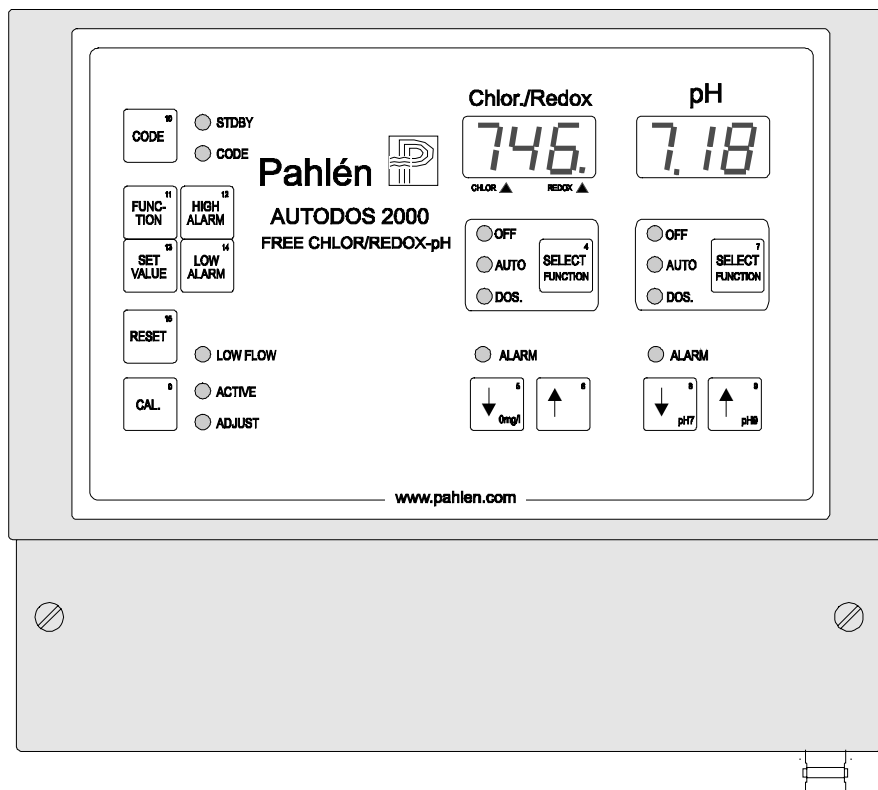


AUTODOS 2000

pH/chlorine monitor
for swimming pools



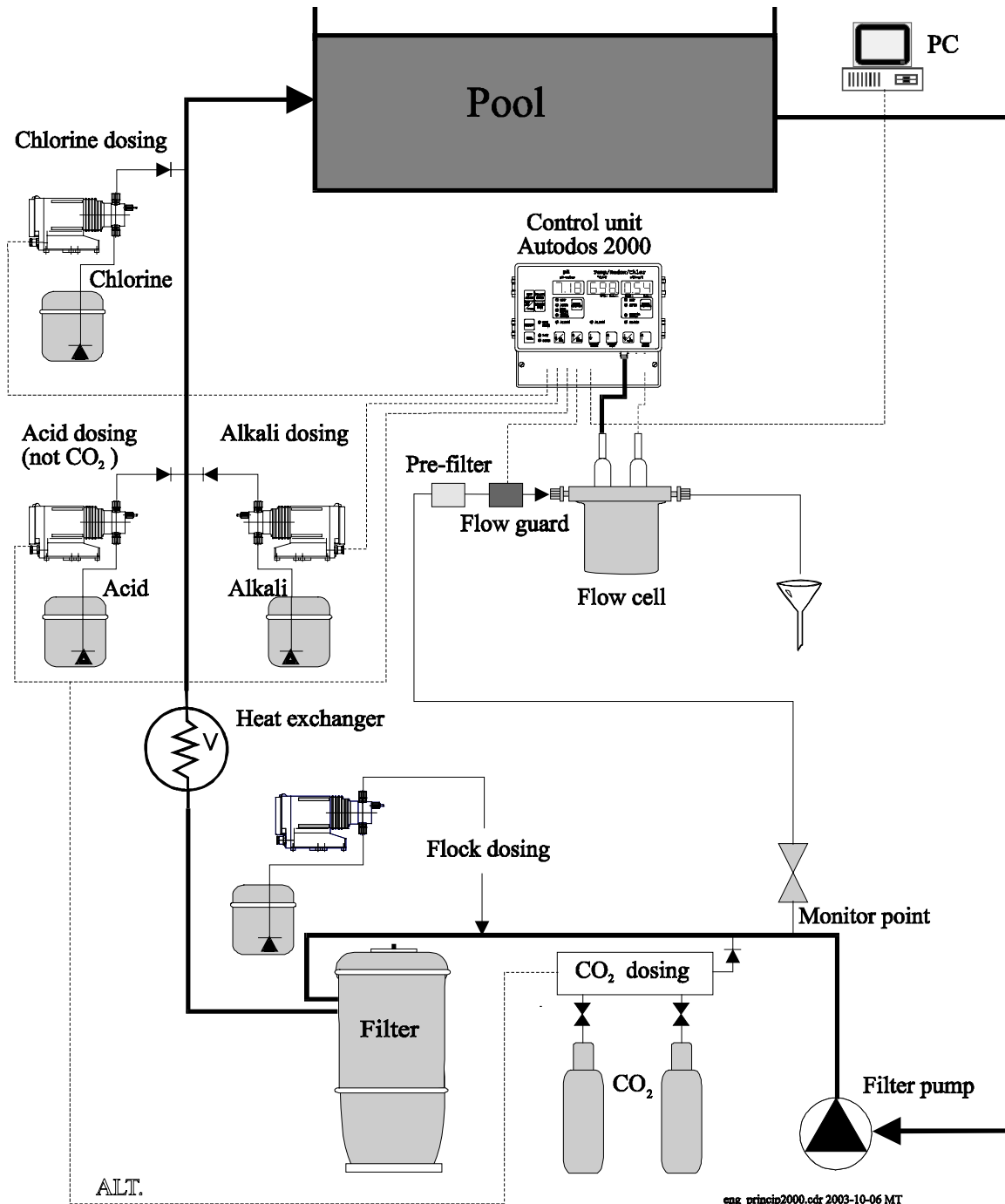
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1. Installation

1.1. Suggested Layout for Installation of AUTODOS 2000



1.2. Guide to Installation of an AUTODOS 2000 System

Important points to note when installing an AUTODOS 2000 system.

Suitable component placement and connections are shown in the preceding diagram.

Monitoring and dosing connections should be made according to the diagram.

The chlorine and acid/alkali injection points should be as separated as possible to avoid any chemical interaction.

Both the control unit and the flow cell should be mounted in a vibration free and dry atmosphere. Suitable water flow is found in the 'Maintenance' chapter.

Place the flow cell as near as possible to the monitoring point to avoid long reaction times. It is also advantageous if the control unit is near to the flow cell to facilitate calibration.

The outlet from the flow cell should be free from pressure. Lead the outlet water to a drain or a pressure equalization tank.

The dosing pumps should be controlled via the filter pump, electrically via a contactor.

A flow guard ought to be used for preventing dosing in the event of no water flow in the flow cell.

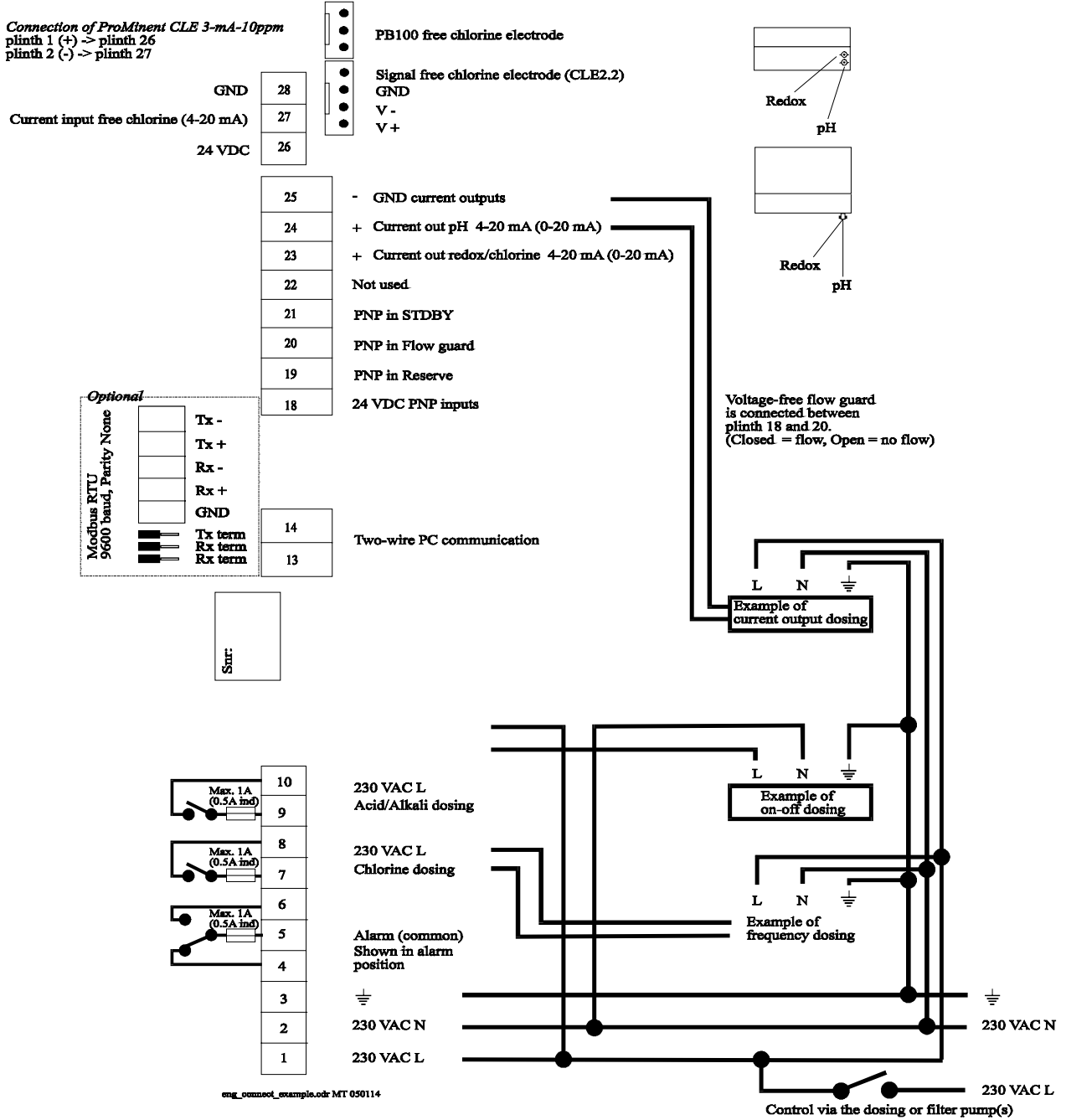
The alarm relay is arranged to operate in a "fail safe" manner. Voltage is applied to the relay when no fault condition exists and is disconnected if a fault condition occurs. This means that the relay may be used to indicate a power fail condition. Electrical connections can be made as suggested in the following diagrams and should be carried out by a qualified electrician.

When installation of an AUTODOS 2000 with free chlorine electrode in swimming pools, that have previously been treated with organic chlorine (trichlor or dichlor), the pool water must be changed. This is because the cyanuric acid content in the pool water, caused by the organic chlorine, results in an exceptionally high value of chlorine when DPD-testing, thus making a correct calibration impossible. The chlorine cells PB-100 and Cle show the free chlorine value, whereas a DPD-test shows the free chlorine together with the cyanuric acid bound chlorine. Calibration shall be made against a photometer.

Dosing relay is max. 1A.

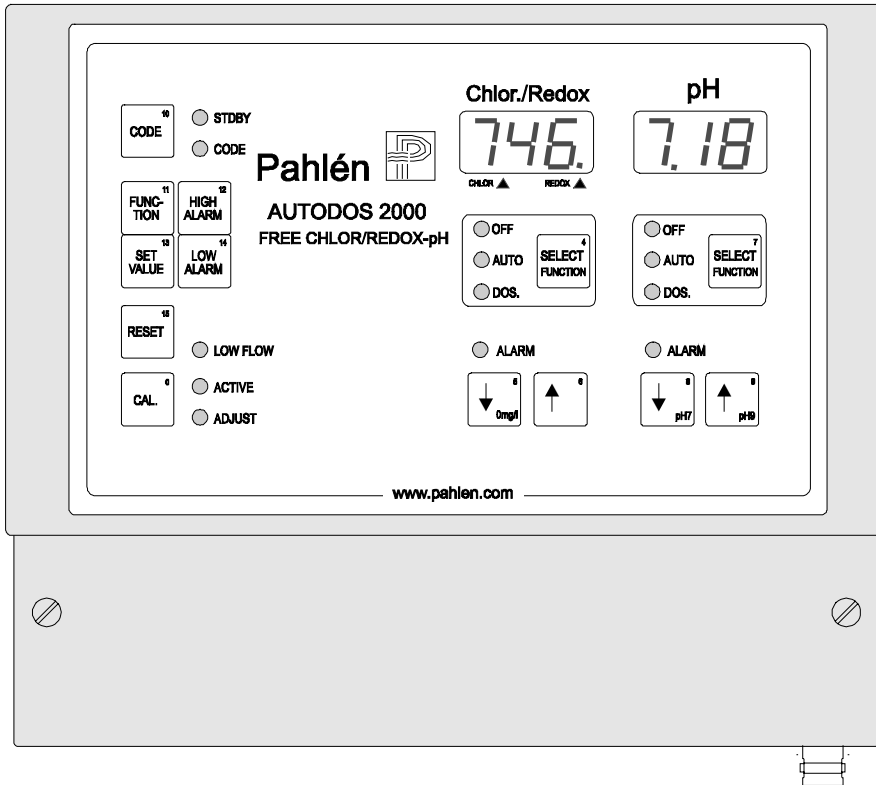
1.3. Suggested Connections

In the example below, connections for the three available regulation alternatives are shown.



2. Operation

2.1. Controls and Indicators



This is a brief description of all functions and indicators.
Refer to the respective sections in this handbook for further information.

NORMAL DISPLAYS

Normally channel 1 displays redox or free chlorine and channel 2 displays pH. Chosen redox or chlorine display is indicated by the decimal point on channel 1. With start or set up or during error conditions short text messages may be displayed (refer to the 'text message' section for further information).

CODE LEVELS

To avoid unintentional alterations and to prevent unauthorised personal from changing the settings, there are two different code levels. In normal mode no settings or values can be altered, you can only RESET the alarms.

CODE LEVEL 1: Set values, alarm limits and regulation mode can be changed and calibration is possible.

CODE LEVEL 2: All available changes, including set-up are possible

If no codes are used, code level 2 is reached directly when the button 'CODE' is pressed.

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ENTER CODE LEVEL

CODE	When the button ' CODE ' is pressed down, the opening code can be entered by using the buttons ' 0 ', ' 4 '–' 9 '. If the entered code is the same as opening code 1, you will enter code level 1 and if the entered code is the same as opening code 2, you will enter code level 2 when the button ' CODE ' is pressed. This is indicated by LED ' CODE ', if the LED ' CODE ' is flashing you are in code level 2 and if there is steady light, you are in code level 1. The opening code can only be altered when you are in code level 2 and in calibration mode, this is described in the set-up chapter. If you have forgotten the code, it can be displayed during the startup sequence. If the button ' CODE ' is pressed during the count-down time, the code for code level 2 is displayed. If no codes are used, code level 2 is reached directly when the button ' CODE ' is pressed.
-------------	---

VIEW/ALTER SET VALUES

SET VALUE	When the button ' SET VALUE ' is pressed down, the set values for chlorine dosing (display 1) and pH dosing (display 2) are displayed. The set values can be altered by using the buttons '↓' or '↑' below the displays for the respective channel. At least code level 1 is required for alteration.
------------------	--

VIEW/ALTER ALARM LIMITS

ALARM HIGH	When the button ' HIGH ALARM ' is pressed down, the high alarm limits are displayed. The high alarm limits can be altered by using the buttons '↓' or '↑' below the displays for the respective channels. At least code level 1 is required for alteration.
ALARM LOW	When the button ' LOW ALARM ' is pressed down, the low alarm limits are displayed. The low alarm limits can be altered by using the buttons '↓' or '↑' below the displays for the respective channels. At least code level 1 is required for alteration.

OTHER DISPLAY

VIEW UNCAL	The uncalibrated value for all electrodes can be shown by pressing the ' FUNCTION ' and ' LOW ALARM ' buttons simultaneously.
VIEW FLOW GUARD	To display the current status of the flow guard input (' F-0 ' = flow OFF, ' F-1 ' = flow ON), press the ' SET VALUE ' and ' HIGH ALARM ' buttons simultaneously. If no flow guard is selected, there will be no display.
VIEW VERSION	To display the current programme version press the ' HIGH ALARM ' and ' LOW ALARM ' buttons simultaneously.
VIEW SERIAL NUMBER	To display the factory programmed serial number, press the ' FUNCTION ' and ' HIGH ALARM ' buttons simultaneously.

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DOSING MODE SELECTION

SELECT FUNC.	When the button ' SELECT FUNCTION ' is pressed, the dosing mode switches between OFF-AUTO-OFF-AUTO-OFF-..... Dosing can be deselected in set-up mode and if this is the case, nothing happens when you press the button. To get manual dosing , press the buttons ' SELECT FUNCTION ' and ' SET VALUE ' simultaneously. Manual dosing is deactivated by pressing the button ' SELECT FUNCTION '. At least code level 1 is required for alteration of dosing mode.
---------------------	---

OFF	No dosing
AUTO	Automatic dosing according to chosen parameters (normal selection)
DOSING	Continuos dosing (even when error)

OTHER BUTTONS

RESET	Press to clear a current alarm condition. When this button is pressed a text is shown on the appropriate channel to indicate the type of alarm, after 1 second the displayed alarm is acknowledged and a new alarm displayed if there are any. When all alarms are acknowledged, the alarm relay is always cleared and depending upon whether the fault condition(s) still exists, the alarm LED is either cleared or goes over to a steady display. Active alarms are displayed while the ' RESET ' button is pressed.
CAL	Use this button to enter the calibration mode. This button operates on a rotary basis selecting either ACTIVE, ADJUST or OFF in turn.
↑↓	The arrow buttons are used for calibration or changing set values and alarm limits on the 2 channels. If either of these buttons are held depressed for more than 1 second a 'fast stepping' mode is entered.

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LED's (INDICATORS) FOR DOSING

- ⊗ **OFF** Dosing not active
- ⊗ **AUTO** Dosing with automatic control
- ⊗ **DOSING** Dosing active

If not '**OFF**' and not '**AUTO**' then manual dosing is selected and if no dosing takes place, the dosing is deselected in the set-up. It may also be off because of too long dosing time if this function is selected but in that case there will also be an alarm.

If the pH value is outside its alarm limits, there is an 'alarm' on the chlorine regulation channel if chlorine dosing is active. The chlorine dosing is stopped until the pH value is within their limits again. This is indicated by flashing AUTO LED on the chlorine channel and alarm text 'PHF'.

LED's (INDICATORS) FOR ALARM

- ⊗ **LOW FLOW** Insufficient water flow through the flow cell
- ⊗ **ALARM** High or low alarm or an electrode fault on the displaying channel

All alarms have a 5 second delay.

LED's (INDICATORS) FOR CALIBRATION

- ⊗ **ACTIVE** Calibration mode entered. Possible to set chlorine zero calibration, pH7 and pH9 values
- ⊗ **ADJUST** Calibration mode entered. Possible to set chlorine calibration values

Note. If the '**ACTIVE**' LED flashes then set up mode has been entered. Leave set up mode by stepping past the last row until the '**ACTIVE**' LED is cleared. Leaving set up mode automatically returns the unit to normal operation.

OTHER LED's (INDICATORS)

- ⊗ **CODE** Indicates active code level 1 or active code level 2 (flashing)
- ⊗ **STDBY** Indicates input STDBY that stops alarm and dosing, alarm relay is activated at STDBY

2.2. Text Messages

Under certain conditions channels 1 and 1 can display the following text messages.

2.2.1. Run Time Texts

The following texts can occur during normal programme operation.

EEP -Er During a first start or with a fault in the EEPROM. Reset returns to the basic program.
SEC ### During start-up, ### is the remaining start delay in seconds.

2.2.2. Fault Texts

These are the texts that can be displayed during calibration or after an incorrect calibration.

EL1 Active electrode fault 1 (low calibration point below limit).
EL2 Active electrode fault 2 (low calibration point above limit).
EL3 Active electrode fault 3 (high calibration point below limit).
EL4 Active electrode fault 4 (high calibration point above limit).
noC Chlorine value too low, calibration not possible.

These are the texts (in priority order) that can be displayed when the '**RESET**' button is pressed, the message is displayed on the affected channel.

FLo Active flow alarm.
Lo Active low alarm.
Hi Active high alarm.
doS Dosing error
PHF Chlorine dosing stopp because of pH exceeding limits
--- Everything OK.

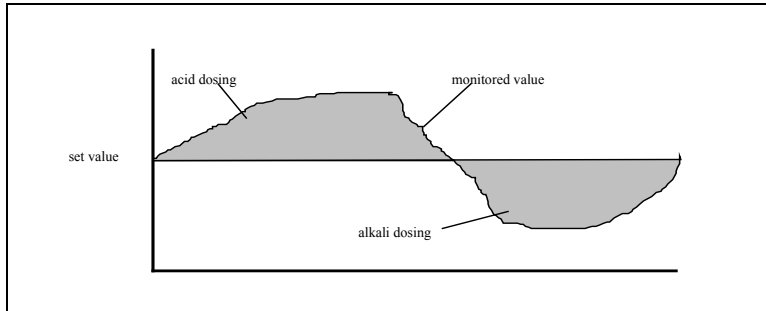
2.3. Start-up Sequence

At start-up the AUTODOS 2000 displays the text ' SEC 059', ' SEC 058'..... showing the remaining start-up delay in seconds. By pressing the '**RESET**' button the start-up sequence may be bypassed. The start-up delay is intended to prevent false alarms due to unstabilised measured values.

2.4. Description of on/off Dosing Control

2.4.1. Acid/Alkali Dosing (on/off) by pH Control

The drawing below illustrates both acid and alkali dosing. AUTODOS 2000 uses acid or alkali dosing (selected in set-up mode).



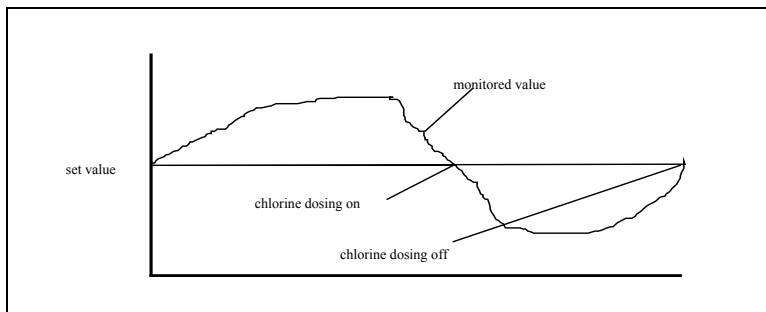
Acid dosing:

If the pH exceeds the acid set value then acid dosing begins and continues until the pH is returned to the acid set value.

Alkali dosing:

If the pH falls below the alkali set value then alkali dosing will commence and continue until the pH exceeds the alkali set value.

2.4.2. Chlorine Dosing (on/off) by Chlorine Monitoring



As long as the monitored value exceeds the set value then chlorine dosing is inactive. If the chlorine level falls below the set value then chlorine dosing commences and will continue until the chlorine level equals or exceeds the monitored value.

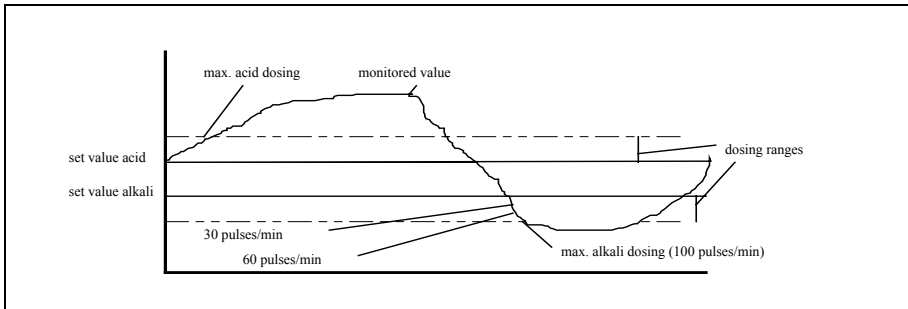
The example above shows the action for regulation of free chlorine, where chemicals are added to get higher free chlorine value. Regulation of combined chlorine works in the opposite manner, dosing is used for lowering the combined chlorinated value.

2.5. Description of Frequency Control Dosing with P-regulation

P-regulation is obtained by setting the D-time = 0 (in set-up mode). When P-regulation is selected the frequency is controlled only by the difference between the set value and the measured value. The examples below uses a maximum pulse frequency of 100 pulses/min.

2.5.1. Acid/Alkali Dosing (frequency) pH Control (P-regulation)

The drawing below illustrates both acid and alkali dosing. AUTODOS 2000 uses acid or alkali dosing (selected in setup-mode).



The dosing range is used to control the operation of the dosing relay whenever a difference occurs between the set value and the monitored value. Dosing range is selected in set-up mode.

Acid dosing:

Referring to the above diagram it can be seen that acid dosing commences when the monitored value exceeds the acid set value. Dosing is dependent upon the dosing range and the maximum dosing of 100 pulses/min will occur whenever the monitored value is equal to or greater than the limit of the dosing range, and will be 0 pulses/min when the monitored value equals the set value. Between these two limits the dosing will be proportional to the difference between the monitored and the set value in the range 0 to 100 pulses/min.

Alkali dosing:

If the monitored value falls below the alkali set value then alkali dosing will commence until the pH value exceeds the alkali set value. With alkali dosing the same principles as for acid dosing apply although in the opposite direction.

2.5.2. Chlorine Dosing (frequency) by Chlorine Monitoring (P-regulation)

Chlorine dosing operates as follows. When the chlorine level falls below the set value dosing commences at the lowest rate, and its rate increases if the chlorine level continues to drop. When the monitored value is equal to or less than the dosing limit then dosing is at the maximum rate of 100 pulses/min. Between the set value and the dosing limit the dosing rate will be proportional to the difference between the monitored and the set value in the range 0 to 100 pulses/min. Dosing range is selected in set-up mode.

Regulation of combined chlorine works in the opposite manner, dosing is used for lowering the combined chlorined value.

2.6. Description of Frequency Control with PD-regulation

PD-regulation is selected when the regulation is frequency controlled and the D-time > 0 seconds (selected in set-up). PD-regulation implies that the frequency is controlled by the difference between the set value and the measured value (P) and also by the speed of change in the difference (D).

The idea behind making a PD-regulator and not a PID-regulator, is because the system in itself has a large integration factor (I). The D-part helps to smooth the result, especially in small pools, because the PD-regulator changes the dosing as soon as a change in the value is detected and this makes the regulator faster.

Set values are viewed by pressing the 'SET VALUE' button. The displayed set values may be changed by pressing the '↑' or '↓' buttons under the appropriate display while holding the 'SET VALUE' button depressed. If either of these arrow buttons are held down for more than 1 second a 'fast stepping' mode is entered.

The other parameters needed for the PD-regulation are set in the set-up. The parameters are:

1. **P-band** The difference between measured value and set value needed for full output. A small P-value makes the regulator react more for a given difference.
2. **D-time** Sets how much the regulator shall react for a given change of the measured value. A large D-value gives a large reaction.

2.6.1. Parameter Choice for PD-regulation

A good approach for selection of PD-regulation parameters is to begin with a P-regulator, and adjust this to a satisfactory result, and then start with a short D-time and increase this until a good regulation result is reached.

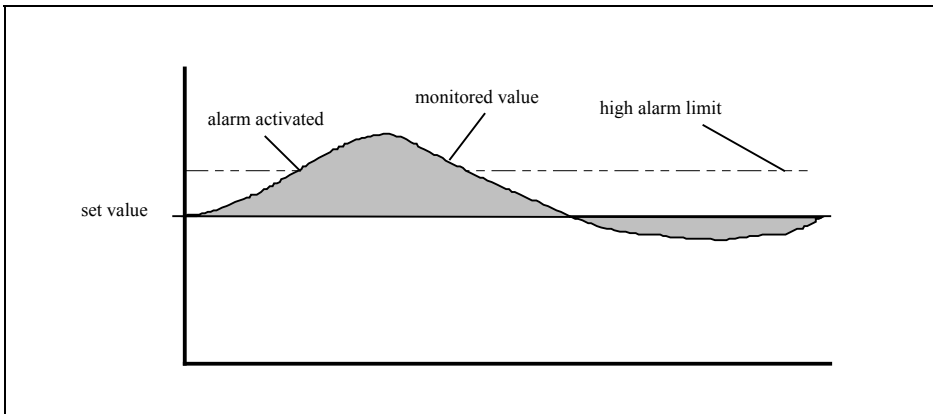
If the PD-regulator is too slow, it is advisable to reduce the P-band.

The delaytime between dosing and the measured effect of it shall be kept as short as possible. The shorter the delaytime, the better the regulator works.

2.7. Dosing Control via Current Output

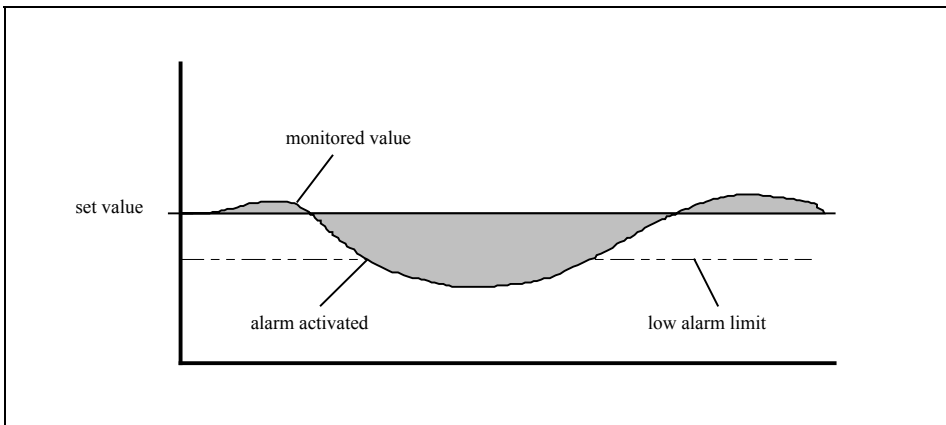
When dosing control via the current output is selected all set values and controls are used in the same manner as when frequency control is used. The relay output still functions as in frequency control when current output regulation is selected. Current output regulation is selected in the set-up.

2.8. Alarm High



A high alarm occurs whenever the monitored value of the appropriate channel exceeds the user determined limit.

2.9. Alarm Low



A low alarm occurs if the monitored value of the appropriate channel is below the user determined limit.

2.10. Alarm and Flow Fault LED's

A fault condition is indicated by a flashing '**ALARM**' LED and the common alarm relay is also activated. Note that the alarm relay is called during normal operation and is released (voltage free) if a fault condition occurs. After a RESET the alarm relay is always reset (voltage applied) and the '**ALARM**' LED is either cleared or goes over to a steady display, depending upon whether or not the fault condition still exists. Indications are made for low alarm, high alarm and flow faults.

Dosing is effected by the alarms as follows:

Flow	stops all dosing (re-starts when flow is OK)
Low pH	stops chlorine dosing (re-starts when the value is within the limits)
High pH	stops chlorine dosing (re-starts when the value is within the limits)
Low redox/chlorine	-
High redox/chlorine	-
Dos pH	stops pH dosing (re-starts at RESET)
Dos chlorine	stops chlorine dosing (re-starts at RESET)

All alarms have a 5 second delay time.

2.11. Reset

RESET of all alarms is made by pressing the '**RESET**' button until the LED stops flashing. While the button is held down text(s) will be shown - for alarms that were active at the time the button was pressed - on displays 1 to 2 with a one second interval. When the button is released the non active cleared alarms will disappear and a second press on the '**RESET**' button will display the active cleared alarms.

2.12. Probe Check (display uncalibrated values)

The uncalibrated electrode values on all channels may be displayed by pressing the '**FUNCTION**' and '**LOW ALARM**' buttons. This can be of help when electrodes do not behave as normal.

2.13. Set-up

2.13.1. Set-up

It is possible to *enter the set-up* only if *code level 2 is active*, and first you must also enter calibration mode. If you try entering calibration mode without first enter code level 2, the display shows 'Cd'.

Enter opening code for code level 2:

When the 'CODE' button is held pressed, the opening code for code level 2 may be entered using the buttons '0', '4'-'9'. If the entered code is correct, you enter code level 2 when the 'CODE' button is released. Active code level 2 is indicated by a flashing diode 'CODE'. Even if the code function is not used, you need to press the 'CODE' button to enter code level 2.

2.13.2. Change Opening Code for Code Level

If you have forgotten the code, it can be displayed during the startup sequence. If the button 'CODE' is pressed during the count-down time, the code for code level 2 is displayed.

Code level 2 must be active if you are going to change the opening codes.

Enter opening code (code level 1):

When the 'CODE' button is held pressed, the opening code for code level 1 may be entered using the buttons '0', '4'-'9'. Up to 6 digits can be used in the opening code.

Enter opening code (code level 2):

When the 'CODE' button is held pressed next time, the opening code for code level 2 may be entered using the buttons '0', '4'-'9'. Up to 6 digits can be used in the opening code.

2.13.3. Enter Selected Set-up Mode

Set up mode is entered via calibration, first enter calibration by pressing the 'CAL' button until the 'ACTIVE' LED lights. There are three set-up alternatives and the following button combinations are used for entering the selected set-up mode:

11 + 15 (FUNCTION + RESET):	set-up options common for both channels
13 + 4 (SET VALUE + SELECT FUNCTION channel 1):	set-up options for chlorine dosing (channel 1)
13 + 7 (SET VALUE + SELECT FUNCTION channel 2):	set-up options for pH dosing (channel 2)

As long as the buttons are held down, a text describing the set-up mode you have entered is displayed. When the buttons are released, active set-up mode is indicated by a flashing diode 'ACTIVE' and if one of the channel specific set-up modes have been chosen, this is indicated by flashing diodes 'OFF' and 'AUTO' on the selected channel.

2.13.4. Change Set-up Options

All set-up option editing is essentially alike. All set-up modes consist of a number of rows and the row is altered by pressing the '↓' or '↑' button below display 1. While the '↓' or '↑' button is pressed, display 2 shows the present row number and display 1 shows the selected set-up type. When the buttons are released, display 1 shows a descriptive text and display 2 shows an editable numerical value or a text. The set-up options are edited by pressing the '↓' or '↑' button below display 2, with numeric values you decrease/increase the value and with text information you switch between alternatives. The chosen set-up types (common, chlorine, acid, alkali) are indicated via one of the following texts: 'SET', 'FCL', 'ORP', 'ACI' or 'BAS'.

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2.13.5. Common Set-up

You have pressed the buttons 'FUNCTION' + 'RESET' and entered the set-up common for both channels, indicated by the text 'Set' and steady lit LED's 'OFF' and 'AUTO'. To exit the set-up, press 'CAL' or step out from the last row. The following alterations may be made in set-up common for both channels:

Row	Text	Setting	Explanation
-01	FLo	oFF/on	Flow guard OFF/ON
-02	FCL	Pb/Cur	Electrode selection for free chlorine, PB-100/4-20mA
-03	C-o	FCL/orP	Display 1 – chlorine/redox
-04	FCL	non/PH-	pH-compensate free chlorine
-05	PHd	ACi/bAS	Acid/Alkali dosing
-06	PC	no/rES/Prg	Type of PC access (no/only RESET/full programming)
-07	Sio	0-255	Modbus identification number

If Prominent CLE 2.2 or Jesco electrodes are used, the setting on row 2 shall be 'Pb'.

2.13.6. Channel Specific Set-up (Chlorine/Redox)

Press the buttons 'SET VALUE' + 'SELECT FUNCTION' for the redox/chlorine channel and you will enter the redox/chlorine channel set-up, indicated by the text 'SEt FCL' or 'SEt orP' and flashing LED's 'OFF' and 'AUTO' on the redox/chlorine channel. To exit the set-up, press 'CAL' or step out from the last row. The following alterations may be made in channel specific set-up (Free Chlorine):

Row	Text	Setting	Explanation
-01	dos	oFF/ono/FrE/Cur	Dosing type – no dosing/on-off/frequency/current output
-02	P	0.10-2.00	P-band
-03	d	000-100	D-time
-04	dF	010-180	Max. dosing frequency, strokes/min
-05	Ldt	000-060 (min)	Long dosing time alarm, 0 = no alarm function
-06	oFt	000-600 (sec)	Min. time OFF for relay, 0 = no function (on-off)
-07	ont	000-600 (sec)	Min. time ON for relay, 0 = no function (on-off)
-08	Cur	--0/--4	Current output 0-20mA/4-20mA
-09	C-L	0.00-9.99/000-999	Value for 0/4mA
-10	C-H	0.00-9.99/000-999	Value for 20mA

The row is altered by pressing the '↓' or '↑' button below display 1. While the '↓' or '↑' button is pressed, display 2 shows the present row number and display 1 shows the selected set-up type (ex. 'FCL' '-01'). When the buttons are released, display 1 shows a descriptive text and display 2 shows an editable numerical value or a text. The set-up options are edited by pressing the '↓' or '↑' button below display 2, with numeric values you decrease/increase the value and with text information you switch between alternatives.

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2.13.7. Channel Specific Set-up (Acid/Alkali)

Press the buttons 'SET VALUE' + 'SELECT FUNCTION' for the pH channel and you will enter the pH channel acid/alkali set-up, indicated by the text 'Set ACi' or 'Set bAS' and flashing LED's 'OFF' and 'AUTO' on the pH channel. To exit the set-up, press 'CAL' or step out from the last row. The following alterations may be made in channel specific set-up.

Row	Text	Setting	Explanation
-01	dos	oFF/ono/FrE/Cur	Dosing type – no dosing/on-off/frequency/current output
-02	P	0.10-2.00	P-band
-03	d	000-100	D-time
-04	dF	010-180	Max. dosing frequency, strokes/min
-05	Ldt	000-060 (min)	Long dosing time alarm, 0 = no alarm function
-06	oFt	000-600 (sec)	Min. time OFF for relay, 0 = no function (on-off)
-07	ont	000-600 (sec)	Min. time ON for relay, 0 = no function (on-off)
-08	Cur	--0/--4	Current output 0-20mA/4-20mA
-09	C-L	0.00-9.99	Value for 0/4mA
-10	C-H	0.00-9.99	Value for 20mA

The row is altered by pressing the '↓' or '↑' button below display 1. While the '↓' or '↑' button is pressed, display 2 shows the present row number and display 1 shows the selected set-up type (ex. 'FCL' '-01'). When the buttons are released, display 1 shows a descriptive text and display 2 shows an editable numerical value or a text. The set-up options are edited by pressing the '↓' or '↑' button below display 2, with numeric values you decrease/increase the value and with text information you switch between alternatives.

3. Maintenance

3.1. Calibration

Calibration may only be entered if at least code level 1 is active, indicated by flashing LED '**CODE**'.

During calibration no other adjustments may be made (other than by entering the set up mode) and all alarm tests are halted. Automatic dosing is also suspended and the signal outputs are frozen.

CALIBRATION **ACTIVE** is entered by holding down the '**CAL**' button until the '**ACTIVE**' LED lights.

CALIBRATION **ADJUST** is entered from CALIBRATION **ACTIVE** by pressing the '**CAL**' button until the '**ADJUST**' LED is lit. No pH value is shown on display 2, instead it shows '---' to indicate that no pH calibration is possible.

LEAVE CALIBRATION by pressing the '**CAL**' button until the '**ADJUST**' LED is cleared.

3.1.1. pH Calibration

Two point calibration at values pH 7 and pH 9.

1. Enter calibration '**ACTIVE**' as described in previous chapter. The '**ACTIVE**' LED should light.
2. Take the newly cleaned and rinsed pH electrode and place it in the reference solution for pH 7 (use a separate container, never the supply container), lightly agitate the electrode to ensure a good reading and allow the measured value to stabilise (5-30 seconds.). Now depress the calibration button '**pH7**' and hold it depressed until the display shows '---'.
3. Rinse the electrode and repeat the procedure in section 2 but this time using buffer solution pH 9 and pressing the button '**pH9**' to obtain the display '---'.
4. Replace the electrode in the flow cell and pH calibration is now complete. Leave pH calibration, by pressing the '**CAL**' button until the '**ACTIVE**' LED is cleared.
5. Dispose of the used buffer solution.

Note. If the electrode signal differs significantly from the expected values an electrode fault will be indicated by text display 'EL1', 'EL2', 'EL3' or 'EL4'. The AUTODOS 2000 will continue to use the calibration values from the last successful calibration and the electrode fault will be automatically reset about one second after releasing the calibration button.

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3.1.2. Free Chlorine Calibration (ProMinent chlorine electrode CLE 2.2)

Two point calibration (zero point and gain) against a photometer measured value (ex. DPD no.1).

Gain calibration should be carried out weekly, zero point calibration less often. If the zero point calibration is not to be performed then ignore item 2 below (but pay attention to correct water flow!).

1. Enter calibration by pressing the 'CAL' button until the 'ACTIVE' LED lights.
2. For zero point calibration detach the measuring cable from the electrode. Wait one minute and then press the button '↓' below display 1, zero point calibration is now complete. Before any further calibration can take place the cable must be reconnected to the electrode and the electrode allowed to monitor in the metering cell for at least 5 minutes. This is to ensure a reliable reading for the next calibration.
3. Enter calibration ADJUST by pressing the 'CAL' button until the 'ADJUST' LED lights. The latest correct electrode signal is now stored.
4. Take a water sample and ascertain the correct chlorine value.
5. Set the correct chlorine value on display 1 by means of the '↓' or '↑' buttons.
6. Leave calibration by pressing the 'CAL' button until the 'ADJUST' LED is cleared.

Note. If the electrode signal differs significantly from the expected values an electrode fault will be indicated by text display 'EL1' or 'EL2'. The AUTODOS 2000 will continue to use the calibration values from the last successful calibration and the electrode fault will be automatically reset about one second after releasing the calibration button. Chlorine value may be calibrated down to a lower limit of 0.05 ppm.

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3.1.3. Free Chlorine Calibration (ProMinent chlorine electrode 4-20mA CLE 3-mA-10ppm)

Two point calibration (zero point and gain) against a photometer measured value (ex. DPD no.1). Gain calibration should be carried out weekly, zero point calibration is normally not needed but is possible. If the zero point calibration is not to be performed (normal case) then ignore item 2 below (but pay attention to correct water flow!).

1. Enter calibration by pressing the 'CAL' button until the 'ACTIVE' LED lights.
2. For zero point calibration place the electrode in chlorine free water or in the air. Wait one hour and then press the button '↓' below display 1, zero point calibration is now complete. Before any further calibration can take place the electrode must be allowed to monitor in the metering cell for at least 5 minutes. This is to ensure a reliable reading for the next calibration. 1 hour is a long time to wait for **zero calibration** and a **quicker alternative** is to remove the membrane, in that case the zero value is stabilised in one minute.
3. Enter calibration ADJUST by pressing the 'CAL' button until the 'ADJUST' LED lights. The latest correct electrode signal is now stored.
4. Take a water sample and ascertain the correct chlorine value.
5. Set the correct chlorine value on display 1 by means of the '↓' or '↑' buttons.
6. Leave calibration by pressing the 'CAL' button until the 'ADJUST' LED is cleared.

Note. If the electrode signal differs significantly from the expected values an electrode fault will be indicated by text display 'EL1' or 'EL2'. The AUTODOS 2000 will continue to use the calibration values from the last successful calibration and the electrode fault will be automatically reset about one second after releasing the calibration button. Chlorine value may be calibrated down to a lower limit of 0.05 ppm.

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3.1.4. Free Chlorine Calibration (PB-100 chlorine electrode)

Two point calibration (zero point and gain) against a photometer measured value (ex. DPD no.1).

Gain calibration should be carried out weekly, zero point calibration less often. If the zero point calibration is not to be performed then ignore item 2 below (but pay attention to correct water flow!).

1. Enter calibration by pressing the 'CAL' button until the 'ACTIVE' LED lights.
2. For zero point remove the electrode from the flow cell. Wait one minute and then press the button '↓' below display 1 and hold it depressed until the display shows '---', zero point calibration is now complete. Before any further calibration can take place the electrode must be re-installed and the electrode allowed to monitor in the metering cell for at least 2 minutes. This is to ensure a reliable reading for the next calibration.
3. Enter calibration ADJUST by pressing the 'CAL' button until the 'ADJUST' LED lights. The latest correct electrode signal is now stored.
4. Take a water sample and ascertain the correct chlorine value.
5. Set the correct chlorine value on display 1 by means of the '↓' or '↑' buttons.
6. Leave calibration by pressing the 'CAL' button until the 'ADJUST' LED is cleared.

Note. If the electrode signal differs significantly from the expected values an electrode fault will be indicated by text display 'EL1' or 'EL2'. The AUTODOS 2000 will continue to use the calibration values from the last successful calibration and the electrode fault will be automatically reset about one second after releasing the calibration button. Chlorine value may be calibrated down to a lower limit of 0.05 ppm.

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3.1.5. Free Chlorine Calibration (Jesco chlorine electrode)

Two point calibration (zero point and gain) against a photometer measured value (ex. DPD no.1).

Gain calibration should be carried out weekly, zero point calibration less often. If the zero point calibration is not to be performed then ignore items 2 and 3 below (but pay attention to correct water flow!).

Note. To obtain a correct measurement there must have been a satisfactory water flow for 3 hours. This is to allow the glass beads to clean the electrode.

1. Enter calibration by pressing the '**CAL**' button until the '**ACTIVE**' LED lights.
2. Fill the metering cell with chlorine free water and wait for about 10 seconds.
3. For zero point calibration press the button '↓' below display 1. Before continuing calibration allow the electrode to monitor in the metering cell for about 2 minutes. This is to ensure a reliable reading for the next calibration.
4. Enter calibration ADJUST by pressing the '**CAL**' button until the '**ADJUST**' LED lights. The latest correct electrode signal is now stored.
5. Take a water sample and ascertain the correct chlorine value.
6. Set the correct chlorine value on display 1 by means of the '↓' or '↑' buttons.
7. Leave calibration by pressing the '**CAL**' button until the '**ADJUST**' LED is cleared.

Note. If the electrode signal differs significantly from the expected values an electrode fault will be indicated by text display 'EL1' or 'EL2'. The AUTODOS 2000 will continue to use the calibration values from the last successful calibration and the electrode fault will be automatically reset about one second after releasing the calibration button. Chlorine value may be calibrated down to a lower limit of 0.05 ppm.

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3.1.6. Redox Calibration

One point calibration at any value. Calibration is made at installation of a new redox electrode or at need. The redox calibration may alter the redox value within ± 50 mV relative to the uncalibrated value.

1. Check that the '**ACTIVE**' LED is lit.
1. Take the newly cleaned and rinsed redox electrode and place it in the reference solution with a known redox value and allow the measured value to stabilise.
3. Enter calibration high by pressing the '**CAL**' button until the '**ADJUST**' LED lights. The latest correct electrode signal is now stored.
4. Adjust the displayed value to the known calibration value by means of the '**↑**' or '**↓**' buttons.
5. Reinstall the electrode in the flow cell and wait until the redox reading has stabilised (up to one hour). Leave redox calibration by pressing the '**CAL**' button until the '**ACTIVE**' LED is cleared.
6. Dispose of the used buffer solution.

Proposed buffer solutions and their approximate readings:

Mixture	Redox potential		
	20 °C	25 °C	30 °C
Buffer pH 2 + Quinhydrone (undissolved crystals in solution)	385 mV	381 mV	377 mV
Buffer pH 4 + Quinhydrone (undissolved crystals in solution)	268 mV	263 mV	258 mV
Buffer pH 7 + Quinhydrone (undissolved crystals in solution)	92 mV	86 mV	79 mV
Buffer pH 8 + Quinhydrone (undissolved crystals in solution)	33 mV	27 mV	19 mV

Note. Quinhydrone solution is unstable and should be disposed of after use. The time required for stabilisation of the new monitored value is a measure of electrode condition. Age and contamination give a longer stabilisation time.

Note. Calibration can only be made within the limits of reasonable electrode signals. The AUTODOS 2000 will not allow adjustment to values exceeding these limits.

3.2. Maintenance Schedule

This is a summary of items that should be carried out, or checked, at the intervals stated. For full details on how to perform calibration and control refer to the previous sections. The intervals below are only examples and may be used as a guideline if you have no local maintenance schedule.

Daily:

Check the water flow through the flow cell.

Weekly:

Check if the chlorine value is correct (normally against DPD no.1 test) and if not perform a chlorine calibration.

Monthly:

Clean the pH electrode and calibrate.

Clean the redox electrode and perform a redox control.

Change the electrolyte in the chlorine cell and clean the membrane. (Prominent)

Check the cell water flow.

Yearly:

Replace the pH and redox electrodes.

Replace the chlorine electrode (PB-100).

Replace the chlorine cell membrane. (Prominent)

3.2.1. Cleaning Electrodes

Electrodes should be cleaned each month. Remove the electrode and carefully clean the glass bulb (pH) or the platinum top (redox) with a damp paper serviette or similar. If necessary immerse the electrode in a cleaning fluid for a few minutes to remove scale or fat etc. After cleaning, perform a redox control and/or pH calibration.

3.2.2. Free Chlorine Cell Control

Prominent: Control daily that the water flow is correct. It should be approx. ½ l/min (30 l/h).

PB-100: Control daily that the water flow is correct. It should be approx. 40 l/h (2/3 l/min). Check water filter before flow cell and if necessary, clean it.

Jesco: Control daily that the water flow is correct. It should be approx. 50 l/h (0.8 l/min). The flow should have sufficient force to cause the glass beads to rotate to the top of the cell but it should not be too violent. Check water filter before flow cell and if necessary, clean it.

3.2.3. Free Chlorine Cell Maintenance (Prominent)

Every month replace the electrolyte and clean the membrane with a damp cloth or by immersion in a 1% solution of hydrochloric acid. The gold tip of the metering cell should be kept clean and free from oxides. Clean with a fresh paper serviette, or if necessary, with the cleaning material supplied. Replace the membrane yearly.

NOTE. Do not handle the grey electrode.

3.2.4. Chlorine Cell Maintenance (PB-100)

Replace the electrode yearly.

3.2.5. Chlorine Cell Maintenance (Jesco)

This cell does not need any regular maintenance because the glass beads keep the electrodes clean. However, due to chemicals in the water it is possible that deposits can build up faster than the glass beads can clean the electrodes. If this occurs the copper electrode may be cleaned with a suitable fine abrasive.

4. General Description of Pool Water Cleaning

AUTODOS 2000 automatically monitors and controls the condition of swimming pool water maintaining the chlorine and pH levels to desirable set values.

For effective bacterial control and sanitation of pool water it is essential to maintain the correct level of free chlorine, but free chlorine readily combines with bather contaminants such as perspiration, cosmetics, hair lotions etc. and becomes ineffective. Hence the need for continuous control and adjustment of free chlorine levels.

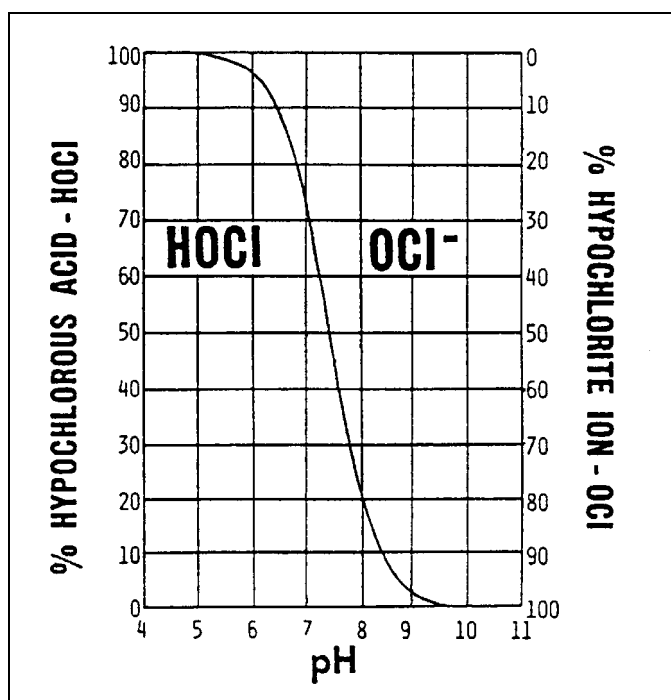
pH, which is a measure of the acid/alkaline balance in the pool water is also an essential element of pool water control. When chlorine is added to pool water it produces two types of free chlorine, one fast acting and effective (hypochlorous acid) and another which is slow acting and ineffective (hypochlorite ion). These two chlorine variations are produced in a ratio determined by the level of pH, as the pH rises in value less of the effective free chlorine is produced, and at a pH of 8.0 only 20% of the free chlorine produced is effective.

To regulate the correct chlorine level both pH and either redox or chlorine levels are monitored.

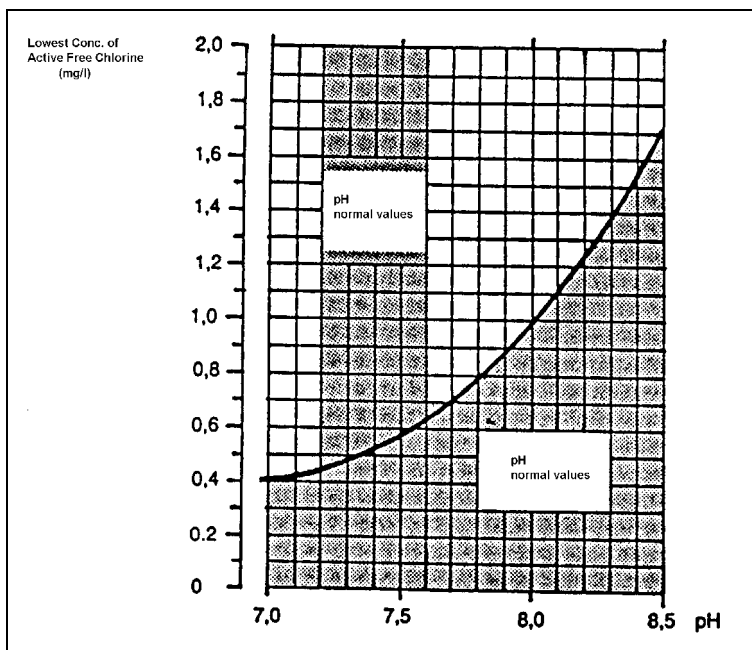
When chlorine gas is used for chlorine control the pool pH is lowered and a pH+ chemical (alkali) must be used to correct the pH level.

When using either solid or liquid chlorine for chlorine control the pool pH is raised and a pH- chemical (acid) must be used for pH correction. AUTODOS 2000 is suitable for both applications.

The figure below describes the relationship between hypochlorous acid and hypochlorite ions when the pH value is altered. The figure is taken from 'Oregon Study - PPM or ORP: Which Should Be Used' by Jacques M. Steininger.



4.1. Wanted Regulation Result



The figure above is taken from 'Naturvårdsverket allmänna råd 88:1, bassängbad - vattenkvalitet och kontroll'.

4.2. pH Regulation

As previously stated the pH value of pool water is a measure of its acid/alkaline balance (pH is actually a logarithmic measure of free hydrogen ions). Neutral water has a pH of 7.0, acidic water has a lower pH, and alkaline water a higher pH, a suitable pH value for pool water is 7.4. This choice of a slightly alkaline water is to allow the production of maximum amounts of the useful free active chlorine and at the same time reduce the risk for skin and eye irritation. pH value does not remain constant in a swimming pool but is affected by dissolved solids in the water resulting from chlorine additions and the bathing load etc.

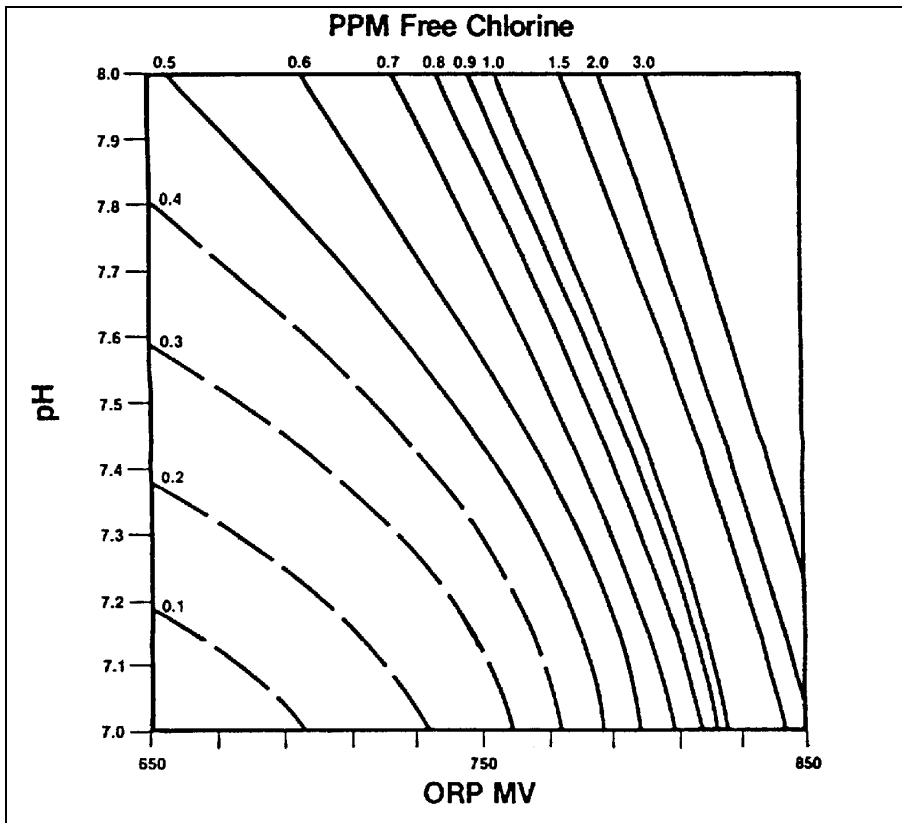
A low pH level can cause eye and skin irritation and give a corrosive water that attacks metals.

A high pH level will reduce the sanitation effect of the added chlorine.

4.3. Chlorine regulation by redox measurement

Normally the redox potential is used to control chlorine dosing. Redox potential is a measure of oxidation effect (ORP), chlorine may be used to control oxidation and conversely redox potential may be used to indicate the quantity of free chlorine. A suitable level of redox potential for pool water is 740 mV.

The figure below describes the relationship between ORP and PPM Free Chlorine when the pH value is altered. The figure is taken from 'Oregon Study - PPM or ORP: Which Should Be Used' by Jacques M. Steininger.



4.4. Chlorine regulation by chlorine measurement

It is also possible to use the direct measurement of free chlorine ions (in mg/l) to control chlorine dosing. A suitable value in normal pool water is 0.60 mg/l and 1.0 mg/l in bubble pools. (dependent upon the pH value).

When installation of an AUTODOS 2000 with free chlorine electrode PB-100 or ProMinent Cle 2.2 in swimming pools, that have previously been treated with organic chlorine (trichlor or dichlor), the pool water must be changed. This is because the cyanuric acid content in the pool water, caused by the organic chlorine, results in an exceptionally high value of chlorine when DPD-testing, thus making a correct calibration impossible. The chlorine cells PB-100 and Cle 2.2 show the free chlorine value, whereas a DPD no.1 test shows the free chlorine together with the cyanuric acid bound chlorine.

5. General Description

AUTODOS 2000 is designed to control swimming pool water conditions. It is equipped with 2 independent channels for monitoring chlorine or redox and pH. AUTODOS 2000 can regulate pH (by acid or alkali dosing) and chlorine levels. Regulation of chlorine is done by lowering the total chlorine level and raising the content of free chlorine.

Display:

channel 1:	free chlorine	-.99-9.99 mg/l (ppm)
	or	
	redox	-99.-999. mV
channel 2:	pH	0.00-14.0

However the displays are usually limited by the hardware in use and are normally within the range:

pH	3.00-11.0
redox	-99.-999. mV
Free/combined chlorine	dependent upon the electrode

By pressing the probe check buttons the uncalibrated electrode values can be displayed.

pH control is either (acid or alkali):

1. Manual OFF
2. Automatic control:
 - a. on-off dosing
 - b. frequency dosing (P or PD regulator 10-180 pulses/min)
 - c. current output dosing (P or PD regulator 0/4-20mA)
3. Manual dosing:
 - a. on-off dosing: relay ON
 - b. frequency dosing 10-180 pulses/min
 - c. current output dosing 20mA

Chlorine control is either:

1. Manual OFF
2. Automatic control:
 - a. on-off dosing
 - b. frequency dosing (P or PD regulator 10-180 pulses/min)
 - c. current output dosing (P or PD regulator 0/4-20mA)
3. Manual chlorine dosing:
 - a. on-off dosing: relay ON
 - b. frequency dosing 10-180 pulses/min
 - c. current output dosing 20mA

The display/monitor choices described above are made in set-up (described in separate chapter).

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The following alarm conditions may be detected:

Flow failure	selected in set-up
Low value	adjustable limit
High value	adjustable limit
Dosing error	

The alarms are indicated by a flashing red LED if activated, plus a common alarm relay for both channels. All alarms are cleared by pressing '**RESET**' whereby the cause of the alarm is displayed as a text message on the appropriate display.

All alarms have a 5 second delay.

pH value exceeding the limits also creates an 'alarm' on the chlorine dosing if chlorine dosing is active. The chlorine dosing is stopped until the pH value is within the limits again, the 'alarm' is indicated by flashing diodes AUTO on the chlorine channels and alarm text 'PHF' at RESET. When the pH value returns to normal values, the chlorine dosing starts again if dosing shall take place, the AUTO diodes return to steady light.

The optional over dosing check (selected in set-up mode) functions as follows. If operated the alarm LED flashes, the alarm relay is activated, and dosing ceases. Dosing alarm is set by either:

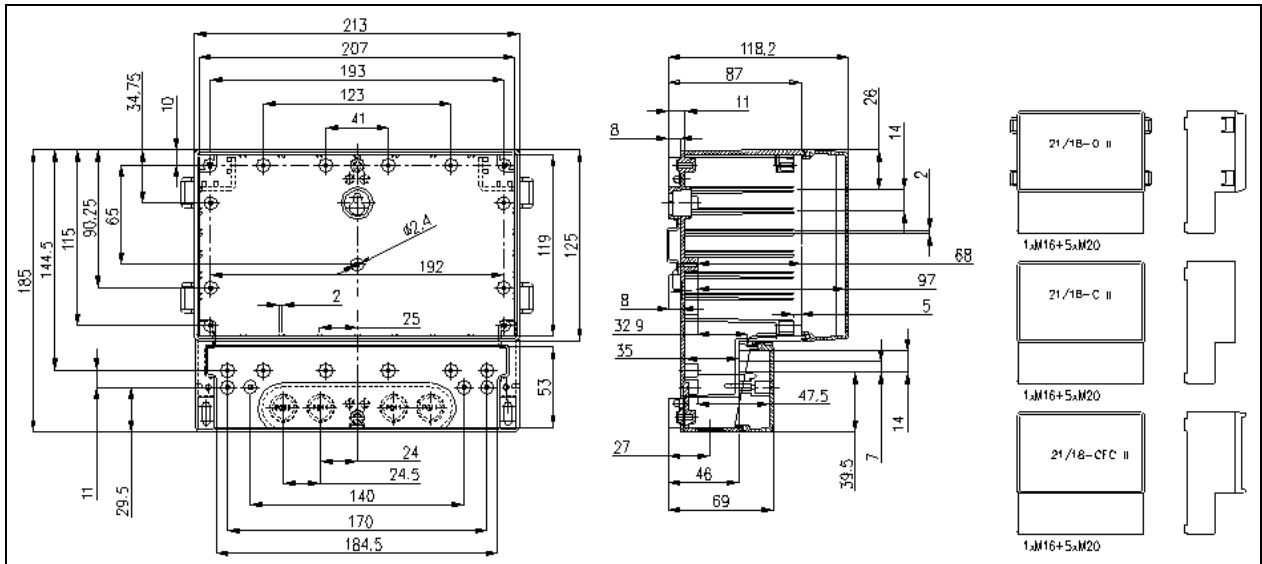
1. ON/OFF - AUTO. Alarm is activated after continuous dosing for a period longer than the specified maximum dosing time (1-60 minutes).
2. ON/OFF - MAN. Alarm is activated after continuous dosing for a period longer than the specified maximum dosing time (1-60 minutes).
3. FREQUENCY/CURRENT - AUTO. Alarm is activated after dosing (> 0%) with exceeded low or high alarm limit for a period longer than the specified maximum dosing time (1-60 minutes).
4. FREQUENCY/CURRENT - MAN. Alarm is activated after dosing for a period longer than the specified maximum dosing time (1-60 minutes).

The AUTODOS 2000 is equipped with two current outputs, selectable (in set-up) 0-20 mA or 4-20 mA. Normally the outputs monitor the value for channel 1-2, but can also be set up as regulation signal.

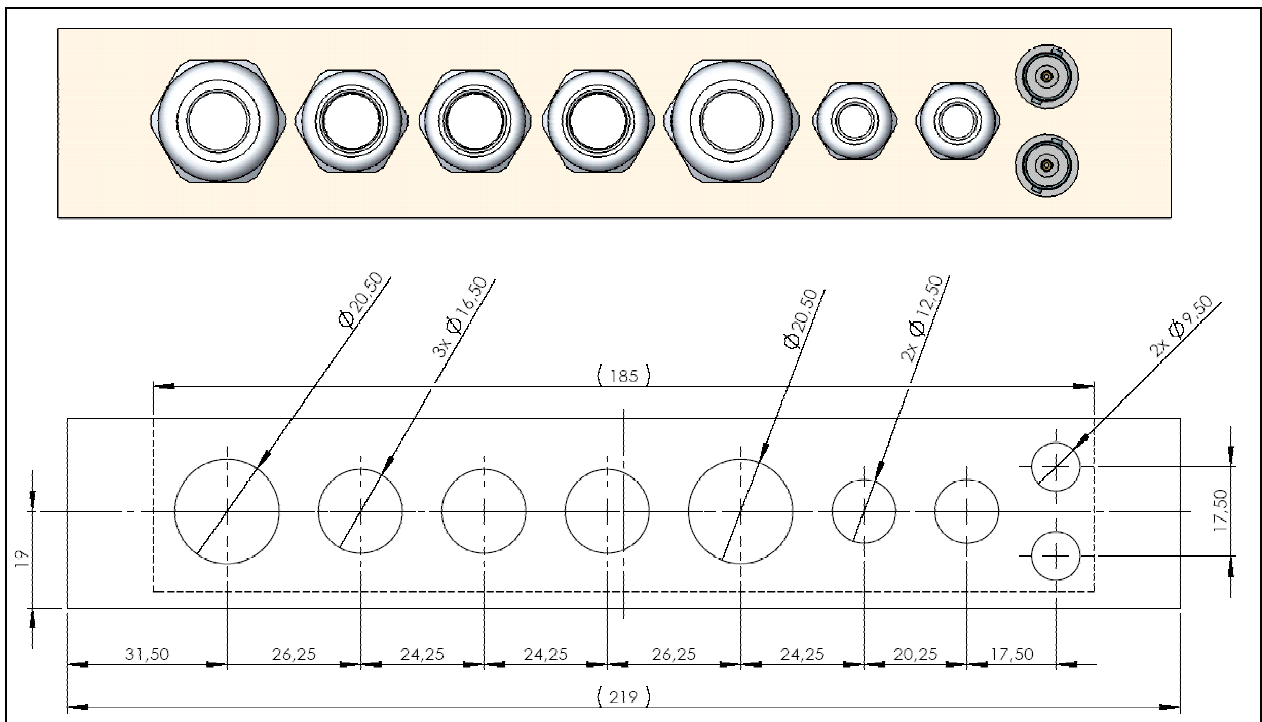
While being entered, newly configured set values are stored in an EEPROM, alternating between 2 separate memory areas. This is to prevent loss of data if a power fault occurs during this critical phase.

Two point calibration to ensure accurate monitoring.

6. Box (Fibox Cardmaster PC21/18 CFC II)

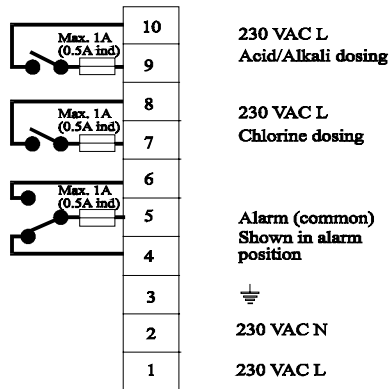
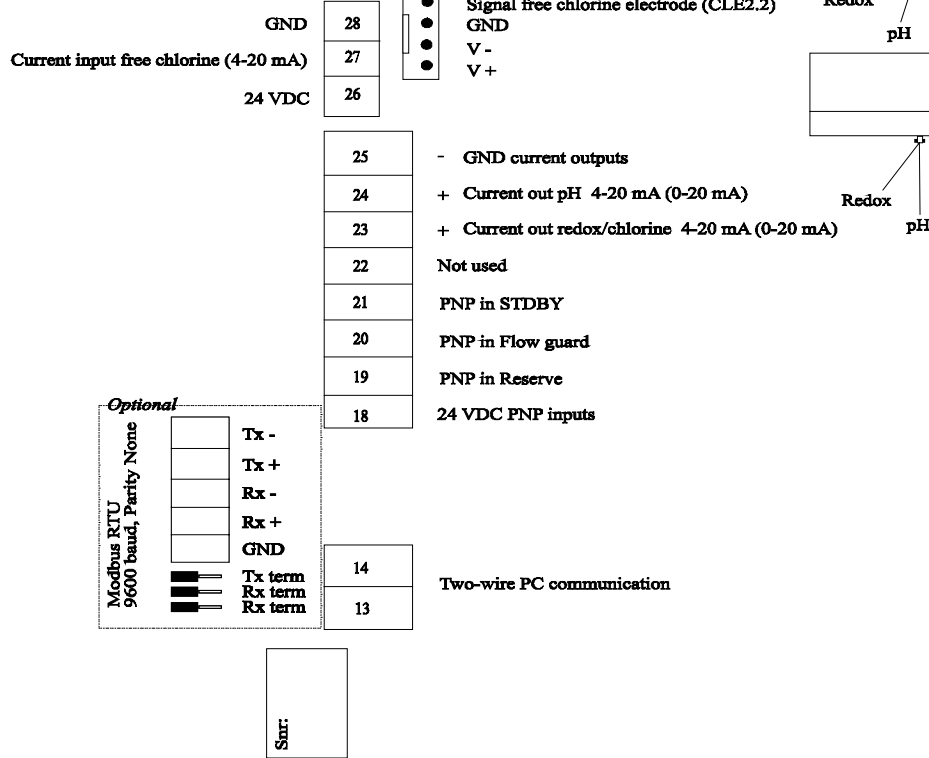


The enclosure has special made cut-outs for Autodos 2000 and the drawing below show these.



7. Electrical Connections

Connection of Prominent CLE 3-mA-10ppm
 plinth 1 (+) -> plinth 26
 plinth 2 (-) -> plinth 27



eng_connect.cdr MT 040227

8. Factory Settings

Set-up:

	pH	redox	klor
Set value	7.40	740	1.00
Low alarm limit	6.80	600	0.40
High alarm limit	7.80	800	2.00

Code Level: **No** code level from factory.

Common Set-up:

Row	Text	Setting	Explanation
-01	FLo	oFF	Flow guard OFF
-02	FCL	Pb	Electrode selection for free chlorine, PB-100
-03	C-o	FCL	Display 1 – chlorine
-04	FCL	non	do not pH-compensate free chlorine
-05	PHd	ACi	Acid dosing
-06	PC	no	No PC access
-07	Sio	001	Modbus identification number

If Prominent CLE 2.2 or Jesco electrodes are used, the setting on row 2 shall be 'Pb'.

Channel Specific Set-up Chlorine/Redox:

Row	Text	Setting	Explanation
-01	dos	ono	Dosing type – on-off
-02	P	0.20	P-band
-03	d	000	D-time
-04	dF	100	Max. dosing frequency, strokes/min
-05	Ldt	000 (min)	Long dosing time alarm (no alarm function)
-06	oFt	000 (sec)	Min. time OFF for relay (no function (on-off))
-07	ont	000 (sec)	Min. time ON for relay (no function (on-off))
-08	Cur	--4	Current output 4-20mA
-09	C-L	0.00/500	Value for 4mA
-10	C-H	5.00/999	Value for 20mA

Channel Specific Set-up pH:

Row	Text	Setting	Explanation
-01	dos	ono	Dosing type – on-off
-02	P	0.20	P-band
-03	d	000	D-time
-04	dF	100	Max. dosing frequency, strokes/min
-05	Ldt	000 (min)	Long dosing time alarm (no alarm function)
-06	oFt	000 (sec)	Min. time OFF for relay (no function (on-off))
-07	ont	000 (sec)	Min. time ON for relay (no function (on-off))
-08	Cur	--4	Current output 4-20mA
-09	C-L	6.00	Value for 4mA
-10	C-H	8.50	Value for 20mA

9. Fault Finding

FAULT	PROBABLE CAUSE	REMEDY
Controller completely dead.	No supply voltage.	Check the electrical supply.
Incorrect monitored values of pH or redox.	1.Electrode not connected. 2.Broken connections. 3.Contaminated electrode 4.No test water. 5.Incorrect calibration.	1.Check the connections. 2.Check the cable. 3.Clean the electrode. 4.Check the flow cell. 5.Re-calibrate with fresh buffer solution.
Impossible to calibrate.	1.Faulty electrode. 2. Bad electrical connections.	1. Check the electrode for bubbles and replace if not correctable. 2.Check the cables even those connecting the cable connector to the PCB.
Electrode is incorrect when monitoring, gives a correct value with a buffer solution but has a slow reaction.	1.Contaminated electrode. 2.Spent electrode.	1.Clean the electrode. 2.Replace the electrode.
Monitored value fixed at pH7, 0 mV or 0ppm.	Monitor signal is short circuited.	Check electrode, cables and Connections.
No dosing despite requirement. Dosing LED not lit or AUTO LED is blinking	1.Controller not set to AUTO. 2.PHF failure	1.Set the controller to AUTO. 2.Check the reason and RESET, the dosing starts when pH is correct
No dosing despite AUTO requirement. Dosing LED is lit.	Dosing equipment incorrectly connected.	Check the connections.
No "click sound" when dosing. Dosing LED is lit.	Faulty dosing relay.	Return the unit for repair.
Incorrect chlorine measurements (Prominent measuring cell).	1.Air bubbles on the membrane. 2.Contaminated membrane. 3.Pressure difference. 4.Unstable pH value. 5.Incorrect calibration.	1.Lightly tap the electrode container or temporarily increase the water flow past the cell. 2.Clean the membrane and fill with fresh electrolyte. 3.Ensure that the flow cell outlet is not pressurised 4.pH value must be stabilised, adjust to 7.2. 5.Perform a chlorine calibration.
Incorrect chlorine measurements (PB-100 measuring cell).	1. Insufficient water flow. 2. Unstable pH value 3. Contaminated copper electrode (low signal). 4. Incorrect calibration.	1. Adjust the water flow. 2. Control pH channel. 3. Polish the electrode with a suitable fine abrasive. 4. Calibrate.
Monitored chlorine value too low to adjust to measured value.	1.Poor electrolyte. 2.Meter cell gold tip is oxidised.	1.Replace electrolyte, clean the cell gold tip with a paper serviette. 2.Polish very carefully with a suitable fine abrasive.

10. Technical Data

Computer	AUTODOS 2000
Supply voltage	230VAC +15% -10%
Power consumption	12VA
Flow guard input	24V PNP, 10 mA
pH electrode connection	BNC
Redox electrode connection	BNC
Chlorine electrode connection	electrode dependant
Display	2 x 3 digits, 7 segment LED
Current output	2 x 4-20 (0-20) mA
Dosing output Relay	2 x 1A resistive
Alarm Relay	output, normally open/closed, 1A resistive
Max. load current output	400 ohm
Protection form	IP54
Ambient temperature	5 - 40 °C.
Fuses	3 x T1A 5x20mm
Dimensions H/W/D (mm)	188/216/113
Weight	1.5 kg

Measuring range:

-200 mV < pH < 200 mV

--99 mV < redox < 1000mV

chlorine: electrode dependent (min 0-1.99 mg/l)

Galvanic separation between the channels.

Set values and parameters are stored in an EEPROM.

11. Program Versions

ver 2.2:

First commercial version.

ver 3.0:

Upgraded communication with better modem control functions (Jesco chlorine electrode setting).

ver 3.1-3.3:

Special version, not standard Autodos 2000.

ver 3.4:

Function as 3.0 but with standard chlorine electrode setting.

12. Disclaimer

We reserve for ourself the right to make changes, enhancements, revisions and alterations to the AUTODOS 2000 or its manual without notice. We do not take any responsibility for the consequences of faults in the AUTODOS 2000 or in its manual.

We are however interested in keeping the manual as free from errors as possible, so please inform us if there are any faults, and we will try to correct them.

13. AUTODOS 2000 PC Interface (optional)

With an easily installed optional PCB (Printed Circuit Board) it is possible to connect the AUTODOS 2000 to a PC computer. The AUTODOS 2000 PC Interface parts are:

- Data logger with real time clock
- Communications module

The PCB connects to the AUTODOS 2000 board through a connector and plastic clips. The PCB is externally connected to either a communications module via 2-wire connection or via RJ45 connector direct to the serial port of a PC computer or a modem. The modem communication is not supported in program version 1.0 but is planned for later versions.

Data logger

- 32kB EEPROM
- Real time clock
- 24kB (3 days) with minute interval average values for 4 channels
- 8kB events (255), an event can be an alarm or calibration for instance

Communications module

- RS232 PC communication, cables are supplied
- Two-wire communication with AUTODOS 2000
- With recommended (not supplied) cable FKAR-PG 0.5mm², up to 200m and 5 units may be connected to the two-wire circuit
- External 9VAC transformer is supplied

Identification of separate AUTODOS 2000 on the two-wire circuit is made by using a unique factory programmed serial number for every single AUTODOS 2000.

Communications program 'Autodos Monitor' is used for monitoring AUTODOS 2000 and changing its parameters, the program is described in a separate document.

14. AUTODOS 2000 PLC Interface (optional)

With an easily installed optional PCB (Printed Circuit Board) it is possible to connect the AUTODOS 2000 to a PLC. The AUTODOS 2000 PLC Interface parts are:

- Data logger with real time clock
- Modbus RTU

The PCB connects to the AUTODOS 2000 board through a connector and plastic clips. The PCB is externally connected via a 5-pole plint to the RS422 interface.

Data logger

- 32kB EEPROM
- Real time clock
- 24kB (3 days) with minute interval average values for 4 channels
- 8kB events (255), an event can be an alarm or calibration for instance

Modbus RTU interface in Autodos2000.

Baudrate 9600 baud
Parity None.

Modbus RTU communicaton in Autodos 2000. The Autodos responds to only 1 message:

Slave address as set in the Autodos 'common set-up'
Function 03H, Read holding registers
Starting Address Hi 00H
Starting Address Lo 01H
No. of Points Hi 00H
No. of Points Lo 0BH
CRC 55H
CRC CDH

If slave address is set to 1 the query is: 01 03 00 01 00 0B 55 CD

The Autodos is responding with data:

PH (16 bit, lsb = 0.01 pH)
Combined chlorine (16 bit, lsb = 0.01 mg/l)
Free chlorine (16 bit, lsb = 0.01 mg/l)
AD0 (16 bit, lsb = prog. dependent)
Redox (16 bit, lsb = 1 mV)
Temp, NTC input (16 bit, lsb = 0.1 °C)
Alarm Active (16 bit)
Alarm Reset (16 bit)
Setvalue pH (16 bit, lsb = 0.01 pH)
Setvalue Comb.chlorine (16 bit, lsb = 0.01 mg/l)
Setvalue Free chlorine (16 bit, lsb = 0.01 mg/l)

pH/chlorine regulator AUTODOS 2000 - 2005-01-17

Alarm Active (16 bit)

- bit 0: Standby mode
- bit 1: Flow
- bit 2: High alarm pH
- bit 3: High alarm Combined chlorine
- bit 4: High alarm Free chlorine
- bit 5: Low alarm pH
- bit 6: Low alarm Combined chlorine
- bit 7: Low alarm Free chlorine

Alarm Reset (16 bit)

- bit 0: Standby mode
- bit 1: Flow
- bit 2: High alarm pH
- bit 3: High alarm Combined chlorine
- bit 4: High alarm Free chlorine
- bit 5: Low alarm pH
- bit 6: Low alarm Combined chlorine
- bit 7: Low alarm Free chlorine