UNI EN ISO 9001:2000
CERT. N. 9115 BCEL

OPERATOR'S MANUAL

TU 7685

TURBIDITY METER MICROPROCESSOR BASED

Rev. A
Valid for: TU7685-TU810-TU910

Scales:	0/4/40/400/4000 NTU
	0/9/999 PPM/mg/l
	0/99/9999 PPM/mg/l
Power supply:	110/220 Vac

Software: R2.0x

B&C Electronics Srl – Via per Villanova 3 – 20040 Carnate (Mi) – Italy P.IVA 00729030965
Tel +39 039 631 721 – Fax +39 039 607 6199 bc@bc-electronics.it - www.bc-electronics.it

1 FEATURES

* Input from preamplified probe
* Selectable scales:
  0/4.000 0/40.00 0/400.0 0/4000 NTU
  0/9.999 0/99.99 0/999.9 0/9999 PPM mg/l of SiO
* Autoranging
* Automatic Zero calibration
* Check signal visualization

* Alphanumeric back-lighted LCD
* Dual Software filter on the readout
* Automatic and manual operation

* 0/20 mA or 4/20 mA programmable isolated output

* Dual set-points with hysteresis, delay and min/max programmable functions

* Alarms relay for:
  Min/max values
  Set-points timing
  Dirty probe
  No liquid on the cell
  Ambient light too high

* Autoclean relay with holding function

* Software:
  - 3 access levels
  - user friendly
  - keyboard lock
  - access code
  - watch-dog

* EEPROM parameter storage
* Automatic overload protection and reset
* Extractable terminal blocks
* 96X96 (1/4" DIN) housing

Input

The instrument accepts input from an Ion Selective Electrode.
A second input is provided for 2 or 3 wires Pt100 RTD Temperature.

2 SPECIFICATIONS

2.1 FUNCTIONAL SPECIFICATIONS

Software filter

The unit is provided with a dual programmable software filter, to be inserted when the readout is not stable.

The user may select different filter values for small and large signal fluctuations.

Calibration

The unit recognizes automatically standard solutions.
The operator may calibrate at any Turbidity value.

Analog output

Either a 0/20 mA or 4/20 mA programmable and isolated output may be selected, for use as an interface with computers or data loggers.
The input range corresponding to the output is programmable.

Control relays

The monitor is equipped with two SPDT control relays.

Each control relay may be programmed for set-point, high/low, hysteresis or delay time actuation.

The full display indicates the current settings and current status of each relay.

Alarm relay

The unit contains a SPST relay designated as an alarm relay.

This relay may be used to warn of conditions that may indicate operational problems.
The relay will activate on either high/low value conditions, or on failure of the control relays to maintain proper control.

In addition this relay may be activated for dirty probe, lack of water in the cell and external light too high.

Check signal

The operator may activate the Check signal which detects the surface condition of of the lens.
This signal should be calibrated at 100% when the probe is clean.
In general the signal decreases with the increasing of the dirt on the lens surface and it increases when the cell is dry.

The operator may set min/max values in order to get an alarm for the above conditions.

Operating mode

The instrument is provided with 2 programmable modes of operation.

- Automatic operation:

The Automatic mode is the normal operation mode of the unit.

- Manual operation:

This mode of operation would normally be used for control system troubleshooting.
The unit will allow the relays to be manually actuated by pushing up/down keys.

The letter "M" flashing on the display, indicates the instrument is in manual operation mode.

Configuration

A number of programming functions are provided in the Configuration menu and are protected by a selectable access number, which must be entered to allow changes in this setting.
The keys on the front panel of the monitor can be used for both changing the display and for calibrations and set-point adjustments.

When the monitor is shipped, all functions are accessible.
However, the adjustment and calibration functions may be locked in order to prevent unauthorized adjustments to the instrument.

Options

091.3711 Dual isolated and programmable output.
Two outputs may be configured for Concentration or Temperature.

091.701 RS232 isolated output.
The output sends the data to the serial port of the computer.

091.404 24 VAC power supply.

2.2 TU 7685 TECHNICAL SPECIFICATIONS

The *Default* values are correspondent to the factory calibration values.
Parameters marked by " * " can be modified in the Configuration procedures.

OPERATING MODE	*Default*
Automatic/Manual	Auto

TURBIDITY READOUT	*Default*
Probe: TU 810 - TU 820	
* Measuring unit: NTU/mg/l/PPM	NTU
* Range:	
4/400 NTU - 40/4000 NTU	4/400
9/999 PPM - 99/9999 PPM	9/999
9/999 mg/l - 99/9999 mg/l	9/999
* Input scales (depending of selected range):	
Range 4/400 NTU - 9/999 PPM - 9/999 mg/l	
0/4.000 - 0/40.00 - 0/400.0 NTU	4.000 NTU
0/9.999 - 0/99.99 - 0/999.9 PPM SiO2	9.999 PPM
0/9.999 - 0/99.99 - 0/999.9 mg/l SiO2	9.999 mg/l
Range 40/4000 NTU - 99/9999 PPM - 99/9999 mg/l	
0/40.00 - 0/400.0 - 0/4000 NTU	4000 NTU
0/99.99 - 0/999.9 - 0/9999 PPM SiO2	9999 PPM
0/99.99 - 0/999.9 - 0/9999 mg/l SiO2	9999 mg/l
Resolution: 0.05% of scale	
* Autoranging: Off/On	On
Software filter 90% RT:	
* Large signals: 5/220 sec.	40 sec.
* Small signals: 5/220 sec.	120 sec.
Zero of the probe: 0.0/10.0% f.s.	0.0%
Sensitivity of the Range 4/400 NTU: 80.0%/120.0%	100 %
Sensitivity of the Range 40/4000 NTU: 80.0%/120.0%	100 %
Standard solutions recognized by the unit: 2.000NTU - 20.00 NTU - 200.0 NTU - 2000 NTU 5.000PPM - 50.00 PPM - 500.0 PPM - 5000 PPM 5.000mg/l- 50.00 mg/l- 500.0 mg/l- 5000 mg/l	

CHECK SIGNAL	*Default*
* Check signal readout: On/off	On
Measuring value: 0.0%/220.0%	
Sensitivity: 50.0%/200.0%	100.0%
Alarm for dirty probe: 0.0%/100.0%	10.0%
Alarm for lack of liquid in the cell: 100.0%/200.0%	200.0%
Delay: 0.0/99.9 sec.	10.0 sec.
Alarm conditions: in OR on Relay C	

SET POINT A/B(relays A and B)	*Default*
Action: ON-OFF	
Set point value: 0 to full scale as selected	0 NTU
Hysteresis: 0/10 % of the scale	0.010 NTU
Relay delay: 0.0/99.9 sec.	0.0 sec.
* Function: HI/LO (Max/Min)	LO
Relay contacts: SPDT 220 V 5 Amps Resistive load	

ALARM (relay C)	*Default*
Low value: from 0 to full scale	0.000 NTU
High value: from 0 to full scale	4.000 NTU
* Alarm on max. SA: ON/OFF	OFF
* Max. time SA: 0/60 minutes	60 m
* Alarm on max. SB: ON/OFF	OFF
* Max. time SB: 0/60 minutes	60 m
* Alarm on external light too high: ON/OFF	OFF
Delay: 0.0/99.9 sec.	0.0 sec.
* Contact type: ACT/DEA (DEA needs an internal jumper)	ACT
Relay contacts: SPDT 220 Vac 5 Amps Resistive load	

AUTOCLEAN (relay D)	*Default*
* Action: Off/Manual Clean/Auto+Manual Clean	Off
Auto Clean (Manual):	
Repetition of cycle: 0.1/24.0h (only for Auto)	24.0h
* Cleaning time: 0.5/60.0 sec.	15.0 sec.
* Holding time: 0.1'/20.0' (to be added to the cleaning time)	3'
(analog output in holding, A,B,C relays deactivated)	
Relay contacts: SPST (N.O.)	

ANALOG OUTPUT Nr. 1	*Default*
* Range: 0-20/4-20 mA	0-20 mA
* Point 1 (out 0 or 4 mA): 0 to full scale	0.000 NTU
* Point 2 (out 20 mA): 0 to full scale	4.000 NTU
Response time: 10 sec. for 98%	
Isolation: 250 Vca	
R max: 600 ohm	

ANALOG OUTPUT Nr. 2 (option 091.3711)	*Default*
* Range: 0-20/4-20 mA	0-20 mA
* Point 1 (out 0 or 4 mA): 0 to full scale	0.000 NTU
* Point 2 (out 20 mA): 0 to full scale	4.000 NTU
Response time: 10 sec. for 98%	
Isolation: 250 Vca	
R max: 600 ohm	

SERIAL COMMUNICATION (option 091.701)	*Default*
Baud Rate: 4800 bit/s	
Bit length: 8 bit	
Nr. of Stop bit: 1	
Parity: None	
Isolated from measure circuits	
Data frequency: at each readout update	

Data format:

```
' ±x.xxx NTU   ±xxx.x %
 …..+…....|…....+…..|….        If Check signal is  ON
```

```
' ±x.xxx NTU
 …..+…...|.....                 If Check signal is OFF
```

followed by characters CR LF.

±x.xxx NTU (mg/l PPM): Turbidity values
±xxx.x %: Check signal values

CONFIGURATION (*)	*Default*
Free calibration (Access code not required):	
Keyboard locked/unlocked	unlocked
LCD contrast (0/7)	4
Access code number required for:	0
Measuring unit: NTU, PPM,mg/l	NTU
Range: 4/400 NTU, 40/4000 NTU	4/400 NTU
Scale: 4.000/40.00/400.0/4000	4.000 NTU
Autorange: On/Off	On
Large signal RT filter SW: (5/220)	40 sec.
Small signal RT filter SW: (5/220)	120 sec.
Output Nr.1 range: (0/20 4/20)	0/20 mA
Point 1 (for 0 or 4 mA): (0 to full scale)	0.000 NTU
Point 2 (for 20 mA): (0 to full scale)	4.000 NTU
Output Nr.2 range: (0/20 4/20) (option 091.3711)	0/20 mA
Point 1 (for 0 or 4 mA): (0 to full scale)	0.000 NTU
Point 2 (for 20 mA): (0 to full scale)	4.000 NTU
Relay A function: (LO/HI)	LO
Relay B function: (LO/HI)	LO
Alarm on max. operating time of SA: (ON/OFF)	OFF
Max. operating time of SA: (0/60)	60 m
Alarm on max. operating time of SB: (ON/OFF)	OFF
Max. operating time of SB: (0/60)	60 m
Alarm on external light too high: (ON/OFF)	OFF
Delay: (0/99 sec.)	10.0 sec.
Alarm relay status: (ACT/DEA)	ACT
Cleaning function: (Auto/Manual/Disabled)	Disabled
Cleaning time: (0.5/60.0 sec.)	15.0 sec.
Holding time: (0.1/20.0 min.)	3.0 min
Access number: 0/999	0

GENERAL SPECIFICATIONS

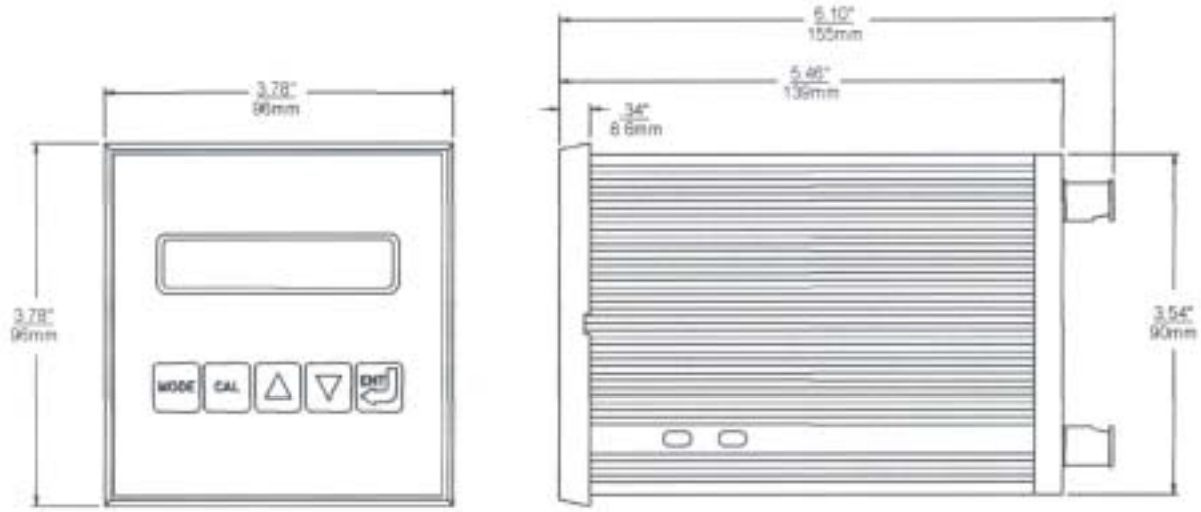
Alphanumeric display: 1 line x 16 characters
Acquisition time: 0/50°C
Humidity: 95% without condensation
Power supply: 110/220 volt ac +/- 10 % 50/60 Hz
Isolation: 4000 V between primary and secondary (IEC 348)
Power: 5 VA max.
Terminal block: extractable
Weight: 850 g
Dimensions: 96 x 96 x 155 mm. (DIN 43700)

2.3 PHYSICAL SPECIFICATIONS

The controller enclosure is designed for surface or panel mounting.
It consists of an anodized aluminium case built according to the standard DIN 43700, with an aluminium panel coated with scratch-proof and non-corrosive polycarbonate membrane.

Signal and power cable connections are made by using two special extractable terminal blocks placed in the back of the instrument.

The package is supplied complete with fixing clamps for panel-mounting.
A transparent front door SZ 7601 can be added to protect the unit.



FRONT VIEW

SIDE VIEW

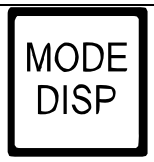
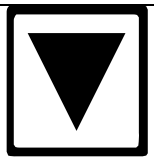
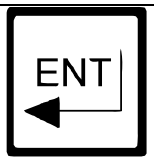
2.4 TU 810 TECHNICAL SPECIFICATIONS

Range	0/4000 NTU
Resolution	0,001 on scale 0/4.000 NTU 0,01 on scale 0/40.00 NTU 0,1 on scale 0/400.0 NTU 1 on scale 0/4000 NTU
Accuracy	± 5% of reading on 0/400 NTU ± 10% of reading on 400/4000 NTU
Response time	10 sec.
Measuring method	Nephelometric
Light source	LED IR 890 nm
Preamplifier	built-in
Power	± 12 Vdc
Ambient Temperature	0/50 °C
Sample Temperature	0/50 °C
Sample Pressure	6 Bar max. a 20 °C
Connector	7 pin IP 65
Body	PVC
O.Ring	NBR
Lens	Acrylic
Diameter	40 mm
Cable length	100 m max.

2.5 TU 910 TECHNICAL SPECIFICATIONS

Flow of sample	0.2/25 lt/min.
Temperature	0/50 °C
Temperature of sample	0/50 °C
Pressure of sample	6 Bar max. a 20 °C
Material	PVC
Fixing of probe	2 1/2" nut (DN50)
Fittings	1/4"
Tubing	PVC 4x6 mm l=5mt

3 SOFTWARE DESCRIPTION

KEY	FUNCTION
	- it allows the operator to go to the next Display - it allows to go back to the main Display. The eventual new parameter values will not be memorized
	- it allows the access of calibration sequences
	- it allows to increase the displayed parameters - it allows to choose between different functions
	- it allows to decrease the displayed parameters - it allows to choose between different functions
	- it allows to enter the selected data and to return to the main Display **D0**

3.1 READOUT SEQUENCES

Applying the power to the instrument the display will show the Ion selected for approximately 3 seconds, then will show the main display (DO).

Press MODE DISP to visualize the following Display:

D0	xx.xxNTU □AL ■ BL	Main display, relay status/functions
D1	xx.xxNTU	Turbidity value
D2	CHECK C.: xxx.x%	Check signal value
D3	SA xx.xxNTU *■ LO	Set-point A parameters
D4	SB xx.xxNTU *□ HI	Set-point B parameters
D5	AL x.x/xx.xNTU	Alarm parameters
D6	CLEANING OFF	Cleaning parameters
D7	01 xx.xmA/x.xxx	Analog output Nr.1/input values
D8	02 xx.xmA/x.xxx	Analog output Nr.2/input values
D9	Configuration	Configuration display
D10	TU7685 R2.00	Instrument P/N and software release

(D0) 

Concentration value,
set-point status/functions

xxx.xNTU Turbidity value
□ relay A deactivated
▬ relay A delayed
■ relay A activated
B relay B status

L minimum function (LO)
H maximum function (HI)

MESSAGE	FUNCTION
(>>>>)	over range
(M flashing)	manual operating mode
"CLEANING"	cleaning cycle in duty
"HOLDING "	unit in holding
(flashing values)	alarm condition
"ALARM: MEASURE"	measuring in alarm
"ALARM: SET A"	set point A in alarm
"ALARM: SET B"	set point B in alarm
"ALARM: DRY CELL"	dry cell
"ALARM: FOULING"	dirty probe
"ALARM: EXT.LIGHT"	external light too high

press to go to the next alarm message if the unit is in alarm

to activate the procedure of the manual/automatic mode selection

to go to

(D1) 

Turbidity display

xx.xx NTU: Turbidity value and measuring unit

to activate the calibration sequence

MODE DISP to go to

(D2) CHECK C.: xxx.x% Check signal display

CHECK C.: Check control signal
xxx.x%: Check signal value in %

CAL to activate the Check signal calibration sequence

MODE DISP to go to

(D3) SA xx.xxNTU *■ LO

SA: set-point A parameters
xxx.xNTU: set-point value
■: set-point A status (relay activated)
LO: selected function (minimum)
*: alarm function on set-point A is activated

CAL to activate the set-point value, hysteresis and delay time programming sequences

MODE DISP to go to

(D4) SB xx.xxNTU *□ HI Set-point B parameters

SB: set-point B parameters
xxx.xNTU: set-point value
□ : set-point B status (relay activated)
HI: selected function (maximum)
*: alarm function on set-point B is activated

CAL to activate the set-point value, hysteresis and delay time programming sequences

MODE DISP to go to

(D5) `AL x.x/xx.xNTU` Alarm parameters display

AL: Turbidity values alarm (NTU)
x.x: low alarm value
xxx.x: actual high alarm value

CAL to activate the alarm values programming sequences

MODE DISP to go to

(D6) `CLEANING OFF` Autoclean parameters display

OFF: autoclean disabled
(MANUAL CLEAN): manual cleaning
(AUTO CLEAN): automatic cleaning

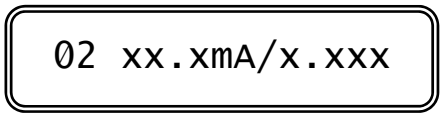
CAL to activate the parameters calibration

MODE DISP to go to

(D7) `01 xx.xmA/x.xxx` Analog output Nr.1/input values

01: analog output Nr.1
xx.xmA: analog output value (mA)
x.xx: input measuring value

MODE DISP to go to

(D8) 

Analog output Nr.2/input values
(only option 091.3711)

02: analog output Nr.2
xx.xmA: analog output value (mA)
x.xx: input measuring value

MODE DISP to go to

(D9) 

Configuration display

CAL to activate the programming sequences of keyboard lock/unlock, display contrast, visualization and modification of the instrument configuration parameters

MODE DISP to go to

(D10) 

Instrument P/N and software release

MODE DISP to go back to the main display (D0)

3.2 CALIBRATION SEQUENCES

The following procedures will be active whenever the instrument is not in the keyboard lock condition.

To unlock the keyboard follow the procedures mentioned in the "Configuration" chapter.

The following procedures allow the sensor calibration, the set-point and alarm parameters programming.

The sequence (1, 2, ...) helps the operator to perform the regular calibration sequence.

IMPORTANT NOTE: during the calibration procedure the microprocessor turn the unit to the main display if no keys have been pressed within 5 minutes.

3.2.1 Manual/automatic mode

Normally the instrument works in automatic mode.

Follow this procedure to change operating mode Automatic/Manual.

1. MODE DISP to go to

(D0) XX.XXNTU □ AL ■ BH

2. CAL to access the operating mode selection

CAL MODE: AUTO | CAL MODE:MANUAL

AUTO: automatic mode
MANUAL: manual mode

MODE DISP to go back to (DO)

3. ▲ ▼ to select the operating mode

4. ENT to confirm the selected operating mode and to go back to (DO)

MESSAGE	FUNCTION
UPDATE	the selection has been memorized The unit go back to (D0)

3.2.2 Zero and Sensitivity adjustment

Perform this calibration periodically and during the installation.

The unit will adjust the Zero on the 3 scales of the selected range. The operator must confirm the calibration value for each scale.

The Sensitivity adjustment is done by changing the Turbidity value on the display.

Note:

- Press first CAL to access the calibration sequence and the previous visualization of the value to be adjusted.
- Press CAL again to access the parameter adjustment.
- Press MODE DISP to exit from the procedure and to turn to (D1).

Zero adjustment

1. MODE DISP to go to

(D1) xx.xx NTU

2. CAL to access the calibration sequence

ZERO C.: xx.x % Zero visualization

ZERO C.: Zero calibration sequence
xx.x %: Zero value in % of the scale

ENT to end the Zero calibration and to go to the Sensitivity calibration

3. [CAL] to access the Zero calibration

CAL ZEROx: xx.x%

CAL ZERO: Zero calibration
x: measuring scale (1.2.3.)
xx.x%: Zero value of the probe in % of the scale

4. Choose one of the following alternatives:

[MODE DISP] to exit from the procedure and turn to (D1)

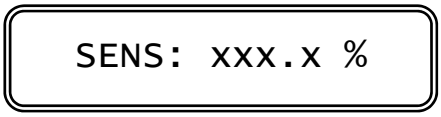
[ENT] enter the new Zero and to go to the next scale

[▲] + [▼] + [ENT] press 3 keys to turn to Factory calibration

MESSAGE	FUNCTION
UPDATE	data are memorized
z > 10% ON x	Zero > 10% of range x (from 1 to 3)

The unit turn to the Sensitivity calibration sequence.

Sensitivity adjustment



Sensitivity visualization

SENS: Sensitivity calibration sequence
xxx.x %: Sensitivity value of the probe

MODE DISP to exit from the procedure and to turn to (D1)

ENT to enter the value and to turn to (D1)

1. CAL to access the Sensitivity calibration

CAL S: Sensitivity calibration
xx.xxNTU: Turbidity value
(xx.xxSTD): Standard solution values as recognized by the unit.

Note
The unit try to recognize the value of the Standard solution in order to perform the calibration. If the solution is recognized the display will show the value followed by the message STD.

Standard solution automatically recognized by the unit:

2.000 NTU - 20.00 NTU - 200.0 NTU - 2000 NTU
5.000 PPM - 50.00 PPM - 500.0 PPM - 5000 PPM
5.000 mg/l - 50.00 mg/l - 500.0 mg/l - 5000 mg/l

MODE DISP to exit from the procedure and to turn to (D1)

▲ + ▼ + ENT press 3 keys to turn to the Factory calibration

2. ▲ ▼ insert the value if it is different of the recognized value

3. ENT to enter the new value and to turn to (D1)

MESSAGE	FUNCTION
SA xx.xxNTU *■ LO	data are memorized
SENS > 120.0%	Sensitivity> 120.0%
SENS < 80.0%	Sensitivity < 80.0%
NO UPDATE	data are not memorized

3.2.3 Check signal calibration

After the cleaning of the lens of the probe, we suggest to adjust the Check signal at the value 100%.

1. [MODE DISP] to go to

(D2) CHECK C.: xxx.x%

2. [CAL] to access the calibration sequence

CAL C.: xxx.x%

CAL C.: Check signal calibration sequence
xxx.x%: Sensitivity value of the Check sensor

[MODE DISP] to exit from the procedure and to go to (D2)

[▲] + [▼] + [ENT] press 3 keys to turn to Factory calibration

3. [CAL] to turn to 100 % the Sensitivity

4. ENT to enter the new value and to go to next step

MESSAGE	FUNCTION
UPDATE	data are memorized
SENS > 200.0%	Sensitivity > 200.0%
SENS < 50.0%	Sensitivity < 50.0%
NO UPDATE	data are not memorized

The unit will turn to this display:

FOULING: xx.x%

FOULING: dirt level
xx.x%: minimum alarm value for dirty probe

MODE DISP to exit from the procedure and turn to (D2)

5. ▲ ▼ to modify the alarm value

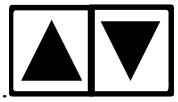
6. ENT to enter the new value and to turn to next step

The unit will turn to this display:

DRY CELL: xxx.x%

DRY CELL: cell without liquid
xxx.x%: maximum alarm value for the dry cell

MODE DISP to exit from the procedure and turn to (D2)

7.  to modify the alarm value

8. 

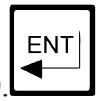
to enter the new value and to turn to next step

The unit will turn to this display:

DELAY: delay adjustment
xx.x s: actual value of the delay of the alarm

to exit from the procedure and turn to (D2)

9.  to modify the delay value

10. 

to enter the new value and to turn to (D2).

3.2.4 Set-point A/B calibration

For each set-point it is possible:

- to insert the set-point
- to insert the hysteresis
- to insert the delay time

1. MODE DISP to go to

(D3) SA xx.xxNTU *■ LO

(D4) SB xx.xxNTU *■ HI

The following procedure are suitable for both set-point A and B.

Set-point value

2. CAL to access the calibration sequences

CAL SA S: xx.xx

CAL SA S: set-point A calibration
xx.xx: set-point value

MODE DISP to exit from the procedure and to go back to (D3)/(D4)

3. ▲ ▼ to insert the set-point value

4. ENT to confirm and to go to the next step

CAL SA I: hysteresis calibration of Set-point A
x.xx: actual hysteresis value

MODE DISP to exit from the procedure and to go to (D3)/(D4)

5. ▲ ▼ to insert the hysteresis value

6. ENT to confirm and to go to the delay time insertion

x.xs actual delay time value

MODE DISP to exit from the procedure and to go to (D3)/(D4)

7. ▲ ▼ to insert the delay time value

8. ENT to confirm and to go back to (D3)/(D4)

The calibration is accepted

3.2.5 Alarm calibration

The following operations are possible:

- to select the min/max alarm value
- to select the delay time value

1. MODE DISP to go to

(D5)

CAL AL L: xx.xx

2. CAL to access the calibration sequences

CAL AL H: xx.xx

CAL AL L: low alarm calibration
xx.xx: actual low alarm value

MODE DISP to exit from the procedure and to go to (D5)

3. ▲ ▼ to insert the alarm value

4. ENT to confirm and to go to the high alarm insertion

AL x.x/xx.xNTU

CAL AL H: high alarm calibration
xx.xx: high alarm value

MODE DISP to exit from the procedure and to go to (D5)

5. ▲ ▼ to insert the alarm value

6. ENT to confirm and to go to the delay time selection

CAL AL D: xx.xs

CAL AL D: delay alarm calibration
x.xs: delay time value

MODE DISP to exit from the procedure and to go to (D5)

7. ▲ ▼ to insert the delay value

8. ENT to confirm and to go back to (D5)

" UPDATE "

Data are memorized

3.2.6 Cleaning function calibration

1. MODE DISP to go to

(D6)

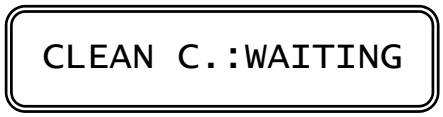
CLEANING OFF

Cleaning function display

2. CAL to access to the calibration sequence of the manual clean or the auto clean as selected in the Configuration

MANUAL CLEAN

The following Display will be shown:



CLEAN C: cleaning function calibration
WAITING: the unit is waiting for the new cycle
(START): the unit is ready to start a manual cleaning cycle

MODE DISP to exit from the procedure and turn to (D6)

3A. ▲ ▼ select START or WAITING

4A. ENT to enter the new parameter

- by confirming WAITING the unit will turn to (D6)

- by confirming START the unit will turn to (D0) and a cleaning cycle will start.

AUTO CLEAN

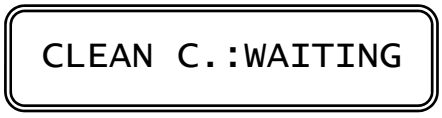
The following Display will be shown:

NEXT CYCLE: next cleaning cycle
xx.xh: Time to go to next cycle (hours)

MODE DISP to exit from the procedure and to turn to (D6)

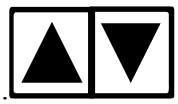
▲ + ▼ + ENT press 3 keys to reset the waiting time to next cycle

3B. ENT to visualize the waiting time to next cycle



WAITING: the unit is waiting for the new cleaning cycle
(START): the unit is ready to start a new cleaning cycle

MODE DISP to exit from the procedure and to turn to (D6)

4B.  select START or WAITING

5B. 

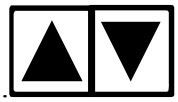
to enter the new parameter

- by confirming START the unit will turn to (D0) and a manual cleaning cycle will start.

- by confirming WAITING the unit will turn to the insertion of the repetition time of the cycle.

REPETITION: repetition of the cycle
xx.xh: repetition time (hours)

to exit from the procedure and to turn to (D6)

6B.  insert the repetition time

7B. 

to enter the new value and to turn to (D6)

3.3 CONFIGURATION

The following operations are possible:

- keyboard locked/unlocked selection
- display contrast selection
- access number insertion

1. 

to go to

(D9) 

2. 

to access the configuration sequences

3.3.1 Keyboard locked/unlocked

to go back to (D9)

3. 
to select one of the two options (locked/unlocked)

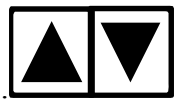
4. 

to confirm and to go to the next step

3.3.2 LCD display contrast

x: contrast level

MODE DISP to go back to (D9)

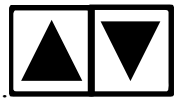
1.  to select the contrast from 0 to 7

2.  to confirm and to go to the access number insertion

3.3.3 Access number

0: access number request

MODE DISP to go back to (D9)

1.  to insert the access number (when keeping the key pressed the number will scroll with 3 speed level)

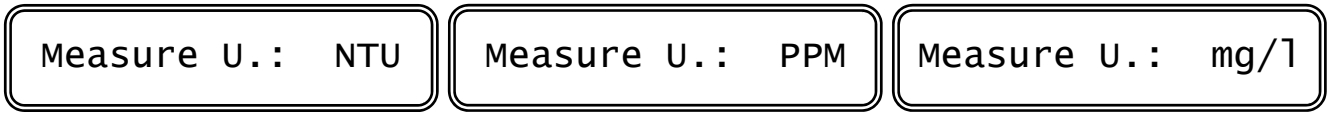
2.  to confirm and to proceed with the configuration

IMPORTANT NOTE: any number different from the right access code, will allow the visualization of the parameters and not the modification.
The following message will appear:

MESSAGE	**FUNCTION**
Cal inhibition	Configuration changes are inhibited

3.3.4 Measuring unit

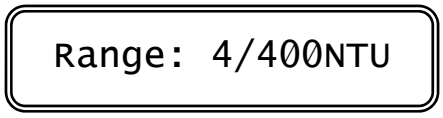
Select NTU, PPM or mg/l.



Active keys: MODE DISP - ▲ ▼ - ENT

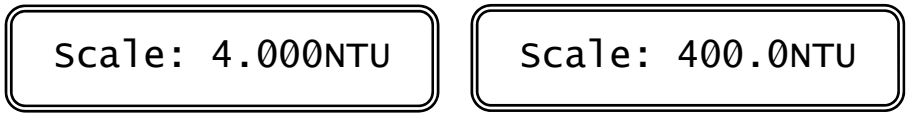
3.3.5 Measuring range

Select 4/400 NTU or 40/4000 NTU
(9/999 PPM mg/l , 99/9999 PPM mg/l).



Active keys: MODE DISP - ▲ ▼ - ENT

3.3.6 Measuring scale



Active keys: MODE DISP - ▲ ▼ - ENT

3.3.7 Autorange

Select autorange ON or OFF

Active keys: MODE DISP - ▲ ▼ - ENT

3.3.8 Software filter

Large s RT: response time for large signal fluctuations
xxxs: software filter value (sec.)

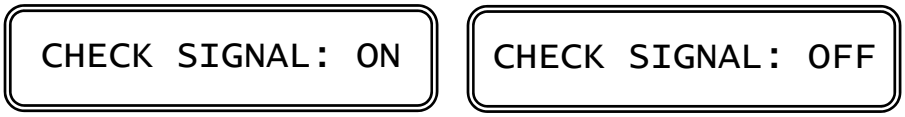
Active keys: MODE DISP - ▲ ▼ - ENT

Small s RT: response time for small signal fluctuations
xxxxs: response time value (sec.)

Active keys: MODE DISP - ▲ ▼ - ENT

3.3.9 Check signal

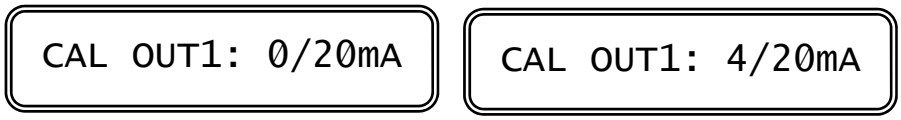
Select Check signal ON or OFF



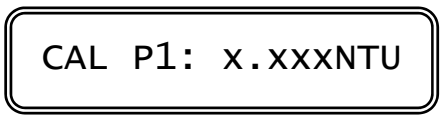
Active keys: MODE DISP - ▲ ▼ - ENT

3.3.10 Analog output n°1 range

Select 0/20 mA or 4/20 mA and the corresponding input range

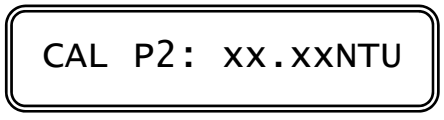


Active keys: MODE DISP - ▲ ▼ - ENT



CAL P1: beginning of the output range
x.xxNTU: measuring value corresponding to 0 (4) mA

Active keys: MODE DISP - ▲ ▼ - ENT



CAL P2: end of the output range
xx.xxNTU: measuring value corresponding to 20 mA

Active keys: MODE DISP - ▲ ▼ - ENT

Note: If the Turbidity value corresponding to P1 is higher than P2, the output will be reverse.

If the option 091.3711 is installed the unit will turn to the Output N° 2 calibration.

3.3.11 Analog output n°2 range

Select 0/20 mA or 4/20 mA and the corresponding input range

CAL OUT2: 0/20mA	CAL OUT2: 4/20mA

Active keys: MODE DISP - ▲ ▼ - ENT

CAL P1: x.xxxNTU

CAL P1: beginning of the output range
x.xxNTU: measuring value corresponding to 0 (4) mA

Active keys: MODE DISP - ▲ ▼ - ENT

CAL P2: xx.xxNTU

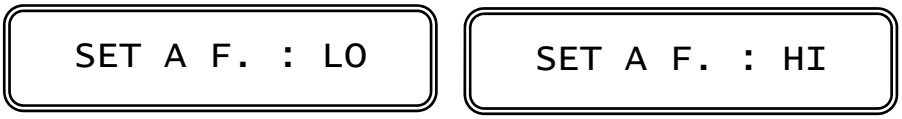
CAL P2: end of the output range
xx.xxNTU: measuring value corresponding to 20 mA

Active keys: MODE DISP - ▲ ▼ - ENT

Note: If the Turbidity value corresponding to P1 is higher than P2, the output will be reverse.

3.3.12 Set-point A function

Select the function minimum (LO) or maximum (HI).



Active keys MODE DISP - ▲ ▼ - ENT

3.3.13 Set-point B function

Select the function minimum (LO) or maximum (HI).

Active keys: MODE DISP - ▲ ▼ - ENT

3.3.14 Set-point A alarm

Select alarm ON or OFF.

Active keys: MODE DISP - ▲ ▼ - ENT

two alternatives:

- by selecting OFF the alarm function is not activated.
The unit goes to the next parameter calibration.

- by selecting ON the alarm function is activated.
(when the relay A will be active longer than the time selected in the following procedure).

TIME SET A: activation time of the Set-point A
xx m: actual time value (minutes)

Active keys: MODE DISP - ▲ ▼ - ENT

3.3.15 Set-point B alarm

Select alarm ON or OFF.

Active keys: MODE DISP - ▲ ▼ - ENT

two alternatives:

- by selecting OFF the alarm function is not activated.
The unit goes to the next parameter calibration.

- by selecting ON the alarm function is activated.
(when the relay B will be active longer than the time selected in the following procedure).

TIME SET B: activation time of the Set-point B
xx m: actual time value (minutes)

Active keys: MODE DISP - ▲ ▼ - ENT

3.3.16 External light alarm

Select the external light too high alarm ON OFF.

EXT.LIGHT AL: alarm on external light

Active keys: MODE DISP - ▲ ▼ - ENT

two alternatives

1A. "OFF" the unit will turn to the C relè contact.

or

1B. "ON". The unit will turn to the delay insertion.

2B. Insert the delay time of the alarm

DELAY: delay before relay activation
xx.xs: actual delay time (sec.)

Active keys: MODE DISP - ▲ ▼ - ENT

3.3.17 C relay contacts

Select ACT or DEA

ACT: active alarm = activated relay
DEA: active alarm = deactivated relay

Active keys: MODE DISP - ▲ ▼ - ENT

Note by selecting DEA it is necessary to modify an internal jumper.

3.3.18 Cleaning function

Select one of the following displays:

DISABLED: Cleaning function is Off
MANUAL: Manual clean
AUTO: Auto clean

Active keys: MODE DISP - ▲ ▼ - ENT

If Manual or Auto clean has been selected, the unit will turn to the following calibrations:

Cleaning time

CLEANING T: cleaning time insertion
15.0": actual time (seconds)

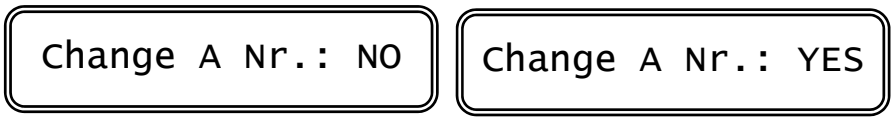
Active keys: MODE DISP - ▲ ▼ - ENT

Holding time

HOLDING T: holding time insertion
3.0': actual time (minutes)

Active keys: MODE DISP - ▲ ▼ - ENT

3.3.19 New access number



NO (YES): access number changing not required (required)

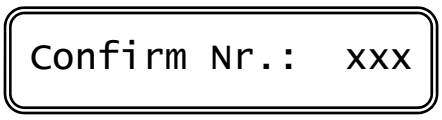
Active keys: MODE DISP - ▲ ▼ - ENT

- by selecting NO the unit will go to the Configuration display
- by selecting YES the unit will go to the following display:

xxx: actual access number

Active keys: MODE DISP - ▲ ▼ - ENT

The instrument ask the operator to insert again the new access number.



xxx: actual access number

Active keys: MODE DISP - ▲ ▼ - ENT

The double insertion of the new access number avoid mistakes of the new code.
As soon as the new number is entered the message **UPDATE** will appear.
Should the operator insert two different numbers, the instrument will not modify the access number and the message **NO UPDATE** will be shown.

ENT press several time the key to verify the selected parameters before leaving the Configuration routine.

MODE DISP press to exit from the Configuration menu.

4 INSTALLATION

4.1 HYDRAULIC INSTALLATION

Sample line

Run the sample line with the short dark tubing enclosed into the TU 910 package, to minimize the flow time to the instrument and the algae growth.

Take the sample from the middle of the process pipe line.
Sample taken from the bottom might ingest sediment from the pipe line.
Sample taken from the top might ingest air bubble from the pipe line.

The Turbidity probe and cell are both rated 6 Bar at 20 °C.

Measuring cell

The TU 910 measuring cell is suitable for the TU 810 Turbidity probe.
It is provided with two hose barb fittings for use with plastic tubing and with a wall fixing clamp.

A sample shutoff-flow control valve is provided with the outlet fitting, in order to control the flow rate from 0.1 to 3 lt/min.

Install the cell in horizontal position with the outlet fitting turned up, to avoid air bubble growth close to the probe.

Turbidity measurements at very low value need an installation with total absence of air bubble.

Note
The air bubble growth happens when the sample is under pressure and the flow cell discharges at atmospheric pressure.
To avoid this effect the installator must maintain the cell pressurized by reducing the output by the small tap of the cell.

WARNINGS:

Do not open completely the tap if the cell is under pressure to avoid the discharge of the liquid through the tap.

4.2 TU 810 PROBE INSTALLATION

Install the TU 810 probe into the TU 910 cell in order to get an accurate Turbidity measuring in the range 0/40 NTU.
Insert the probe into the horizontal cell and tighten the nut by hand.

The probe may be installed in vertical or horizontal position into a 2" T for measuring more than 40 NTU.

4.3 CONTROLLER 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 reflection of the internal pipe may be compensated by adjusting the zero.

4.4 ELECTRICAL INSTALLATION

Connections within the controller are made on detachable terminal strips located on the rear side (fig. 2).

Power and output-recorder connections are made at the 13 pin terminal strip, while input signal connections are made at the 12 pin terminal strip.

Connecting the power

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

(If 091.404 option is installed, connect 24 VAC to 1-3 terminals)

WARNINGS:

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

An internal device protects the unit against power overloads.
Disconnect the power and wait few minutes before powering again.

Connecting the TU 810 probe

Connect the probe to the instrument by means of the cable SZ 9481 with marked wires from 0 to 7 and provided with a connector type 2231520.

Cable wire nbr.	**TU 7685 Controller** terminal nbr.	**Description**
0	23	Shield
1	22	HI Turbidity signal
2	25	LO Turbidity signal
3	24	Check signal
4	19	Control LED
5	21	0
6	18	+ 12 V
7	17	- 12 V

Do not interrupt the cable. If necessary use only junction box with high isolation terminals.

Connecting a recorder

Connect to terminals 14-16 for the 1st channel output
Connect to terminals 15-16 for the 2nd channel output (091.3711 option)

- terminal 14 connect to the terminal (+) of the recorder N°1
- terminal 15 connect to the terminal (+) of the recorder N°2
- terminal 16 connect to the terminal (-) of the two recorder

Series connection is required for driving more loads having a total input Resistance lower than 600 ohm for each channel.

Connecting control relays

The output connections referred to set-point SA and set-point SB are made at terminal strip and they consist of two independent SPDT relays corresponding to Regulator A and Regulator B.

RELAY "A" SET-POINT "SA"

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

RELAY "B" SET-POINT "SB"

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

Connecting alarm relay

The output connection referred to alarm consists of SPST relay C.

RELAY "C" ALARM

terminal 12 marked C common contact
terminal 11 marked NO normal open contact

Connecting auto clean relay

The output connection referred to autoclean function consists of SPST relay D.

RELAY "D" AUTOCLEAN

terminal 12 marked C common contact
terminal 13 marked NO normal open contact

Arc suppressor

Install a suitable snubber between relay terminals if the relay activation causes interferences on the display. (B&C Electronics snubber SX101)

5 OPERATING THE SYSTEM

Checking

Before connecting the system to the power supply:

- 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 power voltage is correct.

Pre-operation check

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

The meter has a LCD display 1 indicating that the unit is on.

If Probe has been connected correctly, as described in the above sections, the system should function correctly needing only the start up and the parameters calibrations as described in the following section.

Quick start guide

The unit may be installed for the following purposes:

- measuring;
- measuring and regulation;
- measuring, regulation and recording.

The instrument is shipped with factory calibration and configuration suitable for the most popular applications.

For this reason the operation may require just the following steps:

measuring

1. Connect the probe to the meter.

2. Switching-on the meter will assume the factory calibration.
   The display will go to (D0) Display.

3. The meter is configured for 4/400 NTU range and 0/4.000 NTU scale.
   Go to the Configuration menu in order to select other range/scale.
   From (D0) press 9 times [MODE DISP] to start the Configuration sequence.

measuring and regulation

Add the following to the preceding operations:

1. Press [CAL] [▲] [ENT] to go to the manual operation.
   If the automatic mode is selected, go to the step 2.

2. A and B relay are configured as LOW (Minimum).
   Select HIGH (Maximum) if necessary.

3. Select the Set-point, the Hysteresis and the Delay of A and B relay.
   From (D0) press 3 times MODE DISP to start the Set-point A selection sequence.
   From (D0) press 4 times MODE DISP to start the Set-point B selection sequence.

4. The alarm on the activation time of A and B relay is deactivated.
   Activate this kind of alarm if necessary.

5. Select alarm values of min/max and delay if necessary.
   From (D0) press 5 times MODE DISP to start the alarm selection sequence.

measuring, regulation and recording

Add the following to the preceding operations:

1. Analog output is configured as NTU at 0/20 mA corresponding to the input scale.
   Select 4/20 mA and a suitable input span if necessary.

2. If option 091.3711 is installed, follow the step 1. for the second output.

Manual operation

When the instrument is programmed for the manual operation (see Calibration sequences) the flashing "M" will appear on the display.

Analog outputs and alarm relay will remain activated.

▲ while pressing the key, A relay will be activated.

▼ while pressing the key, B relay will be activated.

Check signal

Check signal is activated as default.
If the operator doesn't use this signal, must be deactivated into the Configuration.

From display (D0) press 2 times MODE DISP to start the sequence of the Sensitivity and Alarm calibration of the Check signal.

It is possible to calibrate the following:

- sensitivity calibration at 100%.
  It is suggested to calibrate 100% after the probe and cell cleaning;
- minimum alarm setting in order to detect the dirt on the lens of the probe;
- maximum alarm setting in order to detect the lack of water into the cell.

auto clean function

The unit may activate a manual or automatic cleaning cycle of the probe by external device.

This function must be activated into the Configuration together with the cleaning time and the holding time of the analog outputs.

The operator may also activate a manual cycle and select the repetition time of the automatic cleaning cycle during 24 hours.

From display (D0) press 6 times MODE DISP to start the manual cleaning sequence or to change the repetition time of the auto clean cycle.

alarm of too high external light

The unit may activate an alarm if too high external light condition occurs.

This function must be activated into the Configuration together with the delay of the alarm relay.

When this function is activated, the C alarm relay will consider this condition in addition.
Main display will send the message **"ALARM:EXT.LIGHT"** when this condition will occur.

The unit might go to the next scale if the auto range is activated.

6 CALIBRATION

The instrument and the probe are factory calibrated individually.
So the accuracy of the system is independent of the coupling between probe and unit.

Perform the following calibration procedure periodically in order to maintain the requested accuracy.

Zero calibration

The unit measures continuously the ambient light, giving an alarm when it is too high.

Therefore the zero calibration is not necessary for measuring values higher than 40 NTU.

When using the scale 4.000 NTU with readout smaller than 0.1 NTU, the operator may effect the zero calibration to compensate the residual Turbidity value due to the light diffusion by water free of particles.

This residual value, by using the TU 910 cell is estimated 0.015 NTU.

The operator may use the instrument without calibrating the zero and by taking in account this residual value or he may perform the zero calibration.

Sensitivity calibration

It is suggested to check this calibration every month and to calibrate the unit every three months, depending of the requested accuracy.

The checking and the calibration may be effected in two ways:

- by means of Formazine standard solutions

- by means of grab sample analysis with a properly calibrated laboratory Turbidity meter

6.1 CALIBRATION WITH FORMAZINE

Before calibrating with Formazine standard solutions it is suggested to clean the cell and the optical window of the probe.

1) Position the cell in vertically.

2) Close or interconnect with a short pipe the two hose fittings.

3) Gently stir the Formazine bottle and pour slowly the solution into the cell, avoiding air bubble production.

4) Insert the probe into the cell.

5) Allow to stand until the reading stabilizes.

6) Calibrate the unit by following the procedure of the chapter "Calibration sequences".

7) Clean the cell with pure water.

8) Reinstall the cell and the probe in the process.

Note

Calibrate by using Formazine standards not lower than 20 NTU because of the difficulty to achieve the accuracy required to prepare a low Turbidity standard.

Because of the linearity of the instrument, accuracy even at very low Turbidity levels is assured by calibrating at 20 NTU.

6.2 CALIBRATION WITH COMPARISON METHOD

This method transfers the calibration of a laboratory instrument to the on-line unit.

Before performing this calibration, make sure the laboratory Turbidity meter to be used is properly calibrated.

Do not use this method when the sample Turbidity is less than 2 NTU.

Take a grab sample and immediately measure with the Turbidity meter.

Go back to the unit and calibrate the readout according to the laboratory result.

7 PREVENTIVE MANTENIANCE

Controller

Quality components are used to give the controller a high reliability.

The frequency of such maintenance depends on the nature of each particular application.

As in any electronic equipment, the mechanical components, such as switches, relays and connectors, are the most subject to damage.

Probe

The measuring window of the probe must be inspected and cleaned periodically.

The frequency is depending of the application and the accuracy requested for the system.

Clean the probe before the calibration, by removing the dirt from the body with a soft paper filter, avoiding to scratch the window surface.

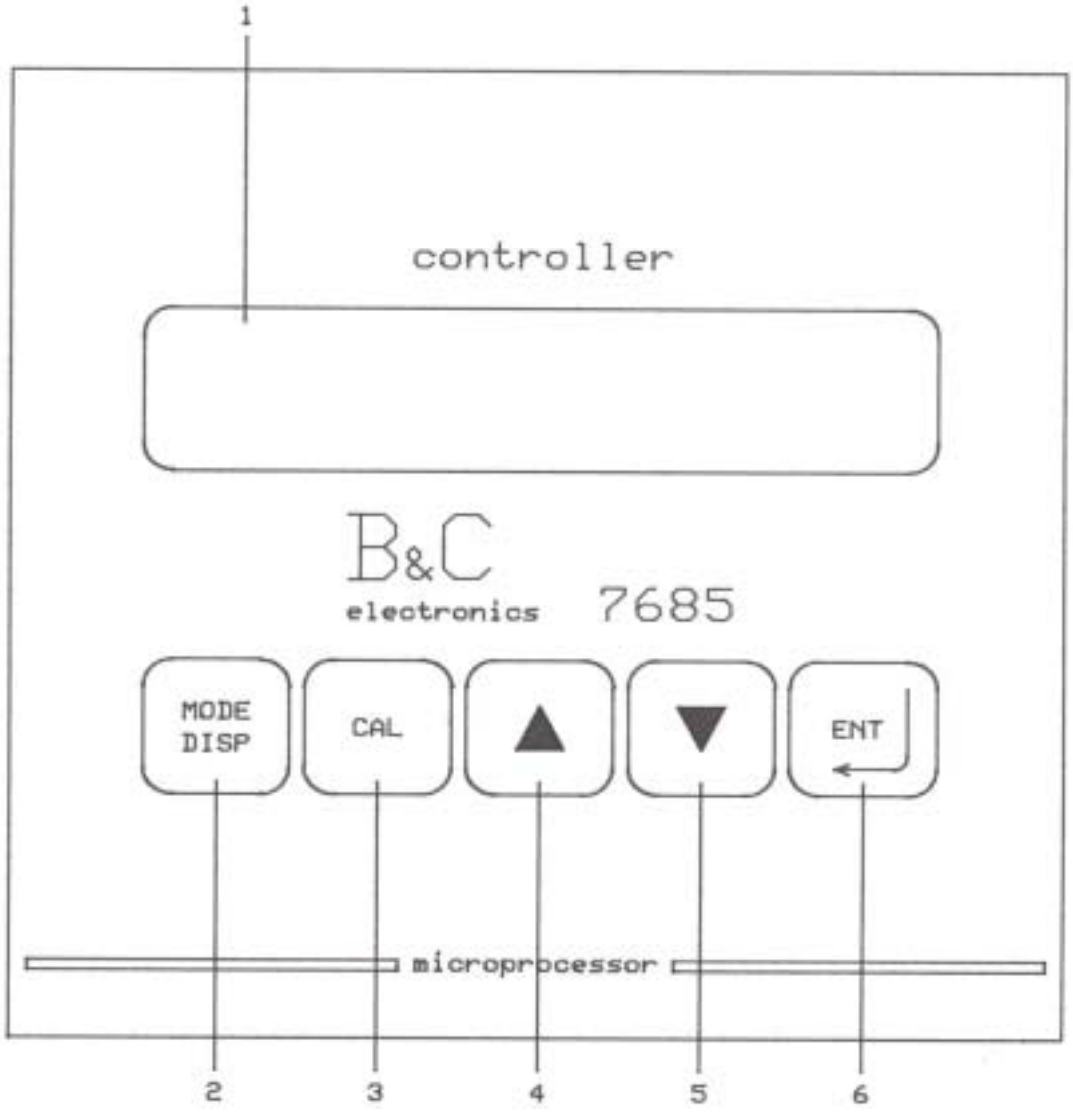
It is possible to install an auto clean system by using the cleaning function of the controller.

Cell

Clean the cell in the same way as the probe.

In order to clean properly, remove the disk from the bottom of the cell and clean carefully the internal part of the cell.

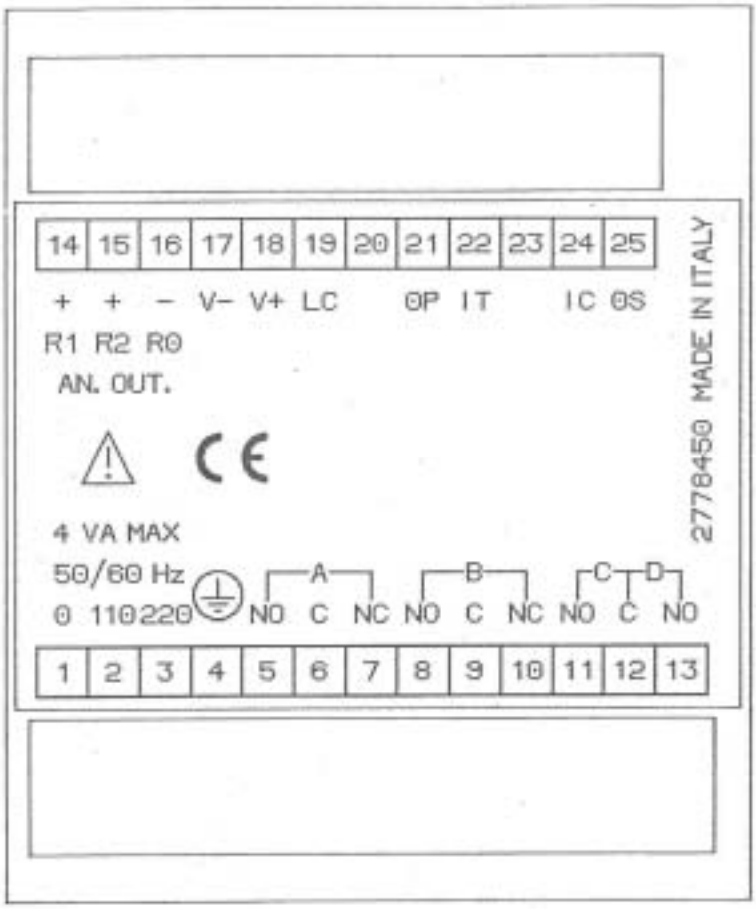
DIGITAL CONTROLLER



1. DISPLAY
2. MODE-DISPLAY KEY
3. CALIBRATION KEY
4. INCREASE KEY
5. DECREASE KEY
6. ENTER KEY

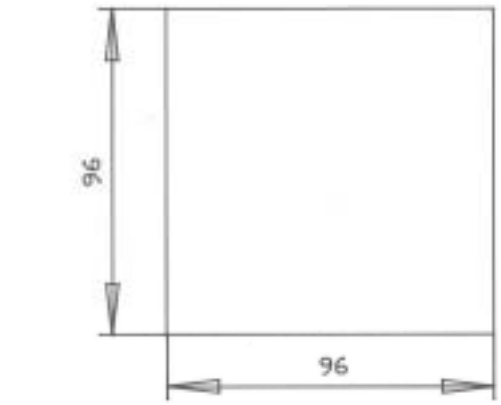
FIG. 1

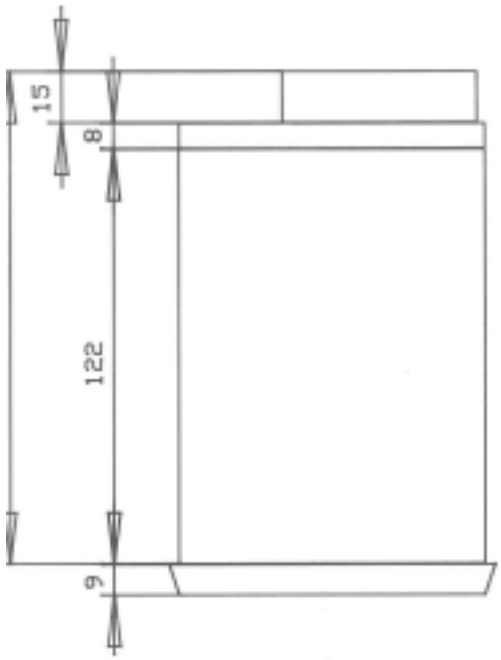
TU 7685
REAR PANEL CONNECTIONS



1.2.	110 V. Power supply
1.3.	220 V. Power supply
4.	Ground (power)
5.6.	A Relay N.O. contacts
6.7.	B Relay N.C. contacts
8.9	B Relay N.O. contacts
9.10.	B Relay N.C. contacts
11.12.	C Relay N.O. contacts (alarm)
12.13.	D Relay N.O. contacts (cleaning)
14.	Recorder output 1 (+)
15.	Recorder output 2 (+) (option)
16.	Recorder output 1 and 2 (-)
17.18.19.21.	
22.23.24.25.	Connection to TU819 – TU820
23.24.25.	Temperature sensor input

CONTENITORE DIN 43700 MOD. 7685
BOX





PIANO DI FORATURA
DRILL PLAN

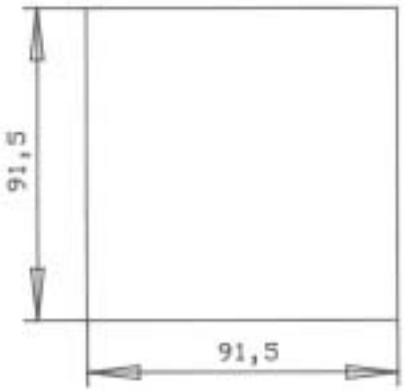


FIG. 3