



EF300 pH/Chlorine

with CAC Cell

INSTRUCTION MANUAL



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.

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 our 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 unit is supplied complete with:

1. pH electrode with direct cable and BNC connector
2. CAC-CLO-M1 cell with spare electrolyte (50 ml)
3. SD-CAC2 down-flow type probe-holder, complete with prewired flow sensor
4. PT100 temperature probe (prewired)
5. Installation kit (Kit B), including 2 PVC valves M/F ½", 2 PVC fittings with ½" threaded nut, PE hose 6x8 (5 m)
6. pH4 and pH7 buffer solutions (90 ml each)
7. Screws and stoppers for wall mounting
8. Instruction manual

INTRODUCTION

EF300 is a compact system easy to install (wall) and maintain, which allows to monitor and control the pH and chlorine levels in swimming pools.

The EF300 system includes a digital controller which operates accordingly with the set thresholds, pH electrode, temperature probe, chlorine cell and down-flow type probe-holder.

INSTALLATION



Warning! Always follow the warnings and general safety information referred at the beginning of this manual!

Install the EF300 unit away from heat sources, in a dry place protected from direct sunlight, at a maximum ambient temperature of 45°C.

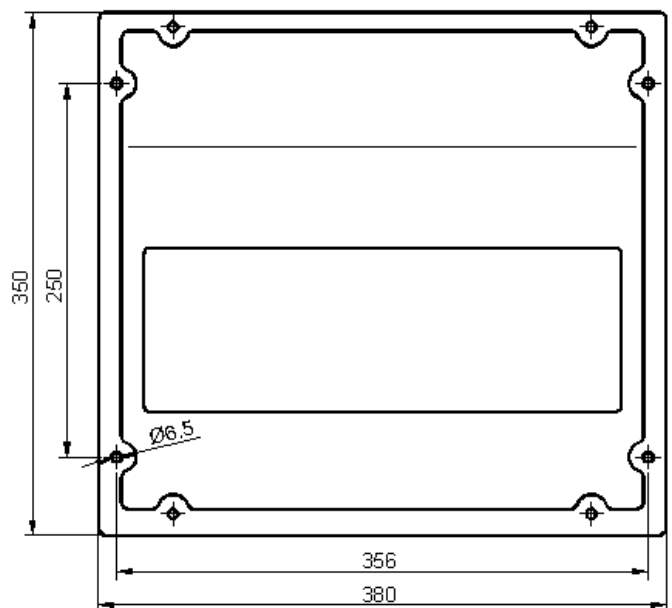
The minimum temperature shall be such as to ensure the solution to be dosed remains in a fluid state and in no case less than that declared in the "Technical Data" section.

The EF300 unit must be installed on a vertical wall and securely clamped. Choose a location that allows easy calibration operations, use and maintenance.

Connect the connectors may be disconnected for packaging reasons to the respective inputs on the bottom of the unit (see the "Functional description" section for further details).

TECHNICAL DATA

pH Input	available on BNC connector, input impedance > 10 ¹² Ω
Chlorine Input	available on M8 connector, for CAC cell
Temperature Input	prewired input for PT100 sensor
Measure Ranges	0.00 to 14.00 pH, 0.00 to 5.00 ppm chlorine, 0 to 100°C
Precision	better than 1% of the full scale
Repeatability	better than 0.2% of the full scale
Configuration	two configuration level (standard and advanced)
Adjustment Outputs	PUMP1 and PUMP2, 230 V~, for driving two dosing pumps
FLOW Input	1 input for 3-wire micro-magnetic flow sensor
Serial Port	RS232, available on external connector
Display	large, 2-row (x 16 characters), alphanumeric LCD, with backlight
Probe-holder	down-flow type, transparent methacrylate body, with PP connections for hose 6x8, sampling valve and housings for chlorine cell, pH electrode, temperature probe and flow sensor
Power Supply	230 V~, 50 Hz
Protection Fuse	F3.15A 5x20
Environment	Storage temperature -20 ... +60 °C Working temperature -10 ... +45 °C RH max 90% noncondensing
Casing	self-extinguishes plastic material with polyester front panel
Installation	wall installation with supplied screws and stoppers
Protection Rate	IP65
Dimensions	380 x 350 x 175 mm
Fixing Template	356 x 250 mm
Weight	approx. 2 kg



FUNCTIONAL DESCRIPTION OF THE SYSTEM

Front view



- Control panel with large display and keyboard (see details on next page)
- 3-wire micro-magnetic flow sensor (prewired)
- Down-flow type probe-holder with transparent methacrylate body and flow regulator
- PT100 temperature probe
- pH electrode with direct cable and BNC with protective sheath
- CAC-CLO-M1 cell for free chlorine measurement

Bottom view: connections

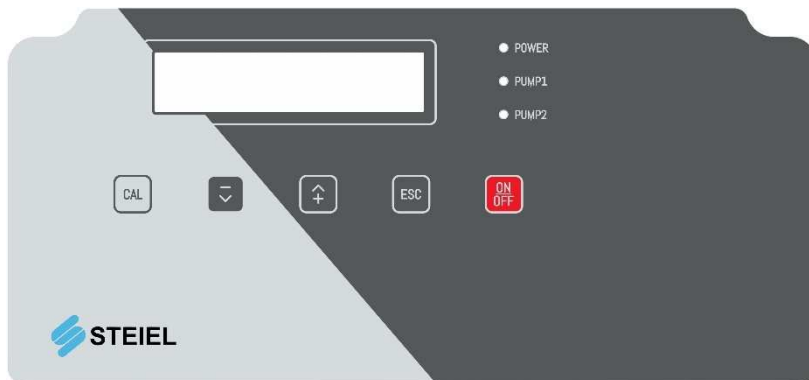


POWER	Power cable (prewired)
PUMP1	Output for pump 1 connection (pH adjustment)
PUMP2	Output for pump 2 connection (chlorine adjustment)
RS232	Connector wired to the RS232 serial port
pH	BNC plug for pH electrode
PT100	Connection cable of temperature sensor (prewired)
CL	Connector wired to the measurement input for CAC cell



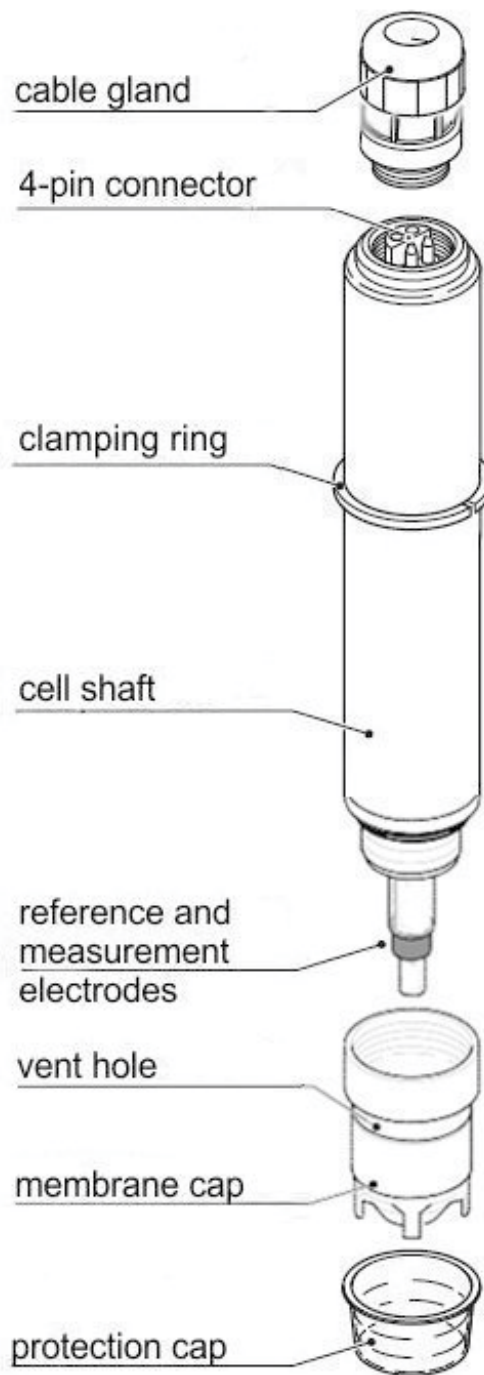
Warning! Never power the unit if PUMP1 and PUMP2 outputs are not connected!

Front panel



POWER LED	Green light: slow flashing indicates that the unit is powered and normally functioning, while fast blinking indicates a fault (lack of liquid to be dosed or pump disabled)
LED PUMP1, 2	Red light is on when the corresponding pump is dosing
CAL Key	Provides access to the “Configuration”, “Calibration” and “Manual Mode” menus; confirms parameter modifications
↓ Key	Scrolls the available menus/options; in calibration and configuration modes decreases the displayed value
↑ Key	Scrolls the available menus/options; in calibration and configuration modes increases the displayed value
ESC Key	In calibration and configuration modes exits without saving the modifications; from manual mode resumes to normal operations
ON/OFF Key	Activate / de-activates the unit or confirms alarms; both the disabled dosing and alarm condition are indicated by the POWER LED that flashes fast (Warning! The unit remains disabled even in case of shutdown / restart)

CAC-CLO-M1 Probe



ELECTRICAL CONNECTIONS

The EF300 unit is supplied internally prewired and complete with power cable.
Standard power supply: 230 V~, 50 Hz, monophasic.



Carefully follow all the rules of electrical safety.

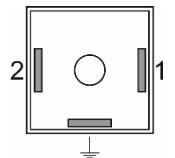
Before starting the unit, check that all electrical and plumbing connections have been properly executed.

The measure input from pH electrode is available on BNC plug, while the chlorine cell input is on M8 connector. The connection cables for temperature sensor and flow sensor are internally prewired, while the pump inputs are available on special connectors that allow an extremely quick and easy wiring even by unskilled personnel.

Note: the pH input should never be open; if not used, it is necessary to make a short-circuit.

Connections of Dosing Pumps

The system is equipped with two connectors for wiring two dosing pumps, using 3-wire cables. See picture: pin 1 = phase, pin 2 = neutral.



Warning! Never power the unit if PUMP1 and PUMP2 outputs are not connected!

Flow Control

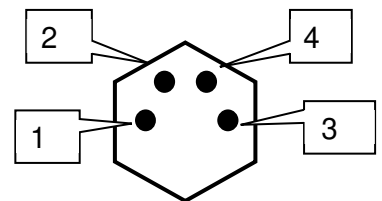
For correct operations, the CAC cell must be mounted on a special probe-holder, complete with flow sensor for detecting the correct water flow. This 3-wire (brown, blue, black) sensor is supplied prewired and preinstalled in the probe-holder.

The system is configured at the factory to stop dosage in case of water flow lack.

Input for CAC Cell

The measurement input is wired to an axial connector, with the configuration described here below:

- pin 1 = -5V (brown wire)
- pin 2 = IN (white wire)
- pin 3 = GND (yellow wire)
- pin 4 = +5V (green wire)

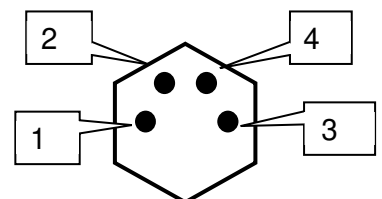


Serial Port

The serial port (optional) is wired to an axial connector, for connecting – for example – an RW14 remote control device.

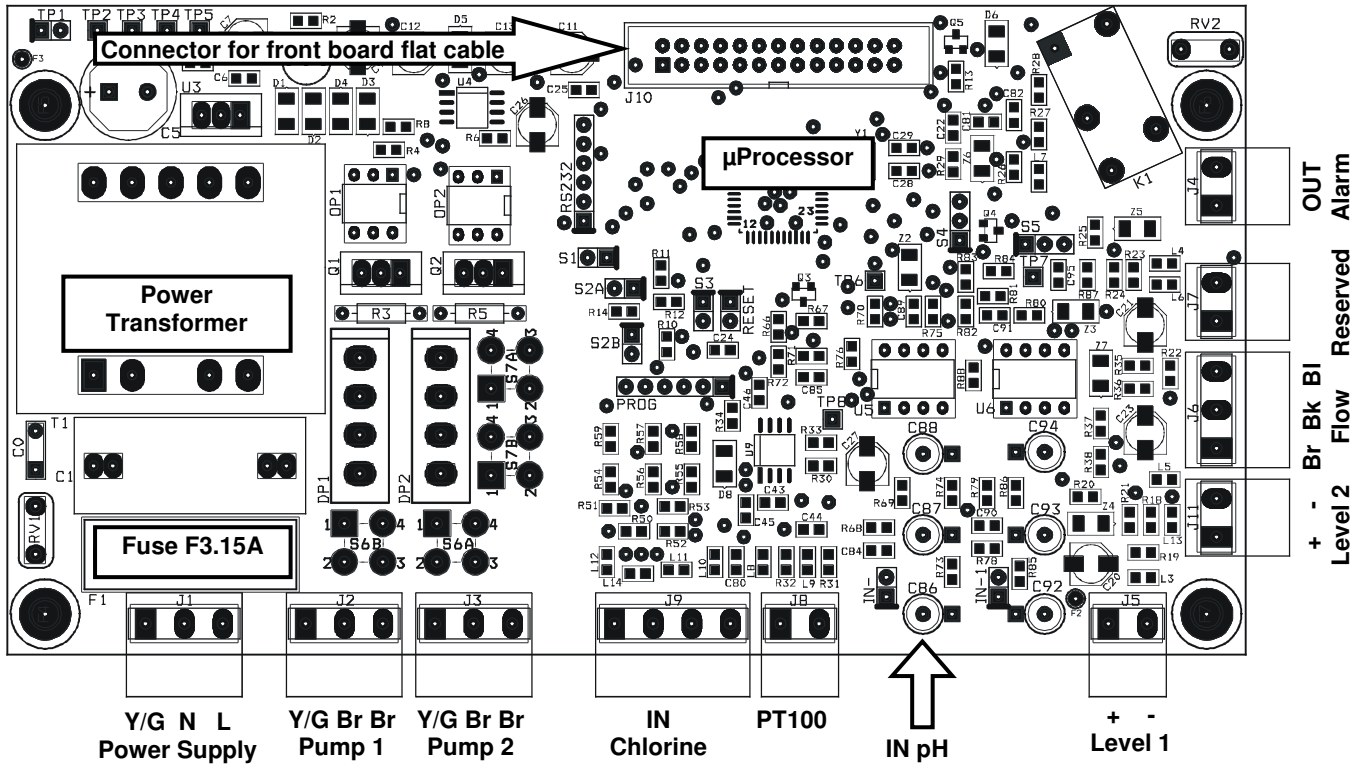
The connector configuration is described here below:

- pin 1 = RX
- pin 2 = TX
- pin 3 = GND
- pin 4 = not used



Internal Connections (for technical personnel only)

The unit is provided internally prewired, and all connections of normal use (power supply, dosing pumps, measurement sensors and flow sensor) are available externally via cable or connector. However, if you need to operate on the electronic boards or replace blown fuses, refer to the diagram below.



Notes:

- The possible reversal of the connections line / neutral of the power supply does not affect the normal operation.
- If the level and flow inputs are not used, leave them open (not connected).

START-UP

At start-up the microcontroller displays for a couple of seconds information about the firmware (type / version), then shows the two measures flashing for all the start-up delay time (if set) and then starts operating accordingly with the configured working mode.

VISUALIZATIONS

During normal operations, the display shows the two measured values on the top line, while the bottom row switches between the temperature measurement and the status of the two pumps.

For example: "7.25pH 0.80ppm"
 "P1 ON P2 020%"
 (pump 1 ON in ON/OFF mode, pump 2 ON in proportional mode with indication of the functioning percentage)

In these conditions, pressing the ↓ ↑ button, you can display the OFFSET and GAIN values of the pH and chlorine measurements.

For example: "7.25pH"
 "O=-4 G=1.000"

This information is useful to verify the sensor status. Note that an electrode in good condition should have an offset close to zero and a gain close to 1.000. When these values deviate from the ideal ones, indicate a dead electrode or sensor aging.

During manual working mode, the display shows on the top line the pump to which the information refers, while the bottom row shows the pump status.

For example: "Pump 2 manual"
 "ON "

In these conditions, pressing the ON/OFF button allows to enable / disable the pump.

In case of fault or alarm condition, the pump stops dosing until the normal working conditions are restored.

OPERATION OF THE ELECTRONIC UNIT

To access the configuration, calibration and manual mode menus, press the CAL button. The display will show the following available options:

- **Standard Configuration**
- **Advanced Configuration**
- **Calibration IN1 (input 1) pH**
- **Calibration IN2 (input 2) redox**
- **Manual Mode 1 (pump 1, acid dosage)**
- **Manual Mode 2 (pump 2, chlorine dosage)**

Use the ↓ ↑ keys to scroll the available options, then press CAL to enter the highlighted mode or ESC to return to measurement visualization.



For a complete list of parameters, valid values and related explanations, see the "List of Configuration Parameters" section.

Standard Configuration

The standard configuration mode allows the customer to set a series of parameters related to the normal functioning of the unit. These parameters can be freely accessed and configured from the front keyboard.

- 1) Once selected the “Standard Configuration” option, press the CAL button to edit the list of parameters, or press ESC to return to the normal visualization mode.
- 2) Now use the ↑ ↓ keys to scroll the list of the available parameters.
- 3) To modify the displayed parameter, press CAL; to quit the mode press ESC.

S	T	A	N	D	A	R	D		C	O	N	F	I	G	.
C	A	L	>	Y	E	S			E	S	C	>	N	O	
P	0	1		F	U	N	C	.	T	Y	P	E		P	1
				O	n	O	f	f							

Advanced Configuration

The advanced configuration mode also includes the parameters protected by password, that allow a complete configuration of the system. This mode is normally accessed only by authorized technical personnel.

- 1) Once selected the “Advanced Configuration” option, press the CAL button to edit the list of parameters, or press ESC to return to the normal visualization mode.
- 2) Now use the ↑ ↓ keys to scroll the list of the available parameters.
- 3) To modify the displayed parameter, press CAL; to quit the mode press ESC.

A	D	V	A	N	C	E	D		C	O	N	F	I	G	.
C	A	L	>	Y	E	S			E	S	C	>	N	O	

List of Configuration Parameters

In this section are listed all the configuration parameters.

It is recommended to fill the last column with the values set for your application.

PAR.	Description	Min Value	Max Value	Default Value	Set Value
P01	Functioning Type Pump 1	ON-OFF / Proportional		ON-OFF	
P02	Setpoint Pump 1	0.00pH	14.00pH	7.00pH	
P03	Hysteresis Pump 1	0.20pH	2.00pH	0.50pH	
P04	Dosage Pump 1	Acidification / Alkalinisation		Acidification	
P05	Time Base Pump 1 if P01= ON-OFF if P01= Proportional	5% 30 sec	100% 360 sec	60% 60 sec	
P06	Functioning Type Pump 2	ON-OFF / Proportional		ON-OFF	
P07	Setpoint Pump 2	0.00ppm	5.00ppm	1.20ppm	
P08	Hysteresis Pump 2	0.20ppm	2.00ppm	0.50ppm	
P09	Dosage Pump 2	Chlorination / De-chlorination		Chlorination	
P10	Time Base Pump 2 if P06= ON-OFF if P06= Proportional	5% 30 sec	100% 360 sec	60% 60 sec	
P11	Alarm Pump 1	0min	240min	0min	
P12	Alarm Pump 2	0min	240min	0min	
P13	Start Delay	0min	60min	0min	
P14	Language	Italiano - English Français - Español		English	

PAR.	Description	Min Value	Max Value	Default Value	Set Value
P15	Autoset	0	255	0	
P16	Password	0	255	0	
P17	Alarm Functioning	Relay NO / Relay NC		Relay NO	
P18	Flow Functioning	Input NO / Input NC		Input NO	
P19	pH Equilibrium	0min	240min	0min	

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 that are not protected by password (highlighted in bold in the table above).

PARAMETER 01 FUNCTIONING TYPE OF THE PUMP 1

This parameter allows to set the functioning type of pump 1, typically used for the pH control.

PARAMETER 02 SET-POINT PUMP 1

This parameter allows to enter the desired pH value for the swimming pool water. The dosing pump is activated / de-activated to reach this value and keep it constant.

PARAMETER 03 HYSTERESIS PUMP 1

This parameter is used to adjust the functioning hysteresis of pump 1 around the threshold set in P02. It is recommended to set a narrow window in case of ON-OFF mode, while for proportional mode it is advisable to set a window of at least points.

PARAMETER 04 DOSAGE DIRECTION OF PUMP 1

This parameter allows to set the dosage direction. The choice depends on the product dosed to adjust the pH level: if you dose an acid, set this parameter to “Acidification”, while if you dose a base set “Alkalinisation”.

PARAMETER 05 TIME BASE FOR PUMP 1

If the pump is configured to ON-OFF mode, this parameter indicates a percentage of operation of the pump, on a fixed time base of 100 seconds. 100% corresponds to pump always ON, while 5% indicates that the pump is ON for 5% of time (=5 seconds) and OFF for the remaining 96% (=95 seconds). If the pump is configured for proportional operation, this parameter indicates the time base.

PARAMETER 06 FUNCTIONING TYPE OF THE PUMP 2

This parameter allows to set the functioning type of pump 2, typically used for controlling the chlorine level. See description of parameter P01.

PARAMETER 07 SET-POINT PUMP 2

See parameter P02 but referred to chlorine measurements.

PARAMETER 08 HYSTERESIS PUMP 2

See parameter P03 but referred to chlorine measurements.

PARAMETER 09 DOSAGE DIRECTION OF PUMP 2

See P04 but referred to redox measurements and dosing directions “Chlorination / De-chlorination”.

PARAMETER 10 TIME BASE FOR PUMP 2

See parameter P05 but referred to the pump 2.

PARAMETER 11 DOSAGE ALARM OF PUMP 1

This parameter allows to generate an alarm when the measurement does not return to the setpoint value within a set time interval, from 0 (function disabled) to 240 minutes. The counter starts when the unit detects a measurement that exceeds the setpoint value, and automatically resets to zero when

measurement returns to an acceptable. If measurement remains outside of the setpoint for a time longer than that set, an alarm is generated, the display shows the message “**Al.1**” and the pump stops dosing. To reset the alarm and resume to normal operations, press the ON/OFF button or shutdown and restart the unit.

This condition can occur when the dosage is insufficient to reach the setpoint (P02).

PARAMETER 12 DOSAGE ALARM OF PUMP 2

See parameter P11 but referred to pump 2.

PARAMETER 13 START-UP DELAY

This parameter allows to set a start-up delay, which is a time of waiting before starting measurements to allow the correct polarization and stabilization of the measuring electrodes. This prevents unreliable initial readings. Typically, in the case of pH measurements one minute is enough, while for redox electrodes may be necessary a delay of 30 minutes. This waiting time also allows to compensate for any hydraulic delays which may occur at the start-up of the plant. Set a time (in minutes) during which, after turning on the electronic unit, the system waits, measurements blink on the display and the pumps are not active. After this time, the system begins normal operation.

PARAMETER 14 LANGUAGE

This parameter allows to select the display language.

PARAMETER 15 AUTOSET

This feature allows to restore the factory configuration if you want to delete incorrect or undesired settings. Once confirmed this option, all custom setting will be lost.

To enable the feature, enter the value “12”.

PARAMETER 16 PASSWORD

This parameter allows to enter a password (numeric value within 1 and 255) to protect the system from unauthorized access. Once set and confirmed, the password will be requested to access the menus “Advanced configuration” and “Manual mode”.

The instrument is supplied with no password set (P16=0).

Warning! *If you forget the password, you need to send back the unit to the factory for a complete reconfiguration (out of warranty)!*

PARAMETER 17 FUNCTIONING OF THE ALARM OUTPUT

This parameter allows to select the functioning mode of the alarm relay, normally open “NO” (factory setting) or normally closed “NC”.

PARAMETER 18 FLOW FUNCTIONING

This parameter allows to select the functioning mode of the “flow” input, normally open “NO” (factory setting) or normally closed “NC”.

Warning! *The inversion of this parameter compared to the default setting can determine the functioning of the device even in the absence of flow!*

PARAMETER 19 pH EQUILIBRIUM

This parameter allows to set a maximum waiting time before activating the chlorine adjustment, during which only the pH adjustment is active.

This time is counted from the start-up of the equipment, simultaneously to a possible start-up delay set in P13, during which the entire measuring system is in stand-by.

In other words, the pH adjustment is activated after the start-up delay (P13) has elapsed, while the chlorine regulation is activated when the pH reaches the set threshold (P02) or in any case at the end of the “pH Equilibrium” period.

For example, if a 1-minute start-up delay is set and you want the pH is adjusted for a maximum of 15 minutes before also activate the chlorine regulation, the “pH Equilibrium” time should be set to 16 minutes. To disable this feature, simply set the parameter to 0 (default).

Notes:

- Once in configuration mode, if no button is pressed for 30 seconds, the unit automatically returns to the idle mode.
- The system is factory configured with default values; you can delete undesired settings and restore the initial configuration, using the "AUTOSET" function (P15).

Electrochemical Calibration

pH Calibration

1) Rinse the pH electrode with distilled water, then immerse it in the pH 7.01 pH buffer solution.

2) Press the CAL key to enter the menu mode and use the ↑ ↓ keys to select the option "IN1 CALIBRATION".

I	N	1		C	A	L	I	B	R	A	T	.		P	H
C	A	L	>	Y	E	S				E	S	C	>	N	O
I	N	1		C	A	L	I	B	R	A	T	.		P	H
↓				O	F	F	S	E	T	↑		G	A	I	N

3) Press CAL again to confirm.

4) Press ↓ to select the OFFSET calibration and confirm by pressing CAL.

5) The system automatically recognizes and displays the buffer value (7.01 pH).

6) If necessary, use the ↑ ↓ keys to adjust the calibration value.

7) Press CAL to confirm calibration, or ESC to quit the procedure and keep the previous calibration.

8) Rinse the pH electrode with distilled water, then immerse it in the pH 4.01 (or 9.01) buffer solution.

9) Press the CAL key to enter the menu mode and use the ↑ ↓ keys to select the option "IN1 CALIBRATION".

I	N	1		C	A	L	I	B	R	A	T	.		P	H
C	A	L	>	Y	E	S				E	S	C	>	N	O
I	N	1		C	A	L	I	B	R	A	T	.		P	H
↓				O	F	F	S	E	T	↑		G	A	I	N

10) Press CAL again to confirm.

11) Press ↑ to select the GAIN calibration and confirm by pressing CAL.

12) The system automatically recognizes and displays the buffer value (4.01 or 9.01 pH).

13) If necessary, use the ↑ ↓ keys to adjust the calibration value.

14) Press CAL to confirm calibration, or ESC to quit the procedure and keep the previous calibration.

Notes

- If the system does not automatically recognize the buffers or the "Calibration Impossible" error occurs, it can be due to
 - a) buffer solution contaminated or expired
 - b) electrode faulty or dead
 - c) connection cable or connector damaged
- If you try to calibrate the offset at a pH value too different from 7.00, the calibration is automatically ignored. Similarly, if you try to calibrate the gain with a buffer solution at a pH too close to neutrality, the procedure will fail.
- During normal operation, it is possible to view the offset (pressing ↓) and gain (pressing ↑) values, to check the electrode status. The ideal values are an offset close to zero and a gain close to 1.000. When these values are close to the max / min limits (offset: -1.00pH ... +1.00pH; gain: 0.750 ... 1.500), the electrode is contaminated or dead.

Calibration of the CAC-CLO-M1 Cell

To calibrate the cell, a colorimeter for measuring the chlorine concentration in aqueous solutions is needed (for example with DPD1 method).

Run instrument and cell for at least 6 hours with chlorinated water, containing an average chlorine working concentration. Temperature, pH and water flow values should be constant and close to the working levels.

Note: Generally, you just need to calibrate del cell GAIN, and therefore start from step 7 of the procedure below. Normally the zero (offset) calibration is not required. However, if necessary, you can easily perform the electrical calibration, since the instrument input and cell polarization have been designed so that the electrical zero practically coincides with the electrochemical zero.

- 1) Disconnect the cell from the unit.
- 2) Press the CAL key to enter the menu mode, then use the \uparrow \downarrow keys to select the "CALIBRAT. IN.2" option.
- 3) Press \downarrow to select the OFFSET calibration and press CAL to confirm.
- 4) The system displays the value 0.00 ppm.
- 5) If necessary, adjust the displayed value using the \uparrow \downarrow to show 0.00 ppm.
- 6) Press CAL to confirm the calibration or press ESC to exit without saving.
- 7) Connect the cell and let flow the measurement water (containing chlorine).
- 8) Wait for stable reading (approx. 5 minutes)
- 9) Use the colorimeter for measuring the chlorine concentration in the water exiting from the probe-holder.
- 10) Press CAL to access menu mode, then use the \uparrow \downarrow keys to select the "CALIBRAT. IN.2" option
- 11) Press CAL again to confirm.
- 12) Press the \uparrow key to select the GAIN calibration, then press CAL to confirm.
- 13) Use the \uparrow \downarrow keys to adjust the displayed value.
- 14) Press CAL to confirm the calibration, or ESC to exit without saving and keep the previous calibration.

C	A	L	I	B	R	A	T	.	I	N	.	2		C	L
\downarrow		O	F	F	S	E	T								
C	A	L	I	B	R	A	T	.	I	N	.	2		C	L
C	A	L	>	Y	E	S				E	S	C	>	N	O

C	A	L	I	B	R	A	T	.	I	N	.	2		C	L
\uparrow		G	A	I	N										
C	A	L	I	B	R	A	T	.	I	N	.	2		C	L
C	A	L	>	Y	E	S				E	S	C	>	N	O

Notes

If you try to calibrate the gain at a value too far from the limits, the instrument automatically discards the calibration and generate an error. The display shows the message "**Calibration Failed!**". Check that all the required initial conditions are satisfied and the status of electrolyte and membrane (if necessary, replace them).



For more details about cleaning and maintenance operations, please refer to the specific section.

If you try to calibrate shortly after switching on, the error "**Wait for chlorine probe stabilization!**" appears. Wait at least the time set in P18.

Warning! If a calibration is performed with CAC cell not correctly polarized, the unit could complete the procedure and display the "**Cal. Cl₂ in 24h**", which alerts the user about the need of a new calibration after 24 hours.

This warning message will remain on the display and the unit will work in a "tentative" mode, adjusting the chlorine with a halved threshold value, until a calibration is performed with a cell signal within the expected limits.

Manual Mode

At any time, you can force a manual working mode, useful for a temporary use of the system. If a password has been set (see parameter P16), the system will require it to enable the access to this feature.

- 1) Press the CAL key to enter the menu mode and use the ↑ ↓ keys to select the option “MANUAL FUNC.1” (or “MANUAL FUNC.2”).
- 2) Press CAL again to confirm.
- 3) Similarly proceed for pump 2.
- 4) Press ESC at any time to exit the manual mode.

M	A	N	U	A	L		F	U	N	C	.		P	1	
C	A	L	>	Y	E	S				E	S	C	>	N	O
M	A	N	U	A	L		P	U	M	P			1		
O	F	F													



Warning! In manual mode only one pump at a time can be activated.

CAC-CLO-M1 CELL

The supplied cell measures the organic free chlorine concentration in water and is provided complete with a spare electrolyte bottle.

The CAC-CLO cells are membrane covered, amperometric, 2-electrode sensors, with the electrodes immersed in a specific electrolyte. They allow to determine the concentration in water of available chlorine. The chlorine diffuses from tested water through the membrane up to the electrolyte, generating a depolarization current of the measurement electrode, proportional to the chlorine concentration. This current is converted by the cell electronics into a standard signal, read by the control unit. Thanks to the built-in thermo-compensation, the signal is not affected by the water temperature. This cell correctly used, provides a continuous and extremely reliable monitoring.

Technical Data

Working Temperature	5 ... 45°C
Thermo-compensation	automatic, through built-in sensor, without thermal shocks
Conductivity of Sample	(aqueous solution) 50 ... 10'000 µS/cm
Working Pressure	max 1 bar
Flow Rate	at inlet, through the flow sensor: 40 ... 60 l/h recommended value 20 ... 100 l/h min ... max flow
Response Time	T ₉₀ : approx. 60 seconds
Power Supply	±5 V
Output Signal	0 ... 2 V
Connection	-pole (signal + supply) shielded cable), standard length 1 m
Cell Shaft	PP
Dimensions	dia. 25 x L 221 mm
Membrane Life	approx. 1 year, depending on water quality
Protection Rate	IP65
Storage Temperature	5 ... 50°C

Cell Commissioning

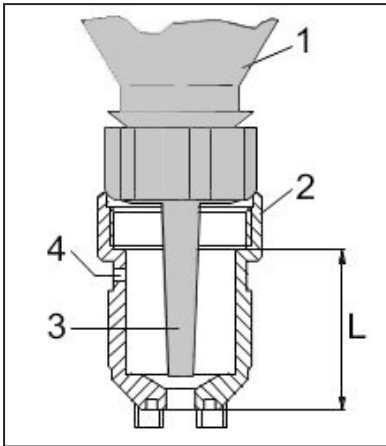
Before use, fill the membrane-cap with the electrolyte.



Caution! Do not touch the membrane or the electrodes with your fingers. Do not damage them and avoid any contact with greasy substances.

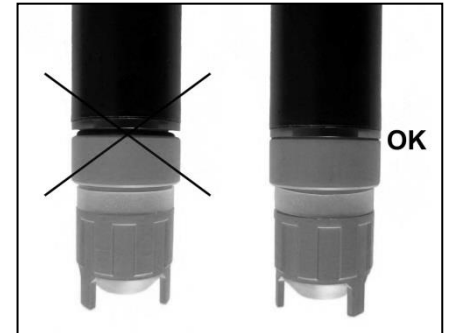
Proceed as follows, also referring to the figure:

- Remove the protection cap and unscrew the membrane-cap from the cell shaft.
- Open the electrolyte bottle, screw the nozzle and expel excess air.
- Rinse the membrane-cap with some electrolyte, then fill it till the indicated level (see the drawing), by avoiding the possible formation of air bubbles.
- Remove any air bubble by lightly tapping the cap on an even surface.
- Place the cell upright onto the filled membrane-cap and screw it by hand **till the stop**, by proceeding **slowly** for not damaging the membrane and paying attention to not close the vent hole with your fingers, because the excess electrolyte should be able to leak freely.
- Remove the leaked electrolyte with a moist cloth or by rinsing off with water.
- Thoroughly wash the nozzle with warm water.



Legend

- 1. Electrolyte bottle
- 2. Membrane-cap
- 3. Nozzle
- 4. Vent hole
- L. Electrolyte filling level



Important Notes

- **To avoid measurement errors, the membrane-cap must be correctly screwed till the stop (see picture).**
- *The electrolyte easily oxidizes with air. After use, always keep the bottle closed. Do not transfer to other containers.*
- *Before use, always check the expiration date on the electrolyte bottle.*
- *Store the bottle upside-down in vertical position, for pouring the electrolyte easily without forming air bubbles.*
- *Any small air bubbles in the electrolyte do not interfere with the measurement, while the larger bubbles rise to the top edge of the membrane-cap.*



The membrane-cap can be used only once.

Cell Installation in the Probe-Holder

Insert the cell slowly, taking care not to push it against the bottom of the probe-holder! Install the cell into the probe-holder, inserting the seal and fittings in the correct order (see picture) and **positioning the cell at approx. 2 cm from the bottom**. Then screw the threaded rings and tighten by hand.

Never exceed the maximum working pressure of the cell!

Warning! *It is recommended to provide for safety measures and systems, such as a control of the dosing time or redox measurement (upper limit), in order to prevent any damage or erroneous dosage in case of cell malfunctioning.*

Warning! *If the cell gets out of the probe-holder or breaks suddenly, the process water may spill around. Provide adequate collection measure.*

First open the water outlet valve, then slowly open the water inlet. Avoid installations that allow air bubbles to enter the water to be analysed.



Cell Wiring

The cell is provided with a 4-wire (signal + power supply), shielded, direct cable. For connection to the terminal block, please refer to the instruction manual of the electronic unit and follow the below colour code:

brown wire = -5V
white wire = IN
yellow wire = GND
green wire = +5V

Connections are protected against polarity inversion of the power supply.

The instrument associated to the cell must be galvanically insulated from other devices immersed in the same liquid!

Starting Operation

To obtain a stable and reliable measurement signal, the sensor needs a polarization time, that depends on the type / quality of the measured water and on the temperature.

- First commissioning: 1 ... 24 h (standard time: 6 hours)
- New commissioning: 1 ... 24 h (standard time: 6 hours)
- After replacing the electrolyte / membrane: 1 ... 3 hours

Warning! *When using hazardous substances, always take the safety measures indicated in the relevant safety data sheets, which must be updated and available.*

Warning! *Dosing errors due to damaged or old sensor may cause damages to persons and materials! Check, calibrate and maintain the cell regularly, with a frequency that depends on use and on quality of the tested water.*

For details about the calibration procedure, refer to the instructions for the electronic unit.

CONTROL EXAMPLES

Typical application in swimming pool control: acidification when pH exceeds the pH value of 7.30.

Refer to the "List of configuration parameters" and set:

- P01 → ON/OFF working mode for pump 1
- P02 → set point 7.30 pH
- P04 → dosage direction "ACIDIFICATION"
- P11 → alarm pump 1 = 60 minutes

Typical application in swimming pool control: chlorination when chlorine level falls below 1.20 ppm.

Refer to the "List of configuration parameters" and set:

- P06 → PROPORTIONAL working mode (recommended for an easier stabilisation)
- P07 → set point 1.20 ppm
- P09 → dosage direction "CHLORINATION"
- P10 → if the quantity of the product to be injected is not known, it is recommended to start with a time base of 60 seconds (default), and if the chlorination process would last too long, decrease the time base gradually until a conditioning time of approx. 30-45 minutes
- P12 → alarm pump 2 = 60 minutes

Common settings for the two examples described above:

- P13 → start-up delay of 15 minutes (average time required for the polarization of redox electrodes)
- P16 → protection PASSWORD to prevent unauthorized access

ERRORS / ALARMS

Every error or anomaly detected by the system generates an alarm message on the display:

FLOW	The flow sensor detected an anomaly that can be due to low pressure into the hydraulic circuit or wrong adjustment of the flow sensor in the electrode-holder; restore the flow or adjust the sensor
STOP	This message indicates that the pumps have been manually de-activated by pressing the ON/OFF button
UR / OR	Under/Over Range: measurement out of range; this signal can be generated by a dead or broken electrode, or by a damaged or disconnected cable; check the system and restore correct measurement conditions
AL.1 / AL.2	Dosing time alarm for pump 1 or 2: measurement is outside the set-point for a time longer than the set limit, due to an insufficient dosage or a wrong configuration of the alarm time (see parameters P11 and P12); set the parameters properly
Calibration Impossible	Check the status of electrode and connection cable; check that the calibration solutions are not expired or contaminated; repeat the procedure

MAINTENANCE

The periodic maintenance operations are essential for the proper functioning of the system and its duration in time. The below advice should be strictly followed.



Before any operation, make sure the system is unplugged!

pH Electrode

Typically, it is recommended to clean the electrode when the response is slow or measurements are not reliable, and when it has been used for a long time, especially in aggressive solutions, pollutants, very acidic or very alkaline environments. STEIEL provides a kit of solutions for the cleaning and storage of pH and redox electrodes. The kit includes three solutions:

- Solution A: dip the electrode in this solution for cleaning it
- Solution B: use this solution to rinse the electrode, before and after cleaning
- Solution C: storage solution to be used for filling the electrode protective cap when the electrode is not used (wintering, closure of the plant)

CAC Cell

Regular maintenance is needed to prevent incorrect dosing due to a sensor failure. Never touch the electrodes and avoid them to touch greasy substances. The maintenance intervals depend on application.

- Regularly check the cell for dirt, algae and air bubbles. Avoid contamination of the membrane by solid deposits as much as possible. Any air bubbles on the external part of the membrane can be eliminated by temporarily increasing the water flow.
- Periodically check the sensor reading on the measurement / control unit, by comparing it with the result of a photometric analysis with DPD method.
 - If necessary, calibrate the cell.
 - If calibration cannot be completed successfully, replace the membrane-cap and recalibrate.
 - If the sensor still displays unstable or too low values, contact the technical service.

Replacement of the Membrane-Cap

- It is advisable to replace the membrane-cap once a year or when it is not possible to perform a successful calibration, due to unstable or too low readings
 - Unscrew and dispose the membrane-cap.
 - Rinse the electrodes with warm running water to remove any residual electrolyte
 - Leave the electrodes dry windblown, DO NOT RUB!
 - Fill the new membrane-cap with fresh electrolyte (see “Cell Commissioning” for details).
 - Screw the cap by hand till the stop, by proceeding slowly for not damaging the membrane and paying attention to not close the vent hole with your fingers, because the excess electrolyte should be able to leak freely.
 - Wait for cell re-polarization, then re-calibrate.

Cell Storage

- Unplug the cell.
- Depressurize and empty the probe-holder.
- Loosen the locking ring and slowly remove the sensor.
- Unscrew the membrane-cap from the cell shaft and empty it.
- Rinse membrane and electrodes with clean water and leave them dry windblown, making sure that no dust deposits. DO NOT RUB.
- To protect the electrodes, screw a new membrane-cap to the cell, leaving it loose.
- Cover the membrane with the special protective cap.



The cell must be stored dry. In fact, a cell immersed and not powered undergoes a premature aging process.

ACCESSORIES AND SPARE PARTS

Item	Description	Code
pH Electrode	pH electrode with plastic body, direct cable and BNC connector	80094111
CAC-CLO-M1	Cell for determination of available/organic chlorine (range 10 ppm), 1 m cable with prewired M8 connector	80611283
PT101-CP	Pt100 sensor with PP threaded body for installation in down-flow type probe-holder, 0.75 m cable, working temperature max 100°C	80390013
CAC-EL-3	Spare electrolyte for CAC-CLO cells, 50 ml	80611023
CAC-ME-4	Membrane-cap for CAC-CLO cells, orange	80611004
CON16/F	Female axial connector (M8)	51300526
CAV2M8D	Four-wire cable with M8 female connector, L = 2 m	80099142
SD-CAC2	Down-flow type probe-holder with transparent methacrylate body, PP connections for hose 6x8 mm, sampling valve and housings for chlorine cell, pH electrode, temperature probe and flow sensor	80610256
SD-SF/PNP	3-wire, PNP, flow sensor for CLE12 and SD series probe-holders, for connection to instruments S507 / S508 / EF300 / EF315	54500009
SLP2	level sensor with 2 m cable and connector	97009002
pH4-S	pH 4 buffer solution, 90 ml bottle	80090095
pH7-S	pH 7 buffer solution, 90 ml bottle	80090096
KRE	Cleaning & storage kit for pH and redox electrodes	80099902
SHP01/3 EVO	Hand-held photometer for chlorine, pH and cyanuric acid analyses	88000052
Kit B	Installation kit, including 2 PVC valves M/F 1/2", 2 PP fittings with 1/2" threaded nut, PE hose 6x8 mm (5 m)	80509915