STEIEL

Digital Controller for Pools

EF315

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.

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.

TABLE OF CONTENTS

PACKING LIST

The **EF315** controller is supplied complete with instruction manual.

INTRODUCTION

The EF315 controller has been specially designed for the analysis and control of the main parameters of pool water.
Available as pH/RX version with inputs for pH and redox electrodes on BNC connectors, or as pH/CL version with inputs for pH electrode (BNC connector) and for chlorine cell (prewired input).
This unit can be assembled on panels, complete with dosing pumps and measurement sensors.

Main technical features:

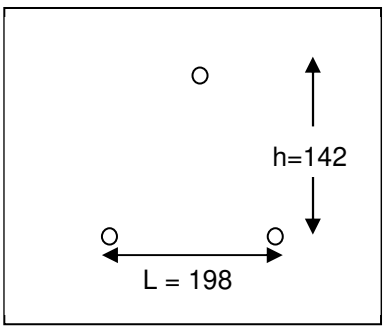
- Multilingual interface
- Three measurement inputs: 2 to be specified upon order and 1 for temperature probe
  Standard version: meas.1 = pH, meas.2 = redox, meas.3 = temperature
- Control outputs, for driving dosing pumps in On-Off mode (230 or 115 V~ outputs to power electromagnetic or peristaltic pumps) or PFM mode (pulse simulation signal)
- FLOW input to monitor the water flow to the sensors
- EXT.CONS. input for external consent signal
- Two LEV (level) inputs to monitor the level of reagents to be dosed
- Alarm output (to be wired on the terminal block by the customer)
- Alarms and errors (diagnostic) directly shown on display
- Configuration and calibration data stored in the no volatile memory, for at least 10 years
- Optional RS232C serial port, for communication with a supervisor
- Maintenance schedule

Note: *For typical pool applications, measure 1 is always pH, while measure 2 is used for determining the chlorine level indirectly (redox measurement, simple and cost effective), or directly with two-electrode amperometric cell CLE12 or probe with ion-selective membrane (CAC series).*

TECHNICAL DATA

Inputs Specifications
*(**Note**: Precision and repeatability data refer to the electronics)*

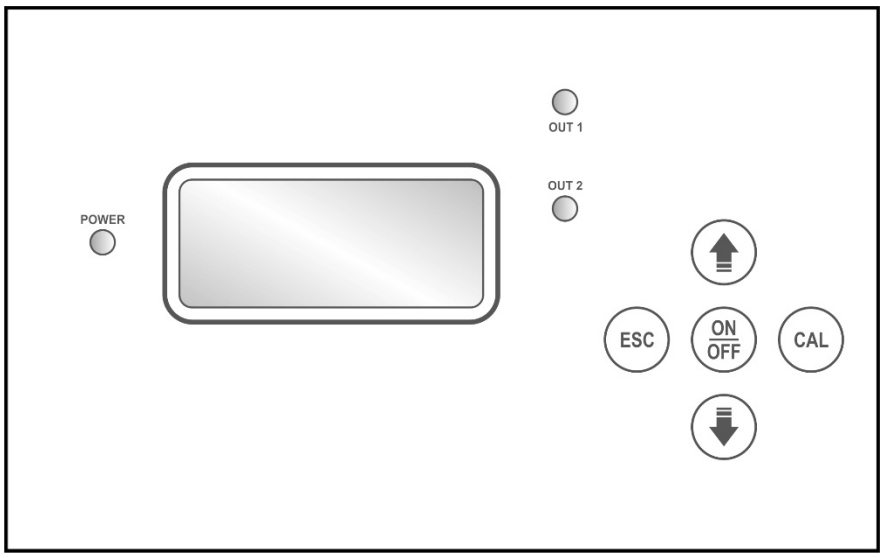
	pH	Range 0.00 … 14.00 pH; input impedance > 10^12 Ohm (precision better than ±0.02 pH, repeatability better than ± 0.01 pH)
	RX	Range 0 … +1000 mV; input impedance > 10^12 Ohm (precision better than ± 0.02 mV, repeatability better than ± 0.01 mV)
	Cl_2	- *input for CLE12 amperometric cell* Range 0 … 2.00 ppm Cl_2 (can reach 5 ppm with saturation error) (precision better than ±0.02 ppm, repeatability better than ±0.01 ppm) - *input for CAC series cell* Range 0 … 1.00, 0 … 2.00, 0 … 5.00 ppm Cl_2 (specify) (precision better than ±0.02 ppm, repeatability better than ±0.01 ppm)
	Temperature	Range 0.0 … +100.0 °C; input from Pt100 (Pt1000 upon order) (precision better than ±0.3°C, repeatability better than ±0.2°C)
Display		4-row (x 16 characters) alphanumeric LCD, with backlight
Power Supply		230 V~ (upon request: 115 V~), 50/60 Hz, 5 VA
Control Outputs		**P1, P2** ; can be configured for: • Output 230V (or 115V, depending on power supply voltage), F3.15 A; max load 3A resistive @ 230V~ • PFM (Power Frequency Modulation) = output with static relay for pulse simulation; max load 30 V-, 50 mA
Alarm relay		configurable as NO / NC; output normally energized, that deactivates upon alarm or malfunctioning; max load: 2A resistive @230V~ ***Note**: Add a cable gland to wire this output*
FLOW Input		accept signal from 3-wire proximity sensor; configurable as NO / NC
EXT.CONS Input		external consent; accept voltage-free signal from filter pump contactor; configurable as NO / NC
LEV1, LEV2 Inputs		contacts from level sensors of tanks 1 and 2 (e.g. acid and chlorine)
Serial Line		(optional) RS232C, available on M8 connector
Environment	Storage temperature	-20 … +60 °C
	Working temperature	0 … +50 °C
	RH max	90% not condensing
Housing		Polycarbonate
Protection Rate		IP65
Dimensions		L 235 x H 185 x 120 mm
Installation		with three dowels; first drill the upper hole and hang the device, then drill the bottom fixing holes
Weight		approx. 1.5 kg



NOTES AND GENERAL ADVICES

1) Install the unit (electronic device) as far as possible from heat source and humidity.
2) Once installation has been completed, close carefully the cable glands, the terminal block compartment and the cover, in order to prevent oxidations of the electronic boards.
3) If the unit cannot be switched on even if powered, check the fuse F1. The fuse location is shown in the “Electrical connections” section.
4) Generally, the sensor connection cables (signal cables) must be as short as possible and kept far from power cables.
5) Exchange power phase and neutral connection, means that the internal protection fuse (F1) is connected to the neutral, but the device can operate properly.
6) The “earth” of the power supply (terminal 3) must be connected to the electrical system grounding. This connection is mandatory for safety reason, because it also involves outputs P1 and P2, and it is useful to avoid any electrical noise coming from the mains.
7) In case of P1 and P2 outputs configured PFM, never exceed the maximum allowed values; the static outputs relays do not require any polarity. The max load on the alarm relay output is 3A resistive @250V~; with inductive load the max current is 1A.
8) To have the unit always at top performance even in noisy environments, it is recommended to follow these instructions:
   - install ferrites on the power cable for RF lock
   - ground any metallic shield of the input signal cables
   - perform correct grounding of the device
9) The unit must be always powered to avoid sensor polarization delays, and subsequent control errors. To stop the device (for example when the filtration is not working), it is recommended to use the EXT.CONS. input connected to a voltage-free contact of the filter pump contactor.

DESCRIPTION OF THE FRONT PANEL



CAL Key	Allow to access a circular menu for system calibration and configuration, with options scrollable using the arrow keys: - Calibration Measure 1 (pH) - Calibration Measure 2 (chlorine) - Calibration Measure 3 (temperature) - Standard Configuration - Advanced Configuration - Output Test *(**Note**: Please see specific sections for further details)*
⇑ Key	Increase the displayed item in calibration and/or configuration mode
⇓ Key	Decrease the displayed item in calibration and/or configuration mode
ESC Key	Ignore the modification of the displayed item in calibration and/or configuration mode, or quit the parameter configuration
ON/OFF Key	Enable / disable outputs
LED POWER	This LED flashes differently, depending on the configuration and status of the pump; see the meaning of related parameter in the "Configuration" section
LED OUT1, OUT2	Light ON to indicate the status of the related output (LED ON = peristaltic pump working or pulse to the pump magnet). If not otherwise indicated, OUT1 refers to the pH output and OUT2 to the chlorine output

DISPLAY VISUALIZATIONS

Normally the display shows measurements, status of the two main outputs, volume of liquid injected by each output, and temperature value detected by a PT100 sensor or set manually (shown within brackets).
The side drawing shows a typical screen:

	7	.	2	1	p	H				6	9	1	m	V	
		0		p	/	m				3	7		p	/	m
	3	0	.	1		L			5	8	.	0		L	
	(	2	5	.	0	°	C	)							

In case of active errors or alarms, the related messages are displayed on the fourth line, in place of the temperature.
If the temperature display is programmed on the third row, it is shown alternating with the injected volumes and working thresholds.

From this screen, pressing the arrow keys, specific displays will be visualized for each measurement, for example:
The top row shows the final measurement (with offset and gain corrections), then will follow - within brackets - the value measured by the instrument before the corrections, and finally the offset and gain factors.

			7	.	2	3	p	H					
	(		7	.	0	7	p	H		)			
O	f	f	s	e	t		=			-	.	1	7
		G	a	i	n		=		1	.	0	3	8

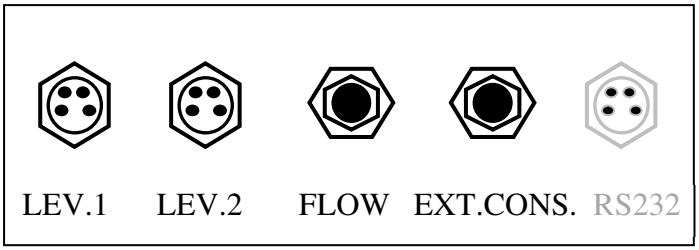
In this specific case, the electrode has an offset of -0.17pH and a gain value of 1.038. Further details about the importance of these correction factors can be find in the following sections.

Press again the arrow keys to display the details of the remaining two measurements.

ELECTRICAL CONNECTIONS

Normally the device is supplied prewired and assembled on a panel. However, this section provides info about the electrical connections to be performed by technical personnel only.

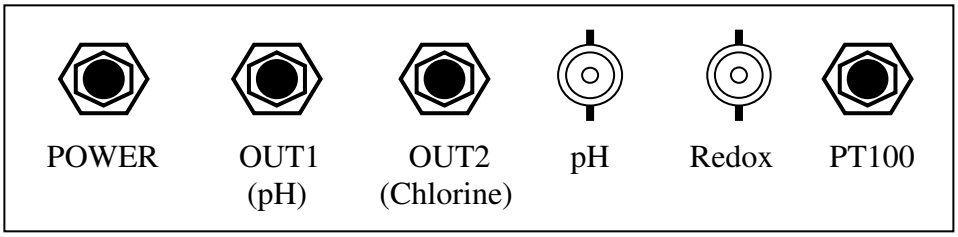
View of the right side:



- LEV.1: connector for level sensor of tank 1 (acid)
- LEV.2: connector for level sensor of tank 2 (chlorine)
- FLOW: input for NPN micro-magnetic flow sensor
- EXT.CONS.: OFF contact from contactor
- RS232: (optional) RS232 port wired on M8 connector

Version pH/RX

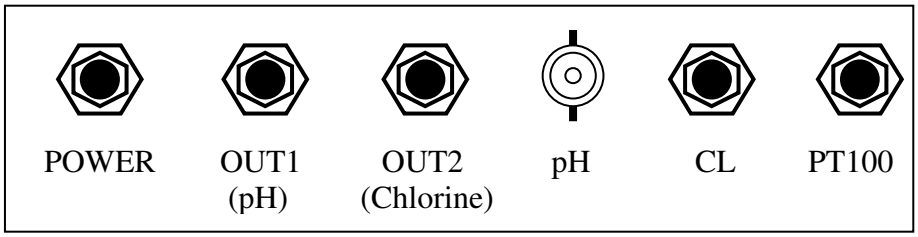
Front view:



- POWER: power cable (prewired)
- OUT1: driving output for pump 1 (pH control)
- OUT2: driving output for pump 2 (chlorine control)
- pH: BNC connector for pH electrode
- Redox: BNC connector for redox electrode
- PT100: input for Pt100 sensor

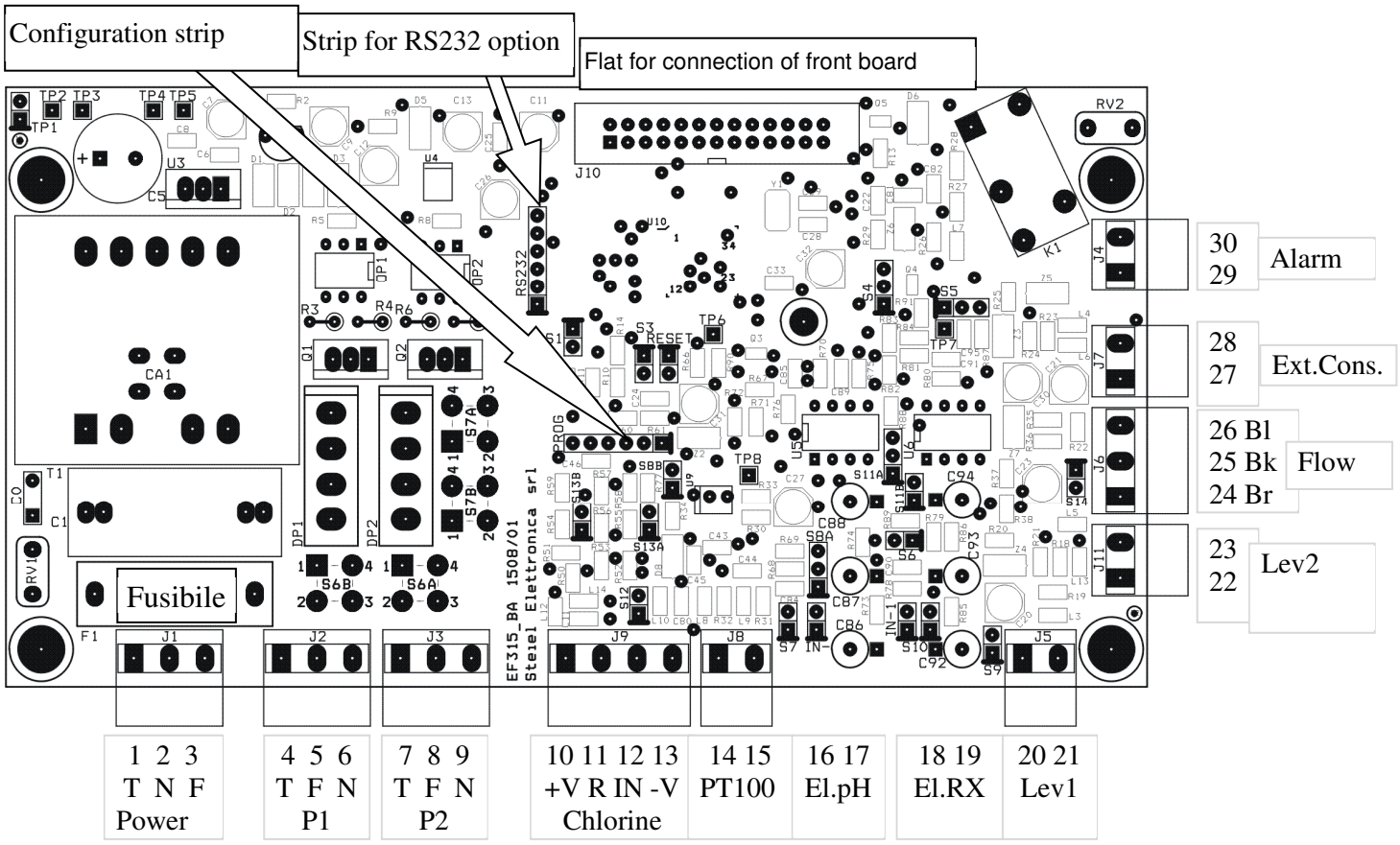
Version pH/Chlorine

Front view:



- POWER: power cable (prewired)
- OUT1: driving output for pump 1 (pH control)
- OUT2: driving output for pump 2 (chlorine control)
- pH: BNC connector for pH electrode
- CL: input for chlorine cell
- PT100: input for Pt100 sensor

To access the terminal blocks, remove the compartment cover. The electronic board is equipped with removable terminal blocks, as indicated here below.



- **Terminals 1,2,3** (Earth, Neutral, Phase): **power supply** (standard 230V~); exchanging neutral and phase does not affect the device operation
- **Terminals 4,5,6** (Earth, Phase, Neutral): output for **pump 1** (pH) – electromagnetic or peristaltic
  Warning! *This output can also be PFM type (pulse simulation with static relay)*
- **Terminals 7,8,9** (Earth, Phase, Neutral): output for **pump 2** (chlorine) – electromagnetic or peristaltic
  Warning! *This output can also be PFM type (pulse simulation with static relay)*

- **Terminals 10,11,12,13**: input for **measure 2** in case of chlorine cell
    - For **CAC cell**, connect as follows:
        terminal 10 = positive = green wire
        terminal 11 = reference = yellow wire
        terminal 12 = IN = white wire
        terminal 13 = negative = brown wire
    - For **amperometric cell CLE12**, connect as follows:
        terminal 10 = NC
        terminal 11 = reference
        terminal 12 = brown wire (Pt electrode)
        terminal 13 = blue wire (Cu electrode)
- **Terminals 14,15**: temperature input for **PT100** sensor
- **Terminals 16,17** (IN- =shield, IN+ =C86): input for **measure 1** (pH), input at very high impedance, connected to the BNC coaxial cable
- **Terminals 18,19** (IN- =shield, IN+ =C92): input for **measure 2** in case of redox electrode, input at very high impedance, connected to the BNC coaxial cable
- **Terminals 20,21** (IN+, Rif.): input **Level 1** (pH), contact closed = missing level
- **Terminals 22,23** (IN+, Rif.): input **Level 2** (chlorine), contact closed = missing level
- **Terminals 24,25,26**: **FLOW** input; depending on configuration, this input can be connected to a NPN micro-magnetic flow sensor (+Va = brown wire, IN = black wire, Ref. = blue wire), or to a voltage-free contact of a flow-switch, using only terminals 25 and 26.
- **Terminals 27,28**: **EXT.CONS.** input – voltage-free contact of a flow switch or filter pump contactor
- **Terminals 29,30**: output contact for **alarm relay**
- An additional **optional board** can also be present for the **RS232C serial** communication, wired to an M8 connector as follows: pin 1 = RX, pin 2 = TX, pin 3 = GND, pin 4 = not used.

Warning! *The connection of the serial port to a PC/PLC or other device with different reference with respect to the liquid to be analysed, can cause instability, unreliable readings and - in extreme cases – damages to the measurement sensors. In these cases it is recommended to use a serial galvanic insulator.*

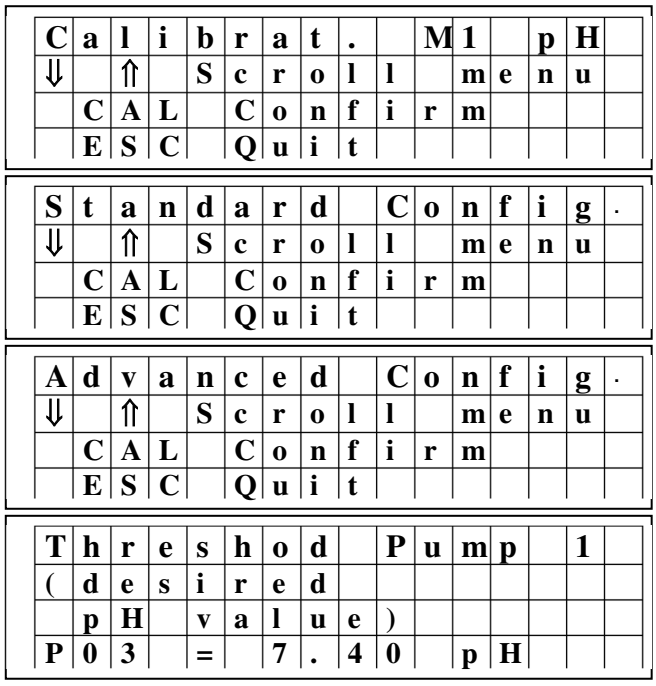
START-UP

At start-up, the EF315 displays for a few seconds the software version and the output configurations, then checks the memory status and shows an error messages if stored data are not correct.
Finally, enters the normal measuring mode by displaying readings and updating the control outputs and the relay status.

CONFIGURATION

The controller features two configuration levels, **standard** and **advanced**.
The standard configuration is reserved for the end customer, which normally only needs to change the adjustment thresholds. The advanced configuration instead allows to change all parameters and is normally password-protected, as this could be dangerous in case of intervention by unskilled personnel. The procedure is however the same for both levels.

1) Starting from any display, press the CAL button
2) The display offers the Calibration of measure 1
3) Press the ⇑ button three times, until the "Standard Configuration" option is displayed
4) Press again the ⇑ key to display the "Advanced Configuration" option
5) Press CAL to confirm the desired option, press ESC to quit, or press again the ⇑ ⇓ buttons for other choices
6) If a "Configuration" is confirmed, the display shows the first editable parameter, with the cursor below the parameter number (e.g. 03)
7) Now you can:
   - Press ESC to quit configuration procedure
   - Press ⇑⇓ to see the next / previous parameter
   - Press CAL to edit the parameter value; in this case the cursor will move below the parameter value:
     - Use the arrow keys to enter the parameter value
     - Press CAL to confirm and save the new value, or ESC to exit without saving modifications
     - The cursor will move back below the parameter value
8) Proceed as described here above to see / configure the remaining parameters



- *Once confirmed the access to configuration mode, the outputs are automatically disabled.*
- *If no key is pressed for a couple of minutes, the unit automatically exits from configuration mode.*
- *In standard configuration mode, only the editable parameters can be displayed; to access the complete parameter list, it is necessary to access the advanced configuration menu.*
- *The allowed values are restricted by the processor, however you should always check the consistency between the application and the set value, referring to sections "Configuration Parameters" and "Meaning of Parameters".*
- *If a password has been set, you must type it (and confirm) to access the configuration mode.*
- *When exiting configuration mode, the access level returns to zero.*
- *When exiting configuration mode, the outputs are disabled; press ON/OFF to reactivate.*
- *All the menus are "circular", i.e. when the maximum is reached, the menu returns to the minimum and vice versa.*

CONFIGURATION PARAMETERS

In this section are listed all configuration parameters.
It is advisable to fill the last column with the values set for the application.

PAR.	DESCRIPTION		MIN VALUE	MAX VALUE	DEFAULT VALUE	SET VALUE
P01	Operation Pump 1 (pH)	0 = ON-OFF 1 = Proportional	0	1	0	
P02	Dosage direction Pump 1 (pH)	0 = Acidification 1 = Alkalization	0	1	0	
P03	Threshold (desired value) Pump 1 (pH)		5.00 pH	8.00 pH	7.40 pH	
P04	Hysteresis (no intervention value or proportional band) Pump 1 (pH)		0.05 pH	2.00 pH	0.40 pH	
P05	Frequency (magnet) or Percentage (peristaltic) Pump 1 (pH)		2 i/m 5 %	150 i/m 100 %	100 i/m 100 %	
P06	Max Dosing Time Pump 1 (pH) (h : min)		0:00	9:59	1:00	
P07	OFF Status Pump 1 (pH)	Weight 1 = Level 1 failed Weight 2 = Level 2 failed Weight 4 = Flow/Consent missing Weight 8 = Maintenance required	0	15	15	
P08	Operation Pump 2 (chlorine)	0 = ON-OFF 1 = Proportional	0	1	1	
P09	Dosage direction Pump 2 (chlorine)	0 = De-chlorination 1 = Chlorination	0	1	1	
P10	Threshold (desired value) Pump 2 (chlorine)		0 mV 0.00 Cl_2	1000 mV 10.00 Cl_2	680 mV 1.00 Cl_2	
P11	Hysteresis (no intervention value or proportional band) Pump 2 (chlorine)		5 mV 0.05 Cl_2	50 mV 0.50 Cl_2	40 mV 0.40 Cl_2	
P12	Frequency (magnet) or Percentage (peristaltic) Pump 2 (chlorine)		2 i/m 5 %	150 i/m 100 %	100 i/m 100 %	
P13	Max Dosing Time Pump 2 (chlorine) (h : min)		0:00	9:59	2:00	
P14	OFF Status Pump 2 (chlorine)	Weight 1 = Level 1 failed Weight 2 = Level 2 failed Weight 4 = Flow/Consent missing Weight 8 = Maintenance required	0	15	15	
P15	Start-up Delay (min : sec)		00:10	59:59	00:10	
P16	Delay after restoring Flow/Consent (min : sec)		00:00	59:59	00:05	
P17	Chlorin. Delay at Start-up for pH Stabiliz. (min : sec)		00:00	59:59	01:00	
P18	Chlorine calibration delay (minutes)		5	240	15 (RX) 120 (CAC)	
P19	Alarm Relay Configuration	0 = NO (contact closed = alarm) 1 = NC (contact open = alarm)	0	1	1	
P20	FLOW Input Configuration	0 = NO (input open = OK) 1 = NC (input closed = OK)	0	1	0	
P21	EXT.CONS. Input Configuration	0 = NO (input open = OK) 1 = NC (input closed = OK)	0	1	0	
P22	Working Temperature without PT100		0°C	100°C	27°C	
P23	Password for Standard Configuration		0	999	0	
P24	Password for Advanced Configuration		0	999	0	
P25	Language (0 = ITA, 1 = ENG, 2 = FRA, 3 = ESP)		0	3	0	

PAR.	DESCRIPTION		MIN VALUE	MAX VALUE	DEFAULT VALUE	SET VALUE
P26	Flow Rate Pump 1 (pH) – see value on tables		0.2 L/h	50.0 L/h	8.6 L/h	
P27	Autonomy Pump 1 (pH) – Litres up to maintenance		0 L	999 L	200 L	
P28	Reset Litres P1 (pH) – Enter psw to reset		0	999	0	
P29	Flow Rate Pump 2 (chlorine) – see value on tables		0.2 L/h	50.0 L/h	8.6 L/h	
P30	Autonomy Pump 2 – Litres up to maintenance		0 L	999 L	200 L	
P31	Password to reset autonomy of pump P2 (chlorine)		0	999	0	
P32	LED POWER		0	1	0	
P33	Display on 3rd line	Weight 1 = litre-counter Weight 2 = working thresholds	3	0	0	
P34	Telephone numbers		0	9	0	
P35	Autoset (Restore Factory Settings)		0	999	0	

Some parameters have double meaning, depending on the instrument configuration; see next section for details.

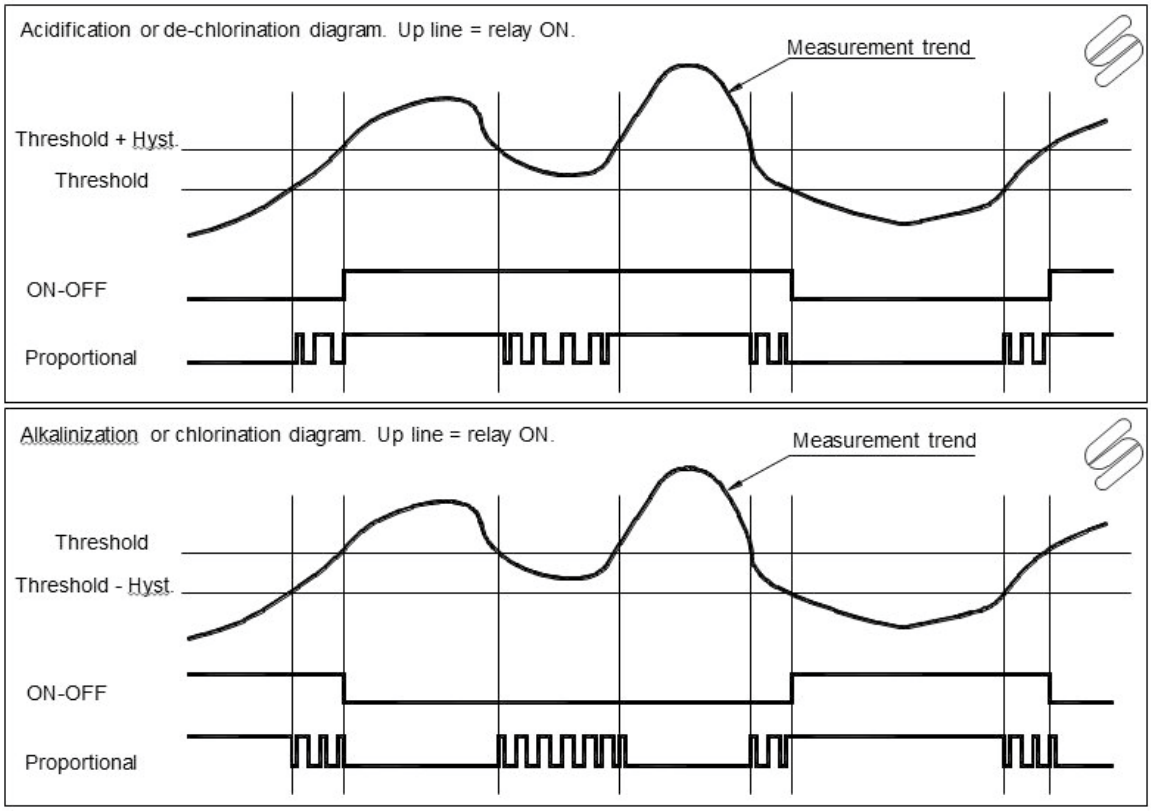
MEANING OF PARAMETERS

PARAMETER 01 OPERATION PUMP 1 (pH)

Achieving the desired threshold can be done by simple ON-OFF control or proportional adjustment.

- ON-OFF control with output for electromagnetic pump: the pump works at constant rate (parameter P05, pulses/minute) until the set threshold (parameter P03) is reached, and stops dosing when the threshold is exceeded; the pump resumes operation when measurement deviates again from the threshold value minus the non-intervention value (parameter P04, hysteresis).
- ON-OFF control with output for peristaltic pump: operation is the same described here above for the magnet output, with the only difference in setting parameter P05, in which the pump rate is entered as percent of operation.
- Proportional control with output for electromagnetic pump: in this case the working frequency (pulses/minute) goes from zero (threshold reached) to the maximum value set in parameter P05 (dosing rate when measurement is far from the desired threshold more than the value of proportional band set in P04). The frequency is automatically calculated by the micro-controller. With this type of adjustment, the desired threshold is reached with a smoother trend with respect to the ON-OFF operation. This setting is mandatory in case of PFM output.
- Proportional control with output for peristaltic pump: as in the previous case, the operation percentage of the peristaltic pump automatically adapts to the threshold value to be achieved and proportional band.

The diagrams on the next page show the different adjustments that can be set with parameters P01...P04 for output 1 (acid) and with parameters P08...P11 for output 2 (chlorine):



PARAMETER 02 DOSAGE DIRECTION PUMP 1 (pH)
Swimming pool water normally needs to be acidified, and therefore set P02=0.
You can rarely have an acid replenishment water, and therefore p=2 is set to 1 to alkalize.

PARAMETER 03 THRESHOLD PUMP 1 (pH)
Enter the pH value to be reached.

PARAMETER 04 HYSTERESIS or PROPORTIONAL BAND for PUMP 1 (pH)
The meaning of this parameter depends on the controller configuration. Recommended values:
- ON-OFF control: this parameter is used to define the “no intervention” window for the relay, normally set quite narrow, of about 0.15 … 0.30 pH.
- Proportional control: this parameter sets the proportional band, typically between 0.30 and 0.50 pH.

PARAMETER 05 DOSING FREQUENCY or PERCENTAGE of PUMP 1 (pH)
The meaning of this parameter depends on the configuration of the control unit. In particular:
- Out 1 for electromagnetic pump and ON-OFF control: dosing frequency, pulses/minute
- Out 1 for electromagnetic pump and proportional control: max dosing frequency, pulses/minute
- Out 1 for peristaltic pump and ON-OFF control: dosing percentage
- Out 1 for peristaltic pump and proportional control: max dosing percentage (PWM)

PARAMETER 06 ALARM MAX DOSING TIME PUMP 1 (pH)
This parameter allows to enter a limit for the maximum dosing time of the pump (hours **:** minutes).
When measurement deviates from the set threshold and the dosage starts, simultaneously starts this timer. If measurement does not return to the threshold value before the set time has elapsed, it means that something is not working properly and an alarm is generated, which blocks dosage.
The alarm is cancelled automatically reset if measurement returns to the threshold value, or manually pressing the ON-OFF button.
Note: *The precision of this alarm is in minutes, therefore, the intervention normally occurs with a small delay (max one minute).*

Set this parameter to zero means not using this feature.

PARAMETER 07 OFF STATUS PUMP 1 (pH)

The operation of pump P1 depends on measurement 1. However some conditions may happen that block the pump, as a measure out of range (UR/OR), start-up delay (P15), pressing the ON/OFF key, alarm for max dosing time (P06). This parameter allows to configure the dosage block even due to other conditions. In particular, enter the sum of weights correspondent to the conditions to be enabled:

Weight 1 = Level 1 failed
Weight 2 = Level 2 failed
Weight 4 = Consent/Flow missing
Weight 8 = Maintenance request for Pump 1

For example, if pump 1 should be disabled when level 1 and flow are missing, enter the value 1 + 4 = 5. In this case the maintenance request (see P26) will only be a warning message but operations will not be locked.

To disable the dosage even for a maintenance request, also include the weight 8 in the sum. Therefore, P07 value becomes 1 + 4 + 8 = 13.

Warning! *This parameter should be set by skilled personnel only!*

PARAMETER 08 OPERATION PUMP 2 (chlorine)

See parameter P01.

Warning! *If this output is used for triggering a salt chlorinator, this parameter has to be set for ON-OFF operation and the dosing percentage at 100%!*

PARAMETER 09 DOSAGE DIRECTION PUMP 2 (chlorine)

Swimming pool water normally needs to be chlorinated, and therefore set P09=1.
If, instead, you need to dechlorinate the discharge water of the swimming pool, set P09=0.

PARAMETER 10 THRESHOLD PUMP 2 (chlorine)

Enter the desired chlorine level. In case of direct chlorine measurement, this value is entered in ppm Cl_2. In case of indirect measurement through redox readings, this parameter is set in mV.

PARAMETER 11 HYSTERESIS or PROPORTIONAL BAND for PUMP 2 (chlorine)

The meaning of this parameter depends on the controller configuration. Recommended values:

- ON-OFF control with chlorine cell: range 0.15…0.30 ppm
- ON-OFF control with redox measurements: narrower range, approx. 5…10 mV
- Proportional control with chlorine cell: proportional band of about 0.25…0.50 ppm
- Proportional control with redox measurements: proportional band of about 25…40 mV

PARAMETER 12 DOSING FREQUENCY or PERCENTAGE for PUMP 2 (chlorine)

The meaning of this parameter depends on the controller configuration. In particular:

- Out 2 for electromagnetic pump and ON-OFF control: dosing frequency, pulses/minute
- Out 2 for electromagnetic pump and proportional control: max dosing frequency, pulses/minute
- Out 2 for peristaltic pump and ON-OFF control: dosing percentage (PWM control)
- Out 2 for peristaltic pump and proportional control: max dosing percentage (PWM)
- Out 2 used for triggering a salt chlorinator: set 100% (different values could damage the chlorinator)

PARAMETER 13 ALARM MAX DOSING TIME PUMP 2 (chlorine)

See parameter P06.

PARAMETER 14 OFF STATUS PUMP 2 (chlorine)

See parameter P07. The deactivation conditions always included are: measurement out of range (UR/OR), start-up delay (P15), ON/OFF key pressed, alarm for max dosing time (P13) and chlorination delay (P17).

The settable conditions are: Weight 1 = Level 1 failed
Weight 2 = Level 2 failed
Weight 4 = Consent/Flow missing
Weight 8 = Maintenance request for Pump 2

If pump 2 should be disabled only when level 2 and flow are missing, enter the value 2 + 4 = 6. For adding the monitoring of level 1 (lack of acidification affects the chlorine measurement), add weight 1. If dosage should be disabled even upon maintenance request, also include weight 8.
Warning! *This parameter should be set by skilled personnel only!*

PARAMETER 15 START-UP DELAY
This parameter allows to set a start-up delay, i.e. a waiting time before starting operation, in order to allow the proper polarization and stabilization of measurement sensors. This will prevent unreliable initial readings. Typically, in case of pH measurements, one minute is enough, while a redox electrode or amperometric cell may need a delay of 30 minutes. This waiting time also allows to compensate for any hydraulic delays that may occur at plant start-up.
Set a time (in minutes : seconds) during which, after powering the electronic unit, the system remains in stand-by, the display shows the delay countdown and outputs are disabled. Once this time has elapsed, the system starts normal operations.

PARAMETER 16 DELAY AFTER RESTORING FLOW/CONSENT
Similarly to the parameter P15, you may need to enter a stabilization period after restoring the flow to the sensors. Normally this time is shorter than that set in P15. During the lack of water flow (no Flow consent) outputs are disabled (see P07 and P14), and remain deactivated even after the flow/consent is restored for the time set in this parameter. P16=0 means entering a minimum delay of 2 seconds.

PARAMETER 17 CHLORINATION DELAY AT START-UP FOR pH STABILIZATION
A pH electrode needs a polarization time significantly shorter than the sensors used for chlorine determination. Moreover, the pH value affects the response of almost all the chlorine sensors.
This parameter allows to enter a delay (in minutes : seconds) before starting the chlorine control, during which the system checks if the pH level reaches the desired threshold. If the threshold is reached before this time has elapsed, the timer is zeroed, otherwise the system will wait for all the delay. During this time, the output P2 (related to redox or chlorine measurements) is disabled, waiting for pH stabilization. This function can substitute (or been added to) the start-up delay (P15). Setting P17 to zero means not use this function.

PARAMETER 18 CHLORINE CALIBRATION DELAY
As explained in parameter P15, a waiting time is required at start-up to allow the sensors to polarize completely, so that they can give a correct and reliable signal. Similarly, it is necessary to wait for a stable signal before performing an electrochemical calibration.
This parameter allows to enter a time control, to avoid that an unskilled operator performs a calibration of the chlorine sensor (redox electrode or amperometric cell) before its complete stabilization.
In the case of RX electrode, the minimum time is 15...20 minutes, while for an amperometric cell the minimum time varies between two and four hours.

PARAMETER 19 ALARM RELAY CONFIGURATION (NO / NC)
This parameter allows to configure the operating mode of the alarm relay. In particular:
- P19=0 → relay normally energized (contact open); it energize (contact closes) upon alarm
- P19=1 → relay normally energized (contact closed); it deactivates (contact opens) upon alarm (configuration “fail-safe”).

PARAMETER 20 FLOW INPUT CONFIGURATION (NO / NC)
This parameter allows to configure the operating mode of the FLOW input, depending on the flow control or consent used.
In particular:
- P20=0 → EF315 unit enabled with input open (NO)
- P20=1 → EF315 unit enabled with input closed (NC)

Note: *If a NPN micro-magnetic flow sensor is use, set P20=1.*

PARAMETER 21 EXT.CONS. INPUT CONFIGURATION (NO / NC)
This parameter allows to configure the operating mode of the EXT.CONS. input.
- P20=0 → EF315 unit enabled with input open (NO)
- P20=1 → EF315 unit enabled with input closed (NC)

PARAMETER 22 WORKING TEMPERATURE WITHOUT PT100
Normally the reference / working temperature is the measure 3 value (PT100 sensor).
If no temperature probe is connected, the controller uses the value set in this parameter as working temperature and as reference for thermo-compensation.

PARAMETER 23 PASSWORD FOR STANDARD CONFIGURATION
To prevent any access to the configuration menu by unauthorized personnel, set a protection password in this parameter. In this case, when trying to access the standard configuration mode, the unit will request this password before proceeding. The unit is supplied with no password (P23=0).
Warning! *If password is forgotten, the unit must be sent to the manufacturer for a complete reconfiguration (not under warranty)!*

PARAMETER 24 PASSWORD FOR ADVANCED CONFIGURATION
Same meaning and use of parameter P23, but referred to the advanced configuration.

PARAMETER 25 LANGUAGE
This parameter allows to set the interface language, choosing among the 4 available options:

PARAMETER 26 / 29 FLOW RATE PUMP 1 / PUMP 2 (litres/h)
EF315 is equipped with the litre-counter of injected product. The flow rate of dosing pumps (Pump 1 and Pump 2) depends on model and system back pressure, and therefore is a value to be set at installation. It is important that this value is as close as possible to the real one, to avoid big displaying and totalization errors. The total of injected litres is always shown on the third line of the display.

PARAMETER 27 / 30 AUTONOMY PUMP 1 / PUMP 2 (litres) – MAINTENANCE REQUEST
In order to prevent undesired stops of the system and always keep its top performance, it is recommended to schedule maintenance interventions. For dosing pumps, the maintenance frequency depends on the amount of injected product.
This parameter allows to set a volume threshold (dosed litres) beyond which the EF315 unit will require maintenance. This request can be a simple warning message or even generate an alarm, with subsequent disabling of the pump, by properly setting the parameters P7 and P14. If this function is not needed (for example, in case of P2 output used for triggering a salt chlorinator), set the related parameter to zero.

PARAMETER 28 / 31 RESET LITRES PUMP 1 / PUMP 2 – ENTER PASSWORD FOR RESET
After performing the scheduled maintenance, enter in this parameter the password (default = 12) to zero the litre-counter and remove the maintenance request message.

PARAMETER 32 LED POWER
This parameter allows to set the way the LED POWER indicates the instrument status.
If P32 = 0, the LED can blink in three different modes:
- Slow flashing → regular operation of the controller
- Quick flashing → indication of an alarm, fault or block condition
- Two flashes and one pause → data editing or calibration in progress

If P32 = 1, the LED can blink in two different modes:
- Steady light → regular operation, no alarm
- Quick flashing → indication of an alarm, fault or block condition

PARAMETER 33 DISPLAY OF THIRD LINE

The third line of the display is typically dedicated to the temperature (and any telephone numbers). This parameter allows to add the displaying of the injected litres of product and / or threshold values.
Data are shown in sequence, at intervals of about 3 seconds.

- Weight 1 = add displaying of litre-counter
- Weight 2 = add displaying of thresholds

Examples: P33 = 0: shows only the temperature value
P33 = 1: alternates temperature and litre-counter
P33 = 2: alternates temperature and working thresholds
P33 = 3: alternates temperature, litre-counter and working thresholds

PARAMETER 34 TELEPHONE NUMBERS

In the event of errors or alarms (shown on the fourth line of the display), a telephone number for technical assistance or a message can be displayed on the third line.
This parameter allows to select one of the nine telephone numbers (or messages) stored in the controller memory and pre-set at the factory following the customer indications (***Note****: in the absence of customer's instructions, no number is stored*).
The operator can set or modify these numbers (or messages) by connecting the EF315 control unit to a PC via a serial line and using a simple communication program (e.g. Sercom or Hyperterminal). Enter the desired values with the command "Tn=0123456789ABCDEF", followed by "Enter", where "n" is a number between 1 and 9, while the 16 characters that follow the "=" are exactly those that will appear on the third display line. Configuring P34 = 0 means excluding this function.
Warning*! For a correct visualization, do not use in the message characters not allowed, such as accented letters or with dieresis (for technical personnel: the allowed ASCII characters are those between 32d and 126d).*

PARAMETER 35 AUTOSET (RESTORE FACTORY SETTINGS)

This parameter allows to restore the factory settings. The standard value to activate this function is 12 for pH/RX measurements, and 13 for pH/Chlorine version. Anyway the customer can also ask for a different value for restoring his specific configuration. This function should be used only if the unit does not work properly, due to wrong configuration or if a complete reset of the unit is necessary, for a following new installation. This function also cancels all measurement offset and gain factors.

Warning! *After restoring the factory settings, you must check and set again (if necessary) the pump flow rate values and maintenance thresholds.*

ERRORS / ALARMS

When an error or alarm occurs, the display shows the related warning message on the fourth line. If more than one error / alarm is active, is shown the sequence of all warning messages. If you have set the displaying of the telephone number (or message) when an error occurs (P33 ≠ 0), the number to contact for technical assistance appears on the third line of the display.
Messages that can appear on the fourth line of the display, are listed here below:

No alarm	Everything is functioning properly!
Start-up mm:ss	This message is displayed at start-up, if a value different from zero has been entered in parameter P15 (start-up delay), and shows the countdown of this delay. Once the delay has elapsed, the message disappears.
pH Stabiliz. mm:ss	This message is displayed at start-up, if the pH value is not at its threshold and therefore the waiting time for pH stabilization (parameter P17) has been triggered. This message shows the countdown of this delay. Once the delay has elapsed or the pH threshold has been reached, the message disappears.
Level 1 failed	Low level in tank 1 (acid). Add liquid to restore the level.
Level 2 failed	Low level in tank 2 (chlorine). Add liquid to restore the level.
Al. MAX T Pump1	Pump 1 has dosed for longer than the time set in P06 without reaching the desired threshold. Check pump P1 for proper functioning and, if necessary, the value set in P06 (maybe too short for the installation). Cancel the alarm by pressing twice the ON/OFF key.
Al. MAX T Pump2	Pump 2 has dosed for longer than the time set in P13 without reaching the desired threshold. Check pump P2 for proper functioning and, if necessary, the value set in P13 (maybe too short for the installation). Cancel the alarm by pressing twice the ON/OFF key.
Manual Stop	The ON/OFF has been pressed.
Flow mm:ss	The consent to the Flow input is missing. The displayed time is the value set in parameter P16. Once the consent is restored, the time countdown starts, and when reaches zero, the alarm disappears.
Maintenance P1	Request of maintenance for pump 1 (pH/acid). Once completed the maintenance operations, reset the litre-counter (and therefore the warning message) by entering the correct password in P27.
Maintenance P2	Request of maintenance for pump 2 (chlorine). Once completed the maintenance operations, reset the litre-counter (and therefore the warning message) by entering the correct password in P30.
Alarm Meas.1	In case of input 1 signal too low or too high, the unit shows the meassages **UR (Under Range)** or **OR (Over Range)** in the area normally reserved to the measurement 1. In these conditions the input signal is not reliable and, therefore, an alarm is generated, with consequent stop of the dosage. Check for the correct connection of the signal cable, the general conditions of the sensor, and possible strong oxidations.
Alarm Meas.2	As above, but referred to input 2.

ELECTROCHEMICAL CALIBRATIONS

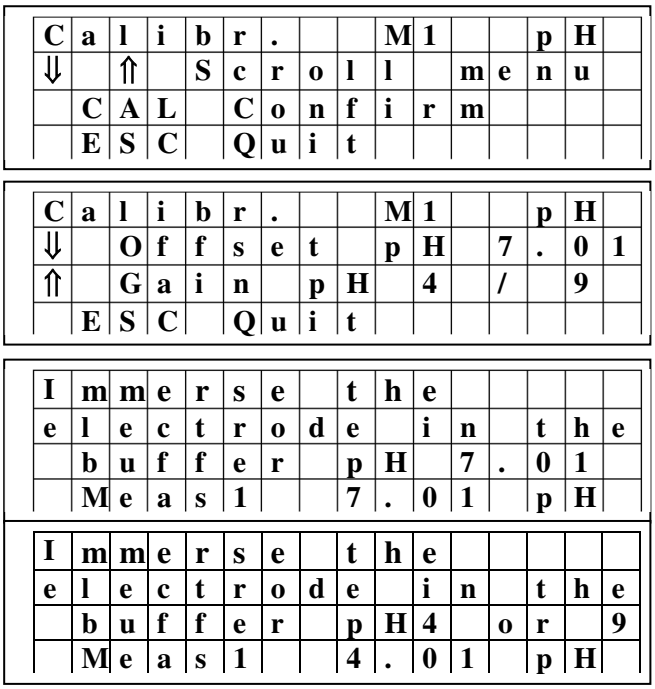
pH Calibration

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) Close the water flow to the sensors

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 CAL key
4) The display will show the first calibration screen "CALIBR. M1 pH".
   Press ESC to quit calibration, or press CAL to confirm; if calibration is confirmed, the display shows two options
6) Press the ⇓ key to proceed with the OFFSET (pH 7.01) calibration
7) The unit automatically recognizes and displays the buffer value
8) If necessary, use the ⇑ ⇓ keys to adjust the calibration value
9) Press CAL to confirm the calibration, or ESC to exit without saving (and the previous calibration data are kept)
10) Rinse the electrode with distilled water, then dry it
11) Immerse the electrode into the pH 4.01 (or 9.01) buffer solution
12) Repeat steps from 4 to 9, but pressing the ⇑ key at step 6, to choose the GAIN calibration
13) Install back the pH electrode and Pt100 probe (if used) for normal control operations
14) Open the water flow to the system and press ON/OFF to resume 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 required calibration, EF315 displays the message "**Calibration Failed !**". Even if you try to calibrate the offset with an incompatible input value, the message "**Calibration Failed !**" will appear.*
Possible causes:

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

ORP (Redox) Calibration

Preparation:
a) Check availability and expiration date of the calibration solution (e.g. 230 mV)
b) Close the water flow to the sensors

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. 230 mV)
3) Press CAL
4) Press the ⇑ key to display "CALIBR. M2 mV" and confirm by pressing CAL
5) Press the ⇓ key to proceed with the OFFSET calibration
6) The unit can automatically recognize the redox standard solutions at 230 mV, 468 mV and 650 mV
7) If necessary, use the ⇑ ⇓ keys to adjust the calibration value
8) Press CAL 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) Install back the pH electrode for normal control operations
11) Open the water flow to the system and press ON/OFF to resume normal operations

The redox calibration is a single-point procedure (offset).

*If you try to calibrate the offset with standards different from those in memory, the unit will provide the input value as calibration point (no automatic recognition). If, after the calibration the "**Calibration Failed!**" error appears, it may be due to one of the following causes:*
a) The buffer solution is contaminated / expired
b) The electrode is not working properly (damaged or exhausted)
c) The connection cable is damaged

*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.*

Chlorine Input Calibration

The zero/offset calibration is carefully performed at the factory. This adjustment is therefore recommended to authorized personnel only and is not described. The user can (and has to, at least monthly) only adjust the gain factor.

Preparation. Check that:
a) The pH level is stable at a value lower than 7.80
b) The cell polarization has been completed (working since at least 8 hours)
c) There is a proper and stable water flow
d) The chlorine level is high enough (> 20% FS)
e) A portable photometer is available for chlorine analysis

Proceed as follows:
1) Take a water sample from the sampling valve on probe-holder and analyse it with the photometer
2) Press CAL, then press the ⇑ key three time, until the message "CALIBR. M2 CL_2" is displayed
3) Press the ⇑ key to proceed with the GAIN calibration
4) Use the ⇓ ⇑ keys to adjust the displayed value to that read with the portable photometer
5) Press CAL to confirm
6) Press ON/OFF to resume normal operations

*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. Moreover:*

a) *Cleanliness of the CLE12 cell (if cleaning is required, then make the cell work for about 8 hours before proceeding with a new calibration)*
b) *Status of the electrolyte and membrane of the CAC (or CP) cell; if necessary, substitute them*

Refer to the instruction manuals of the cells for more details about cleaning and maintenance operations.

*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. Cl_2 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.

Temperature Calibration

The electronic calibration of the instrument 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 std.). Therefore, no user calibration is required.

***Note**: Factory calibration is performed with a sensor with 2 m cable. Using a probe with a cable longer than 2 meters could introduce a greater reading error.*

ADDITIONAL VISUALIZATIONS

If the arrow keys are pressed during normal operation, the display shows the specific parameters of the 4 measurements. The value within brackets is the input signal before corrections, the “G” value is the gain factor, while the “O” value is the offset.

pH	(mV value without thermo-compensation) G = gain factor 0.750 ... 1.500 O = offset @ 25°C -0.50 ... 0.50
Redox	(mV value without offset correction) G = gain factor (1.000), fixed O = offset in mV (-100 ... 100)
Residual chlorine with amperometric cell CLE12	
	G = gain factor (0.050 ... 1.500) O = offset in ppm (-0.40 ... 0.40)
Residual chlorine with CAC cell series (input value in mV, without offset/gain corrections)	
	G = gain factor (0.200 ... 3.000) O = offset in ppm (-0.20 ... 0.20)
Temperature	(value without offset/gain corrections) G = gain factor (0.940 ... 1.060) O = offset in °C (-2.0 ... 2.0)

In general, the more the Offset value is close to zero, the better are the sensor conditions.
Similarly, the more the Gain value is clos e to 1.000, the better are the sensor conditions.
The only exception is the CLE12 amperometric cell, for which the average Gain value is 0.100. However, this value depends strongly on the chemical conditions as well as the type of dosed chlorine, and, therefore, it is not possible to establish preventively a typical value.

MANUAL OPERATION

The controller allows to perform some manual testing operations, useful for example during priming or maintenance of pumps connected to the unit.

To enter this mode, press CAL and then the ⇓ ⇑ keys, until the “Test Outputs” message is displayed. Press CAL to access the mode.
The unit displays the first available test, referred to the Pump 1 output.
Confirming with CAL, the initial zero rate is displayed (or the stop status, in case of peristaltic pump) and the state of the ON/OFF key.
Now select the desired rate and turn on / off the pump using the ON/OFF button.
Then, you can choose whether to start / stop even the pump 2 and the alarm relay K.Al.
The selection is made by pressing the ⇓ ⇑ keys, while the change of status is obtained by pressing CAL.

	T	**e**	**s**	**t**		**O**	**u**	**t**	**p**	**u**	**t**	**s**	
⇓		**⇑**		**S**	**c**	**r**	**o**	**l**	**l**		**m**	**e**	**n**	**u**	
	C	**A**	**L**		**C**	**o**	**n**	**f**	**i**	**r**	**m**				
	E	**S**	**C**		**Q**	**u**	**i**	**t**							

T	**e**	**s**	**t**		**p**	**u**	**m**	**p**		**1**		(	**p**	**H**	)
⇓		**⇑**		**C**	**h**	**o**	**o**	**s**	**e**		**p**	**u**	**m**	**p**	
	C	**A**	**L**		**C**	**o**	**n**	**f**	**i**	**r**	**m**				
	E	**S**	**C**		**Q**	**u**	**i**	**t**							

T	**e**	**s**	**t**		**p**	**u**	**m**	**p**		**1**		(	**p**	**H**	)
				0		**p**	**u**	**l**	**/**	**m**	**i**	**n**			
	E	**S**	**C**		**Q**	**u**	**i**	**t**		**t**	**e**	**s**	**t**		
	M	**a**	**n**	**u**	**a**	**l**		**S**	**t**	**o**	**p**				

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

Warning! *The relay energization can cause dangerous activations of the device connected to it.*

SERIAL LINE (optional)

EF315 may be equipped with an RS232C serial line, for communicating with terminals, PC or advanced PLC. The recommended application is the RW14 WEB interface, that allows to remotely monitor the unit, and configure it. The dialogue on the serial line is a simple exchange of ASCII characters without any protocol and without control characters. The transmitting-receiving characteristics are the following:

9600 BAUDS, 8 BITS, NO PARITY, 1 STOP BIT

The messages sent on serial line have been designed to be as simple and intuitive as possible.
The pin association on the M8 connector is described in the "Electrical Connections" section.
Automatically EF315 send the following messages:

- START-UP EF315 Vxx at start-up
- LOW POWER at start-up or in case of power lowering

EF315 interprets the following commands:

Command	Effect		Command	Effect
M1	Display measure 1 value		**RR**	Microprocessor reset (reboot)
M2	Display measure 2 value		**HH**	Command Help
M3	Display measure 3 value		**Pxxx**	Read value of parameter xxx
SS	Status of inputs, outputs, alarms		**Pxxx = YYYY**	Write value YYYY in parameter xxx
ZZ	Reset Offset/Gain values		**Tn**	Read telephone number (or message) "n"
			Tn=[16chr]	Write telephone number (or message) "n"

Also are valid other calibration commands not listed in the above table, because they are for internal use only (factory configuration).
After each command, press <CR> (or <ENTER>).
All messages on the serial line are fixed and do not depend on the chosen language.
If a wrong command is entered, press <CR> to send it anyway (it will have no effect), and then send again the desired command.

Configuration from Serial Line (for skilled personnel only)

This section is reserved to skilled users who wish to connect the EF315 unit to its own supervision system. When connecting the EF315 unit to the RW14 remote supervisor, the communication between the two devices is user friendly.
Configuration procedure through RS232C (serial line):

1) Connect the supervisor (for example, a PC) to the serial port plug, while paying attention to the connections.
2) To the Pxx (CR) command sent by the supervisor, EF315 answers by sending the parameter value "xx".
3) If the supervisor command is Pxx=1234 (CR), EF315 interprets the 4 digits following the sign "=" as the new value of that parameter.

- *All values read or to be written, have no comma: for example, if P03 is set to 7.20pH (K1 threshold), it will be read as 0720; also if you want to set P03 to 7.30pH, the command should be P03=0730 (CR).*
- *The EF315 stores the value in memory without checking. It is the supervisor that has to check the limits.*
- *Commands sent through serial line can be both uppercase and lowercase.*
- *The "Cancel" command is not active. If you enter a wrong value, you have to re-enter it.*