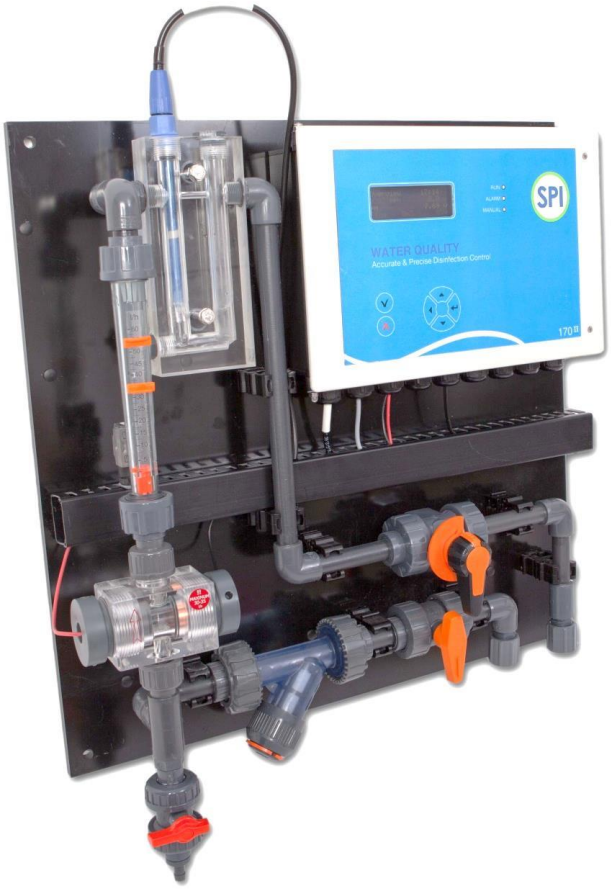
User Manual

SPI-C170 AMP

CHLORINE



Version 3

Index

Foreword:

The manual for the SPI-C170 AMP is meant for the following authorized employees:

- Electrotechnical staff
- Watertechnical staff
- Laboratory staff

This manual is intended for the proper installation and operation of the SPI-C170 AMP.

- Please read this manual carefully;
- Only allow authorised personnel to work with the SPI-C170;
- Ensure that the manual is accessible to every user;
- In case of emergency, please contact your supplier

Warranty limitation
This documentation is supplied by SPI Technology Ltd, trading as SEM Waterbehandeling B.V., hereinafter referred to as, the manufacturer. It is in no way liable for any damage, direct or indirect, arising from the use of this documentation.
No guarantee is given for suitability for any special applications and parameter settings. The manufacturer. is limited to the replacement of parts or documentation insofar as defects have not been caused by improper use.

1. Introduction

1.1 Purpose of the SPI-C170 AMP

The SPI-C170 AMP is designed for correctly measuring controlling and monitoring a water treatment process.

The SPI-C170 AMP is suitable for the following sectors:

- Water companies
- Other locations that measure and regulate Chlorine levels

1.2 Important specifications

The most important specifications of the SPI-C170 AMP are:

- Amperometric measurement of free available chlorine content in water
- Potentiometric measurement of pH value
- Measuring the flow rate through a pulse or mA sensor.
- Controlling dosing pumps for chlorine and acid, related to the measured value of the parameters.
- Implementing a dosing stop in case of insufficient flow (no or insufficient flow = no dosing)
- Circulation contact on/off protection
- Sending a general alarm signal.
- The power supply for SPI-C170 AMP is an external 12Vdc mains adapter (100-240Vac 50/60Hz).

Specifications of the measurable parameter:

- Free available chlorine in aqueous solution, method: Amperometric
- pH in an aqueous solution, method: pH electrode (potentiometric)
- Flow of a circulation system, method: with pulse or flow emitting flow sensor

Measurement	Method	Range	Accuracy
Chlorine	Amperometric	0.00 - 9.99 mg/l	± 5 % (depending on flow accuracy and calibration)
pH	Elektrode	2,00 – 12,00	± 0.05
Flow	Pulse or Current	0 – 100 %	± 5%

The accuracies are based on strict adherence to the procedures in this manual.

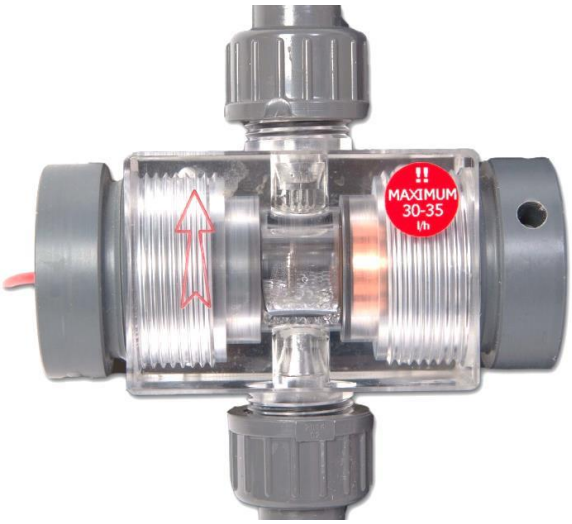
1.3 Warnings

The SPI-C170 AMP has been developed and manufactured with the utmost care.
Before assembling, please note:

- Please ensure that no voltages higher than 12Vac/dc or 24Vac/dc are fed inside the SPI-C170 AMP.
- Possible damage due to transport. Report transport damage within 3 working days

1.4 Background information

The SPI-C170 AMP, based on the amperometric measurement principle, (see image below) with a platinum and copper electrode. This combination of electrodes provides an output signal of several microamperes that is directly proportional to the chlorine concentration. The measurement and control unit converts this signal to a value in milligrams per litre (mg/l). A 2-point calibration displays the free chlorine value.



1.5 Conditions of use

- Surroundings free of aggressive vapours
- Temperature of the room housing the SPI-C170 is between 5°C - 40°C
- Relative humidity lower than 80%
- Take possible sources of interference such as frequency converters and softstarters into account when placing them. (EMC sensitivity)

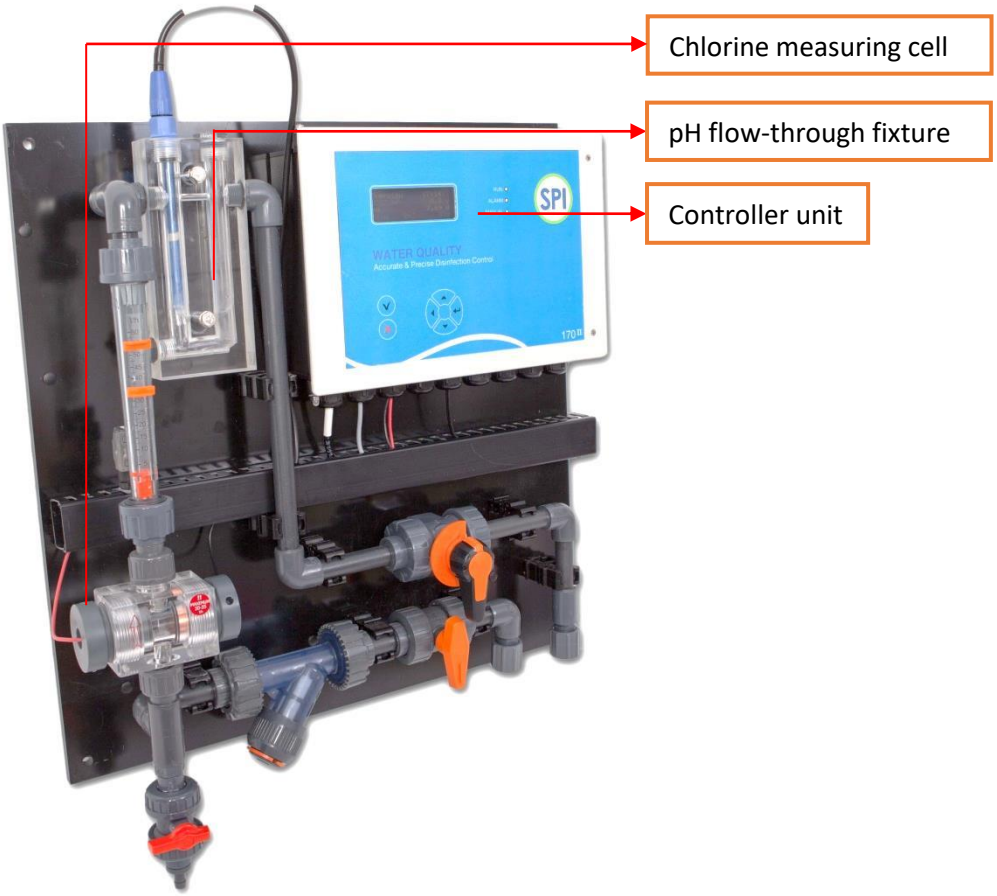
2. Description and operation

2.1 Description of the SPI-C170

The SPI-C170 AMP is delivered ready-to-use on a single mounting plate equipped with:

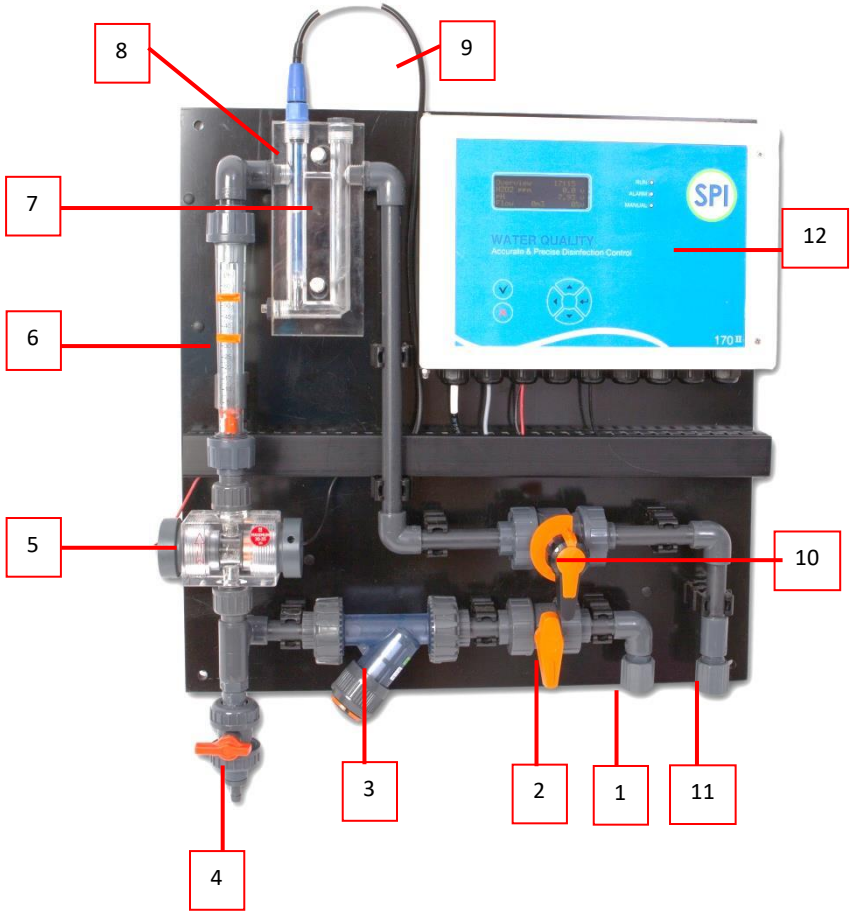
- 1 SPI controller unit
- 1 chlorine measuring cell
- 1 pH flow-through fixture
- Measuring water inlet and outlet connections, measuring water valve and dirt trap
- Panel dimensions (lxwxh) = 485mmx485mmx100mm

All parts are technically or electronically connected. See image below.
All parts are preinstalled either water technical or electro technical.



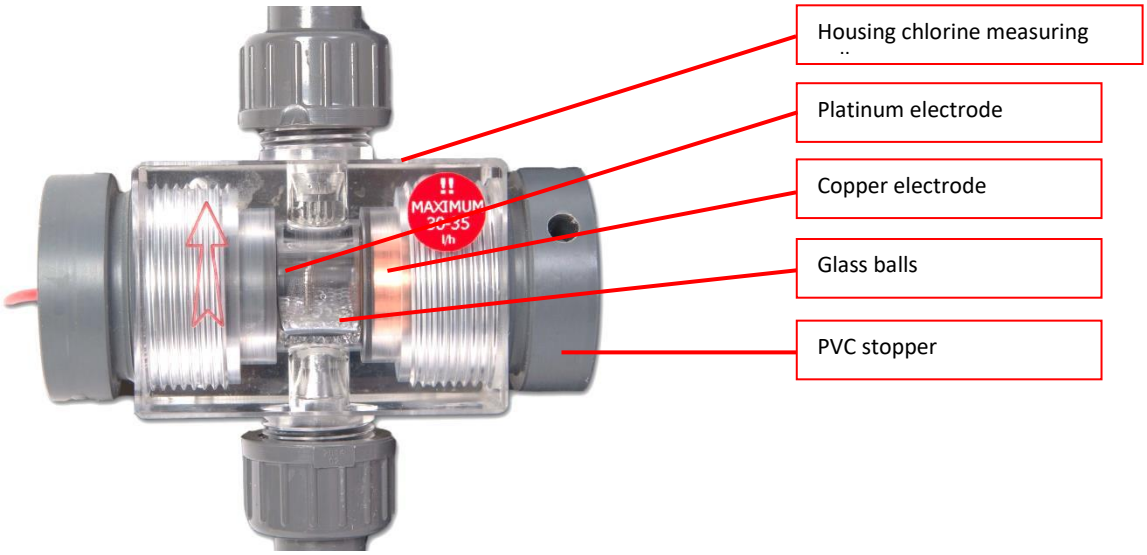
2.2 Operation of the SPI-C170 AMP

The measuring water is supplied by the piping on the measuring panel. The SPI-C170 AMP continuously measures the free chlorine value and pH value. The chlorine measurement is done with an amperometric measuring cell consisting of a copper and platinum element. The pH is measured with a glass electrode. Excess water can constantly flow back into the filter system under pressure. See image below.

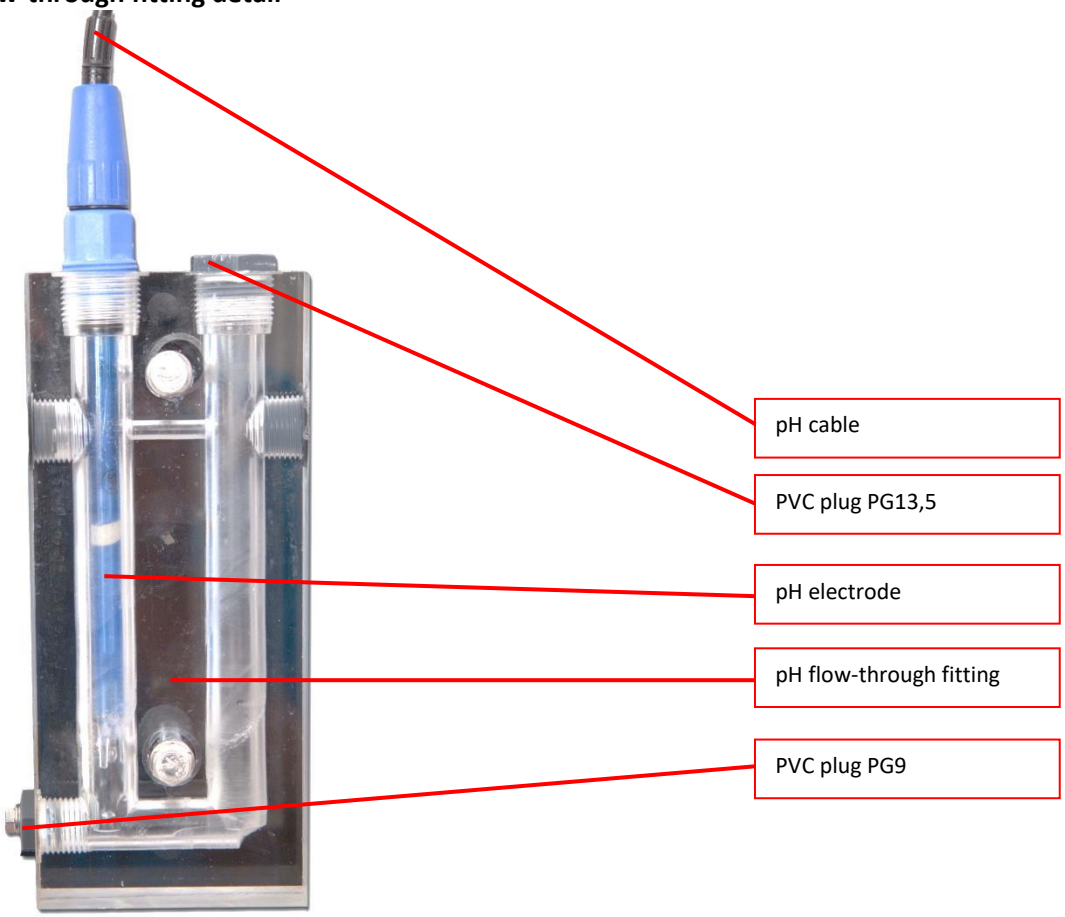


1	**Measuring water supply**: hose connection for 6x12mm reinforced PVC hose
2	**Supply valve:** allows the measuring water to be shut off during maintenance and service
3	**Pre filter with sieve**: prevents contamination of the measuring system
4	**Sampling tap:** allows a water sample to be taken during calibration
5	**Chlorine measuring cell**: consists of a flow-through fixture with a platinum and copper electrode. This combination of electrodes provides an output signal of several microamperes that is directly proportional to the chlorine concentration. The measurement and control unit converts this signal to a value in milligrams per litre (mg/l).
6	**Flow-through fitting with flow contact**: The flow rate can be read from this. The flow contact switches off the output signal to the dosing pumps when the flow is too low. The normal flow should be 35 l/h..
7	**pH electrode flow-through fitting**: This contains the pH electrode. There is room for two electrodes. The right-hand position is capped.
8	**PH electrode:** The pH value is measured with a pH electrode. This is a glass electrode that produces a voltage of a few millivolts. The pH electrode is connected with a special shielded cable to conduct the sensitive signal interference-free to the measuring and control unit. The measuring amplifier converts the signal from the electrode to a value on the pH scale (0-14).
9	**pH cable:** connect the pH electrode to the measuring amplifier
10	**Flow control valve:** this valve allows the flow to be regulated
11	**Measuring water return:** hose connection for 6x12mm reinforced PVC hose
12	**Controller:** converts the signals from the sensors and displays them on the display.

Chlorine measuring cell detail

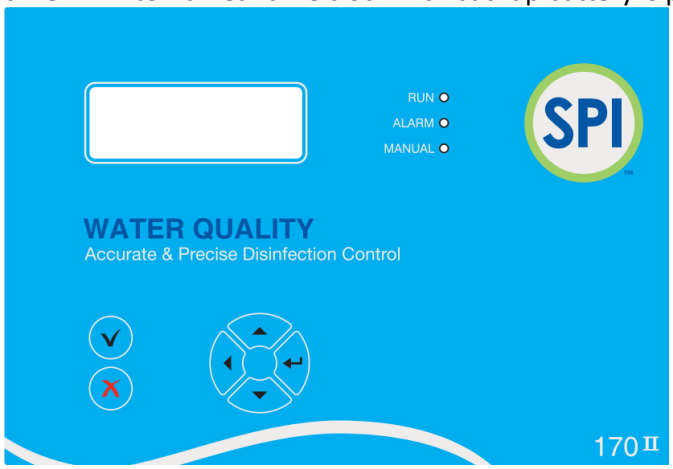


pH flow-through fitting detail

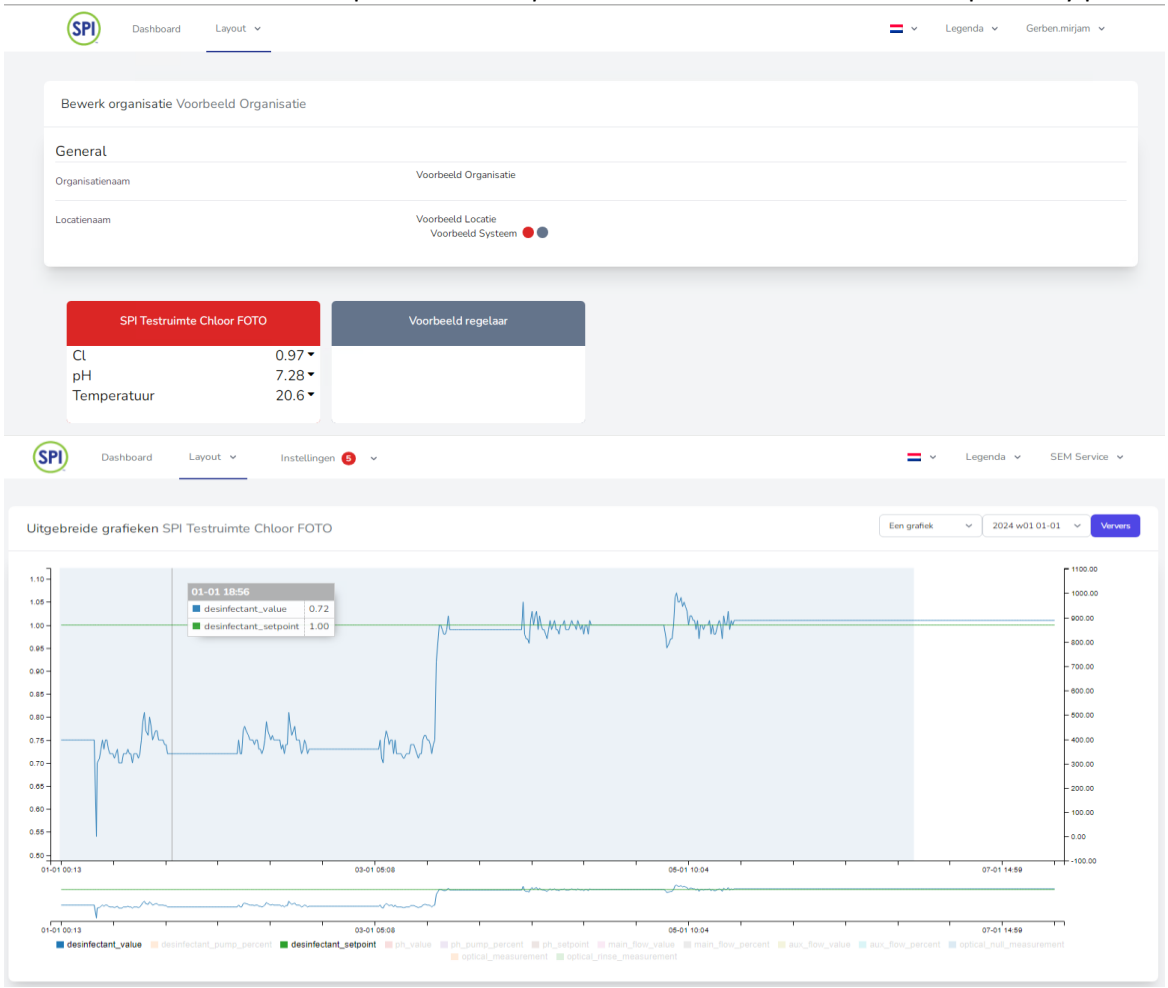


2.3 Software structure of the SPI-C170 AMP

Full operation is performed on the front panel (with keypad and display) of the system. The display shows the measured values and other important information. The hardware has an internal memory in which data, reports and calibrations are stored. This data is retrievable and provided with date and time. An internal real-time clock with backup battery is provided for this purpose.



Optional is the use of SPI Webmonitor. This makes it possible to read the SPI remotely via a web page and download all data and view it in graph form. To use this functionality, the optional communication module is required. *See chapter 16.4.* real-time clock with backup battery provided.



3. Safety

3.1 Safety regulations

The SPI-C170 AMP has been carefully developed in terms of safety. This minimises safety risks for the user and installer.

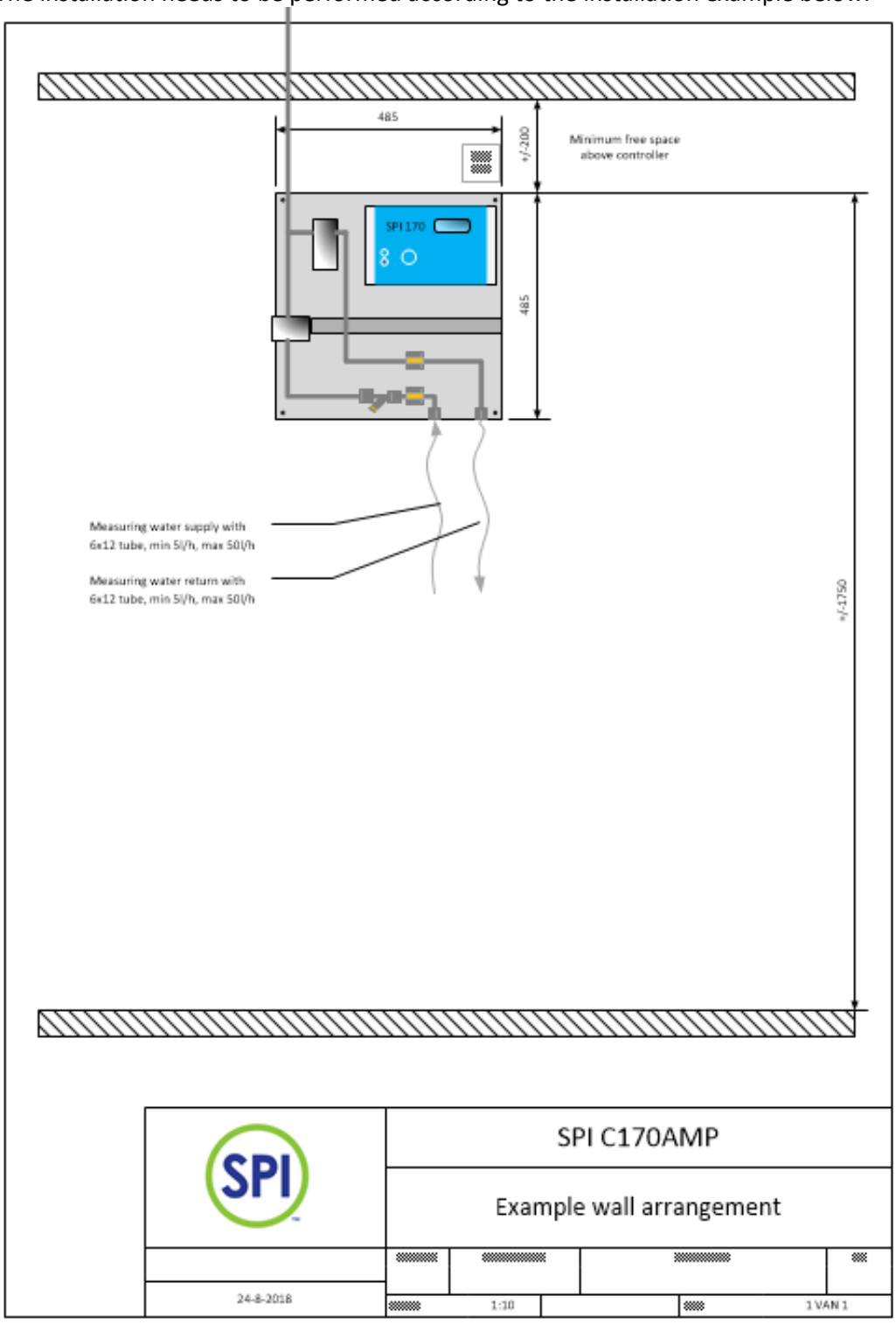
- The SPI-C170 AMP is powered via an external 12Vdc adapter from a WCD (230Vac). This means that no dangerous mains voltage (230Vac) is present in the entire SPI unit.
- The remote control option (communication module and internet access) allows remote service.

4. Installation

The following sections describe the structure and installation of the SPI-C170.

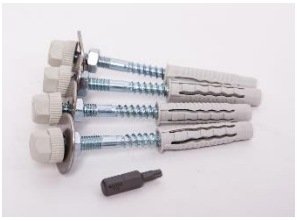
4.1 Mounting and water-side connection

The SPI-C170 is complete preassembled on a pannel provided with the units as named in chapter 5.1.
The installation needs to be performed according to the installation example below.



Please follow the instructions for installing the SPI-C170:

1. Remove the SPI from the box.
2. Check if the cables are installed correctly in the cable glands
3. Mount the pannel. Use the included connection materials. Drill 8mm holes in the wall. Push the plugs in the wall and turn the M6 threaded ends with the included torx bit in the plugs. Place the pannel over the wire ends and place the included washers and cap nuts M6. Optionally there is a special mounting frame available. With the frame, the SPI can be mounted from 100 to 150 mm from the wall. See chapter 19 Accessories SPI 170



4.2 Water-side connection

1. Connect the measuring water to the supply connection 'supply measuring water' with 6x12 reinforced PVC hose and ensure sufficient flow (maximum 35 l/h). The value is readable on the flow meter. Connect hose connection 'measuring water return' to return pipe (filter system is possible). Optionally, this can go to a tank emptied with a submersible pump. See chapter 18 Spare parts and accessories

Supply of measuring water

Return of measuring water

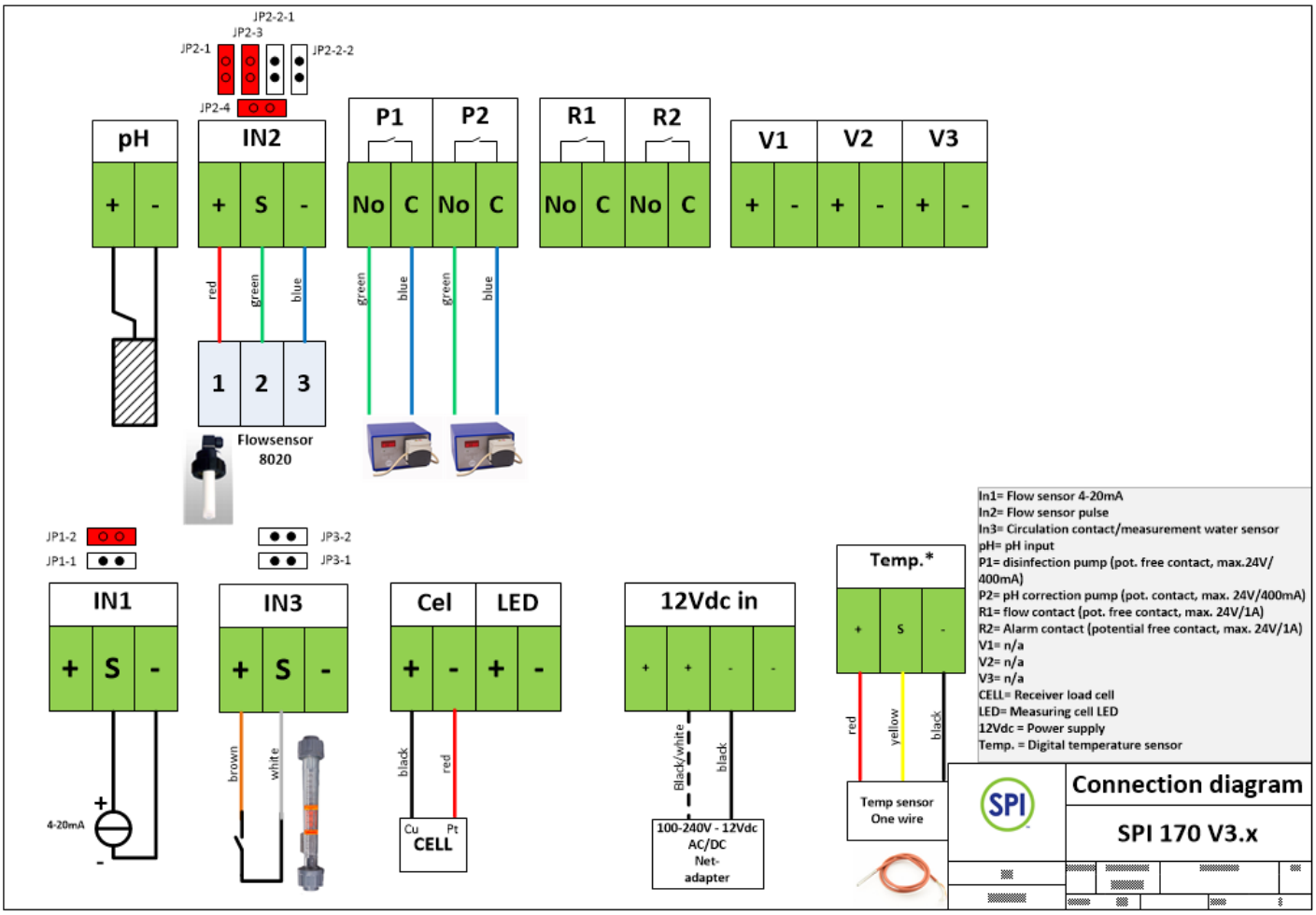
2. Remove the left drain plug from the pH flow-through fixture. Insert the supplied pH electrode into the left shaft. Screw the supplied pH cable onto the pH electrode. If the SPI will not be put into operation immediately, leave the drain plug in place and ensure that the SPI is covered so that no dust or construction debris can enter the flow-through fixture. Dust or construction debris can damage the pH electrode
3. The measuring water supply can be opened if the supply and return are connected. Adjust the flow to 35l/hour (constant flow) with the flow control valve.
4. Connect the controller electrically, *see chapter 5*
5. Put the regulator into operation, *see chapter 6.*

5. Electrical connection

5.1 Connecting SPI controller (default configuration)

Connect the cables of the control unit according to the connection diagram below.

When the SPI 170 is delivered, a standard configuration of the inputs is used. The table on the next page details all connection points



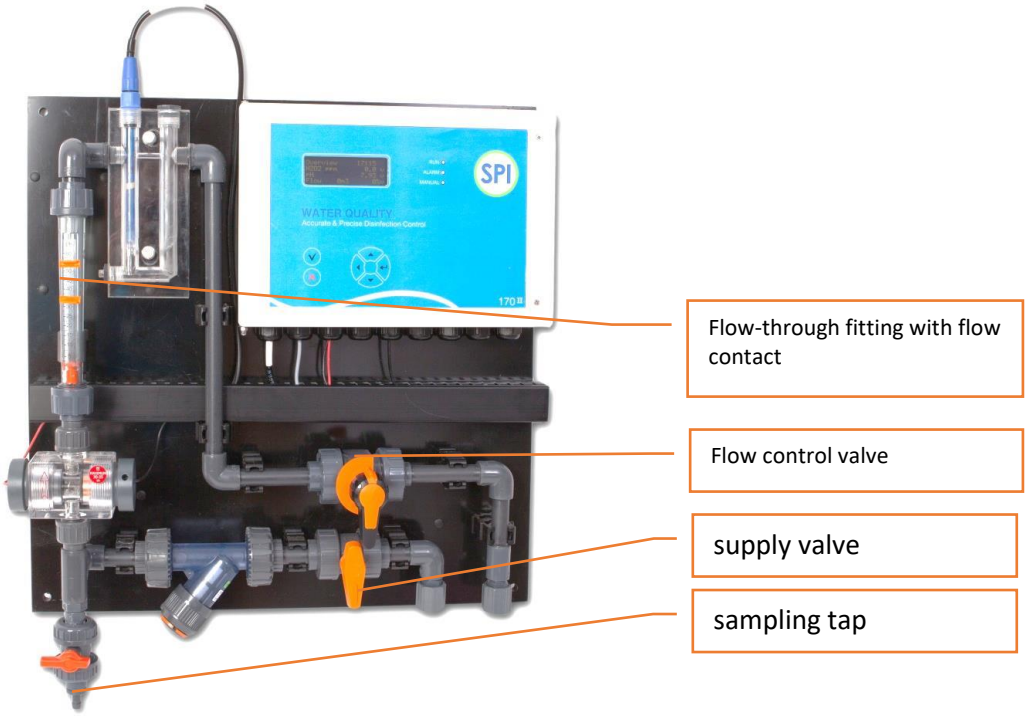
Clamp	connection	description
	Supply 12VDC	Black/white= +, black = - This is the connection for the 12V power adapter. Note: only use the supplied adapter.
pH	pH electrode	Core (transparent cable) = +, shield (black cable) = -
In1	Flow measurement 4-20 mA signal	An external flow sensor can be connected to this input, with a 4-20mA signal and a power supply 12V max 100mA. Then use the +, S and terminal. This sensor measures the flow of the filter system. It is also possible to connect a 4-20mA signal from an external system. Then use the S and the clamp. Use only one of the two flow inputs! This signal is scalable in the system configuration menu.
In2	Flow measurment pulse signal	A flow sensor with pulse signal (30Hz per m / s) can be connected to this input, such as the 8020 sensor. This sensor is powered by the SPI (12V / max 100mA). This sensor measures the flow of the filter system. Use one of the two flowing angles. This signal is scalable in the system configuration menu.
In 3	Circulation contact	Potential free contact between + and S, or when measuring water sensor brown = + 12V, black = S, Blue = -) With this input, the SPI detects whether or not measuring water is being offered. A closed contact means that there is measuring water and then the SPI will start measuring and controlling. With a closed contact, the SPI starts a new measuring cycle for the chlorine measurement. An open contact means that there is no measuring water and then the SPI will stop measuring and controlling. A beep will sound and the SPI will indicate a fault (circulation error). The contact can come from a circulation pump, a flow meter or the optional measuring water sensor (see wiring diagram below this table). A wire bridge has been installed at the factory. An adjustable delay time is available in the system configuration menu
P1	Disinfection pump (Chlorine)	Solid state contact, this contact is used for controlling a dosing pump by pulses or on-off control. This output is configurable in the system configuration menu. (Contact load max 24V / 400mA)
P2	Acid/lye pump	Solid state contact, this contact is used for controlling a dosing pump by pulses or on-off control. This output is configurable in the system configuration menu. (Contact load max 24V / 400mA)

R1	Flow alarm contact	Relay contact max 24V / 500mA. This relay contact can be used for the release of metering pumps and heating (protection at low flow). The contact closes as soon as the flow is sufficiently high. The contact can be configured as normally opened or normally closed by means of a jumper. This contact is open at low flow at the factory. Use this contact to switch an auxiliary relay with 12V or 24V coil voltage. Note: this relay contact is not protected by a fuse.
R2	Alarm contact	Relay contact max 24V / 500mA. This relay contact can be used as a general fault contact (for example for reporting on a building management system or controlling a fault indicator on the lifeguard station). The relay is attracted under normal conditions. In the event of a fault, the relay drops out and the contact is closed. In this way, the power failure of the inverter is also reported as a fault. The contact can be configured as normally opened or normally closed by means of a jumper. This contact is closed at the factory in the event of a malfunction. Use this contact to switch an auxiliary relay with 12V or 24V coil voltage. Note: this relay contact is not protected by a fuse.
Led/Cel	Chlorine cell input	Measuring cell connection contacts Receiver: **GND:** brown (old coding brown) **BPW_in**: black (old coding white) Transmitter (LED): **LED**: red (old coding green) **+12V**: orange (old coding yellow)
V1/V2/V3	Valve connections	Measuring water valve: orange/white Reagentvalve: orange/white Drainvalve: orange/white
Temp	Temperature	Not in use

After the electrical connection, the SPI can be commissioned, *see chapter 6 Commisioning*

For advanced configuration settings, *see chapter 16 Configuration*

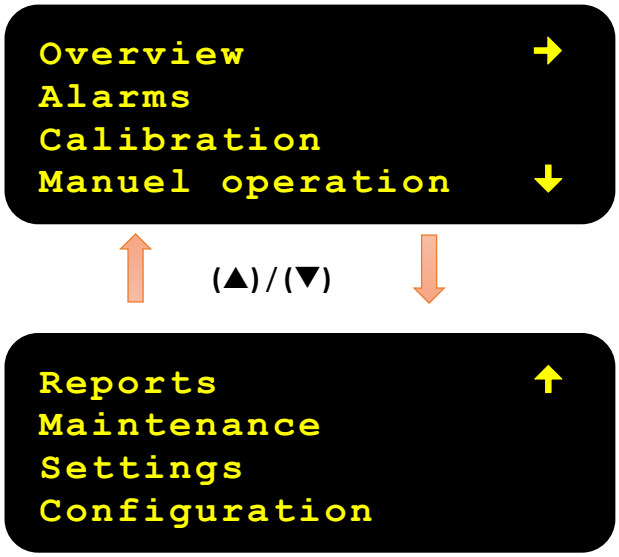
6. Commissioning



The following operations must be carried out to commission the SPI-C170 AMP:

1. Ensure that the SPI is clean before commissioning. Dust, drilling debris etc. in the measuring cell or flow-through block can cause damage and lead to malfunctions. Thoroughly flush the measuring water hoses first when commissioning for the first time.
2. Plug the adapter into a wall socket.
3. Start the measuring panel water flow by opening the supply valve. Adjust the flow with the flow control valve to 35 litres per hour.
4. The display then shows the intro screen. It also displays the current software version.

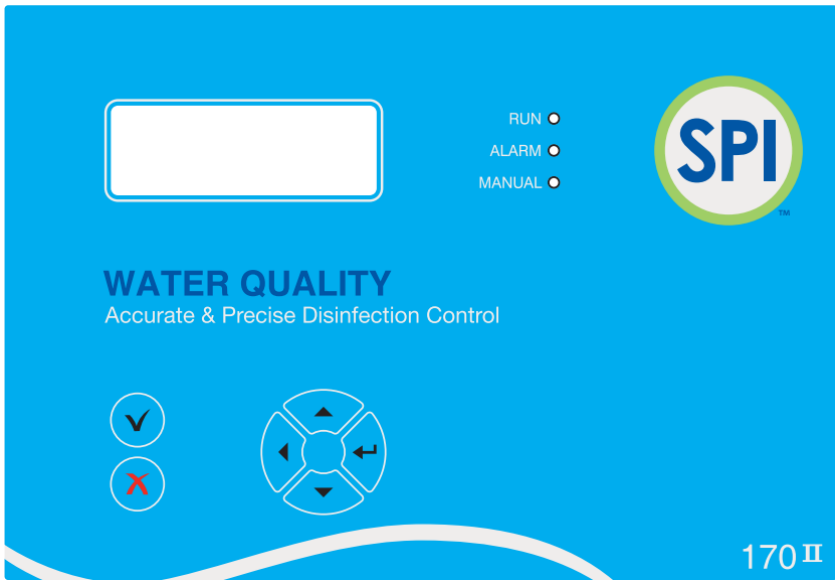
5. After the intro screen, the main menu will be displayed (NL), with the choices:



6. The SPI-C170 can be set in 3 different languages, English, Dutch and French. Setting the desired language is done via the **[Configuration]** menu **[User settings.], [Language].** For most applications, the factory settings are sufficient. *See chapter 16 Configuration* for more information on configuring the controller.
7. Let the measuring water flow over the measuring board for several hours.
8. Now perform a chlorine calibration, To do this, go to **[Calibration], [chlorine],** *see chapter 10 Calibration, chlorine*
9. Place the pH electrode in the pH holder in the left shaft as shown.
10. Now the pH measurement can be calibrated. Go to **[Calibration], [pH],** *see section 10 Calibration, pH.*
11. The regulator is ready for use. Now set the desired control parameters, *see chapter 11 Settings.*
12. Finally, test whether the dosing pumps are controlled correctly. It also displays the current software version.

- **By default, the flow measurement of the SPI device is enabled (pulse sensor), see section 5. If no flow sensor is connected, it should be switched off.** ***See chapter 16 configuration,Systemconfig. , Flow.***
- **By default, the EXPERT MODE of the SPI device is ON. If a simple display of alarms is desired without letters but by means of an icon, the EXPERT MODE can be switched off.** ***see chapter16 Configuration, Users. Setting.***
- **There is a possibility to set an access restriction.** ***See chapter 16 Configuration, System config, Access restriction***

7. Operation



7.1 Navigation

Using the keyboard, you can perform all operations. You simply follow the options through the menu structure on the display.

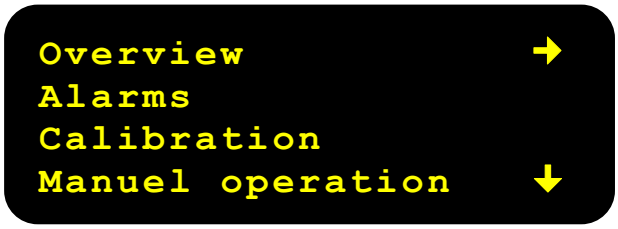
Navigating through the menu structure is done using the arrow buttons. The display displays a maximum of 4 lines a time. The menus often contain more information or possible choices. To display these, you can browse through using the arrow buttons.

Key	Description
(▲)	cursor up
(▼)	cursor down
(◀)	a step back or move cursor to the left
(↵)	"Enter" confirm the selection or place cursor to the right
(✓)	confirm change. *
(×)	go back to main menu or cancel change

* Only in the [Overview] menu this key has a 2nd function, the manual start of a chlorine measurement.

7.2 Selecting a choice

Choices in the various menus can be made by moving the cursor (blinking arrow " → " at the end of a line) with one of the navigation keys **(▲)** en **(▼)**.

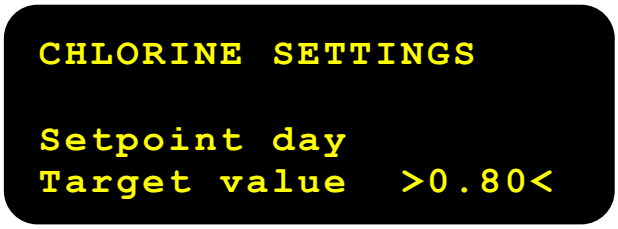


Confirm the selection by pressing 'enter' key **(↵) .** In the above example, the choice is to go to the **[Overview]** menu. Going back one screen can be done with the **(◀)** key.

7.3 Changing a value or setting

Changing a setting is done by placing the cursor on the relevant parameter (value) with the navigation keys.

Go to the relevant parameter and press the 'enter' key **(↵).**Around the relevant parameter, 2 brackets will be placed **>0.80<** and the cursor starts flashing at the first position of the parameter.



- Position the cursor **(_)** on the digit to be changed using the **(◀)** and **(↵).**
- Increase or decrease the value with the **(▲)** and **(▼)**
- Confirm the change with **(✓)**
- Cancel the change with (×). This is only possible if the change has not yet been confirmed with **(✓)** .
- If the change has been confirmed **(✓)** the 2 brackets around the parameter will disappear again.

7.4 LED indication

There are 3 LEDs on the front panel:

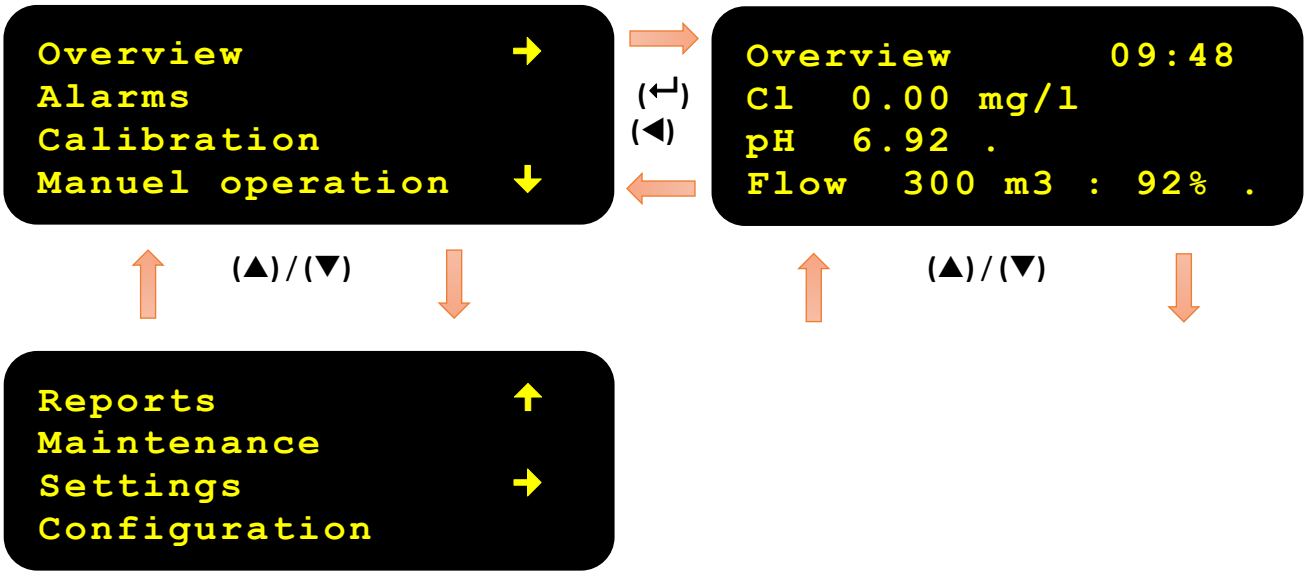
LED	Description
RUN	Flashing during normal operation
ALARM	Flashing during active alarm Fire continuously during adjusted alarm
MANUAL	Fire continuously if one of the control channels (chlorine, pH or flow) is on manual mode.

8. Main menu

The main menu allows access to all major functions of the SPI C170. The main menu consists of the following items:

Menu	Explanation
Overview	Most important information such as current measured values, alarms, dosing pump control and time.
Alarms	The active alarms as soon as they occur. All alarms can be adjusted in this menu.
Calibration	Calibrate the controller (Chlorine, pH) for precise measurement
Manual operation	In this menu, automatic, manual or semi-manual operation can be enabled, disabled and adjusted.
Reports	The historical reporting of alarms, calibrations, maintenance and measurement data (data logger).
Maintenance	An operating mode in which no alarms are reported if maintenance is set to ON. This menu contains the functions Reagent refill, measurement cell settings and controller restart (Reboot).
Settings	Setting all control parameters and alarm limits.
Configuration	Configuration shows all system and user settings. Access only by code

The main menu consists of 8 submenus. Move the cursor **(▲) / (▼)** up or down to move through the different menus.



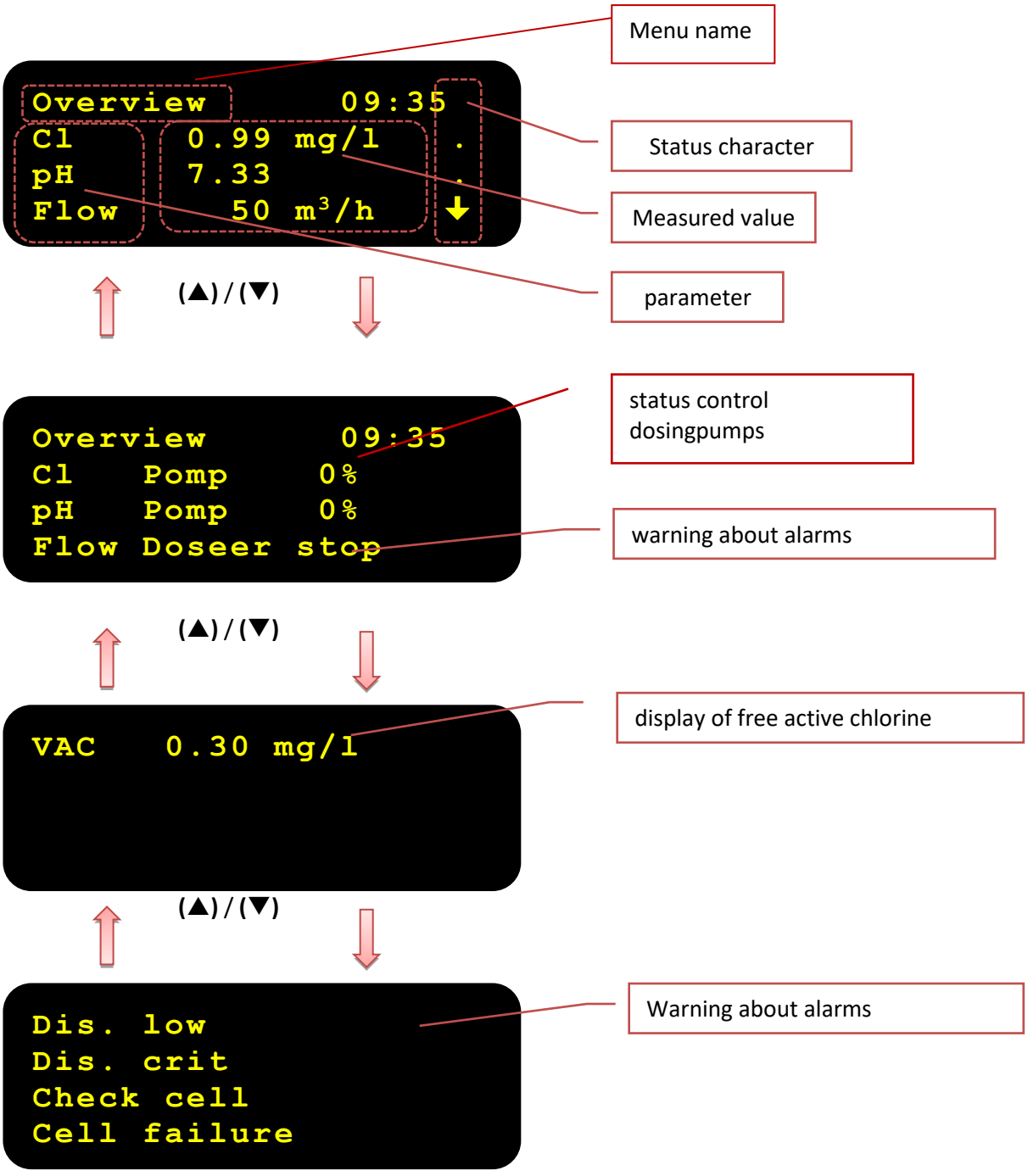
The following sections explain all menus in more detail.

NOTE: There may be an access restriction that requires code entry. ***See section 16.1.7 Access restriction.***

9. Overview

In the **[Overview]** menu as shown below, the most relevant information concerning the operation of the SPI-C170 is shown.

You will go through this menu to choose in the main menu **[Overview].**



Show on display	Description
Overview : 09:35 C	Name of current menu
Chlorine mg/l : 0.99 .	Measured chlorine value of 0.99 mg / l
pH : 6.92 .	Measured pH value of 6.92
Flow 300m3 : 92% .	Measured flow 300m³ / hour, which corresponds to 92% of the nominal flow (100% defined in the configuration menu).

By default, the SPI 170 is delivered in EXPERT MODE (ON)
The following status characters can occur (*for more info see chapter 12 Alarms*)

Character	Description
.	No alarm available
v	Pre-alarm, an alarm value that has been exceeded, but the alarm delay time has not yet been exceeded.
A	Alarm, an alarm value that has been exceeded and also exceeded the alarm delay time.
a	Adjusted alarm, an alarm confirmed by the user in the menu **[alarms],** but still present
M	Manual mode active
X	Blocked
x	Blocked by maintenance function
c	Measuring cell becomes contaminated
C	Measuring cell is contaminated

By default, EXPERT MODE is enabled on the SPI device. If a simple display of alarms is desired without letters but by means of an icon (🔔) EXPERT MODE can be disabled. ***see chapter 16 Configuration, Users. Setup.***

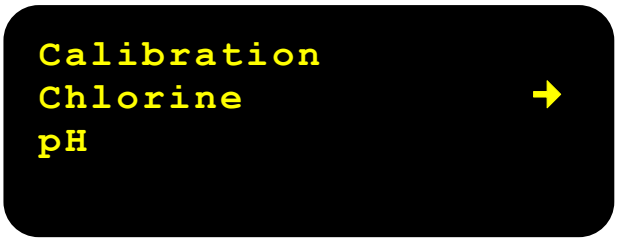
10.Calibration

The measurements of the SPI-C170 must be checked (regularly) and, where necessary, corrected by calibration against a known value. Calibration is done with a hand-held meter. This benefits the quality of the measurements.
CAUTION: only perform a calibration if the chlorine value is between 0.5 - 3.0mg/l!

Press (×) in the overview screen to return to the main menu.

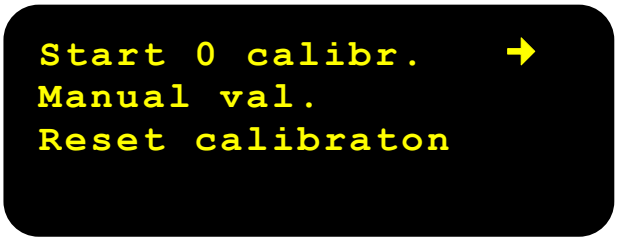
From the main menu, select **[Calibration].** The following channels can be calibrated:

- Choose **[Chlorine]**, calibrate chlorine channel
- Choose **[pH],** calibration of pH channel



10.1 Chlorine

Select **[Calibration]** for **[Chorine**] and the following menu will be displayed.

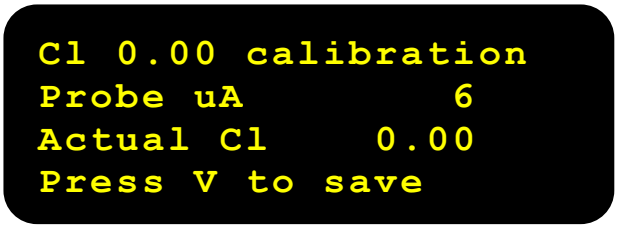


The calibration of the chlorine is done at 2 points :

- Zero point calibration **[Start 0 calibr.]**
- Handmeter calibration **[Manual val.]**

10.1.1 Zero point calibration

Select **[Start 0 calibr.]** and the following menu will be displayed.

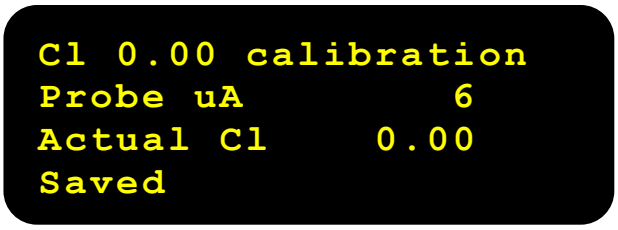


Now perform the following actions:

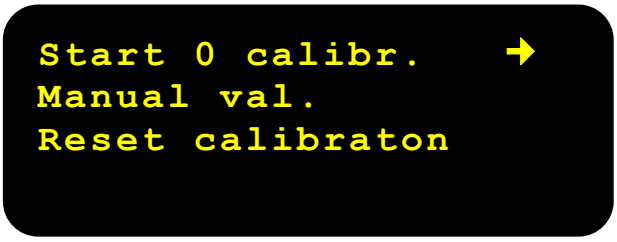
1 Shut off the metering water supply by closing the supply and return valves. Controller will now give a circulation error with audible signal.

2 Now wait for about 5 minutes. The chlorine value will decrease and eventually stabilise. Press [**V**] to confirm the new zero point. The calibration of the zero point is done.

3 After confirming the zero point, the display will show the screen below.



Then use **(◀)** to return to the Chlorine calibration menu, the screen below appears:

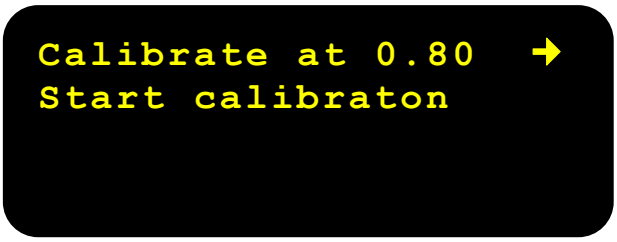


Now perform the following actions:

1. Open the metering water supply and return valves and adjust the flow rate to 35l/hour

10.1.1 Handmeter calibration

Select in the menu chlorine **[Manual val.**

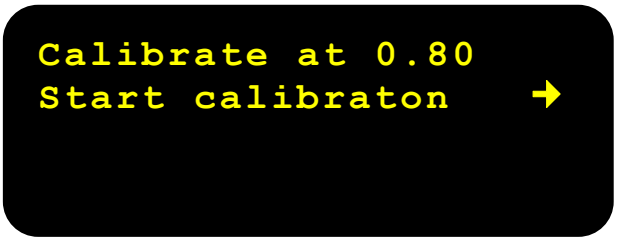


Select **[Calibrate at]**, the value to be calibrated can be entered here. Two brackets will be placed around the value after [Calibrate on] **>0.80<** and the cursor starts flashing at the first position of the parameter.

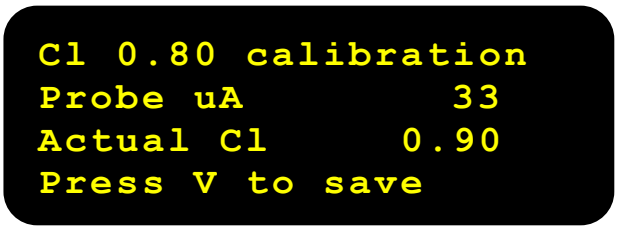
Perform the following actions :

1. Take a water sample from the sampling tap at the bottom left of the measuring water panel
2. Determine the free chlorine value of this water sample using the hand-held meter.
3. Compare the value from the handmeter to the dispenser.
4. Increase or decrease the displayed value **>0.80<** with the **(▲)** and **(▼)** to the measured value with handmeter.
5. Confirm the set value with **(✓)** , the brackets disappear

The following screen will appear :



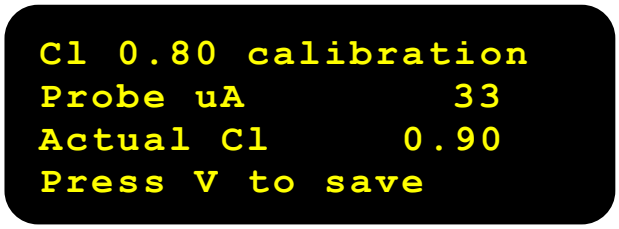
Select **[Start calibration]**, the following screen will appear



Now perform the following actions:

1. The controller shows on the display **'Cl 0.80 calibration'** the entered measured value (from point 5 above).
2. At **'Actual Cl'**, the controller displays the last measured value.
3. Check that the **'Actual Cl'** and **'Electrode uA'** values are stable and press (✓).
4. Now the set hand-measured value is adopted.
5. **'Saved'** appears on the bottom line.

6. The measurement is calibrated
7. The controller remains in the **[Cl calibration]** screen, see screen below:



Now perform the following actions:
1. Return to the main menu with **[X]** and confirm with [↵] to go to **[Overview].**
2. The overview screen now shows the new value. This value should be equal to the manual measurement and therefore the entered value.

- **Calibration of the SPI is only possible for chlorine values between 0.50 and 3,00 mg/l. If the measurement is lower than 0.50 mg/l and higher than 3,00 mg/l, the calibration cannot be carried out.**
- **It is recommended to carry out a calibration at a chlorine value of 0.5 - 1.5 mg/l.**

Note: With a new electrode or a high chlorine content, the waiting time may be longer than 5 minutes for the zero point calibration. If a correct zero point calibration cannot be obtained, it is also possible to fill the chlorine cell with chlorine-free (tap) water.
After filling, wait about 10 sec. and repeat the zero calibration as described above. If the water has been treated with chlorine tablets or granules (so-called chlorine 60 or 90, chlorine with isocyanurate compounds), the regulator cannot be calibrated or cannot be calibrated correctly.
The controller can always be reset to factory calibration by selecting the 'reset calibration' option.

Error messages:

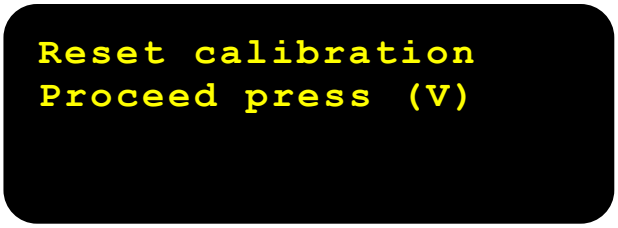
Display	Description	Solution
Out of range	Probe failure, low calibration point < 4 µA	Slecht contact
Out of range	Probe failure, low calibration point > 30 µA	Wachttijd te kort
Out of range	Probe failure, high calibration point < 30 µA	Chloorwaarde te laag

- **Calibration of the SPI is only possible for chlorine values between 0.50 and 3,00 mg/l. If the measurement is lower than 0.50 mg/l and higher than 3,00 mg/l, the calibration cannot be carried out.**
- **It is recommended to carry out a calibration at a chlorine value of 0.5 - 1.5 mg/l.**

10.1.2 Reset calibration

With **[reset calibration],** the controller is reset to the factory calibration. This allows a wrong calibration to be quickly restored. The factory calibration already gives a sufficiently reliable measurement result for most applications. A proper calibration with a handmeter ensures a minimal difference between the SPI 170's AMP measurement and the handmeter.

Move the cursor to [Reset calibration] and press enter **(↵)**. The screen below appears:



- Confirm with the **(✓)** key and the factory calibration will be loaded.

10.2 pH

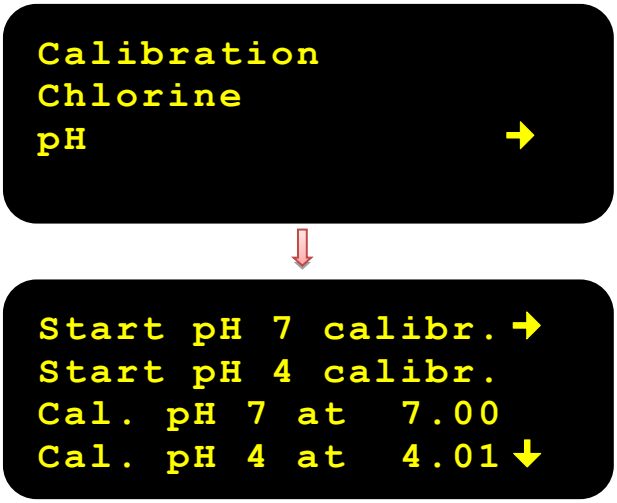
Calibration of the pH value is done with 2 different buffer solutions (pH 7.00 and pH 4.01). A pH electrode is subject to wear and tear. A periodic check is necessary. In case of deviation, the SPI must be calibrated

Press (✗) in the overview screen to return to the main menu.

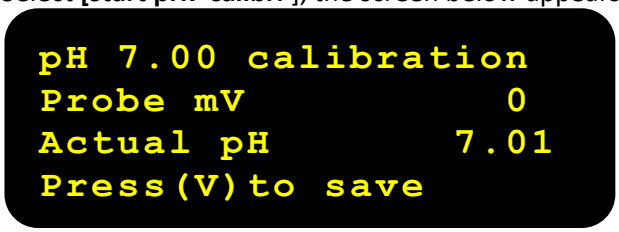
10.2.1 pH calibration

Calibration of pH is done as follows:

1. Prepare 2 cuvette with buffer 7.00 and 4.00 and make sure the pH buffers are at an appropriate temperature.
2. Go to the pH calibration menu via **[Calibrate], [pH]**, and press **(↵).** The screen below appears:

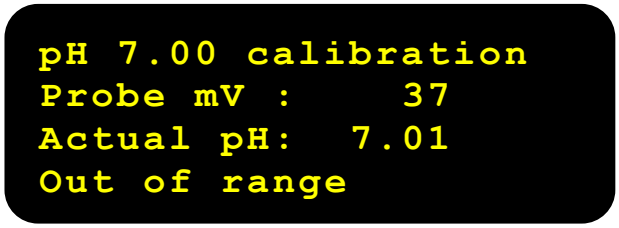


3. Select **[start pH7 calibr.**], the screen below appears



4. Remove the pH electrode from the measuring buffer jar. Place the pH probe in a cuvette containing buffer 7 solution. Wait until the pH value stabilises and does not change (approx. 1 minute). Save the calibration with **(✓)**

The SPI displays an 'out of range' message on the screen if the calibration is incorrect. Signal from pH electrode deviates too much. Check electrode and/or buffer.



5. Leave the menu with (◀)
6. Select **[start pH4 calibr.],** press **(↵)** onderstaand scherm verschijnt:

```
pH 4.01 calibration
Probe mV     :   174
Actual pH    :  3.99
Press(V)to save
```

7. Remove the pH electrode from the pH 7 buffer, rinse it with (tap) water. Place the pH probe in a cuvette with buffer 4 solution. Wait until the pH value stabilises and no longer changes (approx. 1 minute). Save the calibration with **(✓)**

The SPI displays an 'out of range' message on the screen if the calibration is incorrect. Signal from pH electrode deviates too much. Check electrode and/or buffer.

```
pH 4.00 calibration
Probe     mV :   114
Actual pH    :  4.01
Out of range
```

8. Leave the menu with (◀);

9.Press **(×)** toets, go to overview. Rinse the electrode with (tap) water. Place the electrode in the pH 7 buffer again and check the pH. It should now be at 7.00 (+/- 0.05). If not, repeat points 2 to 9.

10. The calibration is now complete.
11. Place the probe back in the buffer jar.
12. Discard the used buffer solution; this is a consumable.

If calibration with buffer 7 and 4 fails or has gone wrong, [reset Calibration] can be used to return to the factory setting. See chapter 10.2.3. Reset Calibration

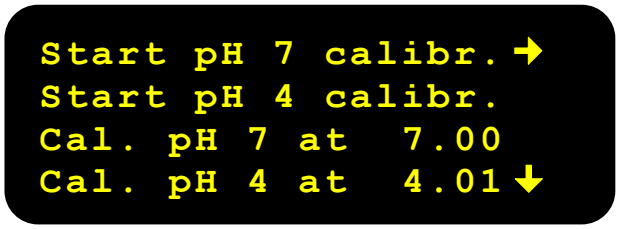
Note

Always pour a small amount of buffer liquid from the bottle into a cuvette. After use, discard the contents of the cuvette. Buffer fluid is a consumable product.

Do not store buffer solution in the refrigerator. After opening the container, buffer solution has a limited shelf life. Replace it regularly!

10.2.2 Changing buffer values

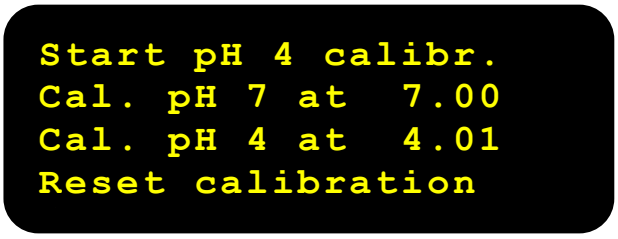
If the buffers differ from the values 7.00 and 4.01, the value of the benchmarks can be changed. Go via **[calibraion], [pH]** to the screen below:



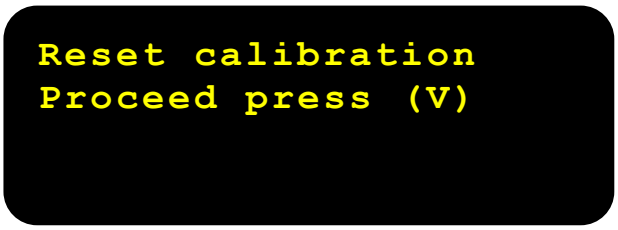
- Go with **(▼)** to the calibration value (7.00 or 4.01) to be adjusted and press **(↵)**
- The calibration value is placed between brackets
- Increase or decrease the displayed value with **(▲)** and **(▼)** to the desired value (in this example >7.00< of >4.01<) en druk op **(↵)**
- Then perform a calibration via **[start pH7 calibration]** or **[start pH4 calibration]** to apply the new calibration value(s).

10.2.3 Reset calibration

With [reset calibration], the controller is reset to the factory calibration. This allows a wrong calibration to be quickly restored. The factory calibration already gives a sufficiently reliable measurement result for most applications. A good calibration with a handmeter ensures a minimal difference between the SPI 170's measurement and the handmeter.



Move cursor to **[Reset calibration]** and press enter **(↵)**. The following screen appears:



- Confirm with the **(✓)** key and the factory calibration will be loaded.

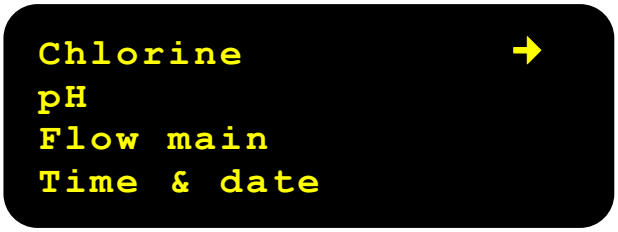
11.Settings

In the **[Settings]** menu, all control, and alarm parameters are available. These define the control characteristics and alarm limits of the SPI. These may be different for each situation. The factory settings are a good basis for most pool applications. By changing the values, the control can be adapted to a specific installation.

From the main menu, select **[Settings]** to view and/or change the SPI's settings related to:

- Chlorine
- pH
- Flow main
- Time & date

Onderstaand menu verschijnt:

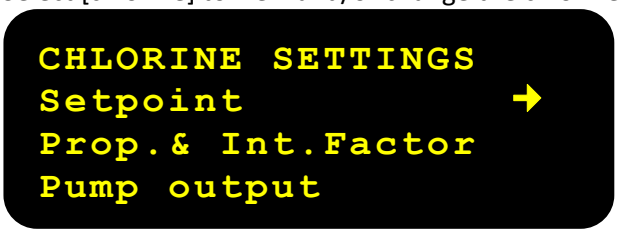


If a day and night setpoint is selected, an adjustable night setpoint is available (with associated alarm values). *see chapter 16 Configuration*

Note:
Consult local legislation for the correct parameters and alarm settings!

11.1 Chlorine settings

Select [chlorine] to view and/or change the chlorine channel settings. The following screen appears:



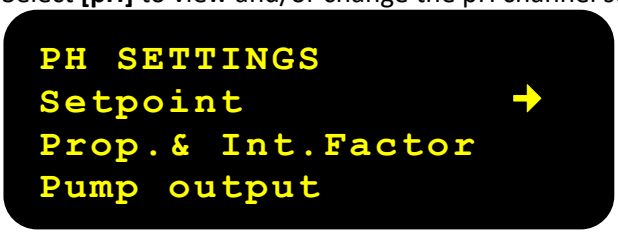
The following parameters can be set :

Menu	Parameter	Explanation	Ex factory
Setpoint	**Setpoint day**	Display which setpoint is displayed in the menu.	-
	Target value	Desired chlorine value to be controlled	0.80
	Hi alarm	Limit for high alarm chlorine value	1.50
	Lo alarm	Limit for Low alarm chlorine value	0.50
	Critical alarm	Limit for critical low alarm. If the chlorine value falls below this value, the controller will stop. This is because the controller does not know if that the chlorine value is really low, or if the DPD reagent liquid may have run out or if there is fading of the DPD reagent due to a chlorine value higher than 10mg/l.	0.05
	Alarm delay s.	Delay time in seconds. An (pre-)alarm becomes an active alarm after the alarm delay time has elapsed. This prevents short over- or under-running of an alarm value from immediately leading to an active alarm.	1200
Prop.& Int. Factor	**P factor**	This setting affects the proportional gain of the control. The higher this P-factor is set, the faster the maximum output of the control. (adjustable between 0.00-10.00, disabled at 0.00)	1.00
	I factor	The integration factor ensures that the difference between the setpoint and the measured value becomes as small as possible (zero). If the I factor is set to 0.00, this function is disabled. (adjustable between 0.00-1.00)	0.00
	I time	This is the sample interval in seconds. For this, select the minimum value of the measurement time. Minimum time is the sample time of the SPI 170 (measurement cycle). If the I factor is set to 0.00, the I time is automatically disabled (adjustable between 0-1999)	600
Pump output	**Pump Timeout**	The maximum time the dosing pump is allowed to be driven before a dosing pump alarm is triggered. This is also called response protection. If the pump is driven for 2 hours (7200s) consecutively at maximum power without the chlorine value increasing, the control will fall into alarm and stop the pump. This usually means a defect on the dosing pump, blocked injection valve, defective transport hose or empty chlorine tank. Setting the setting to "0" disables this function.	7200
	Pump min%	Minimum control of the dosing pump (in percentage of maximum pulse rate).	0
	Pump max%	Maximum control of the dosing pump (in percent of maximum pulse frequency)	100

Use the keys (▲) / (▼) to scroll through the different parameters.
P and I factor are advanced measurement and control settings, which can only be set perfectly after seeing a graph. They affect how effectively the system is regulated. There are no fixed guidelines for these settings, as each application is different. The above parameters are already set at the factory.

11.2 pH settings

Select **[pH]** to view and/or change the pH channel settings. The following screen appears:



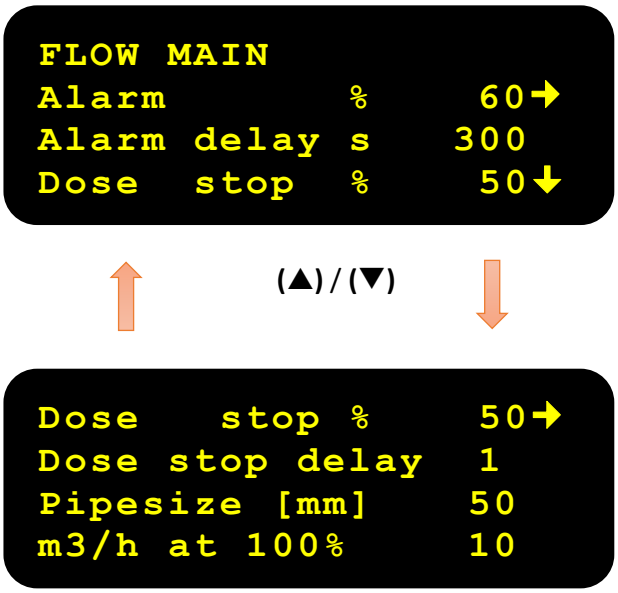
The following parameters can be set :

Menu	Parameter	Explanation	Ex Factory
Setpoint	**Setpoint day**	Display which setpoint is displayed in the menu.	-
	Target value	Desired pH value to be controlled	7.30
	High alarm	Limit for high alarm pH value	7.60
	Lo alarm	Limit for low alarm pH value	7.00
	Critical alarm	Limite for critical low alarm. If the pH value falls below this value, the controller will stop the chlorine channel. This is a protection against dosing chlorine when pH is too low.	6.80
	Alarmvert sec.	Delay time in seconds. An (pre-)alarm becomes an active alarm after the alarm delay time has elapsed. This prevents short over- or under-running of an alarm value from immediately leading to an active alarm.	1200
Prop.& Int. Factor	**P factor**	This setting affects the proportional gain of the control. The higher this P-factor is set, the faster the maximum output of the control. (adjustable between 0.00-10.00, disabled at 0.00)	1.00
	I factor	The integration factor ensures that the difference between the setpoint and the measured value becomes as small as possible (zero). If the I factor is set to 0.00, this function is disabled. (adjustable between 0.00-1.00)	0.00
	I tijd	This is the sample interval in seconds. For this, select the minimum value of the measurement time. Minimum time is the sample time of the SPI 170 (measurement cycle). If the I factor is set to 0.00, the I time is automatically disabled (adjustable between 0-1999)	600
Pump output	**Pump timeout**	The maximum time the dosing pump is allowed to be driven before a dosing pump alarm is triggered. This is also called response protection. If the pump is driven for 2 hours (7200s) consecutively at maximum power, without the pH value dropping (rising with base dosing), the regulation will fall into alarm and stop the pump. Usually this means a fault on the dosing pump, blocked injection valve, faulty transport hose or empty vessel. Setting the setting to "0" disables this function.	7200
	Pump min %	Minimum control of the dosing pump (in percentage of minimum pulse rate).	0
	Pump max %	Maximum control of the dosing pump (in percent of maximum pulse frequency)	100

Use the keys (▲) / (▼) to scroll through the different parameters.
P and I factor are advanced measurement and control settings, which can only be set perfectly after seeing a graph. They affect how effectively the system is regulated. There are no fixed guidelines for these settings, as each application is different. The above parametersare already set at the factory.

11.3 Flow main

Select **[Flow main]** to view and/or change the flow channel settings. In the default configuration, a pulse flow sensor is configured on In2. The following parameters are adjustable:



Parameter	Explanation	Ex factory
Alarm %	Limit for alarm notification low flow.	60
Alarm delay s	Alarm delay time in seconds. When this delay is exceeded, an (pre-)alarm becomes active.	300
Dose stop %	Dose stop limit. If the flow falls below this limit, the dosing pumps will be blocked (stop) after the expiry of the dosing stop delay time.	50
Dose stop delay	Dose stop delay time in seconds.	1
Pipe size [mm]	The pipe size (outer diameter) of the pipe in which the flow sensor is placed is entered here.	50
m^3/h at 100%	Nominal flow of the installation.	10

To turn flow measurement on or off, *see chapter 16 Configuration*

Note:
Consult local legislation for the correct parameters and alarm settings!

Note:

If the manufacturer has set the flow channel to Input1 (4-20mA) flow sensor then the table below applies:

Parameter	Explanation	Ex factory
Alarm %	Limit for alarm notification low flow.	60
Alarm delay s	Alarm delay time in seconds. When this delay is exceeded, an (pre-)alarm becomes active.	300
Dose stop %	Dose stop limit. If the flow falls below this limit, the dosing pumps will be blocked (stop) after the expiry of the dosing stop delay time.	50
Dose stop delay	Dose stop delay time in seconds.	1
m³/h at 20mA	Here, the flow is set at 20mA output from the sensor.	10
m³/h at 100%	Nominal flow of the installation.	10

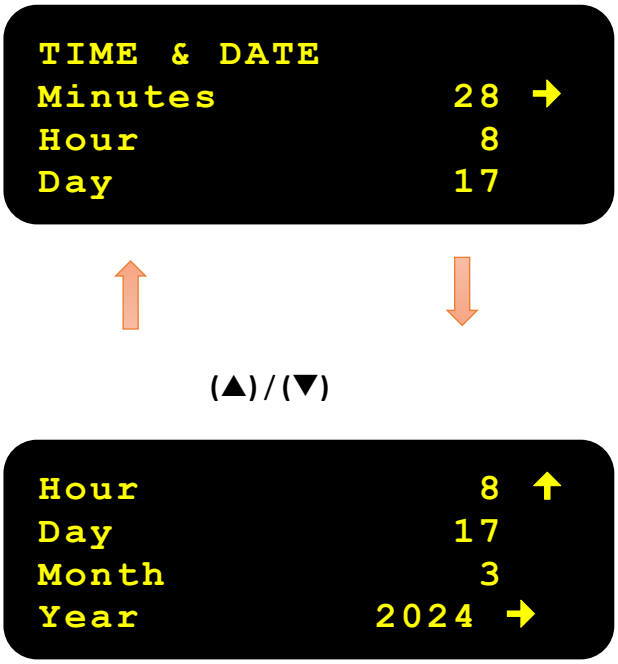
11.4 Time & date settings

Select the **[time & date]** option to set the date and time correctly. The following parameters are adjustable:

Parameter	Explanation	Setting
Minutes	Minutes from current time	0..59
Hour	Hours from current time	0..23
Day	Day of the month	1..31
Month	Month of the year	1..12
Year	Year	20..

Setting the correct time is important because the SPI's operation largely depends on it. If the time is not set correctly, the system will not perform the day and night settings correctly. Also, the date and time of the reports and data logger will not be correct.

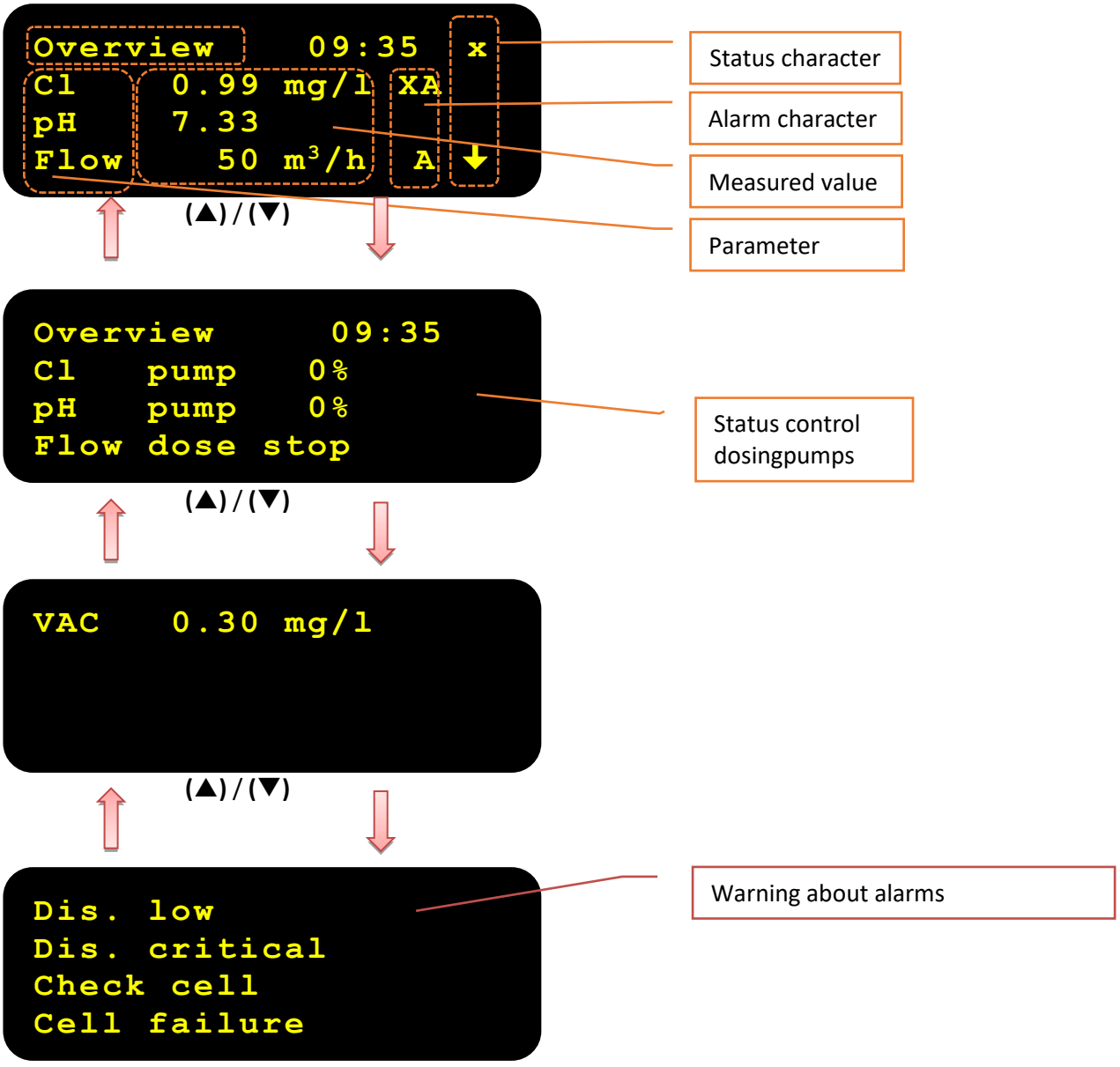
The SPI 170 contains 1 CR2032 battery as power reserve for the real time clock. If it runs low, the date and time are reset in case of power failure.



The default configuration of the SPI 170 is equipped with a day setpoint. If a night setpoint is desired, this must be activated in the configuration menu *see chapter 16*

12.Alarms

If any of the measured values exceeds or drops below an alarm limit, an alarm message will be displayed. In the standard configuration, this is shown by a status character behind the measured value (chlorine, pH, flow) or dosing pump (chlorine pump, acid pump). A character is also displayed behind the time entry. This is a general message.



12.1 Alarm codes and characters

By default, the SPI 170 is delivered with EXPERT MODE (ON)

The following characters may appear on the display:

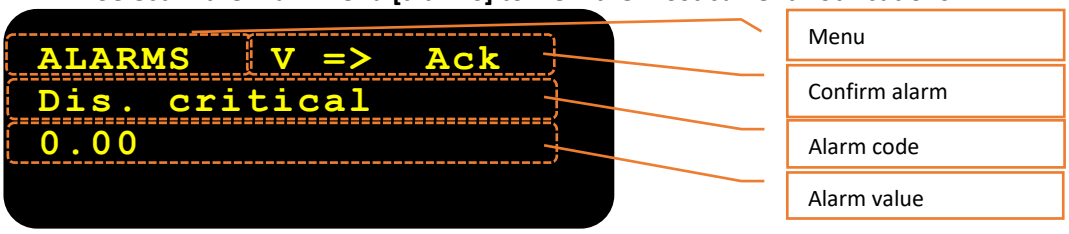
Character	Description	Explanation	Expert mode ON	Expert mode OFF
.	No alarm present	The measurement is within alarm limits. The alarm screen displays that there are no alarms.	X	-
v	Pre alarm	The measurement has exceeded or fallen below an alarm limit. The pre-alarm is now made active and the alarm delay time starts. When the measurement comes within the alarm limits, the pre-alarm disappears.	X	-
A	Alarm active	The measurement has exceeded or fallen below an alarm limit and the alarm delay time has been exceeded. An alarm is then created. The red alarm LED flashes and the alarm relay switches. This alarm is reflected in the *Alarms menu*. A report is also created.	X	-
a	Alarm adjusted	The alarm has been seen by the user and confirmed in the *alarms menu.* The red alarm LED lights up continuously. The alarm is under attention and a solution can be worked on. When the measurement comes back within limits, the alarm expires and the alarm LED turns off. The alarm relay also switches.	X	-
M	Manual	The channel is operated manually. This applies to the dosing pumps, but this can also apply to the flow channel. In this case, flow protection is switched off. More on this in chapter 13.	X	X
X	Controller deactivated	The controller is deactivated by means of an external signal on the disable input (see input configuration chapter 16) Blue LED indication will no longer flash	X	X
x	System off (Controller deactivated)	The controller is deactivated by putting it into maintenance via the [Maintenance] menu. This means that the controller is disabled for maintenance and does not emit alarms.	X	X
S	Semi Automatic	Dosing pumps are controlled at the [manual %] until the desired value is reached. After that, the SPI automatically returns to the [auto] position.	X	X
🔔	Alarm bell (simple display)	The measurement has exceeded or fallen below an alarm limit and the alarm delay time has been exceeded. When the measurement comes back within the limits, the alarm expires and the alarm LED turns off. The alarm relay also switches. A pre-alarm is not displayed.	-	X

By default, the EXPERT MODE of the SPI device is on. If a simple display of alarms is desired without letters but by pictogram (🔔) EXPERT MODE can be deactivated. ***see chapter 16 Configuration, Users. Setting.***

12.2 Confirm alarm (adjust)

If there is an alarm notification, the red status LED on the control panel will flash.

- Select in the main menu **[alarms]** to view the most current notifications.



This menu displays alarm messages in the following format (see screen above):

1. The possibilty to confirm an alarm (adjust).
2. Description of alarm.
3. The value at which the alarm was activated.

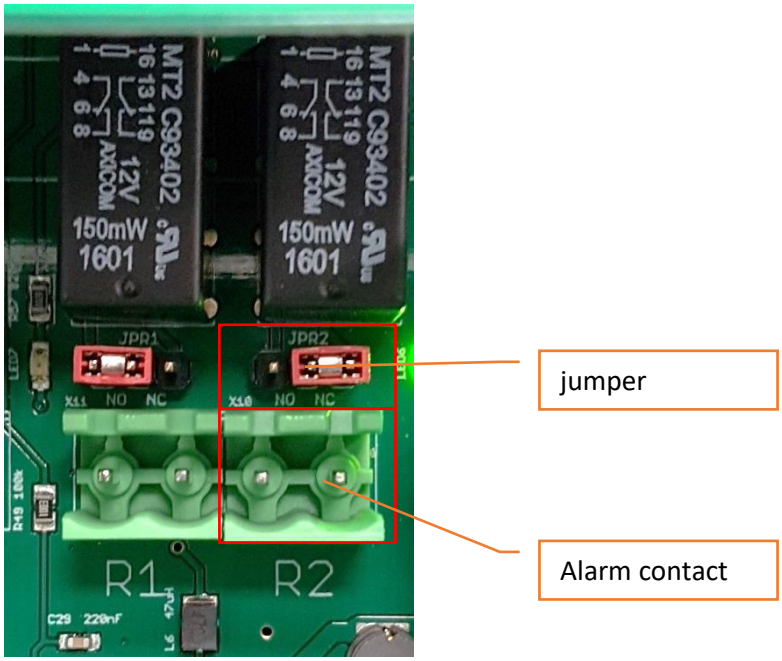
- Confirm the alarm with **(✓).** The alarm is then adjusted and the red alarm LED is then continuously on. Once the alarm is resolved (measured values within the alarm limits), the alarm LED goes off.
- The alarm is recorded in the alarm report *see chapter 14 Reports*
- If all alarms are confirmed, the screen below will appear:

Depending on the alarm, action will need to be taken. See the table below for the explanation of the different codes:

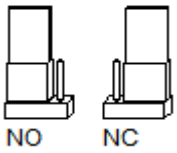
Alarm	Description
Dis high	Disinfection (chlorine) value higher than alarm value
Dis low	Disinfection (chlorine) value lower than alarm value
Dis. critical	Chlorine value very low (too low for reliable measurement)
Dis. Pump	Maximum dosing time (pulse time) chlorine pump exceeded (pump stops)
Check cell	Low zero value of measuring water, measuring cell becomes contaminated
Cell failure	Error in chlorine measuring cell (incorrect zero measurement), controller stops measuring and controlling
pH high	pH value higher than alam value
pH low	pH value lower than alarm value
pH critical	pH value so low that chlorine dosing stops
Acid pump	Maximum dosing time (pulse time) acid pump exceeded (pump stops)
Low flow	Flow lower than alarm value, dosing pumps remain in operation
Dose stop	Flow lower than dosing stop value, dosing pumps are switched off
Circ. Failure	No circulation through measuring cell (no measuring water)
Optional alarms	These are only applicable if configured
Reag. low	Stock of reagents in reagent holder has reached low level
Sys. Disable	System blocked by external signal
Temp. high	If temperature higher than alarm value setting
Temp. low	If temperature lower than alarm value setting

12.3 Alarm contact

The SPI-C170 includes an alarm contact. This is a potential-free contact that can be used to report an alarm to external equipment such as BMS or alarm centre.
See *chapter 5* for electrical connection of this contact.



With jumper CONN21, the choice can be made to use the contact as a normally open (NO) or normally closed (NC) contact. The advantage of a normally closed contact is that voltage failure of the SPI is also detected (failure safe). The contact can be set so that no alarm can be triggered at night. See *chapter 16 Configuration*



12.4 Resolve alarms

With correct use and timely regular maintenance, the fewest hardware-related failures will occur.
For maintenance, see chapter 15.

Problem solving goes as follows:

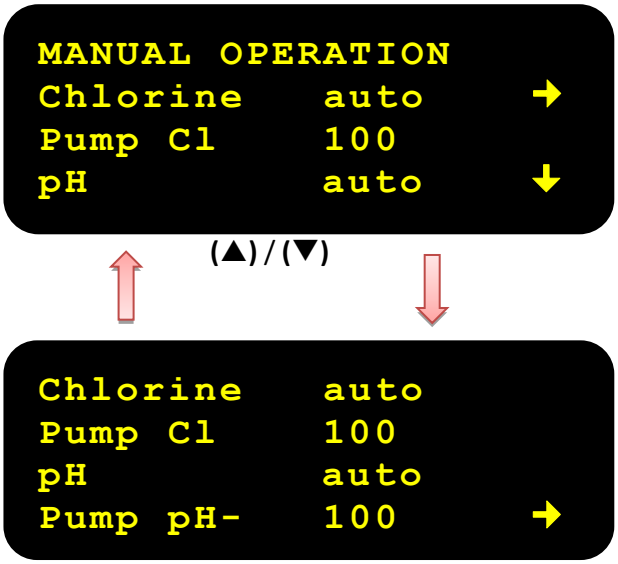
1. Identify the problem, look in the menu **[alarms]** for an active alarm. If the alarm has already been acknowledged, check the menu **[reports]** and then select **[alarm log]**
2. Then, using the list below, investigate what could be causing the malfunction:

Alarm	Possible cause
Dis. high	- Chlorine pump: dosing pump is on manual dosing or pump siphoning - Wrong control settings (P too high)
Dis. low	- Pump settings not correct - Incorrect control settings - Chlorine tank empty - Default in chlorine supply , hose or injection valve blocked, air in hose
Dis. crit	- Dosing pump settings or dosing pump malfunction. - Wrong control settings - Chlorine tank empty - Default in chlorine supply - Reagent tank empty - Chlorine value higher than 10mg/l (DPD bleaching and decolourisation)
Dis. pump	- Dosing pump malfunction or dosing pump settings - Chlorine tank empty - Fault in chlorine supply, injection valve blocked
pH high	- Pump settings incorrect, acid pump at fault, leach pump on manual control - Wrong control settings - Acid tank empty - Default in acid supply, hose or injection valve blocked, air in hose
pH low	- Pump fault, dosing pump is on manual dosing or pump siphoning - Invalid control settings - pH electrode or cable defective
pH crit	- Pump fault, dosing pump is on manual dosing or pump siphoning - Invalid control settings - pH electrode or cable defective
Acid pump	- Dosing pump settings or dosing pump malfunction - Acid tank empty - Defect in the acid supply - pH electrode defective
Low flow	- Circulation fault , circulation pump failed, filter clogged - Flow sensor defective - Incorrect flow settings
Dose stop	- Default in circulation , circulation pump failed, filter clogged - Flow sensor defective - Incorrect flow settings
Check cell	-Measurement cell begins to foul -Measurement cell is contaminated
Circ failure	- Circulation pump or measuring water pump is off - Pre filter is clogged, blockage in measuring water supply, valve closed

13.Manual operation

The SPI 170 can control the dosing pumps fully automatically. However, it is also possible to choose manual or semi-automatic control. This can be practical for testing the control of the dosing pumps or in case of calamities.

From the main menu, select **[Manual operation]** and the following screen appears:



13.1 Modes and settings

The SPI C170 has 3 operating modes by which the dosing pumps can be controlled:

[Automatic mode] (auto) default setting
In automatic mode, the unit controls the dosing of chemicals to the pool according to the measurements taken and the desired setpoint and other control parameters.

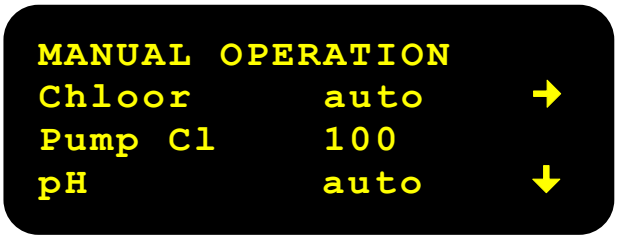
[Manual mode] (hand)
In manual mode, the user sets the dosing of chemicals to the pool. This is a useful tool if the dosing pumps need to be tested or if a problem has occurred with the automatic measurement.

Please note that in this case, the dosing pumps are not controlled automatically and therefore an additional manual check of the water quality is necessary. The recommendation is to use the semi-automatic mode.

[Semi automatic mode] (semi)
In semi automatic mode, the unit controls the dosing pumps at a fixed speed (0-100%), but once the setpoint is reached, the control will switch to automatic mode. When manual or semi-automatic operation is in progress, the yellow MANUAL LED on the control panel will illuminate.

Changing the operating mode is as follows:

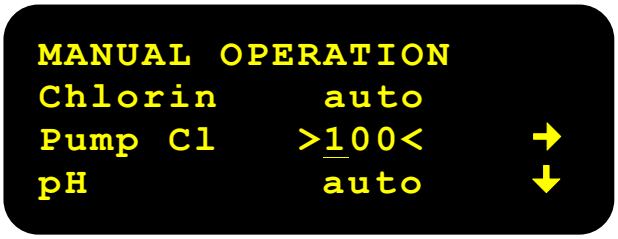
- Place the cursor (→) behind “Chlorine ” and press **(↵)** until the desired mode (auto/ semi/ hand) appears.



Changing the pump control (setting the pulse rate) is done as follows:

- The manual dosing capacity (in %) can be set by placing the cursor **(→)** behind “Pump Cl’’ and press **(↵)**.

Next screen appears :



- Increase or decrease the value between **>….<** with **(▲)** , **(▼)** , **(↵)** and **(◀)** to the desired dosing capacity (0 - 100%)
- Cancel the change with (×) (only possible if the change has not been confirmed with **(✓)**).
- Confirm the selection with **(✓)**.

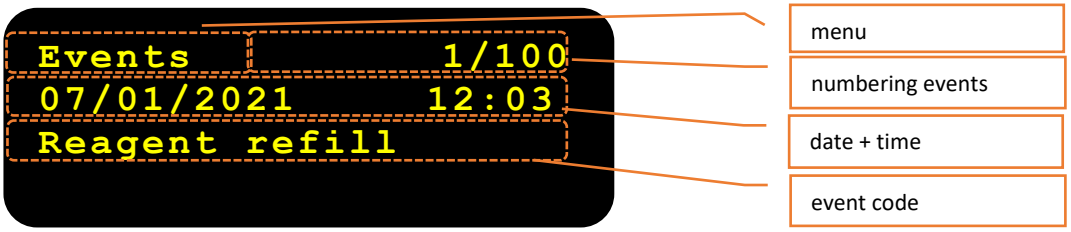
14.Reports

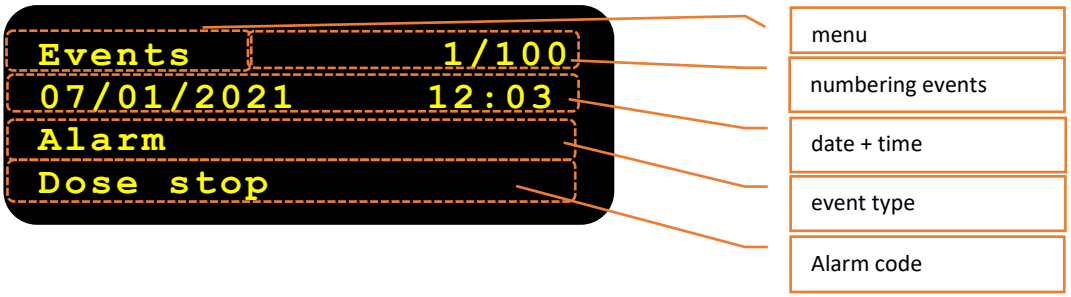
The **[Reports]** menu stores some important data in a logbook. This data is very useful in troubleshooting faults and or alarms. The SPI-C170 creates the following reports:

1. Events
2. Alarm log
3. Cal. log
4. Data log (measurement data)

14.1 Events

Select **[Events]** to view the history of events. The screen below will appear:





Scrolling back to previous records can be done with **(▲).**
To quickly scroll to the oldest record, press (in the screen with the most recent record) the **(▼)**.

See table below for the explanation of the different events:

Events	Explanation
System boot	Reset SPI (equal with on and off power supply)
System disabled	System stopped (via menu or external signal)
System enabled	System activated
System disabled timeout	System activated after being stopped for 1800 sec
Alarm	Aktive alarm
Alarm ack	Alarm confirmed
Calibration dis.	Calibration disinfectant (Chlorine or peroxide)
Calibration dis. reset	Calibration reset (Chlorine or peroxide)
Calibration pH	Calibration pH
Calibration pH reset	Calibration pH reset
Calibration Cell	Cell adjustment
Refill	Reagent aspiration procedure initiated
Changed Acces	Access code changed
Changed Var ……X……	Change of specified parameter X = relevant variable/setting

14.2 Alarm log

Select **[Alarm log]** to view the history of alarms. The screen below will appear:

The log screen shows the most recent notifications with date and time and description.

Scrolling back to previous alarms can be done using the **(▲).**
To quickly scroll to the oldest record, press (in the screen with the most recent record) the **(▼)**. Keep pressing the button to move to a more recent record each time.

See Chapter 12.2 for the alarm codes

14.3 Calibration log

Select **[Cal. log]** to view the history of calibrations (last 10 calibrations).
The log screen shows the most recent record with date and time and a description below it.

Scrolling back to previous alarms can be done using the **(▲).** To quickly scroll to the oldest record, press (in the screen with the most recent record) the **(▼)**. Keep pressing the button to move to a more recent record each time.

Reading out the calibration report:
Below the time and date are the following values:

1. Null (zero value of the sample water)
2. Set (entered value of the current manual measurement)
3. ACT (actual measured value of the SPI)

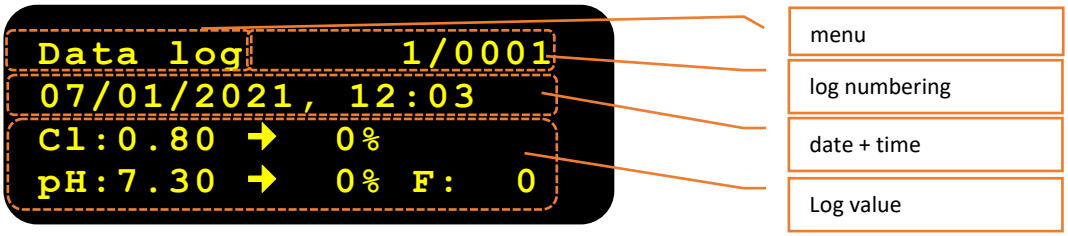
After a calibration, the ACT value (actual value of SPI) will be adjusted to the value of Set (manual measurement).

The screens below may appear :

IJk log	Explantion	Screen
Calibration Cl	Manual calibration performed	Cal. log 1/10 07/01/2023 11:53 0.00 mg/l 0 uA 0.80 mg/l 40 uA
Reset Cl calibration	Reset Chlorine Calibration factors	Cal. log 6/10 07/01/2023 11:53 0.00 mg/l 0 uA 0.80 mg/l 40 uA
pH calibration	Calibration pH	Cal. log 7/10 23/12/2020 11:53 pH = 4.01 191 mV pH = 7.00 - 3 mV
Reset pH calibration	Reset pH Calibration factors	Cal. log 10/10 23/12/2020 11:53 pH = 4.01 191 mV pH = 7.00 0 mV

14.4 Data log

Select **[Data log]** to view the history of measured values and associated control of the dosing pumps.



The log screen shows the most recent message with date and time and below it the measurement values chlorine, pH, flow and pump control (%).

Scrolling back to previous alarms can be done using the **(▲).**
To quickly scroll to the oldest record, press (in the screen with the most recent record) the **(▼)**. Keep pressing the button to move to a more recent record each time.

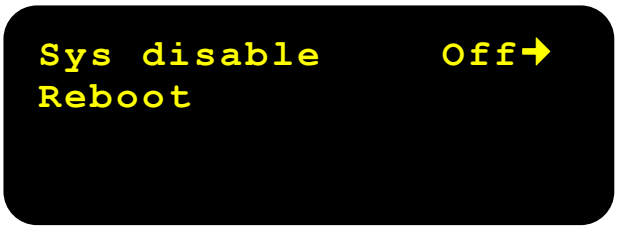
The log period can be set in the menu **[configuration], [Log interval], [Log period].** Factory setting is 900 seconds. This means that a new measurement is logged every 900 seconds (15 minutes).

See Chapter 16.1.6 Log interval

15.Maintenance

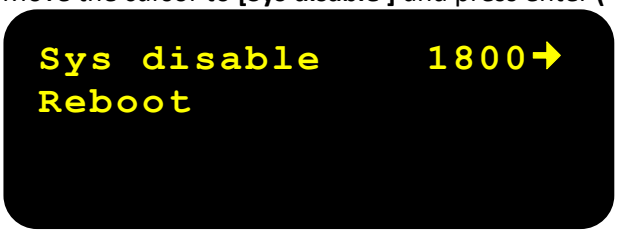
The **[Maintenance]** menu gives access to a number of specific parameters related to the photometric measurement cell. If maintenance is going to be performed on the SPI, the SPI can be stopped. A notification is also made in the SPI's event log. This makes it possible to look back to see when maintenance was performed

Select **[Maintenance] (↵)** and the following menu will be displayed



15.1. System disable

Move the cursor to **[Sys disable]** and press enter **(↵)**. The following screen appears:



The SPI C170 AMP will now stop for 1800 sec and after 1800 sec the SPI will start measuring and controlling again. If you want to stop the timer in the meantime and set **[System off]** to Off again press enter **(↵)**

15.2 Reboot

The SPI can be restarted by the option **[reboot].**

Confirm wiht **(↵).** The controller is restarted.

Alternatively, you can unplug it and put it back after 20 seconds.

15.3 Maintenance schedule

The maintenance schedule below can serve as a guide and is derived from a swimming pool application. The frequency of some maintenance points depends on the application of the SPI, the measurement frequency and the environment in which the unit is placed. As a result, a different maintenance schedule may be necessary.

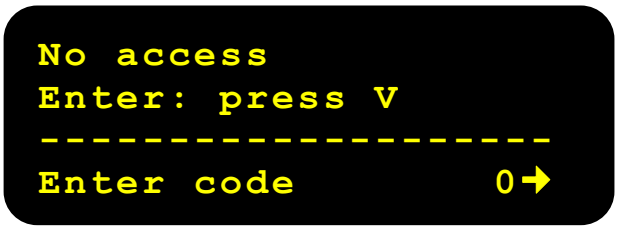
Frequenty	Description of control point
Daily	• Compare measurements of SPI with handmeter • Faults on display • Measuring water flow
Weekly	• Check pH electrode in buffer solution • Cleaning measuring water filter • Compare measurements of SPI with handmeter (if deviations with handmeter then perform calibration)
Montly	• Check pH electrode in buffer solution • Cleaning measuring water filter • Compare measurements of SPI with handmeter (if deviations with handmeter then perform calibration)
Yearly	• Replace pH electrode and buffer fluid; • Replace O-ring set • Replace measuring water filter • Replace copper probe and glass balls
NOTE	Fit only original SPI replacement parts. See annex for a complete overview of all parts of the SPI C170.

16. Configuration

Go to the **[Configuration]** menu to adjust the configuration of the SPI controller. These are settings that are often done only once to set up the controller optimally for the application.

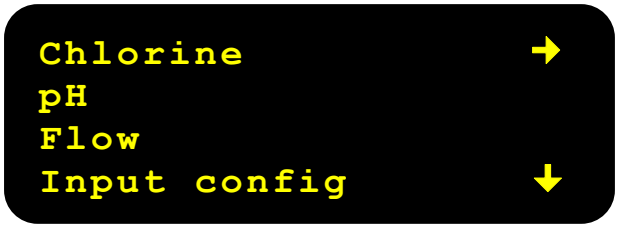
The following items are available in the configuration menu:

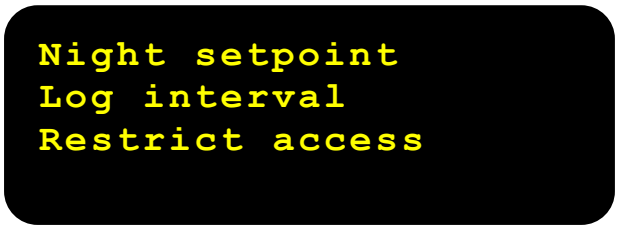
1. System setup
2. User settings
3. System info

Choice	Explanation
System setup *Chapter 16.1*	System setup, here inputs and outputs can be configured. This menu can only be accessed with a dealer code On selecting this option, the screen below will appear: 
User settings *Chapter 16.2*	Here the user settings of the SPI 170 can be changed.
System info *Chapter 16.3*	Here the system info is displayed from the SPI 170

16.1 System setup

In the configuration menu, select **[System setup]** and the items below will be available:





Parameter	Explanation
Chlorine	Menu to change settings in the chlorine controller
pH	Menu to change settings in the pH controller
Flow	Menu to change settings in the Flow controller
Night setpoint	Menu to change settings for additional night setpoint and alarms
Log Interval	Menu to set the event log period
Restrict access	Menu to set an access restriction.

A number of inputs and outputs can be configured in the system configuration menu.
A factory **default configuration** will be delivered according to the table below:

Controller	Setting	Description
Chlorine	On	Chlorine controller for the chlorine measurement
pH	On	pH Controller for the pH measurement
Flow	On	Flow measurement

Input	Setting	Description
In1	None	Disabled, hardware prepared Flow measurement 4-20 mA signal
In2	Pulse	Flow measurement puls signal
In 3	Circ.	Circulation contact

If you want a different configuration for input In1 / In2 / In3, please contact SEM Waterbehandeling BV. If inputs need to be configured differently, it is possible that hardware changes to the jumpers on the SPI print are also required.

A configuration adjustment must be carried out by SEM Waterbehandeling BV. This must be specified in advance when ordering. If this must be done on location, there are costs involved.

16.1.1 Chlorine controller

Select option **[Chlorine]** to change the settings of the chlorine controller.
The screen below will appear:

```
CHLORINE CONTROL.
Active          On
Type            P-I↓
Pump config     PPM→
```

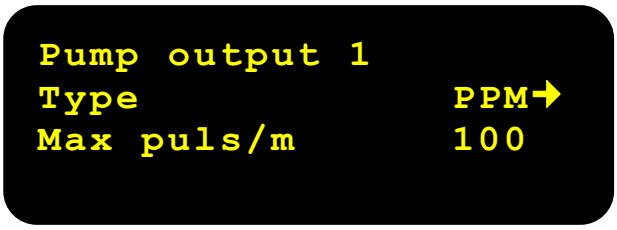
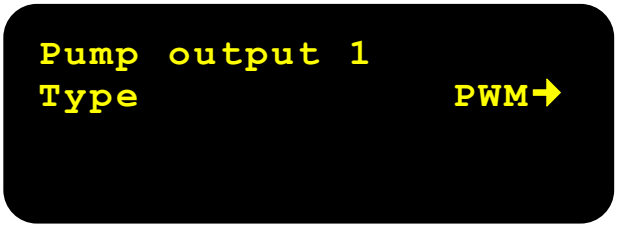
Parameter	Explanation	Ex works
Active	Off = does not measure chlorine (chlorine channel disabled) On = does measure chlorine (chlorine channel enabled)	On
Type	P – I = proportional control with pulses On/ Off = on/off control	P-I

Pump config *	**PPM :** Pulses per minute function where the dosing pump is controlled with pulses. **(recommended default setting)**
	`Pump output 1`
	`Type PPM→`
	`Max puls/m 100`
	Max puls/m: maximum pulse frequency adjustable 0-100 pulses per minute.
	PWM: Pulse width modulation function, period time is 60 sec.
	`Pump output 1`
	`Type PWM→`
		PPM
		
		100

*** This setting is not available if chlorine control type is set to ON/OFF. The chlorine control is ex works set to P-I control (PPM)**

16.1.2 pH controller

Select option **[pH]** to change the settings of the pH controller.
The screen below will appear:

Parameter	Explanation	Ex works
Active	Off = does not measure pH (pH channel disabled) On = does measure pH (pH channel enabled)	On
Type	P – I = proportional control with pulses On/ Off = on/off control	P-I
Pump config PPM *	**PPM :** Pulses per minute function where the dosing pump is controlled with pulses. **(recommended default setting)**  **Max puls/m:** maximum pulse frequency adjustable 0-100 pulses per minute. **PWM:** Pulse width modulation function, period time is 60 sec. 	PPM 100
Dosing	pH - = pH controller dosage is adjusted downwards (ACID) pH + = pH controller dosage is adjusted upwards (LYE)	pH-

*** This setting is not available if chlorine control type is set to ON/OFF. The chlorine control is ex works set to P-I control (PPM)**

16.1.3 Flow measurement

Select option **[flow]** to change the settings of the flow measurement.
The screen below will appear:

Parameter	Explanation	Ex works
Active	Off = does not measure flow (flow channel disabled) On = does measure flow (flow channel enabled)	On

If the Flow measurement is ON, the flow settings can be set via **[Settings], [Flow Main]** *see chapter 11.3*

The flow measurement ensures that there is no dosing if there is no or too little flow.
It is advisable to always have the flow measurement switched on.

Note: if the flow measurement is OFF, this means that the dosing pumps do not switch off when the flow is too low.

16.1.4 Input config

Select option **[Input config]** to change the input channel settings. The screen below will appear:

```
Input channels  →
Measurement Cell
pH measurement
```

Parameter	Explanation

Input channels *	Input configuration
	
	This menu is not accessible for installer or user. This can only be adjusted by SEM Waterbehandeling!
	
	`Input 1: None`
	`Input 2: Flow Main`
	`Input 3: Circ.`
	`OneWire : No devices`

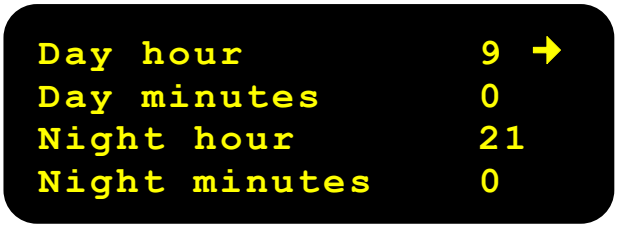
Measurement cell	Adjustment pH input This menu is not accessible for installer or user. This can only be adjusted by SEM Waterbehandeling!
pH measurement *	Adjustment pH input This menu is not accessible for installer or user. This can only be adjusted by SEM Waterbehandeling!

*** When selecting this option the screen below will appear:**

```
No access
Enter: press V
--------------------
Enter code        0→
```

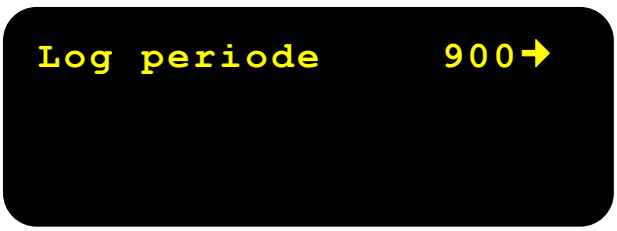
16.1.5 Night Setpoint

Select **[Night setpoint]** to be able to change the settings of the times for the night setpoint. The screen below will appear:

Parameter	Explanation	Ex works
Night setpoint	Off = night setpoint disabled On = night setpoint enabled	Off
Edit times	If night setpoint is set to Off this menu is not available If night setpoint is set to On the following screen will appear:  This menu sets when the day starts (pool is opened) and the night starts (pool is closed). With this setting, different setpoints and alarm values can be used during the day and at night. See *chapter 11.1 chlorine settings 11.2 pH settings for the setpoint and alarm* In the example above, the pool opens at 9:00 and closes at 21:00, then the 'day' settings apply.	

16.1.6 Log interval

Select option **[Log interval]** to adjust the time interval for data storage of the measurement data. The screen below will appear:

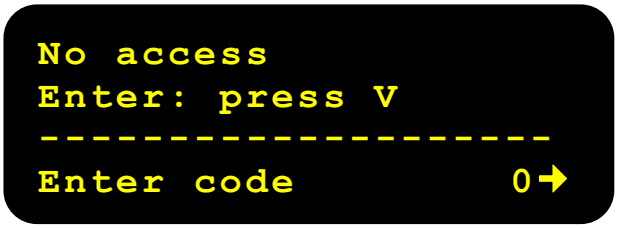


16.1.7 Restrict access

The SPI 170 is secured by default with one code that gives access to the configuration menu (installer). All other menus are accessible as a user. If this is not desirable, an access restriction can be set by activating a user code.
This imposes the following restrictions:

Menu	User	Dealer
Overview	Fully accessible	Fully accessible
Alarms	Fully accessible	Fully accessible
Calibration	Not accessible	Fully accessible
Manual operation	Fully accessible	Fully accessible
Reports	Fully accessible	Fully accessible
Maintenance	Fully accessible	Fully accessible
Settings	Accessible, read-only	Fully accessible
Configuration	Limited access - user settings accessible - system info accessible - reboot menu accessible - system setup. not accessible	Limited access - user settings accessible - system info accessible - reboot menu accessible - system setup. restricted access

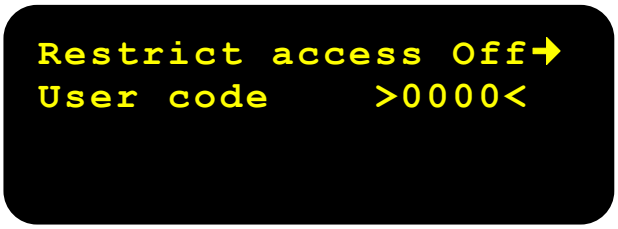
If an access code applies, the screen below will appear:



Entering the access code will give you access to the menu.

Select option **[Restrict access]** to set an access restriction (user code).

In the menu the limitation can be switched on and off (OFF/ON). Also a 4-digit code can be set.
Ex works the restriction is disabled and the code is set to '0000'.

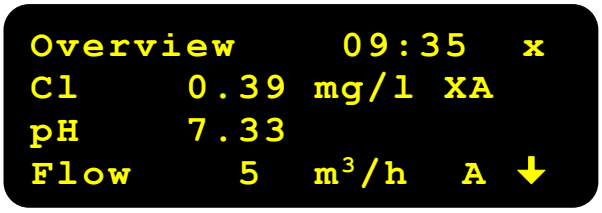
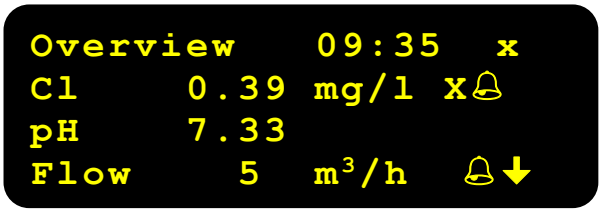


The dealer code is supplied to installers separately from the manual with the SPI 170.

16.2 User settings

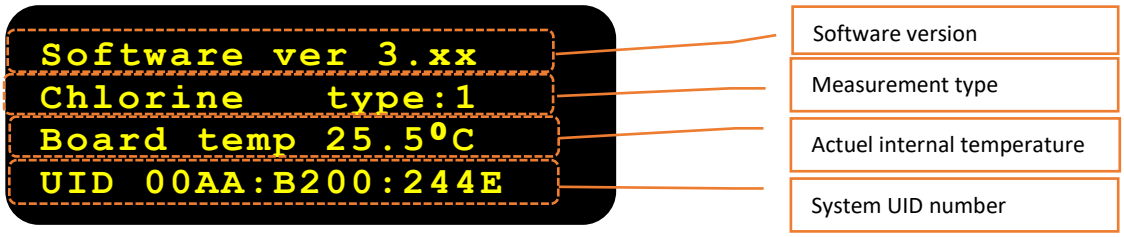
Select **[User settings]** to view or change them.

All settings in this menu can be adjusted by moving the cursor to the relevant setting and changing it with enter **(↵)** . The following settings are possible:

Setting	Explanation	Ex works
Language	There are 3 languages selectable, English (Eng), Dutch (Nl) and French (Fr). The selected language will be visible directly on the screen.	NL
Key beep	Beep (On/Off) when operating the keys on the front foil.	Off
Alarm beep	Alarm beep (On/Off) during an alarm.	On
BL timeout	Backlight (On/Off) for LCD screens. (not applicable for OLED screen)	On
Expert mode	By enabling or disabling this function, an extended display or a simple display of the alarms is possible. See below the different screen options: **EXPERT MODE ON:**  **EXPERT MODE OFF:**  For the meaning of the letters in Expert mode *see chapter 12.1 Alarm codes and characters*	Off

16.3 System info

Select the option **[System info]** to view the system info. The screen below will appear:



16.4 Options and expansion modules

The SPI can optionally be equipped with additional sensors and expansion modules.

- Analog module
- Modbus communication module
- Measuring water sensor
- Temperature sensor

16.4.1 Expansion modules

There are 2 different expansion modules available for the SPI 170:

- Analogue module (for BMS, salt electrolysis or other application)
- Modbus communication module (for communication with MODBUS Master devices, such as BMS, PLC or other systems and SPI Webmonitor via internet)

The SPI has 2 expansion slots and thus space for 2 expansion modules. It is not possible to place two identical modules. It is possible to place both an analog and a modbus communication module.

The procedure for placing the modules is as follows:

- Switch off the mains power;
- Gently press the module into the black connector, making sure all pins of the module fit into the connector on the mainboard;
- Place the white spacers in the expansion module and the corresponding holes of the mainboard;
- Connect the necessary wiring;
- Switch on the mains power;

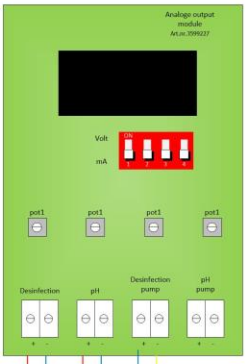
16.4.1.1. Analog module

The analog module contains 4 analog outputs 0/4-20mA or 0-10V.
2 Analog outputs for measured values (pH and chlorine)
2 Analog outputs for dosing pump control signal (pH correction and chlorine)

When connecting the analog outputs, pay attention to the maximum load of the signals:
Maximum load mA range (250 Ohm);
Maximum load 0-10V 10kohm;

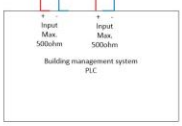
Selection of the output signal is done via dip switches.
The analog module is placed in expansion slot 2 of the SPI 170. The module is automatically recognized. The menu is shown if the module is placed.

NOTE: When inserting the module, the SPI 170 power supply must be switched off!



Scale factor:
Disinfection: chlorine value 0/4-20= 0,00-2,00 mg/l
Disinfection Peroxide 0/4-20=0-100 mg/l
pH: pH value 0/4-20= 6,00-8,50)
Disinfection pump:0/4-20= 0-100%
Acid/base pump:0/4-20= 0-100%
Use the potentiometers pot to pot 4 for the fine adjustement of the channels if necessary.

Connection example:
use preferably cable diameter
2x0,34mm² twisted pair



	SPI 170
	Analoge output module

For analog module settings, go to **[Configuration], [System setup]** the screen below will appear:

```
Chlorine          →
pH
Flow
Input config      ↓
```

```
Night setpoint
Log interval
mA module         →
Restrict access
```

A dealer code is required to access this menu!

Select **[mA module]** to view and/or change the settings of the analog module. The following screen will appear:

```
Outp. 1:  Dis input→
Outp. 2:  pH input
Outp. 3:  Dis pump
Outp. 4:  pH pump
```

Select the desired output and the following screen will appear:

```
mA module: Output 1
Type   :  Dis input →
0/4mA  :  0
min    :  0.00
```

```
Type   :  Dis input
0/4mA  :  0
min    :  0.00
max    :  5.00      →
```

Output	Parameter	Explanation	Af fabriek
1	**0/4**	Minimum output current 0 or 4 mA	4
	min	Lower limit of scaling at 0/4 mA	0.00
	max	Upper limit of scaling at 20 mA	5.00
2	**0/4**	Minimum output current 0 or 4 mA	4
	min	Lower limit of scaling at 0/4 mA	6.00
	max	Upper limit of scaling at 20 mA	8.50
3	**0/4**	Minimum output current 0 or 4 mA	4
	min	Lower limit of scaling at 0/4 mA	0
	max	Upper limit of scaling at 20 mA	100
4	**0/4**	Minimum output current 0 or 4 mA	4
	min	Lower limit of scaling at 0/4 mA	0
	max	Upper limit of scaling at 20 mA	100

Use the (▲) / (▼) keys to scroll through the different parameters.

A configuration adjustment for the mA module must be carried out by SEM Waterbehandeling BV. This must be specified in advance when ordering. If this must be done on location, there are costs involved.

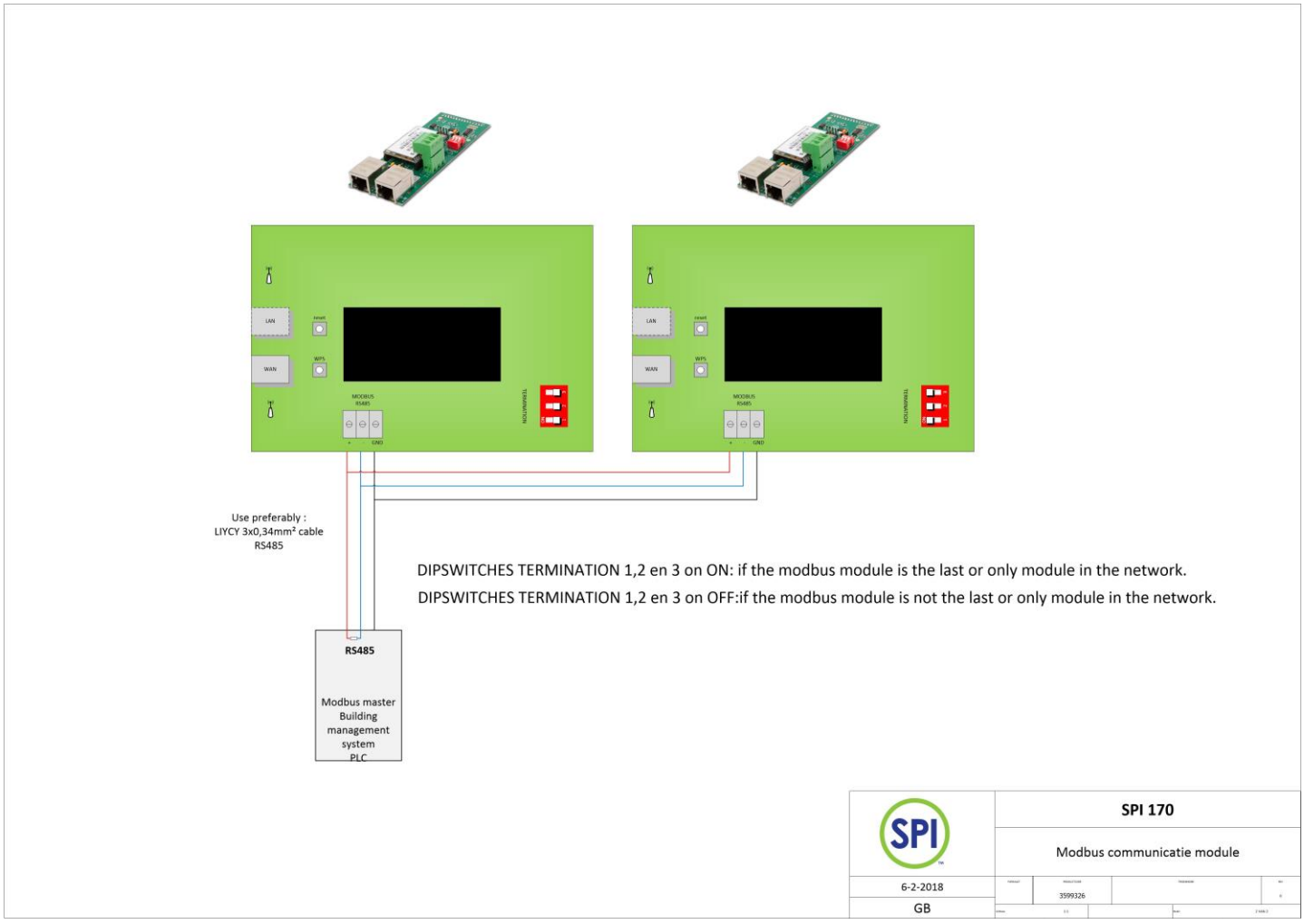
16.4.1.2. MODBUS communication module

The modbus module is connected according to the connection diagram below:

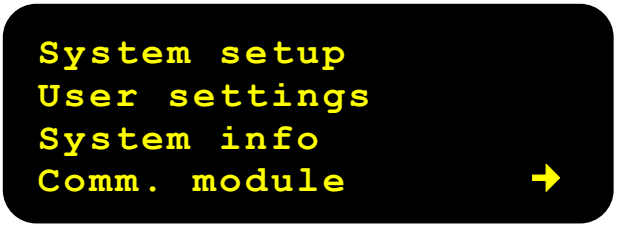
The SPI Modbus module manual, which is supplied with the module, contains all information about configuring and using the module.

The Modbus module is placed in expansion slot 1 of the SPI 170. The module is automatically recognized. The menu is displayed if the module is placed.

NOTE: When inserting the module, the SPI 170 power supply must be switched off!

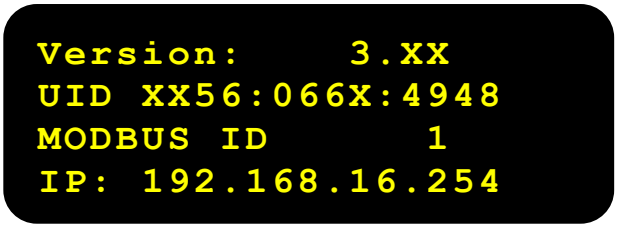


For Modbus module settings, go to **[Configuration]** the screen below will appear:



A dealer code is required to access this menu!

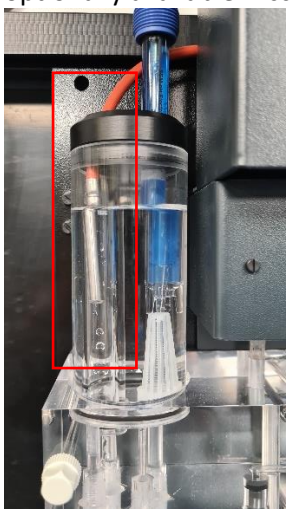
Select **[Comm module]** and the sreen below will appear:



Item	Explanation	Ex works
Version	Modbus module version	-
UID	Unique ID number is shown here	-
MODBUS ID	Modbus ID of the module in combination with controller.	1
IP	If there is a network connection, the IP address will be shown here. If there is no connection, 'NO IP' will be shown here.	-

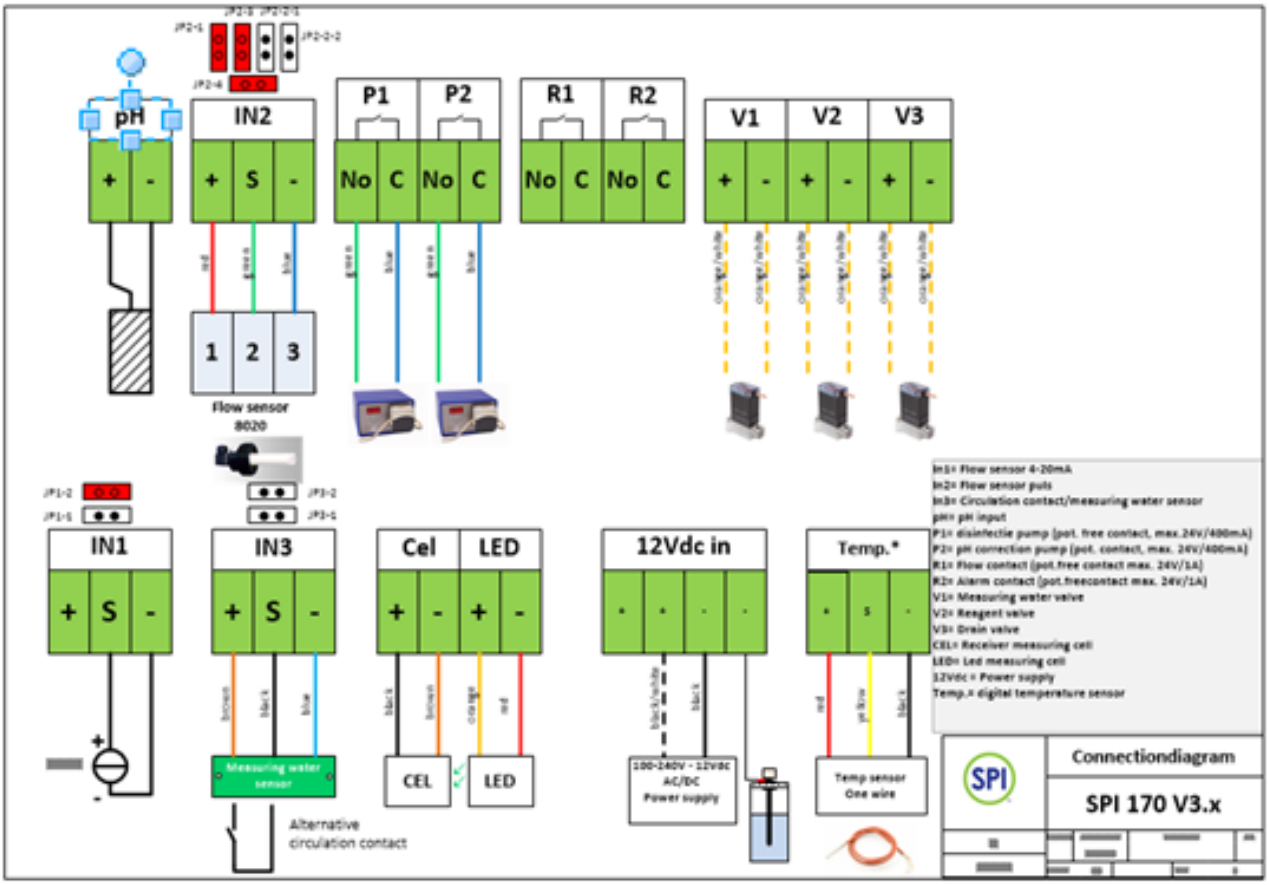
16.4.2 Temperature sensor

A temperature sensor that measures the temperature of the water in the measuring water pot is optionally available. According to the illustration below, the sensor can be installed :

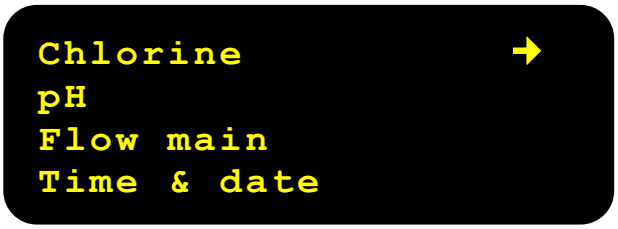


Procedure for electrically connecting the temperature sensor:Schakel de netspanning uit;

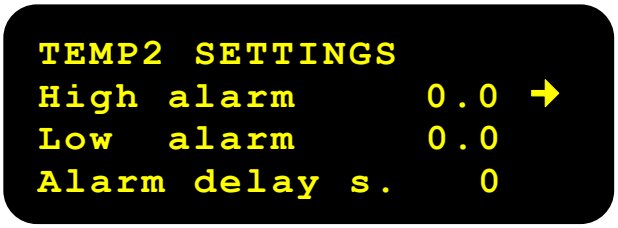
- The temperature sensor (one wire) is connected according to the wiring diagram below;
- Switch on the mains voltage.



Select the menu **[Settings]**. The **[Temp 2]** menu is displayed if the temperature sensor is inserted.



Select **[Temp 2]** to view and/or change the temperature input settings. The following screen appears:



The following parameters can be set :

Parameter	Explanation	Ex works
High alarm	Limit for High alarm temperature value	0.0
Low alarm	Limit for Low alarm temperature value	0.0
Alarm delay sec.	Delay time in seconds. An (pre-)alarm becomes an active alarm after the alarm delay time has elapsed. This prevents short over- or under-running of an alarm value from immediately leading to an active alarm.	0

Use the (▲) / (▼) keys to scroll through the various parameters.

NOTE: If the [TEMP 2] menu is not visible, the SPI 170 should be de-energised. When power is switched on, this sensor will be automatically detected.

17. Decommissioning, transport and storage

17.1 Decommissioning

If you'd like to decommission the SPI-C170 for (longer) periods, follow the below procedure:

1. Remove the reagent supply bottle from the reagent holder.
2. Empty both the bottle and the reservoir.
3. Empty the measuring water pot using the drain valve and remove the dirt trap to allow all the water to drain out of the panel.
4. Remove the pH electrode and store it carefully (remember the protective cap with KCl solution or water).
5. Flush the valves with clean water or when possible with demineralised water. Do this by filling the measuring water jar with this. In particular, the reagent valve should be cleaned thoroughly. This is because the reagent will crystallise as it dries. Do this by filling the reagent reservoir with clean (demineralised) water. Now control the valves a few times. *See chapter 15.2.4. Manual cell operation.*
6. Thoroughly rinse the analysis unit with clean water or demi water and dry it.
7. Clean all hoses with clean water and dry.
8. Before unscrewing the SPI from the wall, all water-carrying parts should be dry.
9. Remove the adapter from the electricity so that SPI no longer has voltage.
10. Dismantle all input cables in the control unit.
11. Dismantle the attached hoses.
12. Unscrew the SPI panel from the wall.

17.2 Transport

- After disassembly, the SPI can be placed in a box with the front of the plate facing up.
- Protect the corners of the mounting plate well against impacts.
- Cover the upward facing parts with padding or bubble wrap.
- Seal the box with tape.
- Make sure the box remains undamaged.

17.3 Storage

During storage of the SPI unit, the space must comply with:

- Moisture free area
- Frost-free area
- Space free of aggressive vapours.
- Room temperature between 5°C - 40°C

17.4 Disposal

The SPI-C170 contains electronic components. Inform to the possibilities to seperate and recycle these components during discarding.

Remove possible chemical remains like Chlorine or the corresponding reagents colour and discard these as chemical waste.

When in doubt, contact your supplier. They are able to serve you with advise.

18. Spare parts

18.1 Spare parts

Part	Description	number
9920500	Torx bit for mounting set SPI-170	1,000
9903590	Washer M6x25mm stainless steel	4,000
9601003	SEM Buffer solution pH 4, 50ml	1,000
9601001	SEM Buffer solution pH 7, 50 ml	1,000
8916001	pH elektrode Hamilton Polyplast, PG13,5 (with cable connector)	1,000
8556110	Box SPI 170 500x500x150 (amperometric + photometric)	1,000
8006008	Delta plug 8 mm	4,000
7106092	Galvanized stud M6x60	4,000
3816440	pH cable for SPI 170 (without plug) 1,0m	1,000
3701016	Earthing amperometric (for production)	2,000
3599274	SPI 170 plate screw 3.5x10 (fastening on backplate)	4,000
3599237	SPI-170 Cap nut M6	4,000
3599294	SPI 170 connection europe power supply 12 VDC (2018)	1,000
3599292	SPI 170 power supply 12 VDC (2018)	1,000
3540178	SPI-170 Measuring water panel (Amperometric)	1,000
3540181	SPI-170 Controller	1,000
3803110	Chlorine measuring cell Pt/Cu transparent complete with Cu and Pt electrode	1,000
1910914	Inox nut M6	4,000

18.2 Accessoiries

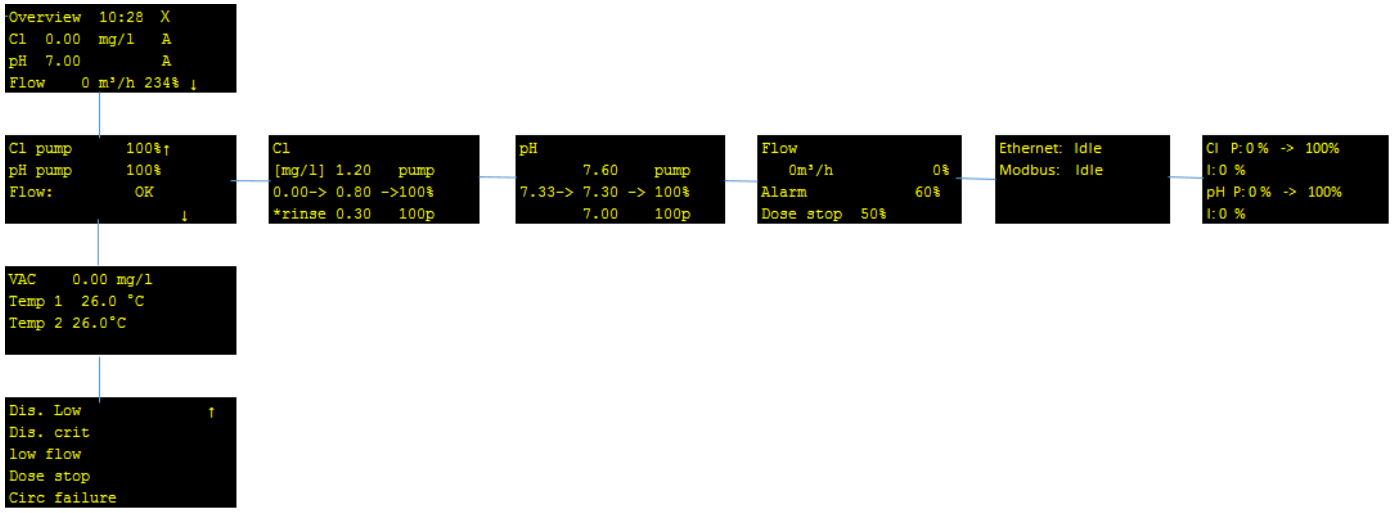
Image	Article	Description	
	3119010	Flow sensor 8020	1,000
	3599518	SEM SPI 170 Temperature sensor 3 wire with 2m cable	1,000
	3599517	PVC sealing plug + cable gland for SPI 170 temperature sensor	1,000
	3599298	SPI 170 Replacement Kit (Amperometric)	1,000
	3599326	SPI 170 MODBUS module	1,000
	3599227	SPI 170 Analog module	1,000
	2513031	Measuring pump set with prefitler and connection kit	1,000

Annex A : Menu structure with factory settings

Main menu

```
Overview
Alarms
Calibration
Manual operation
Reports
Maintanance
Settings
Configuration
```

Overview

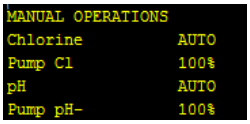


Alarms

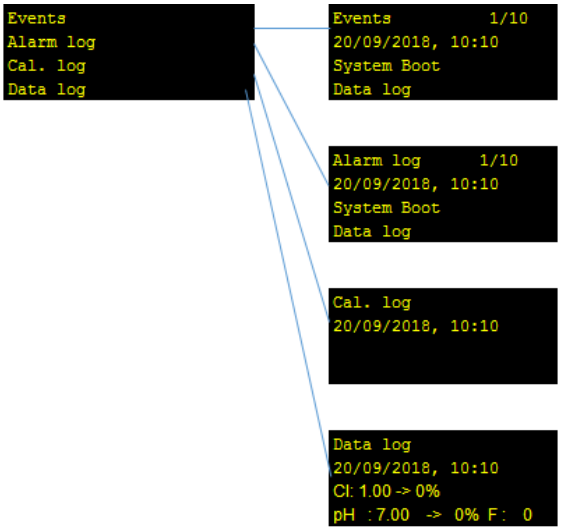
```
Alarms      V=> Ack
Dis. Low
    0.00
```

Calibration

Manual operations



Reports



Maintenance

```
Sys disable        Off
Reboot
```

Settings

```
Chlorine
pH
Flow
Time & Date
Temp1
Temp2
```

```
CHLORINE SETTINGS:
Setpoint
Prop. & Int. Factor
Pump output
```

```
Settings day
Target Value    0.80
Hi alarm        1.20
Lo alarm        0,30
Critical alarm  0,05
Alarm delay s.  1200
```

```
Settings night
Target Value    0.80
Hi alarm        1,20
Lo alarm        0,30
Critical alarm  0,05
Alarm delay s.  1200
```

```
P factor        1.00
I factor        0.00
I time           100
```

```
pump Timeout    7200
pump Min %         0
pump max %       100
```

```
PH SETTINGS:
Setpoint
Prop. & Int. Factor
Pump output
```

```
settings day
Target Value    7.30
Hi alarm        7,60
Lo alarm        7.00
Critical alerm  6,80
Alarm delay s.  1200
```

```
settings night
Target Value    7.30
Hi alarm        7,60
Lo alarm        7.00
Critical alerm  6,80
Alarm delay s.  1200
```

```
P factor        1.00
I factor        0.00
I time           100
```

```
Pump Timeout    7200
Pump Min %      0,00
Pump Max %       100
```

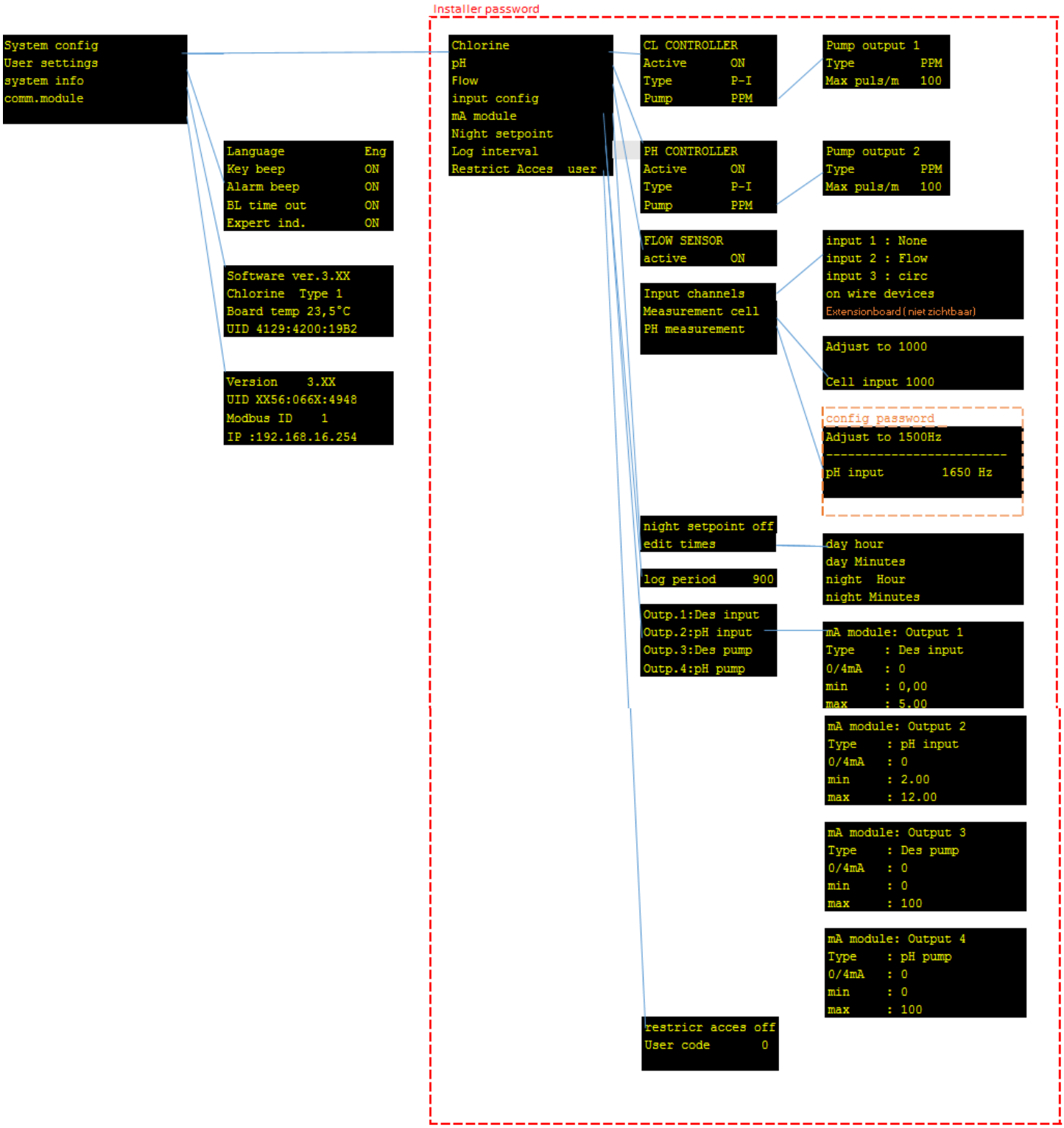
```
FLOW MAIN
Alarm       %     60
Alarm delay s    300
Dose stop   %     50
Dose stop delay s  1
Input 1 settings
Pipe size [mm]    50
m3/h at 100%      10
Input 2 settings
m3/h at 20mA      50
m3/h at 100%      10
```

```
TIME & DATE
Minutes
Hour
Day
Month
Year
```

```
TEMP1 SETTINGS
Hi Alarm        0.0
Lo Alarm        0.0
Critical alarm    0
```

```
TEMP2 SETTINGS
Hi Alarm        0.0
Lo Alarm        0.0
Critical alarm    0
```

Configuration



Annex B : Parameter list

		Factory	MIN	MAX	Settings customer
Calibration/Chlorine	Manuel value	>0.80<	0.00	2.99	
Calibration/pH	Cal pH 7 at 7,00	7.00	6,5	7,49	
Calibration/pH	Cal pH 4 at 4,01	4.01	3,5	4,49	
Manual operation	Pump Cl	100%	0	100	
Manual operation	Pump pH-	100%	0	100	
Settings/Chlorine/Setpoint	Target value	0.80	0.00	9.99	
Settings/Chlorine/Setpoint	Hi alarm	1,20	0.00	9.99	
Settings/Chlorine/Setpoint	Lo alarm	0,30	0.00	9.99	
Settings/Chlorine/Setpoint	Critical alarm	0,00	0.00	2.99	
Settings/Chlorine/Setpoint	Alarm delay s.	1200	0	7200	
Settings/Chlorine/Prop. & Int. Factor	P factor	1,00	0.01	9.99	
Settings/Chlorine/Prop. & Int. Factor	I factor	0,00	0	99	
Settings/Chlorine/Prop. & Int. Factor	I time	600	0	1999	
Settings/Chlorine/Pump output	Pump Timout	7200	10	7200	
Settings/Chlorine/Pump output	Pump Min %	0	0	99	
Settings/Chlorine/Pump output	Pump max %	100	1	100	
Settings/pH/Setpoint	Target value	7,30	0.00	9.99	
Settings/pH/Setpoint	Hi alarm	7,60	0.00	9.99	
Settings/pH/Setpoint	Lo alarm	7,00	0.00	9.99	
Settings/pH/Setpoint	Critical alarm	6,80	0.00	9.99	
Settings/pH/Setpoint	Alarm delay s.	1200	0	7200	
Settings/pH/Prop. & Int. Factor	P factor	1,00	0.01	9.99	
Settings/pH/Prop. & Int. Factor	I factor	0,00	0	99	
Settings/pH/Prop. & Int. Factor	I time	600	0	1999	
Settings/pH/Pump output	Pump Timout	7200	10	7200	
Settings/pH/Pump output	Pump Min %	0	0	99	
Settings/pH/Pump output	Pump max %	100	1	100	
Settings/Flow Main	Alarm %	60	0	100	
Settings/Flow Main	Alarm delay s	300	0	7200	
Settings/Flow Main	Dose stop %	50	0	100	
Settings/Flow Main	Dos stop delay	1	0	7200	
	Input 1 instelling				
Settings/Flow Main	Pipesize [mm]	50	0	315	
Settings/Flow Main	m3/h at 100%	10	0	999	
	Input 2 instelling				
Settings/Flow Main	m3/h at 20mA	50	0	999	
Settings/Flow Main	m3/h at 100%	10	0	999	
Settings/Time & date	Minutes		0	59	
Settings/Time & date	Hour		0	23	
Settings/Time & date	Day		0	31	
Settings/Time & date	Month		1	12	
Settings/Time & date	Year		2000	2999	

		Fabriek	MIN	MAX	Klantinstelling
Settings/Temp 1	Hi alarm	0.0	0	50	
Settings/Temp 1	Lo alarm	0.0	0	50	
Settings/Temp 1	Alarm delay s	0	0	50	
Settings/Temp 2	Hi alarm	0.0	0	50	
Settings/Temp 2	Lo alarm	0.0	0	50	
Settings/Temp 2	Alarm delay s	0	0	50	
Configuration/System setup/Chlorine/ Pump config	Max puls/m	100	0	249	
Configuration/System setup/pH/ Pump config	Max puls/m	100	0	249	
Configuration/System setup/mA module/Outp. 1 Dis input	0/4mA :	4	0	4	
Configuration/System setup/mA module/Outp. 1 Dis input	min :	0.00	0.00	5.00	
Configuration/System setup/mA module/Outp. 1 Dis input	max :	5.00	0.00	5.00	
Configuration/System setup/mA module/Outp. 2: pH input	0/4mA :	4	0	4	
Configuration/System setup/mA module/Outp. 2: pH input	min :	2.00	2.00	12.00	
Configuration/System setup/mA module/Outp. 2: pH input	max :	12.00	2.00	12.00	
Configuration/System setup/mA module/Outp. 3: Dis pump	0/4mA :	4	0	4	
Configuration/System setup/mA module/Outp. 3: Dis pump	min :	0	0	100	
Configuration/System setup/mA module/Outp. 3: Dis pump	max :	100	0	100	
Configuration/System setup/mA module/Outp. 4: pH pump	0/4mA :	4	0	4	
Configuration/System setup/mA module/Outp. 4: pH pump	min :	0	0	100	
Configuration/System setup/mA module/Outp. 4: pH pump	max :	100	0	100	
Configuration/System setup/Night setpoint/Edit times	Day hour		0	23	
Configuration/System setup/Night setpoint/Edit times	Day minutes		0	59	
Configuration/System setup/Night setpoint/Edit times	Night hour		0	23	
Configuration/System setup/Night setpoint/Edit times	Night minutes		0	59	

Notes

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