

Dr. Kelvin /pH

TEMPERATURE - pH CONTROLLER



USER GUIDE

Version 1.14

CONTENTS

1.1	Keys and display.	<u>3</u>
1.2	Summary of the keys.	<u>4</u>
1.3	Setting and changing parameters.	<u>5</u>
1.4	Locking arrow buttons.	<u>5</u>
1.5	Changing SET TEMP.	<u>6</u>
1.6	Changing SET pH.	<u>6</u>
2.2	Automatic altering of set-temperatur.	<u>6</u>
2.3	HEATING-COOLING.	<u>7</u>
2.4	BASE -ACID.	<u>7</u>
2.5	Minimum runtime (!).	<u>7</u>
2.6	Hour counters.	<u>7</u>
2.7	Manuel control /STOP of heating and cooling.	<u>8</u>
2.8	Temp*days.	<u>8</u>
2.9	Water l/min.	<u>8</u>
3.0	Start/stop of alarm supervision.	<u>8</u>
3.1	Alarm test.	<u>9</u>
3.2	Alarm situations.	<u>9</u>
3.3	Setting alarm levels.	<u>10</u>
4.0	Historical data, LOG-function.	<u>11</u>
4.1	Reading minimum and maximum values.	<u>11</u>
4.2	Recall of logged data, entering <i>historic mode</i>	<u>12</u>
5.0	Installation, special parameters.	<u>13</u>
5.1	PID-regulator parameters, temperature regulator.	<u>13</u>
5.2	PID-regulator parameters, pH regulator.	<u>13</u>
5.3	Time, date and year.	<u>13</u>
5.4	Communication parameters.	<u>14</u>
5.5	Communication with a PC.	<u>14</u>
5.6	Register/parameter survey.	<u>14</u>
6.1	Working modes - heating, cooling or both ?	<u>16</u>
6.2	Adjustment of temperature sensor.	<u>17</u>
6.3	Adjustment of pH probe.	<u>17</u>
6.4	Maintenance of pH-probe.	<u>17</u>
7.1	Connection diagram.	<u>18</u>

1.1 Keys and display

A parameter is shown by pressing a key. When the key is activated a little lamp, corresponding to the key, will be turned on in order to indicate what is shown in the display. In this manual keys are printed in **bold**.

The **ALARM SETTINGS** key contains 7 registers, that is shown in sequence by pressing the key. In order to indicate what is shown in the display, other lamps will be lit.

The **SHIFT** key is used for special settings such as installation parameters. After pressing the **SHIFT** key, another key is to be pressed and the lamps for both keys will light up. Press **RETURN** to return to normal operation.

Examples:

Pressing **SHIFT** followed by **TEMP 2** is shown as:

SHIFT	TEMP 2	
--------------	---------------	--

ALARM SETTING pressed four times is shown as:

ALARM SETTINGS⁴	
-----------------------------------	--

1.2 Summary of the keys

KEY	Display shows
TEMP	Measured temperature
ACTUAL SET TEMP	The current set temperature
DAYS	Number of days at which the controller changes ACTUAL SET TEMP towards FUTURE SET TEMP .
DAYS²	Pause (number of days) before the change starts.
FUTURE SET TEMP	The future set temperature, you want when DAYS have passed.
pH	Measured pH-value
SET pH	Set pH-value
MAX	Present the maximum measured value this day
MIN	Present the minimum measured value this day
HEATING -COOLING	Runtime in % for the temperature controller. Cooling is shown as negative figures
BASE -ACID	Runtime in % for the pH-controller, supply of BASE. supply of ACID is shown as negative figures
DATE	Current date
TIME	Current time of day
RETURN	Return to normal operation (display TEMP).
START STOP	a. Start and stop alarm supervision. b. If HEATING-COOLING or BASE -ACID key is active: manual mode (state): a fixed value may be set using the arrow keys.
ALARM SETTINGS	Alarm code (STATUS).
ALARM SETTINGS²	Minimum temperature limit, - absolute
ALARM SETTINGS³	Maximum temperature limit, - absolute
ALARM SETTINGS⁴	Minimum temperature limit, - relative to ACTUAL SET TEMP
ALARM SETTINGS⁵	Maximum temperature limit, - relative to ACTUAL SET TEMP
ALARM SETTINGS⁶	Minimum pH limit
ALARM SETTINGS⁷	Maximum pH limit
SHIFT	Change to special settings such as installation parameters.

1.3 Setting and changing parameters

In order to change a specific parameter, e.g. an alarm limit, press one of the following keys.

ARROW UP increases shown value

ARROW DOWN decreases shown value

The arrow keys are repeating, i.e. the value goes on changing as long as the button is kept pressed. After pressing 3 sec. (marked by an audible "beep") the value changes to the second lowest significant figure. This is to allow large-scale changes to be made quickly.

Measured and calculated figures cannot be changed.

For safety purposes, upper and lower limits for the variable values are built in.

1.4 Locking arrow buttons

The arrow buttons have a locking facility so that the figures cannot be changed. This is to prevent unauthorised operation.

The lock self-activates a certain number of minutes after the last time the buttons were pressed. Thus one only needs to unlock the system when necessary.

To unlock the buttons, press **SHIFT** and then both arrow buttons at once.

SHIFT	MAX	No. of minutes until self-locking activates.
--------------	------------	--

Eg if it is set at 10, it will lock after 10 minutes.
 If it is set to 0, it will not lock.

1.5 Changing SET TEMP

Press **ACTUAL SET TEMP** and change it with the arrow keys.

The controller will always try to reach this set-point, thus fluctuations will be concentrated around this set-point.

1.6 Changing SET pH

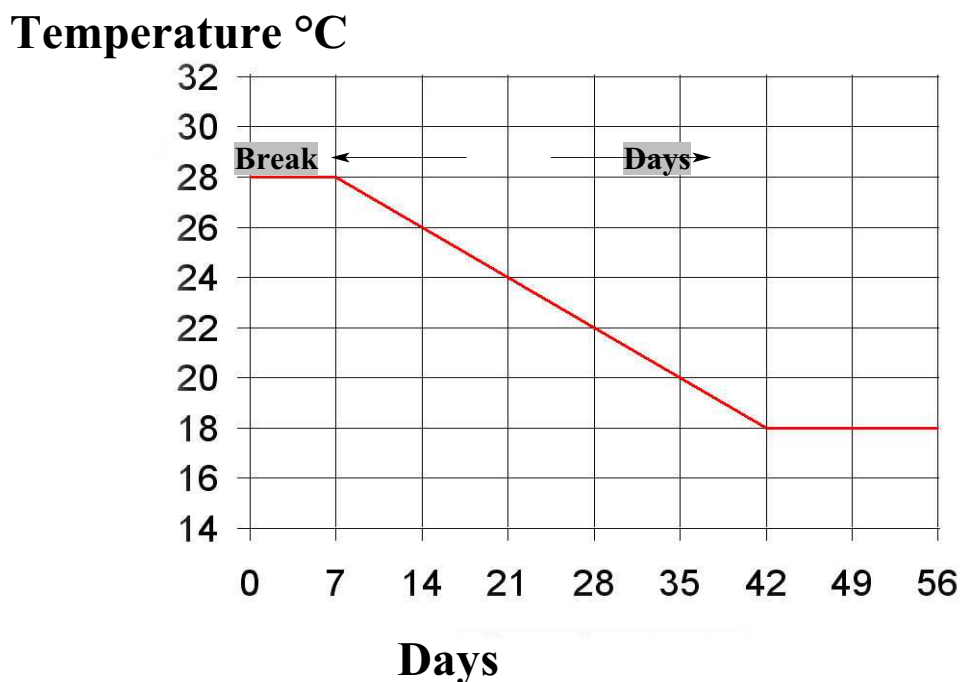
Press **SET pH** and change it with the arrow keys.

The controller will always try to reach this set-point, thus fluctuations will be concentrated around this set-point.

2.2 Automatic altering of set-temperatur

DAYS	Number of days at which the controller changes ACTUAL SET TEMP towards FUTURE SET TEMP .
DAYS²	Break - idle period - number of days, before the change starts

DAYS² decreases one every day at midnight (0.00), and when it reaches 0, the changing of **ACTUAL SET TEMP** will begin. At that point, **DAYS** will start to decrease.



2.3 HEATING-COOLING

The keys **HEATING-COOLING** and will show the percentage output for heating/cooling.

! Negative figures indicate that cooling is applied and positive figures that heat is applied.

The Xp-band - **SHIFT ACTUAL SET TEMP** is 2.0°C but may be lowered to 1.0 to perform greater accuracy or increased to avoid periodical fluctuations, “overshooting”.

Please note, that the controller continuously calculates the output needed to maintain the temperature, thus the output may assume values between -100 and +100, although the temperature seems to be correct. A certain time with fluctuating values can be expected just after startup or after various parameters have been changed.

2.4 BASE -ACID

The key **BASE -ACID** will show the percentage output for supply of base and acid

! Negative figures indicate that cooling is applied and positive figures that heat is applied.

The Xp-band - **SHIFT SET pH** is 2.0°C but may be lowered to 1.0 to perform greater accuracy or increased to avoid periodical fluctuations, “overshooting”.

Please note, that the controller continuously calculates the output needed to maintain the pH-value, thus the output may assume values between -100 and +100, although the temperature seems to be correct. A certain time with fluctuating values can be expected just after startup or after various parameters have been changed.

2.5 Minimum runtime (!)

In order not to submit the refrigerating unit to an overload, a minimum runtime is specified.

SHIFT - HEATING-COOLING	Minimum runtime for temperature controller: 30 sec
SHIFT - BASE -ACID	Minimum runtime for pH-controller: 30 sec

! Instead of a fixed cycle, a dynamic cycle is utilized.:

HEATING -COOLING	ON Time	OFF Time
1%	30 sec	49½ minutes
10%	33 sec	5 minutes
50%	10 minutes	10 minute

Figures correspond to minimum runtime = 30

2.6 Hour counters

A total of 4 hour counters is at your service in order to compare the consumption.

HEATING -COOLING	TIME TIME²	Number of hours cooling has been activated Number of hours heating has been activated
BASE -ACID	TIME TIME²	Number of hours base supply relay has been activated Number of hours acid supply relay has been activated

Counters can be **reset** using **ARROW DOWN**, keeping it depressed, until it reaches 0.

2.7 Manuel control /STOP of heating and cooling

When the **HEATING-COOLING** or **BASE -ACID** key is activated, **START STOP** can be pressed, and the value is set to 0. The **START STOP** key will flash, and the output can now be manually controlled using the **ARROW UP** and **ARROW DOWN**.

The desired value can be set, and that value is maintained until **START STOP** is pressed again, even if other keys are pressed in the meantime.

Please note, that the output relay will not start/stop immediately due to the minimum runtime function.

When **RETURN** is pressed, manual control is indicated by flashing with the keys in question.

2.8 Temp*days

Temp*days is continuously calculated as **TEMP** multiplied by time passing. Thus a temperature of 10°C over a period of time of 10 days, yields 100 temp*days.

2.9 Water l/min

The **WATER l/min** holds 2 registers:

1. value actual output
2. value output per minute. (Display shows "A" before the value)

This is a simple timer with fixed cyclus time = 1 minute. It may be used to control water flow, once measured the flow per minute.

WATER l/min	WATER l/min²	ON Time	OFF Time
5	10	30 sec	30 sec
1	60	1 sec	59 sec
50	150	20 sec	40 sec
1	3	20 sec	40 sec

3.0 Start/stop of alarm supervision

Alarm supervision can be enabled or disabled using the **START STOP** key.
(Except when **HEATING-COOLING** and **BASE -ACID** keys lights.)

ALARM-lamp	ALARM, state
light	OK, alarm supervision active
flashing	Alarm condition
off	Alarm supervision stopped

3.1 Alarm test

In case of alarm, the alarm relay goes into no-signal mode (no current on the coil).

SHIFT	ALARM SETTINGS	Alarm test
--------------	-----------------------	------------

Press **RETURN** to stop the test.

3.2 Alarm situations

An alarm is signalled by the ALARM light flashing. There are various alarm situations, indicated by code numbers. Press **ALARM SETTINGS** to see the alarm code number displayed.

ALARM CODE	MEANING
-1	Alarm monitoring is off
0	OK
1	Minimum temperature limit, regulator 1 - absolute
2	Maximum temperature limit, regulator 1 - absolute
3	Minimum temperature limie, regulator 1 - relative to ACTUAL SET TEMP
4	Maximum temperature limit, regulator 1 - relative to ACTUAL SET TEMP
5	Minimum pH-value limit
6	Maximum pH-value limit
7	Short-circuit on temperature sensor
8	Broken wire on temperature sensor

States of alarm - code no.1-6 - are also indicated by flashing on the display when the relevant alarm-level is displayed.

3.3 Setting alarm levels

The alarm levels are also on the **ALARM SETTINGS** key. CODES 1 to 6 represent the number of times the **ALARM SETTINGS** key must be pressed to change the alarm level concerned.

CODE	PRESS	Alarm limit	Lamp indication
1	ALARM SETTINGS ²	Minimum temperature limit, regulator 1 - absolute	TEMP + MIN
2	ALARM SETTINGS ³	Maximum temperature limit, regulator 1 - absolute	TEMP + MAX
3	ALARM SETTINGS ⁴	Minimum temperature limit, regulator 1 - relative til ACTUAL SET TEMP	ACTUAL SET TEMP + MIN
4	ALARM SETTINGS ⁵	Maximum temperature limit, regulator 1 - relative til ACTUAL SET TEMP	ACTUAL SET TEMP + MAX
5	ALARM SETTINGS ⁶	Minimum pH-value limit	pH + MIN
6	ALARM SETTINGS ⁷	Maximum pH-value limit	pH + MAX

4.0 Historical data, LOG-function

With a 10 minutes interval all most all data is stored:

- Measured temperatures.
- Values vital to heat and cooling control.
- All controlling parameteres, alarm limits and alarm codes.

Since only variations are interesting, the data are only stored if the figure differs from what it was 10 minutes before. In the case of an ALARM and on start/stop of alarm monitoring, any changes are logged, whether 10 minutes have passed or not.

4.1 Reading minimum and maximum values

TEMP	MAX MIN	Highest measured temperature within the current day (from 00.00) Lowest measured temperature within the current day (from 00.00)
pH	MAX MIN	Highest measured pH-value within the current day (from 00.00) Lowest measured pH-value within the current day (from 00.00)

Please note, that the HISTORIC lamp will flash to indicate that the readings displayed are not current.

When in historic mode - the HISTORIC lamp flashes, one can also go one or more days back in time by pressing **DATE** followed by **ARROW DOWN**. Press **MIN** or **MAX** again. The corresponding time of day can be seen, by pressing **TIME**.

Please note: *The controller must be running for a full 24 hours, that is passing midnight in order to be able to show MIN/MAX values. Otherwise a dash is shown.*

NB! Press **RETURN** to leave the historic function, and return to normal operation.

4.2 Recall of logged data, entering *historic mode*

All values are available from a PC' using PROFESSOR PARTYLINE PC software.

The most important ones can also be shown directly on the controller.

Activating HISTORIC mode		
TEMP or pH	ARROW DOWN	Display now shows the last measured temperature that differs from the present one. Keep pressing ARROW DOWN to see even older values.
	ARROW UP	Moves forward in time.

Please note, that the HISTORIC lamp will flash to indicate that the readings displayed are not current.

When the HISTORIC lamp is flashing, the following keys are available:

KEY	Display will show
TEMP	Corresponding temperature
pH	Corresponding pH-value
HEATING -COOLING	Corresponding cooling/heating output value
BASE -ACID	Corresponding Base -Acid output value
ALARM SETTINGS	Corresponding alarm code
TIME	Point in time. Are shown in 10 minute divisions except when an alarm situation occurred, or START STOP was pressed. Thus odd points in time can occur.
DATE	Date. Using ARROW UP or ARROW DOWN moves from day to day (00.00)
ARROW UP/DOWN	Moves 1 LOG-value forward/backward in time. The points in time that is shown refers to the active key: TEMP, pH, HEATING-COOLING, BASE -ACID and ALARM SETTINGS
RETURN	Back to normal operation.

5.0 Installation, special parameters.

SHIFT is used to enter these special parameters.

	Display shows
SHIFT key lights	----

After pressing the **SHIFT** key a second key is pressed as described in the next sections, which is divided into subjects.

5.1 PID-regulator parameters, temperature regulator

KEY		Parameter	Default
SHIFT	ACTUAL SET TEMP 1	Xp band	2.0 °C
	ACTUAL SET TEMP 1²	Degree of integration	20 %
	ACTUAL SET TEMP 1³	Integration time	10 minutes
	ACTUAL SET TEMP 1⁴	Differential effect	0.2 °C

5.2 PID-regulator parameters, pH regulator

KEY		Parameter	Default
SHIFT	SET pH	Xp-band	2.0
	SET pH²	Degree of integration	20 %
	SET pH³	Integration time	10 minutes
	SET pH⁴	Differential degree	0.2

5.3 Time, date and year

TIME	Time of day
DATE	Date
SHIFT - DATE	Year

Time, date and year are used as a time stamp when data is logged, enabling the user to recall logged data.

5.4 Communication parameters

KEYS		Parameter
SHIFT	FUTURE SET TEMP	Station number to identify unit. More units must be installed with separate numbers

5.5 Communication with a PC

Checklist:

- Station number must be specified - **SHIFT FUTURE SET TEMP**
- printer LOG must be disabled = 0. **SHIFT TIME**
- Dipswitch 4 must be set to OFF (RS485) (ON=RS232)
- Verify that **TIME, DATE** and year (**SHIFT - DATE**) is correct.

5.6 Register/parameter survey

Reg. No.	Keys	Text	Default-setting	User-setting
1	TEMP	WATER TEMPERATURE	-	
2	pH	pH VALUE	-	
3	BASE -ACID	BASE(-)/ACID SUPPLY	-	
4	HEAT -COOLING	HEAT(-)/COOLING SUPPLY	-	
5	ACTUAL SET TEMP.	ACTUAL SET TEMP.		
6	FUTURE SET TEMP.	FUTURE SET TEMP.		
7	DAYS	NO. OF DAYS	0	
8	SHIFT SET pH	pH XP-BAND		
9	SHIFT ACTUAL SET TEMP.	HEAT/COOLING XP-BAND		
10	ALARM SETTINGS ⁴	RELATIVE MIN. TEMP.		
11	ALARM SETTINGS ⁵	RELATIVE MAX. TEMP.		
12	ALARM SETTINGS ²	ABSOLUTE MIN. TEMP.		
13	ALARM SETTINGS ³	ABSOLUTE MAX. TEMP.		
14	ALARM SETTINGS	ALARM CAUSE	-	
15	START STOP	ALARM SUPERVISION ON/OFF	-	
22	SHIFT ACTUAL SET TEMP. ²	INTEGRATION ADD IN % TO TEMP.		
23	SHIFT ACTUAL SET TEMP. ³	INTEGRATION TIME TO TEMP.		
25	BASE-ACID START STOP	ACID/BASE SUPPLY START-STOP		

Reg. No.	Keys	Text	Default-setting	User-setting
26	HEAT-COOLING START STOP	HEAT/COOLING SUPPLY START-STOP		
27	pH SET	pH SET		
29	TIME	CURRENT TIME OF DAY	-	
30	DATE	CURRENT DATE	-	
31	SHIFT DATE	CURRENT YEAR	-	
32	SHIFT BASE-ACID ²	INTEGRATION ADD IN % TO pH		
33	SHIFT BASE-ACID ³	INTEGRATION TIME TO pH		
34	HEAT-COOLING TIME	HOUR COUNTER FOR HEAT SUPPLY	0	
35	HEAT-COOLING TIME ²	HOUR COUNTER FOR COOLING SUPPLY	0	
36	BASE-ACID TIME ²	HOUR COUNTER FOR ACID SUPPLY	0	
37	BASE-ACID TIME ²	HOUR COUNTER FOR BASE SUPPLY	0	
38	SHIFT ACTUAL SET TEMP. ⁴	DIFFERENTIAL LIMIT TEMP.		
39	SHIFT pH SET ⁴	DIFFERENTIAL LIMIT pH		
40	ALARM SETTINGS ⁶	ABSOLUTE MIN. pH		
41	ALARM SETTINGS ⁷	ABSOLUTE MAX. pH		
42	SHIFT TEMP	OFFSET TEMPERATURE		
43	SHIFT pH	OFFSET pH	0	
44	SHIFT HEAT-COOLING	ON/OFF TIME TEMP	30	
45	SHIFT BASE-ACID	ON/OFF TIME pH	30	
50	DAYS ²	DAYS PRIOR TO AUT. LOWERING OF SET.	0	
81		Dip switch		

6.1 Working modes - heating, cooling or both ?

! To make the regulator work properly, it is necessary to set dipswitches according to the heating and cooling equipment connected to Dr.Kelvin:

Eight dipswitches are placed on rear side of the panel, by the circular battery. To access, please unscrew the six panel screws.

Nr.	OFF (=OPEN)	ON (dipswitch top in low position)
1	Default	-
2	Heating equipment connected to terminal 3/4 (regulator #1.)	No heating equipment connected to terminal 3/4 (regulator #1.)
3	Cooling equipment connected to terminal 7/8 (regulator #1.)	No cooling equipment connected to terminal 7/8 (regulator #1.)
4	RS485 kommunikation is activated	RS232 kommunikation is activated
5	Heating equipment connected to terminal 9/10 (regulator #2.)	No BASE SUPPLY equipment connected to terminal 9/10
6	Cooling equipment connected to terminal 11/12 (regulator #2.)	No ACID SUPPLY equipment connected to terminal 11/12
7	Default	-
8	Default	If set to ON during power up, the on-board memory is erased, and default settings are loaded. The erasing process takes a few seconds during which the display is blanked.

6.2 Adjustment of temperature sensor

In order to show the correct temperature, the sensors must be calibrated during installation.

The temperature sensors are pre-calibrated from the factory, and supplied with an offset value, that should be entered:

SHIFT	TEMP	Adjusting temperature sensor
--------------	-------------	------------------------------

6.3 Adjustment of pH probe

- Submerge the tip of the probe in a pH= 7.0 buffer liquid for a few minutes. Examine, that there is no air trapped on/in the tip. Reading should be 7.0 in the display (**pH**-key). Otherwise adjust by entering the difference at **SHIFT pH**.
- Submerge the tip of the probe in a buffer liquid with a pH-value of 4.0, for a few minutes. Examine, that there is no air trapped on the tip. Reading should be 4.0 in the display (**pH**-key). When not, press **SHIFT pH²** (**pH**-key twice), and then both arrow keys at the same time. Three “beeps” will sound and the gain-factor, shown in the display will change to a value, that makes pH- reading be 4.0.

Note ! If gain-factor changes to 0.200 or 5.000 the pH-probe is not working properly, or, is submerged in the wrong buffer liquid!

Tip If you have buffer liquid of another value 3.0 or 5.0 you may use this, but this value must be entered at **SHIFT pH³** (default 4.0)

6.4 Maintenance of pH-probe

Once every month, or when bio-film appears, the probe should be cleaned. The tip is very delicate, thin glass with a micro crack, which must not be filled with dirt.

Caution !

The tip of the pH-probe must not be allowed to dry out. Whenever stored the cap must be filled with buffer liquid 7.0 pH or 4.0 pH and affixed to the probe. Tapwater may be used for a couple of days, but never distilled water.

Life expectancy: @ 2 years (Battery loses power)

Cleaning procedure:

1. Dissolve 1/4 teaspoonfull of washing detergent with enzymes in a cup.
2. Submerge the probe for 2 minutes.
3. Rinse thoroughly under running, fresh water. (if not clean, repeat)
4. After cleaning it should be calibrated.

Dr.Kelvin /pH

TEMPERATURE - pH CONTROLLER

7.1 Connection diagram

