.6 INSTALLATION OF OD 8525

This probe is designed for use online or in the flow cell TU 910 or TU 920 (refer to the latter's instructions for proper installation).

The probe can also be installed in a tank with extension pipe adapter SZ 7521.

⚠ Do not unscrew/remove the cable gland fitting. You can damage the internal circuits.
Warranty will not be applied if sensors are tampered with.

5.7 ELECTRICAL INSTALLATION

Connect the probe to the meter by following the color of the wires of the cable.
Theoperation mode via the current loop uses the white and green wires which are protected against any reversal in connection.
The shield of the cable is not connected inside the probe but must be connected to the system ground.

Wire colour	Function
Shield	not connected
Yellow	RS485 A (+)
Grey	RS485 B (-)
Brown	not connected
Green	+ current loop
White	- current loop / COM RS485

⚠ Do not connect the power supply on the RS485 interface wires (yellow and gray) to prevent breakage.

Avoid interruptions of the cable. If you need use junction boxes with high insulation and the extension cable p/n 2423405 (5x0.25 - D 5.70 mm).
Keep the cable away from the power cables also inside the electrical panel.

5.7.1 CONNECTION IN ANALOG MODE TO B&C INSTRUMENTS

Connect the probe to instruments BC 7335 - BC 7635 - BC 7687 - BC 6587 of B&C Electronics in order to simplify their use by their characteristics listed below:

- configuration of the scale 0 ÷ 20 ppm or 0 ÷ 200 % sat corresponding to 4-20 mA input signal;
- zero adjustment and sensitivity;
- two independent set points;
- alarm relay minimum / maximum;
- isolated output 0-20 mA or 4-20 mA;
- digital input to maintain the instrument in terms of hold during calibration or in the cycle of self cleaning.

Connect the sensor to the controller as follows:

Wire color	BC 7335	BC 7635	BC 7687	BC 6587
Green	20	20	20	25
White	22	22	22	23

Calibration

When the probe is connected to these controllers, you can calibrate the oxygen measurement using the zero/sensitivity adjustment available in the controllers and described in specific instruction manuals.

Working in this way avoids carry out the calibration of the probe by means of the digital connection that might be necessary only in case of degradation of the optical element.

5.7.2 NETWORK CONNECTION (RS485)

These digital probes use a RS485 driver with slow switching fronts.

This implies that it is not necessary to complete the termination of the transmission line even for long distances.

The following directions are to be considered as examples.

If the driver of the master device has very fast switching fronts, it may be necessary to terminate the beginning and end of the transmission line. In this case it should be inserted in the transmission line a pull-up and pull-down Rp resistors to keep the line polarized and to ensure the starting condition (start bit).

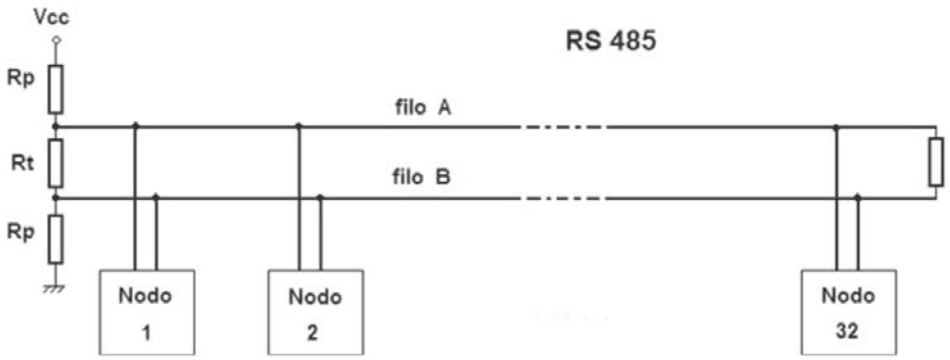


Fig. 1 Pull-up and pull-down resistors termination

If no power supply is available to insert the pull-up and pull-down resistances on the line, or to not overload the driver increasing the consumption of the sensors and devices, make an AC termination by inserting a capacitor in series with the terminating resistor.

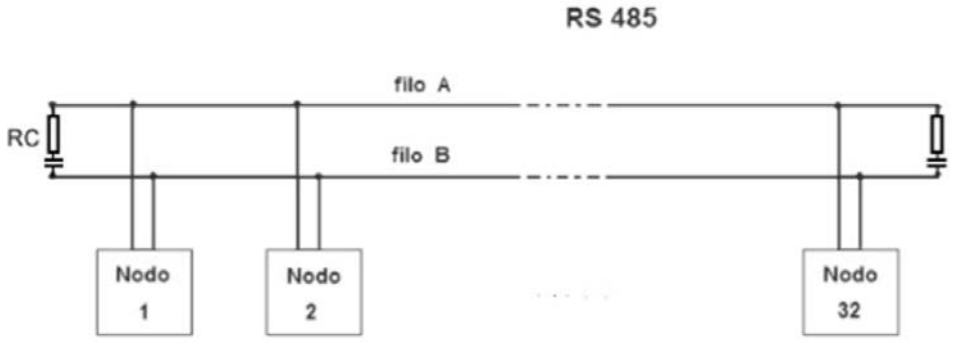


Fig. 2 AC termination

The capacitors to be used depend on the length of the cables and as an indication they are the following:

10 nF (150 m) - 22 nF (300 m) - 47 nF (600 m) - 100 nF (1200 m).

5.7.3 CONNECTION IN DIGITAL MODE TO B&C INSTRUMENTS

In digital mode is possible to connect the oxygen probe to instruments MC 7687 and MC 6587 of B&C Electronics.

For the available functions, refer to the instruments specific manuals.

Connect the sensor to the controller as follows:

Wire color	MC 7687	MC 6587
Green	40	35
White	37	32
Yellow	39	34
Grey	38	33

5.8 DISPOSAL

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

6 OPERATING PROCEDURE

6.1 OPERATING PRINCIPLE

A light beam of a specific wavelength is sent to a special fluorescent layer in contact with the sample.

The absorbed light energy is partially released as a light pulse with an higher wavelength.

This phenomena is called fluorescence.

If oxygen molecules are in contact with the sensing layer, the fluorescing is reduced (quenching).

By measuring the amount of quenching it is possible to determine the oxygen concentration.

6.2 OPERATING MODE

The probe can be configured to operate in analog or digital mode.

For operation in analog mode you must configure "digital mode = 0".

For operation in digital mode you must configure "digital mode = 1 o 2".

The user can modify the operating mode by setting the new parameter, switching off and then switching on the probe.

6.3 ANALOG MODE

In analog mode, the probe 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 150 % of the measuring scale.

The probe in the analog mode can be connected to BC 7335 - BC 7635 - BC 7635.010 - BC 7687 - BC 6587 B&C Electronics instruments, which allow the visualization of the measure and have two set point on/off and an alarm window.

The probe is supplied with the factory configuration in analog mode (digital mode = 0).

The probe requires 2 seconds from the switching on to stabilize the operation of the internal circuits.

After 8 seconds, the current loop settles for the next 16 seconds to set current values that allow the operator to identify the scale of measurement selected in the configuration:

- 10 mA for ppm scale;
- 12 mA for % sat scale.

If during the time interval from 2 to 18 seconds from the switching on any RS485 serial interface activity was detected, the probe will enter definitively in analog mode with 4-20 mA current loop ignoring any subsequent activity present on the serial.

If during this interval an RS485 serial interface activities is detected, the probe will go into digital mode (typical absorption 7 mA, may be higher during transmission).

6.4 DIGITAL MODE

In digital mode the probe is a slave device that interacts with a master device through the RS485 serial interface.

In case of connection to a PC, a RS485/RS232 or RS485/USB (as BC 8701) converter can be required.

The communication is via the RS485 connection with the B&C protocol (ASCII) and Modbus RTU (function 03 - 06 -16) protocol described in the following chapters.

When switched on the probe requires 2 seconds to stabilize its internal circuits.

After that period, if configured for digital mode with the parameter "digital mode = 1" or "digital mode = 2", the probe is ready to receive commands from the master device or manually through the Hyperterminal program or similar.

After 2 seconds approx from the switching on, for digital mode = 1 the current loop will provide10 mA if the selected scale is in ppm, or 12 mA if the selected scale is in % air saturation.

For digital mode = 2 the current loop will provide 7 mA.

Alarm states are signaled with an error flag in the transmitted record.

6.4.1 B&C COMMUNICATION PROTOCOL

Connect the probe to a PC for data management and calibration, using a simple terminal emulation program (example Hyperteminal).

Mode of transmission

Code system	ASCII
Number of bits per character:	
- start bits	1
- data bits	8
- parity	no parity
- stop bits	1
Error check (only A command)	BCC
Speed	9600 baud (default)

Commands format using ID (01 ÷ 99) or (1 ÷ 99)

1 or 2 byte ID probe (01 ÷ 99 or 1 ÷ 99)

1 or 2 byte of command

n byte to be inserted if required by the command

1 byte <cr> (carriage return) end command

The probe transmits only if the ID sent is correct or is 00.

⚠ Do not use 00 ID if more than one probe is connected, to avoid overlap of the communication.

Commands format using ID + SNxxxxxx

1 or 2 byte ID probe (01 ÷ 99 or 1 ÷ 99)

8 byte serial number (SNxxxxxx)

1 or 2 byte of command

n byte to be inserted if required by the command

1 byte <cr> (carriage return) end command

The probe transmits only if the ID + serial number sent is correct or if it is 00 + serial number.

⚠ If the communication port is set to a different speed the probe will not communicate.

All the available commands are listed in the following pages.

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

COMMANDS USING ID

HELP

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

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

By sending the command **H** the probe responds by sending a record containing the list of available commands with a brief description of their meaning.

```
-------------------------------------------------------------------------------
HELP MENU, COMMAND LIST       B&C ELECTRONICS
-------------------------------------------------------------------------------
OD8x25     OPTICAL D.O. PROBE   Rev.fw:3.00  S/N:156458 Dye:V1

00H  <cr>  Help menu
00A  <cr>  Acquisition
00Mx <cr>  Digital mode:      0000             (0=analog 1=digital 2=dig.LP)
00Ox <cr>  Analog out 4/20mA: 0000             (0=ppm 1=%sat)
00Xx <cr>  Scalable output %: 0100             (10-150% full scale)
00RLx<cr>  RT90% large signal 0040 s           (8-220s)
00RSx<cr>  RT90% small signal 0120 s           (8-220s)
00Jx <cr>  Temp. adjust       not done    0.0  (5.0°C max) (00JR reset)
00Cx <cr>  Chloride salinity: 0000 x 100ppm    (0-600 x 100ppm)
00Px <cr>  Atm. pressure:     0760 mmHg        (500-800mmHg)
00Ux <cr>  Relative humidity: 0050 %RH         (0-100%RH)
00S  <cr>  Sens. calibration: OK               (point cal 1)
00Z  <cr>  Zero  calibration: OK               (point cal 2)
00Vx <cr>  Sens. HI cal val.: 150.0 %sat       (2-32ppm 120-320%sat)
00SH <cr>  Sens. HI calib.  : not done  100.0% (50-200%) (00SR reset sens)
00Dx <cr>  Last cal date:     00/00/00         (XX/XX/XX, XX=00-99)
00Ix <cr>  ID B&C:            0008             (01-99)or(1-99)
00Ex <cr>  ID modbus:         0008             (1-243)
00Bx <cr>  Baud rate:         0003             (1=2400 2=4800 3=9600 4=19200)

Type ID number or 00 before command
example, if ID=15 type 15A <cr> or 00A <cr>
Use 00A <cr> if only one probe is connected
Query commands: 00H?,00Z?,00S?,00SH?,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:

```
OD8X25- 02,FW:3.00,SN:156458,Dye:V1DB,M:0000,O:0000,X:0100,RL:0040,RS:
....+....|....+....|....+....|....+....|....+....|....+....|....+....|
0120,J:not done ±   0.0°C  ,C:0000,P:0760,U:0050,S:OK      ,Z:OK
....+....|....+....|....+....|....+....|....+....|....+....|....+....|
,V: 150.0%sat,SH:not done    100.0%   ,D:00/00/00,IA:0008,EA:0008,BA:0
....+....|....+....|....+....|....+....|....+....|....+....|....+....|
003,BCC:4BB8,xx
```

OD8X25	Probe code (OD 8325, OD 8525 or OD 8625)
02	Probe 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 probe with the format NAME PARAMETER: VALUE.

FW:3.00	Firmware version
SN:156458	Probe's serial number
Dye:V1DB	Sensing element lot number
M:0000	Operating mode
O:0000	Analog output/scale setting
X:0100	Scalable output
RL:0040	Large software filter value
RS:0120	Small software filter value
J:not done 0.0°C	Temperature correction
C:0000	Chloride salinity
P:0760	Pressure
U:0050	Relative humidity
S:OK	Sensitivity calibration outcome (not done, ok, error)
Z:OK	Zero calibration outcome (not done, ok, error)
V:150.0%sat	HI sensitivity calibration solution value (ppm/%sat)
SH:not done 100.0%	HI sensitivity calibration outcome (not done, OK, error)
D:00/00/00	Last calibration date
IA:0008	ID B&C protocol
EA:0008	ID Modbus protocol
BA:0003	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 probe 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 probe's configuration data.

BCC calculation

The BCC messages sent by the probe 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 probe responds by sending a record containing the code, the ID, date, time, and the value of all the measures.

Record format

```
OD8x25- 10 0.0 01/01/01 00:00:00 ± 200.0%sat ± 20.00ppm  ±  20.0°C   ±
....+....|....+....|....+....|....+....|....+....|....+....|....+....|....+....|
 60000ppm  ± 760mmHg ±    50%RH  13/11/10xx
```

OD8325	Probe code (OD 8325, OD 8525 or OD 8625)
10	Probe ID
0.0	Power voltage (not implemented)
01/01/01	Date (not implemented)
00:00:00	Time (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)
Measuring unit	- 4 characters - left alignment - 1 blank (ASCII 32)
± 20.00 ppm	Dissolved oxygen value ppm scale
± 200.0 % sat	Dissolved oxygen value % sat scale
± 20.0 °C	Temperature
± 60000 ppm	Chloride salinity
± 760 mmHg	Pressure
± 50 % RH	Relative humidity

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

13/11/10	Last calibration date
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.

BCC use

The BCC can be used if you want to create a master program that interrogates the probe.

The BCC is used to check the validity of records received.

DIGITAL MODE

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

Example: if ID=14 and digital mode = 1 type 14M1 <cr> or 00M1 <cr>

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

The probe can be configured to operate in digital mode (digital mode = 1 or 2) or in analog 4-20 mA mode (digital mode = 0).

For this command, and for all the following commands the response of the sensor is a replica of the command received with the addition of a <lf> line feed (head) at the beginning and end of the response.

ANALOG OUTPUT

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

Example: if ID=14 and analog out = % sat type 14O1 <cr> or 00O1 <cr>

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

4-20 mA analog output can be matched to the scale ppm or% sat.

Set parameter:

x=0 for ppm scale

x=1 for % sat scale

SCALE FACTOR

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

Example: if ID=14 and scale factor is 50 % type 14X50 <cr> or 00X50 <cr>

Response of the unit:	**<cr> <lf> ID + X + 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**.
Example of scale factors:

Scale factor	Full scale value
150 %	300 % sat / 30 ppm
100 %	200 % sat / 20 ppm
50 %	100 % sat / 10 ppm

LARGE FILTER (Response time 90 % large signal)

Command format: **ID + RL + x <cr>**
Example: if ID=14 and the response time relative to signals of large variation is 100 s type 14RL100 <cr> or 00RL100 <cr>

Response of the unit:	**<cr> <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 **H?** or **H**.
The large filter can be set from 8 to 220 seconds.

SMALL FILTER (Response time 90 % small signal)

Command format: **ID + RS + x <cr>**
Example: if ID=14 and the response time relative to signals of small variation is 100 s type 14RL100 <cr> or 00RL100 <cr>

Response of the unit:	**<cr> <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 **H?** or **H**.
The large filter can be set from 8 to 220 seconds.

TEMPERATURE CALIBRATION

Command format: **ID + J +x <cr>**
Example: if ID=14 and the temperature value is 23.2°C typredigitare 14J23.2 <cr> oppure 00J23.2 <cr>

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

Possible results:

'ok'	calibration done
'error'	error during calibration
'not done'	default factory calibration value

To check the result of the sensitivity calibration using the **J?** or **H**.

In the event of a successful test with the **A**, the reading must be about the one entered.

TEMPERATURE CALIBRATION RESET

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

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

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

This command allows to return to the default temperature zero value.
Verify the outcome of the operation through the command **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 characters value> <4 characters measure unit><cr> <lf>**	command executed correctly
Response of the unit:	none	command failed

Record format

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

Possible results: ok / not done / error.

SALINITY

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

Example: if ID=14 and the salinity (chloride concentration) is 20000 ppm type 14C200 <cr> or 00C200 <cr> (1 unit = 100 ppm)

Response of the unit:	**<cr> <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 **A**, **H?** or **H**.

PRESSURE

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

Example: if ID=14 and the atmospheric pressure is 780 mmHg type 14P780 <cr> or 00P780 <cr>

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

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

RELATIVE HUMIDITY

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

Example: if ID=14 and the relative humidity is 50 % RH type 14U50 <cr> or 00U50 <cr>

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

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

SENSITIVITY CALIBRATION

During the sensitivity calibration the probe automatically performs the recovery operations of the factory values relative to the optics and electronics.

This series of operations is performed in a time of about 5 seconds.

Only after their completion, the probe returns to wait for further commands.

The sensitivity calibration in a saturated water or in the air you have to perform mandatory before the zero calibration.

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

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

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

Possible results:

'ok'	calibration done
'error'	error during calibration
'not done'	default factory calibration value

To check the result of the sensitivity calibration using the **S?**, **H?** or **H**.

In case of positive result check with the command **A**, the reading in% sat must be about 100%.

The probe reading settles around the following values depending on the liquid temperature:

Temperature	O_2 concentration
15 °C	100.0 % sat - 10.06 ppm
20 °C	100.0 % sat - 9.06 ppm
25 °C	100.0 % sat - 8.24 ppm

The values are indicative, vary as a function of salinity, atmospheric pressure and relative humidity.

If the operation is successful (ok), you must proceed with the zero calibration to complete the probe calibration.

If the zero calibration is not performed, the readout may not be correct and the 4-20 mA output will jump alternately from 3.5 mA to 21 mA in every 8 seconds.

If the operation has failed (error), check that the probe is actually in the saturated air or water.

Possibly inspect the status of the sensor, if damaged, replace it and proceed to the new sensitivity and zero calibration.

In the case of a negative result the probe restores the previous values of efficiency, sensitivity and zero.

SENSITIVITY CALIBRATION TEST

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

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

Response of the unit:	**<8 characters outcome> <cr> <lf>**	command executed correctly
Response of the unit:	none	command failed

Record format

```
not done
....+....|....+....|....+....|....+....|....+....|....+....|....+....|....+....|
```

Possible results: ok / not done / error.

ZERO CALIBRATION

Zero calibration in water without oxygen (eg. Sodium bisulfite) should only be performed after the calibration of the sensitivity.

Zero adjustment can be repeated several times without having to re-calibrate the sensitivity.

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

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

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

Possible results:

'ok'	calibration done

'error'	error during calibration
'not done'	default factory calibration value

To check the result of the sensitivity calibration using the **Z?**, **H?** or **H**.
In the event of a successful test with the **A**, the reading in% sat must be about 0% sat.

If the operation has failed (error), check whether the probe is actually in the water without oxygen.
Inspect the state of the sensing element, if damaged replece it and recalibrate sensitivity and zero.

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

Record format

```
not done
....+....|....+....|....+....|....+....|....+....|....+....|....+....|....+....|
```

Possible results: ok / not done / error.

SENSITIVITY SOLUTION VALUE

Command format: **ID + V + x <cr>**
Example: if ID=14 and the calibration solution is150.0 %sat type 14V150.0 <cr> or 00T150.0 <cr>

Response of the unit:	**<cr> <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 **H?** or **H**.

HI SENSITIVITY CALIBRATION

The HI sensitivity calibration operation is performed at oxygen values a bove 120% and the correction is applied to values a bove 100%
The reference solution can be set in ppm or% sat.
This series of operations is performed in a time of about 5 seconds.
Only after their completion, the probe returns to wait for further commands.
Command format: **ID + SH <cr>**
Example: if ID=14 type 14SH <cr> or 00SH <cr>

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

Possible results:

'ok'	calibration done
'error'	error during calibration
'not done'	default factory calibration value

To check the result of the sensitivity calibration using the **SH?**, **H?** or **H**.

HI SENSITIVITY CALIBRATION TEST

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

Response of the unit:	**<8 characters outcome> >blank> <7 characters value> <4 characters measure 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 + XX/XX/XX <cr>** (XX = 00 ÷ 99)
Example: if ID=14 and the date to be inserted is 11/05/18 type 14D11/05/18 <cr> or 00D11/05/18 <cr>

Response of the unit:	**<cr> <lf> ID + D + XX/XX/XX <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 the proposed format.

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

If ID is less than 10 depending on the input mode the first digit will then be displayed as blank or zero in controls **00A** and **00H?**.
If you want a view with a zero first you must enter the ID with 0 as 00I07 but if you want it with the blank you have to type it without 0 example 00I7.
The probe activates the new ID immediately after the response to the command.

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

The probe activates the new ID immediately after the response to the command.

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

The probe activates the new baud rate immediately after the response to the command.
Set the parameter:
x=1 for 2400 baud
x=2 for 4800 baud
x=3 for 9600 baud
x=4 for 19200 baud

COMMANDS USING ID + SNxxxxxx

From release R3.00 it has been added the possibility to query the probes by inserting the serial number of the probe in addition to the ID for **all the commands provided**.

Example: the command to acquire the measurement of a probe with ID=14 and SN123456 can be performed with:

interrogation using ID	14A <cr> or 00A <cr>
interrogation using ID+SNxxxxxx	14SN123456A <cr> or 00SN123456A <cr>

The interrogation with ID + SNxxxxxx becomes a unique command thus allowing to be able to insert more than 99 devices on the network, limit imposed by the commands with ID.

A command is also provided with serial number broadcast ID + SN000000 to which all the probes respond.

SEARCH PROBE TYPE, ID AND SERIAL NUMBER

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

Example: if the ID is known (ID=14) type 14SN? <cr> to know code and serial number or type 00SN? <cr> to search all the probes in the network.

Response of the unit:	**<6 characters code> <2 characters ID> <6 characters serial number> <2 characters BCC> <cr> <lf>**	command executed correctly
Response of the unit:	none	command failed

```
OD8325,14,123456,xx
....+....|....+....|
```

This command allows to search all the probes in a network.

The probes respond by providing their identity: code, ID, serial number.

The probe response occurs after a random time chosen by the probe itself between 8 time intervals: 0 ms, 200 ms, 400 ms, 600 ms, 800 ms, 1000 ms, 1200 ms, 1400 ms to avoid as much as possible an overlap of the answers when there are more probes on the network.

If there are more probes, some overlap of communication will be unavoidable.

The master device must manage the probes search by disabling the commands of the probes it has found, repeating the search command several times until it has found all the probes in the network.

At this point the master can re-enable the commands of the probes he has found.

To disable and re-enable the probe commands, see the command **ID + SNxxxxxx + MUx <cr>**.

The automatic management of probes is implemented in the MC 6587 and MC 7687 instruments of the B&C Electronics.

DISABLE/ENABLE COMMANDS USING ID

Command format: **ID + SNxxxxxx + MUx <cr>**

Example: to disable commands using ID of a probe with ID=14 and serial number 123456 type 14SN123456MU1 <cr> or 00SN123456MU1 <cr>

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

Set parameter:

x=0 to enable commands using ID

x=1 to disable the commands using ID

When the probe is disabled to commands using ID:

- can only execute commands with **ID + SNxxxxxx**;
- does not run the probe search command **ID + SN?**.

6.4.2 MODBUS PROTOCOL

On the probe, in addition to the ASCII B&C protocol, is implemented the Modbus RTU protocol limited to the function 03, 06, and 16.

In Modbus communication network the probe 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 (0x03)

Function 03 (MASTER QUERY)

Address	1 byte	1 ÷ 243 (probe ID)
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.

Function 03 (SLAVE ANSWER)

Address	1 byte	1 ÷ 243 (probe ID)
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

If you query requesting registers outside the defined limits, the probe answers assigning zero to all of the registers out of range.

If an error occurs in the request, the response takes the following form:

Address	1 byte	1 ÷ 243 (probe ID)
Function	1 byte	0x83 (read holding register + error)
Error	1 byte	2 = illegal data address 3 = illegal data value
Error verification	2 bytes	CRC-16

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

MODBUS FUNCTION 06 (0x06)

Function 06 (MASTER QUERY)

Address	1 byte	1 ÷ 243 (probe ID)
Function	1 byte	06 (write single register)
Address data HI	1 byte	Address of the register
Address data LO	1 byte	
Value of the register HI	1 byte	Value to be written
Value of the register LO	1 byte	
Errors verification	2 bytes	CRC-16

The transmitter considers valid the message if CRC-16 valid, ID valid and function=06.
Function 06 (SLAVE ANSWER)

Address	1 byte	1 ÷ 243 (probe ID)
Function	1 byte	06 (write single register)
Address data HI	1 byte	Address of the register
Address data LO	1 byte	
Value of the register HI	1 byte	Value to be written
Value of the register LO	1 byte	
Errors verification	2 bytes	CRC-16

When writing some calibration commands (eg zero calibration), the probe responds to the request and then remains silent for the time necessary to perform the operation.
If an error occurs in the request, the response takes the following form:

Address	1 byte	1 ÷ 243 (probe ID)
Function	1 byte	0x86 (write single register + error)
Error	1 byte	2 = illegal data address 4 = slave device failure
Error verification	2 bytes	CRC-16

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

MODBUS FUNCTION 16 (0x10)

Function 16 (MASTER QUERY)

Address	1 byte	1 ÷ 243 (probe ID)
Function	1 byte	16 (write multiple registers)
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	
Number of byte	1 byte	2 byte per register
Value of registers	n byte	n = 2 byte x number of registers
Errors verification	2 bytes	CRC-16

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

Function 16 (SLAVE ANSWER)

Address	1 byte	1 ÷ 243 (probe ID)
Function	1 byte	16 (write multiple registers)
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

When writing some calibration commands (eg zero calibration), the probe responds to the request and then remains silent for the time necessary to perform the operation.

If an error occurs in the request, the response takes the following form:

Address	1 byte	1 ÷ 243 (probe ID)
Function	1 byte	0x90 (write multiple registers + error)
Error	1 byte	2 = illegal data address 3 = illegal data value 4 = slave device failure
Error verification	2 bytes	CRC-16

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

BROADCAST COMMANDS

Modbus 06 and 16 queries can be made by the master in broadcast mode.

The broadcast mode consists in sending the message with the identifier 0, all the probes perceive the message and execute the command but do not respond to the master in order not to create conflicts.

DATA THROUGH MODBUS FUNCTION 03

MEASURE AND STATE (address 0x00xx)

	Modbus address	Parameter	Range	Unit	Scale	Data type	R/W
1	0x0000	Oxygen % sat	0 ÷ 3200	0.1	0.0 ÷ 320.0 % sat	IS	R
2	0x0001	Oxygen ppm	0 ÷ 3200	0.01	0.0 ÷ 32.00 ppm	IS	R
3	0x0002	Temperature °C	-50 ÷ 500	0.1	-5.0 ÷ 50.0 °C	IS	R
4	0x0003	Salinity ppm	0 ÷ 600	100	0 ÷ 60000 ppm	IS	R
5	0x0004	Pressure mmHg	500 ÷ 800	1	500 ÷ 800 mmHg	IS	R
6	0x0005	Relative humidity % RH	0 ÷ 100	1	0 ÷ 100 % RH	IS	R
7	0x0006	BCC EEPROM	0 ÷ 65535	1	0 ÷ 65535	I	R

IS = integer signed / I = integer
R = read / W = write

ZERO CALIBRATION (address 0x010x)

	Modbus address	Parameter	Range	Unit	Scale	Data type	R/W
8	0x0102	Zero command/flag - zero cal - flag zero cal	 0x5A00 0 = not done 1 = OK 2 = error	 1 1		I	 W R

IS = integer signed / I = integer
R = read / W = write

SENSIBILITY CALIBRATION (address 0x011x)

	Mod-bus address	Parameter	Range	Unit	Scale	Data type	R/W
9	0x0112	Val. Sens HI unit	0 = ppm 1 = %sat	1		IS	R
10	0x0113	Standard sens	1200 ÷ 3200 200 ÷ 3200	0.1 0.01	120.0 ÷ 320.0 %sat 2.00 ÷ 32.00 ppm	IS	R/W
11	0x0114	Sens command/flag - sens cal - sens cal HI - reset sens HI - flag sens cal - flag sens cal HI	 0x5300 0x5348 0x5352 LO byte 0 = not done 1 = OK 2 = error HI byte 0 = not done 1 = OK 2 = error	 1 1 1 1 1		I	 W W W R R
12	0x0115	Sens HI value	500 ÷ 2000	0.1	50.0 ÷ 200.0 %sat	IS	R

IS = integer signed / I = integer

R = read / W = write

CHECK CALIBRATION (address 0x012x)

	Mod-bus address	Parameter	Range	Unit	Scale	Data type	R/W
13	0x0120	Temp command/flagl - reset temp - flag temp cal	 0x4A52 0 = not done 1 = OK 2 = error	 1 1	IS	I	 W R
14	0x0121	Temp. adj Temp zero value	-50 ÷ 500 -50 ÷ 50	0.1 0.1	-5.0 ÷ 50.0 °C -5.0 ÷ 5.0 °C	IS	 W R

IS = integer signed / I = integer

R = read / W = write

SETUP (address 0x020x)

	Mod-bus address	Parameter	Range	Unit	Scale	Data type	R/W
15	0x0200	Large filter	8 ÷ 220	1	8 ÷ 220 s	IS	R/W
16	0x0201	Small filter	8 ÷ 220	1	8 ÷ 220 s	IS	R/W

IS = integer signed / I = integer
R = read / W = write

TU 8X2X SETUP (address 0x021x)

	Mod-bus address	Parameter	Range	Unit	Scale	Data type	R/W
17	0X0210	Salinity ppm	0 ÷ 600	100	0 ÷ 60000 ppm	IS	R/W
18	0x0211	Pressure mmHg	500 ÷ 800	1	500 ÷ 800 mmHg	IS	R/W
19	0x0212	Relative humidity %RH	0 ÷ 100	1	0 ÷ 100 % RH	IS	R/W

IS = integer signed / I = integer
R = read / W = write

CONFIGURATION (address 0x030x)

	Mod-bus address	Parameter	Range	Unit	Scale	Data type	R/W
20	0x0300	Digital mode	0 = analog 1 = digital 2 = dig. low power	1		IS	R/W
21	0x0301	Scale	0 ÷ 1	1		IS	R/W
22	0x0302	Scalable output	10 ÷ 150	1	10 ÷ 150 %	IS	R/W
23	0x0303	Baud rate	1 = 2400 2 = 4800 3 = 9600 4 = 19200	1		IS	R/W
24	0x0304	ID B&C	1 ÷ 99	1		IS	R/W
25	0x0305	ID Modbus RTU	1 ÷ 243	1		IS	R/W

IS = integer signed / I = integer
R = read / W = write

INFO PROBE (address 0x040x)

	Modbus address	Parameter	Range	Unit	Scale	Data type	R/W
26	0x0401	Code	6 characters			I	R
27	0x0404	Serial number	6 characters			I	R
28	0x0407	Rev. fw	4 characters			I	R
29	0x0409	Last cal date (1)	00 ÷ 99	1		IS	R/W
30	0x040A	Last cal date (2)	00 ÷ 99	1		IS	R/W
31	0x040B	Last cal date (3)	00 ÷ 99	1		IS	R/W

IS = integer signed / I = integer

R = read / W = write

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 MAINTENANCE

Oxygen sensitive optical element at the bottom of the probe should be inspected and cleaned periodically.

Cleaning is recommended before zero and sensitivity calibration.

Remove any deposit on the sensitive optical coated with silicon by using a soft, damp cloth or paper towel without pushing on the surface to avoid scratching it.

If necessary, use a soft detergent or a very dilute acid if the deposits are of limestone type.

The frequency of cleaning depends on the type of use, the nature and the concentration of the measuring sample.

The probe OD 8325 is designed for automatic cleaning by means of an external system that sends air to the probe.

Contact our sales department for more information.

During these operations avoid removing the cable gland.

This removal is reserved to the manufacturer and if carried out by the operator it will damage the internal circuits voiding the warranty.

7.1 CALIBRATION

The probe is supplied with a factory setting of the zero and sensitivity in air saturated water.

Checking and periodic calibration of the probe is always necessary to ensure the accuracy of the measure.

The sensing element and optical components can have small drifts during the life.

Replace the sensing element if:

- mechanically damaged;
- after the calibration procedure it does not produce the expected values.

The calibration of the probe must satisfy this sequence:

1 calibration of sensitivity in water-saturated air or air;

2 calibration of the zero in the water with sodium bisulfite.

It is not possible to perform only the sensitivity calibration.

Before the zero and sensitivity calibration it is necessary to allow the internal temperature sensor to reach the thermal equilibrium.

This time could be equal to 5 or 10 minutes depending of the difference between the sensor and the room temperature.

Sensitivity calibration

It is done in air saturated water or in air following the procedure in chapter "SENSITIVITY CALIBRATION (page 28)".

Zero calibration

It is done in fresh bisulphite solution or through a nitrogen/argon saturated ambient following the procedure in chapter "ZERO CALIBRATION (page 29)".

High sensitivity calibration

HI sensitivity calibration should be performed when dissolved oxygen values e xceed 100 %sat and after zero and sensitivity calibrations.

This calibration sets a third calibration point, has to be performed at dissolved oxygen values above 120 %sat.

This calibration is applied only to values a bove 100 %sat and only affects values above 100 %sat. (Eg measurement = 128 %sat: HI sensitivity is applied to 28 %sat considering 100 %sat as 0).

It can be done in %sat or ppm, the value in ppm depends on temperature and salinity.

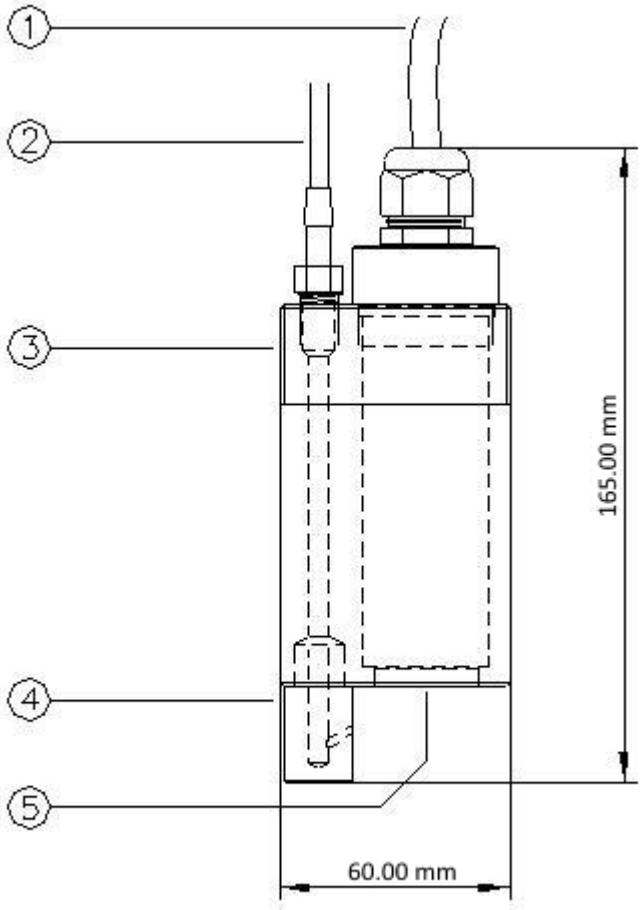
During calibration, the value in ppm is converted to %sat and is verified to be greater than 120 %sat.

The minimum acceptance limit of the sensitivity solution in ppm has been set at 2 ppm which is the value 120 %sat at 50 °C and with salinity 60000 ppm.

In case of salt water application contact B&C Electronics for technical assistance on the procedures to be followed during the zero/ sensitivity calibration.

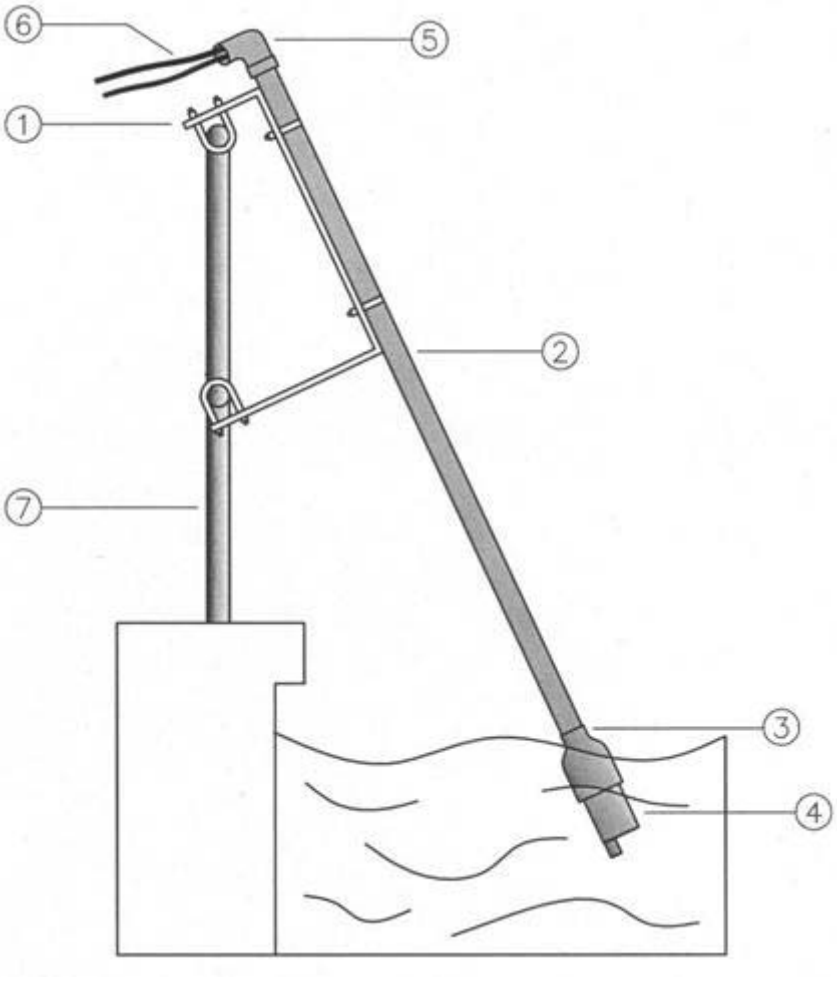
8 INSTALLATION DRAWINGS

8.1 OD 8325 - DIMENSIONS



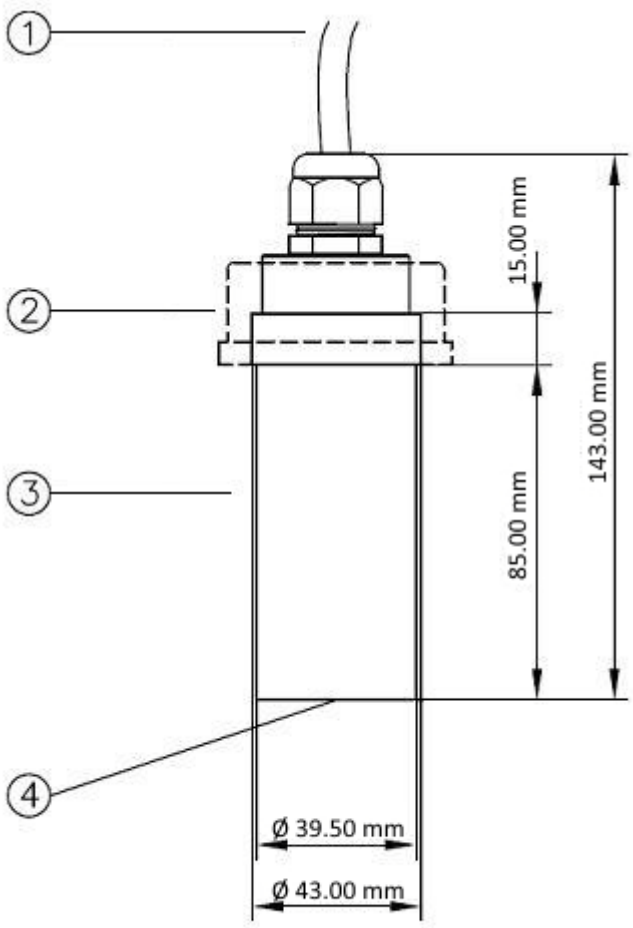
Description		Connections	
1	Cable	Shield	not connected
2	Air input	Yellow	RS485 A (+)
3	Thread	Grey	RS485 B (-)
4	Air nozzle	Brown	not connected
5	Sensing element	Green	+ current loop
		White	- current loop / COM RS485

8.2 OD 8325 - TYPICAL INSTALLATION



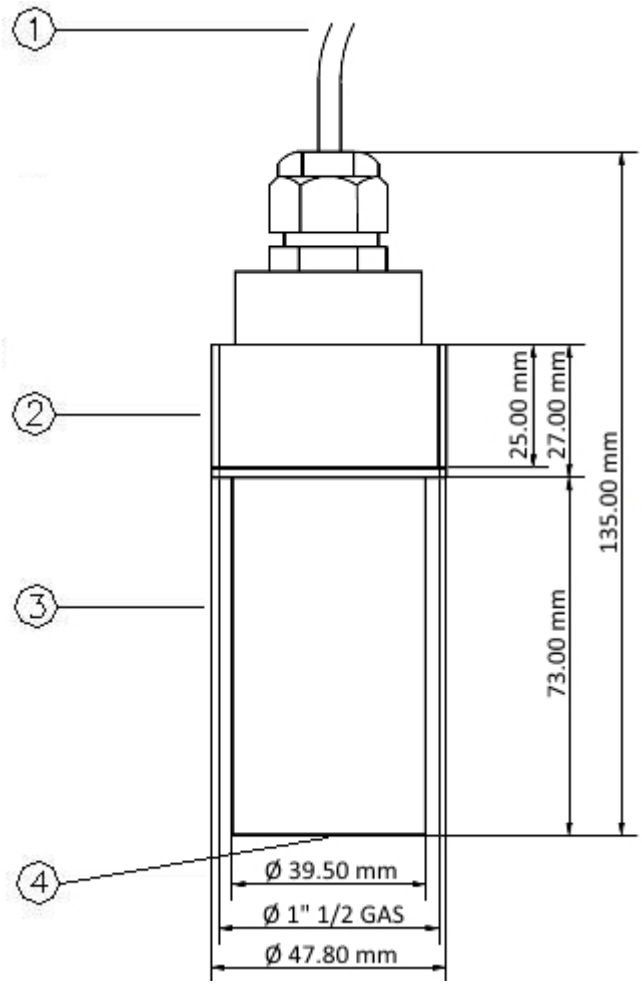
1 Swivel mounting (0012.000624)
2 Extension pipe
3 Adapter (0012.450043)
4 DO sensor with autoclean nozzle
5 Rain protection
6 Cable and air tubing
7 Rail

8.3 OD 8525 - DIMENSIONS



Description		Connections	
1	Cable	Shield	not connected
2	Thread	Yellow	RS485 A (+)
3	Air nozzle	Grey	RS485 B (-)
4	Sensing element	Brown	not connected
		Green	+ current loop
		White	- current loop / COM RS485

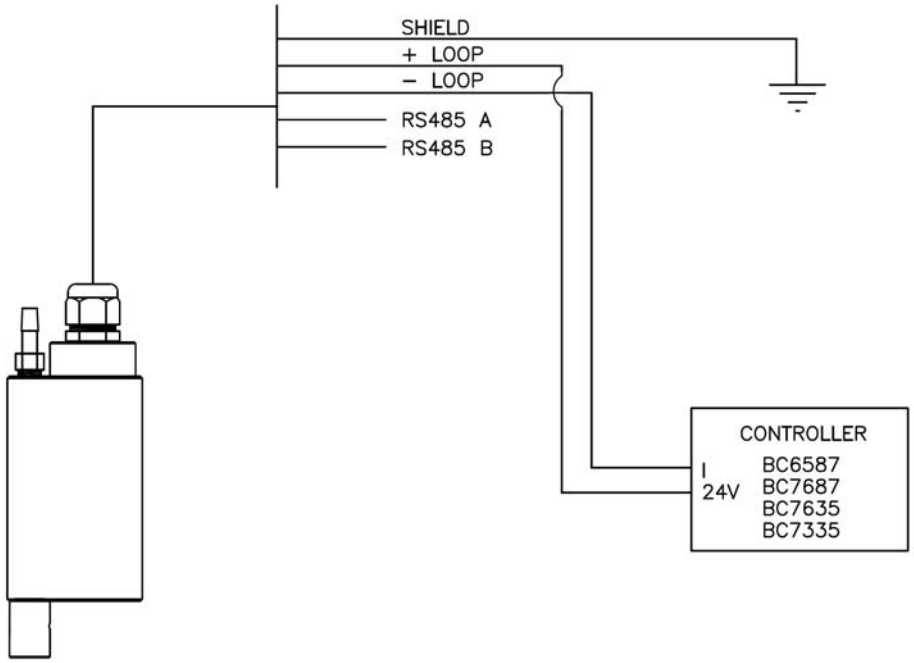
8.4 OD 8625 - DIMENSIONS



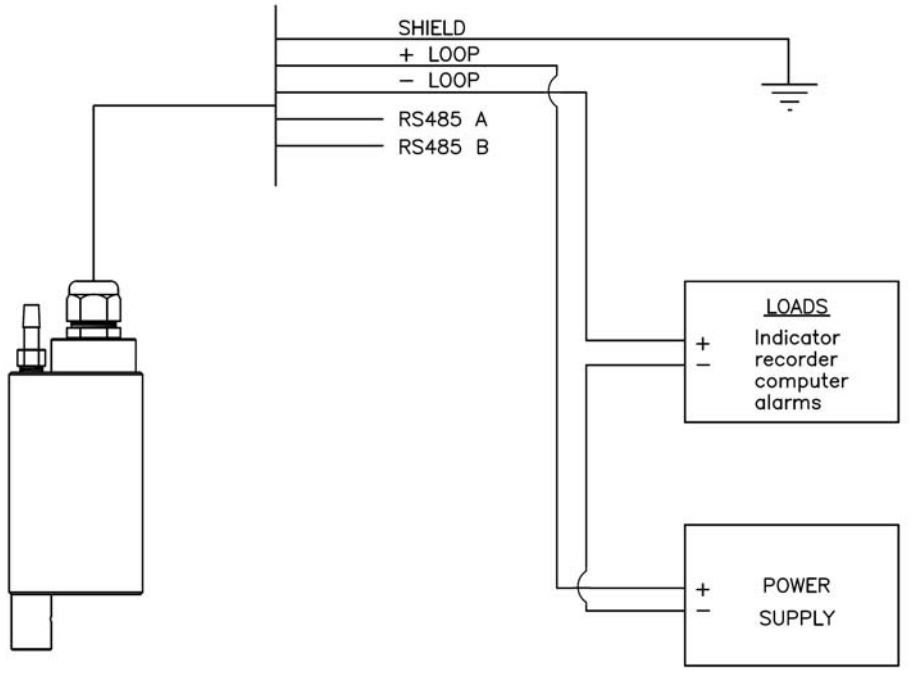
Description		Connections	
1	Cable	Shield	not connected
2	Thread	Yellow	RS485 A (+)
3	Air nozzle	Grey	RS485 B (-)
4	Sensing element	Brown	not connected
		Green	+ current loop
		White	- current loop / COM RS485

8.5 ANALOG MODE WIRING

The connection shown in the figure is possible for all models.



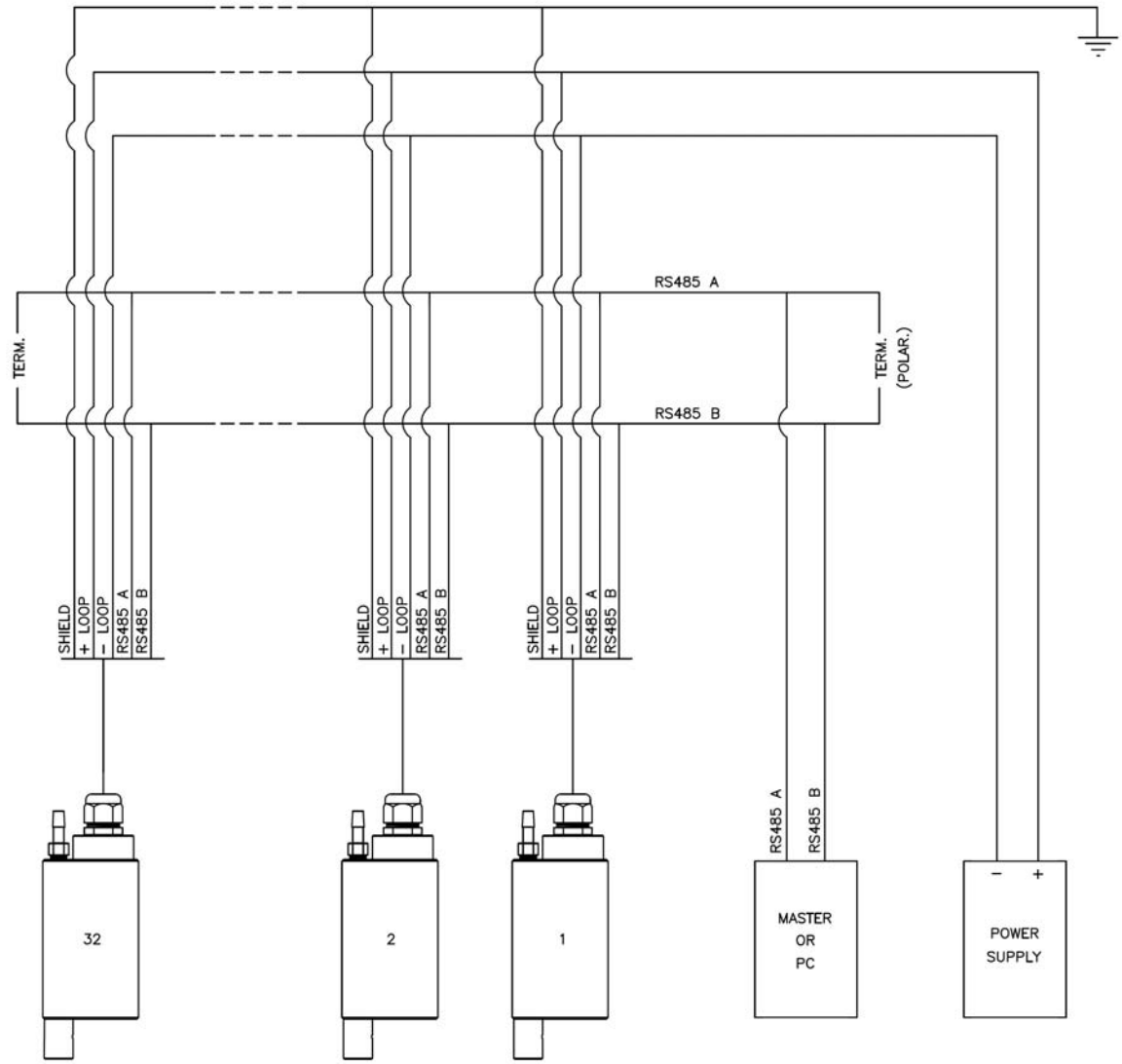
Connection to B&C Electronics' instruments



Connection to PLC or data logger

8.6 DIGITAL MODE WIRING

The connection shown in the figure is possible for all models.



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 misusing its instruments and products.

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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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