User Manual

SPI-C170

CHLORINE

Index

Foreword:

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

- Electrotechnical staff
- Watertechnical staff
- Laboratory staff

This manual is made for the installation and operation of the SPI-C170 Chlorine.

In this manual you will find various enumeration characters:

(-) Enumeration of functions
(1.) To be performed actions

- Please read this manual thoroughly
- Only let authorized staff work with the SPI-C170
- Make sure the manual is available for every user
- In case of emergency, please contact your supplier

Limited warranty
This manual is made with care, although SEM Waterbehandeling B.V. is not taking any responsibility according the consequential for any failures made in this manual.

1. Introduction

1.1 Purpose of the SPI-C170

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

The SPI-C170 is suitable for the following sectors:

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

1.2 Important specifications

The most important specifications of the SPI-C170 are:

- Measuring the cChlorine level
- Measuring the pH level
- Measuring the flow
- Controlling the dosing pumps for Chlorine and acid
- Flow protection **(No flow, no dosing)**
- Monitoring of Circulation contact input
- A supply voltage of 12VDC

Specifications of the measurable parameters:

- Chlorine
  Method: reagents colour
- pH
  Method: pH gel-electrode
- Flow
  Method: Via pulse or current sending flow meters like VDO or INEL (if your type isn't mentioned, please contact your supplier)

Measurement	Method	Range	Accuracy
Chlorine	Reagents colour	0 – 5,00 mg/l	± 3 %
pH	Electrode	1 - 14 pH	± 0.05 pH
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 is designed and produced with the greatest care. However, you should take into account that:

- The SPI-C170 makes use of dangerous and harmful chemicals.
- No higher supply voltage than 12VDC is used.

1.4 Background information

After years of collaboration with a team of specialists in the field of water treatment, the SPI measure and control system was introduced. The SPI-C170 is the fourth generation of its kind. The SPI-C170 is a water control system based on the colorimetric measuring method that utilizes reagents colour discoloration. The intensity of the discoloration after a measurement with the reagent is a measurement of the quantity of Chlorine in the water. The greatest advantage of colorimetric measuring is that it is not affected by external factors like pH and flow.

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%
- No condensation

2. Description and operation

2.1 Description of the SPI-C170

The SPI-C170 is supplied and preassembled on one assembly plate provided with:

- 1 Control-unit
- 1 Analysis-unit

Dimensions (L x W x H) = 480 x 480 x 100 mm

All parts are preinstalled either water technical or electro technical. See *figure 2.1.1.*

2.2 Operation of the SPI-C170

The sample water is fed into the buffer jar. The buffer serves, as the name implies, as a buffer from where the water can flow to the measuring cell. The surplus water will flow back to the pool's buffer system. The SPI-C170 will run the measurements of the water within a freely adjustable time. See *figure 2.2.1.*
The measuring cycle of the SPI-C170 is as following:

- Empty cell of previous measurement
- Fill cell with the sample water and empty once more (rinse)
- Fill cell with to be measured water and start measuring the zero value and empty again
- Provide a shot of reagent, and fill the cell with a limited supply of water, measure the discoloration
- Fill the cell with some extra water and measure the discoloration again (2^{nd} measurement to check the saturation of the reagent, and to adapt the reagent valve time to save reagent), then empty cell
- Fill cell with the to be measured water and empty once more (rinse)
- Fill cell fully with water

The drain valve empties the cell after every step. That water exiting the cell is led to the sewer.

2.3 Software structure of the SPI-C170

The SPI-C170 makes use of easy to use operating software. The complete operation is executed using the buttons on the unit. The display shows measured values and settings. The hardware features an internal memory wherein data, reports, and calibration settings are stored. This data is available on demand and provided with a date and time of occurrence. When you have the optional SPI-REMOTE software, it is possible to control and see the information of the SPI using a network or internet connection. With the optional SPI-GRAPHS software, you can use the data downloaded with the remote software and use this for data acquisition.

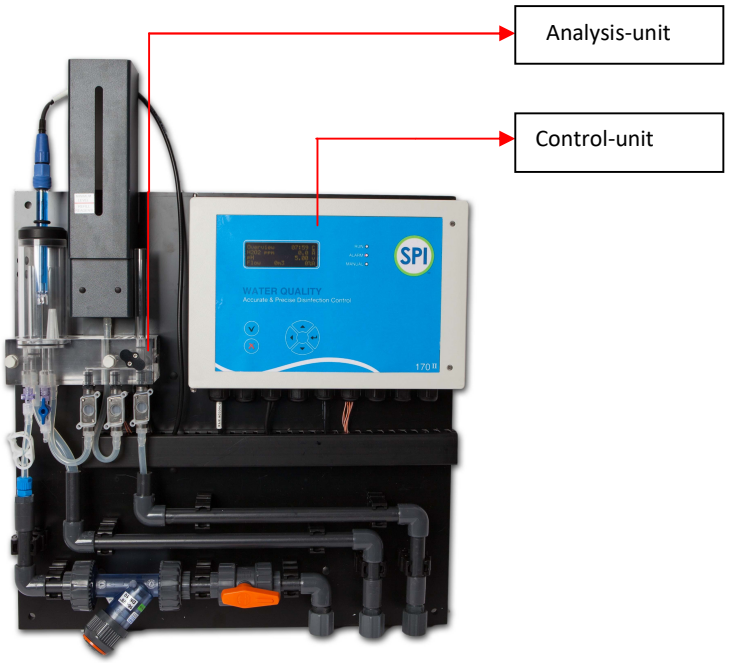


Figure 2.1.1.

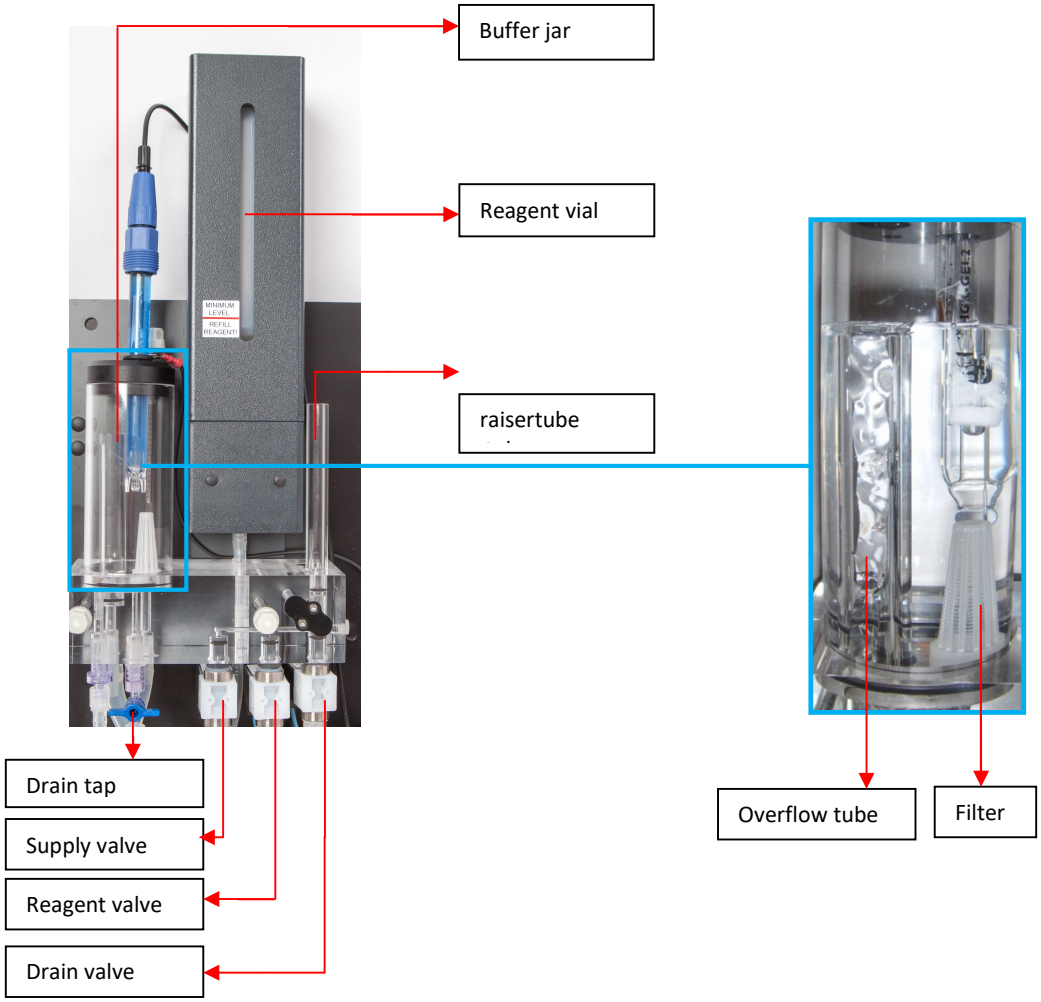


Figure. 2.2.1

3. Safety

3.1 Safety regulations

The SPI-C170 is as careful as possible designed with the eye on safety. We tried to reduce the safety risks to a minimum.

- The SPI-unit is supplied with a 12VDC adapter via a power outlet.
- While the SPI-unit and the analysis-unit are placed next to each other, the water is not interfering with the electrical systems.
- Using the remote software (optional) youre dealer is ableto provide remote assistance

3.2 Risks

To provide risks, be caurefull with:

- Refilling the reagent
- Cleaning spilled compound
- Store reagent in a cool, dark environment, provided with instructions.
- Keep the SPI-unit and the analysis-unit clean from any remaining reagent, because this will create stains with time.

3.3 Personal protective equipment

- while in direct contact with the reagent, wear safety glasses, latex gloves and protective clothing.

4. Transport and storage

4.1 Disassembly

To disassemble the SPI-C170, follow the next procedure:

1. Remove the adapter from the power outlet so that the unit is powerless.
2. Remove the reagent vial from the holder (watch out for spilling reagent from the tube).
3. Empty the reagent vial, and seal it with the cap.
4. Empty the buffer jar using the drain tap.
5. Remove pH electrode and store this for later use (don't forget the protective cap with KCl-solution).
6. Flush the valves with clean water or when possible, distilled water. Do this by filling the buffer jar with water. Especially the reagent valve needs extensive cleaning. The reagent will cristalize when it dries. Do this by replacing the reagent vial with a container of clean water. Now control the valves a few times. See chapter *10.1.4.3 Times & test*, and for the reagent valve *chapter 10.1.4.2.*
7. Flush the analysis-unit well with clean water, then make sure the unit is empty and dry.
8. Clean all tubes with clean water and dry.
9. Remove all inserted cables from the SPI-unit.
10. Before the taking the assembly plate off the wall all parts should be dry.
11. Take the SPI-unit off the wall.

4.2 Transport

1. After disassembly, make sure the SPI-unit is placed in a firm box, with the components facing upwards. This may also be standing upward.
2. Protect the corners well from impacts.
3. Cover the upward facing components with filling or air foil.
4. Close the box with tape.
5. Make sure the box remains free from damage.

4.3 Storage

While storing make sure the environment meets the following requirements:

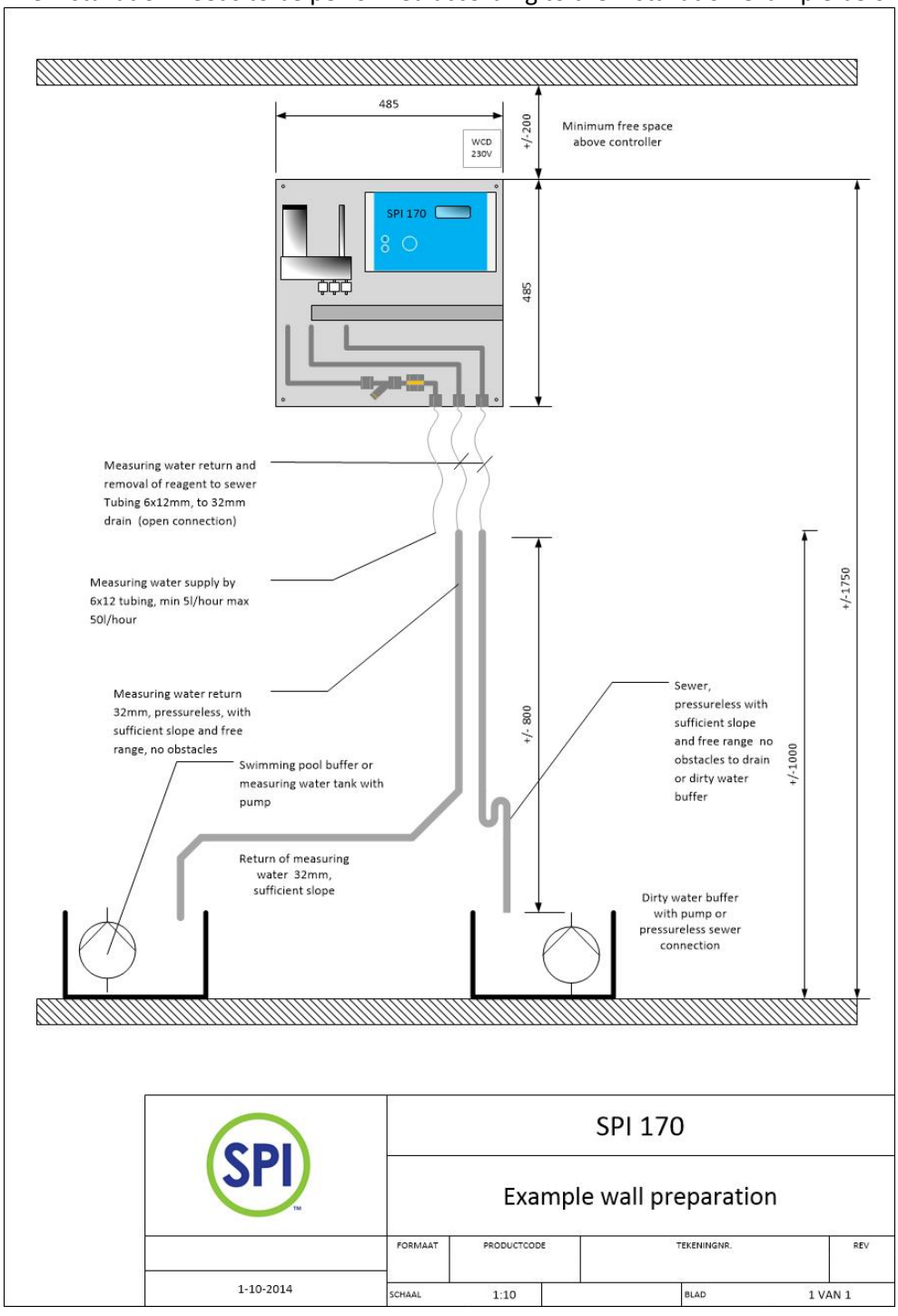
- Moisture free
- Free of corrosive vapours
- Temperature between 5°C - 40°C

5. Installation

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

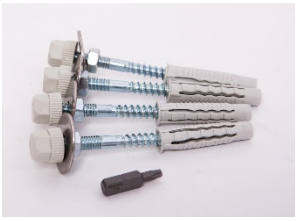
5.1 Mounting and water-side connection

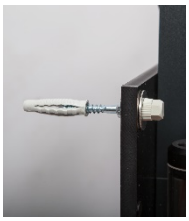
The SPI-C170 is complete preassembled on a pannel provided with the units as named in chapter 5.1. The installation needs to be performed according to the installation example below.



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





5.2 Water-side connection

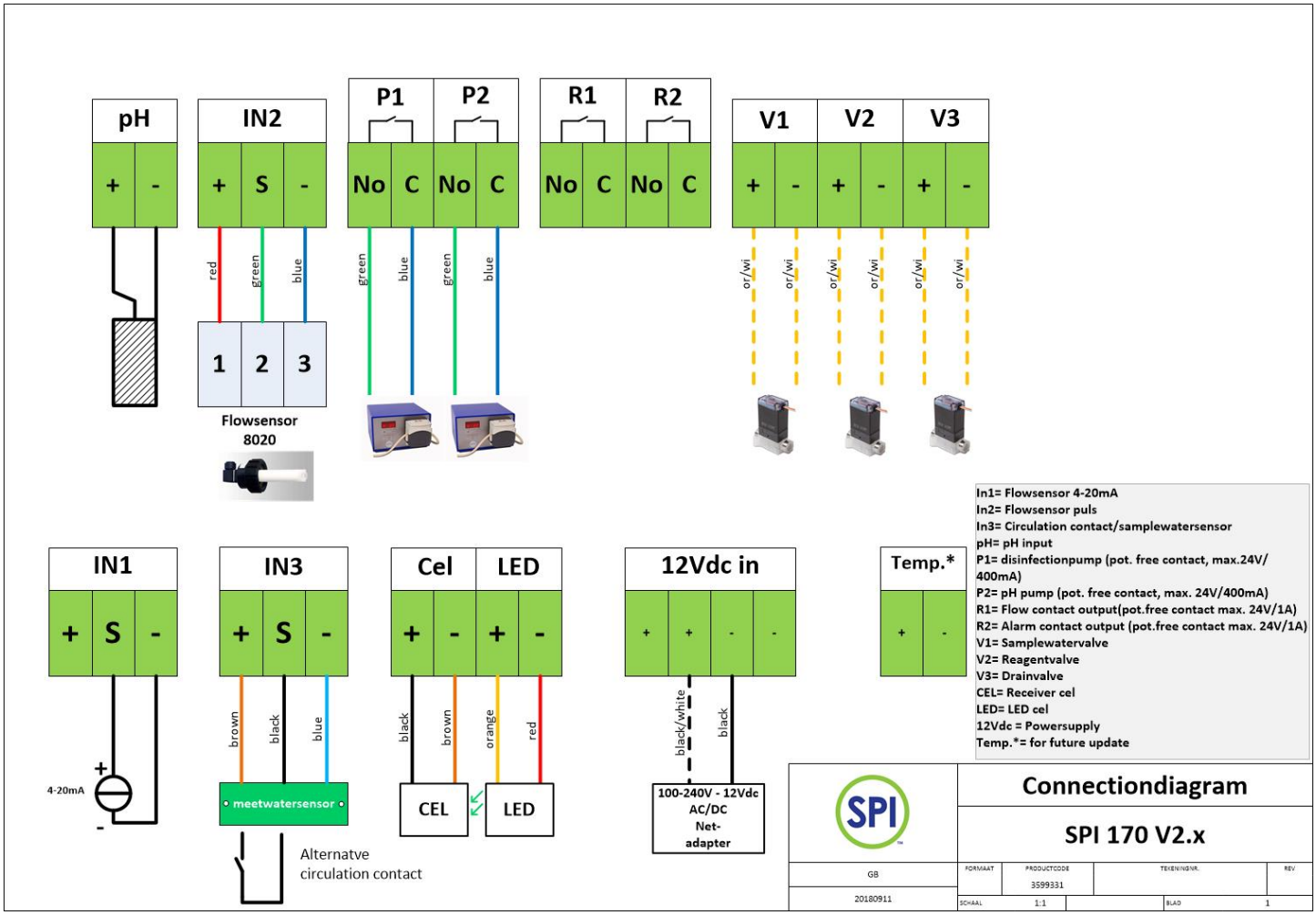
1. Connect the water supply to the water supply connection with reinforced tube 6x12mm,
   Bring the return measuring water without pressure to the bath, (intermediate) buffer, skimmer or sewer. Optionally, return the measuring water to a tank with a submersible pump that pumps out the water. See chapter 19 Accessories SPI regulator.
   Make sure there is enough slope, so no air bubbles can accumulate that impede the flow.

Water supply	Return water	Drain reagent

2. Connect the drain reagent with reinforced tube 6x12mm to a drain. Make sure there is enough slope.
3. Remove the red plugs in the measuring pot and the raiser tube before commissioning. If the SPI is not immediately operational, leave the red plugs in place. Be sure the SPI measuring cell and measuring pot is protected against dust or dirt. Dust or dirt can damage the valves and measuring cell.
4. If the supply and return line are connected, the measuring water supply can be opened. Ensure for sufficient flow (minimum 5 l / h). If the water runs off quietly via the overflow pipe the flow is sufficient. Advice is about 20-50l / hour for sufficient flow in the measuring water pipes.
5. The SPI can now be connected electrically, *see chapter 5.3*
6. Put the SPI into operation, *see chapter 6*

5.3 Electrical connection

Connect the cables of the control unit according to the connection diagram below.
A number of inputs and outputs can be configured in the system configuration menu. In the table on the next page describes 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)

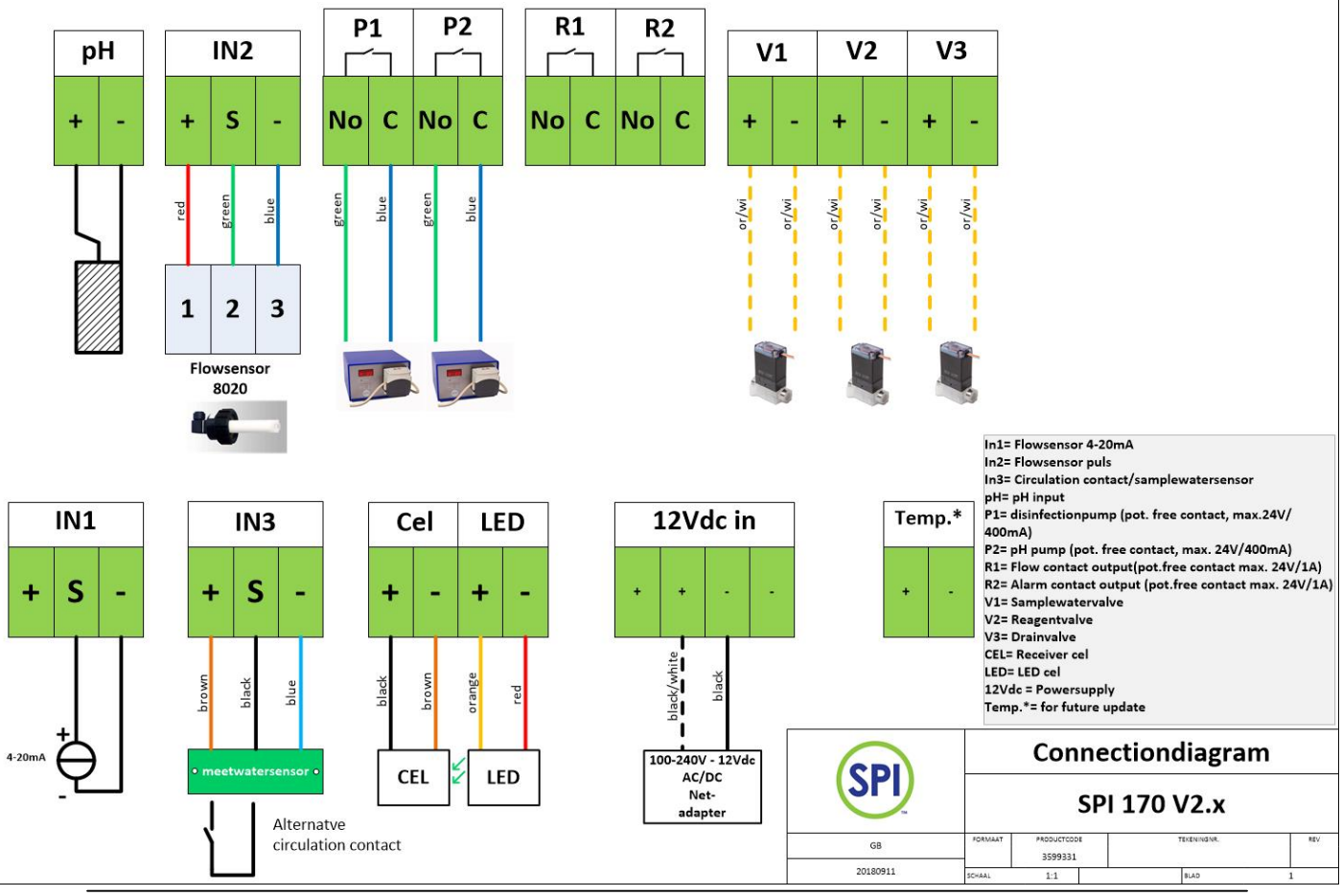
R1	Flow alarm contact	Relay contact max 24V / 500mA. This relay contact can be used for the release of metering pumps and heating (protection at low flow). The contact closes as soon as the flow is sufficiently high. The contact can be configured as normally opened or normally closed by means of a jumper. 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*

5.4 Optional measuring water sensor

Optionally, a capacitive measuring water sensor is available that allows the flow of the measuring water guarded. If it is mounted on the panel, the yellow LED on the sensor light up by sufficient flow. *See the electrical connection diagram below.*

On the table on the next page describes all connection points.



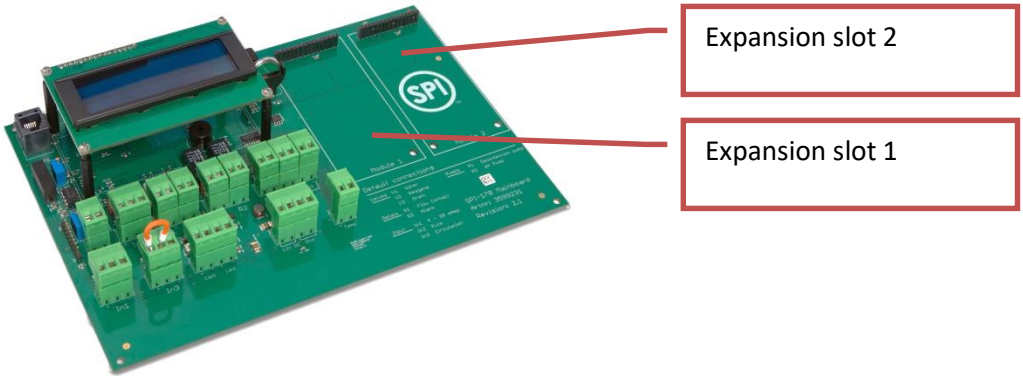
5.5 Expansion modules

There are 3 different expansion modules available for the SPI 170:
Analog module (for GBS, salt electrolysis or other application)
Modbus communication module (for communication with MODbus Master devices, such as GBS, PLC or other systems and SPI remote via internet)

The SPI has 2 expansion slots and so has space for 2 expansion modules. It is not possible to to place two equal modules. However, it is possible to use both an analog and a communication module.

Procedure for placing the modules is:

- Switch off the power supply;
- Carefully press the module into the black connector, ensuring that all the pins of the module are inserted the connector of the mainboard fall;
- Place the white spacers in the expansion module and the corresponding holes from the mainboard;
- Connect the necessary wiring;
- Switch on the power supply.

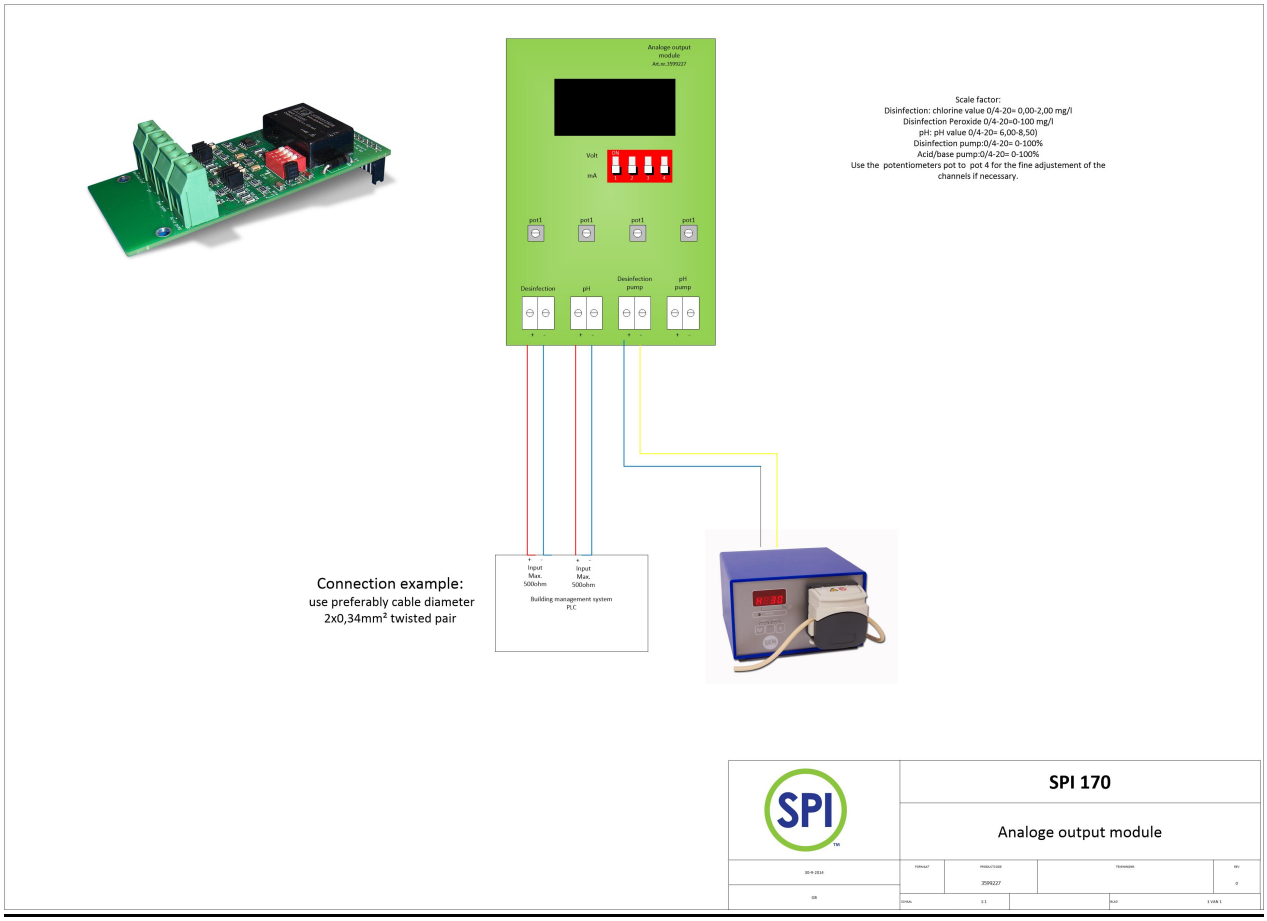


5.5.1. Analoge module

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

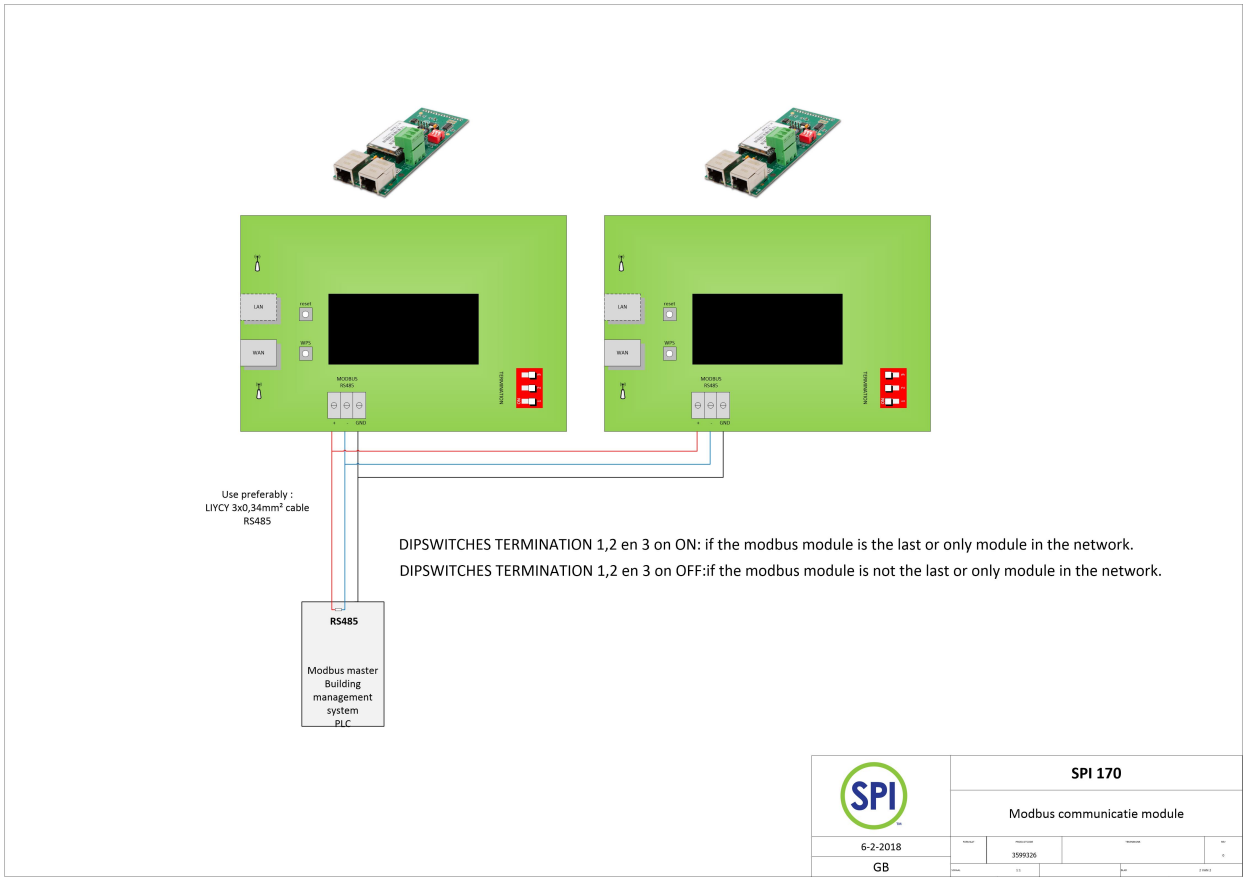
When connecting the analog outputs, pay attention to the maximum load of the signals:
Maximum load mA range (250 Ohm);
Maximum load 0-10V 10kohm;

Selection of the output signal is by dip switches.
The analog module is placed in expansion slot 2 of the SPI 170. The module is automatically recognized. Setting and configuration can be done in the [Configuration] menu [mA Card]
See chapter 16 Configuration.



5.5.2. MODBUS module

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



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

6. Commissioning

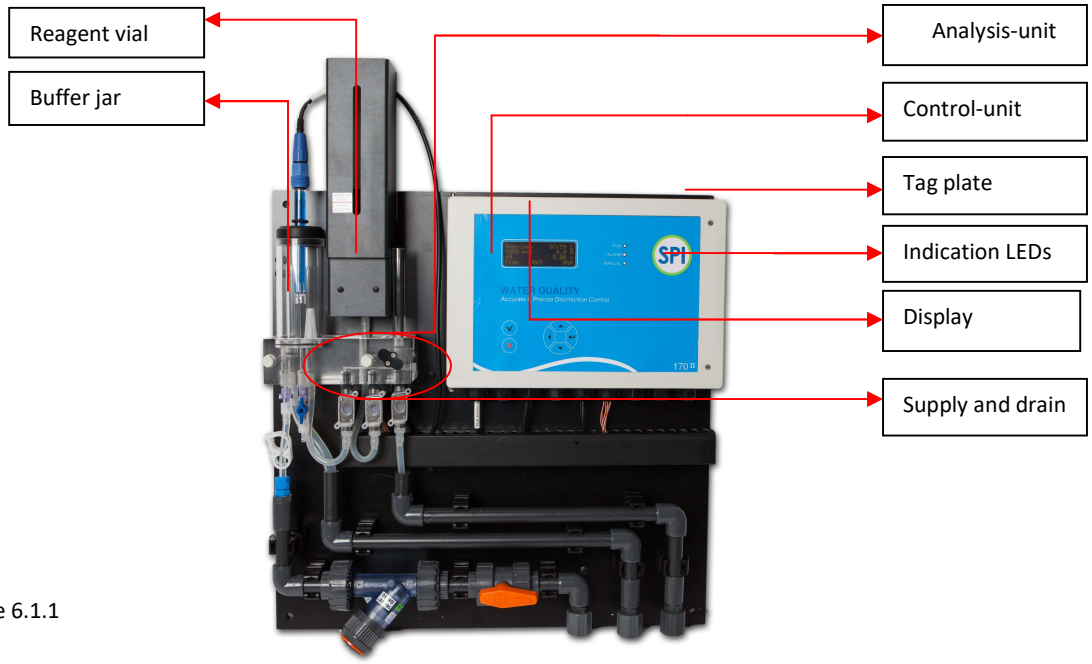


Figure 6.1.1

6.1 Turning on the SPI-C170

The following procedures are to be followed to turn on the SPI-C170:

1. Put the 12 VDC adapter in the power outlet.
2. The boot screen appears on the display. The current software version is also displayed. See *figure 6.1.2.*

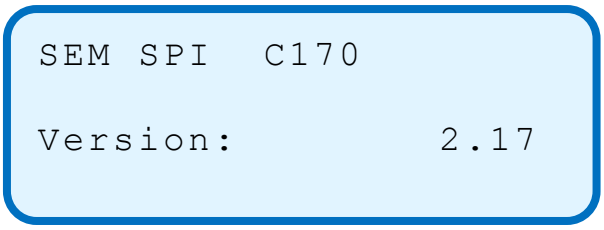


Figure 6.1.2.

6.2 Language choice

The SPI-C170 can be set to work with various languages. More about this can be found in chapter 15.4.

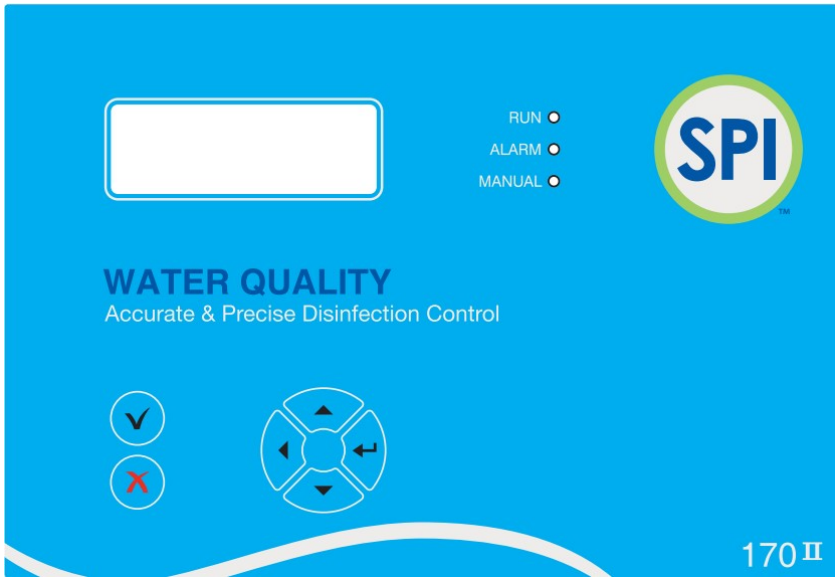
6.3 Indication LEDs

After the SPI-C170 has configured itself, the blue LED will start flashing.
On the front panel of the SPI-C170 control-unit are a total of 3 LEDs. The explanation of these LEDs are as following:

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.

! The images of the screens in this manual are for presentation and indication only. The shown values and settings may not be correct for your situation.

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.

! **To return to the main menu after every step, press (×).**

7.2 Selecting a choice

When you made a decision in the menu, you can select and enter this option by navigating the cursor to the correct line using the arrows. This cursor is always at the end of the sentence, and will flash. Most often, the indication that you can enter a next menu is done with the '**>**' symbol. When you select this symbol with the cursor and you press enter, you will go into this menu. Going back is always done with the left arrow **(◀)**.
See *figure 7.2.1.*

Figure 7.2.1.

7.3 Changing a value or setting

When a value or setting needs to be changed, and you press enter on that specific setting, a special menu appears. This menu displays the current setting, as well as the minimum and maximum settings this value can have.
With the cursor **(▓)** you select what digit to change, and you use the up **(▲)** and down **(▼)** buttons to modify the value. If you have made your choice, you press the tick **(✓)** button to confirm and safe. If you want to cancel and not safe the setting you press the cross **(✘)** button.
See *figure 7.3.1.*

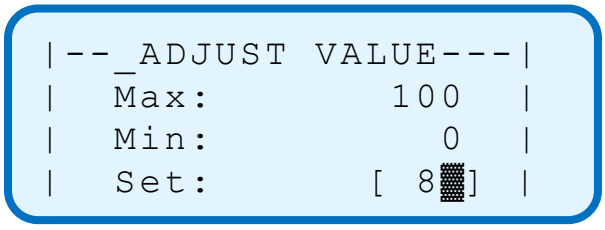


Figure 7.3.1.

8. Main menu

Using the main menu, all important functions of the SPI-C170 can be reached. The main menu is what you get to see after starting the SPI-C170, and is where you always get back to. The main menu consists of the following options: See *figure 8.1*.

Menu	Explanation
Overview	The most important measurements and current alarms are displayed
Calibration	Calibrate the controller (Chlorine, pH) for precise measurement
Settings	Setting of all control parameters and alarm limits.
Alarms	The active alarms as soon as they occur. All alarms can be adjusted in this menu.
Manual operation	In this menu can be set and enable automatic, semi-automatic or manual mode.
Report	The historical reporting of alarms, calibrations, maintenance and measurement data (data logger).
Maintenance	An operating mode were no alarms are reported. This is useful during maintenance.
Configuration	Configuration shows all system settings

The main menu is where you end up after pressing the cross **(✕)** button.

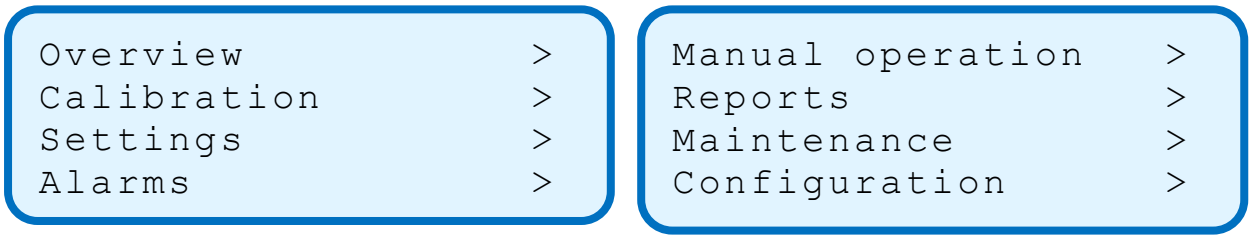
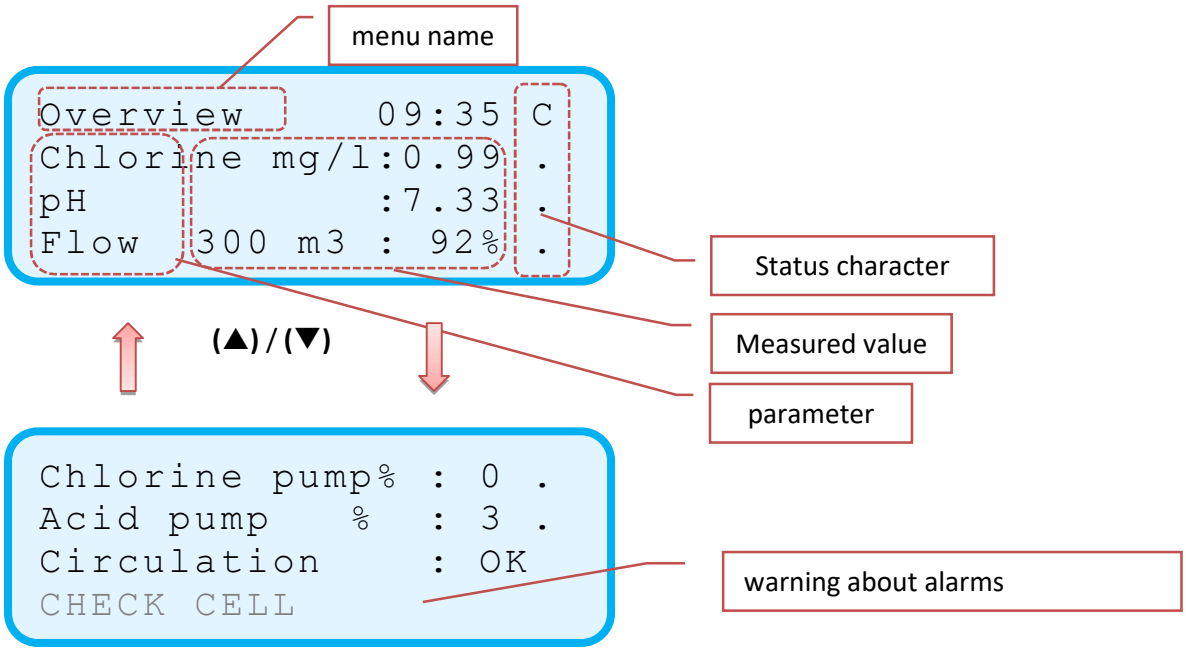


figure 8.1.

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 0.99mg / 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).

The following status characters can occur (for more information 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]**
M	Manual mode active
X	Measuring channel switched off
c	Measuring cell becomes contaminated
C	Measuring cell is contaminated

10.Calibration

All measurements connected to the SPI-C170 must be regularly checked and, if necessary, be calibrated. This ensures the quality of the measurements made. You can enter this menu by selecting *Calibration* from the main menu.

Calibrating the measurements is done by using calibrated third party equipment. The following measurements can be calibrated on the SPI-C170 Chlorine:

- Chlorine
- pH

See *figure 10.1.*

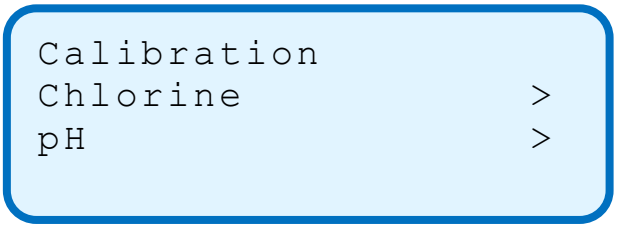


Figure 10.1.

10.1 Chlorine

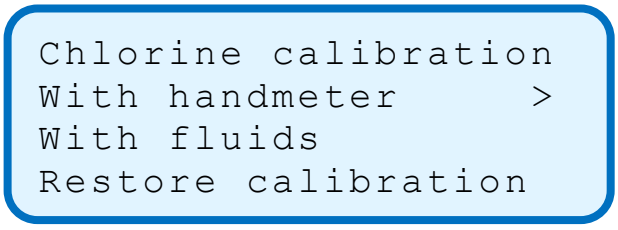
At the procedure of calibrating Chlorine you are able to choose between 2 different methods of calibration:

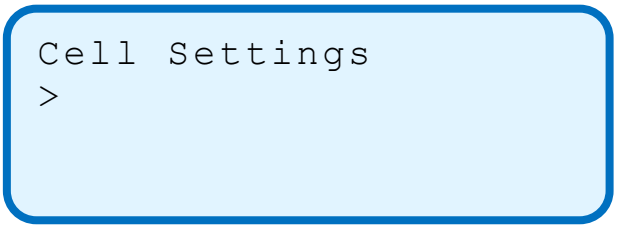
- With handmeter (a relatively fast method to calibrate Chlorine measurement using a handmeter)
- With fluids (a method to calibrate the Chlorine measurement using professional calibration fluids)

Next to calibrating you can also choose for:

- Restore calibration (restores the calibration settings to the factory settings)
- Settings (various settings for controlling the valve times, checking the current cell values and refilling the reagent vial)

See *figure 10.1.1.*





10.1.1 Calibrating with handmeter

When you select Calibrating *with handmeter* the menu as in *figure 10.1.1.1* will appear. Here you can perform a calibration using a third party handmeter. Now perform the following instructions:

1. Take a sample from the drain tap under the buffer jar and measure this with the handmeter. Refer to the handmeter's instructions here.
2. Compare the value of *Current* with the measurement of the handmeter.
   If there is a big difference between the current and metered values, press enter **(↵)**.
3. You now get to see the *Adjust Value* screen where you must enter the correct metered value at *Set*
4. Press the tick **(✓)** now.
5. The measurement has been calibrated.

! Start calibrating the measurement only after at least one measurement has been performed. Otherwise this could cause a wrong calibration.

```
Hand calibration
SPI       : 0.69 mg/l
Manual    : 0.65 mg/l
Press (V)to save
```

Figure 10.1.1.1.

10.1.2 Calibrating with fluids

Calibrating using fluids guarantees a more dependable calibration then when using a handmeter. The system lets you first perform a zero point measurement, and after that a measurement using a control fluid of your choice. The measurement will then be calibrated at 2 points.

To calibrate with fluids, select
calibrating *with fluids,* the menu as in *figure 10.1.2.1* will appear.

```
Fluids calibration
SPI      : 0.50 mg/l
Cal at   : 0.52 mg/l
Begin 0 mg/l calib >
```

Figure 10.1.2.1

Follow the following steps to calibrate with fluids:

1 Make sure you have the correct control fluids and tools within reach. Here we will use a control fluid of 0.52 mg/l.

Select the line *Cal at … mg/l* and press enter **(↵)**. Fill in the value of your control fluid in mg/l, and confirm with the tick **(✓)**.

Now select *Begin 0 mg/l* calibration and press enter **(↵)**. The menu of *figure 10.1.2.2* now appears.

```
Calibration at 0mg/l
Expect : 980-1015 mV
SPI    :       964 mV
Begin 0.52mg/l cal >
```

```
Supply valve       >
Drain valve        >
Color valve       >
Remeasure          >
```

Figure 10.1.2.2.

When you scroll down you have free use of the valves. Just select and press enter **(↵)**. Use the supply valve to fill the cell with water.

Now select *Remeasure* and press enter **(↵)**. The actual *value* now needs to show between 980 and 1015 millivolt (mV).

If the *value* is correct, select and press enter **(↵)** on *Begin 0.52 mg/l cal*. The menu of *figure 10.1.2.3* now appears.

```
Cal at 0.52 mg/l
SPI     :  0.51 mg/l
Expected:  0.52 mg/l
Press(V)to save
```

Figure 10.1.2.3

```
Supply valve        >
Drain valve         >
Colour valve        >
Remeasure           >
```

6 Rinse the cell a few times by alternating the use of the supply valve and the drain valve.
7 Fill the cell with your chosen control fluid. You can either simply pour it gently in the filling tube, or injecting it with a tool.

Now select *Remeasure* and press enter **(↵)**. The cell will now start measuring the control fluid. The *value* needs to show a result close to 0.52 mg/l. If this is not the case, try to recalibrate again. Otherwise, select *Press (V) to save,* and press the tick **(✓)** to save the calibration.

8 The measurement is now calibrated.

! Start calibrating the measurement only after at least one measurement has been performed. Otherwise this could cause a wrong calibration.

10.1.3 Reset Calibration

If you are not satisfied with the current Chlorine calibration or you don't have the right tools to calibrate, you can reset the calibration settings to the factory settings. To do a calibration reset, select *Restore calibration* from the Chlorine calibration menu. The screen from *figure 10.1.3.1* will now appear.

Reset calibration

To perform a restore, press the tick **(✓)** while in this screen, the Chlorine calibration will then be restored to its factory settings.

After restoring the calibration to its factory settings, it is important to check the calibration as soon as possible.

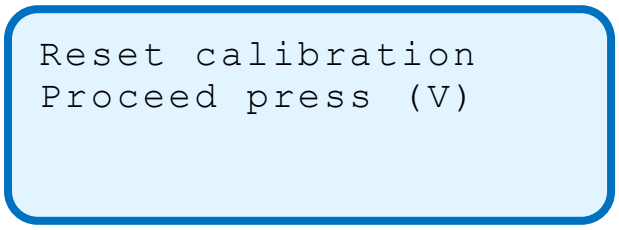


Figure 10.1.3.1.

10.1.4 Settings

When you select Cell *Settings* from the Chlorine calibration menu, the menu as in *figure 10.1.4.1* will appear. In this menu are a few advanced options and settings for the Chlorine calibration. You can make a choice out of the following options:

- *Cell values* (gives a quick overview of the current cell values)
- *Colour empty* (when the vial of reagents colour is empty or near empty, this menu helps you replace it)
- *Timing & test* (You will be able to test and control the valve times in this menu)

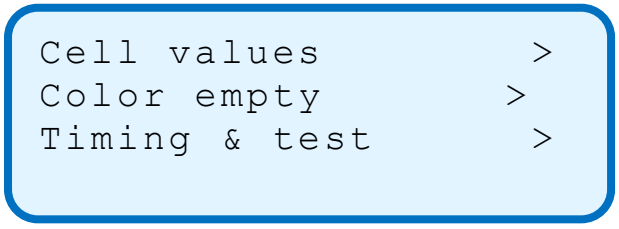


Figure 10.1.4.1.

10.1.4.1 Cell values

When you select *Cell values* from the Chlorine settings menu, the menu as in *figure 10.1.4.1.1* will appear. In this menu it is possible to check the current cell values:

1. Cell null: the zero value of the measuring water without reagents colour.
2. Cell active: the value of the measuring water with the reagents colour added.
3. Cell 2^{e} ctrl: The value of the measuring water with the reagents colour added, plus a little more measuring water added.

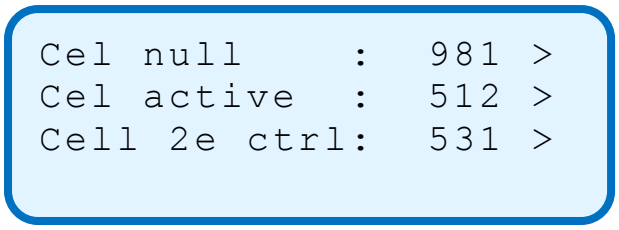


Figure 10.1.4.1.1.

10.1.4.2 Resupply reagent

When you select *Colour empty* from the Chlorine settings menu, the menu as in *figure 10.1.4.2.1* will appear. In this menu it is possible to refill the vial of reagents colour. The cell is preparing itself for re the vial now.
To avoid air bubbles in the reagent supply tube to the analysis-unit, the reagent first has to be guided through the tube before use.

! Prior to refillthe vial, check if the supply tube is completely filled with reagents colour. If this is the case, you can skip the steps mentioned underneath, and simply switch the vial, and stick the tube back in

If the supply tube is dry because it is for example just out of storage, the following steps need to be taken:

1. Take out the tube of the old vial, and take the vial out of its holder. Check if there is still some reagent left, you can reuse this.
2. Refill the vial and place it in the designated holder on top of the analysis-unit.

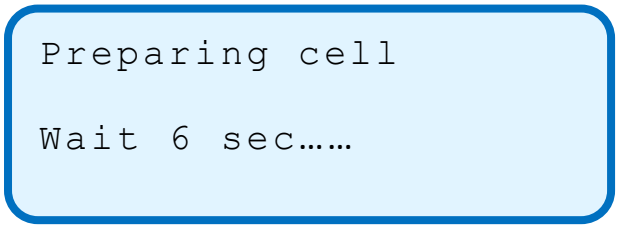
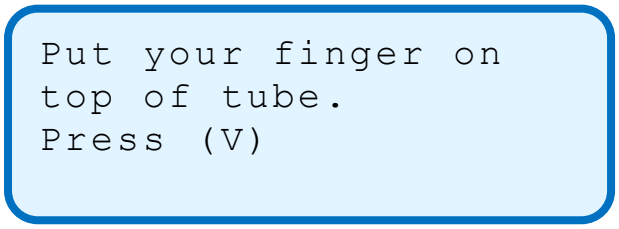


Figure 10.1.4.2.1



4. By now the menu as in *figure 10.1.4.2.2* has appeared. The cell is prepared.

5. You are asked to place your finger on the top of the filling tube. Do this and ensure an airtight seal. See *figure 10.1.4.2.3.*

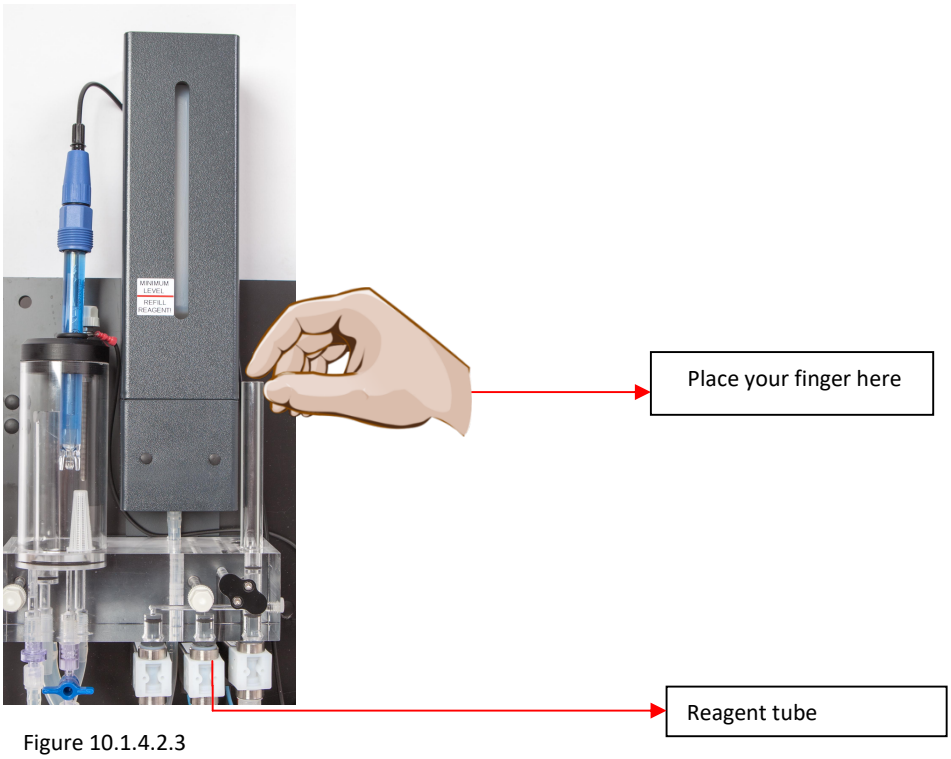


Figure 10.1.4.2.3

6. Now press the tick **(✓)**. Button. The colour valve and the drain valve will open now. Because of the pressure difference, the reagents colour will be sucked down to the cell. The tube is now free of air.

! Warning! Chlorine reagents colour contains a strong acid. Make sure you have the right tools and protection. Clean up spills directly and work preferably with gloves.

! It is advised when replacing the empty reagent vial with a new one, to clean the cell with a cotton swab. Remove the filling tube temporarily (when there's no fluids in the tube remaining), moisten the swab lightly with clean water, and clean the cell. Then start replacing the reagent vial like normal. This keeps the cell in condition.

10.1.4.3 Timing & testing

When you select *Timing & test* from the Chlorine settings menu, the menu as in *figure 10.1.4.3.1* will appear. In this menu it is possible to change the times that the valves will be open to supply water, reagent, or drain.

The following functions can be performed here:

- *Supply time* (the time the supply valve will be opened in tenths of a second. Setting this as 10 means an opening time of 1 second.)
- *Test supply* (tests the water supply valve with the above set time)
- *Colour time* (the time the colour valve will be opened in hundreds of a second. Settings this as 19, means an opening of 0,19 second. **Setting as 0, means automatic reagent dosing**)
- *Test colour* (tests the colour supply with the above set time)
- *Drain time* (the time the drain valve will be opened in tenths of a second. Setting this at 100, means an opening of 10 seconds)
- *Test drain* (tests the drain valve with the above set time)
- *Rinse time* (the time the supply valve will fill the cell and the filling tube in seconds. Setting this at 100, means a rinse time of 10 seconds)
- *Test rinse* (tests the rinse time with the above set time)
- *Cycle time* (The time the SPI-C170 will 'wait' between 2 measurements in seconds. Setting this at 300, means that the SPI will wait 5 minutes, before the next measurement starts.

Parameter	Explantion	Factory settings
[Supply time]	Time (x 0.1 s) that the measuring water valve opens to fill the cell	15
[Test supply]	Measuring water valve is opened with set time.	
[Color time]	Time (x 0.01 s) that the reagent valve opens.	30
[Test color]	Reagent valve is opened with set time.	
[Drain time]	Time (x 0.1 s) that the drain valve opens.	40
[Test drain]	Drain valve is opened with set time.	
[Rinse time]	Time (x0.1 s) that the measuring water valve opens to flush the cell.	80
[Test rinse]	test the rinse with the time set above	
[Cycle time]	Time (x 1 s) that the SPI-C170 'waits' between 2 measurements in seconds. A low value means more frequent measurement, so also a higher reagent consumption. A high value is the opposite. At the factory, the setting is 180 sec.	180

```
Cycle timing & test
Supply time 0,1s  10
Test supply        >
Colour time 0,01s 40
```

```
Test colour        >
Drain time  0,1s 40
Test drain         >
Rinse time 0,1s  60
```

```
Test rinse         >
Cycle time 1 s   300
```

! **The cycle time is responsible for the quantity of measurements. A low time here means more measurements, but also more reagents colour use. More time means fewer measurements, but it saves more reagents colour.**

! **The SPI-C170 will temporary stop measuring and controlling as long as this menu is opened. The pumps will remain pumping at the same level as before this menu was opened. Therefore, close this menu when ready with the timing settings.**

10.2 pH

When you select *pH* from the calibration menu, the menu as in *figure 10.2.1* will appear. In this menu it is possible to calibrate the pH.

For calibrating the pH value, it is important to have the right tools at hand. The pH is calibrated using 2 independent constant buffer solutions with different pH values. Make sure you have these solutions with you before starting the calibration.

To check the pH measurement, we advise to have a well calibrated third party handmeter with its own pH electrode. A colorimetric comparison like the phenol-red solution is only an indication, not an absolute value

```
pH calibration
Start pH 7 calibr. >
Start pH 4 calibr. >
Reset pH calibr.   >
```

```
Cal. pH 7 at     7.00
Cal. pH 4 at     4.01
pH input Hz      200
```

Figure 10.2.1

Take the following steps in order to calibrate the pH:

1. Make sure the pH fluids are at the right temperature
   Select *Calibrate pH 7 at 7.00* and press enter **(↵)**.
   Either fill in your choice of buffer solution, or leave this unchanged at 7.00. Confirm with **(✓)**.
2. Take the electrode out of the buffer jar and flush it with clean water.
   Now select *Start pH 7 calibration* and press enter **(↵)**.
3. The top screen as in *figure 10.2.2* appears. Take your pH electrode and put it in the pH solution of your choice.

```
pH 7.00 calibration
Probe  mV     :  0,0
Actual pH     :  7.01
Press (V)to save
```

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

Figure 10.2.2.

4. Gently stir the electrode through the solution for about a minute.
5. Check the value at *Actual pH*. Wait for this value to get stable, then confirm with **(✓)**.
6. Now flush the electrode with clean water.
7. Execute steps 2 -8 with the pH 4.01 calibration (or your own calibration).
8. The pH is now calibrated at 2 points.
9. As final confirmation, we advise to flush the electrode once more, and to put it in the pH 7.00 solution.
10. Press **(✘)**, and select *Overview*. Check if the pH is now at 7.00 or very close.
11. Flush the electrode once more, and place it in the buffer jar.

11 Settings

In the settings menu it is possible to change the settings of specific parts of the SPI-C170. You can enter this menu by selecting *Settings* from the main menu. You can choose between the following submenus:

- Chlorine
- pH
- Flow
- Time & date
- Day/night
- Sample water pump

See *figure 11.1.*

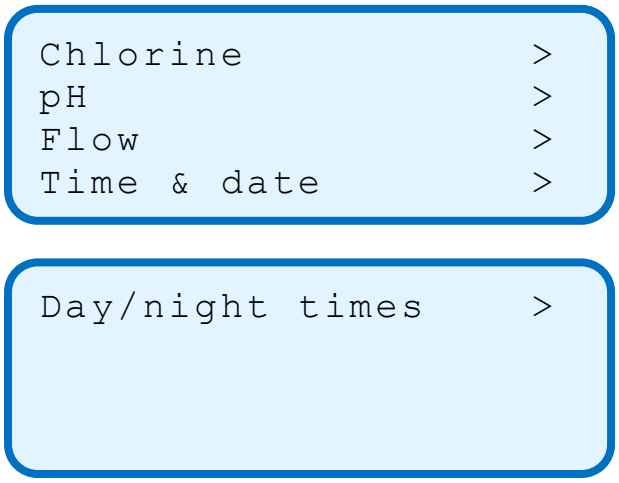


Figure 11.1.

11.1 Chlorine settings

*Chlorine*ChlorineChlorineChlorineChlorineChlorineChlorineChlorineChlorineChlorine
Choose **[chlorine]** to view and / or change the settings of the chlorine channel. The following settings are available:

Parameter	Explanation	Factory setting
H alarm day	Limit for high alarm chlorine value in the day situation	1.50
H alarm night	Limit for high alarm chlorine value in the night situation	1.50
Setpoint day	Desired chlorine value that is regulated in the day situation	0.80
Setpoint night	Desired chlorine value regulated in the night situation	0.80
L alarm day	Limit for low alarm chlorine value in the day situation	0.50
L alarm night	Limit for low alarm chlorine value in the night situation	0.50
Critical alarm	Critical low alarm limit. If the chlorine value falls below this value, the controller will stop. Namely, the controller does not know whether the chlorine value is really low, or whether the DPD reagent liquid is run out or if bleaching of the DPD reagent occurs due to a chlorine value higher than 10mg / l.	0.05
Alarmdelay sec.	Delay time in seconds. A (pre) alarm becomes an active alarm after the alarm delay time has elapsed. This prevents the short overrun or underrun of an alarm value leading directly to an active alarm.	1200
Delta %	This value must be at 99 and may not be changed.	99
Prop factor	This setting affects the proportional reinforcement of the regulation. The difference between the measured value and the setpoint is multiplied by this factor, resulting in the total action by which the pump is sent in%. This setting works together with the integration time below	2.00
Int factor s	The integration time ensures that the difference between the setpoint and the measured value becomes as small as possible (zero). Every set time that the measured value is lower than the setpoint, the pump will be controlled 1% faster. Once the setpoint has been achieved, each set time will reduce the pump control by 1%. This setting works together with the above proportional band.	1800
Pump min %	Minimum control of the dosing pump (in percent of the maximum pulse frequency)	0
Pump max %	Maximum control of the dosing pump (in percent of the maximum pulse frequency)	100
Max pulstime s	The time that the dosing pump can be controlled to the maximum before a dosing pump alarm is given. This is also called a response security. If the pump is operated for 2 hours (7200s) at maximum power, without the chlorine value increasing, the control will fall into alarm and stop the pump. Usually this means a malfunction of the dosing pump, blocked injection valve, defective transport hose or empty chlorine tank. By setting the setting to "0" this function is disabled.	7200

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

Delta, Prop and Int factor are advanced measurement and control settings that can only be perfectly adjusted after seeing a graph. They influence how effectively the installation is controlled. There are no fixed guidelines for these settings, because each application is different. The above parameters are already set at the factory.

11.2 pH settings

Choose the option **[pH]** to view and / or change the settings of the pH channel. The following parameters are adjustable:

Parameter	Explanation	Factory settings
H alarm day	Limit for High alarm pH value in the day situation	7.60
H alarm naight	Limit for High alarm pH value in the night situation	7.60
Setpoint day	Desired pH value that is regulated in the day situation	7.30
Setpoint night	Desired pH value that is regulated in the night situation	7.30
L alarm day	Limit for Low alarm pH value in the day situation	7.00
L alarm night	Limit for Low alarm pH value in the night situation	7.00
Alarmdelay sec.	Delay time in seconds. A (pre) alarm becomes an active alarm after the alarm delay time has elapsed. This prevents the short overrun or underrun of an alarm value leading directly to an active alarm.	1200
Delta %	This value must be at 99 and may not be changed.	99
Prop factor	This setting affects the proportional reinforcement of the regulation. The difference between the measured value and the setpoint is multiplied by this factor, resulting in the total action by which the pump is sent in%. This setting works together with the integration time below	2.00
Int factor s	The integration time ensures that the difference between the setpoint and the measured value becomes as small as possible (zero). Every set time that the measured value is lower than the setpoint, the pump will be controlled 1% faster. Once the setpoint has been achieved, each set time will reduce the pump control by 1%. This setting works together with the above proportional band.	1800
Pump min %	Minimum control of the dosing pump (in percent of the minimum pulse frequency)	0
Pump max %	Maximum control of the dosing pump (in percent of the maximum pulse frequency)	100
Max pulstime s	The time that the dosing pump can be controlled to the maximum before a dosing pump alarm is given. This is also called a response security. If the pump is operated for 2 hours (7200s) at maximum power, without the pH dropping (increases at base dosing), the control will fall into alarm and stop the pump. Usually this means a malfunction of the dosing pump, blocked injection valve, defective transport hose or empty container. By setting the setting to "0" this function is disabled.	7200

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

Delta, Prop and Int factor are advanced measurement and control settings that can only be perfectly adjusted after seeing a graph. They influence how effectively the installation is controlled. There are no fixed guidelines for these settings, because each application is different. The above parameters are already set at the factory.

11.2 Flow settings

Kies voor **[flow]** om de instellingen van het flow kanaal te bekijken en/of te wijzigen. De volgende parameters zijn instelbaar:

Parameter	Explanation	Factory settings
Alarm %	Limit for alarm notification flow (flow too low)	60
Alarm delay sec	Alarm delay time in seconds. When this delay is exceeded, a (pre) alarm is activated.	300
Dose stop %	Limit for dosing stop. If the flow falls below this limit, the dosing pumps will be blocked (stop) after the dosing stop delay time has elapsed.	50
Dos stop delay	Delay time of the dosing stop in seconds	1

```
Flow settings
Alarm        %  :  60
Alarm delay sec: 300
Dose stop %     :  50
```

(▲) / (▼)

```
Dos stop delay :   1
```

The above parameters are already set at the factory. These meet the legal requirements. Changing this is not recommended.

11.3.1 Advanced flow settings

Flowsensors are sensors that send out voltage pulses or a current. The frequency in Hertz (Hz) of those pulses, or the amount of current (mA) is proportional with the flow. You can fill in the correct value in the *System setup* of the *Configuration* menu.

When you have a flowsensor that uses pulse signals, you need to fill in the maximum amount of m3/h at 30Hz in the *m3/h at 30Hz* option in chapter 16.1. When you have a flowsensor that uses current signals, you need to fill in the maximum amount of m3/h at 20mA in the *m3/h at 20mA* option in chapter 16.1

Next, you need to fill in the amount of cubic litres of water each hour when the flow should be at 100% in the *m3/h at 100%* option in chapter 16.1. This information should be in the design plans you got supplied with your system by the installer.

Example: Bürkert sensor type 8020
30Hz corresponds to 1m/s. Tube diameter 50mm, fill in the number 6 at (m3/h bij 30Hz).

Diameter	Flow m^3/h (at v=1m/s)
50	6,0
63	9,5
75	13,5
90	19,4
110	29,0
125	37,4
140	46,9
160	61,3
200	95,7
225	121,2
250	149,8

11.4 Time & date settings

When you chose for *Time & date* settings in the settings menu, you'll see the screen as in *figure 11.4.1.*
Setting the right time is important, because the correct operation of the SPI-C170 is dependable on this setting. If the date or time settings are not correct, the system could be able to load different day/night settings at the wrong moments. The date and notes that would be written in the reports and logs would be wrong too.

Here you can view or change the following settings:

Parameter	Explantion	Settings
minute	Minutes of current time	0..59
hour	Hours of current time	0..23
day	Day of the month	1..31
Month	Month of the year	1..12
year	Year	20..

It could happen that the SPI-C170 has reset the date & time settings at a power failure. If this is the case, the SPI will start counting from it's default date and time values. The cause of this is most likely a bad battery. Contact the supplier if you suspect this.

```
Time & date
Minutes     :       28
Hour        :        8
Day         :       22
```

```
Month       :        4
Year        :     2018
```

11.5 Day/night settings

When you chose for *Day/night* settings in the settings menu, you'll see the screen as in *figure 11.5.1.*

```
Day start hour :    7
Day start min  :    0
Night start hour: 21
Night start min :   0
```

Figure 11.5.1.

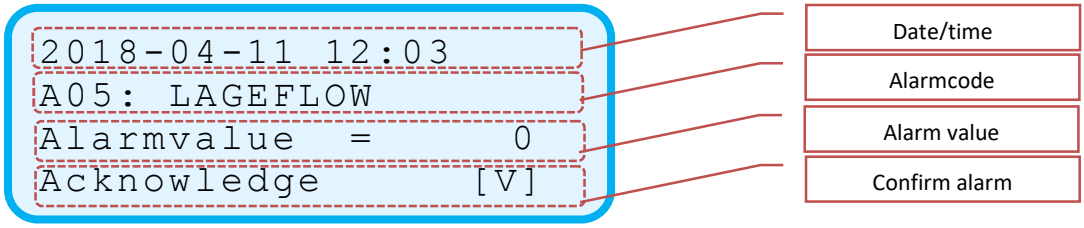
These settings make different settings for day/night times of the system possible. For example, at night, you could set a lower value for the Chlorine setpoint You can find these settings in the Chlorine or pH settings as explained in chapter *11.1* and *11.2*.

12.Alarms

All current alarms and their alarm values will be shown in the *Alarms* menu. If an alarm has presented itself, the red LED will flashing on the keypad of the SPI-C170. You can enter this menu by selecting *Alarms* from the main menu.
When you select alarms, the screen as *figure 12.1* will appear.

The alarms will be shown in the following format:

1. The date and time of the event.
2. The alarm code and the description.
3. The value at which the alarm went off



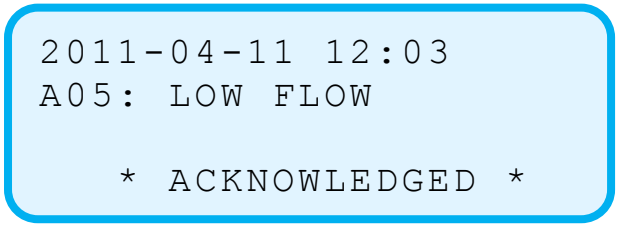
Figuur 12.1.

12.1 Alarm codes and characters

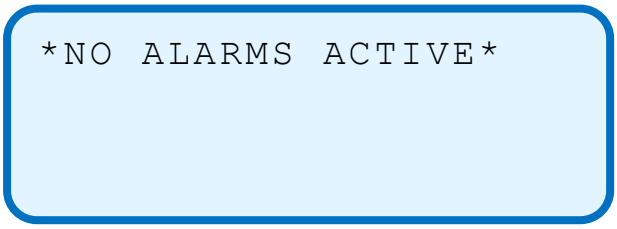
Depending on each alarm, action will be taken. The alarms come with a code. These alarmcodes and how to solve them can be seen in chapter 12.3

During an alarm situation it can occur that an alarm will not be directly given. This is possible by setting alarm delays. When a measurement returns back to a non-alarm state, the alarm will void. You can read these alarms back in the alarm reports. For this we link you to chapter 14.

If you start fixing the alarm cause, you can select *Acknowledge* to turn the alarm off using the **(✓)**. The alarm will then be acknowledged and the red alarm LED will run continuously.



If all alarms have been confirmed, the screen below will appear



In the *Main menu* all main measurements and important functions are shown together with their current status. The character behind each line is an indication of how this part functions. The following characters can be seen:

Character	Description	Explanation
.	No alarm available	The measurement is within the alarm limits. The alarm screen shows that there are no alarms.
v	Pre-alarm	The measurement has exceeded or falls below an alarm limit. The pre-alarm is now activated and the alarm delay time starts. If the measurement falls within the alarm limits, the pre-alarm disappears.
A	Alarm active	The measurement has exceeded or falls below an alarm limit and the alarm delay time has been exceeded. then an alarm is made. The red alarm LED will flash and the alarm relay will switch. This alarm can be seen in the Alarms menu. A report is also made.
a	Alarm adjusted	The alarm is seen by the user and is confirmed in the alarms menu. The red alarm LED lights up continuously. The alarm is under consideration and a solution can be worked on. If the measurement returns within the limits, the alarm is canceled and the alarm LED goes off. The alarm relay also switches
M	Manual mode	The channel is manually operated. This applies to the dosing pumps, but this can also apply to the flow channel. In this case, the flow protection is turned off. More about this in chapter 13.
X	Measuring channel switched off / maintenance	The concerned channel is switched off. Even when the controller is in maintenance mode, an X will be displayed behind the time format. This means that the controller functions normally, but does not send alarms due to maintenance work.
c	Measuring cell becomes contaminated	The measuring cell starts to pollute and the baseline measurements become lower. The cell needs to be cleaned, but the regulator is still working normally.
C	Measuring cell is contaminated Circulation failure	In the measuring cell, such a contaminated has developed that this noticeably influences the measurements. The cell must be cleaned urgently. The controller stops measuring and controlling. A ‘C‘ is also shown if the measuring water circulation stops. The controller stops measuring and controlling and a warning tone sounds.
S	Semi Automatic	Dosing pumps run on the "hand" % until the desired value is reached. Then the SPI returns to the "automatic" position

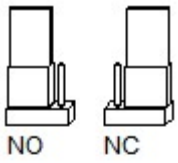
Action will have to be taken depending on the alarm. The alarms are provided with a code. See the table below for explanation of the different codes:

Alarm code	Description
A01: CHLORINE HIGH	Chlorine value higher than alarm value
A02: CHLORINE LOW	Chlorine value lower than alarm value
A03: pH HIGH	pH value higher than alarm value
A04: pH LAOW	pH value lower than alarm value
A05: LOW FLOW	Flow lower than alarm value, dosing pumps remain in operation
A06: CHECK CELL	Low zero value of measuring water, measuring cell becomes contaminated
A07: CELL FAILURE	Error in chlorine measuring cell (incorrect zero measurement), controller stops measuring and controlling
A08: FLOW DOSE STOP	Flow lower than dosing stop value, dosing pumps are switched off
A09: ACID PUMP	Maximum dosing time (pulse time) acid pump exceeded (pump stops)
A10: CHLORINE PUMP	Maximum dosing time (pulse time) chlorine pump exceeded (pump stops)
A11: CIRC FAILURE	No circulation by measuring cell (no measuring water)
A12: CHLORINE CRIT	Chlorine value very low (too low for reliable measurement)

12.2 Alarm contact

The SPI-C170 contains an alarm contact. This is a potential free contact that can be used to transmit the alarm signals to equipment of third parties. The alarm contact is closed when an alarm is being detected on the SPI.

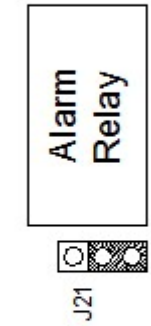
You can connect the alarm contact from the SPI-C170 to an alarm centre for example. See *figure 5.2.1* from chapter 5.2 for the location of this contact.



You are able to change the relay function to normally open (NO) or normally closes (NC) using jumper 21 on the circuit board.

For more information about connecting and setting of the jumper settings.

The contact is adjustable to a night mode. This means that when set to night mode, the alarm contact will not work in night times. See chapter 16.1



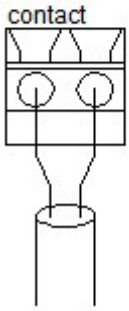


Figure 12.2.1

12.3 Solving alarms

With correct use and regular maintenance, the least hardware errors will occur. For maintenance, see chapter 15.

For solving problems you follow the following steps:

1. Check the problem, you can do this by selecting *Alarms* from the main menu. You are able to see the active alarm here. If you or someone else has already acknowledged the alarm, you can read this back in the *Alarm* reports. For more information about this, see chapter 14.
2. Research the alarm with below list. Check if the alarm code matches, and try the solutions mentioned.

Alarm	Solution(s)
A01:Chlorine HIGH	-Pump settings -Wrong settings -Wrong calibration
A02: Chlorine LOW	-Pump settings -Wrong settings -Chlorine tank empty -Defect in the Chlorine supply -Wrong calibration
A03: pH HIGH	-Pump settings -Wrong controller settings -Acid tank empty -Defect in the acid supply
A04: pH LOW	-Pump failure -Wrong settings
A05: LOW FLOW	-Pump settings -Flowmeter defect -Defect in the sample water supply -Wrong flow settings
A06: CHECK CELL	-Starting cell contamination -Cell is dirty
A07: CELL FAILURE	-Cell is dirty -Sample water supply defect -Reagents colour valve is leaking in the cell -Cell is defect
A08: CRITICAL FLOW	-Pump settings -Flowmeter defect -Defect in the water supply -Wrong flow settings
A09: ACID PUMP	-Pump settings -Acid tank empty -Defect in the acid supply -pH electrode defect
A10: CHLORINE PUMP	-Pump failure -Chlorine tank empty -Defect in the Chlorine supply
A11: CIRC FAILURE	-Pump is OFF -Pump defect
A12: Chlorine CRIT.	-Pump settings -Wrong controller settings -Chlorine tank empty -Defect in the Chlorine supply
A13: FILTER DIRTY	-Filter dirty

Example

On the keypad, the red LED is flashing. The alarm "*A09: pH PUMP*" is shown on the *Alarm* menu. This alarm means that the pump has been at full power for over a course of <1800> seconds (this time is adjustable), and the pH value is still high. This indicated a problem with the dosing. 3 possible solutions are:

- Pump error
- Acid tank empty
- Defect in the acid supply

1. First, check whether or not the pump is still working. Maybe the pump is turned off, or has a power failure.
2. Second, check if the acid supply tank is empty.
3. Third, you should check whether or not the transport from the acid might be defect. There could be a leak.

See **enclosure A** for a more detailed list of alarm information and their solutions.

12.4 Hot start

When the SPI-C170 has a power failure, or someone removed the adapter from the power outlet, the SPI turns off. The system contains a battery, which keeps the clock set, and if the power comes back on, the SPI will still contain the same settings as before
The temporarily turning off of the SPI-C170 with data preservation, is called the **hot start**
As the unit is commissioned for a longer period of time, the battery ages. This is causing the SPI no longer retaining the clock settings. As soon as this seems to be the fact, we advise you to take steps to replace the battery. Information about this is available with your supplier.

12.5 Cold start

In extreme cases you must move on to a **cold start**.

A cold start means a complete reset of the SPI-C170 to its factory settings. The default settings are being loaded in the machine. Your own settings need to be saved again. It is therefore advisable to first note down these settings before proceeding.

Follow the below steps to perform a cold start:

1. Take the power supply adapter out of the power outlet;
2. Press the **(✕)** button, and keep it pressed;
3. Put the power supply adapter back in the power outlet, wait until the screen's backlight lights up, then release the **(✕)** button.
4. The normal boot screen like *figure 12.3.1.1* appears, and the line 'READING ROM' flashes.

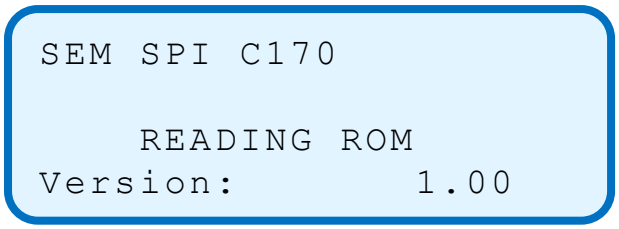


Figure 12.3.1.1.

13.Manual operation

The SPI-C170 contains the possibility to let the user control the Chlorine or the acid pumps on manual or semi-automatic mode. When you select *Manual operation* from the main menu, the screen as *figure 13.1* appears.

```
Manual operation
1)aut 2)hand 3)semi
Chlorine mode   :   1
Chlorine pump %:  50
```

```
pH mode         :   1
Acid pump %     :  50
Avg pulse chl       7
Avg pulse acid      7
Flowprotection  :   1
```

Figure 13.1.

Please note that when using manual mode to control your pumps, you should check the quality of the water yourself regularly.

13.1 Modes and settings

The SPI has a total of 3 control modes:

1. Automatic (default)
2. Manual
3. Semi-automatic

Automatic mode
In the automatic mode, the SPI-C170 controls the dosing of chemicals by the measured values. Interference of the user is not necessary.

Manual mode
In the manual mode, the user controls the dosing of chemicals by settings made by hand. This might be useful when a problem has occurred, or no measurements can be done. The “M” is shown behind the pump signal in the overview menu

Semi-automatic mode
In the semi-automatic mode, the user controls the dosing of chemicals to the pool by hand. But when the setpoint is reached, the automatic controller overrides the semi-automatic mode and the SPI continues as an automatic system. The “S” is shown behind the pump signal in the overview menu

When the manual or semi-automatic mode is active, the orange status LED will light up on the keypad.

Setting mode

The set the right mode for a pump, you select the mode of that specific pump, and press enter **(↵)**. You can fill in the following values for each mode:

1. Automatic
2. Manual
3. Semi-automatic

Confirm with **(✓)**.

Setting pulses

The following settings are for setting the correct pump capacity in percent.
For example, you have a pump with a capacity of a maximum of 120 pulses. Maximum pumping is 100%. When you set the *Chlorine/pH pump %* at 80% now, the pump will use 80% of those 120 pulses. This means the pump will use 96 pulses at 80%. Filling in the max pump capacity in pulses will be explained in chapter 15.

13.2 Flow protection

Optionally, you can turn on (1) or turn off (0) the *flow protection*. The flow protection makes sure the Chlorine and acid pump will not work when the flow is low or not present at all. When you turn the flow protection off (0), the *Overview* menu will show an M (Manual) behind the flow reading.

14.Reports

When you select *Reports* from the main menu the screen as *figure 14.1* appears. In this menu you can read back and check various reports such as:

1. Alarm reports
2. Calibration reports
3. Maintenance services reports
4. Data log reports

```
Alarm reports      >
Calibration rpts   >
Maintenance rpts   >
Data logger rpts   >
```

Figure 14.1.

14.1 Alarm reports

When you select *Alarm reports* from the previous menu, the screen as in *figure 14.1.1* appears. In this screen you can see all logged alarms. The first log you see is the most recent.

The log screen consists of a date and time, followed by an alarm code and description. When this alarm was acknowledged before, the final line shows whether or not the alarm was acknowledged.

When you want to browse back, you press the **(▲)** button. When you want to start at the end of the list, you press the **(▼)** button.

The following alarms logs can be seen (see chapter 12.3 for more details):

Alarm	Description
A01: Chlorine HIGH	Chlorine max exceeded
A02: Chlorine LOW	Chlorine min undershot
A03: pH HIGH	pH max exceeded
A04: pH LOW	pH min undershot
A05: LOW FLOW	Flow low
A06: CHECK CELL	Zero measurement value low
A07: CELL FAILURE	Zero measurement value very low
A08: CRITICAL FLOW	Flow very low
A09: pH PUMP	Defect in acid supply
A10: Chlorine PUMP	Defect in Chlorine supply
A11: CIRC FAILURE	No circulation
A12: Chlorine CRIT	Chlorine very low
A13: FILTER DIRTY	Filters are polluted

```
2011-04-11 12:03
A05: LOW FLOW

  * ACKNOWLEDGED *
```

Figure 14.1.1.

14.2 Calibration reports

When you select *Calibration reports* from the previous menu, the screen as in *figure 14.2.1* appears. In this screen you can see all logged calibrations. The first log you see is the most recent.

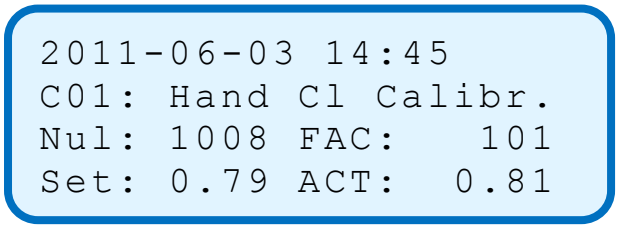


Figure 14.2.1.

The log screen consists of a date and time, followed by a calibration code and description. Also some details of the specific calibration.

When you want to browse back, you press the **(▲)** button. When you want to start at the end of the list, you press the **(▼)** button.

The following calibration logs can be seen:

Calibration	Description
C01: Hand Cl Calibr.	Chlorine hand calibration
C02: Fluids Cl Cal.	Chlorine fluid calibration
C03: Cell Calibr.	Zero water calibration
C04: Cal. Override	Calibration overridden
C05: Reset Cl Calibr	Reset calibration factors Chlorine
C06: pH Calibration	Calibration pH
C07: Reset pH Calibr	Reset calibration factors pH

Reading the calibration report

Under the time and calibration code are the following values:

1. NUL (zero value of the measuring water)
2. FAC (calibration factor)
3. SET (calibrated value)
4. ACT (current value)

The FAC is a factor that represents the current measurement calibration, and how it differs from the previous calibration. It indicates whether the calibration is adjusted up (>100) or down (<100). The default value is 100, when no calibrations are made.

When a calibration is done, the current value is measured: the ACT. After that, you are asked to fill in the hand measured value: the SET.

14.3 Maintenance reports

When you select *Maintenance reports* from the previous menu, the screen as in *figure 14.3.1* appears. In this screen you can see all logged maintenance services. The first log you see is the most recent. The log screen consists of a date and time, followed by a system code and description. Also some details of the specific system message.

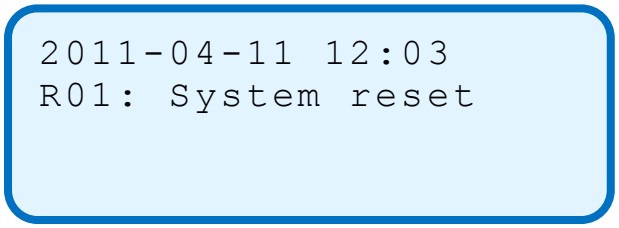


Figure 14.3.1.

When you want to browse back, you press the **(▲)** button. When you want to start at the end of the list, you press the **(▼)** button.

The following maintenance logs can be seen:

Event	Description
R01: System reset	System reset “hot start”
R02: Cold start	System reset “cold start”
R03: Maint started	Maintance started
R04: Maint stopped	Maintenance stopped
R05: Maint timeout	Maintenance timed out
R06: Software reset	Software reset

14.4 Data log repors

When you select *Data log reports* from the previous menu, the screen as in *figure 14.4.1* appears. In this screen you can see all logged data from the readings of that moment. The first log you see is the most recent.

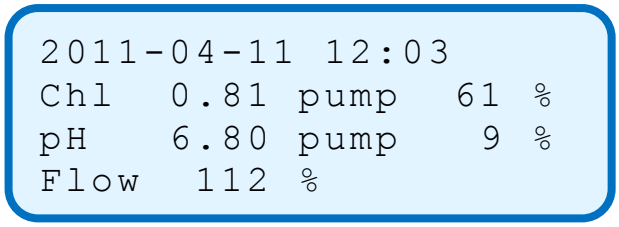


Figure 14.4.1.

The log screen consists of a date and time, followed by a system code and description. Also the following details on the moment of logging:

- The Chlorine value in mg/l
- The Chlorine pump action in %
- The pH value in %
- The acid pump action in %
- The flow value in %

When you want to browse back, you press the **(▲)** button. When you want to start at the end of the list, you press the **(▼)** button.
The data logger registers every once in a while the value of the previously mentioned values and pump actions. The time between every log is adjustable. This *Log period* can be changed under *System setup*. For more information about this we link you to chapter 16.

15.Maintenance

Whenever maintenance needs to take place on the SPI-unit, and you need to detach/replace critical parts, you can start a maintenance session in the menu *Maintenance* from the main menu as seen in *figure 15.1*.

```
Maintenance    (1800)
Start               >
Stop                >
Remaining      : 1639
```

Figure 15.1

To perform maintenance, select *Start* and press enter(↵). Now the maintenance timer will start counting. You get a standard time of 1800 seconds or 30 minutes to do your maintenance. During this time, the SPI won't send out alarms

15.1 Regular maintenance

For correct operating of the SPI-C170 it is important to regularly check on the correct operation of the unit, and keeping everything clean. This implies:

- Cleaning and keeping dry
- Checking the valves
- Checking the measuring cell for pollution
- Regularly checking the cell on the correct zero measurement
- Calibrating when necessary
- Rinsing
- Replacing bad or broken parts

Cleaning and keeping dry

1. Keep the unit clean and dry. Clean up spilled reagents colour or measuring water directly with a clean piece of cloth and dry.
2. Make sure no fluids are on the outside of the SPI-unit or analysis-unit.
3. Check the inside of the SPI-unit for possible water or moisture

Checking the valves on correct operation

One of the most important parts of the SPI-C170 are the valves that regulate the supply and drain of measuring water and chemicals.

Because of the intensive use of these valves they need to be checked routinely on their operation:

1. The water supply valve can be checked by confirming the following:
   - Sufficient cell filling capacity
2. The cell drain valve can be checked by confirming the following:
   - Sufficient draining capability
3. The reagents colour valve can be checked by confirming the following:
   - A relatively short reagent opening time from the valve when the reagent vial is full (You can check this in *Cell values,* see chapter 10.1.4.1)
   - Stable use of reagent
   - The sample water has a yellow colour while measuring

Checking the measuring cell on pollution
The measuring cell can be checked on pollution by checking the zero water value. Normal water should have a zero value of around 1000. But whenever pollution in the cell is occurring, the less light from the LED reaches the receiver. The measurement is then affected. Check chapter 16.3.1 for more information. You can check the current zero value of the measurement in *Cell setup* under *Configuration*. See chapter 16 for this. When pollution is occurring, you can clean the cell with acrylic polishing paste.

Adjusting zero value to 1000
Like mentioned before, the zero value is at best when the value is measured at or around 1000. After a while when light pollution obstructs the flow of light in the cell, this value can differ. The zero value must be calibrated back to 1000. See chapter 16.3.2 for this.

Calibration
Every once in a while we advise to check the measurements for abnormalities, and when necessary, to calibrate them. When this is the case, calibrate the measurements of the SPI-C170 with well calibrated equipment of third parties. More about calibrating is described in chapter 10.

Rinsing
Rinse the analysis-unit thoroughly at major maintenance with clean water. This will clean out particles that might have came through the filter in the buffer jar.

Replacing parts
Replace broken of bad performing parts where necessary with new parts. Contact your supplier when in doubt.

15.1.1 Maintenance instruction of valves

For a proper operation of the valves it is important to follow these instructions well.
The valves are not supposed to dry with water, reagent, or other fluids containing chemical components. If you want to store the SPI-unit for a longer period, please follow the intructions as described in *chapter 4.1*.
The valves may never be opened.
The screws in these valves are tightened with a torque driver, and these valves perform less when these screws are tightened too firm or too loose. They could then stop fluid from getting through, or even leaking. Opening the valves voids the warranty.

! Please note! The valves on the cell are sensitive equipment. We cannot guarantee the warranty if you maintain these yourself, so send them back when they seem defect.

Valve	Cause
Measuringwatervalve	A faulty measuring water valve will ensure that the delivery tube does not fill completely or very slowly. A leaking valve will cause an increasing level in the cell during the active measurement.
reagentvalve	A defective reagent valve will color the water in the riser during the zero measurement or will not allow reagent to pass through.
drainvalve	A faulty discharge valve will ensure that the measuring cell can not be completely filled by continuous water running off. A blocked valve will not drain the measuring tube or very slowly
comment	Always replace valves completely. Measuring water valve, reagent valve and drain valve are of the same type. If in doubt, contact the SPI dealer.

15.2 Maintenanceschedule

The following maintenance schedule can serve as a guide and is derived from a swimming pool application. The frequency of some maintenance points is related to the application of the SPI, the measuring frequency and the environment in which the device is placed. This may require a different maintenance schedule.

Frequence	Control point description
Dailey	• Compare measurements of SPI with hand meter (in case of deviations with hand meter than calibration measurements) • Faults on display • Flow measuring water • Reagent level (measuring fluid) • Cycle measuring cell*
Weekly	• Refill reagent (about 1800 measurements per 100ml) about 1x14 days 250ml • Cleaning the measuring water filter • Clean the panel with a dry cloth
Monthly	• Check cell values chlorine cell and if cell zero value is lower than 700 cleaning measuring cell (with brush) or if SPI indicates this • Check the valves *
Annually	• Replace pH electrode and buffer fluid; • Replace O-ring set • Replace silicone hose set • Replace check valve • Replace the measuring water filter • Clean / rinse the reagent tank with demineralised water • Check cell monitoring (see configuration menu), adjust zero value to 1000
Comment	Only place original SPI spare parts. See appendix for a complete overview of all parts of the SPI C170.

<u>* Control measurement cycle:</u>
The measuring cycle of the chlorine measuring cell of the SPI will only run correctly if both the measuring water valve, the reagent valve and the discharge valve function correctly. A correct cycle has the following characteristics:

- With every zero measurement, the cell including the fill pipe must be completely filled with clear water. The level in the fill pipe should then be equal to the level in the measuring water pot.
- During an active measurement, the level is stopped and only the cell is filled, not the delivery tube.After a (zero) measurement and rinse the cell runs completely empty;

16. Configuration

When you select *Configuration* from the main menu, the screen as *figure 16.1* appears. With the help of this menu you can check and change various settings used for the configuration of your SPI system.

The menu contains the following options:

1. System setup
2. Version info
3. Cell setup
4. Language
5. System reset
6. mA card

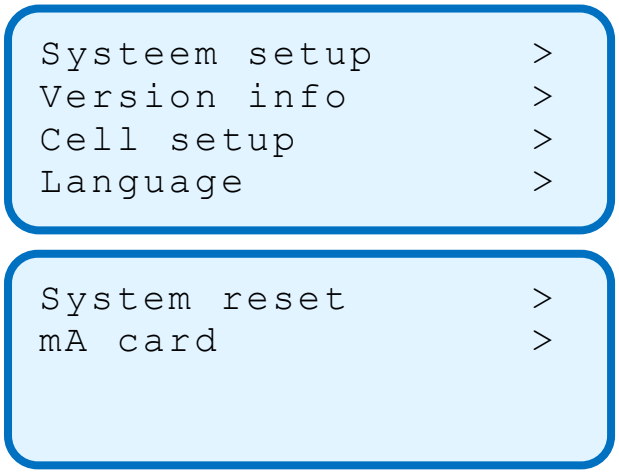


Figure 16.1

16.1 System configuration

Choose In the menu configuration [system configuration] and the item below are available.

Parameter	Explanation	Factory setting
Has Chlorine	0 = does not measure chlorine (chlorine channel switched off) 1 = does measure chlorine (chlorine channel switched on)	1
Has pH	0 = does not measure pH (pH channel switched off) 1 = measure pH (pH channel switched on)	1
Flow Type **0)NC, 1)puls, 2)mA**	0 = Not connected, no sensor connected 1 = Sensor with pulse output 2 = Sensor with 4-20mA output	1
Chlorinepump p/m	Number of pulses per minute where dosing pump is 100% controlled. 0 = 0n / off mode (on display 0 = pump off, 150 = pump on)	100
Acidpump p/m	Number of pulses per minute where dosing pump is 100% controlled. 0 = 0n / off mode (on display 0 = pump off, 150 = pump on)	100
External Contact	0 = no external contact (via internet) with the controller possible 1 = external contact (via internet) with the controller possible	1
Log period	Time interval for data storage of measurement data (in seconds)	900
m3/h by 30Hz :	Flow (m3 / hour) at pulse signal of 30Hz (flow rate 1m / s) at 8020 sensor (only applicable for pulse sensor)	12
m3/h by 100% :	Number of m^3 / hour at a flow of 100% (to express m3 / hour in%)	12
m3/h by 20mA :	Number of m^3 / hour with a current signal of 20mA (only applicable for sensor with 4-20mA signal)	100
Circ. delay	Switching delay circulation contact	5
Get dirty	Value of baseline measurement where SPI alarm gives the message "cell contaminated"	700
Cell dirty	Value of zero measurement where SPI stops measuring by severely contaminated chlorine measuring cell.	600
Alarmdelay cell:	Delay in sec. where cell alarm is given.	900
Systeem ID:	ID number (must be 1)	1
Alarm night:	0 = no alarm during the night hours (see chapter 11.4) 1 = alarm during the night	1
pH mode **0)acid, 1) lye**	0 = dosing of pH lowering agent (acid) 1 = dosing of pH-increasing agent (lye)	0
***Min rea valve**	Minimum valve time of reagent valve	30
Beep On/Off	0 = beep off, if circulation is lost 1 = beep on, if there is no circulation	1
BL always on:	0 = Backlight automatically off after 180 sec. no controls 1 = Backlight always on	0
Temp		

16.2 Version info

When you chose for *Version info* in the *Configuration* menu, the screen as in *figure 16.2.1* appears. In the version information menu it is possible to view the following information:

1. Software (the current version of the SPI-C170 Chlorine software)
2. System ID (Your custom system ID of this SPI model)

You can use this information if the supplier asks for this for technical assistance.

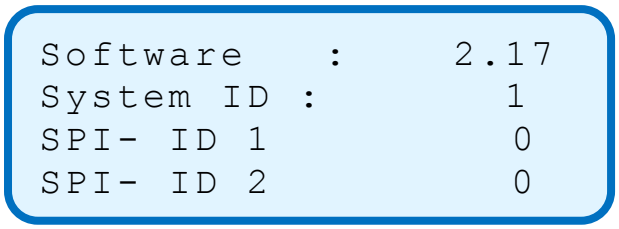
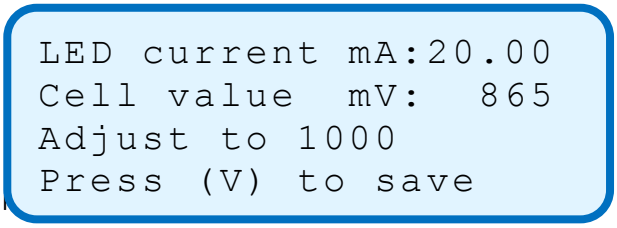


Figure 16.2.1

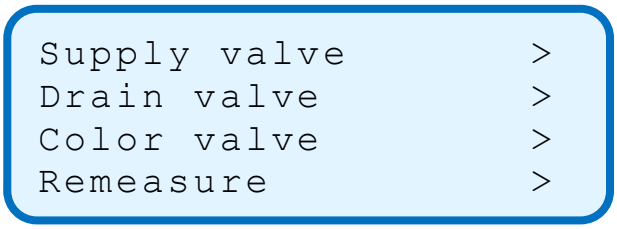
16.3 Cell setup

When you chose for *Cell setup* in the *Configuration* menu, the screen as in *figure 16.3.1* appears. In the cell setup menu are a few settings and options relative to the measuring cell. You can also calibrate the zero value of measuring water here. This indicates that you set the default value of the zero water measurement at 1000.
You can find the following settings and options in this menu:

1. *LED current mA* (the amount of milliamps sent through the LED when measuring, only change on advise of the supplier)
2. *Cell value* (the current amount generated by the receiver)
3. *Adjust to 1000, press (V) to save* (calibrating the zero measurement, execute this a few seconds after the LED has dimmed)



4. *Supply valve* (activate the supply valve)
5. *Drain valve* (activate the drain valve)
6. *Colour valve* (activate the colour valve)
7. *Remeasure* (start measuring)



16.3.1 Principle of the measurement

The cell consists of:

- A LED (Light Emitting Diode) (sender)
- A transparent hollow chamber (the cell)
- A Photodiode (receiver)

See *figure 16.3.1.1*.

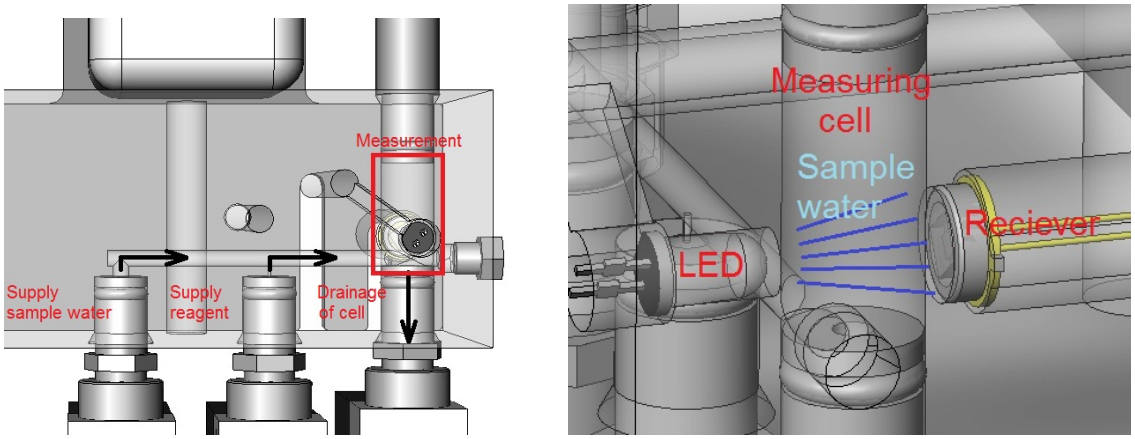


Figure 16.3.1.1.

A current is sent through the LED, and it will light up. This light falls through the chamber's walls, through the water, on the photodiode. Because of the so-called photovoltaic effect, a small voltage is generated in the photodiode. This voltage is measured by the SPI-C170 and converted in an internal value.

The amount of Chlorine in the measuring water is determined by adding a small dose of reagents colour, that reacts with the Chlorine and causes the water to discolour to a slight yellow colour, hence the name *reagent*. The more discolouration, the more Chlorine is present in the sample water.

Because of the discolouration, the water will get more dark, and absorb more light. When this happens, less light will fall on the receiver, resulting in less voltage. The SPI will measure this change. A measurement without reagents colour should give an internal value of around 1000. A good measurement with reagents colour added will be much lower.

16.3.2 Calibrating zero value

When the zero value starts to differ a lot from the normal value of 1000, it is important to check if the cell is clean. If the cell is clean, the cell might need to be calibrated. Calibrating implies that the zero value must be set back to its default value of 1000.
To calibrate the cell, follow below steps:

1. Check for serious zero value difference (lower then 800) You can do this by pressing *Remeasure* and checking *Cell value* (Main menu->Configuration->Cell setup)
2. If there is deviation, go to the *Cell setup* menu.
3. For using the valves go down. Rinse the cell a few times, select *Supply valve* and press **(↵)**. Do the same with the *Drain valve* and repeat this.
4. If the cell is rinsed, activate the supply valve once more, select Remeasure and press **(↵)**.
5. The screen now shows the top screen again and the cell will measure the water. You can see the value of this water in *Cell value.* This measurement can take 15-20 seconds.
6. If the measurement shows a value 800-1000), you press the tick **(✓)** button to accept the calibration. See *figure 16.3.2.1.* If the value is lower, clean the cell first, and try again. Otherwise, contact your supplier.
7. The cell is now calibrated.

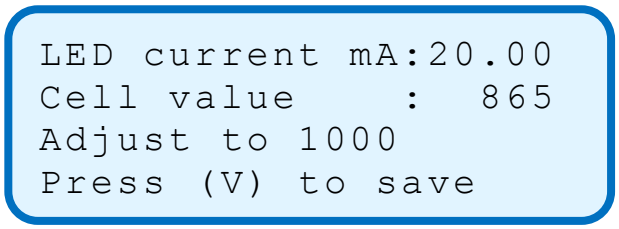


Figure 16.3.2.1

16.4 Language

The SPI-C170 contains a language menu where you can select the language of your prefered choice. When you choose *Language* in the configuration menu, you see the screen as *figure 16.4.1.* You can make a choice out of 2 languages:

- English (0)
- Dutch (1)

The default language will be in English. To change this setting, go from the main menu to *Configuration*, then to *Language* and there you select language and press enter **(↵)**. Fill in 0 for English, and 1 for Dutch. Press (✓) to accept.

```
Set language
0)EN 1)NL  2) FR

Language      :    1
```

Figure 16.4.1.

16.5 System reset

The SPI-C170 contains an option to reset the system using the screen instead of taking out the adapter out of the socket. This way, you can reset the SPI using the SPI-REMOTE software. When you choose *System reset* in the configuration menu, you see the screen as *figure 16.5.1.* If you press (✓) in this menu, the SPI-C170 will be reset using the hot start method.

```
System reset
Press (V) to reset
```

Figure 16.5.1

17. Decommissioning

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

1. Remove the adapter from the power outlet.
2. Remove the reagents colour vial from the holder an rinse the tube with clean water. (please take the necessary safety precautions).
3. Close the vial with the original cap without holes.
4. Empty the buffer jar with the tap underneath it.
5. Flush all components using clean water and dry these as well a possible.
6. Disassemble all cables and tubes to the SPI.
7. Before taking the assembly off the wall, we once again point out that everything must be dry by now.
8. Take the assembly off the wall and follow the storage instructions from chapter 4.

18. Discarding

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

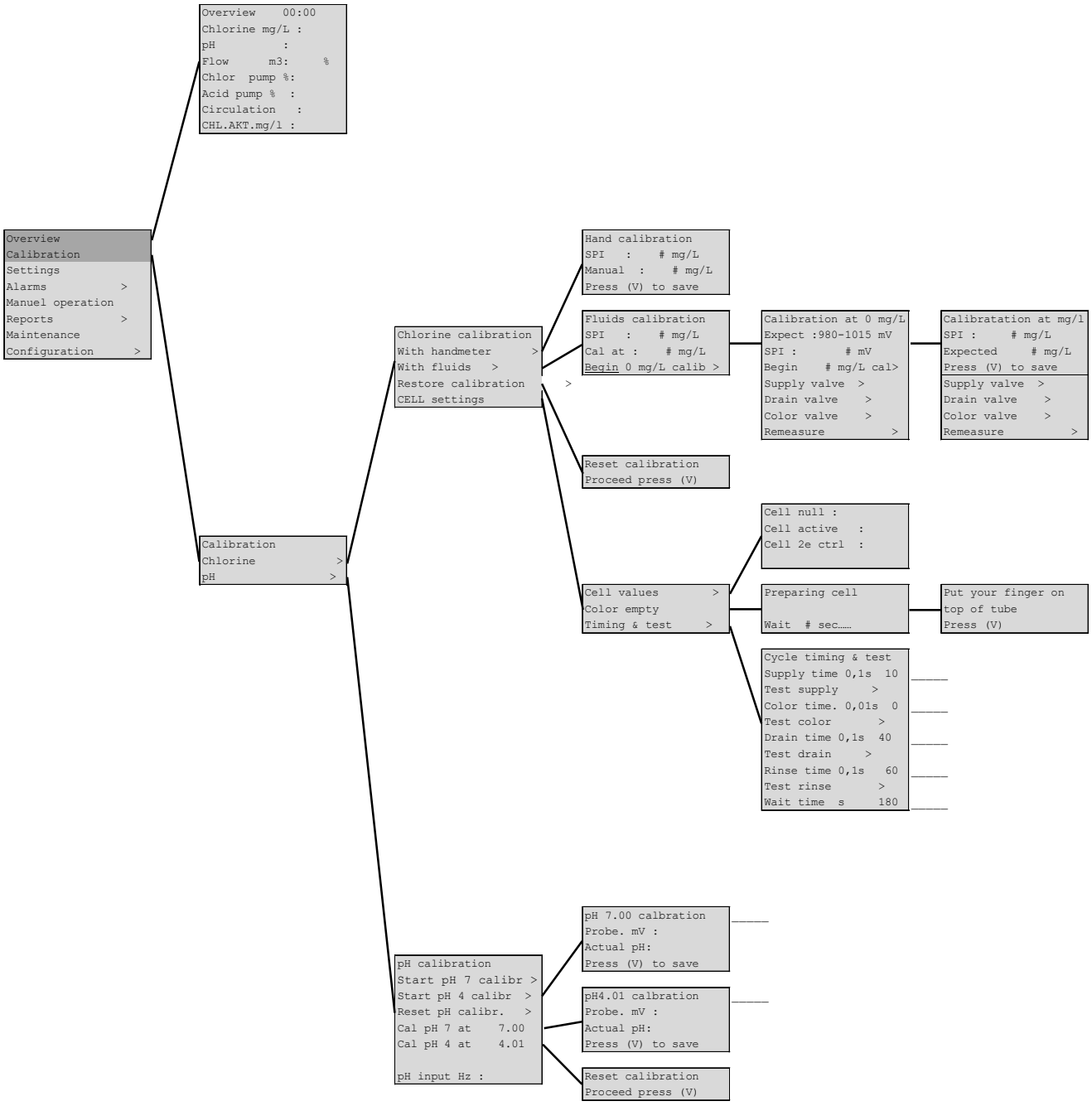
Remove possible chemical remains like Chlorine or the corresponding reagents colour and discard these as chemical waste.

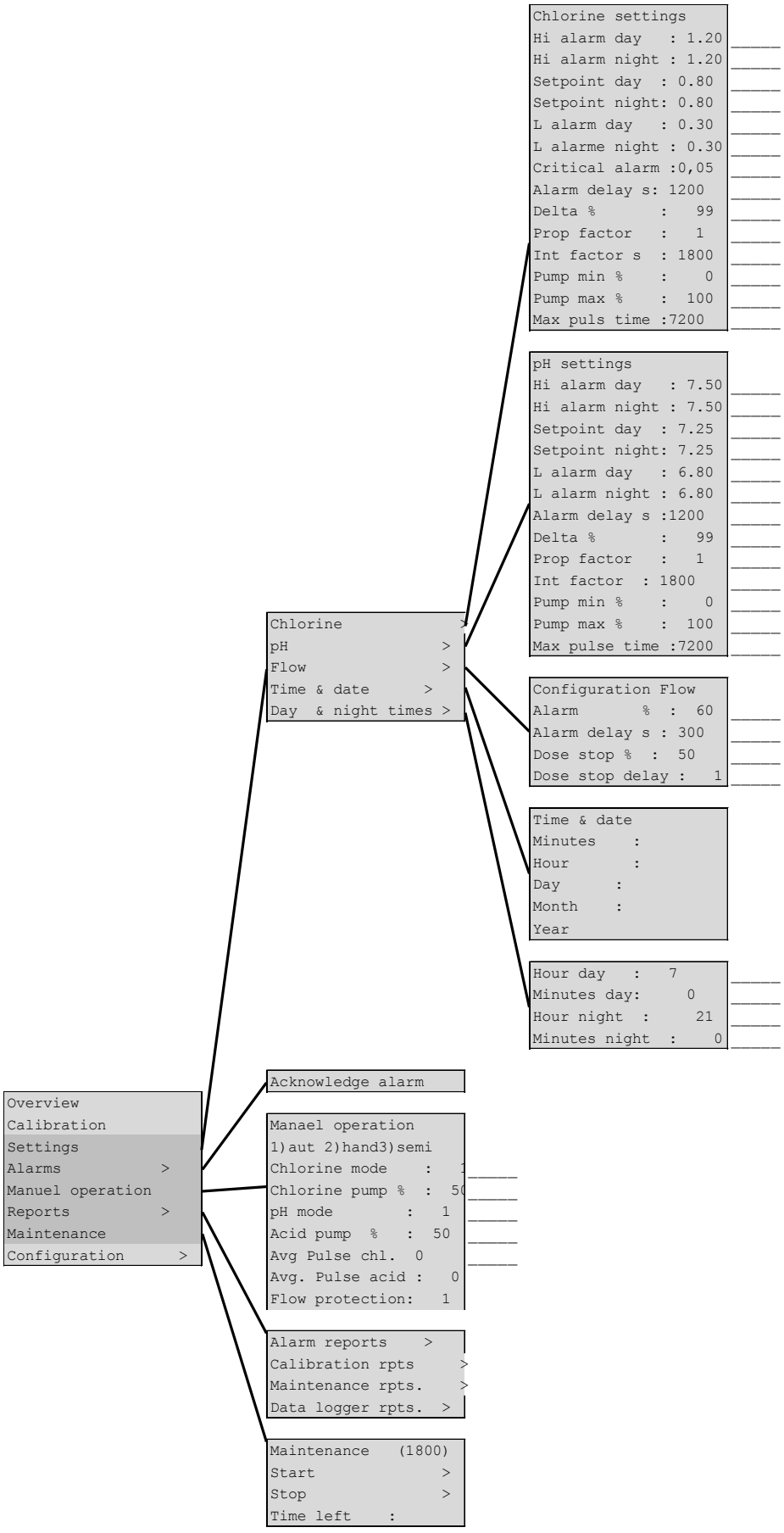
When in doubt, contact your supplier. They are able to serve you with advise.

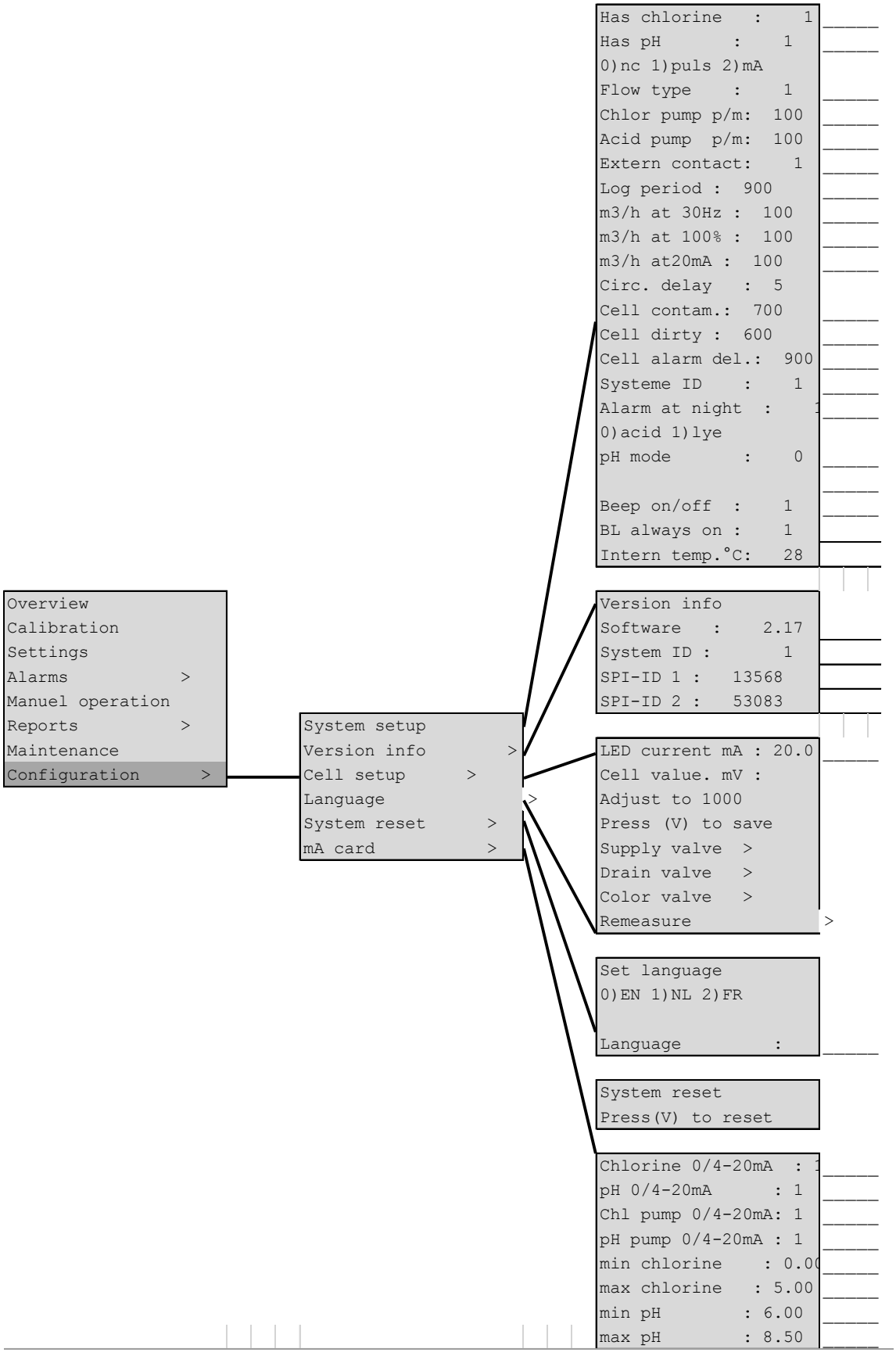
19. Spare parts

Part	Description	Pieces
3504010	Reagens SPI C 170 A (total 1L reagent)	1
3530305	Reagent bottle 100ml round	1
3540177	SPI-170 Measuring water panel complete (Fotometric)	1
3540179	SPI 170 measuring cell Chlorine (measuring block with LED and photodiode)	1
3540181	SPI-170 Controller	1
3599013	SPI 170 silicone tubing 7x4mm	1
3599014	SPI 170 silicone tubing 12x8mm	1
3599016	SPI 170 knee for hose 4mm	1
3599019	SPI 170 blue faucet for water/reagent measuring unit	1
3599024	SPI 170 hose connection return meetpot	1
3599026	SPI 170 hose clamp (3-10mm)	1
3599032	SPI-170 measuring filter conical	1
3599127	Selonoid valve SPI 127 12Vdc (inlet+outlet)	3
3599208	SPI-170 valve connection	3
3599210	SPI 170 Check valve	1
3599253	O-ring 170 PVC valve connection for SPI	3
3599260	SPI170 connection de tube 4mm x 1/8"-27 NPT (for SPI-117 valve)	4
3599261	SPI 170 afdop plug measuring cell	1
3599262	SPI 170 Luer connection blue faucet and check valve	2
3599263	Sample water supply connection 4mm	2
3599264	Collar for connecting supply with water	2
3599268	Cap with silicone hose for SPI	1
3599274	SPI 170 parker 3,5x10mm	4
3599292	SPI 170 power supply 12 VDC (2018)	1
3599294	SPI 170 connection europe power supply 12 VDC (2018)	1
3599315	Cover set for SPI-170	1
3599505	Mounting set for Spi 170 panels	1
3599506	Swivel insert set for SPI 170	1
3606525	Reagent bottle 250ml round	1
3816440	pH cable for SPI 170 (without plug) 1.0m	1
8556110	Box SPI 170 500x500x150	1
8916001	pH elektrode Hamilton Polyplast, PG13,5 (With cable connector)	1
9601001	SEM buffer solution pH 7, 50ml	1
9601003	SEM buffer solution pH 4, 50ml	1

Annex A : Menu structure with factory settings




Chlorine settings
Hi alarm day : 1.20
Hi alarm night : 1.20
Setpoint day : 0.80
Setpoint night: 0.80
L alarm day : 0.30
L alarme night : 0.30
Critical alarm :0,05
Alarm delay s: 1200
Delta % : 99
Prop factor : 1
Int factor s : 1800
Pump min % : 0
Pump max % : 100
Max puls time :7200
pH settings
Hi alarm day : 7.50
Hi alarm night : 7.50
Setpoint day : 7.25
Setpoint night: 7.25
L alarm day : 6.80
L alarm night : 6.80
Alarm delay s :1200
Delta % : 99
Prop factor : 1
Int factor : 1800
Pump min % : 0
Pump max % : 100
Max pulse time :7200
Chlorine >
pH >
Flow >
Time & date >
Day & night times >
Configuration Flow
Alarm % : 60
Alarm delay s : 300
Dose stop % : 50
Dose stop delay : 1
Time & date
Minutes :
Hour :
Day :
Month :
Year
Hour day : 7
Minutes day: 0
Hour night : 21
Minutes night : 0
Overview
Calibration
Settings
Alarms >
Manuel operation
Reports >
Maintenance
Configuration >
Acknowledge alarm
Manael operation
1)aut 2)hand3)semi
Chlorine mode : 1
Chlorine pump % : 50
pH mode : 1
Acid pump % : 50
Avg Pulse chl. 0
Avg. Pulse acid : 0
Flow protection: 1
Alarm reports >
Calibration rpts >
Maintenance rpts. >
Data logger rpts. >
Maintenance (1800)
Start >
Stop >
Time left :


Overview
Calibration
Settings
Alarms >
Manuel operation
Reports >
Maintenance
Configuration >
System setup
Version info >
Cell setup >
Language >
System reset >
mA card >
Has chlorine : 1
Has pH : 1
0)nc 1)puls 2)mA
Flow type : 1
Chlor pump p/m: 100
Acid pump p/m: 100
Extern contact: 1
Log period : 900
m3/h at 30Hz : 100
m3/h at 100% : 100
m3/h at20mA : 100
Circ. delay : 5
Cell contam.: 700
Cell dirty : 600
Cell alarm del.: 900
Systeme ID : 1
Alarm at night : 1
0)acid 1)lye
pH mode : 0
Beep on/off : 1
BL always on : 1
Intern temp.°C: 28
Version info
Software : 2.17
System ID : 1
SPI-ID 1 : 13568
SPI-ID 2 : 53083
LED current mA : 20.0
Cell value. mV :
Adjust to 1000
Press (V) to save
Supply valve >
Drain valve >
Color valve >
Remeasure >
Set language
0)EN 1)NL 2)FR
Language :
System reset
Press(V) to reset
Chlorine 0/4-20mA : 1
pH 0/4-20mA : 1
Chl pump 0/4-20mA: 1
pH pump 0/4-20mA : 1
min chlorine : 0.00
max chlorine : 5.00
min pH : 6.00
max pH : 8.50

Notes

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