STEIEL

Colorimetric Unit

MCO14_EVO (v.0320)

Modbus

TECHNICAL MANUAL

CE

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Certified Company, according to UNI EN ISO 9001 standards

WARNINGS

This manual is dedicated to the technical personnel responsible of the installation, management and maintenance of the plants. The manufacturer assumes no responsibility for damages or malfunctions occurring after intervention by non-authorized personnel, or not compliant with the prescribed instructions.

Before performing any maintenance or repair action, ensure that the system is electrically and hydraulically insulated.

Dispose of waste material and consumables accordingly with local regulations.

Warning! Before performing any kind of start-up operation on the system, carefully read the HSDS of the reagents to be used, in order to define the proper behaviours to be followed, and the personal safety equipment to be worn.

The use of non-original reagents STEIEL prejudices the proper functioning of the colorimetric unit and invalidates any warranty!

How to ship the instrument

To send back the device for repairing or calibration purposes, proceed as follows:

- Fill the module “REPAIR REQUEST AND DECONTAMINATION DECLARATION” supplied with this manual, and include it in the transport documentation.
- Clean the device properly, to eliminate any hazardous residuals.

The manufacturer can modify the instrument or the technical manual without advanced notice.

Warranty

All STEIEL products are warranted for a period of 12 months from the delivery date.

Warranty is not valid if all instructions of installation, maintenance and use, are not strictly followed by the user. Local regulations and applicable standards have also to be followed.

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PACKING LIST

The **MCO14** control unit is supplied complete with:
1) EURO2010-pH, glass-body pH electrode
2) EURO2110-RX/Pt, glass-body ORP electrode with platinum sensor
3) PT100S temperature sensor (for model MCO14/5_EVO)
4) Screws and wall plugs for installation
5) Instruction manual

INTRODUCTION AND MAIN TECHNICAL NOTES

MCO14 is a rational and accurate system for managing analyses and controlling the main parameters in the pool waters.
The unit can monitor pH, redox and temperature levels using proper probes, and it is also equipped with a colorimetric control system of free and total (combined) chlorine. This kind of analysis is more precise and reliable than amperometric measurements, because readings are performed by an optical system, which avoids errors due to temperature variations or chlorination agent (hypochlorite, isocyanurate, etc.).
This device features user-friendly configuration and calibrations menus, 2-row LCD, digital and analogic outputs completely settable through software, and a serial port for communication with PC or modem for remote control. Inputs can be factory set according to customer requests.
Other important technical characteristics include:
1) Multi-language interface
2) Five measure inputs; if both free and total chlorine analyses are performed, the measures become six, because the combined chlorine is calculated as the difference between total and free chlorine
3) Digital outputs: relays configurable as set-point, max. or min. alarms, timed proportional control (PWM), pulse proportional control (PFM), scheduled adjustments
4) Possibility to have a low voltage output (24V~), for driving small dosing pumps or solenoid valves without adding transformers and with safety voltage; max 20VA of power consumption (to be requested upon order)
5) Analog outputs for exporting measurement values to external devices; with galvanic separation
6) OFF input for disabling control relays (to be connected to the filter pump contactor)
7) FLOW input for monitoring the water flow to the equipment
8) IMP input to freeze measurements when the plant is not working, or for synchronization with automatic cleaning
9) OK output for remote indication of correct operations
10) Alarms and errors (diagnostic) directly shown on the display
11) Date and time label always displayed, even in case of power failure
12) Configuration and calibration data saved on non-volatile memory for at least 10 years
13) Data log downloadable through serial line
14) RS232C or RS485 serial line (optional, to be specified upon order), with galvanic separation. Compatible with our standard (ASCII with no protocol) or with Modbus RTU protocol.

OPERATING PRINCIPLE OF COLORIMETER

Water to be analysed comes from the inlet hose, and remains at the constant level determined by the spillway. As the analysis is requested, the water goes through the solenoid valve to the measurement cell. First a turbidity reading is performed, and the zero calibration is done. Then the two reagents are injected and properly mixed. If water contains free chlorine, the reagents develop a red colour with an intensity depending on the chlorine concentration. The detector reads the colour and transmits the information to the microprocessor, that gives the chlorine concentration in ppm units. This value is stored till the next analysis cycle. If total chlorine analysis has to be also performed, the cycle continues by adding and mixing the third reagent, and measuring the new colour to obtain the total chlorine concentration in ppm units. After the cycle is completed, the solenoid valve is open to discharge the analysed water, and allow the measurement cell cleaning.

TECHNICAL DATA

Standard Configuration:

In1 (meas1) = pH
In2 (meas2) = ORP (redox)
In3 (meas3) = not used
In4 (meas4) = free chlorine with DPD1 colorimetric analysis (5 ppm FS)
In5 (meas5) = temperature
(meas6) = total chlorine with DPD3 colorimetric analysis (5 ppm FS)
(meas7) = combined chlorine (calculated as Meas6 – Meas4)

Input Specifications

Cl_{2F}	Free Chlorine: 0.00 … 5.00 ppm Cl_2 – with colorimetric method (resolution 0.01 ppm Cl_2 ; precision better than ±0.05 ppm up to 1 ppm Cl_2, ±0.15 ppm from 1 to 2 ppm, ±0.25 ppm from 2 to 5 ppm)
Cl_{2T}	Total Chlorine: 0 … 2.00 ppm Cl_2 – with colorimetric method (optional) (precision better than ±0.02 ppm, repeatability better than ± 0.01 ppm)
Cl_{2C}	Combine Chlorine: value obtained from the difference Cl_{2T} - Cl_2
pH	0.00 … 14.00 pH; input impedance > 10^12 Ohm (precision better than ±0.02 pH, repeatability better than ± 0.01 pH)
ORP	–1000 … +1000 mV; input impedance > 10^12 Ohm (precision better than ± 0.02 mV, repeatability better than ± 0.01 mV)
Temperature	0.0 … +100.0 °C; input from Pt100 sensor (Pt1000 upon request) (precision better than ±0.3°C, repeatability better than ±0.2°C)

Note: Precision and repeatability data refer to the electronic unit only, and do not take into account the measurement error of the sensors

Display	Two-row (x 16 characters) alphanumeric LCD, with backlight
Power Supply	230 V~ ±10%, 50-60 Hz, 45 VA (110 or 24 V~, 50-60 Hz upon request)
Hydraulic Supply	approx. 50-60 l/h, inlet on hose holder with OD 12 mm; overflow and outlet of analysed water (to be disposed) on hose holders with OD 22 mm (each analysis requires approx. 1 litre of disposable water)
Reagent Tank Volume	1 litre for reagents 1 and 2; 0.5 l for reagent 3 (each analysis uses approx. 0.1 ml of reagents 1 and 2)
Autonomy	With full tanks, at least 10000 analyses can be performed; with sampling time of 10 minutes, the autonomy is 100000 minutes, i.e. 1667 hours, equivalent to 69 days. Anyway, it is not recommended to leave the reagents inside the colorimeter for more than 2 months, to avoid alterations, especially if the device is installed in a warm environment.
Relay Outputs	available on removable terminal blocks; 4 control relays (K1, K2, K4, K5); can be driven by any of the five measurements; 1 alarm relay (K3); normally energized, it deactivates upon anomalies; can be also set as NO; K1, K2 and K3 have contact load max 250V~, 3A resistive, while K4 and K5 have load max 24 V (V~ or V-), 3A

Standard factory configuration (unless otherwise specified by the customer):

- K1 and K2 = output 230 V~
- K3 and K5 = voltage-free contact
- K4 = output 24 V~

Alternative configurations (to be requested upon order):

- K1, K2, K3 = contact output or 230 V~
- K4 and K5 = contact or voltage output (24 V~, max 20 VA) for direct driving of solenoid valves (e.g. tablet feeder)
  K4 and K5 can also be configured as SSR output compatible with the pulse input of dosing pumps. This special configuration must be requested upon order.

***Note**: It is advisable to always check the relay configuration marked on the board, near the related terminals.*

Current Outputs

2 outputs, 0-20 or 4-20 mA, selectable for any measurement (selection through software), with galvanic separation from inputs and microprocessor; max load: 700 Ohm; max error: 0.2% FS

Inputs

accept voltage-free contact;
OFF: contact from the filter pump contactor; if active, disables outputs; can be set as NO or NC acting on the S36 jumper
***Warning**! The remaining jumpers (S37…S41) are factory set and should not be tampered by the user for any reason!*

FLOW: contact from hydraulic flow sensor
LEV1: contact from level sensor of tank 1
LEV2: contact from level sensor of tank 2
LEV3: contact from level sensor of tank 3
IMP: contact for measurement freezing when the plant is not working or synchronization with automatic cleaning

Serial Line

RS232C or RS485, available on miniaturized 4-pin terminal block

Environment

Storage temperature	-20 … +60 °C
Working temperature	0 … +50 °C
RH max	90% no condensing

Protection Rate

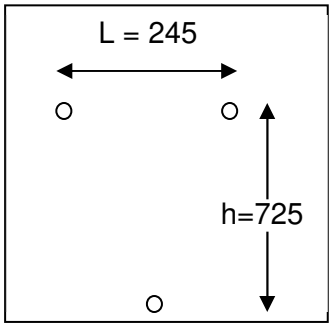
IP56

Dimensions

L 520 x H 900 x W 250 mm

Installation

Using the supplied screws and stoppers;
first drill the two top holes and hang the device,
then drill the fixing hole on the bottom



Cable Glands

5 x PG9 for clamping cables of
dia. 5 .. 9 mm

Weight

approx. 13.5 kg

NOTES AND GENERAL ADVICES

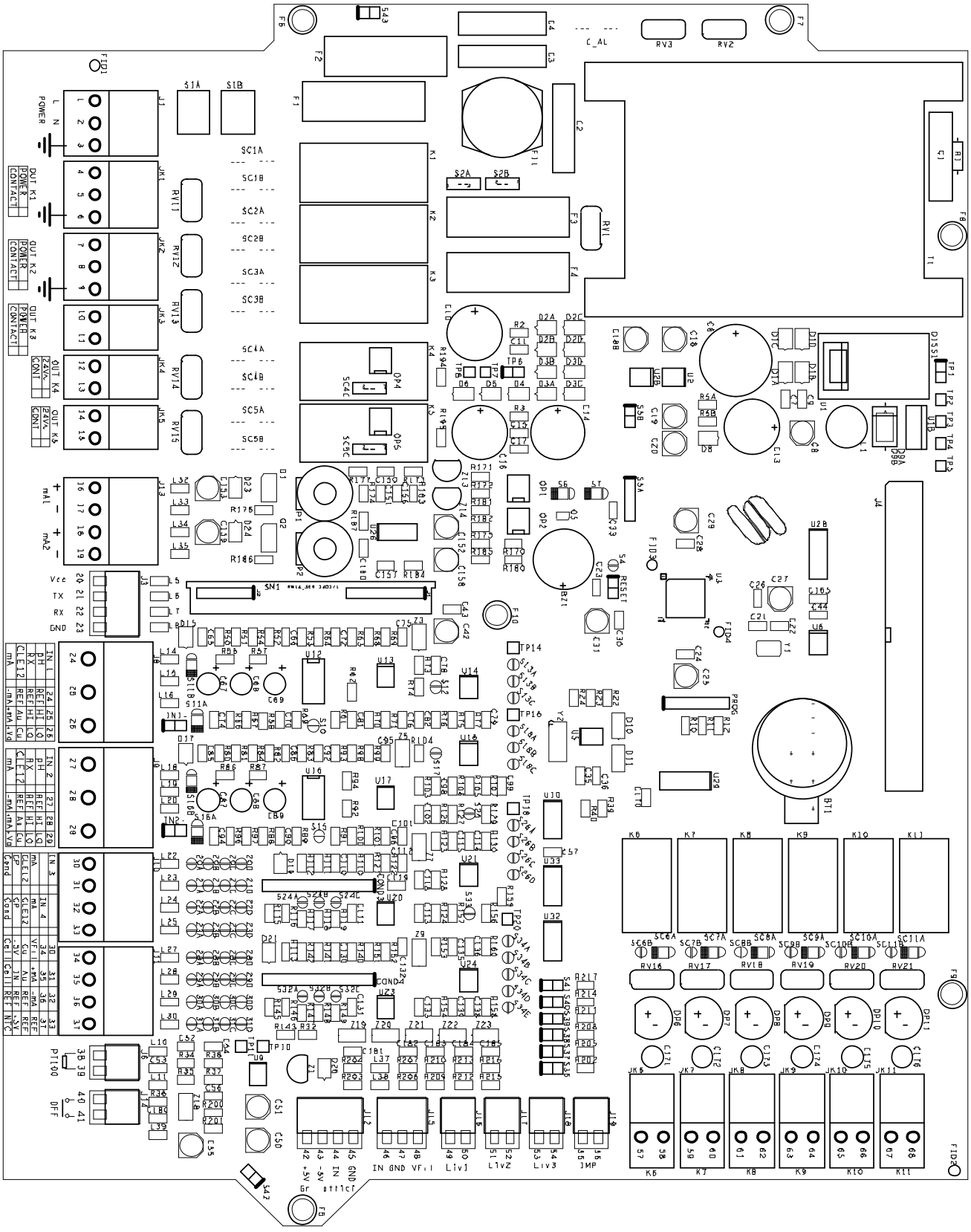
1) The control unit (electronic device) should be installed **as far as possible from heat and humidity sources**.
2) After completing the installation, **carefully tighten** the cable glands, close the terminal block compartment and front cover, to protect electronic components.
3) If the unit does not switch on even when powered, check fuse F2 (0.5A); if the controller turns on but cannot supply voltage at the 230V~ outputs, check fuse F1 (4A); if the unit turns on but does not power the 24V~ outputs, check fuse F4 (2A). The fuse locations are shown in the "Electrical Connections" section. The fuses should be substituted by technical personnel only, and using spare fuses of the same size and rate of the original ones.
4) In general, the sensor connection cables must be as short as possible and located far from power cables.
5) Exchanging the line and neutral connections of the power supply does not affect the correct functioning of the unit, but the internal protection fuse (F1) will be connected to the neutral instead of to the phase. Consequently, also the line and neutral of the 230 V~ outputs will be exchanged.
6) The grounding of the power line (terminal 3) must be connected to the grounding of the electrical system. The connection is not required for safety purposes because MCO14 is a Class II device, but it is essential to eliminate any electrical interference from the mains.
7) The max load of the K1, K2 and K3 relay outputs is 3A @ 250V~ resistive; with inductive load the max current is 1A (with 230V~ power supply, small pumps or solenoid valves with power consumption up to 250VA can be directly driven). For K4 and K5 outputs, it is recommended to not exceed the 24V~ safety voltage.
8) In case of 24V~ outputs, the maximum power is 20VA; any overload may burn the protection fuses.
9) In case of inductive load, the outputs should be protected with proper arch and interference suppression systems (RC networks or varistors in AC, diodes or varistors in DC). Internally the device is equipped with suppressors appropriate for 230V~ on K1, K2 and K3, and suppression systems for 24V~ on K4 and K5. A proper interference suppressor should be chosen by the user accordingly with specific load / power supply.
10) To have your device always at its top performance even in noisy environments, it is recommended to follow the below instructions:
    a. Insert radio frequency block ferrite on the power supply cable
    b. Connect to the grounding system the metallic shield of the input cables
    c. Install RC suppressors (or similar device) in parallel with the load (choose proper size)
    d. Perform an efficient grounding connection of the equipment
    e. Ground the cables of the current outputs longer than 20 meters
11) **The unit should be always on**, to avoid polarization delays of the sensors, with consequent control errors. If it is not necessary to use it for several hours (e.g. at night), it is recommended to lock the operation through the internal clock (see "Configuration" section) or through the activation of the OFF contact (for example by connecting it to a voltage-free contact of the filter pump contactor).

SPECIFIC ADVICES FOR COLORIMETER

12) **Make sure that from the inlet to the unit does not come solids** (such as hair, sand, insects, etc.). These solids easily clog the filter inlet, altering or blocking the measurement. Moreover, if organic substances stop in the filter, these can combine with chlorine and lower its level in water, and the reading will be lower than the actual value. It may be useful to connect the water sampling for analysis after the filter or install an additional filter.
13) **Free discharges are requested**, to prevent regurgitations from spillway or water overfilling of the reading chamber, with possible leakages from the injectors.
14) **The overflow discharge is recoverable**: this is pool water as such that has only lapped the electrodes. If the unit is above the balance tank, the recovery is by fall.
15) **At start-up** select the "manual operation" mode to **start the peristaltic pumps**. Through this function, make reagents flow into the reading chamber and check the tubes for air bubbles. If air bubbles are present, make the pumps work until complete expulsion of bubbles. To facilitate this operation, it is advisable to keep the tube containing air bubbles in vertical position.
16) **First analyses after the start-up may give unreliable results**. This setting phase depends on thermal variations, cleanliness of the optical groups and adaptation of the tubes/injectors.
17) **In case of heavy chlorination**, above 7...8 ppm, the DPD reagent turns red for a few seconds, then returns to be transparent. In this condition the unit indicates a low chlorine level and, if the chlorine dosage system is connected, the unit will continuously dose chlorine. This undesired behaviour is not specific of the MCO14 controller, but depends on the DPD method used for photometers. Usually this anomaly is caused by manual hyper-chlorination, and, therefore, it is recommended to perform manual chlorination only with the colorimetric unit turned off.
    Caution! Strong chlorination involve excessive fumes and consequent widespread oxidations, particularly on the mixer motor.
18) **Never remove the optical groups**! This operation will affect the unit calibration and void the warranty.
19) **The precision depends on chlorine concentration** to be detected. Up to 1 ppm, the maximum error is ±0.05 ppm, and increases as the concentration increases. This limit depends on the DPD method and is common to all colorimetric controllers, so it is normal to find discrepancies between subsequent measurements or between different colorimeters at high chlorine concentrations.
20) At start-up the transmittance value may be low, such as to cause an error. This can be due to fogged lenses, as consequence of the thermal difference between the environment and the water to be analysed. The only thing to do is wait for the spontaneous evaporation of the condensate.
21) **FOR TECHNICAL PERSONNEL ONLY**! If the transmittance level of the unit is constantly lower than 60...70%, even after the settlement period or after the cleaning of optical groups, contact the manufacturer. Also contact the manufacturer is the transmittance is greater than 102%.

ELECTRICAL CONNECTIONS

To access to the terminal blocks, remove the front cover located below the keyboard panel.



All user connections are available on removable terminal blocks.

1. Power supply: first terminal block from the top; pins 1, 2, 3, named LINE, NEUTRAL, EARTH
2. Proceeding downwards, you can find terminals for the 5 output relays:
   - pins 4, 5, 6 = relay K1
   - pins 7, 8, 9 = relay K2
   - pins 10 and 11 = relay K3
   - pins 12 and 13 = relay K4
   - pins 14 and 15 = relay K5

   If K1 and K2 are configured as voltage outputs (230V~), the output sequence follows the power supply sequence: LINE, NEUTRAL, EARTH.

3. The following are two current outputs:
   - pins 16 and 17 = positive and negative of the current output 1
   - pins 18 and 19 = positive and negative of the current output 2
4. Then you find the terminal block of the serial line (RS232C or RS485), with the following layout:
   - pin 20 = V-
   - pin 21 = TX
   - pin 22 = RX
   - pin 23 = GND

   Warning! The power supply (V-) can be used only by recorders as µMMC or RS485/RS232 converters. It is not protected and, therefore, any overload or short-circuit can damage the device! See the "Serial line" section for further details.

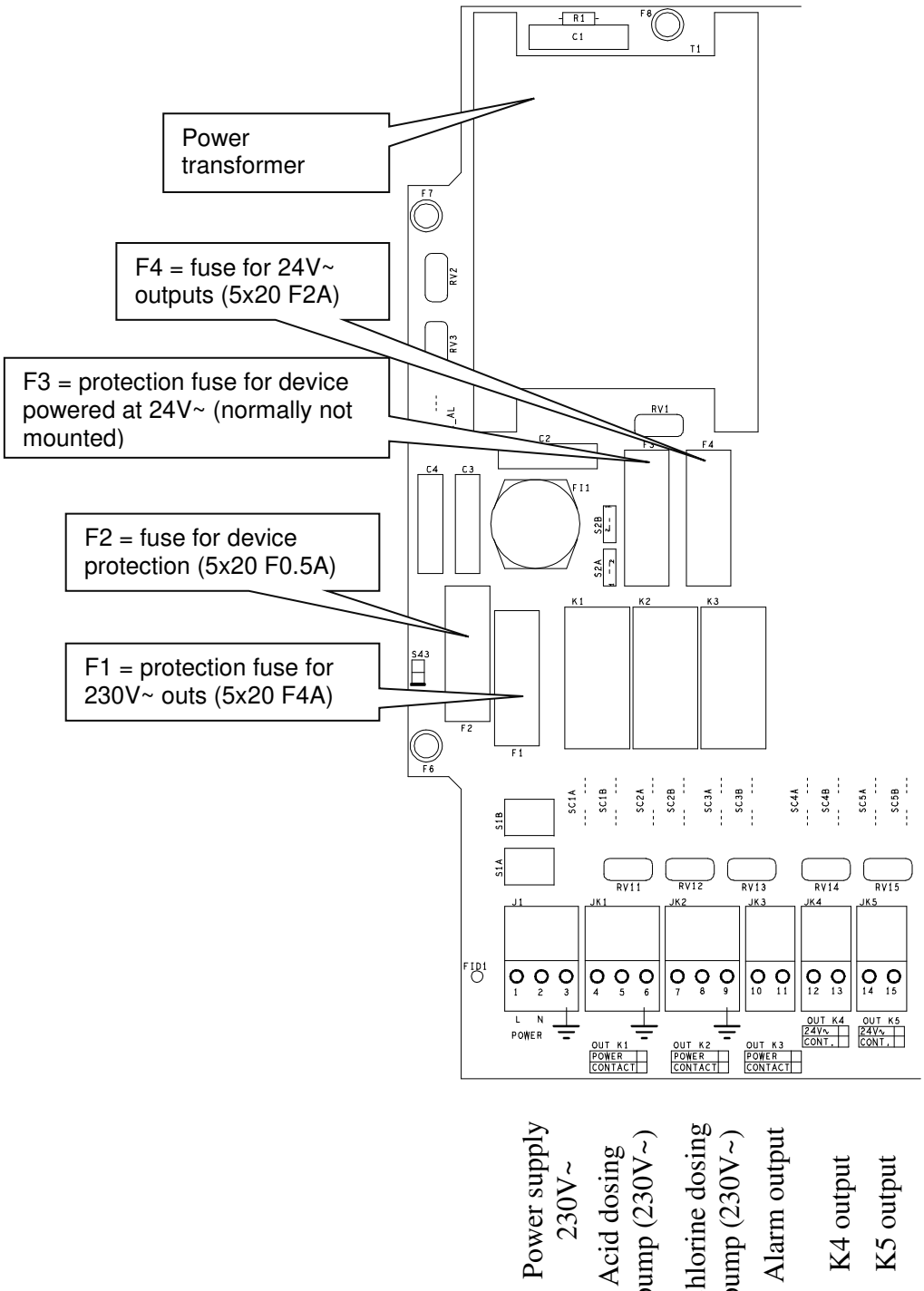
5. In sequence are the pins related to the inputs:
   - pins 24, 25, 26 – measure 1 input (pH): REF (reference), core (positive) and shield (negative) of the shielded cable, respectively
   - pins 27, 28, 29 – measure 2 input (ORP): REF (reference), core (positive) and shield (negative) of the shielded cable, respectively
   - pins 30, 31, 32, 33 – measure 3 input, not used in this version
   - pins 34, 35, 36, 37 – measure 4 input (free chlorine DPD)
   - pins 38 and 39 – measure 5 input (temperature): connect a Pt100 sensor
   - pins 40 and 41 – OFF contact: connect to these pins a voltage-free contact from the filter pump contactor (or, in general, a "system in function" contact); this contact can be NO or NC, because it is configurable through the S36 jumper. Be aware that LED OFF on the front panel turns on to indicate "disabled unit" and, therefore, outputs locked.

***Note**: All terminals not accessible from terminal block compartment, are reserved for different uses and/or factory wired, and do not required any intervention by the user.*

In the side drawing, the power supply and output terminals are highlighted, together with the fuses and, for technical personnel, the jumpers for configuring contact or voltage outputs.

The jumpers for output configuration are marked from SC1 to SC5, referring to the relays from K1 to K5.
Note that the outputs K1, K2 and K3 can be contact or voltage type (230V~, power supply voltage), while the outputs K4 and K5 can be contact type (relay), signal contact (for pulse input of dosing pumps) or at 24V~ (with internal power pack), to be specified / requested upon order.

The jumpers must always be moved in pairs.
The contact configuration is obtained with the jumpers from the centre upwards, while the voltage configuration is obtained with the jumpers from the centre downwards.



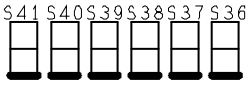
Warning! *Move these jumpers without the permission of the manufacturer will void the warranty!*

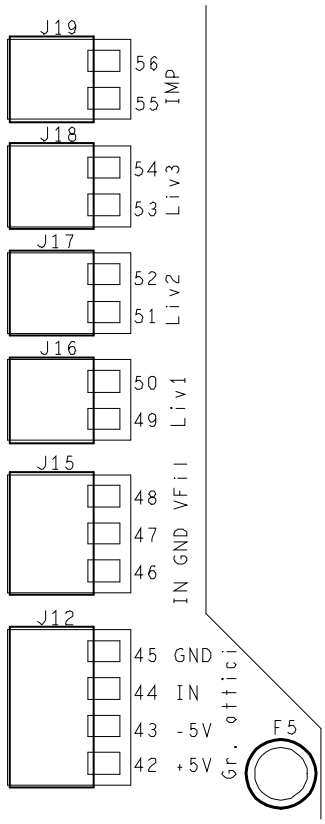
The side drawing shows the jumpers for input inversion.

OFF = input NO
ON = input NC

Starting from the right to the left:

S36 = input OFF
S37 = input FLOW
S38 = input LEV.1
S39 = input LEV.2
S40 = input LEV.3
S41 = input IMP



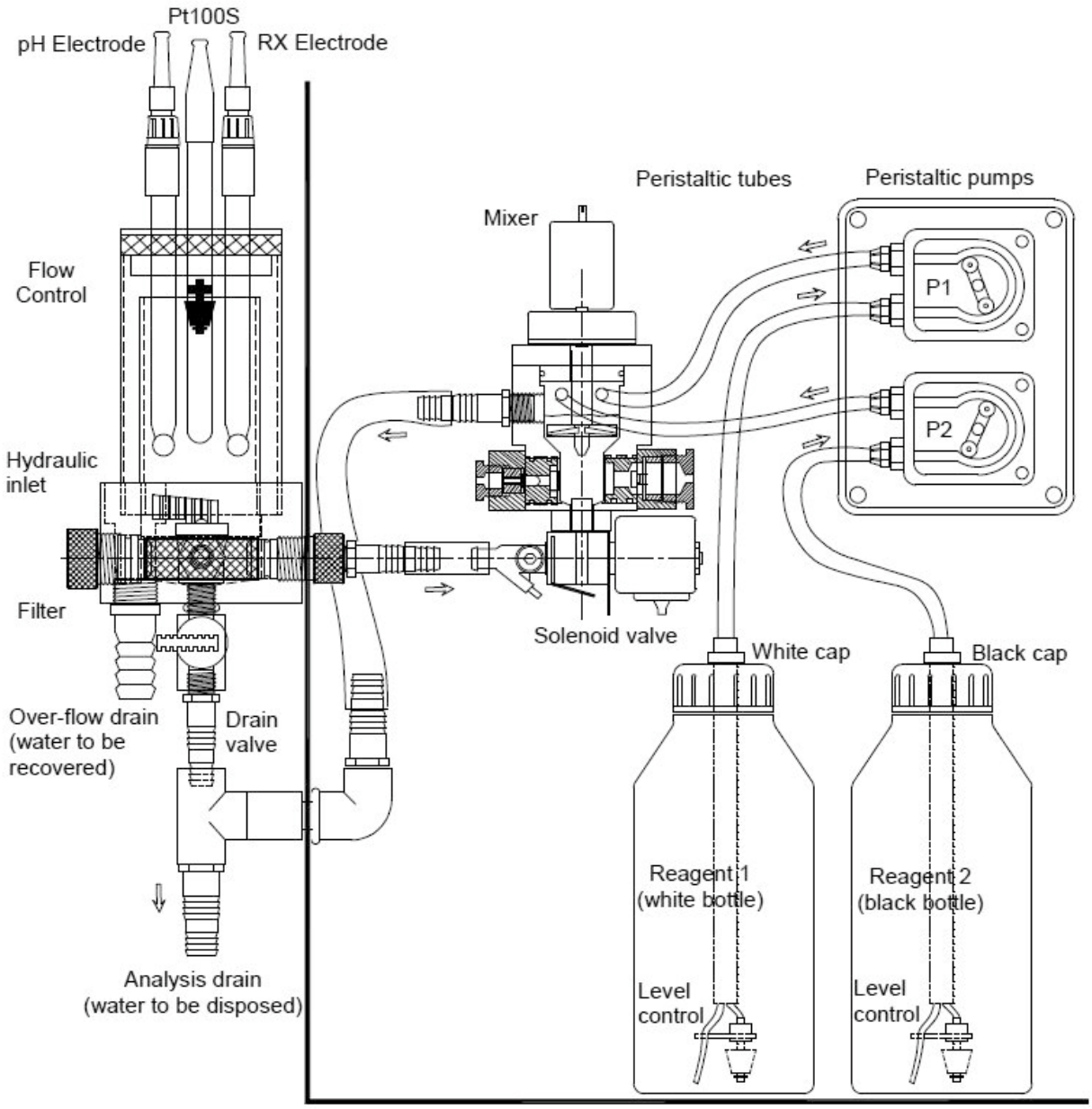


Warning! *These jumpers are set at the factory and, except S36, do not require any user intervention!*

<u>For skilled technical personnel only</u>:

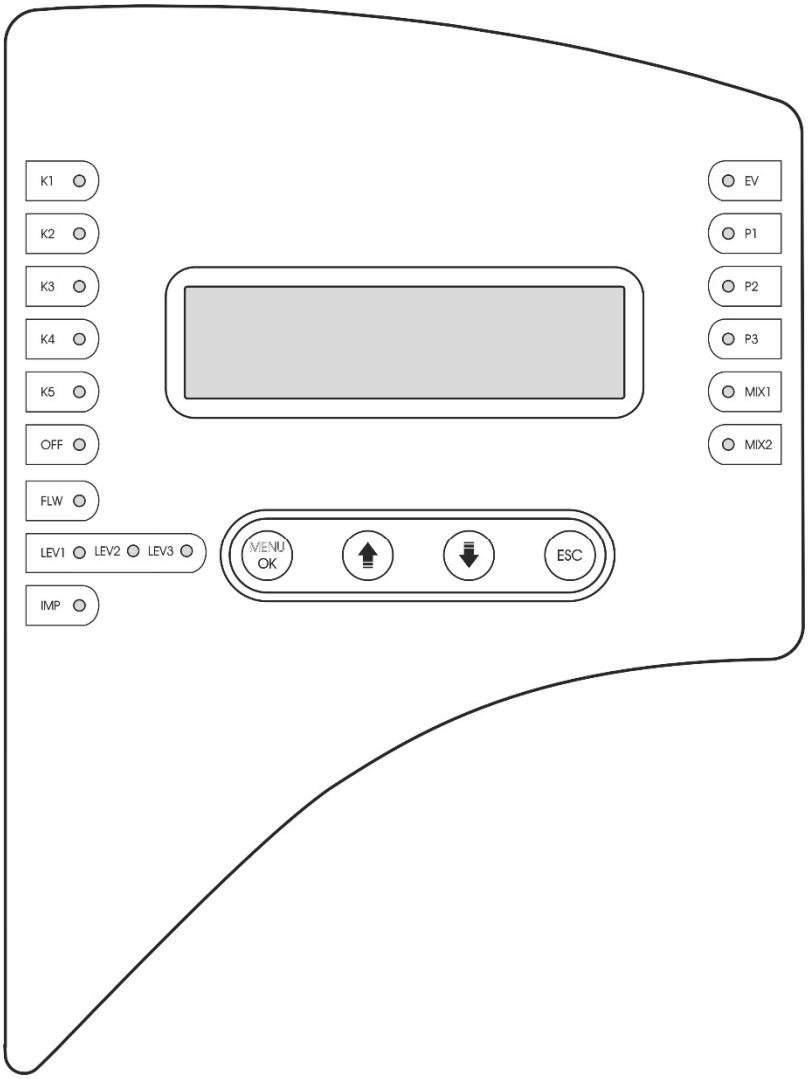
- pins 42, 43, 44, 45 – connection of optical groups: connect the brown wire to terminal 42, the green wire to terminal 43, the yellow wire to terminal 44 and the white wire to terminal 45
- pins 46, 47, 48 – FLOW input: in case of contact sensor, use pins 46 and 47; in case of micro-magnetic sensor, connect the black wire to pin 46, blue wire to pin 47 and brown wire to pin 48
- Inputs for level sensors: contact inputs

HYDRAULIC CONNECTIONS



The above drawing is indicative and not to scale.
The third tank (0.5 L) and the third peristaltic pump are not shown (used only for total / combined chlorine analysis).
The liquid to be analysed enters through the inlet hose (Ø ¼" for tube 12 mm), placed frontally on the spillway. Immediately after the hose, there is a ball valve, to be adjusted to obtain a minimum of water at the overflow outlet even when the solenoid valve is energized (so water enters in the analysis cell).
The spillway drain (water to be recovered) is provided on ½" hose, while the analysed water drain (to be disposed), is available on 3/8" hose.
The water feeding line must have a minimum pressure such as to ensure the correct water flow as set with the inlet valve. It is advisable to take it from a point with little turbulence (are bubbles are an interference). The outgoing liquid at the "analysis drain" contains the reagents used for the colorimetric test and must be neutralized before being discharged or disposed of in compliance with current regulations.

DESCRIPTION OF THE FRONT PANEL



- MENU/OK Key — Allow to access to CALIBRATION and CONFIGURATION circular menu, that can be explored with the arrow keys (⇑ ⇓):
  - **Calibration of measure 1**
  - **Calibration of measure 2**
  - **Calibration of measure 3**
  - **Calibration of measure 4**
  - **Calibration of measure 5**
  - **Calibration of measure 6**
  - **Standard configuration**
  - **Advanced configuration**
  - **Set date / time**
  - **Output tests**
  - **Start colorimetric analysis**
  - **Super chlorination**

  Refer to specific sections for further details
- ⇑ Key — Increase the displayed value in calibration and/or configuration mode
- ⇓ Key — Decrease the displayed value in calibration and/or configuration mode
- ESC Key — Exit from calibration and/or configuration mode

- LED K1…K5 Light up to indicate the status of the related output (ON = contact closed)
- LED OFF Lights up to indicate an external request of shutting down the device
- LED FLW Indicates the presence of water flow to the system; turns off in case of lack of water, and outputs and colorimetric cycle are locked
- LED LEV1, 2, 3 Light up to indicate the presence of reagent 1, 2 and/or 3 in its tank; turn off in case of lack of reagent, and outputs and colorimetric cycle are locked
- LED EV Light up to indicate the energization of the solenoid valve
- LED P1 Light up to indicate that the peristaltic pump of reagent 1 is dosing
- LED P2 Light up to indicate that the peristaltic pump of reagent 2 is dosing
- LED P3 Light up to indicate that the peristaltic pump of reagent 3 is dosing
- LED MIX1 Light up to indicate that the mixer is operating
- LED MIX2 Reserved for future use

DISPLAY VISUALIZATIONS

In normal mode the display shows 4 measurements. A typical visualization may be for example:

	7	.	2	1	p	H		0	0	6	9	1	mV
	2	7	.	8	°	C		0	0	.	7	8	CI2

In one or more boxes can be displayed, alternating with the measure chosen, any fault condition (for example, lack of levels or flow, off from internal clock, etc.). Refer to parameters P79...P82.
Press ⇑ ⇓ keys to display additional info, in the following sequence:
- Details of measure 1 (pH)
- Details of measure 2 (ORP)
- Details of measure 3 (not used)
- Details of measure 4 (free chlorine)
- Details of measure 5 (temperature, if provided)
- Details of measure 6 (total chlorine, if provided)
- Details of measure 7 (combined chlorine, only if total chlorine is provided)
- Current date and time
- Software version
- Temperature of the electronic board
- Details of output relay K1
- Details of output relay K2
- Details of output relay K4
- Details of output relay K5

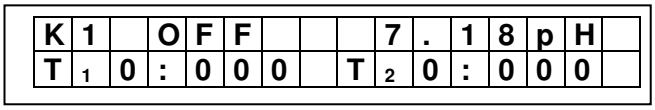
For example, pressing the ⇑ key once, generates a screen that shows the measured pH value, the input signal (in this case, the value within brackets is the input with no thermo-compensation and no offset / gain addition), the offset “O” and gain “G” factors with respect to the electrical calibration (values indicative of the state of the input sensors).

		7	.	2	1	p	H		(		6	.	9	5	)
O	=		-	.	0	6			G	=	1	.	0	1	3

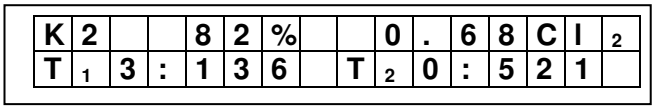
Current date and time are displayed in the following format:

T	h	u	r		1	6		O	c	t		2	0	1	4
				1	6	:	5	3	:	3	0				

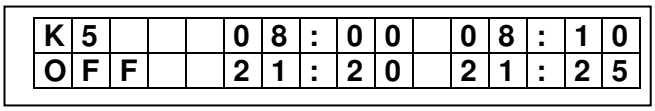
The display of the relay details varies according to the specific configuration of each relay; for example, in the case of ON/OFF control, the screen will be as shown here below.



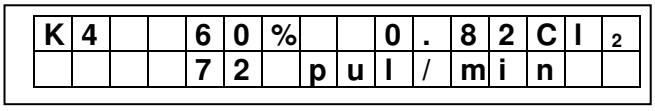
Are shown the relay status (also reported by the corresponding LED on the front panel), the value of the associated measurement, any activation (T1) and deactivation (T2) delays, expressed in minutes and tenths of second.
In case of PWM proportional control, the screen will be as shown here below:



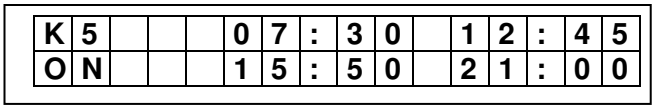
Are displayed the adjustment percentage, the value of the associated measurement, the time base (T1) and the ON time (T2).
If a relay is programmed for a maximum operating time, that value is displayed in alternation with the reading. When the maximum operating time expires, the related alarm is triggered (see “Configuration” section for details).
If the relay is set for timed operation (see “Configuration” section for details), the screen will be as shown here below.



In this example the relay is activated from 08:00 to 08:10 and from 21:20 to 21:25. Specifically, times are set through parameters P35…P38 (see “Configuration” section).
If a relay is designed for PFM proportional operation, the screen will be:



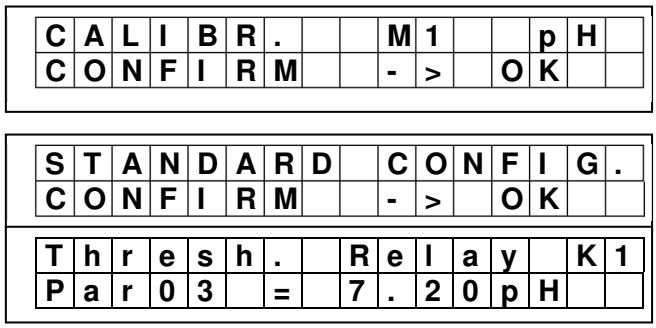
Finally, in case of time scheduled operations, a screen as the one here below will be displayed, which shows the times set through the related configuration parameters:



CONFIGURATION

The MCO14 unit features two configuration levels: **standard** and **advanced**.
The standard configuration is normally accessed by the end user, only to change the relay thresholds and the display language.
The advanced configuration instead allows to change all parameters and is normally protected by a password to prevent incorrect settings by unauthorized personnel.
The procedure is however the same for both configurations.

1) Starting from any screen, press the MENU/OK key
2) Calibration of measure 1 (pH) option is displayed
3) Press the ⇑ key until the display shows the standard configuration option
4) Press MENU/OK to confirm, or ESC to exit (or use the ⇑ ⇓ keys to see different options)
5) If the option is confirmed, the display shows the first editable parameter.
   Now, press MENU/OK to change the displayed value, use the arrow keys to go to the previous or next parameter, or press ESC to exit the configuration menu
6) If the MENU/OK has been pressed at step 5, now use the arrow keys to set the desired value
7) Press again MENU/OK to confirm and store the new value, or press ESC to exit without saving
8) Proceed in the same way for all the parameters



Notes:

- *If no key is pressed for a couple of minutes, the MCO14 automatically exits the configuration menu.*
- *Parameters that can be accessed from standard configuration mode, may vary depending on the instrument customization and settings of certain advanced parameters.*
- *The allowable values are limited by the processor, but it is recommended to always verify the congruence between the application and the set value.*
- *If a password has been entered, to access the configuration mode first type the correct password and then confirm with MENU/OK. When exiting the configuration mode, the access level returns to zero.*
- *All menus are "circular": scrolling with the arrow keys, when reaching the maximum, the minimum is then shown, and vice-versa.*
- *While configuration is in progress, the adjustment outputs (K1, K2, K4 and K5) are disabled. As the configuration menu is quitted, the processor recalculates their status and reactivates them.*

CONFIGURATION THROUGH SERIAL LINE

This section describes the configuration procedure from RS232C (serial line):

1) Connect the supervisor (for ex. a PC) to the terminal block of the serial line, while paying attention to the serial port type (RS232 or RS485)
2) To the command **Pxx (CR)** sent by the supervisor, the MCO14 unit answers with the parameter value "xx"
3) If the supervisor command is instead **Pxx=1234 (CR)**, the unit interprets the four digits following the "=" sign as the new value of the parameter

Notes:

- *All values are without comma. For example, if P03 is set at 7.20pH (K1 threshold), it will be read as **0720**; on the other hand, for setting P03 to 7.30pH, the command will be **P03=0730 (CR)***
- *The MCO14 unit stores the value without any control; it is up to the supervisor to check the limits*
- *The commands from the serial line can be both uppercase and lowercase*
- *The "cancel" command is not active; if you type a wrong datum, you have to rewrite it*
- *In the case of RS485 serial line, the **serial address** must be added to the commands, in the form of lowercase letter, starting from "**a**"*

CONFIGURATION PARAMETERS

The table here below provides the complete list of available configuration parameters.
It is recommended to fill the last column with the values set for your application.

***Warning**! The complete list of parameters can be accessed only from the "Advanced Configuration" menu, while the "Standard Configuration" mode allows to modify only the parameters highlighted in bold in the table below.*

Par.	Description		Min Value	Max Value	Factory Value	Set Value
P01	Measure linked to the relay K1	1 = pH 2 = ORP (Redox) 3 = Not available 4 = Free chlorine DPD 5 = Temperature 6 = Total chlorine DPD	1	6	1	
P02	Output type for relay K1	0 = disabled 1 = close upon threshold exceeded 2 = open upon threshold exceeded 3 = PWM upwards 4 = PWM downwards 5 = alarm NO 6 = alarm NC 7 = PFM upwards 8 = PFM downwards 9 = timed operation	0	9	1	
P03	**P02 = 1…4, 7…8 → threshold to be reached relay K1** **P02 = 5, 6 → central value of alarm threshold relay K1** P02 = 9 → first activation time of relay K1		-1000	2000	7.20pH	
P04	P02 = 1…4, 7…8 → hysteresis relay K1 P02 = 5, 6 → hysteresis above and below the K1 threshold P02 = 9 → first deactivation time of relay K1		0	500	0.20pH	

Par.	Description		Min Value	Max Value	Factory Value	Set Value
P05	P02 = 1, 2, 5, 6 → activation delay for relay K1 P02 = 3, 4 → time base for relay K1 P02 = 7, 8 → not used P02 = 9 → second activation time of relay K1		0:00	30:00	00:10 min : sec	
P06	P02 = 1, 2, 5, 6 → deactivation delay for relay K1 P02 = 3, 4, 7, 8 → not used P02 = 9 → second deactivation time of relay K1		0:00	30:00	00:05 min : sec	
P07	Alarm max dosage time for relay K1 (hours : minutes)		0:00	09:59	02:00	
P08	OFF status relay K1	Weight 1 = lack of level 1 Weight 2 = lack of level 2 Weight 4 = lack of level 3 Weight 8 = UR / OR meas. associated to K1 Weight 16 = alarm max. dosage time K1 Weight 32 = pH stability Weight 64 = internal clock Weight 128 = alarm zero chlorine or redox	0	255	95	
P09	Measure linked to the relay K2	1 = pH 2 = ORP (Redox) 3 = Not available 4 = Free chlorine DPD 5 = Temperature 6 = Total chlorine DPD	1	6	4	
P10	Output type for relay K2	0 = disabled 1 = close upon threshold exceeded 2 = open upon threshold exceeded 3 = PWM upwards 4 = PWM downwards 5 = alarm NO 6 = alarm NC 7 = PFM upwards 8 = PFM downwards 9 = timed operation	0	9	4	
P11	**P10 = 1…4, 7…8 → threshold to be reached relay K2** **P10 = 5, 6 → central value of alarm threshold relay K2** P10 = 9 → first activation time of relay K2		-1000	2000	0.70ppm	
P12	P10 = 1…4, 7…8 → hysteresis relay K2 P10 = 5, 6 → hysteresis above and below the K2 threshold P10 = 9 → first deactivation time of relay K2		0	500	0.20ppm	
P13	P10 = 1, 2, 5, 6 → activation delay for relay K2 P10 = 3, 4 → time base for relay K2 P10 = 7, 8 → not used P10 = 9 → second activation time of relay K2		0:00	30:00	03:00 min : sec	
P14	P10 = 1, 2, 5, 6 → deactivation delay for relay K2 P10 = 3, 4, 7, 8 → not used P10 = 9 → second deactivation time of relay K2		0:00	30:00	00:00 min : sec	
P15	Alarm max dosage time for relay K2 (hours : minutes)		0:00	09:59	00:00	
P16	OFF status relay K2	Weight 1 = lack of level 1 Weight 2 = lack of level 2 Weight 4 = lack of level 3 Weight 8 = UR / OR meas. associated to K2 Weight 16 = alarm max. dosage time K2 Weight 32 = pH stability Weight 64 = internal clock Weight 128 = alarm zero chlorine or redox	0	255	255	

Par.	Description		Min Value	Max Value	Factory Value	Set Value
P17	Activation of input alarms on relay K3	Weight 1 = lack of level 1 Weight 2 = lack of level 2 Weight 4 = lack of level 3 Weight 8 = lack of Flow Weight 16 = no OFF consent	0	31	31	
P18	Activation of sw alarms on relay K3	Weight 1 = start-up delay Weight 2 = pH stability Weight 4 = internal clock Weight 8 = alarm zero chlorine or redox	0	15	15	
P19	Activation of meas.1 alarms on relay K3	Weight 1 = UR / OR measure 1 (pH) Weight 2 = alarm max. dosage time meas. 1	0	3	3	
P20	Activation of meas.2 alarms on relay K3	Weight 1 = UR / OR measure 2 (RX) Weight 2 = alarm max. dosage time meas. 2	0	3	3	
P21	Activation of meas.3 alarms on relay K3	Parameter not used in this version	-	-	-	
P22	Activation of meas.4 alarms on relay K3	Weight 1 = UR / OR meas. 4 (ppm free Cl_2) Weight 2 = alarm max. dosage time meas. 4	0	3	3	
P23	Activation of meas.5 alarms on relay K3	Weight 1 = UR / OR measure 5 (°C) Weight 2 = alarm max. dosage time meas. 5	0	3	3	
P24	Relay K3	NO = 0 / NC = 1	0	1	1	
P25	Measure linked to the relay K4	1 = pH 2 = ORP (Redox) 3 = Not available 4 = Free chlorine DPD 5 = Temperature 6 = Total chlorine DPD	1	6	5	
P26	Output type for relay K4	0 = disabled 1 = close upon threshold exceeded 2 = open upon threshold exceeded 3 = PWM upwards 4 = PWM downwards 5 = alarm NO 6 = alarm NC 7 = PFM upwards 8 = PFM downwards 9 = timed operation	0	9	2	
P27	**P26 = 1…4, 7…8 → threshold to be reached relay K4** **P26 = 5, 6 → central value of alarm threshold relay K4** P26 = 9 → first activation time of relay K4		0	2000	32.0 °C	
P28	P26 = 1…4, 7…8 → hysteresis relay K4 P26 = 5, 6 → hysteresis above and below the K4 threshold P26 = 9 → first deactivation time of relay K4		0:00	500	1.0 °C	
P29	P26 = 1, 2, 5, 6 → activation delay for relay K4 P26 = 3, 4 → time base for relay K4 P26 = 7, 8 → not used P26 = 9 → second activation time of relay K4		0:00	30:00	00:30 min : sec	

Par.	Description		Min Value	Max Value	Factory Value	Set Value
P30	P26 = 1, 2, 5, 6 → deactivation delay for relay K4 P26 = 3, 4, 7, 8 → not used P26 = 9 → second deactivation time of relay K4		0:00	30:00	00:20 min : sec	
P31	Alarm max dosage time for relay K4 (hours : minutes)		0:00	09:59	00:00	
P32	OFF status relay K4	Weight 1 = lack of level 1 Weight 2 = lack of level 2 Weight 4 = lack of level 3 Weight 8 = UR / OR meas. associated to K4 Weight 16 = alarm max. dosage time K4 Weight 32 = pH stability Weight 64 = internal clock Weight 128 = alarm zero chlorine or redox	0	255	255	
P33	Measure linked to the relay K5	1 = pH 2 = ORP (Redox) 3 = Not available 4 = Free chlorine DPD 5 = Temperature 6 = Total chlorine DPD	1	6	4	
P34	Output type for relay K5	0 = disabled 1 = close upon threshold exceeded 2 = open upon threshold exceeded 3 = PWM upwards 4 = PWM downwards 5 = alarm NO 6 = alarm NC 7 = PFM upwards 8 = PFM downwards 9 = timed operation 10 = cyclic automatic cleaning 11 = automatic cleaning synchronized with IMP	0	11	4	
P35	**P34 = 1…4, 7…8 → threshold to be reached relay K5** **P34 = 5, 6 → central value of alarm threshold relay K5** P34 = 9 → first activation time of relay K5		-1000	2000	0.70ppm	
P36	P34 = 1…4, 7…8 → hysteresis relay K5 P34 = 5, 6 → hysteresis above and below the K5 threshold P34 = 9 → first deactivation time of relay K5 P34 = 10 → not used		0	500	0.20ppm	
P37	P34 = 1, 2, 5, 6 → activation delay for relay K5 P34 = 3, 4 → time base for relay K5 P34 = 7, 8, 11 → not used P34 = 9 → second activation time of relay K5 P34 = 10 → pause between two cleanings (hours : min)		0:00	30:00	00:30 min : sec	
P38	P34 = 1, 2, 5, 6 → deactivation delay for relay K5 P34 = 3, 4, 7, 8 → not used P34 = 9 → second deactivation time of relay K5 P34 = 10 → cleaning time		0:00	30:00	00:00 min : sec	
P39	Alarm max dosage time for relay K5 (hours : minutes) P34 = 10, 11 → measure hold time after cleaning		0:00	09:59	00:00 h : min	
P40	OFF status relay K5	Weight 1 = lack of level 1 Weight 2 = lack of level 2 Weight 4 = lack of level 3 Weight 8 = UR / OR meas. associated to K5 Weight 16 = alarm max. dosage time K5 Weight 32 = pH stability Weight 64 = internal clock Weight 128 = alarm zero chlorine or redox	0	255	255	

Par.	Description			Min Value	Max Value	Factory Value	Set Value
P41	Type of current output mA1	0 = 0/20 mA meas. 1	1 = 4/20 mA meas. 1	0	11	1	
		2 = 0/20 mA meas. 2	3 = 4/20 mA meas. 2				
		4 = 0/20 mA meas. 3	5 = 4/20 mA meas. 3				
		6 = 0/20 mA meas. 4	7 = 4/20 mA meas. 4				
		8 = 0/20 mA meas. 5	9 = 4/20 mA meas. 5				
		10= 0/20 mA meas. 6	11= 4/20 mA meas. 6				
P42	**Starting value for output mA1 (0 or 4 mA)**			**-1000**	**2000**	**0.00pH**	
P43	**Full scale value for output mA1 (20 mA)**			**-1000**	**2000**	**14.00pH**	
P44	OFF status output mA1	Weight 1 = lack of level 1 Weight 2 = lack of level 2 Weight 4 = lack of level 3 Weight 8 = UR / OR meas. associated to mA1 Weight 32 = pH stability Weight 64 = internal clock Weight 128 = alarm zero chlorine or redox		0	255	72	
P45	mA upon error for current output mA1			0.00	21.00	2.00mA	
P46	Range of current output 1 (0 = 0…100% ; 1 = -5…105%)			0	1	1	
P47	Type of current output mA2	0 = 0/20 mA meas. 1	1 = 4/20 mA meas. 1	0	11	7	
		2 = 0/20 mA meas. 2	3 = 4/20 mA meas. 2				
		4 = 0/20 mA meas. 3	5 = 4/20 mA meas. 3				
		6 = 0/20 mA meas. 4	7 = 4/20 mA meas. 4				
		8 = 0/20 mA meas. 5	9 = 4/20 mA meas. 5				
		10= 0/20 mA meas. 6	11= 4/20 mA meas. 6				
P48	**Starting value for output mA2 (0 or 4 mA)**			**-1000**	**2000**	**0.00ppm**	
P49	**Full scale value for output mA2 (20 mA)**			**-1000**	**2000**	**5.00ppm**	
P50	OFF status output mA2	Weight 1 = lack of level 1 Weight 2 = lack of level 2 Weight 4 = lack of level 3 Weight 8 = UR / OR meas. associated to mA2 Weight 32 = pH stability Weight 64 = internal clock Weight 128 = alarm zero chlorine or redox		0	255	200	
P51	mA upon error for current output mA2			0.00	21.00	2.00mA	
P52	Range of current output 2 (0 = 0…100% ; 1 = -5…105%)			0	1	1	
P53	Hold measurements with active IMP input			0	31	0	
P54	Start-up delay (minutes : seconds)			00:10	59:59	00:20	
P55	Delay after restoring FLOW consent (minutes : seconds)			00:00	59:59	00:05	
P56	Parameter not used			--	--	--	
P57 … P70	Activation / deactivation time of measurement on Monday, Tuesday, Wednesday, Thursday, Friday, Saturday, and Sunday			00:00	23:59	00:01 23:59	
P71	Parameter not used			--	--	--	
P72	Alarm zero chlorine			0.00	0.50	0.00ppm	
P73	Alarm redox			0	1000	780mV	
P74	Visualization of colorimetric analysis cycle: 0 = none, 1 = value Cl_{2F}, 2 = value Cl_{2T}, 3 = Cl_2 and Cl_T			0	3	2	
P75	Pause between two colorimetric analysis cycles (min : sec)			00:20	15:00	05:00	
P76	Number of normal cycles per total/combined chlorine cycle			0	6	3	
P77	Working temperature			0	100	25°C	
P78	Super chlorination time (hours : minutes)			00:00	24:00	12:	

Par.	Description			Min Value	Max Value	Factory Value	Set Value
P79	Box 1 display	1 = measure 1	11 = measure 1 + errors	1	19	1	
		2 = measure 2	12 = measure 2 + errors				
		3 = measure 3	13 = measure 3 + errors				
		4 = measure 4	14 = measure 4 + errors				
		5 = measure 5	15 = measure 5 + errors				
		6 = measure 6	16 = measure 6 + errors				
		7 = measure 7	17 = measure 7 + errors				
		8 = empty	18 = empty + errors				
		9 = ----	19 = --- + errors				
P80	Box 2 display	1 = measure 1	11 = measure 1 + errors	1	19	2	
		2 = measure 2	12 = measure 2 + errors				
		3 = measure 3	13 = measure 3 + errors				
		4 = measure 4	14 = measure 4 + errors				
		5 = measure 5	15 = measure 5 + errors				
		6 = measure 6	16 = measure 6 + errors				
		7 = measure 7	17 = measure 7 + errors				
		8 = empty	18 = empty + errors				
		9 = ----	19 = --- + errors				
P81	Box 3 display	1 = measure 1	11 = measure 1 + errors	1	19	4 or 5 (depending on model)	
		2 = measure 2	12 = measure 2 + errors				
		3 = measure 3	13 = measure 3 + errors				
		4 = measure 4	14 = measure 4 + errors				
		5 = measure 5	15 = measure 5 + errors				
		6 = measure 6	16 = measure 6 + errors				
		7 = measure 7	17 = measure 7 + errors				
		8 = empty	18 = empty + errors				
		9 = ----	19 = --- + errors				
P82	Box 4 display	1 = measure 1	11 = measure 1 + errors	1	19	16 or 14 (depending on model)	
		2 = measure 2	12 = measure 2 + errors				
		3 = measure 3	13 = measure 3 + errors				
		4 = measure 4	14 = measure 4 + errors				
		5 = measure 5	15 = measure 5 + errors				
		6 = measure 6	16 = measure 6 + errors				
		7 = measure 7	17 = measure 7 + errors				
		8 = empty	18 = empty + errors				
		9 = ----	19 = --- + errors				
P83	Display backlight	0 = LED power (no backlight control) 1 = backlight always ON 2..30 = minutes of backlight ON		0	30	3 min.	
P84	Password for standard configuration			0	9999	0	
P85	Password for advanced configuration			0	9999	0	
P86	Deactivation of electrochemical calibrations			0	1	0	
P87	Delay of chlorine electrochemical calibration (minutes)			5	240	5	
P88	Reset of electrochemical calibrations			0	63	0	
P89	**Language**	**0 = Italian ; 1 = English ; 2 = French ; 3 = Spanish ; 4 = Dutch**		0	4	1	
P90	Type of serial line	0 = reserved for µMMC 1, 2, 3 = ASCII 9600, 19200, 38400 BPS 4, 5, 6 = Modbus 9600, 19200, 38400 BPS		0	6	2	
P91	Serial address			0	126	0	
P92	Summer time (0 = excluded ; 1 = automatic change)			0	1	1	
P93	Data log	Off, 1…7 -> 1, 2, 5, 10, 15, 20, 30min		0	7	2 min.	
P94	Autoset (factory settings)			0	999	0	

Notes:

- *Some parameters have different meaning depending on the selected functioning of the relays; carefully read the related instructions.*
- *Depending on the instrument configuration, some parameters may be not displayed or be displayed as "not used".*
- *The parameter descriptions may vary depending on the software version and factory settings.*

MEANING OF PARAMETERS

PARAMETER 01 MEASURE LINKED TO THE RELAY OUTPUT K1

This parameter associates a measure to relay K1; in other words, if you set P01=1, the measure 1 (standard pH) controls the relay K1. The values normally settable range from 1 to 5; in versions which also provide the calculated value of combined chlorine, valid values arrive up to 6.

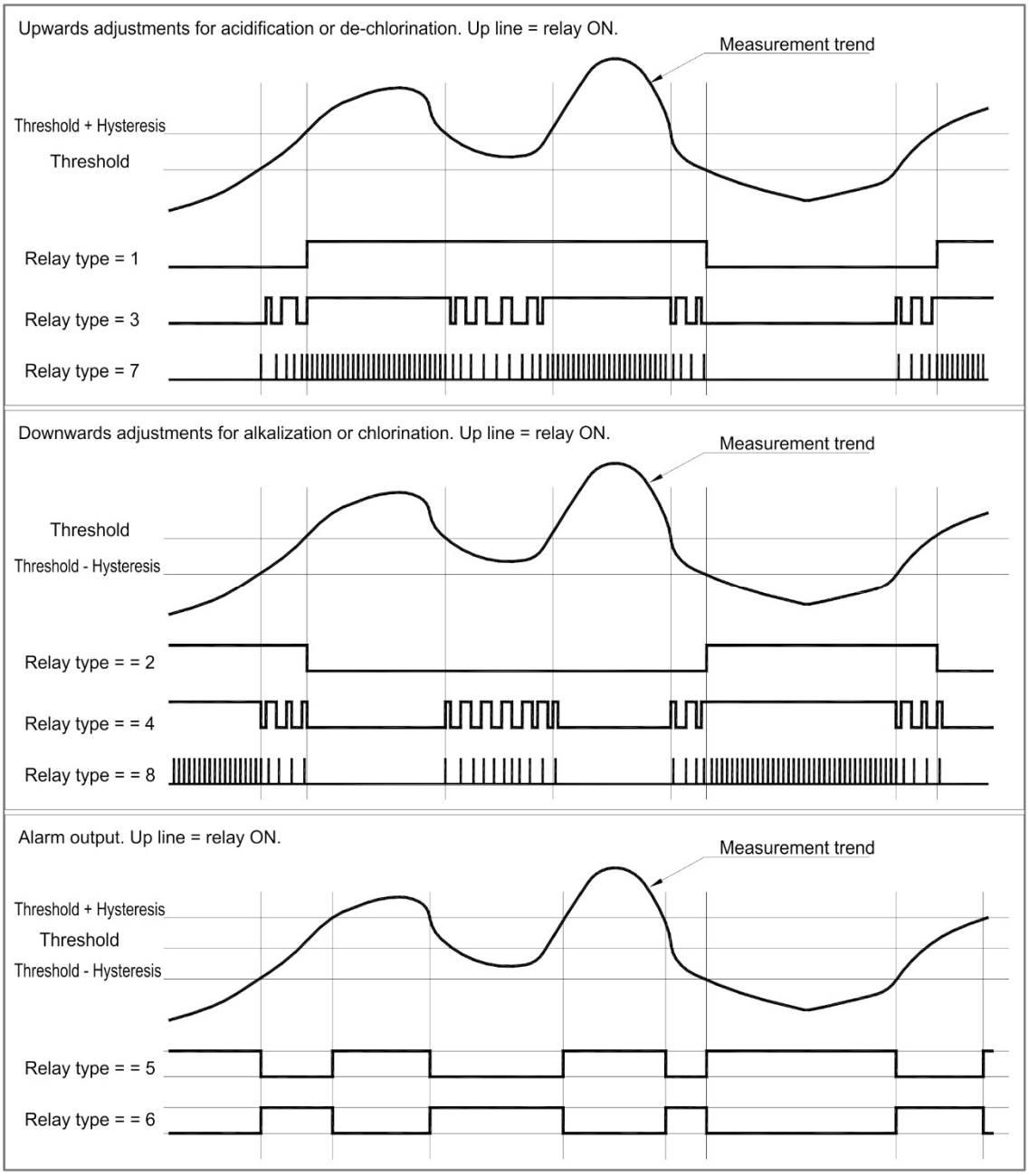
PARAMETER 02 OUTPUT TYPE FOR RELAY K1

The K1 output can operate in different modes, coded as follows:

0 = disabled	The relay is not used
1 = close upon threshold exceeded	ON/OFF control as acidification or de-chlorination
2 = open upon threshold exceeded	ON/OFF control as alkalinisation or chlorination
3 = PWM upwards	Proportional control in time for acidification or de-chlorination
4 = PWM downwards	Proportional control in time for alkalinisation or chlorination
5 = alarm NO	Relay contact closed (alarm) when measure is outside set-point
6 = alarm NC	Relay contact closed (fail-safe) when measure is around set-point
7 = PFM upwards	Proportional control, pulse control, for acidification and de-chlorination
8 = PFM downwards	Proportional control, pulse control, for alkalinisation or chlorination
9 = timed operation	Relay activates / deactivates at scheduled times, not depending on measurement; this features is useful, for example, for controlling pumps that dose additives as flocculants or anti-algae

The diagrams on next page show a graphic explanation of the various operations, and are divided by type of adjustment and the following can be noticed:

1) The adjustment changes depending on the type of operation set for the relay.
2) Up line = relay energized → closed contact.
   Low line = relay not energized → open contact
3) In the terminal block are available only the NO contacts of the relay (or the voltage output); to get the inverse function just change the setting of the relative parameter (e.g. P02 1 → 2).



PARAMETER 03 THRESHOLD FOR RELAY K1 / FIRST ACTIVATION TIME FOR RELAY K1

In case of adjustment relay, this parameter is the value to be reached.
In case of alarm relay, this parameter is the central reference value for the alarm threshold.
In case of timed operation, enter the hour of the first activation of the relay K1.

PARAMETER 04 HYSTERESIS FOR RELAY K1 / FIRST DEACTIVATION TIME FOR K1

For setting the relay hysteresis, there are three cases:

- ON/OFF control: this parameter allows to set a “not intervention” window for the relay, typically to be set quite narrow (10… 20 points)
- Proportional control (PWM or PFM): this parameter allows to set the proportional adjustment band, typically set from 30 to 50 points
- Alarm output: this parameter is used to set the window (above and below the threshold), which defines if measurement is in alarm condition or not

In case of relay configured for timed operation, enter the hour of the first deactivation of the relay. For proper operation, this value must be greater than that entered in parameter P03.

PARAMETER 05 **OUTPUTS ON/OFF:** **ACTIVATION DELAY RELAY K1**
PWM CONTROL: **TIME BASE RELAY K1**
PFM CONTROL: **NOT USED**
TIMED OPERATION: **SECOND ACTIVATION TIME FOR RELAY K1**

The intervention of the relay K1 with respect to the threshold exceeding, can be delayed of a certain time (in minutes : seconds), to be entered in this parameter. If P05=0, no delay is set.
In case of PWM proportional control, this parameter is the time base: the recommended values vary from approximately 10 seconds if the relay is used for activation or control of solenoid valves, up to 5…10 minutes if the relay is used for turning on / off dosing pumps.
In case of PFM control, this parameter is not used and the output is fix between 0 and 120 pulses/min.
In case of timed operation, enter the hour of the second activation of the relay. If a second daily activation of the relay is not required, set this parameter to zero.

PARAMETER 06 **OUTPUTS ON/OFF:** **DEACTIVATION DELAY RELAY K1**
PWM or PFM CONTROL: **NOT USED**
TIMED OPERATION: **SECOND DEACTIVATION TIME FOR RELAY K1**

The deactivation of the relay K1 with respect to the threshold, can be delayed of a certain time (in minutes : seconds), to be entered in this parameter. If P06=0, no delay is set.
In case of PWM proportional control, this parameter is not used.
In case of PFM control, this parameter is not used and the output is fix between 0 and 120 pulses/min.
In case of timed operation, enter the hour of the second deactivation of the relay. If the second activation is not required / used, enter zero. If it is used, for proper operation, it is necessary to enter a value greater than that set in P05.

PARAMETER 07 **ALARM MAX DOSAGE TIME RELAY K1**

This parameter allows to monitor the max dosage time (in hours **:** minutes).
When measurement leaves the set threshold and, therefore, the dosage is triggered, simultaneously starts this timer. If measurement returns to the threshold before the set time is elapsed, adjustment has been successful. If instead the threshold is not reached within the set time, an alarm is generated. This alarm can be only used as failure indication or stop of adjustment (see next parameter). Setting zero means that this alarm is not used.
Warning! The time base of this alarm is in minutes and, therefore, a delay of one minute for the alarm activation or deactivation can be expected!

PARAMETER 08 **OFF STATUS RELAY K1**

The K1 relay normally performs the adjustment set in P02 following the trend of the measurement set in P01. However some alarm / fault conditions can be programmed to force the relay deactivation.
These conditions are:

Bit0	Weight 1	= lack of level 1
Bit1	Weight 2	= lack of level 2
Bit2	Weight 4	= lack of level 3
Bit3	Weight 8	= UR / OR for measure associated to relay K1
Bit4	Weight 16	= alarm max dosage time relay K1
Bit5	Weight 32	= pH stability
Bit6	Weight 64	= internal clock
Bit7	Weight 128	= alarm zero chlorine or alarm redox

Enter in this parameter the sum of the weights of the conditions to be enabled.
For example, for deactivating K1 (connected to the acid dosing pump) in case of measurement failure and internal clock error, set the value 8 + 64 = 72. If you also want to consider the “alarm max dosage”, the value becomes 8 + 16 + 64 = 88.
Warning! The lack of flow or the “system OFF” request also deactivate the output relays. These conditions are always active and cannot be disabled!

PARAMETER 09 **MEASURE LINKED TO THE RELAY OUTPUT K2**

As P01, but referred to relay K2.

PARAMETER 10 OUTPUT TYPE FOR RELAY K2
As P02, but referred to relay K2.

PARAMETER 11 THRESHOLD FOR RELAY K2 / FIRST ACTIVATION TIME FOR RELAY K2
As P03, but referred to relay K2.

PARAMETER 12 HYSTERESIS FOR RELAY K2 / FIRST DEACTIVATION TIME FOR K1
As P04, but referred to relay K2.

PARAMETER 13	**OUTPUTS ON/OFF:**	**ACTIVATION DELAY RELAY K2**
	PWM CONTROL:	**TIME BASE RELAY K2**
	PFM CONTROL:	**NOT USED**
	TIMED OPERATION:	**SECOND ACTIVATION TIME FOR RELAY K1**

As P05, but referred to relay K2.

PARAMETER 14	**OUTPUTS ON/OFF:**	**DEACTIVATION DELAY RELAY K2**
	PWM or PFM CONTROL:	**NOT USED**
	TIMED OPERATION:	**SECOND DEACTIVATION TIME FOR RELAY K1**

As P06, but referred to relay K2.

PARAMETER 15 ALARM MAX DOSAGE TIME RELAY K2
As P07, but referred to relay K2.

PARAMETER 16 OFF STATUS RELAY K2
As P08, but referred to relay K2.

PARAMETERS 17… 24
Relay K3 is only used for managing alarms. Usually, it is configured normally energized, so that it deactivates in case of alarm / fault. This operating mode is known as “fail-safe”. These parameters allow to select (enable) the alarms to be detected on K3.

PARAMETER 17 ACTIVATION OF INPUT ALARMS ON RELAY K3
The inputs which may affect the relay K3 are:
Bit0 Weight 1 = lack of level 1
Bit1 Weight 2 = lack of level 2
Bit2 Weight 4 = lack of level 3
Bit3 Weight 8 = lack of flow
Bit4 Weight 16 = no OFF consent
Enter the sum of the weights of the alarms linked to the inputs to be enabled.
To enable all alarms (recommended), enter the value 1 + 2 + 4 + 8 + 16 = 31.

PARAMETER 18 ACTIVATION OF SOFTWARE ALARMS ON RELAY K3
The software conditions which may affect the relay K3 are:
Bit0 Weight 1 = start-up delay
Bit1 Weight 2 = pH stability
Bit2 Weight 4 = internal clock
Bit3 Weight 8 = alarm zero chlorine or redox
Enter the sum of the weights of the alarms to be enabled. Often the start-up delay, “pH stability” error and stop from internal clock, are not considered errors; in this case, therefore, you should enter only the alarm “zero chlorine or redox”: P18 = 8.

PARAMETERS 19 … 22 ACTIVATION OF MEASURE 1, 2, 3, 4 ALARMS ON RELAY K3
PARAMETER 23 ACTIVATION OF MEASURE 5 (temperature) ALARMS ON RELAY K3
For each measurement you can enable specific alarms, with the following weights:
Bit0 Weight 1 = UR / OR measure x
Bit1 Weight 2 = alarm max. dosage time for measure x
Usually, for the first four measures, both alarms are activated (i.e. P19…22 = 3), while P23 (temperature) is set to zero because often the temperature sensor is not used.

PARAMETER 24 RELAY K3 NO or NC
This parameters allows to set the desired configuration for relay K3:
P24 = 0 → K3 output normally open (NO), that closes upon alarm
P24 = 1 → K3 output normally excited (contact closed, NC), that opens upon alarm (“fail-safe” mode).

PARAMETER 25 MEASURE LINKED TO THE RELAY OUTPUT K4
As P01, but referred to relay K4.

PARAMETER 26 OUTPUT TYPE FOR RELAY K4
As P02, but referred to relay K4.

PARAMETER 27 THRESHOLD FOR RELAY K4 / FIRST ACTIVATION TIME FOR RELAY K4
As P03, but referred to relay K4.

PARAMETER 28 HYSTERESIS FOR RELAY K4 / FIRST DEACTIVATION TIME FOR K4
As P04, but referred to relay K4.

PARAMETER 29	**OUTPUTS ON/OFF:**	**ACTIVATION DELAY RELAY K4**
	PWM CONTROL:	**TIME BASE RELAY K4**
	PFM CONTROL:	**NOT USED**
	TIMED OPERATION:	**SECOND ACTIVATION TIME FOR RELAY K4**

As P05, but referred to relay K4.

PARAMETER 30	**OUTPUTS ON/OFF:**	**DEACTIVATION DELAY RELAY K4**
	PWM or PFM CONTROL:	**NOT USED**
	TIMED OPERATION:	**SECOND DEACTIVATION TIME FOR RELAY K4**

As P06, but referred to relay K4.

PARAMETER 31 ALARM MAX DOSAGE TIME RELAY K4
As P07, but referred to relay K4.

PARAMETER 32 OFF STATUS RELAY K4
As P08, but referred to relay K4.

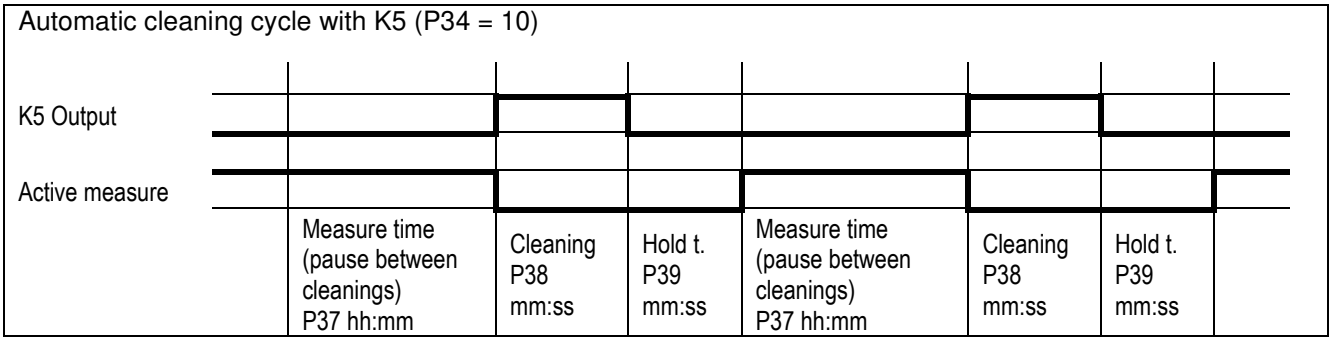
PARAMETER 33 MEASURE LINKED TO THE RELAY OUTPUT K5
As P01, but referred to relay K5.

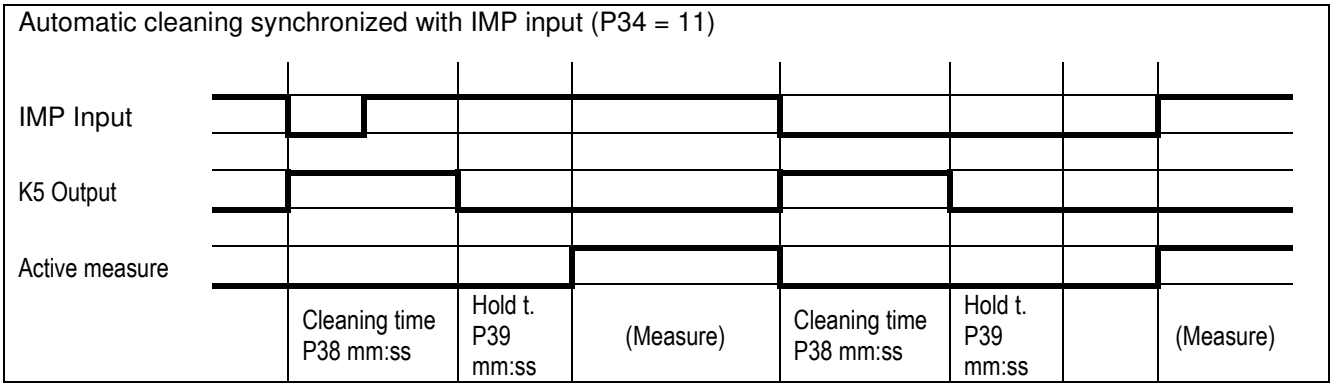
PARAMETER 34 OUTPUT TYPE FOR RELAY K5
This output can operate in the same modes of the other adjustment relays (K1, K2, K4), with two additional functions:

10 = automatic cleaning cycle — The relay connected to the sensor cleaning system activates for the time set in P38; during this time, the measurement(s) is(are) frozen to avoid variations due to the cleaning; then, measurement(s) is(are) hold for the hold time (P39). Finally, the P37 pause time (normal operation) is activated.
For selecting measurements to be frozen, see parameter P53.

11 = automatic cleaning synchronized with IMP input — The functioning is the same explained here above for the automatic cleaning cycle, but the pause time (normal operation) is determined by the external signal to the IMP input (not by parameter P37). In this way, measurement is always active when the plant is working and the sensor cleaning is performed when the system is in standby.

The diagrams on next page shows how the two automatic cleaning modes operate.





Note that the above diagrams are not to scale. As an indication, the cleaning time varies from 5 seconds to 1 minute, the measure hold time lasts approximately double the cleaning time, while the pause time (normal operation) varies from 1 to 6 hours, depending on the system, sensor type, degree of soiling, etc.

Warning*! If K5 is configured for automatic cleaning cycle (P34 = 10), at start-up and each time the configuration mode is exited, after a fixed time of 10 seconds, a cleaning cycle is performed.*

PARAMETER 35 THRESHOLD FOR RELAY K5 / FIRST ACTIVATION TIME FOR RELAY K5
As P03, but referred to relay K5. If P34 = 10 or 11, this parameter is not used.

PARAMETER 36 HYSTERESIS FOR RELAY K5 / FIRST DEACTIVATION TIME FOR K5
As P04, but referred to relay K5. If P34 = 10 or 11, this parameter is not used.

PARAMETER 37 OUTPUTS ON/OFF: ACTIVATION DELAY RELAY K5
PWM CONTROL: TIME BASE RELAY K5
PFM CONTROL: NOT USED
TIMED OPERATION: SECOND ACTIVATION TIME FOR RELAY K5
As P05, but referred to relay K5.

PARAMETER 38 OUTPUTS ON/OFF: DEACTIVATION DELAY RELAY K5
PWM or PFM CONTROL: NOT USED
ON/OFF + DAILY LIMITS: DOSAGE TIME FOR K5
TIMED OPERATION: SECOND DEACTIVATION TIME FOR RELAY K5
AUTOMATIC CLEANING: PAUSE TIME (H : MIN)
AUTOMATIC CLEAN. W/IMP INPUT: NOT USED
As P06, but referred to relay K5; also see explanations related to parameter P34 in case of automatic cleaning.

PARAMETER 39 ALARM MAX DOSAGE TIME RELAY K5
AUTOMATIC CLEANING: MEASURE HOLD DELAY AFTER CLEANING
As P07, but referred to relay K5; also see P34 explanation in case of automatic cleaning.

PARAMETER 40 OFF STATUS RELAY K5
As P08, but referred to relay K5.

PARAMETER 41 TYPE OF CURRENT OUTPUT 1
12 different combinations are available:

0 = 0-20 mA measure 1	1 = 4-20 mA measure 1	(meas. 1 standard = pH)
2 = 0-20 mA measure 2	3 = 4-20 mA measure 2	(meas. 2 standard = ORP)
4 = 0-20 mA measure 3	5 = 4-20 mA measure 3	(meas. 3 standard = not available)
6 = 0-20 mA measure 4	7 = 4-20 mA measure 4	(meas. 4 standard = free chlorine)
8 = 0-20 mA measure 5	9 = 4-20 mA measure 5	(meas. 5 standard = temperature)
10 = 0-20 mA measure 6	11 = 4-20 mA measure 6	(meas. 6 standard = total chlorine)

Through the current output, measurement can be repeated remotely (for example, can be sent to an electrical panel or to a PC or PLC) or you can configure it for proportional adjustment.

PARAMETER 42 STARTING VALUE FOR CURRENT OUTPUT 1
This parameter allows to set the measure value corresponding to the starting value of the first current output (0 or 4 mA depending on the P41 setting).
For example, if measure 1 (pH) has been set and you want to have 4 mA at 3.50 pH, set P42 = 3.50 (of course with P41 = 1).

PARAMETER 43 FULL SCALE VALUE FOR CURRENT OUTPUT 1
This parameter allows to set the measure value corresponding to the full scale of the first current output (20 mA). Referring to the previous example (pH), to get 20 mA at 8.40 pH, set P43 = 8.40.

PARAMETER 44 OFF STATUS OUTPUT mA1
The mA output typically follows the measurement trend, depending on the setting of P42 and P43. Anyway, fault or alarm conditions can be generated, that force the output to a certain value, to be set in the parameter P45. These conditions are:

Bit0	Weight 1	= lack of level 1
Bit1	Weight 2	= lack of level 2
Bit2	Weight 4	= lack of level 3
Bit3	Weight 8	= UR / OR of measurement associated to mA1
Bit5	Weight 32	= pH stability
Bit6	Weight 64	= internal clock
Bit7	Weight 128	= alarm zero chlorine or alarm redox

Enter the sum of the weights of the conditions which force the output to the P45 value.
Warning! The lack of flow or the "system OFF" request also deactivate the mA outputs. These conditions are always active and cannot be disabled!

PARAMETER 45 mA UPON ERROR FOR CURRENT OUTPUT mA1
If any error / fault defined in P44 occurs, the mA1 output will deliver the current set in this parameter. The value can be in the range from 0.00 to 21.00 mA. Typically, for a 4-20 mA output, set a fault current of 2 or 3 mA, so that any receiver can detect the problem or a dosing pump stops.

PARAMETER 46 RANGE OF CURRENT OUTPUT mA1
The mA1 output can be 0-20 or 4-20 mA. If measurement exceeds the limits set in parameters P42 and P43, the value of the output current can stop at the minimum or maximum value, or slightly higher. In this way, any fault is signalised to the receiver.
For example: 4-20 mA output on measure 2 (P41 = 3), from 500 to 800 mV (P42 = 500 , P43 = 800); if P46 = 0 and the reading falls to 480 mV (i.e. below the minimum), the current output will remain at 4.00 mA; if instead P46 = 1, the output current will be 3.00 mA. Similarly, with the reading at 803 mV (above the max) and P46 = 0, the output will be 20.00 mA, while with P46 = 1, the output will be 21.00 mA.
In case of 0-20 mA output, there will be an extended range for the output only for the 20 mA limit, because the MCO14 controller cannot generate a negative current.

PARAMETERS 47…52
As parameters P41…P46, but referred the mA2 output.

PARAMETER 53 HOLD MEASUREMENTS WITH ACTIVE "IMP" INPUT

This parameter allows to choose which measurements to freeze as the IMP input is activated and during the "hold" time of the automatic cleaning cycles. The last acquired values are frozen. Normal operations are resumed as the input is deactivated.

Bit0 Weight 1 = Hold measure 1
Bit1 Weight 2 = Hold measure 2
Bit2 Weight 4 = Hold measure 3
Bit3 Weight 8 = Hold measure 4
Bit4 Weight 16 = Hold measure 5

PARAMETER 54 START-UP DELAY

At start-up, some measurement sensors need a stabilization (or polarization) time, during which readings are not reliable. This parameter allows to set a proper start-up delay, in minutes : seconds.

Note that a pH electrode requires just one minute, while the stabilization of an ORP (redox) electrode may need up to 30 minutes. Sometimes this waiting time is also useful to compensate hydraulic delays at system start-up. Then set a time that activates when the control unit is powered on, during which the outputs are disabled and the "PW mm:ss" message flashes on the display.

As this time elapses, the MCO14 unit begins normal operations.

PARAMETER 55 DELAY AFTER RESTORING THE FLOW CONSENT

When you restore a water flow that was interrupted, a sensor stabilization (or polarization) period may be necessary before the readings are again reliable. On average this time is shorter than the one set in P54. While the flow is lacking the outputs are disabled and remain disabled even after the flow has been restored, for the time set in this parameter.

P55=0 means to have a minimum delay of 2 seconds (factory setting).

PARAMETER 56 PARAMETER NOT USED

PARAMETERS 57, 58 MEASURE ACTIVATION / DEACTIVATION TIME ON MONDAY
PARAMETERS 59…70 AS P57 & P58 FOR THE SIX REMAINING DAYS OF THE WEEK

MCO14 is equipped with an internal clock that allows to set in which time slots the outputs must be activated. These parameters are used for programming the switching on and off time for each day of the week. The values must be entered in the 24 hours format, from 00.00 to 23.59.

During the deactivation period, the display boxes configured for the visualization of error messages (see parameters P80…P83), will show the "TIME" message. This function is disabled by entering activation time 00.00 and deactivation time 23.59.

Typically, the activation time is before the switching-off (for example, activation at 07.00 and switching-off at 22.00), but you can also enter an activation time greater than the switching-off time, for example for swimming pools open till late night (for example, switching-off at 02.00 and reactivation at 08:00).

PARAMETER 71 PARAMETER NOT USED

Parameters reserved for future use.

PARAMETER 72 ALARM ZERO CHLORINE
PARAMETER 73 ALARM REDOX

These parameters allow to trigger an alarm when the chlorine signal becomes too low, and disable the outputs upon alarm (see parameters P08, P16, P32, P40, P44, P50).

- Alarm zero chlorine: Knowing that the chlorine level in the plant / pool can never be lower than a certain value (for example 0.10 ppm of the replenishing water), if measurement is lower than this threshold (P73), the alarm is triggered.

- Alarm redox: Due to manual super chlorination or to dosage system faults, the ORP electrode may be not able to give a mV signal easily convertible into a ppm value. At normal chlorine concentration (0.80 to 1.20 ppm Cl2), the electrode provides a signal of approximately 650-700 mV, that varies depending on the chemical conditions of the pool water; when saturated (chlorine level above 2.50-3.00 ppm), the electrode gives 720-740 mV. This characteristic can be used to disable the chlorine dosing system

operation when ORP (redox) readings are too high. When the alarm condition is resolved, the ORP electrode returns to normal values and the controller resumes normal operation.
The redox alarm threshold (in mV) has to be set in the parameter P73, to be checked experimentally for each plant / pool.
Warning! *The return of the RX electrode from saturation condition occurs with a delay of even 2 hours.*

Setting P72 and P73 to zero means not activating these controls. If an alarm occurs, it is shown in the display boxes configured for the visualization of error messages (see parameters P80…P83), with the "0 Cl2" and "REDOX" messages, respectively.

PARAMETER 74 VISUALIZATION OF COLORIMETRIC ANALYSIS CYCLE
The progress of the colorimetric analysis cycle can be displayed in the chlorine visualization boxes, alternating the analysis results. If this parameter is set to zero, nothing is displayed. If is set to 1, the visualization is in alternation with the free chlorine measurement; if is set to 2 the alternation is with the total chlorine; if is set to 3 the alternation is with both measurements.

PARAMETER 75 PAUSE BETWEEN TWO COLORIMETRIC ANALYSIS CYCLES
This parameter allows to enter a pause time between two subsequent colorimetric cycles for ppm Cl2 reading (measure 4). This time is entered in minutes : seconds. Valid values go from 20 seconds to 15 minutes. Recommended values: 4...8 minutes.

PARAMETER 76 NUMBER OF NORMAL CYCLES PER TOTAL/COMBINED CHLORINE CYCLE
Normally the total chlorine monitoring does not require an high frequency as free chlorine. This parameter allows to set this frequency, as number of normal cycles (free chlorine analysis only) per complete cycle (free and total chlorine).
For example: 0 = never perform a complete cycle, 1 = each cycle is a complete cycle, 2 = one complete cycle every two analyses of free chlorine, etc.
Note: *The total/combined chlorine cycle lasts a quite long time. It is recommended to not perform this analysis too often to not reduce the frequency of free chlorine measurement and affect the mixer life.*

PARAMETER 77 WORKING TEMPERATURE
Usually the working temperature is detected from the measure input 5 (PT100 probe). If no temperature sensor is connected, the value entered in this parameter is used as working temperature and reference for thermo-compensations.

PARAMETER 78 SUPER CHLORINATION TIME
This parameter is specific for pool applications. During super chlorination, the measurement sensors should not be touched by the water, to avoid unnecessary shock or oxidation. Since the super chlorination is a manual operation, before starting it, it is recommended to close the valves for water access to the system, and reopen them only when a normal chlorine level has been restored.
Sometimes the super chlorination can be performed in a semi-manual way, without closing the water inflow to the sensors and activating the specific control function in the MCO14 unit.
Enter in parameter P78 a time (super chlorination time, in hours **:** minutes) during which the control unit does not activate any output. Once this time has elapsed, the unit resumes to normal operation. Minimum time = 0 (function disabled), maximum time = 24 hours.
To trigger this function, go to the main menu. During super chlorination, the display shows the countdown of the remaining time (hh:mm:ss). The displayed time can be increased or decreased by acting on the arrow keys (⇑ ⇓) : each press results in a change of one minute.
In general, this parameter allows to set a time during which the outputs are disabled and, therefore, it can be also used for cleaning or maintenance operations, temporary closure of the plant, etc.

PARAMETERS 79 … 82 BOX 1, BOX 2, BOX 3, BOX 4 DISPLAY
The display of the MCO14 unit is "divided" into four boxes of eight characters each, which normally show measurement values. Depending on the controller configuration, measures may be from two up to six. To choose what to display and in which order, each box is associated to a number between 1 and 6, depending on the desired measurement.

By entering the number of the measure to display +10, if any fault / alarm occurs, the box will show the measure alternating with a short error message (always in English).
Finally, by entering values other than the measure number, dashes or empty fields are displayed.

PARAMETER 83 DISPLAY BACKLIGHT
To save power and extend the display life, the backlight can be set to turn off when no key is pressed.
If this parameter is set to 1, the backlight is always on; values between 2 and 30 (minutes) indicate the lighting up time after the last key press.
The "zero" value is reserved for special versions, provided with a POWER LED for indicating normal operating mode (slow flashing) or alarm / error condition (fast flashing).

PARAMETER 84 PASSWORD FOR STANDARD CONFIGURATION
This parameter allows to lock the standard configuration menu. Set a value other than zero to prevent that unauthorized personnel can access the configuration mode. In this case, when you try to access the standard configuration, the unit will request this password. Only by entering the value set in this parameter, you can program the controller. When delivered, no password is set.
Warning! *If you forget the set password, the configuration menu cannot be accessed and you must send the instrument to the factory for unlocking.*

PARAMETER 85 PASSWORD FOR ADVANCED CONFIGURATION
Same meaning and use of parameter P84, but referred to the advanced configuration.

PARAMETER 86 DEACTIVATION OF ELECTROCHEMICAL CALIBRATIONS
This parameter allows to inhibit all electrochemical calibrations of the unit, to prevent that unqualified personnel performs undesired calibrations. So when an authorized technician wants to perform a calibration, he should first access the advanced configuration menu and set this parameter to zero (once completed the calibration, set back this parameter to 1). If the advanced configuration is password protected (P86), only authorized personnel can unlock the electrochemical calibrations.

PARAMETER 87 DELAY OF CHLORINE ELECTROCHEMICAL CALIBRATION
This parameter is used only for chlorine amperometric measurements. Not for this unit.

PARAMETER 88 RESET OF ELECTROCHEMICAL CALIBRATIONS
This parameter allows to restore the factory calibrations of the various measurement, at any time. It can be useful in case of calibrations performed not accurately or with wrong calibration solutions.
To reset the desired calibration, enter the corresponding code:
P88 = 10 → reset all offset and gain values
P88 = 11 → reset offset and gain for measure 1
P88 = 12 → reset offset and gain for measure 2
P88 = 13 → reset offset and gain for measure 3
P88 = 14 → reset offset and gain for measure 4
P88 = 15 → reset offset and gain for measure 5
P88 = 16 → reset offset and gain for measure 6 (if provided)
Entering a value different from the ones listed will have no effect.

Warning*! If a calibration cannot be completed successfully due to damaged sensor or wrong calibration solutions, it cannot be done even after the reset of the related offset and gain values!*

PARAMETER 89 LANGUAGE
This parameter allows to choose the interface language. The available options are:
0 = Italian ; 1 = English ; 2 = French ; 3 = Spanish ; 4 = Dutch

PARAMETER 90 TYPE OF SERIAL LINE

From the hardware point of view, the serial output can be RS232 (standard) or RS485 (on request). This parameter allows to set the communication speed and the type of data processed, according to the following table:

P90	Speed [BPS]	Protocol / Intended use	P91 to associate
0		ASCII for µMMC	0
1	9600	ASCII for RW14, closed source SW	0…9
2, 3	19200, 38400	ASCII for closed source SW	0…9
4, 5, 6	9600, 19200, 38400	Modbus RTU Protocol	1…126

PARAMETER 91 SERIAL ADDRESS

In case of RS232 hardware, this value is always zero, as communication is only between the supervisor (PC, RW14, µMMC) and the control unit. Instead, in case of multipoint communication, i.e. RS485 serial port, you must enter the specific address to which the control unit will respond.

In the case of ASCII communication without protocol,, the allowed values range from 1 to 9 (then converted to the characters “a” ... ”i”), while for the Modbus protocol, addresses 1 to 126 are provided.

***Note**: In case of connection to RW14 or µMMC, this parameter must be set to zero.*

PARAMETER 92 SUMMER TIME

The internal clock can automatically change from standard to summer time (and vice versa), accordingly with the UE directives.

P92 = 0 → function disabled; P92 = 1 → function active.

***Warning**! This function will work till the year 2040.*

PARAMETER 93 DATA LOGGER

The MCO14 unit is equipped with an auxiliary internal memory, separate from the one used for saving calibration and configuration data, only to store the measurement values. This memory has a limited space, enough for 4080 recordings. Once reached the 4080 recordings, the new values are overwritten in the oldest ones. This feature is useful in particular in the first days of plant start-up, to check the proper performance of measurements and suitable dimension the dosages (for example, if the dosage is too strong, you will notice a saw tooth trend of the measurement). If the system is sufficiently monitored, the data can be downloaded with an appropriate frequency. In fact, using the appropriate serial command (512), all the 4080 data are downloaded in an intuitive format, easily importable into Excel (or similar programs), for creating tables and graphs. With standard communication rate (9600BPS) the data downloading will take approximately 7 minutes (time that is halved in the case of speed 19200BPS and is reduced to a quarter at 38400BPS). During this phase, the unit operates normally, but you cannot access any visualization. You can also use the command 511 to view the last storage, or the command 513 to display the last 50 measurements. Also available is the serial communication program SERCOM, which converts the downloaded data in files split by date, compatible with the format of the µMMC recorder and, therefore, directly readable with the program GENERA. This parameter allows to set the recording sequence as follows:

0 = no recording
1 = recording every minute, duration of about three days
2 = recording every 2 minutes, duration of about six days
3 = recording every 5 minutes, duration of about 14 days
4 = recording every 10 minutes, duration of about 28 days
5 = recording every 15 minutes, duration of about 42 days
6 = recording every 20 minutes, duration of about 56 days
7 = recording every 30 minutes, duration of about 85 days

A second part of the memory is reserved for storing the events, complete with date and time. Also in this case the maximum number of records is 4080. The short commands for event identification are always

in English. The commands to view the content of this part of memory are: 514 = last event, 515 = all events, 516 = last 50 events.

***Note**: The memory life is at least three years with recordings every minute, 6 years with recordings every 2 minutes, and so on.*

PARAMETER 94 AUTOSET

This parameter allows to restore the factory settings for all configuration parameters. The function is activated by entering the value communicated at the delivery. The standard value is 12, anyway different values can be agreed with the customer for specific repairs. This function also resets all offset and gain values of measurements, and should be activated only in case of malfunctioning due to wrong calibrations, or to completely reset the controller to move it to a new plant.

***Warning!** If particular functions have been activated in your device, restoring the factory configuration will make you lose those settings. In particular, the values entered in the parameters P79…P82 (Visualization of the 4 measurements), P83 (Display backlight), P90 and P91 (Serial type and address) will be reset. Parameter P89 (Language) will <u>not</u> be affected.*

CONTROL EXAMPLES

Here are some examples for configuring the control parameters:

1) Acidification control with the pH-meter section, to keep the pH value at 7.40:

1a) Simple ON/OFF control on K1:

MEASURE LINKED = 1 (pH)	(P01 = 1)
RELAY TYPE = 1 (ON/OFF acidification)	(P02 = 0)
THRESHOLD = 7.30	(P03 = 7.30)

It is recommended to set a narrow hysteresis window:

HYSTERESIS = 0.20	(P04 = 0.20)

No delay is requested. Set:

ACTIVATION DELAY = 0	(P05 = 0:00)
DEACTIVATION DELAY = 0	(P06 = 0:00)

1b) PWM proportional control on K1:

MEASURE LINKED = 1 (pH)	(P01 = 1)
RELAY TYPE = 3 (PWM acidification)	(P02 = 3)
THRESHOLD = 7.30	(P03 = 7.30)

The start / end control window (proportional band) should not be too narrow to avoid instability problems. Set:

HYSTERESIS = 0.50	(P04 = 0.50)

The time base has to be set depending on the actuator type (solenoid valves: 10...20 sec; small dosing pumps: 2...3 minutes; bigger pumps: at least 5 minutes):

TIME BASE = 3 min.	(P05 = 3:00)
Parameter not used	(P06 = 0:00)

The following parameters must also be set:

P07 = Alarm max dosage time for K1 → depends on the chemical / hydraulic reaction time; typically, within one hour from the dosage start, the threshold must be reached → P07 = 1:00.

P08 = OFF K1 → K1 can be disabled upon measurement error, alarm max dosage time and internal clock: enter the sum of the weights → P08 = 8 + 16 + 64 = 88

2) Control of the pool chlorination to get a free chlorine level of 0.80 ppm

2a) Simple ON/OFF control on K2:

MEASURE LINKED = 4 (ppm Cl_2)	(P09 = 4)
RELAY TYPE = 2 (ON/OFF chlorination)	(P10 = 2)
THRESHOLD = 0.80	(P11 = 0.80)
HYSTERESIS = 0.15	(P12 = 0.15)
ACTIVATION DELAY = 0	(P13 = 0:00)
DEACTIVATION DELAY = 0	(P14 = 0:00)

2b) PWM proportional control on K2:

MEASURE LINKED = 4 (ppm Cl_2)	(P09 = 4)
RELAY TYPE = 4 (PWM chlorination)	(P10 = 4)
THRESHOLD = 0.80	(P11 = 0.80)
HYSTERESIS = 0.40	(P12 = 0.40)
TIME BASE = 3 min.	(P13 = 3:00)
Parameter not used	(P14 = 0:00)

As for the previous example, the following parameters must also be set:

P15 = Alarm max dosage time for K2 → consider a maximum of one hour and a half to reach the threshold, then set P15 = 1:30.

P16 = OFF K2 → K2 can be disabled upon measurement error, alarm max dosage time, “pH stability” time, internal clock and zero chlorine or redox alarm: enter the sum of the weights → P16 = 8 + 16 + 32 + 64 + 128 = 248

3) Adjust the water temperature to get a heating up to 28.0 °C:

3a) Simple ON/OFF control on K4:

MEASURE LINKED = 5 (temp.)	(P25 = 5)
RELAY TYPE = 2 (open upon threshold exceeded)	(P26 = 2)
THRESHOLD = 28.0	(P27 = 28.0)
HYSTERESIS = 0.4	(P28 = 0.4)
ACTIVATION DELAY = 0	(P29 = 0:00)
DEACTIVATION DELAY = 0	(P30 = 0:00)

Other parameters to be set for K4:

P31 = Alarm max dosage time for K4 → no limits, i.e. P31 = 0:00.

P32 = OFF K4 → K4 can be disabled only upon measurement error, then set only the weight 8 → P32 = 8

4) Check the pool chlorination to have 1 ppm of free, using the K4 output configured as SSR relay and pump with pulse input:

MEASURE LINKED = 4 (ppm Cl_2)	(P25 = 4)
RELAY TYPE = 12 (PFM, chlorination)	(P26 = 12)
THRESHOLD = 1.00	(P27 = 1.00)
HYSTERESIS = 0.30	(P28 = 0.30)

5) Activate timed operation on K5 to control the pump for dosing flocculent.

Suppose we need to set a single daily dosage of flocculent at 06:00, for a period of 15 minutes.

MEASURE LINKED = 1 (pH, insignificant)	(P33 = 1)
RELAY TYPE = 11 (timed operation)	(P34 = 11)
1° ACTIVATION TIME	(P35 = 06:00)
1° DEACTIVATION TIME	(P36 = 06:15)
2° ACTIVATION TIME	(P37 = 00:00)
2° DEACTIVATION TIME	(P38 = 00:00)

Other parameters to be set for K5:

P39 = Alarm max dosage time for K5 → not usable, then P39 = 0:00.

P40 = OFF K5 → K5 is automatically disabled in case of lack of flow or no external consent, so for this setting, this parameter can remain zero.

Important! *In this case the K5 output must be configured as a simple contact and enters as an external consent signal in the pump for flocculent dosing; it has to not interrupt the power supply, since K5 cannot be used at 230V~.*

ADDITIONAL VISUALISATIONS

Pressing the arrow keys (⇑ ⇓) while in normal mode, specific visualizations of the parameters related to the measurements, are displayed. The value within brackets is the input value before being converted, the "G" value is the gain factor, the "O" is the offset.

pH	(mV value without temperature compensation)	
	G (gain factor)	= 0.750 ... 1.500
	O (offset a 25°C)	= -0.90 ... 0.90
ORP (Redox)	(mV value with no offset added)	
	G (gain factor)	= 1.000 (fixed)
	O = offset in mV	= -100 ... 100
Temperature	(value without offset/gain)	
	G (gain factor)	= 0.940 ... 1.060
	O (offset in °C)	= -2.0 ... 2.0
Colorimetric analysis	(transmittance value without offset/gain)	
	G (gain factor)	= 0.700 ... 1.300
	K = self-zeroing offset	= 0.900 … 3.000

In general, the more the offset value is close to zero and the more the gain value is close to 1.000, the better are better are the sensor conditions.

ERRORS

When an error occurs, the display shows a specific error code and a short description. Generally the errors appear when the unit is powered on or when exiting the configuration mode. The error display is shown for about 3 seconds. The possible errors are listed here below:

ERR 11 Calculation mA1 output
The start / full scale values for mA1 output range are too close. Check P42 and P43.

ERR 12 Calculation mA2 output
The start / full scale values for mA2 output range are too close. Check P48 and P49.

ERR 13 Calculation PWM or PFM relay K1
The relay K1 has been configured for proportional control (PWM with P02 = 3 or 4, or PFM with P02 = 7 or 8), but the hysteresis window (proportional band) is too narrow, or the time base has been set to zero. Check the setting of P04 and P05.

ERR 14 Calculation PWM or PFM relay K2
As error 13, but referred to K2. Check the setting of P12 and P13.

ERR 15 Calculation PWM or PFM relay K4
As error 13, but referred to K4. Check the setting of P28 and P29.

ERR 16 Calculation PWM or PFM relay K5
As error 13, but referred to K5. Check the setting of P36 and P37.

ADDITIONAL ALARM MESSAGES
In case of input signals too low or too high, the unit displays the messages **"UR"** (Under Range) or **"OR"** (Over Range). In fact, in these conditions the value of the input signal is not reliable and an error is generated.

During the colorimetric reading cycle, the control unit performs an auto-reset cycle to compensate for water turbidity, dirty lenses and other possible interferences. If the result is not satisfactory, an error is generated and signalled by the message "**No Azz**".

The boxes reserved to the error visualization may also display the following messages:

PW mm:ss	indicates the countdown of the start-up delay before starting normal operation
pH mm:ss	indicates the countdown of the "pH stability" waiting time before starting normal operation
Off	indicates the request of disabling outputs from the OFF contact
Flow	indicates the lack of flow detected by the FLW contact
Time	indicates the request of disabling outputs from internal clock
0 Cl_2	indicates "**alarm zero chlorine"**
Redox	indicates **"alarm redox"**
Max TK1	indicates **"alarm max dosage time K1"**
Max TK2	indicates **"alarm max dosage time K2"**
Max TK4	indicates **"alarm max dosage time K4"**
Max TK5	indicates **"alarm max dosage time K5"**
Lev 1	indicates the lack of reagent 1
Lev 2	indicates the lack of reagent 2
Lev 3	indicates the lack of reagent 3

Instrument block -> memory reset
if the microcontroller finds non-congruent data in the memory and cannot fix them, it blocks the operations of the control unit and generate this alarm. This is an error that occurs very rarely and that may be due only to a memory defect or to noise so strong as to overcome the filters of the power supply and inputs.
Return the instrument to the manufacturer for replacing the microcontroller.

Only for skilled personnel! A limit working time can be set, after which the control unit requests a technical assistance intervention. This warning does not block the system operation,

but serves to schedule the maintenance by an authorized technician. This time is entered via serial line (ASCII code, no ModBus) with the command **AL=dd**, where "dd" are the days of autonomy. Once maintenance has been performed, clear the warning message with the serial command **AZ**.

SERIAL LINE

MCO14 features a serial line (RS232C or RS485) for communication with terminals, PC or advanced PLC. Please note that the supervisor connected to the MCO14 control unit is named "Master". Considering a hypothetical link between MCO14 and PC, on which runs a "HYPERTERMINAL" program or equivalent, what appears on the "Master" video is exactly the answer of the MCO14. Whatever the speed set with parameter P89, the standard transceiver parameters are:
8 BITS , NO PARITY , 1 STOP BIT.
Different characteristics can be requested upon order. The pin-out on the terminal block are described in the "Electrical Connections" section.
Communication can be of **ASCII** type without protocol or with **Modbus RTU** protocol.

ASCII

In case of no protocol, communication takes place using ASCII standard characters, without control character. Messages sent over the serial line have been designed to be as simple and intuitive as possible.
For the connection of the serial line terminal block, see the "Electrical Connection" section.

MCO14 automatically sends to the "Master" the following messages:

MCO14 START-UP	at start-up
ERROR PARAMETER nn	at start-up or when exiting the configuration mode
LOW POWER SUPPLY	at start-up or when detecting low power supply

MCO14 answers to the following commands:

Command	Effect		Command	Effect
M1	Show measure 1 value		**DD**	Show date/time
M2	Show measure 2 value		**Pxxx**	Read PARAMETER xxx value
M3	Show measure 3 value		**Pxxx = YYYY**	Write the value YYYY in parameter xxx
M4	Show measure 4 value		**AP**	Update parameters (required after each setting change)
M5	Show measure 5 value		**511**	Last record of the data logger
M6	Show measure 6 value (if provided)		**512**	Send data stored by the data logger
M7	Show measure 7 value (if provided)		**513**	Send last 50 data stored by the data logger
M8	Show electronic board temperature		**514**	Last event recorded in the data logger
HH	Help dei comandi		**515**	Send events stored by the data logger
UU	Values of mA1 and mA2 outputs		**516**	Send last 50 events stored by the data logger
SS	Status of: inputs, outputs, alarms		**AL=gg**	Time limit (in days) for service request
RR	Microprocessor reset (reboot)		**AZ**	Cancel the service request alert
			ZZ	Reset offset/gain values

Notes:
- *In case of RS485 serial line, these commands (and their answers) are preceded by the unit address, set in parameter P89, which is a lowercase letter starting from "a" (i.e. from "a" to "i" for address from 1 to 9).*
- *There are also other adjustment / calibration commands used only at the factory.*
- *Each command must be confirmed by pressing <CR> (or <ENTER>).*
- *All serial line messages are fixed and are not affected by the language set for the display.*

- *Typing mistakes in a command cannot be corrected. Send the wrong command (which will have no effect) and then enter the correct one.*

In the data logger measurements are stored in fixed format, such as:
150418;15.20;+007.00;-00084.;+000.00;+001.32;+0025.7;+000.00

Which correspond to:
YearMonthDay;Hours.Minutes;Measure1;Measure2;Measure3;Measure4;Measure5

The events are stored as short, simple messages in English, which also include the date and time indication:

Event	Description		Event	Description
Power On	Device switching on		**Offs Mx**	Offset calibration of measure “x”
Std Editor	Standard parameter editor		**Gain Mx**	Gain calibration of measure “x”
Adv Editor	Advanced parameter editor		**Tar.Disab.**	Attempted unauthorized calibration
Test Out	Manual test of outputs		**Wait Tar.**	Attempt to calibrate prematurely
Set Time	Clock adjustment		**Err.Tar.Mx**	Calibration error of measure “x”
Serial Edit	Parameter editing from serial line		**End Tar.**	Successful calibration
TMx=yy	Factory calibrations / settings		**Err. yy**	Error “yy” (see “Errors” for details)
UMx=yy			**MaxTKx=s**	Error max dosage time for relay “x”
VMx=yy			**TimeOff=s**	Device OFF requested from internal clock
IMx=yyyy			**ZeroCl=s**	Alarm zero chlorine
FMx=yyyy			**All RX=s**	Alarm Redox
ISx=yyyy			**SuperCl=s**	Super-chlorination start
FSx=yyyy			**Lev x = s**	Change of status (s) for level “x” input
Res PSW	Reset password		**Flow = s**	Change of status (s) for FLOW input
Res Tar.	Reset offset / gain values		**Off = s**	Change of status (s) for OFF input
DST on	Summer time start		**Imp = s**	Change of status (s) for IMP input
DST off	Summer time end (back to standard time)			

MODBUS RTU

In this case, the communication takes place through the standard protocol by Modicon (**http://www.modbus.org/**). Data exchange takes place via "holding registers", allocated as follows:

Command	Register no.	No. of registers	Action	Result
Read 0x03	101…108	1	Read the single register	Current value of selected measurement
Read 0x03	100	8	Read 8 registers (101..108)	Current value of measurements 1…8
Read 0x03	121	1	Read the single register	Current status of inputs #1
Read 0x03	122	1	Read the single register	Current status of outputs #2
Read 0x03	123	1	Read the single register	Current status of alarms #3
Read 0x03	121	3	Read 3 registers (121..123)	Status of inputs / outputs / alarms
Read 0x03	131	1	Read the single register	Current value 1st mA output
Read 0x03	132	1	Read the single register	Current value 2nd mA output
Read 0x03	131	2	Read registers 131 and 132	Current value of mA outputs
Read 0x03	1…94	1..16	Read registers	Value of related parameter
Write 0x06	1…94	1	Write the single register	Value of related parameter
Read 0x03	141…147	1	Read the single register	Value of the selected offset (M1…M7)
Write 0x06	141…147	1	Write the single register	Forcing selected offset value (M1…M7)
Read 0x03	151…157	1	Read the single register	Value of the selected gain (M1…M7)
Write 0x06	151…157	1	Write the single register	Forcing selected gain value (M1…M7)
Write 0x06	161…167	1	Write the single register	Calculation (and storage if within the limits) of the offset value for the selected measurement (M1…M7)
Write 0x06	171…177	1	Write the single register	Calculation (and storage if within the limits) of the gain value for the selected measurement (M1…M7)
Write 0x06	201	1	Write the single register (value 123)	Update parameters (to be performed after any modification of registers 1…94)
Write 0x06	202	1	Write the single register (value 123)	Microprocessor reset
Read 0x03	190	7	Read 7 registers (190..196)	Current date and time data, in the following order: Year, Month, Day, Day of the week, Hours, Minutes, Seconds
Write 0x10	190	7	Write 7 registers (190..196)	Date and time setting, in the following order: Year, Month, Day, Day of the week, Hours, Minutes, Seconds

#1: Encoding of the status of the inputs:

bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Weight	32768	16384	8192	4096	2048	1024	512	256	128	64	32	16	8	4	2	1
Input											Imp	Off	Flow	Level 3	Level 2	Level 1

***Note**: for normal operation of the unit, all inputs must be ON, i.e. HR121 = 31*

#2: Encoding of the status of the outputs:

bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Weight	32768	16384	8192	4096	2048	1024	512	256	128	64	32	16	8	4	2	1
Output							Mixer	Perist. 3	Perist. 2	Perist. 1	EV	K5	K4	K3	K2	K1

#3: Encoding of the alarms:

bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Weight	32768	16384	8192	4096	2048	1024	512	256	128	64	32	16	8	4	2	1
Alarm	Instrument block	Service request					Super chlorinat.	Redox	Zero chlorine	RTC (clock)	pH stability	Start-up delay	Max. time K5	Max. time K4	Max. time K2	Max. time K1

***Note**: since the time limit for service request cannot be entered via "holding register", the related alarm will never trigger.*

Notes:

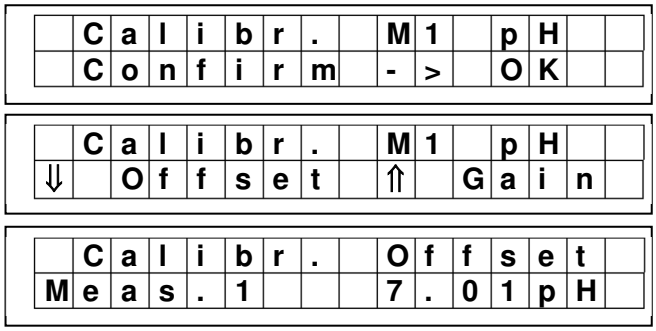
- *All registers are 16-bit.*
- *All values are without comma (therefore they must be correctly interpreted by the "Master").*
- *Parameters can be read individually or in blocks, but it is not possible to write more than one parameter at a time.*
- *Negative numbers are represented in two's complement.*
- *Any commands not included in the above table do not give any answer / effect.*

ELECTROCHEMICAL CALIBRATIONS

pH

Preparation:
a) Check availability and expiration date of the calibration solutions, buffers at pH 7 and pH 4 (or 9)
b) Check the buffer solution temperature (if the temperature is significantly different from the working temperature, use the immerse the temperature compensation sensor into the buffer together with the electrode; wait about 3 minutes for thermal equilibrium)
c) Simulate the OFF contact or close the water inlet valve to activate the “flow” alarm and, therefore, disable all outputs during calibration

Calibration procedure:
1) Remove the electrode from its support, rinse it with distilled water, then dry it
2) Immerse the electrode into the pH 7.01 buffer solution
3) Press the MENU/OK key
4) The instrument ask confirmation to enter the calibration mode: press ESC to exit the calibration mode, or MENU/OK to confirm.
   If calibration option is confirmed, the display shows two choices:
5) Press ⇓ to calibrate the offset (pH 7.01); the instrument automatically recognizes and displays the buffer value
6) If necessary, use the arrow (⇑ ⇓) keys to adjust the calibration value



7) Press MENU/OK to confirm the calibration, or ESC to exit without saving (and the previous calibration data are kept)
8) Rinse the electrode with distilled water, then dry it
9) Immerse the electrode into the pH 4.01 (or 9.01) buffer solution
10) Repeat steps from 4 to 8, pressing the ⇑ key at step 7 to select the gain calibration
11) Install back the pH electrode and Pt100 probe (if used) for normal control operations
12) Open water flow to the system, remove the OFF contact to resume to normal operations

If you try to calibrate the gain at pH lower than 4 or higher than 9, the unit will provide the input value as calibration point (no automatic recognition). If the input value is not compatible with the calibration (too far from the correct values), for both the offset and gain, the instrument automatically discards the calibration and generate an error. The display shows the message “Impossible!” - Possible causes:

a) wrong sequence of keystrokes during the procedure
b) the buffer solution is contaminated or expired
c) the electrode is not working properly (damaged or exhausted)
d) the connection cable is damaged

ORP (Redox)

Preparation:
a) Check availability and expiration date of the calibration solution (e.g. 220 mV)
b) Simulate the OFF contact or close the water inlet valve to activate the “flow” alarm and, therefore, disable all outputs during calibration

Calibration procedure:
1) Remove the electrode from its support, rinse it with distilled water, then dry it
2) Immerse the electrode into the calibration solution (e.g. 220 mV)
3) Press the MENU/OK key

4) Press ⇑ until the display shows the message “CALIBRATION M2 mV”
5) Press ⇓ to perform the offset calibration
6) The instrument automatically recognizes and displays the solution value
*(**Note**: The MCO14 automatically recognizes the standard solutions at 220mV, 468mV and 650mV)*
7) If necessary, use the arrow (⇑ ⇓) keys to adjust the calibration value
8) Press MENU/OK to confirm the calibration, or ESC to exit without saving (and the previous calibration data are kept)
9) Rinse the electrode with distilled water, then dry it
10) Carefully install back the electrode for normal control operations
11) Open water flow to the system, remove the OFF contact to resume to normal operations

<u>The ORP calibration is a single-point procedure (offset).</u>

If you try to perform a ORP calibration with an offset value other than those recognized automatically by the instrument, the display shows the input value as calibration point (no automatic recognition).
If the “Impossible!” error message is displayed, the possible causes are:

a) the calibration solution is contaminated or expired
b) the electrode is not working properly (damaged or exhausted)
c) the connection cable is damaged

Temperature

The instrument electronic calibration and the precision class of the Pt100 sensor, ensure a maximum error of ±0.3°C @0°C and ±0.8°C @100°C (Pt100: class B accordingly with IEC 751). This error is acceptable for most applications, and no temperature calibration is required.
However, if a calibration adjustment is needed, proceed as follows:
1) Carefully remove the Pt100 probe from its installation
2) Immerse the Pt100 probe into a vessel containing a mixture of water and ice (0 °C)
3) Press the MENU/OK key
4) Press ⇑ until the display shows the message “CALIBRATION M5 °C”
5) Press ⇓ to perform the offset calibration
6) The instrument does not recognize the temperature, but shows the read value
7) Use the arrow (⇑ ⇓) keys to adjust the displayed value to the desired calibration point (e.g. 0.0 °C)
8) Press MENU/OK to confirm
9) Immerse the Pt100 probe into a vessel containing hot water (100 °C) or another liquid at known temperature (greater than 70°C)
10) Press the MENU/OK key
11) Press ⇑ until the display shows the message “CALIBRATION M5 °C”
12) Press ⇑ to perform the gain calibration
13) The instrument does not recognize the temperature, but shows the read value
14) Use the arrow (⇑ ⇓) keys to adjust the displayed value to the desired calibration point (e.g. 100.0°C)
15) Press MENU/OK to confirm the calibration, or ESC to exit without saving (and the previous calibration data are kept)
16) Install back the temperature sensor for normal control and temperature compensation operations
17) Open water flow to the system

The instrument can be also calibrated at different values, but it is recommended to perform the thermometer calibration at these two points (0 and 100°C).

Colorimeter

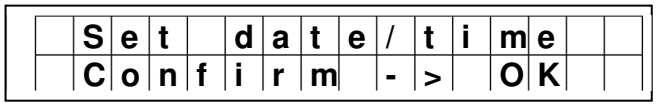
We do not recommend any adjustment of this section. In fact, the colorimeter is factory calibrated with a reference colorimeter. If you would still like to make minor adjustments of the indicated measurement, proceed as follows:

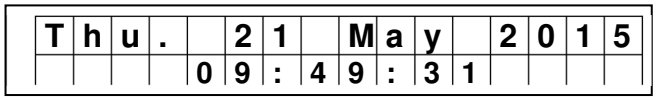
1) Press the MENU/OK key
2) Press ⇑ until the display shows the message “CALIBRATION M4 Cl2”
3) Press ⇑ to perform the gain calibration
4) The display will show the chlorine value currently stored
5) Use the arrow (⇑ ⇓) keys to adjust the displayed value to the desired value
6) Press MENU/OK to confirm the calibration, or ESC to exit without saving (and the previous calibration data are kept)

If measurement is wrong or too low (below 0.50 ppm), calibration cannot be performed.
If the unit can also measure total chlorine, the adjustment can be performed by displaying the option “Calibration CLT”.

SET DATE / TIME

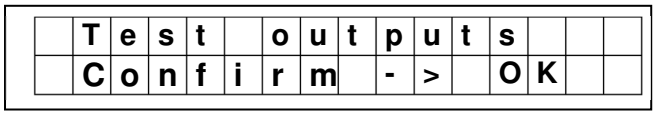
Press the MENU/OK key and use the ⇓ ⇑ keys to access the set date/time procedure.
Press MENU/OK to confirm.
The display shows date and time, with the cursor under the name of the day.
Use the ⇓ ⇑ keys to set the day and then press MENU/OK to confirm, or ESC to exit without saving.
After confirming the setting, the cursor moves to the next field. Proceed to the adjustment of all available fields.

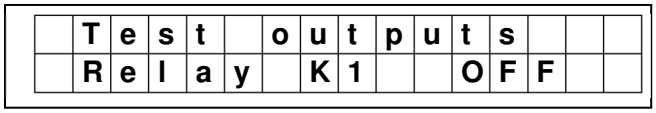




MANUAL OPERATIONS

The controller allows to perform some manual testing operations.
To enter this mode, press MENU/OK once and then press the ⇓ ⇑ keys until the “Test outputs” message is displayed.
Press MENU/OK to access the mode.
The unit displays the first available test, referred to the K1. Use the ⇓ ⇑ keys to scroll the tests of the remaining relays and specific functions/parts for colorimetric analyses.
Press MENU/OK to confirm the desired option.





Please note that:

- K1, K2, K4, K5 are the four control relays; the manual activation of these relays can be useful to check the devices connected to them
- K3 is the alarm relay
- K6, K7, K8, K9, K10 and K11 are the (internal) outputs specific for the colorimeter, and activate EV (solenoid valve), P1 (pump 1), P2 (pump 2), P3 (pump 3), Mix1 (mixer 1) and Mix2 (mixer 2), respectively

To exit the “Test outputs” mode, press ESC.

Warning! *The “Test outputs” menu cannot be accessed while a colorimetric analysis is in progress! The relay energization can cause dangerous activations of the device connected to it.*