STEIEL
ELETTRONICA SRL

Programmer
for reverse osmosis plants

PRG11

TECHNICAL MANUAL

CE

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Certified Company, according to UNI EN ISO 9001 standards

WARNINGS

The PRG11 device has been designed and tested in accordance with IEC publication No. 348 and EN 61010-1, and has been supplied in good condition. This instruction manual provides the information and warnings which must be followed by the user to ensure safe operation of the equipment and to keep it that way over the time. The device has been designed for indoor installation, but it may occasionally be subjected to temperatures between +5 and -10°C without that security is reduced. In accordance with IEC standard EN 61010-1, the PRG11 can be installed in areas with a pollution degree 2.
The power transformer complies with standards EEC 73/23 (4KV insulation between primary and secondary) and IEC 14.6, according to which it is defined as “Class II transformer”.
The PRG11 and this manual are therefore in accordance with IEC 66/1, 2, 3, EN 61010-1 and the harmonized standards EN 50081-1, EN 61000-3-2, EN 61000-3-3, EN 50082-1.

Every action of handling, maintenance, repair of the installations must be performed by trained personnel.

When replacing fuses, check and remove the causes of their burnout. Make sure that the fuses used for replacement are the same type and size of the originals. Do not use different fuses. Do not short-circuit the fuse holder !

The installation room which hosts the equipment, additional materials and consumer products must conform to safety, use and storage requirements stated by the regulations.

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

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

Dispose of waste material and consumables accordingly with local regulations.

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

Warranty

All STEIEL products are warranted for a period of 12 months from the delivery date.
Warranty is not valid if all instructions of installation, maintenance and use, are not strictly followed by the user. Local regulations and applicable standards have also to be followed.

TABLE OF CONTENTS

PACKING LIST

1. The PRG11 programmer
2. This technical manual
3. PG7/9 cable glands (8 pieces)

INSTALLATION OF THE PROGRAMMER

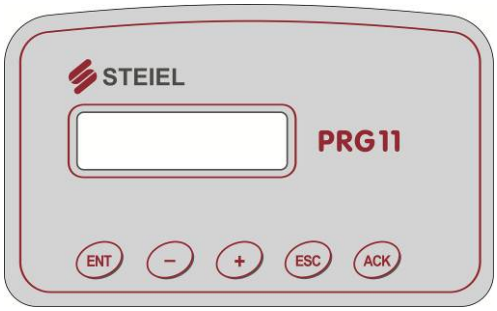
The PRG11 programmer can be mounted on the frame of the osmosis equipment, or wall installed. It is recommended to choose a dry and ventilated location, avoiding confined spaces that restrict programming, testing and maintenance operations.

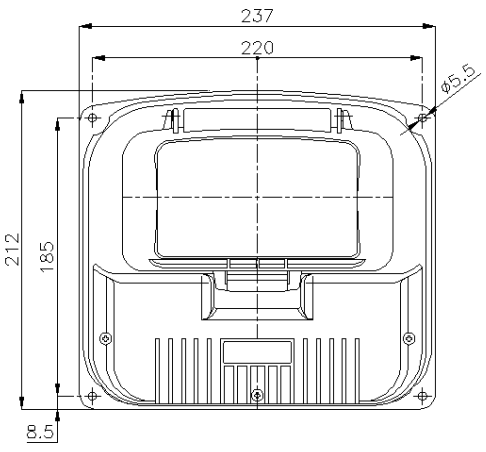
TECHNICAL DATA

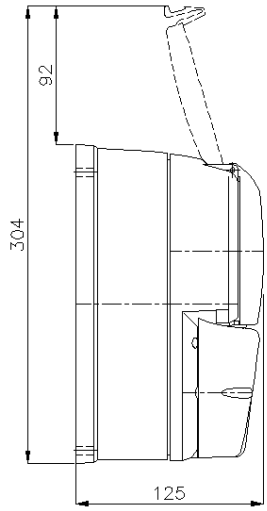
Power supply	230V~ single-phase ±10% 50Hz (other voltages upon request)
Power consumption	30VA max (PRG11 only)
Display	2-row (x 16 characters), alphanumeric LCD with backlight
Protections	3 fuses 5x20 (values referred to 230V~ standard power supply): F1 0.5 A (electronics); F2 4 A (230V~ outputs); F3 2 A (24V~ outputs)
Electrical connections	on removable terminal blocks; cable outlet from electronic unit through supplied PG7/9 cable glands (wiring made by the user)
Materials	shockproof ABS case ; polyester front panel
Protection rate	IP65
Environment	Working temperature: 0 to 50°C Storage temperature: -10 to 60°C RH: max 90% noncondensing
Instrument type	class II
RTC (Real Time Clock)	internal clock powered by CR2032 battery (in the absence of main power), autonomy of at least 2 years in total absence of power supply; Clock precision: ±2 seconds/day Precision of internal timing: ±1 second
Pump output	direct command with the same power of the instrument; max 750VA (1HP)
Dosing pump output	direct command with the same power of the instrument; max 60VA
Output for solenoid valves	direct command with the same power of the instrument; max 40VA each (in case of 24V~ outputs : max 10VA each – specify when ordering)
Alarm output	voltage free contact, max 250V~ and 3A (resistive)
Digital inputs	accept voltage free contact, 18V @ 10mA; 3-wire sensors (magnetic or capacitive), using the power of PRG11 (18V), see “Electrical connections” section
Conductivity inputs	2 inputs from 2-electrode cell, also including NTC sensor and shielded cable ; K=1cm or K=5cm (to be specified upon order) ; available ranges (to be specified upon order): 2.000, 20.00, 200.0, 2000 µS/cm 2.000, 20.00, 200.0, 2000 mS/cm input precision: ±4 points (excluding cell) input repeatability: ±2 points (excluding cell)

Note: *if there are no specific requests by the customer, the inputs are configured by default as follows : K=5cm ; COND1(outlet)=200µS/cm ; COND2(inlet)=2000µS/cm*

Dimensions / Weight	237 x 212 x 125 mm (see figure) / approx. 1 kg

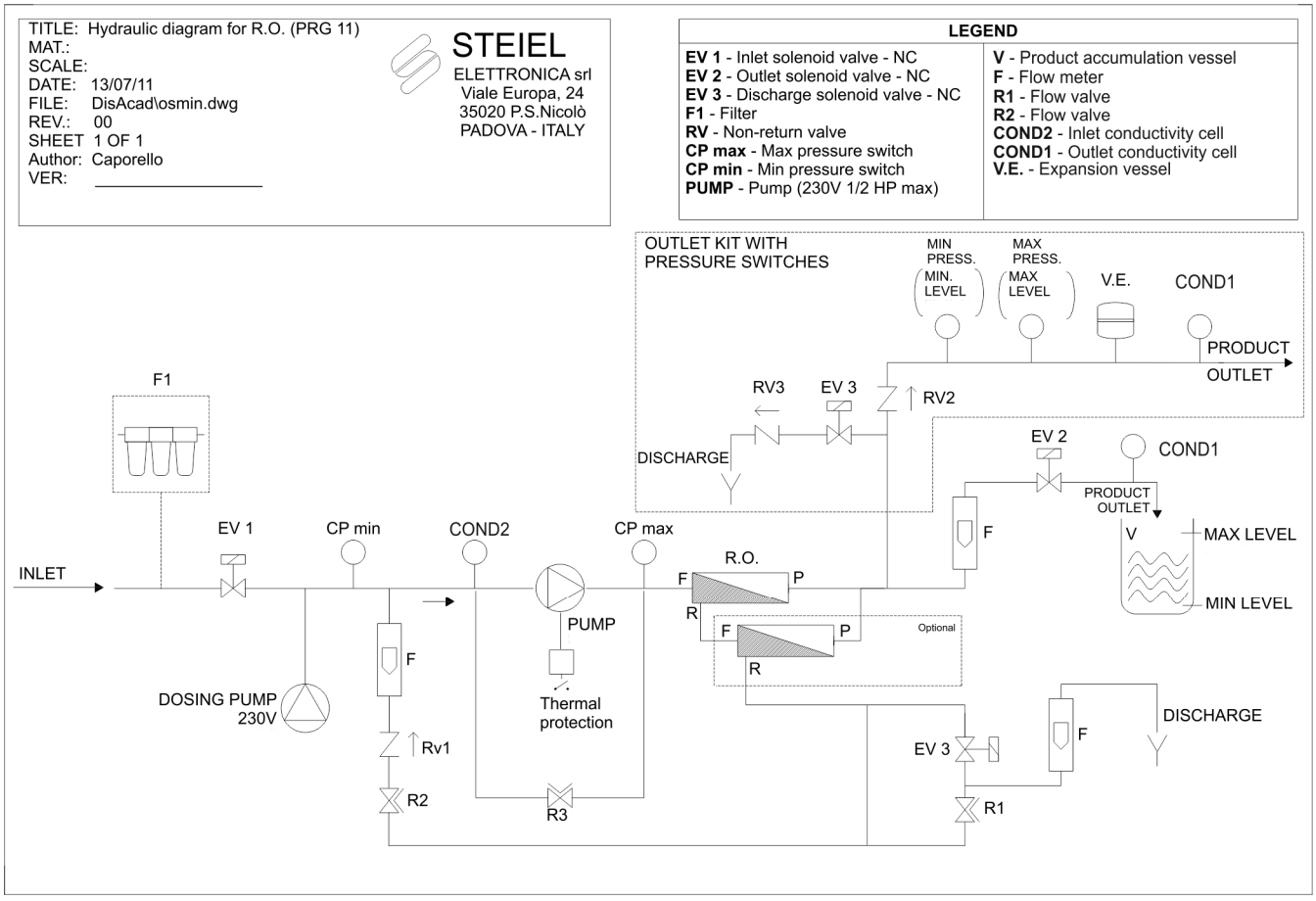






TYPICAL INSTALLATION DIAGRAM

The PRG11 programmer is an electronic unit specifically designed for the control of reverse osmosis plants. The reference hydraulic system is shown in the diagram below.



A typical installation includes the following components:

1. Solenoid valve for water inlet, NC (EV1)
2. Dosing pump for preventive disinfection of the feed water, to preserve the osmotic membrane in the case of water with high concentration of organic pollutants
3. Pressure switch for control of the minimum pressure of the feed water (CP min)
4. Conductivity cell for the analysis of feed water (COND2)
5. Water pump
6. Pressure switch for control of the maximum pressure of the plant (CP max)
7. Osmotic module
8. Solenoid valve for product outlet, NC (EV2)
9. Conductivity cell for the analysis of the product (COND1)
10. Product accumulation vessel with minimum and maximum level control (or outlet kit with pressure switches, with control of the min and max pressures)
11. Discharge solenoid valve, NC (EV3)

OPERATION OUTLINE

Start-up
At start-up the PRG11 displays an initialization message, then performs a cleaning action (if programmed – see parameter P04). Finally, starts the sequence of purified water production.

Production
The controller starts the reverse osmosis system when the product level inside the accumulation vessel drops below the minimum (LEV min). This is the operation sequence:
1. EV1 and EV2 solenoid valves are energized
2. Pause of 3 seconds (fixed)
3. Water pump and dosing pump are powered
4. When the max level is reached in the product accumulation vessel (LEV max), the dosing pump switches off
5. Stand-by of 3 seconds (fixed)
6. Turning off of the water pump
7. Stand-by of 3 seconds (fixed)
8. EV1 and EV2 solenoid valves are de-energized
9. Cleaning action (if programmed)
10. When the minimum level is reached in the product accumulation vessel (LEV min), the la sequence re-starts from step 1

Cleaning
The filter cleaning is performed in the following conditions, only if programmed: at controller start-up, at the end of production (LEV max reached) or at scheduled times (max twice a day).

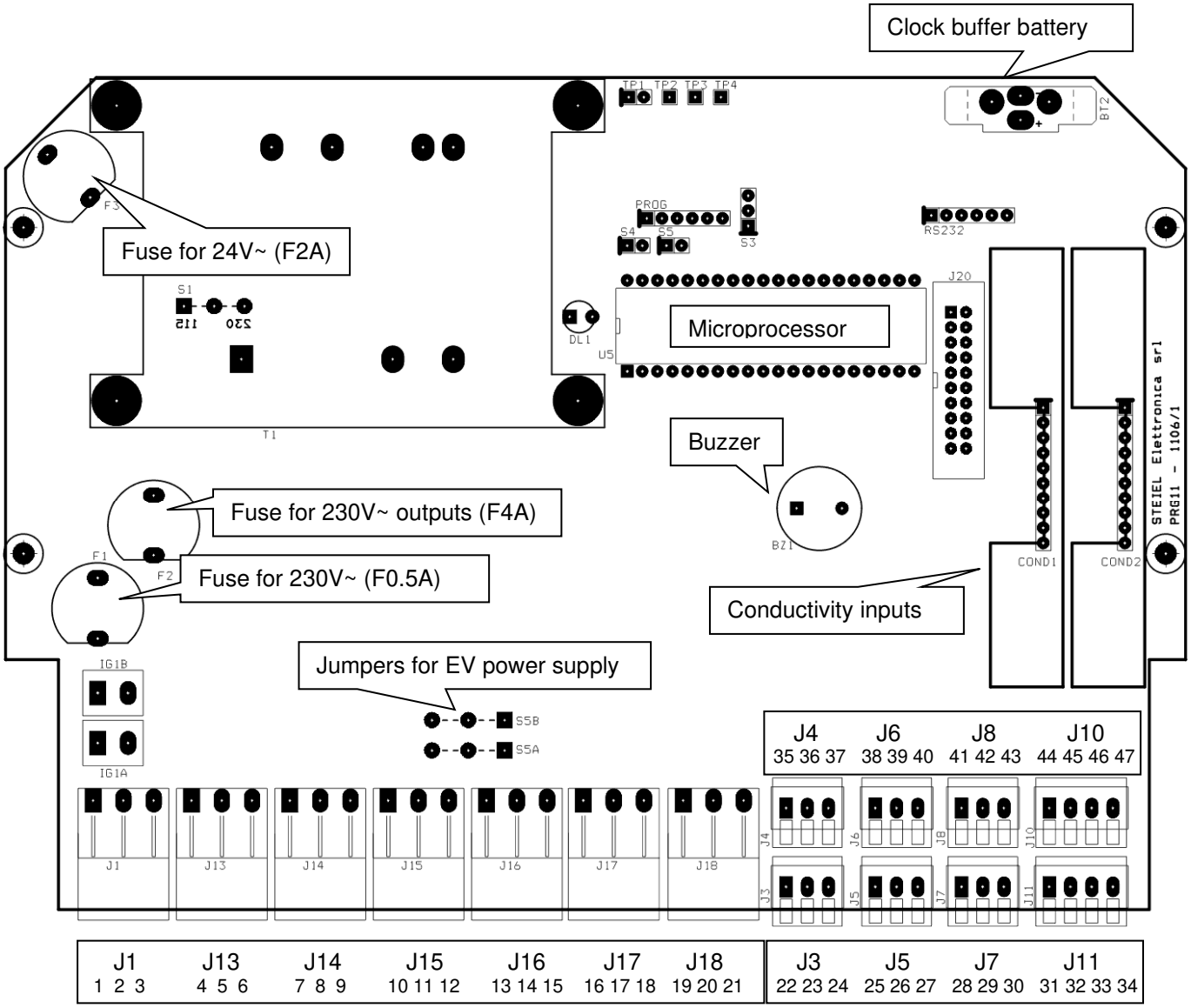
The cleaning involves the following steps:
1. EV1 (if P16=0) and EV3 solenoid valves are energized
2. Pause of 3 seconds (fixed)
3. Water pump is powered
4. Washing with a scheduled duration
5. Turning off of the pump
6. Pause of 3 seconds (fixed)
7. EV1 and EV3 solenoid valves are de-energized

The filter cleaning can also be forced manually: press the ESC key until the display shows “MANUAL CLEANING”, then press ENT to confirm. Before starting the cleaning sequence, the programmer will ask to double confirm: press ENT to proceed with cleaning or ESC to quit the action.

Visualizations
While in normal operation mode, the display shows the current status of the PRG11 programmer.
The top row displays the following sequence: status of the device (standby, production or cleaning), the two conductivity values (COND2 = feed water, COND1 = product water) and the percentage of filter remaining life (if parameter P14 ≠ 0). If measurement exceeds the full scale value, the OR (Over Range) indication is displayed.
The bottom row displays the current time.
If an alarm occurs, the time is substituted by the alarm message and date/time of the alarm activation. If more than one alarm is active, the related messages are displayed in sequence.
During normal operation, if the device is in production or cleaning mode, pressing the [+] or [-] key will display on the bottom row the action in progress and the remaining time to complete it.

ELECTRICAL CONNECTIONS

Check that the device is not powered and open the terminal block cover to perform the electrical connections. Also refer to the diagram below.
Once wiring is completed, tighten the cable glands and close the cover.



Warning! Before performing any action, ensure that the device is not powered!

J1	pins 1, 2, 3	input for **power supply** *(1=phase, 2=neutral, 3=earth)*
J13	pins 4, 5, 6	power output for **water pump** *(4=phase, 5=neutral, 6=earth; at 230V~)*
J14	pins 7, 8, 9	power output for **dosing pump** *(7=phase, 8=neutral, 9=earth; at 230V~)*
J15	pins 10, 11, 12	power output for **EV1** *(10=neutral, 11=phase, 12=earth; 230V~ or 24V~)*
J16	pins 13, 14, 15	power output for **EV2** *(13=neutral, 14=phase, 15=earth; 230V~ or 24V~)*
J17	pins 16, 17, 18	power output for **EV3** *(16=neutral, 17=phase, 18=earth; 230V~ or 24V~)*
J18	pins 19, 20, 21	**alarm** output *(19=NA, 20=NC, 21=common)*
J3	pins 22, 23, 24	input contact for **minimum level** sensor *(22=negative-common, 23=input, 24=positive of power supply). With voltage-free contact sensor, connect pins 23 and 24, and leave pin 22 not connected. With inductive or capacitive sensor (NPN) connect the three pins, accordingly with the sensor characteristics. In the presence of minimum level, the terminals 23 and 24 are shorted.*

J4	pins 35, 36, 37	input contact for **maximum level** sensor *(35=negative-common, 36=input, 37=positive of power supply).* *With voltage-free contact sensor, connect pins 36 and 37, and leave pin 35 not connected. With inductive or capacitive sensor (NPN) connect the three pins, accordingly with the sensor characteristics. In the presence of maximum level, the terminals 36 and 37 are shorted.*
J5	pins 25, 26, 27	input contact for **minimum pressure** switch *(25=negative-common, 26=input, 27=positive of power supply).* *With voltage-free contact sensor, connect pins 26 and 27, and leave pin 25 not connected. With inductive or capacitive sensor (NPN) connect the three pins, accordingly with the sensor characteristics. In the presence of minimum pressure (normal functioning), the terminals 26 and 27 are shorted.*
J6	pins 38, 39, 40	input contact for **maximum pressure** switch *(38=negative-common, 39=input, 40=positive of power supply).* *With voltage-free contact sensor, connect pins 39 and 40, and leave pin 38 not connected. With inductive or capacitive sensor (NPN) connect the three pins, accordingly with the sensor characteristics. In the presence of maximum pressure (alarm condition), pins 39 and 40 are shorted.*
J7	pins 28, 29, 30	input **RUN** for consent from electrical panel *(28=negative-common, 29=input, 30=positive of power supply).* *If the electrical cabinet giving this consent is equipped with voltage-free relay contact, connect pins 29 and 30, and leave pin 30 not connected. Otherwise, in case of logic outputs (PLC), use an NPN output while paying attention to the correct polarity. Functioning is enabled with terminals 29 and 30 shorted.*
J8	pins 41, 42, 43	input **FILT** *(41=negative-common, 42=input, 43=positive of power supply).* *The standard use is the connection of the NC contact of the pump breaker. If the input is not used, short-circuit pins 42 and 43.* *This input can also be configured for different functions: contact the manufacturer for developing specific configurations.*
J10	pins 44 … 47	input **COND1** for 2-electrode conductivity cell with built-in NTC sensor and shielded cable *(44=cell, 45=cell, 46=NTC, 47=NTC + cable shield).*
J11	pins 31 … 34	input **COND2** for 2-electrode conductivity cell with built-in NTC sensor and shielded cable *(31=cell, 32=cell, 33=NTC, 34=NTC + cable shield).*

Notes:

- Normally, in the three-wire sensors (both magnetic and capacitive), the blue wire is the negative, the black wire is the output and the brown wire is the power.
- For STEIEL conductivity cells the pair of wires brown / blue or brown / green is related to the electrodes, while the pair of wires yellow / white or yellow / black is related to the NTC sensor. The cable shield (if present) is a bare copper conductor.
- If the system has only one level control, short together the two inputs.
- If the system does not include the minimum pressure switch, short-circuit the pins 26 and 27.
- If the system does not include the maximum pressure switch, leave the input open.
- If the system does not provide the consent “RUN”, short-circuit the terminals 29 and 30.

DATE/TIME ADJUSTMENT

The PRG11 is equipped with an internal clock that allows to schedule filter cleanings at set times (also see the "Configuration" section).
To adjust the clock, proceed as follows:

1. Press the ESC key until the display shows "DATE/TIME SET"
2. Enter the adjustment mode pressing the ENT key
3. The day value will flash on the display; adjust this value with the [+] and [-] key
4. Press ENT to save the setting or ESC to exit without saving
5. After confirming the day, the hour value will start flashing; set the current hour using the [+] and [-] keys; press ENT to save the setting or ESC to exit without saving
6. Set minutes and seconds with the same procedure

Note: If the clock is not correctly set, the programmer will continue to work, but the scheduled cleanings will be not performed at the right time.
The buffer battery (CR2032, code 52900011) ensures the internal clock functioning for about 5 years. For battery replacement, contact the manufacturer.

CONFIGURATION

To enter the configuration mode, proceed as follows:

1. Press the ESC key until the display shows "CONFIGURATION"
2. Enter the configuration mode pressing the ENT key
3. If a protection password has been set, the instrument will ask to enter it; use the [+] and [-] keys to input the correct value, then press ENT to confirm
4. At this point the instrument proposes the first parameter, with its flashing number
5. To move to the next parameters, press [+]; to move to the previous ones, press [-]
6. Otherwise, to change the value of the parameter displayed, press the ENT key and set the desired value using the [+] and [-] keys
7. Confirm the new setting by pressing ENT, or press ESC to exit without saving

Table of programmable parameters

It is recommended to fill the last column with the values set for the specific installation.

Parameter	Description	Min value	Max value	Default value	Set value
01	Password	0	250	0	
02	Language	0	3	1	
03	Washing time	5	240	15 sec	
04	Start-up washing	0	1	1	
05	End production washing	0	1	1	
06	1st washing time	0:00	23:50	9:00	
07	2nd washing time	0:00	23:50	12:30	
08	Cond1 type	0	7	1	
09	Cond2 type	0	7	2	
10	Threshold Cond1	0	2000	0	
11	Threshold Cond2	0	2000	0	
12	Cond. Alarm delay	0	20	3	
13	Wash at first conductivity alarm	0	1	1	
14	No conductivity alarm in standby	0	1	1	
15	Filter duration	000	25000	1000 hours	
16	Reset filter time	0	250	0	
17	EV IN wash. Off	0	1	0	
18	Pump Off when washing	0	1	0	
19	Automatic reset of errors	0	240	0 sec	
20	Attempts aut. reset	0	8	3	

P01 Password
This parameter allows to set a protection password (different from zero) to prevent the access to the configuration menu by unauthorized personnel.

Warning! If you forget your password, the instrument must be sent back to the factory for a complete reprogramming!

P02 Language
The display interface of the programmer can show messages in the following languages:
0 = Italian ; 1 = English ; 2 = French ; 3 = Spanish

P03 Washing time
This parameter allows to set the duration of the filter washing, in seconds.
(Delays in the switching operations of valves and pumps are added at this time.)

P04 Washing at start-up
With this parameter you decide whether to run a wash at the start-up of the unit.
1= function enabled ; 0= function disabled (no washing).

P05 Washing at the end of production
With this parameter you decide whether to run a wash at the end of production, i.e. after the closing of the contact “LIV max.” and the completion of the system shutdown (shutdown of pumps and valves). Even in this case: 1= function enabled ; 0= function disabled (no washing).

P06 1st washing time
With the internal clock, you can set the time in which to run the washing of the filter (for example, after or before the closing of the plant). This parameter allows to set this time, in steps of 10 minutes. The value 00:00 corresponds to no wash scheduled.

P07 2nd washing time
Like P06, this parameter allows to program the time of a second wash.

P08 Cond1 type
This parameter allows to choose the desired conductivity range for probe 1:

P08 = 0 ⇒ 2.000 µS/cm full scale	P08 = 4 ⇒ 2.000 mS/cm full scale
P08 = 1 ⇒ 20.00 µS/cm full scale	P08 = 5 ⇒ 20.00 mS/cm full scale
P08 = 2 ⇒ 200.0 µS/cm full scale	P08 = 6 ⇒ 200.0 mS/cm full scale
P08 = 3 ⇒ 2000 µS/cm full scale	P08 = 7 ⇒ 2000 mS/cm full scale

The range is indicated on the instrument side label.

Warning! Do not modify this parameter! The instrument is configured at the factory in both hardware and software, i.e. making a simple change of this parameter does not involve a change of range, but unreliable readings!

P09 Cond2 type
As the previous parameter, but for the probe 2.

P10 Threshold of Cond1
This parameter allows to set the conductivity threshold, above which an alarm is generated. The value can be adjusted in steps of 10 points (e.g. range 10.00 µS/cm ⇒ increments of 0.10 µS/cm). Set the parameter to 0 means do not use this alarm.

P11 Threshold of Cond2
See explanation of the previous parameter.

P12 Conductivity alarm delay
The system generates an alarm if one of the conductivity thresholds (P10 and P11) is exceeded for longer than a certain delay time. This parameter allows to set the desired delay time (minutes).
P12=0 corresponds to a minimum delay of 30 seconds.

P13 Washing at first conductivity alarm
P13=0 means disable this feature.
P13=1 means that after exceeding the threshold set at P11 for a time P12, the instrument activates a washing cycle for groped to restore the conductivity value below the threshold. Once the wash is completed, if the threshold P11 is again exceeded for a time P12, the alarm is triggered.

P14 No conductivity alarm in standby
P14=0 means that the conductivity alarm may always activate.
P14=1 means that the conductivity alarm is disabled when the system is in standby.

P15 Filter duration (life)
Set this parameter to filter life. In fact, the PRG11 programmer is able to count the working hours of the filter (production with running pump) and compare them with the value set in this parameter. If the operating time exceeds this threshold, the "FILTER LIFE" alarm. The maximum value that can be entered is 25000 hours (about three years of operation), in steps of 100 hours. If you do not want to use this feature, set the parameter to zero.

P16 Reset of filter time
To reset a "FILTER LIFE" alarm you must enter a password in this parameter. This password is communicated to the installer at the delivery of PRG11.

P17 EV IN (inlet solenoid valve) off during washing
Normally, the washing is performed using the feed water and therefore the solenoid valve EV1 must remain open: set P17=0.
However, in particular installations in which the washing cycle is not performed with the feed water, this valve should be closed when flushing: set P17=1.

P18 Water pump off during washing
Normally, the washing is performed with water pump working: set P18=0.
However, in particular installations, pump has to be off during washing operation: set P18=1.

P19 Automatic reset of errors
In case of alarm the system will automatically lock. The user should therefore check the condition of the system and then start it manually by pressing the ACK key on the front panel.
It is also possible to restart the system automatically after a time (in seconds) set in this parameter, without needing for any intervention by the operator.
If it was a random alarm / error, the system will restart correctly; but if the alarm is due to a breakdown or malfunction, the PRG11 will try several times to start again unsuccessfully.
Set P19=0 means do not use the automatic reset function, but to restart the system manually (recommended).
Note: time intervals lower than 10 seconds are converted automatically to 10 seconds (minimum time).

P20 Attempts of automatic reset of errors
Depending on the setting of the previous parameter, the instrument can automatically restart after an alarm / fault occurs. If the alarm is due to a failure or anomaly that requires a manual reset, an infinite trying loop can be generated. This parameter allows to set the maximum number of attempts, after which, if an alarm is still active, the PRG11 stops waiting for operator intervention.
Set P20=0 means do not use this function, i.e. allow an infinite number of attempts.
Note: The instrument is not able to distinguish the error / alarm type. If for example a maximum of 4 reset attempts has been set and the instrument have several errors, four errors will be reset and the fifth one will block the device.

ALARMS

In case of alarm, the controller stops the system: dosing pump and water pump off, turn off all solenoid valves (EV1, EV2, EV3) and waits for the alarm reset by the intervention of the operator, which restores the system operations pressing the ACK button on the front panel, or for the automatic reset after a time set in the parameter P19.
The alarm is accompanied by a beep and by the displaying of the correspondent error message together with the date/time of the alarm activation.

Possible alarms:

MIN. PRESS. ALARM: this alarm is generated when, with pump working, the pressure of feed water remains below the minimum value (CP min.) for more than 10 seconds.

MAX. PRESS. ALARM: this alarm is generated in any condition when the system pressure exceeds the maximum level (CP max.) for more than 10 seconds.

CONDUCT. ALARM: this alarm is generated during normal plant operation (no cleaning mode) when one of the conductivity thresholds is exceeded for a time longer than that set in P12.

FILTER LIFE ALARM: this alarm is triggered when the filtering time exceeds the limit set in parameter P15; this alarm does not block the system, but is displayed and accompanied by a beep that insists until the alarm is reset.
Since this reset can be performed only by authorized personnel (entering a special password in P16), this alarm can be considered a request for technical assistance.

PUMP PROT. ALARM: this alarm is generated - with a delay of 1 second - upon a failure of the FILT input, which is normally connected to the thermal protection of the pump.

MANUAL TESTS

These operations should be performed only by qualified personnel, using proper simulators to test inputs and outputs.

To perform the input test, proceed as follows:
1. Press ESC until the display shows “INPUT TEST”
2. Press ENT to confirm
3. The display shows “MIN LEV OUT" and its current configuration (OFF=open, ON=closed); at this point you can act on the input contact to control, after suitable delay, the switching of the status
4. Using the [+] and [-] keys you can explore all the inputs of the PRG11
5. When displaying the analogue inputs (conductivity), the top row shows the conductivity reading without any correction (first value) and the offset/gain correction (second value), while the bottom row shows alternatively the offset and gain values
6. Press ESC to exit the input test mode

To perform the output test, proceed as follows:
1. Press ESC until the display shows “OUTPUT TEST”
2. Press ENT to confirm
3. The display shows “PRESS. PUMP" and its current configuration (OFF=off, ON=on); at this point you can switch the output through the ACK key
4. Using the [+] and [-] you can check / activate all the outputs of the PRG11
5. Press ESC to exit the output test mode

Warning! Before running the output test with the PRG11 connected to the installation, assess any risks!

Note: The display messages in “Test” mode are fixed in the English language.

CALIBRATION / CUSTOMIZED CONFIGURATIONS

The PRG11 programmer is accurately calibrated and configured at the factory accordingly with the specific installation needs, and normally does not require any intervention by the installer/customer.

⚠ Any tampering or modification by the customer, not authorized by the manufacturer, will void the warranty, and often cause malfunctioning of the device.

However, in case of very long cables of the conductivity cells or special installations, may be useful to perform an additional calibration of the analogic inputs. Press the ESC key to select the input number and calibration type (offset or gain), then use the [+] and [-] buttons to modify the displayed value. If you try to calibrate the device at values too far from those of the factory, the message “Calibration impossible” is displayed and the procedure is not completed.
Contact the manufacturer to receive any additional instructions. The procedure must always be performed by qualified personnel, with the appropriate calibration solutions.