NIEUWKOOP

METEN.NL

USER MANUAL

EC3005

EC CONTROLLER

TO MEASURE = TO KNOW

Scale : 0/1999 µS
Power supply : 110/220 Vac

Cod. 28003361
Rev. C – 02/19
Valid from S/N 42401

INDEX

1 GENERAL WARNINGS AND INFORMATION FOR ALL USERS

1.1 WARRANTY

This product is guaranteed for all manufacturing defects.
Please take a look at the terms and conditions described on the Warranty certificate at the end of the manual.

1.2 AFTER SALES SERVICE

Nieuwkoop B.V./B&C offers to all of its Customers the following services:
- a free of charge technical assistance over the phone for problems regarding installation, calibration and regular maintenance;
- a repairing service in our Aalsmeer (Netherlands) headquarter for all types of damages, calibration or for a scheduled maintenance.

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

1.3 CE MARKING

This instrument is manufactured according to the following European Community directives:

• 2011/65/EU "Restriction of the use of certain hazardous substances in electrical and electronic equipment"
• 2014/35/EU "Low Voltage" LV
• 2014/30/EU "Electromagnetic compatibility" EMC

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

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

1.4 SAFETY WARNINGS

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

2 GENERAL

This manual applies to the C 3645 digital controllers DIN Rail housing.

It explains the purpose of the equipment, describes the components of the chain and the procedures for installing the equipment, operating it and calibrating it. Some suggestions are also given for its maintenance.

3 FUNCTIONAL DESCRIPTION

This system provides a digital readout of the Conductivity of aqueous solutions.

Automatic Temperature Compensation is employed to provide highly accurate Conductivity measurements over the entire ranges of E.C. and Temperature.

A basic Conductivity monitoring system consists of two elements: a monitor unit, and a probe or cell.

The system can be expanded by adding accessories for field applications: recorders, secondary regulators, proportional regulators and Temperature probes.

The controller contains electronic circuits to control the operation of the entire system. It provides a digital readout of Conductivity on a LCD display.

There is included an internal circuit for controlling an alarm or valve, pump etc.

The Set-point is programmed by a front-panel control 3 and it is visualized by pushing the button 4 .

Red Led 2 on the panel is lighted when the internal relay is activated. The relay action is selected min/max by means of the dip switch S1 marked " m M ".

The relay action may be delayed 0/5 sec. by means of the trimmer R14 marked " SET DEL ".

The controller provides an output of 4/20 mA proportional to the meter reading, for driving a recorder, remote readout or regulators having a non-grounded input.

Zero is adjusted by trimmer 5 and Slope by trimmer 6 on the front panel.

4 PHYSICAL DESCRIPTION

The controller enclosure is designed for DIN Rail mounting.
It consists of a plastic case with front panel coated by a polycarbonate membrane, to ensure the maximum anticorrosion characteristics.
However mounting in a splash proof board is suggested for field applications.
Fig. 3 shows the physical details and dimensions.
Connections to power supply, loads, recorder, RTD, electrodes or probe are carried out by means of extractable terminal blocks.

5 SPECIFICATIONS

Display	LCD
Input	from 2-electrodes E.C. cell from 4-electrodes E.C. cell from NTC 10 K
Output	4/20 mA dc, non-isolated, 300 Ω max.
Scale	0/1999 µS adjustable 199.9 µS to 19.99 mS
Temp. comp. range	automatic 0/80 °C
Temp. reference	20 °C
Temp. comp. coeff.	2%/°C with NTC 10 K
Zero	adjustment ± 15%
Slope	adjustment ± 20%
Temperature	0/50 °C
Humidity	95% without condensate
Regulator	± 0.25% hysteresis (others as requested)
Switching time	< 0.5 s
Relay delay	0/40 s
Relay contacts	5A 220V SPDT resistive load
Voltage	110/220 Vac ± 10% 50/60 Hz
Power	3 VA max
Weight	265 g
Dimensions	105 x 95 x 58 mm (DIN Rail housing)
Terminal blocks	extractable

6 PHYSICAL INSTALLATION

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

For a distance between E.C. sensor and controller greater than cell's cable an extension cable is suggested by means of a waterproof box.

The enclosure is designed for DIN Rail mounting.
It should be mounted in a box protected from the possibility of damage or excessive moisture or corrosive fumes.

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

It must meet the following requirements:

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

This cable too must not be interrupted on overall length.

If interruption is necessary, the extension cable must be fastened to the high insulation terminal strip.

7 ELECTRICAL INSTALLATION

The electrical installation consists of:

- connecting the power supply to the meter;
- connecting the E.C. to the meter;
- connecting alarm, pump, valve if necessary;
- connecting the monitor output to the recorder or similar devices if required;
- connecting other optional accessories (RTD P.I.D. regulators).

All connections within the controller are made on terminal block.

7.1 CONNECTING THE POWER

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

WARNINGS

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

7.2 CONNECTING THE 2-ELECTRODES CELL

Cell cabling is a critical part of the whole system.

- Use a low noise cable on overall length between sensor and input terminals of the meter;
- avoid interruption on the cable if a coax connector and a high insulation terminal block are not available;
- keep the cable away from power wires on the overall length;
- connect the cell between terminals 15 – 18.

7.3 CONNECTING THE 4-ELECTRODES CELL

Connect to the terminals 15 - 18 the field-generator electrodes.
Connect to the terminals 16 - 17 the measuring electrodes.
Refer to the instruction manual of the specific 4-electrodes cell installed.

7.4 CONNECTING ALARMS, PUMPS, VALVES

The output connections are made at terminal block and they consist of SPDT relay contacts.

Terminal 6 marked NO : normal open contact.
Terminal 7 marked C : common contact.
Terminal 8 marked NC : normal closed contact.

To provide an ac-line voltage at the relay commons, connect the ac power phase to the terminal 7 marked C.
Connect one side of an external line-operated device to the terminal NO/NC according to the requirements of the device, and connect the other side of the device to the ac power neutral wire.

ATTENTION

Install a fuse in order to protect the relay contacts.
The device must be powered by an external independent line following the above procedure.
In order to avoid interferences, when necessary, insert the RC anti-spark by connecting the terminal 5 marked "X" to the terminal 6 or 8 connected with the load.

7.5 CONNECTING A RECORDER

A current output for a remote recorder or P.I.D. regulator is available on terminals 11-12.
Connect the recorder "-" to terminal "12" and connect the recorder "+" to terminal "11".
A series connection is required for driving more loads having a total input resistance lower than 300 Ω. Output drives ground-isolated loads only.

7.6 CONNECTING THE NTC

The model C 3645 has the Automatic Temperature Compensation carried out by means of a NTC 10 K.
The Temperature sensor has to be installed in the same solution being measured, close to the electrode in the pipe-line or in the tank.

ATTENTION

Before connecting NTC between the terminals 13-14 as per diagram (to insert the Automatic Temperature Compensation), it's necessary to remove the Resistance from the same terminals in order to avoid errors in the measurement.
Reconnect this Resistance when a non-compensated operation is necessary.

8 CHECKING

Before connecting the system to the power supply:

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

9 OPERATING THE SYSTEM

9.1 PRE-OPERATION CHECK

The system's controls and indicators are all located on the front panel (see Fig. 1). The meter has an LCD display 1 that indicates that the unit is on.

Push button 4 and rotate the control 3. The display will show the set point value.

The regulator has a set-point check by red LED 2 which are part of the circuitry that powers the relay.

When the monitored value is above the set-point value, the LED is alight and the corresponding relay is activated.
If necessary invert the relay action by means of the dip-switch "M m".

Check the correct switching of the relays by rotating the set point control higher or lower than the value simulated, watching the LED 2.

Insert the delay action by means of the trimmer "SET DEL" if necessary. Insert
the RC anti-spark if necessary.

The circuit boards of the controllers are adjusted at the factory.
If sensors and probes have been connected correctly, as described in the above sections, the system should function correctly needing only the zero adjustment to compensate the eventual effect of the cable.

<u>WARNING:</u>

Faults due to bad connections while connecting are not covered by the guarantee.

9.2 ELECTRIC CALIBRATION

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

- connect a Conductivity simulator to terminals 15-18 of the controller
- simulate Conductivity values over the entire scale of the meter
- adjust "zero" and "slope" by the trimmer 5 and 6 on the front panel

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

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

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

10 NORMAL OPERATION

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

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

10.1 CELL CONSTANT ADAPTING

If the cell constant value is not exactly K = 1.00 (see the value marked on the cell) the meter must be calibrated in order to adapt the meter to the cell. The calibration is obtained by means of S.C.S. (Standard Conductivity Solution), adjusting the sensitivity trimmer 5 marked "SENS".
If necessary adjust the coarse sensitivity trimmer (hole on the opposite side of terminal block). The same trimmer allows the unit to operate in the scale 199.9 µS to 19.99 mS.

10.2 CHEMICAL CALIBRATION OF THE CONDUCTIVITY

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

- prepare a standard KCl solution (see tables)
- operate as for non Temperature compensated measuring
- immerse the cell into solution and adjust the fine sensitivity trimmer 6 or the coarse sensitivity trimmer on the rear
- the accuracy of the calibration depends on the purity of the water and the purity of the dissolved salt

STANDARD CONDUCTIVITY SOLUTIONS

Table

KCL CONCENTRATION	**1 N**	**0.1 N**	**0.01 N**
Temperature °C			
0	65.410	7.150	0.776
5	74.140	8.220	0.896
10	83.190	9.330	1.020
15	92.520	10.480	1.147
16	94.410	10.720	1.173
17	96.310	10.950	1.199
18	98.220	11.190	1.225
19	100.140	11.430	1.251
20	102.070	11.670	1.278
21	104.000	11.910	1.305
22	105.940	12.150	1.332
23	107.890	12.390	1.359
24	109.840	12.640	1.386
25	111.800	12.880	1.413
26	113.770	13.130	*
27	115.740	13.370	*
28	*	13.620	*
29	*	13.870	*
30	*	14.120	*

KCl normal solution:

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

Values in mS (millimhos/cm).

Low Conductivity standard solutions are not steady.

11 PREVENTIVE MAINTENANCE

11.1 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, potentiometers and connectors, are the most subject to damage.

- Check for damage of the electrolytic capacitors if the meter is exposed to temperatures above 60 °C;
- check for damage in all the electronic components if the meter is subjected to excessive voltage;
- check for damage of the electronic and mechanical components if the meter is dropped;
- repeat the pre-operation check periodically;
- check that all the connections are free from moisture and contamination.

WARNING:

Disconnect the power supply to the monitor before performing the following procedures:

- Use moisture free air and blow out the interior of the case and terminal board connections as necessary.
- Inspect the printed circuit boards for dirt and corrosion; clean as necessary and blow dry.
- Tighten all the terminal-board connections and mounting hardware.
- Replace the front panel circuit board or the base circuit board.

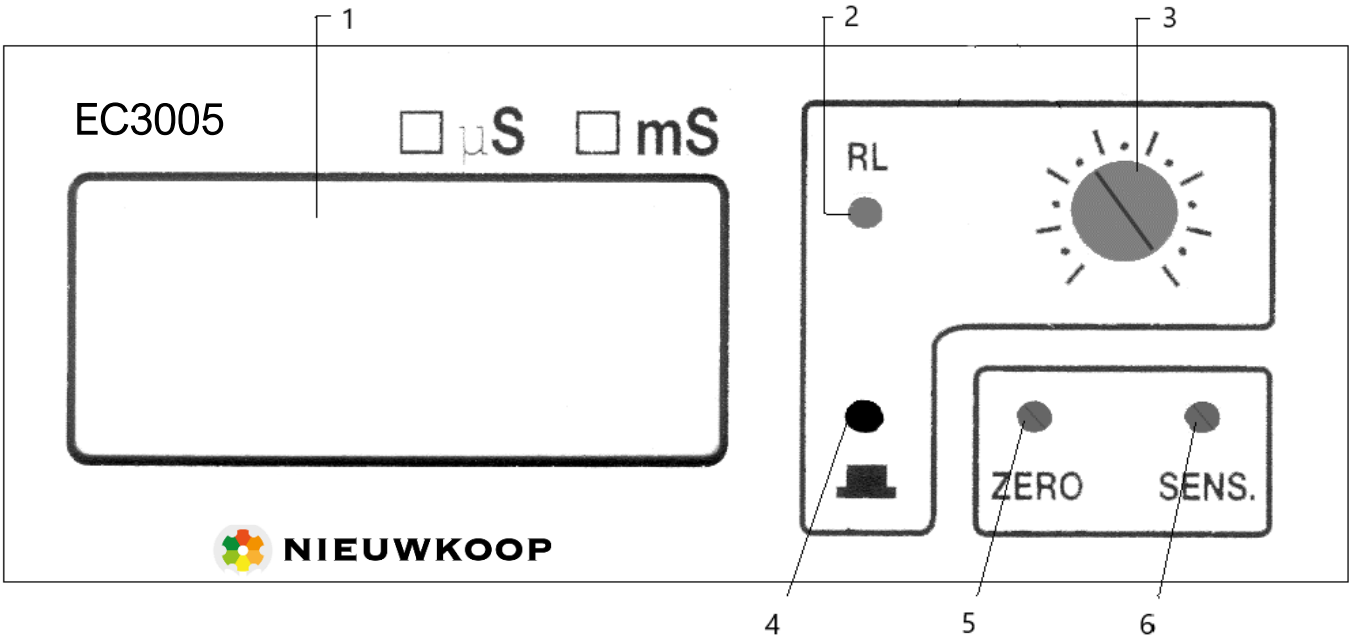
11.2 SENSOR

The state of the cell's surface is critical for the normal operation of the system and should be inspected more frequently when using alkaline liquids, oil and grease containing water, and bio-applications.

12 TROUBLESHOOTING GUIDE

Neither LCD lit nor meter reading	line not connected incorrect power wiring	check power check wiring
No meter reading, but LCD light	I.C. failure inside connector	replace I.C. driver replace circ. board
Meter reading too high/low	cell failure; meter uncalibrated	clean sensor calibrate with S.C.S.
Meter reading does not change	cell damage; short circuit	sensor replacement check cable
Alarm circuit does not operate, meter reading OK	relay contacts; circuit failure	check wiring/loads replace base c.board return to factory
Slope not sufficient	cell damage; temp. compensation	sensor replacement check ATC sensor
Recorder does not operate	recorder not connected output circuits damaged	check wiring replace base c.board

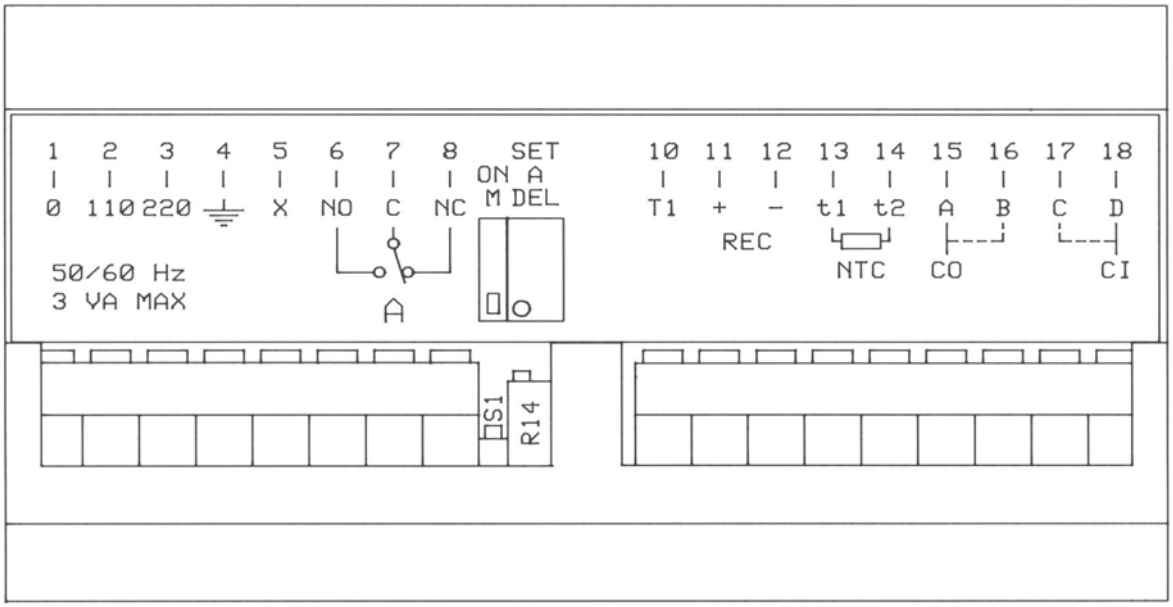
FRONT PANEL



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

Fig. 1

REAR PANEL CONNECTIONS



1.2	110 V power supply
1.3	220 V power supply
4.	Ground (power)
5.	RC Antispark
6.7	Relay A N.O. contacts
7.8	Relay A N.C. contacts
10.	Ground (signal)
11.	Recorder output (+)
12.	Recorder output (-)
13.14	NTC input (A.T.C.)
15.18	Cell input (2 wire)
15.16.17.18	Cell input (4 wire)
R14	Relay A delaying control
S1	Relay A inverting function switch

Fig. 2

DIMENSIONS
(measures in mm)

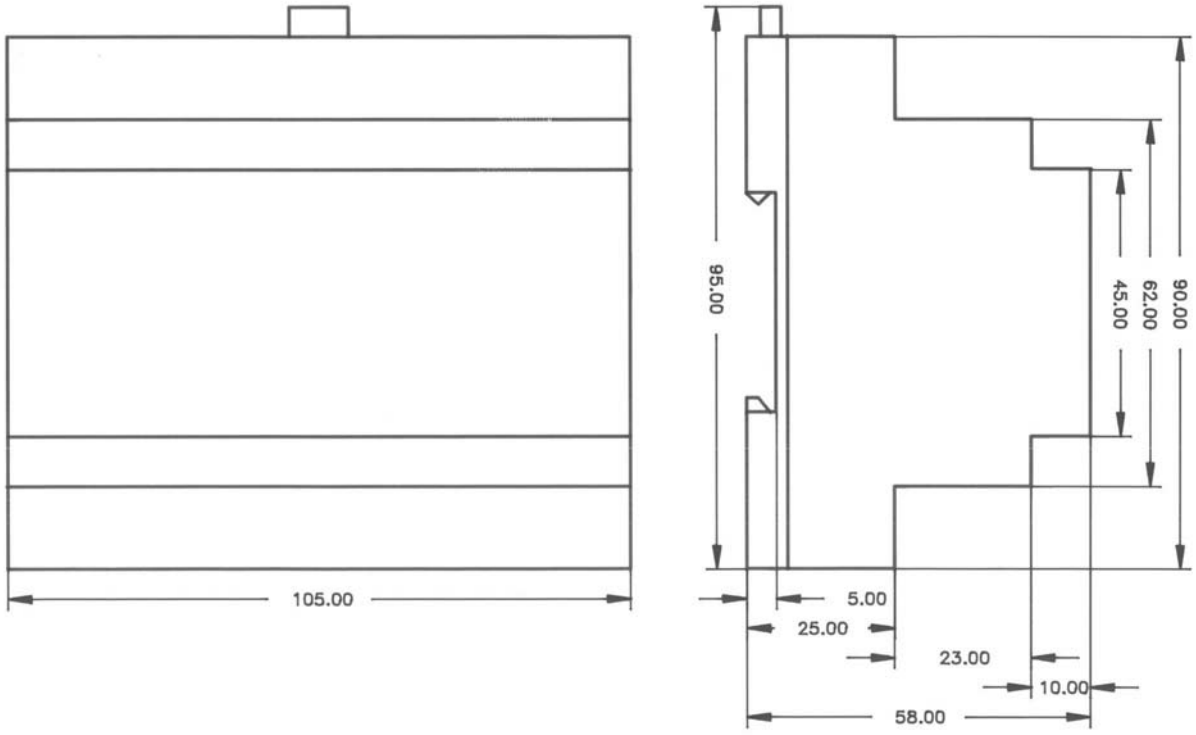


Fig. 3

TO MEASURE = TO KNOW

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