Programming Manual

Lineguard ST4

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LINEGUARD ST4

MICROPROCESSOR-BASED MULTI-CONTROLLER

1. MAIN TECHNICAL NOTES

1. Multi-language interface.
2. Multi-channel: 4 measurements to be specified upon order + temperature input always provided. In case of double potentiostatic input (free + total chlorine), measurements are six, because the combined chlorine value is calculated as difference “total – free”.
3. Output relays configurable as set-point, max or min alarm, PWM (proportional control over time), timed controls. With or without timing.
4. Upon order, low voltage (24V~) outputs can be requested, for driving small dosing pumps or solenoid valves without needing additional transformers and with safety voltage. Max power consumption 20VA.
5. Galvanic separation between inputs / microprocessor and current outputs or serial port.
6. OFF input for disabling control relays (to be connected to the filter pump contactor).
7. OK output for remotely indicating the correct operation of the unit.
8. Alarms and errors (diagnostics) directly shown on the display.
9. Date / time label always displayed, even in case of power failure, with the possibility of activating / deactivating the unit operation at scheduled time.
10. Configuration / calibration data are stored into a non-volatile memory for at least 10 years.
11. Internal data-logger, downloadable via serial line.
12. RS232C or RS485 serial line, to be specified upon order. With galvanic separation.

2. OPERATION OVERVIEW

The device basically consists of the following blocks:

1. Power supply: connected to the mains, provides the power for the operations of all other blocks, and minimizes any noise or fluctuation.

2. Microprocessor: this is the heart of the device; it acquires the analog signals transmitted by the “input” blocks, converts them into the desired range, send these values to the “display” block to be shown, compares the measurements with the configuration values to decide the status of the “digital outputs” (K1… K5) and mA “analog outputs”. It also reads the status of the keys to display / edit the data in memory.

3. Inputs: depending on the order, this stage may be different; however, any configuration produces a signal compatible with the microprocessor input, by adding a noise filtering and related protection.

4. Digital outputs: these are the output relay, complete with driving option.

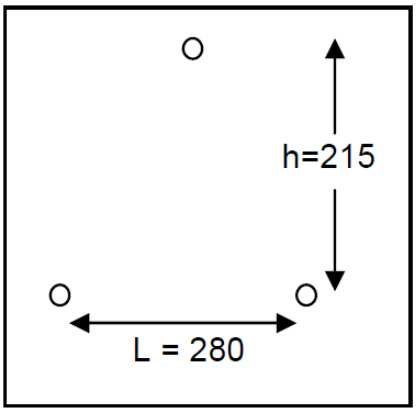
5. Analog outputs: allow to “export” the value of the main measurement to external devices. Also feature “galvanic separation”, useful in case of PC/PLC connections that sometimes operate short-circuits to ground, which adversely affect the acquired measurements.

6. Display: visualization block for all measurement and configuration data.

7. Serial output: connected to an intelligent supervisor, answers to the received commands and therefore allows real time monitoring of all device functions.

3. TECHNICAL DATA

Dimensions	L 320, H 270, W 120 mm
Material	Polycarbonate
Installation	Using the three supplied stoppers. Also see the side drawing. It is recommended to drill first the top hole and hang the device, than drill the fixing bottom holes.
Weight	approx. 3 kg
Cable Glands	5 x PG9, for 5...9 mm dia. cables (different configurations available upon order)
Power Consumption	10VA (version without 24V~ output) or 45VA (version with 24V~ output)
Protection Rate	IP65



Input Standard Configuration	In1 = Meas1 = pH In2 = Meas2 = RX In3 = Meas3 = residual chlorine with CLE12 cell (2 ppm FS) In4 = Meas4 = residual chlorine with potentiostatic cell (5 ppm FS) In5 = Meas5 = temperature

Environment	Storage temperature	-20...+60 °C
	Working temperature	-10...+50 °C
	RH MAX	90% no condensing
Display	2-row (x 16 characters) alphanumeric LCD, with backlight	
Keyboard	4 keys	

Input Specifications
(Note: precision/repeatability data only refer to the electronics)

pH	Range 0.00 ... 14.00 pH. Input impedance > 10^12 Ω. Precision better than ±0.02 pH, repeatability better than ±0.01 pH.
RX	Range –1000 ... +1000 mV. Input impedance > 10^12 Ω. Precision better than ±0.02 mV, repeatability better than ±0.01 mV.
CLE12 Cl_2	Range 0...2.00 ppm

	Precision better than ±0.02 ppm Cl_2, repeatability better than ±0.01 ppm Cl_2
Potentiostatic Cl_2	Range 0…1.00 or 0…2.00 o 0…5.00 ppm Cl_2 – to be specified upon order Precision better than ±0.02 ppm Cl_2, repeatability better than ±0.01 ppm Cl_2
Conductivity Meter	Range and cell constant to be specified upon order. Measurement displayed over 2000 points. Precision better than ±4 points, repeatability better than ±2 points
Standardized Input	Range to be specified upon order (e.g. turbidity meter 0…100NTU) Precision better than ± 0.2 % del FS, repeatability better than ± 0.1 % del FS
Temperature	Range 0.0 … +100.0 °C. Direct input from PT100 (PT1000 upon reques t). Precision better than ± 0.3 °C, repeatability better than ± 0.2 °C.
Relay Outputs for User	4 control relays; labelled as K1, K2, K4, K5; can be controlled from any of the five measurements. 1 alarm relay; labelled K3; normally excited, it de-activates upon alarm / error / fault of the device. Can be also configured as NO. If not otherwise specified upon order, outputs are configured as follows: K1, K2 = 230V~ K3, K4, K5 = voltage-free contact Available on removable terminal blocks. Outputs K1, K2 and K3 have a maximum contact load 250V~ 3A resistive, while K4 and K5 have max load 24V 3A (continuous or alternate). Upon order you can request: K1, K2 and K3 configured as contact or 230V~ output K4 and K5 configured as contact or 24 V~ (max 20 VA) output, for direct control of solenoid valves (e.g. tablet feeder). See further on for the configuration.
Other Outputs	4 additional relays, labelled as K6, K7, K8, K9; can be used as additional setpoints or to handle automatic cleaning cycle, standard configuration at 24 V~.
Current Outputs	2 outputs at 0-20 or 4-20 mA, linked to any of the six measurements, selectable through configuration menu, with galvanic separation from inputs and microprocessor; 700 Ω max load, Err max 0.2% FS Note: the two negative poles of the outputs are short-circuited
Inputs for User	1 OFF input, accepts voltage-free contact from filter pump contactor; if active, disables the outputs. Can be configured NO or NC through the S36 jumper. Warning! The remaining jumpers, S37…S41, are configured at the factory and must not be changed!
Other Inputs	5 inputs available on removable terminal blocks, distributed as follows: Lev.1, Lev.2, Lev.3, Lev.4 : reserved for level sensor contacts

	IMP : input for “system is working” signal
Serial Line	RS232C or RS485, available on miniaturized 4-pin terminal block.

4. GENERAL NOTES AND ADVICES

This section gives some general notes and advices, useful for installation and maintenance operations:

1. Electronic devices should always be installed as far as possible from heat and humidity sources.

2. Once completed the installation, always close carefully the cable glands, the terminal block compartment and the cover, to protect the electronics from oxidation.

3. If the unit does not turn on even if powered, check the fuse F1 (0.5A); if instead the unit turns on but the 230V~ outputs are not powered, check the fuse F1 (4A); if the units turn on but does not power the 24V~ outputs, check the fuse F4 (2A). Fuse positions are shown on the power board image (see “Electrical Connection” section). Fuses should be replaced by qualified personnel only, using fuses of the same size and value.

4. In general, the sensor connection cables should be as short as possible and located far from power cables.

5. Exchanging phase and neutral of the power supply does not affect the correct functioning of the unit, but the internal protection fuse (F1) will be connected to the neutral instead of to the phase. Consequently, even the phase and neutral of the 230V~ outputs are exchanged.

6. The grounding of the power line (terminal 3) must be connected to the grounding of the electrical system. This connection is not needed for safety reason (device of class II), but for avoiding any electrical noise coming from the mains.

7. The max load for K1, K2 and K3 relay outputs is 3A @ 250V~ resistive; in case of inductive load, the max current is 1A (pumps and solenoid valves up to 250 VA @ 230 V~, can be driven). For outputs K4 and K5 it is recommended to not exceed the safety voltage of 24V~.

8. In case of voltage outputs (24V~), the maximum power consumption is 20VA; any overload may burn the protection fuses.

9. In case of inductive load, the outputs should be protected with proper arch and interference suppression systems (RC networks or varistors in AC, diodes or varistors in DC). Internally the device is equipped with suppressors appropriate for 230V~ on K1, K2 and K3, and suppression systems for 24V~ on K4 and K5. A proper interference suppressor should be chosen by the user accordingly with specific load / power supply.

10. To have your device always at its top performance even in noisy environments, it is recommended to follow the below instructions:

11. Insert radio frequency block ferrite on the power supply cable

12. Connect to the grounding system the metallic shield of the input cables

13. Install RC suppressors (or similar device) in parallel with the load (choose proper size)

14. Perform an efficient grounding connection of the equipment

15. Ground the cables of the current outputs longer than 20 meters

16. The unit should be always on, to avoid polarization delays of the sensors, with consequent control errors. If it is not necessary to use it for several hours (e.g. at night), it is recommended to lock the operation through the internal clock (see “Configuration” section) or through the activation of the OFF contact (for example by connecting it to a voltage-free contact of the filter pump contactor).

5. ELECTRICAL CONNECTIONS

To access to the terminal blocks, remove the front cover located below the keyboard panel. All user connections are available on removable terminal blocks (also see drawing on the next page for your reference).

Starting from the top, the first terminal block is the power supply input; terminals 1, 2, 3, named PHASE, NEUTRAL, EARTH, respectively. Exchanging phase and neutral lines does not affect the device operations.

Proceeding downwards, you will find the 5 blocks of the relay outputs:
4, 5, 6 = K1 / 7, 8, 9 = K2 / 10, 11 = K3 / 12, 13 = K4 / 14, 15 = K5
In case of K1 and K2 configured as voltage outputs (230V~), the pin sequence is the same as the power supply block: PHASE, NEUTRAL, EARTH.

Then you will find the two current outputs:

16, 17 = positive and negative of the current output mA1
18, 19 = positive and negative of the current output mA2

Then the serial line (RS232C o RS485) block is provided, with the following connections:
20 = V-, 21 = TX, 22 = RX, 23 = GND

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

The input block is then found:

24, 25, 26 are the input terminals for measure 1 (standard = pH): the sequence is REF (reference), core of the shielded cable (positive), shield of the shielded cable (negative)

27, 28, 29 are the input terminals for measure 2 (standard = REDOX); the sequence is REF (reference), core of the shielded cable (positive), shield of the shielded cable (negative)

30, 31, 32, 33 are the input terminals for measure 3 (standard = CLE12 cell); connect only the first two terminals to signals Cu and Pt. If the cell cable is shielded (distance cell-unit longer than 2 m), the shield can be connected to any of terminals 32 and 33.

34, 35, 36, 37 are the input terminals for measure 4 (standard = potentiostatic cell); connect the wires of the potentiostatic cell cable in the following sequence: brown (-5V), white (IN), yellow (REF) and green (+5V).

Note: In case of inputs different from the standard configuration, refer to the below table for connections

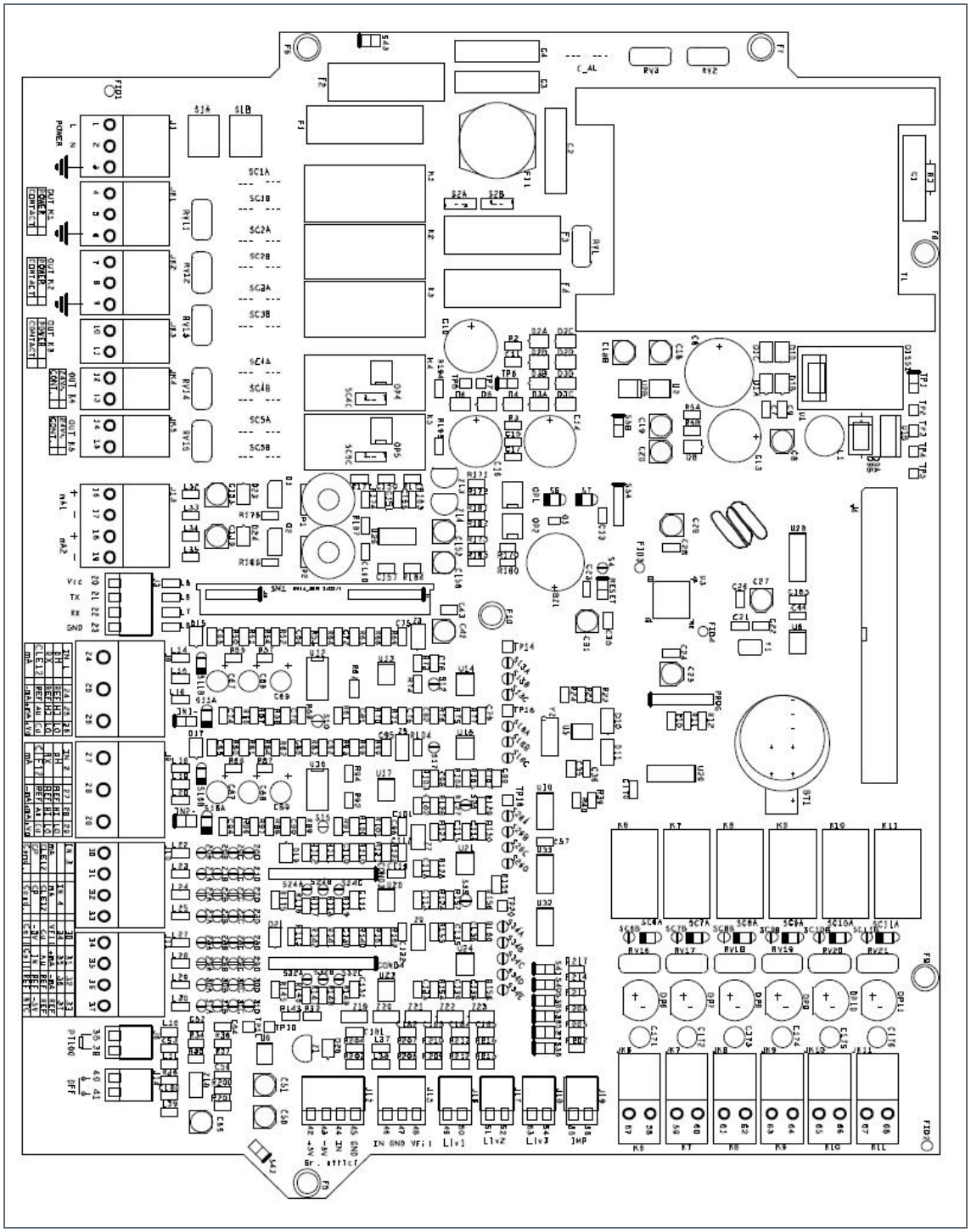
	Terminals In 1			Terminals In 2			Terminals In 3				Terminals In 4			
	24	25	26	27	28	29	30	31	32	33	34	35	36	37
pH	REF	HI	LO	REF	HI	LO								
RX	REF	HI	LO	REF	HI	LO								
CLE 12	REF	Au	Cu	REF	Au	Cu	Cu	Au	REF	REF	Cu	Pt	REF	REF
mA	-mA	+mA	+V	-mA	+mA	+V	+V	+mA	-mA	REF	+V	+mA	-mA	REF
CP							-5V	IN	REF	+5V	-5V	IN	REF	+5V
Cond.							Cell	Cell	REF	NTC	Cell	Cell	REF	NTC

Terminals 38 and 39 : connect the PT100 probe.

Terminals 40 and 41: OFF input. Connect to these pins a voltage-free contact from the filter pump contactor (or, in general, a “system in function” contact); this contact can be NO or NC, because it is configurable through the S36 jumper.

The following terminals are not accessible from terminal block compartment and are connected at the factory: J15 (46, 47), J16 (49, 50), J17 (51, 52) and J18 (53, 54) are linked to level 1, 2, 3 and 4 controls, respectively. J19 (55, 56): IMP input. The corresponding “IMP” LED on the front panel light up to indicate that “the system is working”.

The terminals JK6 (57, 58), JK7 (59, 60), JK8 (61, 62) and JK9 (63, 64) are reserved for the additional relay outputs @ 24 V~.

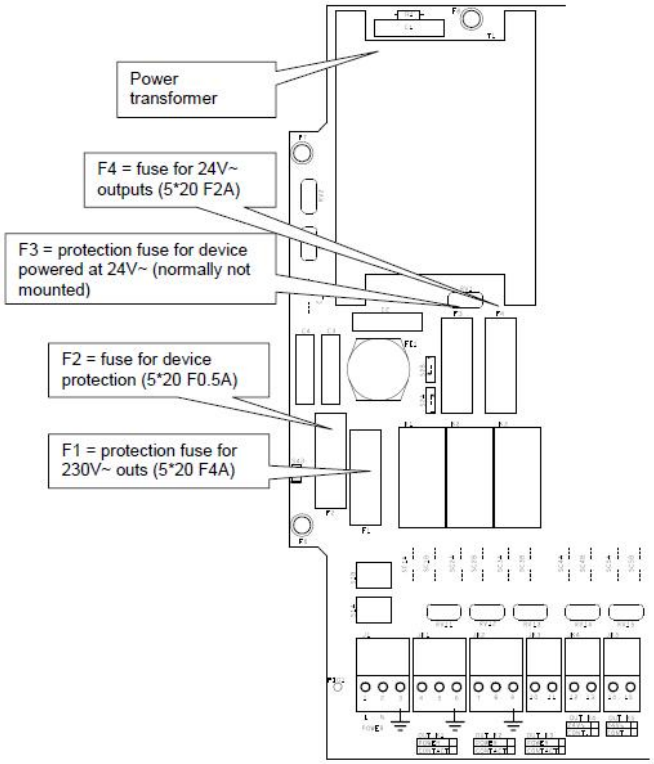


In the side drawing, the power supply and output terminals are highlighted, together with the fuses and, for technical personnel, the jumpers for configuring contact or voltage outputs.

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

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

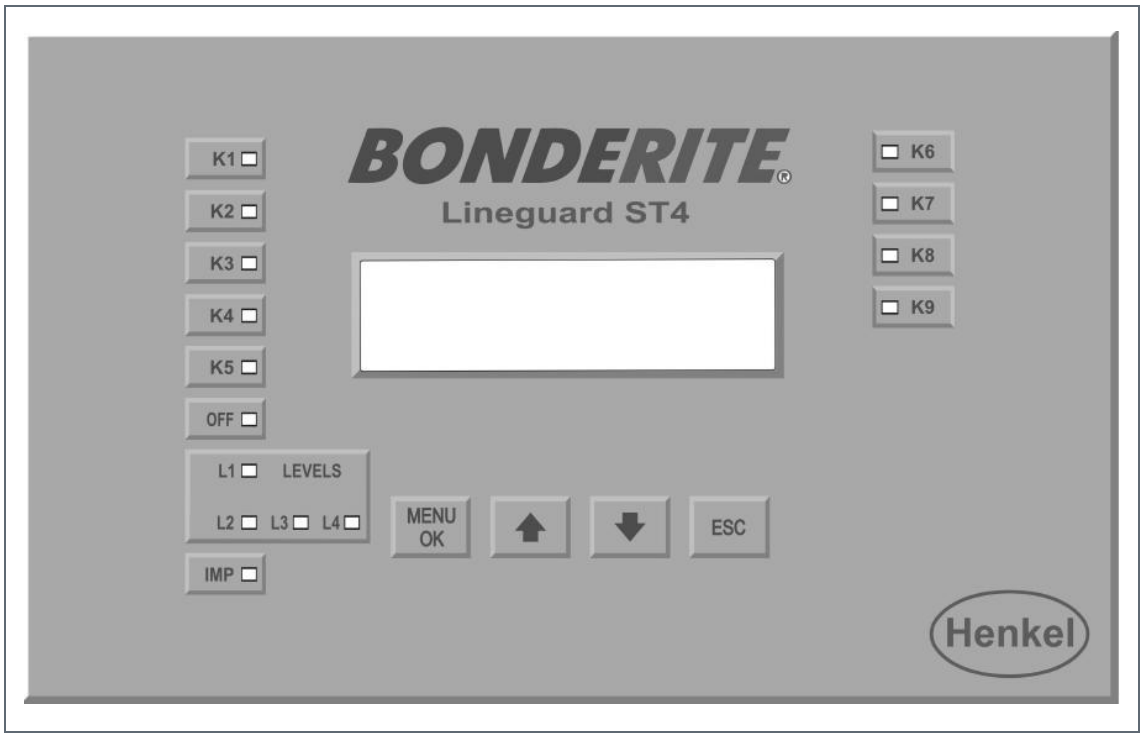
Warning! Moving these jumpers without the permission of the manufacturer will void the warranty!



6. START-UP

At start-up, the LINEGUARD ST4 unit displays the software version, then checks the status of memorized data and shows error messages if any incongruence is detected. For details about error messages, refer to the "ERRORS" section. Date and time are also displayed. Once completing this testing stage, the instrument enters normal operation mode, shows the 4 measurements and updates the relay status accordingly.

7. DESCRIPTION OF THE FRONT PANEL



The front panel is equipped with an alphanumeric display (2 rows x 16 characters), 4 keys and 15 LEDs :

1.	MENU/OK key	Allows to access "CONFIGURATION" and "CALIBRATION" modes
2.	⇑ key	Increases the displayed value, in calibration and/or configuration mode
3.	⇓ key	Decreases the displayed value, in calibration and/or configuration mode
4.	ESC key	Exits calibration and/or configuration mode without saving modifications or new data
5.	LED K1...K5	Light up to indicate the status of the related output (ON = contact closed)
6.	LED OFF	Lights up to indicate the “system is working” status; turns off to indicate an external request of shutting down the device (not from internal clock)
7.	LED LEV1,2,3,4	Light up to indicate the presence of four levels, that – properly enabled – can stop output operations
8.	LED IMP	Lights up to indicate the “system is working” status
9.	LED K6...K9	Light up to indicate the status of the related output (ON = contact closed, or ON = 24V~ provided at output)

8. DISPLAY VISUALIZATIONS

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

	7	.	2	1	p	H		0	0	6	9	1	mV
	2	7	.	8	°	C		0	0	.	7	8	ClO2

In one or more boxes can be displayed, alternating with the measure chosen, any fault condition (for example, lack of levels or flow, off from internal clock, etc.). Refer to parameters P80...P83.

Press ⇑ ⇓ keys to display different info, as specific data related to a particular measurement, current date and time, status of the outputs. For example, pressing the ⇑ key once, generates a screen that shows the measured pH value, the input signal (in this case the value within brackets is the mV input), the gain "G" factor and the offset "O" with respect to the electrical calibration (values indicative of the state of the input sensors):

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

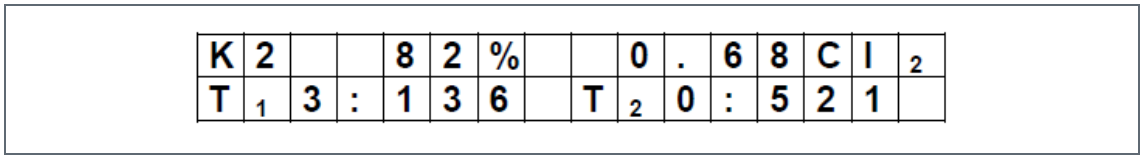
Each time the ⇑ ⇓ key is pressed, the displayed data change, showing the following information: the four measurements (typical displayed that activates at start-up), details of measure 1 (pH), details of measure 2 (RX), details of measure 3 (ppm Cl_2 from cell CLE12), details of measure 4 (ppm Cl_2 from potentiostatic cell), details of measure 5 (temperature in °C), details o f measure 6 (if possible, calculation of combined chlorine, in ppm), date / time, details of the relay outputs K1, K2, K4 and K5. The time is displayed in 24 h format:

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

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

K	1		O	F	F				7	.	1	8	p	H
T_1		0	:	0	0	0		T_2		0	:	0	0	0

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



Are displayed the adjustment percentage, the value of the associated measurement, the time base (T1) and the ON time (T2).

If a relay is programmed for a maximum operating time, that value is displayed in alternation with the reading. When the maximum operating time expires, the related alarm is triggered (see “Configuration” section for details).

9. “MENU/OK” KEY (access to calibration and configuration menus)

The MENU/OK key allows to access a “circular” menu, that can be scrolled with the ⇑ and ⇓ keys, for choosing among the following options:

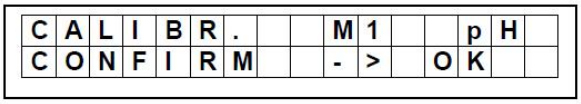
- Calibration measure 1
- Calibration measure 2
- Calibration measure 3
- Calibration measure 4
- Calibration measure 5
- Standard configuration
- Advanced configuration
- Set date / time
- Output tests
- Super chlorination

Refer to specific sections for further details.

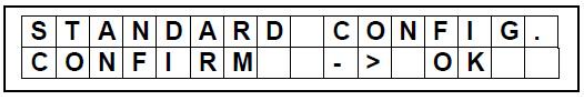
10. CONFIGURATION

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

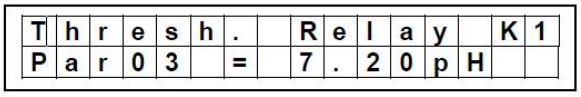
1. Starting from any screen, press the MENU/OK key



2. The display offers the calibration of measure 1 (pH).



3. Press the ⇑ key five times, to display the Standard Configuration option:



4. Press MENU/OK to confirm, press ESC to quite, or use the ⇑ and ⇓ keys for choosing another option

5. If the option is confirmed, the first editable parameter is displayed and the cursor moves below the parameter number (03)

   Now you can:

   - press ESC to quit the configuration mode
   - press MENU/OK for editing the parameter value; the cursor will move below the parameter value
   - press ⇑ to display the next parameter
   - press ⇓ to display the previous parameter

6. If MENU/OK is pressed, the cursor moves below the value of the displayed parameter
7. Press ⇑ to increase the parameter value, or press ⇓ to decrease the parameter value
8. Press MENU/OK to confirm and store the new value, or press ESC to exit without saving the modification
9. The cursor returns back below the parameter value
10. Proceed as described here above for viewing / editing all the parameters

- If no key is pressed for a couple of minutes, the LINEGUARD automatically exits the configuration menu.
- Parameters that can be viewed (and modified) are limited in standard configuration menu; for a full access, the “Advanced Configuration” mode must be entered.
- Operations in “Advanced Configuration” mode are the same as the “Standard Configuration”, but all parameters can be viewed / edited.
- The allowable values are limited by the processor, but it is recommended to always verify the congruence between the application and the set value.
- If a password has been entered, to access the configuration mode first type the correct password and then confirm with MENU/OK.
- When exiting the configuration mode, the access level returns to zero.
- All menus are “circular”: scrolling with the arrow keys, when reaching the maximum, the minimum is then shown, and vice-versa.

11. CONFIGURATION THROUGH SERIAL LINE

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

1. Connect the supervisor (for ex. a PC) to the terminal block of the serial line, while paying attention to the serial port type (RS232 or RS485)

2. To the command Pxx (CR) sent by the supervisor, the LINEGUARD answers with the parameter value “xx”

3. If the supervisor command is instead Pxx=1234 (CR), the unit interprets the four digits following the “=” sign as the new value of the parameter

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

12. LIST OF CONFIGURATION PARAMETERS

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

PAR.	DESCRIPTION		MIN VALUE	MAX VALUE	DEFAULT VALUE	SET VALUE
P01	Measure linked to the relay output K1	1 = Measure1 (pH) 2 = Measure2 (Redox) 3 = Measure3 (Free chlorine CLE12) 4 = Measure4 (Free chlorine CP) 5 = Temperature 6 = Not available	1	6	1	
P02	Output type for relay K1	0 = disabled 1 = close upon threshold exceeded 2 = open upon threshold exceeded 3 = PWM upwards 4 = PWM downwards 5 = alarm NO 6 = alarm NC 7 = close upon thresh. exceeded + daily limit 8 = open upon thresh. exceeded + daily limit 9 = PWM upwards + daily limit 10 = PWM downwards + daily limit	0	10	3	
P03	P02 = 1, 2, 3, 4, 7, 8 → threshold to be reached relay K1 P02 = 5, 6 → central value of alarm threshold relay K1		-1000	2000	7.20pH	
P04	P02 = 1, 2, 3, 4, 7, 8 → hysteresis relay K1 P02 = 5, 6 → hysteresis above and below K1 threshold		0	500	0.20pH	
P05	P02 = 1, 2, 5, 6 → activation delay for relay K1 P02 = 3, 4, 9, 10 → time base for relay K1 P02 = 7, 8 → not used		0:00	30:00	00:00 min:sec	
P06	P02 = 1, 2, 5, 6 → deactivation delay for relay K1 P02 = 3, 4 → not used P02 = 7, 8, 9, 10 → dosage time for K1		0:00	30:00	00:00 min:sec	
P07	Alarm max dosage time for relay K1		0:00	09:59	00:00 h:min	
P08	OFF status relay K1	Weight 1 = lack of level 1 Weight 2 = lack of level 2 Weight 4 = lack of level 3 Weight 8 = lack of level 4 Weight 16 = UR / OR meas. associated to K1 Weight 32 = alarm max. dosage time K1 Weight 64 = internal clock Weight 128 = alarm zero chlorine or redox	0	255	255	
P09	Measure linked to the relay output K2	1 = Measure1 (pH) 2 = Measure2 (Redox) 3 = Measure3 (Free chlorine CLE12) 4 = Measure4 (Free chlorine CP) 5 = Temperature 6 = Not available	1	6	4	

P10	Output type for relay K2	0 = disabled 1 = close upon threshold exceeded 2 = open upon threshold exceeded 3 = PWM upwards 4 = PWM downwards 5 = alarm NO 6 = alarm NC 7 = close upon thresh. exceeded + daily limit 8 = open upon thresh. exceeded + daily limit 9 = PWM upwards + daily limit 10 = PWM downwards + daily limit	0	10	4	
P11	P10 = 1, 2, 3, 4, 7, 8 → threshold to be reached relay K2 P10 = 5, 6 → central value of alarm threshold relay K2		-1000	2000	0.70ppm	
P12	P10 = 1, 2, 3, 4, 7, 8 → hysteresis relay K2 P10 = 5, 6 → hysteresis above and below K2 threshold		0	500	0.20ppm	
P13	P10 = 1, 2, 5, 6 → activation delay for relay K2 P10 = 3, 4, 9, 10 → time base for relay K2 P10 = 7, 8 → not used		0:00	30:00	00:00 min:sec	
P14	P10 = 1, 2, 5, 6 → deactivation delay for relay K2 P10 = 3, 4 → not used P10 = 7, 8, 9, 10 → dosage time for K2		0:00	30:00	00:00 min:sec	
P15	Alarm max dosage time for relay K2		0:00	09:59	00:00 h:min	
P16	OFF status relay K2	Weight 1 = lack of level 1 Weight 2 = lack of level 2 Weight 4 = lack of level 3 Weight 8 = lack of level 4 Weight 16 = UR / OR meas. associated to K2 Weight 32 = alarm max dosage time K2 Weight 64 = internal clock Weight 128 = alarm zero chlorine or redox	0	255	255	
P17	Activation of input alarms on relay K3	Weight 1 = lack of level 1 Weight 2 = lack of level 2 Weight 4 = lack of level 3 Weight 8 = lack of level 4 Weight 16 = no OFF consent	0	31	31	
P18	Activation of software alarms on relay K3	Weight 1 = start-up delay Weight 2 = pH stability Weight 4 = internal clock Weight 8 = alarm zero chlorine or redox	0	15	15	
P19	Activation of meas. 1 alarms on relay K3	Weight 1 = UR / OR measure 1 (pH) Weight 2 = alarm max dosage time meas. 1	0	3	3	
P20	Activation of meas. 2 alarms on relay K3	Weight 1 = UR / OR measure 2 (RX) Weight 2 = alarm max dosage time meas. 2	0	3	3	
P21	Activation of meas. 3 alarms on relay K3	Weight 1 = UR / OR measure 3 (ppm CLE12) Weight 2 = alarm max dosage time meas. 3	0	3	3	
P22	Activation of meas. 4 alarms on relay K3	Weight 1 = UR / OR measure 4 (ppm CP) Weight 2 = alarm max dosage time meas. 4	0	3	3	

P23	Activation of meas. 5 alarms on relay K3	Weight 1 = UR / OR measure 5 (°C) Weight 2 = alarm max dosage time meas. 5	0	3	0	
P24	Relay K3: NO or NC (0 or 1)		0	1	1	
P25	Measure linked to the relay output K4	1 = Measure1 (pH) 2 = Measure2 (Redox) 3 = Measure3 (Free chlorine CLE12) 4 = Measure4 (Free chlorine CP) 5 = Temperature 6 = Not available	1	6	4	
P26	Output type for relay K4	0 = disabled 1 = close upon threshold exceeded 2 = open upon threshold exceeded 3 = PWM upwards 4 = PWM downwards 5 = alarm NO 6 = alarm NC 7 = close upon thresh. exceeded + daily limit 8 = open upon thresh. exceeded + daily limit 9 = PWM upwards + daily limit 10 = PWM downwards + daily limit	0	10	4	
P27	P26 = 1, 2, 3, 4, 7, 8 → threshold to be reached relay K4 P26 = 5, 6 → central value of alarm threshold relay K4		-1000	2000	0.70ppm	
P28	P26 = 1, 2, 3, 4, 7, 8 → hysteresis relay K4 P26 = 5, 6 → hysteresis above and below K4 threshold		0	500	0.20ppm	
P29	P26 = 1, 2, 5, 6 → activation delay for relay K4 P26 = 3, 4, 9, 10 → time base for relay K4 P26 = 7, 8 → not used		0:00	30:00	00:00 min:sec	
P30	P26 = 1, 2, 5, 6 → deactivation delay for relay K4 P26 = 3, 4 → not used P26 = 7, 8, 9, 10 → dosage time for K4		0:00	30:00	00:00 min:sec	
P31	Alarm max dosage time for relay K4		0:00	09:59	00:00 h:min	
P32	OFF status relay K4	Weight 1 = lack of level 1 Weight 2 = lack of level 2 Weight 4 = lack of level 3 Weight 8 = lack of level 4 Weight 16 = UR / OR meas. associated to K4 Weight 32 = alarm max dosage time K4 Weight 64 = internal clock Weight 128 = alarm zero chlorine or redox	0	255	255	
P33	Measure linked to the relay output K5	1 = Measure1 (pH) 2 = Measure2 (Redox) 3 = Measure3 (Free chlorine CLE12) 4 = Measure4 (Free chlorine CP) 5 = Temperature 6 = Not available	1	6	4	

P34	Output type for relay K5	0 = disabled 1 = close upon threshold exceeded 2 = open upon threshold exceeded 3 = PWM upwards 4 = PWM downwards 5 = alarm NO 6 = alarm NC 7 = close upon thresh. exceeded + daily limit 8 = open upon thresh. exceeded + daily limit 9 = PWM upwards + daily limit 10 = PWM downwards + daily limit	0	10	4
P35	P34 = 1, 2, 3, 4, 7, 8 → threshold to be reached relay K5 P34 = 5, 6 → central value of alarm threshold relay K5		-1000	2000	0.70ppm
P36	P34 = 1, 2, 3, 4, 7, 8 → hysteresis relay K5 P34 = 5, 6 → hysteresis above and below K5 threshold		0	500	0.20ppm
P37	P34 = 1, 2, 5, 6 → activation delay for relay K5 P34 = 3, 4, 9, 10 → time base for relay K5 P34 = 7, 8 → not used		0:00	30:00	00:00 min:sec
P38	P34 = 1, 2, 5, 6 → de activation delay for relay K5 P34 = 3, 4 → not used P34 = 7, 8, 9, 10 → dosage time for K5		0:00	30:00	00:00 min:sec
P39	Alarm max dosage time for relay K5		0:00	09:59	00:00 h:min
P40	OFF status relay K5	Weight 1 = lack of level 1 Weight 2 = lack of level 2 Weight 4 = lack of level 3 Weight 8 = lack of level 4 Weight 16 = UR / OR meas. associated to K5 Weight 32 = alarm max dosage time K5 Weight 64 = internal clock Weight 128 = alarm zero chlorine or redox	0	255	255
P41	Measure linked to the relay output K6	1 = Measure1 (pH) 2 = Measure2 (Redox) 3 = Measure3 (Free chlorine CLE12) 4 = Measure4 (Free chlorine CP) 5 = Temperature 6 = Not available	1	6	4
P42	Output type for relay K6	0 = disabled 1 = close upon threshold exceeded 2 = open upon threshold exceeded 3 = alarm NO 4 = alarm NC	0	4	2
P43	P41 = 1, 2 → threshold to be reached relay K6 P41 = 3, 4 → central value of alarm threshold relay K6		-1000	2000	2.00ppm
P44	P41 = 1, 2 → hysteresis relay K6 P41 = 3, 4 → hysteresis above and below K6 threshold		0	500	0.10ppm
P45	Activation and deactivation delay for relay K6		0:00	30:00	00:10 min:sec
P46	OFF status relay K6	Weight 1 = lack of level 1 Weight 2 = lack of level 2 Weight 4 = lack of level 3 Weight 8 = lack of level 4 Weight 16 = UR / OR meas. associated to K6 Weight 32 = alarm max dosage time K6 Weight 64 = internal clock Weight 128 = alarm zero chlorine or redox	0	255	255

P47	Measure linked to the relay output K7	1 = Measure1 (pH) 2 = Measure2 (Redox) 3 = Measure3 (Free chlorine CLE12) 4 = Measure4 (Free chlorine CP) 5 = Temperature 6 = Not available	1	6	4	
P48	Output type for relay K7	0 = disabled 1 = close upon threshold exceeded 2 = open upon threshold exceeded 3 = alarm NO 4 = alarm NC	0	4	2	
P49	P47 = 1, 2 → threshold to be reached relay K7 P47 = 3, 4 → central value of alarm threshold K7		-1000	2000	2.00ppm	
P50	P47 = 1, 2 → hysteresis relay K7 P47 = 3, 4 → hysteresis above and below K7 threshold		0	500	0.10ppm	
P51	Activation and deactivation delay for relay K7		0:00	30:00	00:00 min:sec	
P52	OFF status relay K7	Weight 1 = lack of level 1 Weight 2 = lack of level 2 Weight 4 = lack of level 3 Weight 8 = lack of level 4 Weight 16 = UR / OR meas. associated to K7 Weight 32 = alarm max dosage time K7 Weight 64 = internal clock Weight 128 = alarm zero chlorine or redox	0	255	255	
P53	Measure linked to the relay output K8	1 = Measure1 (pH) 2 = Measure2 (Redox) 3 = Measure3 (Free chlorine CLE12) 4 = Measure4 (Free chlorine CP) 5 = Temperature 6 = Not available	1	6	4	
P54	Output type for relay K8	0 = disabled 1 = close upon threshold exceeded 2 = open upon threshold exceeded 3 = alarm NO 4 = alarm NC	0	4	3	
P55	P54 = 1, 2 → threshold to be reached relay K8 P54 = 3, 4 → central value of alarm threshold K8		-1000	2000	2.00ppm	
P56	P54 = 1, 2 → hysteresis relay K8 P54 = 3, 4 → hysteresis above and below K8 threshold		0	500	1.00ppm	
P57	Activation and deactivation delay for relay K8		0:00	30:00	00:00 min:sec	
P58	OFF status relay K8	Weight 1 = lack of level 1 Weight 2 = lack of level 2 Weight 4 = lack of level 3 Weight 8 = lack of level 4 Weight 16 = UR / OR meas. associated to K8 Weight 32 = alarm max dosage time K8 Weight 64 = internal clock Weight 128 = alarm zero chlorine or redox	0	255	255	
P59	Measure linked to the relay output K9	1 = Measure1 (pH) 2 = Measure2 (Redox) 3 = Measure3 (Free chlorine CLE12) 4 = Measure4 (Free chlorine CP) 5 = Temperature 6 = Not available	1	6	4	

P60	Output type for relay K9	0 = disabled 1 = close upon threshold exceeded 2 = open upon threshold exceeded 3 = alarm NO 4 = alarm NC 5 = auto-cleaning cycle 6 = auto-clean synchronized with IMP input 7 = auto-cleaning with washing stage		0	7	5	
P61	P60 = 1, 2 → threshold to be reached relay K9 P60 = 3, 4 → central value of alarm threshold K9 P60 = 5, 6 → cleaning time (mm:ss) P60 = 7 → washing time (mm:ss)			-1000	2000	01.00 min:sec	
P62	P60 = 1, 2 → hysteresis relay K9 P60 = 3, 4 → hysteresis above and below K9 threshold P60 = 5, 6 → measure delay time after cleaning (mm:ss) P60 = 7 → measurement time (mm:ss)			0	500	01.00 min:sec	
P63	P60 = 1, 2, 3, 4 → activation / deactivation time relay K9 P60 = 5 → measurement time (hh:mm) P60 = 7 → cleaning time (mm:ss)			0:00	30:00	00:15 h:min min:sec	
P64	P60 < 5 : OFF status relay K9	Weight 1 = lack of level 1 Weight 2 = lack of level 2 Weight 4 = lack of level 3 Weight 8 = lack of level 4 Weight 16 = UR / OR meas. associated to K8 Weight 32 = alarm max dosage time K8 Weight 64 = internal clock Weight 128 = alarm zero chlorine or redox		0	255	255	
	P60 = 5 o 6 → not used P60 = 7 → pause time after cleaning (hh:mm)						
P65	Type of current output mA1	0 = 0/20 mA meas1	1 = 4/20 mA meas1	0	11	1	
		2 = 0/20 mA meas2	3 = 4/20 mA meas2				
		4 = 0/20 mA meas3	5 = 4/20 mA meas3				
		6 = 0/20 mA meas4	7 = 4/20 mA meas4				
		8 = 0/20 mA meas5	9 = 4/20 mA meas5				
		10= 0/20 mA meas6	11= 4/20 mA meas6				
P66	Starting value for current output mA1 (0 o 4 mA)			-1000	2000	0.00pH	
P67	Full scale value for current output mA1 (20 mA)			-1000	2000	14.00pH	
P68	OFF status output mA1	Weight 1 = lack of level 1 Weight 2 = lack of level 2 Weight 4 = lack of level 3 Weight 8 = lack of level 4 Weight 16= UR/OR meas. associated to mA1 Weight 64 = internal clock Weight 128 = alarm zero chlorine or redox		0	255	57	
P69	Fault value for current output mA1			0.00	21.00	2.00mA	
P70	Range of current output mA1	0 = 0...100%		0	1	1	
		1 = -5...105%					

P71	Type of current output mA2	0 = 0/20 mA meas1 2 = 0/20 mA meas2 4 = 0/20 mA meas3 6 = 0/20 mA meas4 8 = 0/20 mA meas5 10= 0/20 mA meas6	1 = 4/20 mA meas1 3 = 4/20 mA meas2 5 = 4/20 mA meas3 7 = 4/20 mA meas4 9 = 4/20 mA meas5 11= 4/20 mA meas6	0	11	7	
P72	Starting value for current output mA2 (0 o 4 mA)			-1000	2000	0.00ppm	
P73	Full scale value for current output mA2 (20 mA)			-1000	2000	5.00ppm	
P74	OFF status output mA2	Weight 1 = lack of level 1 Weight 2 = lack of level 2 Weight 4 = lack of level 3 Weight 8 = lack of level 4 Weight 16= UR/OR meas. associated to mA2 Weight 64 = internal clock Weight 128 = alarm zero chlorine or redox		0	255	58	
P75	Fault value for current output mA2			0.00	21.00	2.00mA	
P76	Range of current output mA2	0 = 0...100% 1 = -5...105%		0	1	1	
P77	Measure hold upon IMP input active	Weight 1 = Hold measure 1 Weight 2 = Hold measure 2 Weight 4 = Hold measure 3 Weight 8 = Hold measure 4 Weight 16 = Hold measure 5		0	31	31	
P78	Start-up delay			00:10	59:59	00:20 min:sec	
P79	Not used			0	0	0	
P80	Not used			0	0	0	
P81	Measure activation time on Monday			00:00	23:59	0.01	
P82	Measure deactivation time on Monday			00:00	23:59	23.59	
P83	Measure activation time on Tuesday			00:00	23:59	0.01	
P84	Measure deactivation time on Tuesday			00:00	23:59	23.59	
P85	Measure activation time on Wednesday			00:00	23:59	0.01	
P86	Measure deactivation time on Wednesday			00:00	23:59	23.59	
P87	Measure activation time on Thursday			00:00	23:59	0.01	
P88	Measure deactivation time on Thursday			00:00	23:59	23.59	
P89	Measure activation time on Friday			00:00	23:59	0.01	
P90	Measure deactivation time on Friday			00:00	23:59	23.59	
P91	Measure activation time on Saturday			00:00	23:59	0.01	
P92	Measure deactivation time on Saturday			00:00	23:59	23.59	
P93	Measure activation time on Sunday			00:00	23:59	0.01	

P94	Measure deactivation time on Sunday			00:00	23:59	23.59	
P95	Not used			0	0	0	
P96	Not used			0	0	0	
P97	Alarm zero chlorine			0.00	0.50	0.00ppm	
P98	Alarm redox			0	1000	750mV	
P99	Not used			0	0	0	
P100	Not used			0	0	0	
P101	Not used			0	0	0	
P102	Working temperature			0	100	25°C	
P103	Super chlorination time			00:00	24:00	00:00 h:min	
P104	Box 1 display	1 = measure 1	11 = measure 1 + errors	1	19	1	
		2 = measure 2	12 = measure 2 + errors				
		3 = measure 3	13 = measure 3 + errors				
		4 = measure 4	14 = measure 4 + errors				
		5 = measure 5	15 = measure 5 + errors				
		6 = measure 6	16 = measure 6 + errors				
		7 = measure 7	17 = measure 7 + errors				
		8 = empty	18 = empty + errors				
		9 = ----	19 = --- + errors				
P105	Box 2 display	1 = measure 1	11 = measure 1 + errors	1	19	2	
		2 = measure 2	12 = measure 2 + errors				
		3 = measure 3	13 = measure 3 + errors				
		4 = measure 4	14 = measure 4 + errors				
		5 = measure 5	15 = measure 5 + errors				
		6 = measure 6	16 = measure 6 + errors				
		7 = measure 7	17 = measure 7 + errors				
		8 = empty	18 = empty + errors				
		9 = ----	19 = --- + errors				
P106	Box 3 display	1 = measure 1	11 = measure 1 + errors	1	19	3	
		2 = measure 2	12 = measure 2 + errors				
		3 = measure 3	13 = measure 3 + errors				
		4 = measure 4	14 = measure 4 + errors				
		5 = measure 5	15 = measure 5 + errors				

		6 = measure 6	16 = measure 6 + errors				
		7 = measure 7	17 = measure 7 + errors				
		8 = empty	18 = empty + errors				
		9 = ----	19 = --- + errors				
P107	Box 4 display	1 = measure 1	11 = measure 1 + errors	1	19	14	
		2 = measure 2	12 = measure 2 + errors				
		3 = measure 3	13 = measure 3 + errors				
		4 = measure 4	14 = measure 4 + errors				
		5 = measure 5	15 = measure 5 + errors				
		6 = measure 6	16 = measure 6 + errors				
		7 = measure 7	17 = measure 7 + errors				
		8 = empty	18 = empty + errors				
		9 = ----	19 = --- + errors				
P108	Display backlight	0 = LED power (no backlight control) 1 = backlight always ON 2..30 = minutes of backlight ON		0	30	3 min	
P109	Password for standard configuration			0	9999	0	
P110	Password for advanced configuration			0	9999	0	
P111	Deactivation of electrochemical calibrations			0	1	0	
P112	Language	0 = Italian 1 = English 2 = French 3 = Spanish 4 = Dutch		0	3	0	
P113	Serial address	0 = RS232, 1...9 = RS485 @ 9600BPS 10 = RS232, 11..19 = RS485 @ 19200BPS 20 = communication with µMMC4 recorder		0	20	10	
P114	Data log	Off, 1...8 -> 1, 2, 5, 10, 15, 20, 30, 60min		0	8	2 min	
P115	Autoset (factory settings)			0	999	0	

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

13. MEANING OF PARAMETERS

PARAMETER 01 MEASURE LINKED TO THE RELAY OUTPUT K1

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

PARAMETER 02 OUTPUT TYPE FOR RELAY 1

The K1 output can operate in 11 different modes, coded as follows:

0 = disabled	The relay is not used
1 = close upon threshold exceeded	ON/OFF control as acidification or de-chlorination
2 = open upon threshold exceeded	ON/OFF control as alkalinization or chlorination
3 = PWM upwards	Proportional control in time for acidification or de-chlorination
4 = PWM downwards	Proportional control in time for alkalinization or chlorination
5 = alarm NO	Relay contact closed (alarm) when measure is outside set-point
6 = alarm NC	Relay contact closed (fail-safe) when measure is around set-point
7 = ON/OFF + daily limits	Acidification or de-chlorination ON/OFF + time limit
8 = ON/OFF + daily limits	Alkalinization or chlorination ON/OFF + time limit
9 = PWM upwards + daily limit	PWM control for acidification or de-chlorination + time limit
10 = PWM downwards + daily limit	PWM control for alkalinization or chlorination + time limit

On the next page you can see a graphic explanation of the various operations.

The diagrams are divided by type of adjustment and the following can be noticed:

The adjustment changes depending on the type of operation set for the relay.

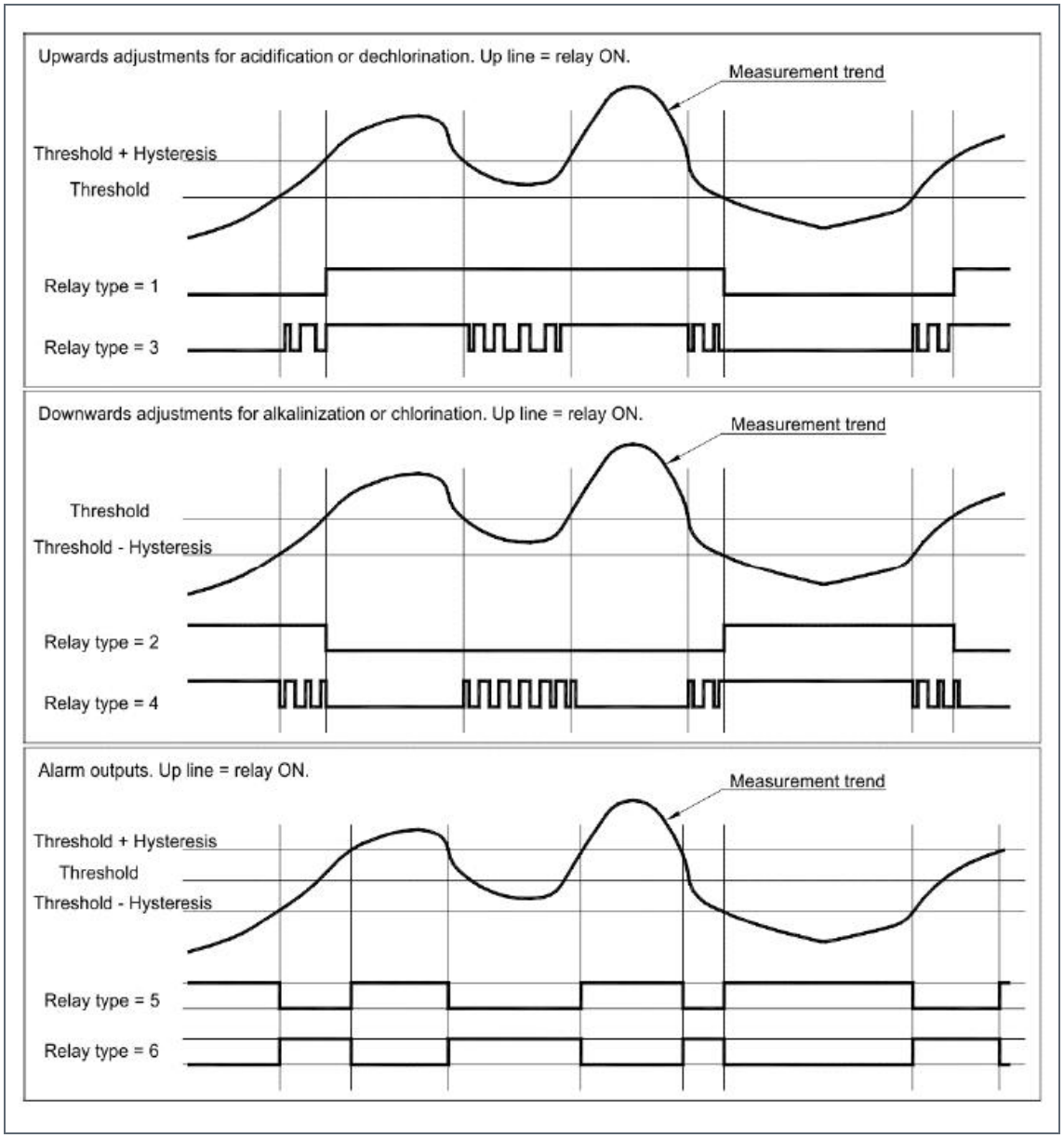
Up line = relay is energized → closed contact.

Low line = relay is de-energized → open contact.

In the terminal block are available only the NO contacts of the relay (or the voltage output); to get the inverse function just change the setting of the relative parameter (e.g. P02 1 → 2).

The ON/OFF and proportional settings with daily limit are not shown in the diagrams because they are identical to the operating modes 1...4, but with a dosage stop, although not required, when the daily dose is reached.

Note: If you want to use these configurations, after completing the programming, the unit must be turned off and then on again (to reset the daily dosage).



PARAMETER 03 THRESHOLD FOR RELAY K1

In case of adjustment relay, this parameter is the value to be reached.

In case of alarm relay, this parameter is the central reference value for the alarm threshold.

PARAMETER 04 HYSTERESIS FOR RELAY K1

For setting the relay hysteresis, there are three cases:

ON/OFF control: this parameter allows to set a “not intervention” window for the relay, typically to be set quite narrow (10… 20 points).

Proportional control: this parameter allows to set the proportional (PWM) adjustment band, typically set from 30 to 50 points.

Alarm output: this parameter is used to set the window (above and below the threshold), which defines if measurement is in alarm condition or not.

PARAMETER 05	ON-OFF Outputs:	ACTIVATION DELAY RELAY K1
	PWM CONTROL:	TIME BASE RELAY K1
	ON-OFF + DAILY LIMIT:	NOT USED

The intervention of the relay K1 with respect to the threshold exceeding, can be delayed of a certain time (in minutes : seconds), to be entered in this parameter. If P05=0, no delay is set. In case of PWM proportional control, this parameter is the time base: the recommended values vary from approximately 10 seconds if the relay is used for activation or control of solenoid valves, up to 5…10 minutes if the relay is used for turning on / off dosing pumps. In case of ON/OFF control with daily limit, this parameter is not used.

PARAMETER 06	ON-OFF Outputs:	DEACTIVATION DELAY RELAY K1
	PWM CONTROL:	NOT USED
	ON-OFF + DAILY LIMIT:	DOSAGE TIME FOR K1

The deactivation of the relay K1 with respect to the threshold, can be delayed of a certain time (in minutes : seconds), to be entered in this parameter. If P06=0, no delay is set. In case of PWM proportional control, this parameter is not used.

In case of ON/OFF control with daily limit, enter the max time (in minutes : seconds) of pump operation, distributed over the day. For example, to get a max dose of product of di 0.5 liters per day with a 4 l/h pump, you must set P06 = 7:30 (minutes : seconds), because the pump will take 0.125 hours (= 7.5 minutes) to inject 0.5 liters.

Or you can calculate: 4 l/h / 60 = 0.067 l/min -> 0.5 l / 0.067 l/min = 7.5 minutes.

PARAMETER 07 ALARM MAX DOSAGE TIME RELAY K1

This parameter allows to monitor the max dosage time (in hours : minutes).

When measurement leaves the set threshold and, therefore, the dosage is triggered, simultaneously starts this timer. If measurement returns to the threshold before the set time is elapsed, adjustment has been successful. If instead the threshold is not reached within the set time, an alarm is generated. This alarm can be only used as failure indication or stop of adjustment (see next parameter). Setting zero means that this alarm is not used.

Warning! The time base of this alarm is in minutes and, therefore, a delay of one minute for the alarm activation or deactivation can be expected!

PARAMETER 08 OFF STATUS RELAY K1

The K1 relay normally performs the adjustment set in P02 following the trend of the measurement set in P01.

However some alarm / fault conditions can be programmed to force the relay deactivation.

These conditions are:

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

Enter in this parameter the sum of the weights of the conditions to be enabled. For example, for deactivating K1 (connected to the acid dosing pump) in case of measurement failure and internal clock error, set the value 8 + 64 = 72. If you also want to consider the “alarm max dosage”, the value becomes 8 + 16 + 64 = 88.

Warning! The lack of flow or the “system OFF” request also deactivate the output relays. These conditions are always active and cannot be disabled!

PARAMETER 09 MEASURE LINKED TO RELAY OUTPUT K2

As P01, but referred to relay K2.

PARAMETER 10 OUTPUT TYPE FOR RELAY K2

As P02, but referred to relay K2.

PARAMETER 11 THRESHOLD FOR RELAY K2

As P03, but referred to relay K2.

PARAMETER 12 HYSTERESIS FOR RELAY K2

As P04, but referred to relay K2.

PARAMETER 13

ON-OFF Outputs:	ACTIVATION DELAY RELAY K2
PWM CONTROL:	TIME BASE RELAY K2
ON-OFF + DAILY LIMIT:	NOT USED

As P05, but referred to relay K2.

PARAMETER 14	ON-OFF Outputs:	DEACTIVATION DELAY RELAY K2
	PWM CONTROL:	NOT USED
	ON-OFF + DAILY LIMIT:	DOSAGE TIME FOR K2

As P06, but referred to relay K2.

PARAMETER 15 ALARM MAX DOSAGE TIME RELAY K2

As P07, but referred to relay K2.

PARAMETER 16 OFF STATUS RELAY K2

As P08, but referred to relay K2.

PARAMETERS 17... 24

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

PARAMETER 17 ACTIVATION OF INPUT ALARMS ON RELAY K3

The inputs which may affect the relay K3 are:

Bit0	Weight 1	= lack of level 1
Bit1	Weight 2	= lack of level 2
Bit2	Weight 4	= lack of level 3
Bit3	Weight 8	= lack of level 4
Bit4	Weight 16	= no OFF consent

Enter the sum of the weights of the alarms linked to the inputs to be enabled. To enable all alarms (recommended), enter the value 1 + 2 + 4 + 8 + 16 = 31.

PARAMETER 18 ACTIVATION OF SOFTWARE ALARMS ON RELAY K3

The software conditions which may affect the relay K3 are:

Bit0	Weight 1	= start-up delay
Bit1	Weight 2	= pH stability
Bit2	Weight 4	= internal clock
Bit3	Weight 8	= alarm zero chlorine or redox

Enter the sum of the weights of the alarms to be enabled. Often the start-up delay, “pH stability” error and stop from internal clock, are not considered errors; in this case, therefore, you should enter only the alarm “zero chlorine or redox”: P18 = 8.

PARAMETER 19 ACTIVATION OF MEASURE 1 ALARMS ON RELAY K3

PARAMETER 20 ACTIVATION OF MEASURE 2 ALARMS ON RELAY K3

PARAMETER 21 ACTIVATION OF MEASURE 3 ALARMS ON RELAY K3

PARAMETER 22 ACTIVATION OF MEASURE 4 ALARMS ON RELAY K3

PARAMETER 23 ACTIVATION OF MEASURE 5 (temperature) ALARMS ON RELAY K3

For each measurement you can enable specific alarms, with the following weights:

Bit0	Weight 1	= UR / OR measure
Bit1	Weight 2	= alarm max dosage time for measure

Usually, for the first four measures, both alarms are activated (i.e. P19...22 = 3), while P23 (temperature) is set to zero because often the temperature sensor is not used.

PARAMETER 24 RELAY K3 NO or NC

This parameter can be set as follows:

- Value 0 = K3 output normally open (NO), that closes upon alarm
- Value 1 = K3 output normally excited, i.e. contact clos (NC), that opens upon alarm (fail-safe mode)

PARAMETER 25 MEASURE LINKED TO RELAY OUTPUT K4

As P01, but referred to relay K4.

PARAMETER 26 OUTPUT TYPE FOR RELAY K4

As P02, but referred to relay K4.

PARAMETER 27 THRESHOLD FOR RELAY K4

As P03, but referred to relay K4.

PARAMETER 28 HYSTERESIS FOR RELAY K4

As P04, but referred to relay K4.

PARAMETER 29	ON-OFF Outputs:	ACTIVATION DELAY RELAY K4
	PWM CONTROL:	TIME BASE RELAY K4
	ON-OFF + DAILY LIMIT:	NOT USED

As P05, but referred to relay K4.

PARAMETER 30	ON-OFF Outputs:	DEACTIVATION DELAY RELAY K4
	PWM CONTROL:	NOT USED
	ON-OFF + DAILY LIMIT:	DOSAGE TIME FOR K4

As P06, but referred to relay K4.

PARAMETER 31 ALARM MAX DOSAGE TIME RELAY K4

As P07, but referred to relay K4.

PARAMETER 32 OFF STATUS RELAY K4

As P08, but referred to relay K4.

PARAMETER 33 MEASURE LINKED TO RELAY OUTPUT K5

As P01, but referred to relay K5.

PARAMETER 34 OUTPUT TYPE FOR RELAY K5

As P02, but referred to relay K5.

PARAMETER 35 THRESHOLD FOR RELAY K5

As P03, but referred to relay K5.

PARAMETER 36 HYSTERESIS FOR RELAY K5

As P04, but referred to relay K5.

PARAMETER 37	ON-OFF Outputs:	ACTIVATION DELAY RELAY K5
	PWM CONTROL:	TIME BASE RELAY K5
	ON-OFF + DAILY LIMIT:	NOT USED

As P05, but referred to relay K5.

PARAMETER 38	ON-OFF Outputs:	DEACTIVATION DELAY RELAY K5
	PWM CONTROL:	NOT USED
	ON-OFF + DAILY LIMIT:	DOSAGE TIME FOR K5

As P06, but referred to relay K5.

PARAMETER 39 ALARM MAX DOSAGE TIME RELAY K5

As P07, but referred to relay K5.

PARAMETER 40 OFF STATUS RELAY K5

As P08, but referred to relay K5.

PARAMETER 41 MEASURE LINKED TO RELAY OUTPUT K6

This parameter associates a measure to the additional relay K6; in other words, if you set P41=1, the measure 1 (standard pH) controls the relay K6. The values normally settable range from 1 to 5; in versions which also provide the calculated value of combined chlorine, valid values arrive up to 6.

PARAMETER 42 OUTPUT TYPE FOR RELAY K6

The K6 output can operate in 5 different modes, coded as follows:

0 = disabled	The relay is not used
1 = close upon threshold exceeded	ON/OFF control as acidification or de-chlorination
2 = open upon threshold exceeded	ON/OFF control as alkalinization or chlorination
3 = alarm NO	Relay contact closed (alarm) when measure is outside set-point
4 = alarm NC	Relay contact closed (fail-safe) when measure is around set-point

The graphic explanation of the above operations is the same as parameter P02.

PARAMETER 43 THRESHOLD FOR RELAY K6

In case of adjustment relay, this parameter is the value to be reached.

In case of alarm relay, this parameter is the central reference value for the alarm threshold.

PARAMETER 44 HYSTERESIS FOR RELAY K6

For setting the relay hysteresis, there are two cases:

ON/OFF control: this parameter allows to set a “not intervention” window for the relay, typically to be set quite narrow (10… 20 points).

Alarm output: this parameter is used to set the window (above and below the threshold), which defines if measurement is in alarm condition or not.

PARAMETER 45 ACTIVATION / DEACTIVATION DELAY FOR RELAY K6

The intervention of the relay K6 with respect to the threshold exceeding and returning to the threshold, can be delayed of a certain time (in minutes : seconds), to be entered in this parameter. If P45=0, no delay is set.

PARAMETER 46 OFF STATUS RELAY K6

As P08, but referred to relay K6.

PARAMETER 47 MEASURE LINKED TO RELAY OUTPUT K7

As P41, but referred to relay K7.

PARAMETER 48 OUTPUT TYPE FOR RELAY K7

As P42, but referred to relay K7.1

PARAMETER 49 THRESHOLD FOR RELAY K7

As P43, but referred to relay K7.

PARAMETER 50 HYSTERESIS FOR RELAY K7

As P44, but referred to relay K7.

PARAMETER 51 ACTIVATION / DEACTIVATION DELAY FOR RELAY K7

As P45, but referred to relay K7.

PARAMETER 52 OFF STATUS RELAY K7

As P46, but referred to relay K7.

PARAMETER 53 MEASURE LINKED TO RELAY OUTPUT K8

As P41, but referred to relay K8.

PARAMETER 54 OUTPUT TYPE FOR RELAY K8

As P42, but referred to relay K8.

PARAMETER 55 THRESHOLD FOR RELAY K8

As P43, but referred to relay K8.

PARAMETER 56 HYSTERESIS FOR RELAY K8

As P44, but referred to relay K8.

PARAMETER 57 ACTIVATION / DEACTIVATION DELAY FOR RELAY K8

As P45, but referred to relay K8.

PARAMETER 58 OFF STATUS RELAY K8

As P46, but referred to relay K8.

PARAMETER 59 MEASURE LINKED TO RELAY OUTPUT K9

As P41, but referred to relay K9.

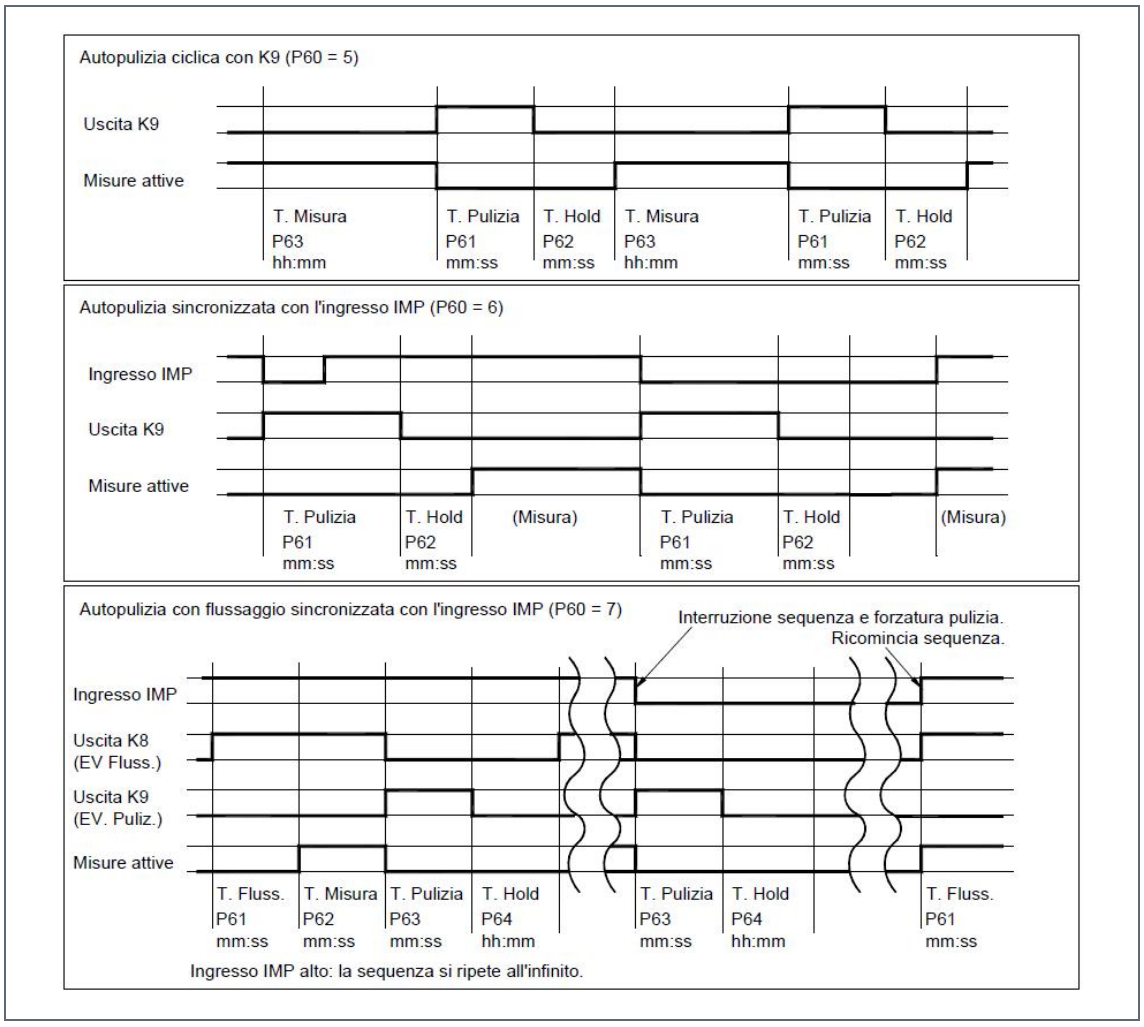
This parameter is not used if K9 is used to control an auto-cleaning cycle.

PARAMETER 60 OUTPUT TYPE FOR RELAY K9

In addition to the 5 operation modes as for the output K6, three different auto-cleaning modes are available:

0 = disabled	The relay is not used
1 = close upon threshold exceeded	ON/OFF control as acidification or de-chlorination
2 = open upon threshold exceeded	ON/OFF control as alkalinization or chlorination
3 = alarm NO	Relay contact closed (alarm) when measure is outside set-point
4 = alarm NC	Relay contact closed (fail-safe) when measure is around set-point
5 = auto-cleaning cycle	
6 = auto-cleaning synchronized with the IMP input	
7 = auto-cleaning synchronized with the IMP input, including washing stage (K8 is also used)	

The diagram here below show the three available types of auto-cleaning:



PARAMETER 61	Control output (P60 = 1,2,3,4) :	THRESHOLD FOR RELAY K9
	Auto-cleaning cycle (P60 = 5,6) :	CLEANING TIME
	Auto-cleaning with washing (P60 = 7) :	WASHING TIME

In case of output configured for adjustment, see parameter P43, but referred to relay K9.

In case of auto-cleaning cycles (P60=5 or P60=6), enter the cleaning time, in minutes : seconds. During the cleaning time, the K9 relay is energized so that it can drive a solenoid valve (or other device) for injecting the detergent.

Typically the detergent is different from the measured liquid, and therefore measurements are in “hold” status.

You can decide which measurements you want to freeze, by setting the parameter P77 (see further on).

In case of auto-cleaning with washing stage (P60=7), this parameter is used to set the washing time (input of liquid to be measured through K8).

PARAMETER 62	Control output (P60 = 1,2,3,4) :	HYSTERESIS FOR RELAY K9
	Auto-cleaning cycle (P60 = 5,6) :	MEASURE HOLD AFTER CLEANING
	Auto-cleaning with washing (P60 = 7) :	MEASUREMENT TIME

In case of output configured for adjustment, see parameter P44, but referred to relay K9.

In case of auto-cleaning cycles (P60=5 or P60=6), enter the additional “hold” time of measurements after cleaning, in minutes : seconds.

In case of auto-cleaning with washing stage (P60=7), this is the time for measuring the liquid just flushed.

During this time, the K8 relay (solenoid valve of the liquid to be measured) is active.

PARAMETER 63	Control output (P60 = 1,2,3,4) :	SWITCHING DELAY FOR RELAY K9
	Auto-cleaning cycle (P60 = 5) :	MEASUREMENT TIME
	Auto-cleaning cycle (P60 = 6) :	NOT USED
	Auto-cleaning with washing (P60 = 7) :	CLEANING TIME

In case of output configured for adjustment, see parameter P45, but referred to relay K9.

In case of auto-cleaning cycles (P60=5), enter the measurement time, in hours : minutes.

In case of auto-cleaning cycles synchronized with the IMP input (P60=6), this parameter is not used.

In case of auto-cleaning with washing stage (P60 = 7), this is the cleaning time, in minutes : seconds. During this time, the K9 relay is active and drives the solenoid valve (or other device) for injecting the detergent.

PARAMETER 64	Control output (P60 = 1,2,3,4) :	OFF STATUS RELAY K9
	Auto-cleaning cycle (P60 = 5,6) :	NOT USED
	Auto-cleaning with washing (P60 = 7) :	PAUSE TIME

In case of output configured for adjustment, see parameter P46, but referred to relay K9.

In case of auto-cleaning cycles (P60=5 or 6), this parameter is not used.

In case of auto-cleaning with washing stage (P60=7), this is the pause time between two subsequent washing/measurement cycles, in hours : minutes.

Note: If you configure parameters 61...64 to zero or too short times, in any case the microcontroller enters minimum safety values.

PARAMETER 65 TYPE OF CURRENT OUTPUT mA1

12 different combinations are available:

0 = 0-20 mA measure 1	1 = 4-20 mA measure 1 (measure 1 standard = pH)
2 = 0-20 mA measure 2	3 = 4-20 mA measure 2 (measure 2 standard = Redox)
4 = 0-20 mA measure 3	5 = 4-20 mA measure 3 (measure 3 standard = chlorine w/CLE12)
6 = 0-20 mA measure 4	7 = 4-20 mA measure 4 (measure 4 standard = chlorine w/CP)
8 = 0-20 mA measure 5	9 = 4-20 mA measure 5 (measure 5 standard = temperature)
10 = 0-20 mA measure 6	11 = 4-20 mA measure 6 (measure 6 standard = combined chlorine)

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

PARAMETER 66 STARTING VALUE FOR CURRENT OUTPUT mA1

This parameter allows to set the measure value corresponding to the starting value of the first current output (0 or 4 mA depending on the P65 setting). For example, if measure 1 (pH) has been set and you want to have 4 mA at 3.50 pH, set P66 = 3.50 (of course with P65 = 1).

PARAMETER 67 FULL SACLE VALUE FOR CURRENT OUTPUT mA1

This parameter allows to set the measure value corresponding to the full scale of the first current output (20 mA). Referring to the previous example (pH), to get 20 mA at 8.40 pH, set P67 = 8.40.

PARAMETER 68 OFF STATUS OUTPUT mA1

The mA output typically follows the measurement trend, depending on the setting of P66 and P67. Anyway, fault or alarm conditions can be generated, that force the output to a certain value, to be set in the parameter P69. These conditions are:

Bit0	Weight 1	= lack of level 1
Bit1	Weight 2	= lack of level 2
Bit2	Weight 4	= lack of level 3
Bit3	Weight 8	= lack of level 4
Bit4	Weight 16	= UR / OR of measurement associated to mA1
Bit6	Weight 64	= internal clock
Bit7	Weight 128	= alarm zero chlorine or alarm redox

Enter the sum of the weights of the conditions which force the output to the P69 value.

Warning! The lack of flow or the “system OFF” request also deactivate the mA outputs. These conditions are always active and cannot be disabled!

PARAMETER 69 FAULT VALUE FOR CURRENT OUTPUT mA1

If any error / fault defined in P68 occurs, the mA1 output will deliver the current set in this parameter. The value can be in the range from 0.00 to 21.00 mA. Typically, for a 4-20 mA output, set a fault current of 2 or 3 mA, so that any receiver can detect the problem or a dosing pump stops.

PARAMETER 70 RANGE OF CURRENT OUTPUT mA1

The mA1 output can be 0-20 or 4-20 mA. If measurement exceeds the limits set in parameters P66 and P67, the value of the output current can stop at the minimum or maximum value, or slightly higher. In this way, any fault is signalized to the receiver.

For example: 4-20 mA output on measure 2 (P65 = 3), from 500 to 800 mV (P66 = 500, P67 = 800); if P70 = 0 and the reading falls to 480 mV (i.e. below the minimum), the current output will remain at 4.00 mA; if instead P70 = 1, the output current will be 3.00 mA. Similarly, with the reading at 803 mV (above the maximum) and P70 = 0, the output will be 20.00 mA, while with P70 = 1, the output will be 21.00 mA. In case of 0-20 mA output, there will be an extended

range for the output only for the 20 mA limit, because the LINEGUARD controller cannot generate a negative current.

PARAMETERS 71...76

As parameters 65 ... 70, but referred to the mA2 output.

PARAMETER 77 MEASUREMENT HOLD UPON “IMP” INPUT ACTIVE

The IMP input can be used for freezing measurements. When the IMP input is energized, the selected measurements will be frozen at the last acquired value. The unit resumes normal operation (active measurement inputs) when the IMP input is deactivated. Measurements chosen with this parameter, will also be the ones frozen during auto-cleaning cycles.

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

PARAMETER 78 START-UP DELAY

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

Note that a pH electrode requires just one minute, while the stabilization of a redox electrode or amperometric cell may need up to 30 minutes. Sometimes this waiting time is also useful to compensate hydraulic delays at system start-up. Then set a time that activates when the control unit is powered on, during which the outputs are disabled and the “PW mm:ss” message flashes on the display. After this time, the LINEGUARD unit begins normal operations.

PARAMETER 78 NOT USED

PARAMETER 79 NOT USED

Parameters reserved for future use.

PARAMETER 81 MEASURE ACTIVATION TIME ON MONDAY

PARAMETER 82 MEASURE DEACTIVATION TIME ON MONDAY

PARAMETERS 83...94 AS P81 & P82 FOR THE SIX REMAINING DAYS OF THE WEEK

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

During the deactivation period, the display boxes configured for the visualization of error messages (see parameters P104...P107), will show the TIME message. This function is disabled by entering activation time 00.00 and deactivation time 23.59. Typically, the activation time is before the switching-off (for example, activation at 07.00 and switching-off at 22.00), but you can also enter an activation time greater than the switching-off time, for example for swimming pools open till late night (for example, switching-off at 02.00 and reactivation at 08:00).

PARAMETER 95 NOT USED

PARAMETER 96 NOT USED

Parameters reserved for future use.

PARAMETER 97 ALARM ZERO CHLORINE

PARAMETER 98 ALARM REDOX

If the chlorine measurement cell is not properly maintained and cleaned, a deterioration of the measurement system may occur (for example oxidation of the copper electrode for the CLE12 cell, electrolyte contamination or membrane damages for the potentiostatic cells), with consequent low signal, almost insensitive to chlorine variations.

These parameters allow to trigger an alarm when the chlorine signal becomes too low.

- Alarm zero chlorine: Knowing that the chlorine level in the plant (or pool) can never be lower than a certain value (for example 0.10 ppm of the replenishing water), if measurement is lower than this threshold (P73), the alarm is triggered.
- Alarm redox: Due to manual super chlorination or to dosage system faults, the redox electrode may be not able to give a mV signal easily convertible into a ppm value. At normal chlorine concentration (0.80 to 1.20 ppm Cl2), the electrode provides a signal of approximately 650-700 mV, that varies depending on the chemical conditions of the pool water; when saturated (chlorine level above 2.50-3.00 ppm), the electrode gives 720 ... 740 mV or more. This characteristic can be used to disable the chlorine dosing system operation when redox readings are too high. When the alarm condition is resolved, the redox electrode returns to normal values and the controller resumes normal operation.

Warning! The return of the redox electrode from saturation condition occurs with a delay of even 2 hours. The parameter P98 allows to set the redox alarm threshold (mV). The value must be determined empirically for each plant / pool.

Setting P97 and P98 to zero means not activating these controls.

These alarms may disable the outputs by counting the weight 128 when setting the corresponding “OFF Status” parameters (P08, P16, P32, P40, P44, P50). The alarm messages are shown in the display boxes configured for the visualization of error messages (see parameters P104…P107), with the messages “0 Cl2” and “REDOX”, respectively.

PARAMETER 99 NOT USED

PARAMETER 100 NOT USED

PARAMETER 101 NOT USED

Parameters reserved for future use.

PARAMETER 102 WORKING TEMPERATURE

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

PARAMETER 103 SUPER CHLORINATION TIME

This parameter is specific for pool applications. During super chlorination, the measurement sensors should not be touched by the water, to avoid unnecessary shock or oxidation. Since the super chlorination is a manual operation, before starting it, it is recommended to close the valves for water access to the system, and reopen them only when a normal chlorine level has been restored.

Sometimes the super chlorination can be performed in a semi-manual way, without closing the water inflow to the sensors and activating the specific control function in the LINEGUARD unit.

Enter in parameter P103 a time (super chlorination time, in hours : minutes) during which the control unit does not activate any output. Once this time has elapsed, the unit resumes to normal operation. Minimum time = 0 (function disabled), maximum time = 24 hours.

To trigger this function, go to the main menu. During super chlorination, the display shows the countdown of the remaining time (hh:mm:ss). The displayed time can be increased or decreased by acting on the arrow keys: each press results in a change of one minute.

In general, this parameter allows to set a time during which the outputs are disabled and, therefore, it can be also used for cleaning or maintenance operations, temporary closure of the plant, etc.

PARAMETER 104 BOX 1 DISPLAY

PARAMETER 105 BOX 2 DISPLAY

PARAMETER 106 BOX 3 DISPLAY

PARAMETER 107 BOX 4 DISPLAY

The 16*2 display of the LINEGUARD unit is “divided” into four boxes of eight characters each, which normally show measurement values. Depending on the controller configuration, measures may be from two up to six. To choose what to display and in which order, each box is associated to a number between 1 and 6, depending on the desired measurement. By entering the number of the measure to display +10, if any fault / alarm occurs, the box will show the measure alternating with a short error message. Finally, by entering values other than the measure number, dashes or empty fields are displayed.

 The short error/alarm messages are displayed always in English.

PARAMETER 108 DISPLAY BACKLIGHT

To save power and extend the display life, the backlight can be set to turn off when no key is pressed. If this parameter is set to 1, the backlight is always on; values between 2 and 30 (minutes) indicate the lighting up time after the last key press.

The “zero” value is reserved for special versions, provided with a POWER LED for indicating normal operating mode (slow flashing) or alarm / error condition (fast flashing).

PARAMETER 109 PASSWORD FOR STANDARD CONFIGURATION

This parameter allows to lock the standard configuration menu. Set a value other than zero to prevent that unauthorized personnel can access the configuration mode. In this case, when you try to access the standard configuration, the unit will request this password. Only by entering the value set in this parameter, you can program the controller. When delivered, no password is set.

Warning! If you forget the set password, the configuration menu cannot be accessed and you must send the instrument to the factory for unlocking.

PARAMETER 110 PASSWORD FOR ADVANCED CONFIGURATION

Same meaning and use of parameter 109, but referred to the advanced configuration.

PARAMETER 111 DEACTIVATION OF ELECTROCHEMICAL CALIBRATIONS

This parameter allows to inhibit all electrochemical calibrations of the unit, to prevent that unqualified personnel performs undesired calibrations. So when an authorized technician wants to perform a calibration, he should first access the advanced configuration menu and set this parameter to zero (once completed the calibration, set back this parameter to 1).

If the advanced configuration is password protected (P110), only personnel qualified for the advanced configuration can unlock the electrochemical calibrations.

PARAMETER 112 LANGUAGE

The LINEGUARD interface currently “speaks” 5 languages:

0 = Italian, 1 = English, 2 = French, 3 = Spanish, 4 = Dutch.

PARAMETER 113 SERIAL ADDRESS

The serial output can be RS232 (standard) or RS485 (upon request). Enter 0 or 10 in case of RS232 port, or a value between 1 and 9 or from 11 to 19 for defining the serial address in case of RS485 port (up to nine devices in the same network). A value smaller than 10 sets the output communication rate to 9600BPS, while a value between 10 and 19 doubles the rate to 19200BPS. The communication rate must be chosen in function of the distance between the controller (or various controllers) and the supervisor.

Set this parameter to 20 if the unit has to communicate with a µMMC4 recorder.

PARAMETER 114 DATA LOGGER

The LINEGUARD unit is equipped with an auxiliary internal memory, separate from the one used for saving calibration and configuration data, only to store the measurement values.

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

This parameter allows to set the recording sequence, with 0 = no recording, and values from 1 to 8 indicating the recording time (in minutes) according to the below table:

1 = one record every minute, duration of about three days

2 = one record every 2 minutes, duration of about six days

3 = one record every 5 minutes, duration of about 14 days

4 = one record every 10 minutes, duration of about 28 days

5 = one record every 15 minutes, duration of about 42 days

6 = one record every 20 minutes, duration of about 56 days

7 = one record every 30 minutes, duration of about 85 days

8 = one record every hour, duration of about six months

A second part of the memory is reserved for storing the events, complete with date and time. Also in this case the maximum number of records is 4080. The short commands for event identification are always in English. The commands to view the content of this part of memory are: 514 = last event, 515 = all events, 516 = last 50 events.

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

PARAMETER 115 AUTOSET

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

The “autoset” function also resets all the offset and gain values of the measurements.

Warning! If particular functions have been activated on your device, restoring the factory configuration will make you lose those settings. In particular, the values entered in the parameters P108 (Display backlight), P112 (Language) and P113 (Serial address) will be reset.

14. CONTROL EXAMPLES

Here are some examples for configuring the control parameters:

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

   1a. Simple ON/OFF control on K1:

   MEASURE LINKED = 1 (pH) (P01 = 1)

   RELAY TYPE = 1 (ON/OFF acidification) (P02 = 0)

   THRESHOLD = 7.30 (P03 = 7.30)

   It is recommended to set a narrow hysteresis window:

   HYSTERESIS = 0.20 (P04 = 0.20)

   No delay is requested. Set:

   ACTIVATION DELAY = 0 (P05 = 0:00)

   DEACTIVATION DELAY = 0 (P06 = 0:00)

   1b. PWM proportional control on K1:

   MEASURE LINKED = 1 (pH) (P01 = 1)

   RELAY TYPE = 3 (PWM acidification) (P02 = 3)

   THRESHOLD = 7.30 (P03 = 7.30)

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

   HYSTERESIS = 0.50 (P04 = 0.50)

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

   TIME BASE = 3 min. (P05 = 3:00)

   Parameter not used (P06 = 0:00)

   The following parameters must also be set:

   P07 = Alarm max dosage time for K1 → depends on the chemical / hydraulic reaction time; typically, within one hour from the dosage start, the threshold must be reached → P07 = 1:00.
   P08 = OFF K1 → K1 can be disabled upon measurement error, alarm max dosage time and internal clock: enter the sum of the weights → P08 = 8 + 16 + 64 = 88

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

   2a. Simple ON/OFF control on K2:

   MEASURE LINKED = 4 (ppm Cl_2) (P09 = 4)

   RELAY TYPE = 2 (ON/OFF chlorination) (P10 = 2)

THRESHOLD = 0.80 (P11 = 0.80)

HYSTERESIS = 0.15 (P12 = 0.15)

ACTIVATION DELAY = 0 (P13 = 0:00)

DEACTIVATION DELAY = 0 (P14 = 0:00)

2b. PWM proportional control on K2:

MEASURE LINKED = 4 (ppm Cl_2) (P09 = 4)

RELAY TYPE = 4 (PWM chlorination) (P10 = 4)

THRESHOLD = 0.80 (P11 = 0.80)

HYSTERESIS = 0.40 (P12 = 0.40)

TIME BASE = 3 min. (P13 = 3:00)

Parameter not used (P14 = 0:00)

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

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

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

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

3a. Simple ON/OFF control on K4:

MEASURE LINKED = 5 (temp.) (P25 = 5)

RELAY TYPE = 2 (open upon threshold exceeded) (P26 = 2)

THRESHOLD = 28.0 (P27 = 28.0)

HYSTERESIS = 0.4 (P28 = 0.4)

ACTIVATION DELAY = 0 (P29 = 0:00)

DEACTIVATION DELAY = 0 (P30 = 0:00)

Other parameters to be set for K4:

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

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

4. Trigger an alarm on K5 upon turbidity measurement (input 3) higher than 12 NTU.

A simple ON/OFF control could be used, with the relay closing when measure exceeds the 12 NTU threshold, but it is advisable to set the relay as "alarm NO", for also checking a wrong negative indication of measurement. Adding delays will prevent that any peaks due to noise can trigger unnecessarily the relay:

MEASURE LINKED = 3 (turbidity) (P33 = 3)

RELAY TYPE = 5 (alarm NO) (P34 = 5)

THRESHOLD = 6.0 (P35 = 28.0)

HYSTERESIS = 6.0 (P36 = 0.4)

ACTIVATION DELAY = 30 sec. (P37 = 0:30)

DEACTIVATION DELAY = 30 sec. (P38 = 0:30)

Other parameters to be set for K5:

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

P40 = OFF K5 → K5 can be disabled only upon measurement error and internal clock: enter the sum of the weights → P40 = 8 + 64 = 72

15. ADDITIONAL VISUALIZATIONS

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

pH	(mV value without temperature compensation)	
	G (gain factor)	= 0.750 ... 1.500
	O (offset a 25°C)	= -0.90 ... 0.90
Redox	(mV value with no offset added)	
	G (gain factor)	= 1.000 (fixed)
	O = offset in mV	= -100 ... 100
Residual Chlorine with CLE12 cell		
	Range 1.00 ppm	(input value referred to 10.00 points FS)
	Range 5.00 ppm	(input value referred to 50.00 points FS)
	G (gain factor)	= 0.050 ... 1.500
	O (offset in input points)	= -0.40 ... 0.40
Residual Chlorine with potentiostatic cell, CP series		
	Range 1.000 ppm	(input value with no offset/gain added)
	Range 5.00 ppm	(input value with no offset/gain added)
	Range 7.00 ppm	(input value with no offset/gain added)
	Range 10.00 ppm	(input value with no offset/gain added)
	G (gain factor)	= 0.500 ... 3.000
	O (offset in input points)	= -0.20 ... 0.20
Temperature	(value without offset/gain)	
	G (gain factor)	= 0.940 ... 1.060
	O (offset in °C)	= -2.0 ... 2.0
Conductivity	(value without offset/gain)	
	G (gain factor)	= 0.750 ... 1.500
	O (offset in points)	= -100 ... 100
Turbidity	Range 100.0 NTU	(input value from CTS07 without offset/gain)
	Range 500 FTU	(input value from CTS07 without offset/gain)
	G (gain factor)	= 0.500 ... 2.000
	O (offset in points)	= -100 ... 100
mA Input	Input value without offset/gain	
	G (gain factor)	= 0.250 ... 4.000
	O (offset)	= -200 ... 200 points

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

The only exception is the gain value for chlorine measurements with CLE12 cell. In fact in this case the gain strongly depends on the water chemical conditions and chlorine type. The average value is 0.100, but it is not possible to establish a typical value.

16. ERRORS

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

ERR11 Calculation mA1 output

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

ERR12 Calculation mA2 output

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

ERR13 Calculation PWM relay K1

The relay K1 has been configured for proportional control (P02 = 3 or 4), but the hysteresis window (proportional band) is too narrow. Check the setting of P04.

ERR14 Calculation PWM relay K2

As error 13, but referred to K2. Check the setting of P12.

ERR15 Calculation PWM relay K4

As error 13, but referred to K4. Check the setting of P28.

ERR16 Calculation PWM relay K5

As error 13, but referred to K5. Check the setting of P36.

17. ADDITIONAL ALARM MESSAGES

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

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

PW mm:ss	indicates the countdown of the start-up delay before starting normal operation
Off	indicates the request of disabling outputs from the OFF contact
Time	indicates the request of disabling outputs from internal clock
0 Cl_2	indicates “alarm zero chlorine”
Redox	indicates “alarm redox”
Max TK1	indicates “alarm max dosage time K1”
Max TK2	indicates “alarm max dosage time K2”
Max TK4	indicates “alarm max dosage time K4”
Max TK5	indicates “alarm max dosage time K5”
Lev 1	indicates the lack of reagent 1
Lev 2	indicates the lack of reagent 2
Lev3	indicates the lack of reagent 3
Lev4	indicates the lack of reagent 4

18. SERIAL LINE

The LINEGUARD features a serial line (RS232C or RS485) for communication with terminals, PC or advanced PLC. All references to the external device connected to the LINEGUARD are named <<VIDEO>>, considering a hypothetical link between the LINEGUARD and PC, on which runs a “HYPERTERMINAL” program or equivalent. In other words, what appears on the screen is exactly the response of the LINEGUARD.

Currently, no communication protocol is managed between the controller and any external device (the communication is performed through standard ASCII codes without control characters). Possible protocols are manageable upon specific request of the customer. Transmission parameters are:

9600 BAUDS, 8 BITS, NO PARITY, 1 STOP BIT (with P89 < 10)

19200 BAUDS, 8 BITS, NO PARITY, 1 STOP BIT (with P89 ≥ 10)

Different characteristics can be requested upon order.

Messages sent over the serial line have been designed to be as simple and intuitive as possible.

For details about the connection of the serial line terminal block, see the “Electrical Connection” section.

The LINEGUARD automatically sends to the <<VIDEO>> the following messages:

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

The LINEGUARD answers to the following commands:

Command	Effect	Command	Effect
M1	Show measure 1 value	RR	Microprocessor reset (reboot)
M2	Show measure 2 value	TT	Show date/time
M3	Show measure 3 value	Pxxx	Read PARAMETER xxx value
M4	Show measure 4 value	Pxxx = YYYY	Write the value YYYY in PARAMETER xxx
M5	Show measure 5 value	511	Last record of the data logger
M6	Show measure 6 value	512	Send data stored by the data logger
HH	Help	513	Send last 50 data stored by the data logger
UU	Values of mA1 and mA2 outputs	514	Last event recorded in the data logger
SS	Status of: inputs, outputs, alarms	515	Send events stored by the data logger
ZZ	Reset offset/gain values	516	Send last 50 events stored by the data logger

- In case of RS485 serial line, these commands (and their answers) are preceded by the unit address, set in parameter P89, which is a lowercase letter starting from “a” (i.e. from “a” to “i” for address from 1 to 9).
- There are also other adjustment / calibration commands used only at the factory.
- Each command must be confirmed by pressing <CR> (or <ENTER>).
- All serial line messages are fixed and are not affected by the language set for the display.
- Typing mistakes in a command cannot be corrected. Send the wrong command (which will have no effect) and then enter the correct one.

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

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

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

Event	Description	Event	Description
Power On	Device switching on	Offs Mx	Offset calibration of measure “x”
Std Editor	Standard parameter editor	Gain Mx	Gain calibration of measure “x”
Adv Editor	Advanced parameter editor	Tar.Disab.	Unauthorized calibration attempted
Test Out	Manual test of outputs	Err.Tar.Mx	Calibration error of measure “x”
Set Time	Clock adjustment	End Tar.	Successful calibration
Serial Edit	Parameter editing from serial line	Err. yy	Error “yy” (see “Errors” section for details)
TMx=yy	Factory calibrations / settings	MaxTKx=s	Error max dosage time for relay “x”
UMx=yy		TimeOff=s	Device OFF requested from internal clock
VMx=yy		ZeroCl=s	Alarm zero chlorine
IMx=yyyy		All RX=s	Alarm Redox
FMx=yyyy		SuperCl=s	Super-chlorination start
ISx=yyyy		Liv x = s	Change of status (s) for level “x” input
FSx=yyyy		Off = s	Change of status (s) for OFF input
		Imp = s	Change of status (s) for IMP input

19. ELECTROCHEMICAL CALIBRATIONS

pH-meter

Preparation:

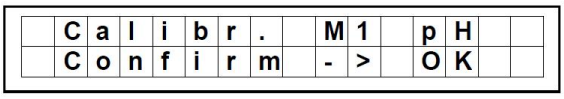
a. Check availability and expiration date of the calibration solutions, buffers at pH 7 and pH 4 (or 9)

b. Check the buffer solution temperature (if the temperature is significantly different from the working temperature, use the immerse the temperature compensation sensor into the buffer together with the electrode; wait about 3 minutes for thermal equilibrium)

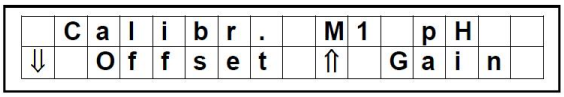
c. Simulate the OFF contact or close the water inlet valve to activate the “flow” alarm and, therefore, disable all outputs during calibration

Calibration procedure:

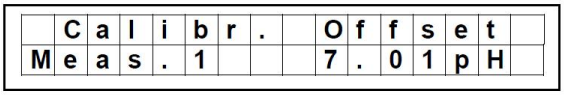
1. Remove the electrode from its support
2. Rinse the electrode with distilled water, then dry it
3. Immerse the electrode into the pH 7.01 buffer solution
4. Press the MENU/OK key
5. The instrument ask confirmation to enter the calibration mode



6. Press ESC to exit the calibration mode, or MENU/OK to confirm; if calibration option is confirmed, the display shows two choices:



7. Press ⇓ to calibrate the offset (pH 7.01)



8. The instrument automatically recognizes and displays the buffer value
9. If necessary, use the arrow (⇑ ⇓) keys to adjust the calibration value
10. Press MENU/OK to confirm the calibration, or ESC to exit without saving (and the previous calibration data are kept)
11. Rinse the electrode with distilled water, then dry it
12. Immerse the electrode into the pH 4.01 (or 9.01) buffer solution
13. Repeat steps from 4 to 8, pressing the ⇑ key at step 7 to select the gain calibration
14. Install back the pH electrode and Pt100 probe (if used) for normal control operations

15. Open water flow to the system

16. Remove the OFF contact to resume to normal operations

If you try to calibrate the gain at pH lower than 4 or higher than 9, the unit will provide the input value as calibration point (no automatic recognition).

If the input value is not compatible with the calibration (too far from the correct values), for both the offset and gain, the instrument automatically discards the calibration and generate an error. The display shows the message “Impossible!”

Possible causes:

a. wrong sequence of keystrokes during the procedure

b. the buffer solution is contaminated or expired

c. the electrode is not working properly (damaged or exhausted)

d. the connection cable is damaged

Redox-meter

Preparation:

a. Check availability and expiration date of the calibration solution (e.g. 220 mV)

b. Simulate the OFF contact or close the water inlet valve to activate the “flow” alarm and, therefore, disable all outputs during calibration

Calibration procedure:

1. Remove the electrode from its support

2. Rinse the electrode with distilled water, then dry it

3. Immerse the electrode into the calibration solution (e.g. 220 mV)

4. Press the MENU/OK key

5. Press ⇑ until the display shows the message “CALIBRATION M2 mV”

6. Press ⇓ to perform the offset calibration

7. The instrument automatically recognizes and displays the solution value
(Note: The LINEGUARD automatically recognizes the standard solutions at 220mV, 468mV and 650mV)

8. If necessary, use the arrow (⇑ ⇓) keys to adjust the calibration value

9. Press MENU/OK 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. Carefully install back the electrode for normal control operations
12. Open water flow to the system
13. Remove the OFF contact to resume to normal operations

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

If you try to perform a Redox calibration with an offset value other than those recognized automatically by the instrument, the display shows the input value as calibration point (no automatic recognition).

If the “Impossible!” error message is displayed, the possible causes are:

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

Residual Chlorine Meter (with input for CLE12 amperometric or CP potentiostatic cell)

Please note that the LINEGUARD unit is equipped with an automatic polarization system of the zero, which ensures a very low error in case of chlorine-free water. It is therefore recommended to not perform the zero calibration.

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 (even during cell polarization time)
d. The chlorine level is high enough (> 20% FS)
e. A portable photometer is available for chlorine analysis

Proceed as follows:

1. Simulate the OFF contact for disabling all outputs during calibration
2. Take a water sample from the sampling valve on the probe-holder and analyse it with the portable photometer
3. Press the MENU/OK key
4. Press ⇑ until the display shows the message “CALIBRATION M3 CL_2” or “CALIBRATION M4 CL_2”

5. Press ⇑ to perform the gain calibration
6. Use the arrow (⇑ ⇓) keys to adjust the displayed value to the one measured with the portable photometer
7. Press MENU/OK to confirm the calibration, or ESC to exit without saving (and the previous calibration data are kept)
8. Remove the OFF contact to resume to 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 “Impossible!”. Check:

a. that all the required initial conditions are satisfied
b. cleanliness of the CLE12 cell (if cleaning is required, then make the cell work for about 8 hours before proceeding with a new calibration)
c. status of electrolyte and membrane of the CP cell (if necessary, substitute them)

Carefully read the instruction manuals of the cells for more details about cleaning and maintenance operations.

Conductivity meter and standardized input (e.g. turbidity meter, dissolved oxygen meter, etc.)

The calibration procedure is similar to the ones described above.

Offset calibration:

1. Set the input signal as close as possible to the minimum (zero); in the case of conductivity measurement, keep the cell in air
2. Press the MENU/OK key
3. Press ⇑ until the display shows the calibration of the desired measurement
4. Press ⇓ to perform the offset calibration
5. The display will show the read value
6. Use the arrow (⇑ ⇓) keys to adjust the displayed value to the correct one (for example zero for the calibration of the conductivity range)
7. Press MENU/OK to confirm the calibration

Gain calibration:

1. Set the input signal as close as possible to full scale value or anyway at a value greater than the 70% of the range
2. Press the MENU/OK key
3. Press ⇑ until the display shows the calibration of the desired measurement
4. Press ⇑ to perform the gain calibration
5. The display will show the read value
6. Use the arrow (⇑ ⇓) keys to adjust the displayed value to the correct one
7. Press MENU/OK to confirm the calibration

Thermometer

The instrument electronic calibration and the precision class of the Pt100 sensor, ensure a maximum error of ±0.3°C @0°C and ±0.8°C @100°C (Pt100: class B accordingly with IEC 7 51). This error is acceptable for most applications, and no temperature calibration is required.

However, if a calibration adjustment is needed, proceed as follows:

1. Carefully remove the Pt100 probe from its installation
2. Immerse the Pt100 probe into a vessel containing a mixture of water and ice (0 °C)
3. Press the MENU/OK key
4. Press ⇑ until the display shows the message “CALIBRATION M5 °C”
5. Press ⇓ to perform the offset calibration
6. The instrument does not recognize the temperature, but shows the read value
7. Use the arrow (⇑ ⇓) keys to adjust the displayed value to the desired calibration point (e.g. 0.0 °C)
8. Press MENU/OK to confirm
9. Immerse the Pt100 probe into a vessel containing hot water (100 °C) or another liquid at known temperature (greater than 70°C)
10. Press the MENU/OK key
11. Press ⇑ until the display shows the message “CALIBRATION M5 °C”
12. Press ⇑ to perform the gain calibration
13. The instrument does not recognize the temperature, but shows the read value

14. Use the arrow (⇑ ⇓) keys to adjust the displayed value to the desired calibration point (e.g. 100.0°C)

15. Press MENU/OK to confirm the calibration, or ESC to exit without saving (and the previous calibration data are kept)

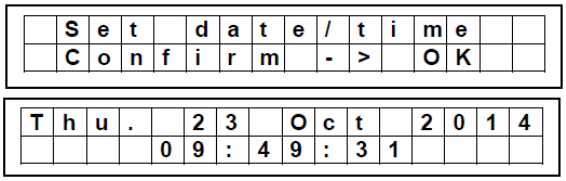
16. Install back the temperature sensor for normal control and temperature compensation operations

17. Open water flow to the system

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

20. SET DATE / TIME

Press the MENU/OK key and use the ⇓ ⇑ keys to access the set date/time procedure.



Press MENU/OK to confirm.

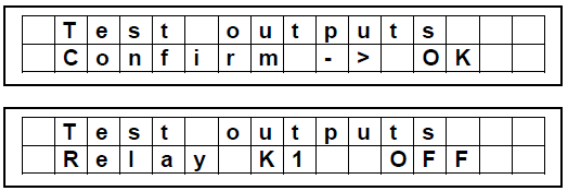
The display shows date and time, with the cursor under the name of the day

Use the ⇓ ⇑ keys to set the day and then press MENU/OK to confirm, or ESC to exit without saving.

After confirming the setting, the cursor moves to the next field. Proceed to the adjustment of all available fields.

21. MANUAL OPERATIONS

The controller allows to perform some manual testing operations.



To enter this mode, press MENU/OK once and then press the ⇓ ⇑ keys until the “Test outputs” message is displayed. Press MENU/OK to access the mode.

The unit displays the first available test, referred to the K1.

Use the ⇓ ⇑ keys to scroll the tests of the remaining relays.

Press MENU/OK to confirm the desired option.

Please note that:

- K1, K2, K4, K5 are the four control relays; the manual activation of these relays can be useful to check the devices connected to them (for example, the manual start of a dosing pump for priming or maintenance/cleaning operations).
- K3 is the alarm relay.
- K6, K7, K8, K9 are the four additional relays; the manual activation of these relays can be useful to check the devices connected to them

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

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