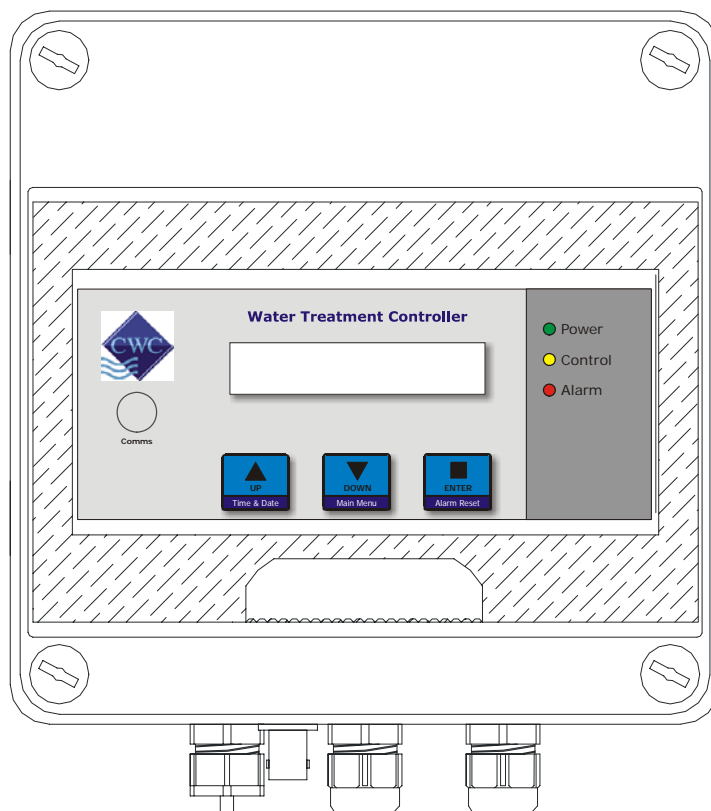


pH Controller Model: PH-XP2



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Manufacturer: Convergent Water Controls Pty Ltd, Sydney Australia.

Note: On-going product development at Convergent Water Controls may lead to changes in the specifications of this product.

Warranty: This product is guaranteed for a period of 12 months from installation date or 18 months from Invoice date (whichever occurs first). The warranty applies to manufacturing or component defects which may cause the unit to malfunction under specified conditions. The guarantee does not cover damage due to abuse, tampering or improper installation.

Disclaimer: Convergent Water Controls will not be held liable for any consequential damage or loss arising resulting from product malfunction.

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1. Introduction

The PH-XP2 measures and controls the pH as read by a pH sensor and can be programmed to dose either an acid or a base. If unstable readings are experienced, the unit can measure pH with respect to an optional solution ground probe (model DCON-CMR) using its differential input amplifier.

When acid is dosed, it causes a decrease in pH. Similarly, when base is dosed, it causes an increase in pH.

The PH-XP2 features 2 methods of pH control: **ON/OFF or proportional**. With ON/OFF control, the controller either turns the pump on continuously when correcting the pH or modulates the pump by turning the pump ON and OFF during the dosing period. (These ON and OFF times are programmable). For more accurate control, the proportional dosing algorithm modulates the pump based on a percentage pH variation from the Setpoint. The further the pH is from the Setpoint, the shorter the OFF period is. The closer the pH is to the Setpoint, the longer the OFF period is.

Other useful features of the PH-XP2 are the programmable alarms, 7-day timer programs and data-logging facility.

2. Installation

Mount the PH-XP2 on a flat vertical surface away from extreme heat, humidity or areas where temperature variations are extreme, ideally at eye-level to allow good visibility of the LCD display. Also ensure that a 240VAC mains power point is located nearby.

2.1 Electrical Wiring

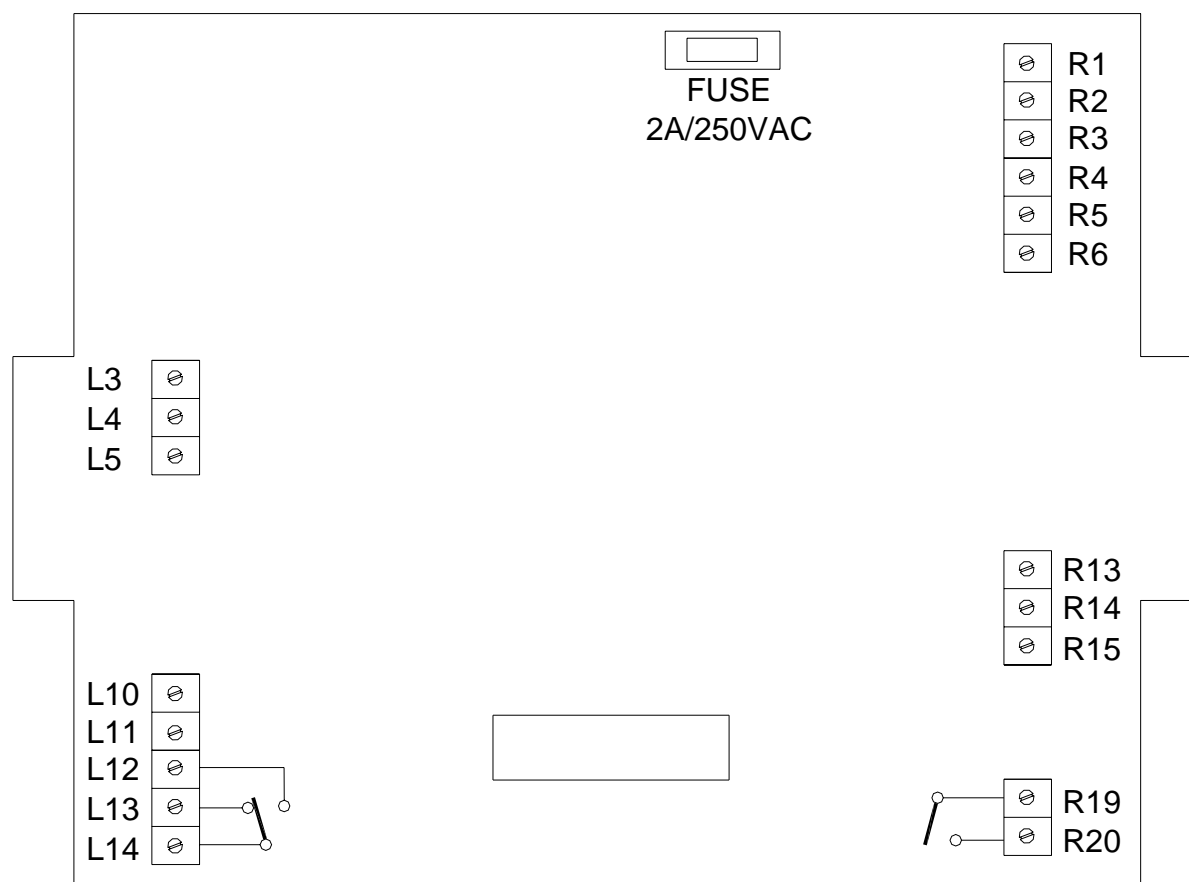
CAUTION: If opening the controller, pull the lid away from the base slowly to ensure you do not impose any strain on the interconnecting cable, which easily unplugs from the motherboard.

NOTES:

1. The BNC connector for the pH sensor is panel mounted in the bottom of the enclosure
2. The solution ground probe connection point is via a screw terminal on the circuit board (terminal L5)
3. The N/O output R19 & R20 is used as a flow-switch repeat contact to be able to daisy-chain multiple controllers together with one flow switch. When

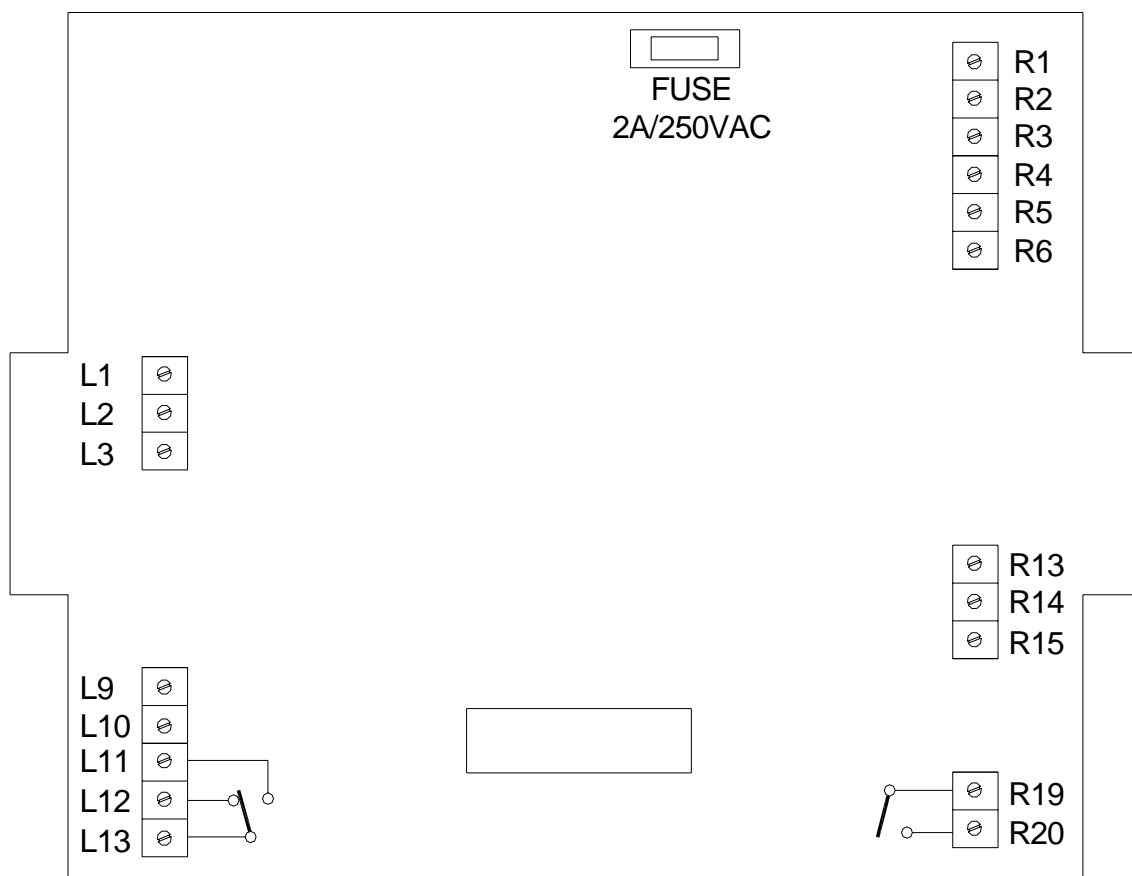
connected to the flow switch input of another controller, one flow switch will disable both controllers on no-flow.

The diagrams below show the connections to the ORP-XP2 controller circuitry (release 1 & release 2):



Release 1

L3:	BNC - pH Signal (White)
L4:	BNC - common (Green)
L5:	Solution Ground Probe
L10:	Flow Switch In
L11:	Flow Switch Common
L12 + L14:	Alarm Relay N/O volt-free (10A/250VAC res)
L13 + L14:	Alarm Relay N/C volt-free (10A/250VAC res)
R1:	Mains Active 240VAC (power supply)
R2:	Mains Neutral
R3:	Auxiliary Continuous Active 240VAC (2A fused)
R4:	Auxiliary Neutral
R5:	Control Output Active 240VAC (2A fused) for connecting dosing pump or solenoid valve
R6:	Control Output Neutral
R13 - R15:	Common Earth
R19:	Flow Switch Repeat common
R20:	Flow Switch Repeat N/O volt-free (10A/250VAC res)



Release 2

L1:	BNC - pH Signal (White)
L2:	BNC - common (Green)
L3:	Solution Ground Probe
L9:	Flow Switch In
L10:	Flow Switch Common
L11 + L13:	Alarm Relay N/O volt-free (10A/250VAC res)
L12 + L13:	Alarm Relay N/C volt-free (10A/250VAC res)
R1:	Mains Active 240VAC (power supply)
R2:	Mains Neutral
R3:	Auxiliary Continuous Active 240VAC (2A fused)
R4:	Auxiliary Neutral
R5:	Control Output Active 240VAC (2A fused) for connecting dosing pump or solenoid valve
R6:	Control Output Neutral
R13 - R15:	Common Earth
R19:	Flow Switch Repeat common
R20:	Flow Switch Repeat N/O volt-free (10A/250VAC res)

2.2 Sensor Installation

Consider carefully the type and location of the pH sensor. Your instrument supplier should be able to advise the correct sensor type for your application.

Any pH sensor has a high output impedance and is susceptible to interference if not installed correctly. Plan the installation such that the pH sensor is as close as possible to the controller. If the sensor needs to be located further away from the pH controller, an extension cable must be obtained. The further the sensor is away from the controller, the greater the effect of electrical interference will be. This may degrade the signal from the sensor and causes incorrect readings. Never attempt to extend the sensor cable by means of a terminal block or soldered connection. This will leave the connection open to interference or moisture, which will affect the accuracy of the system. Always have the connection (when using an extension cable) in a waterproof junction box. A maximum sensor cable length of 10 metres is recommended, however, in a good environment, up to 20 metres is likely to be acceptable.

The optional Solution Ground Probe, if used, must be inserted into the same solution as the pH sensor. The controller uses common mode rejection technology to eliminate any electrical interference on the pH sensor. This function must be enabled in the SETUP MENU of the controller. Solution ground probes are only recommended if there is an unacceptable level of fluctuation in the pH readout on the controller.

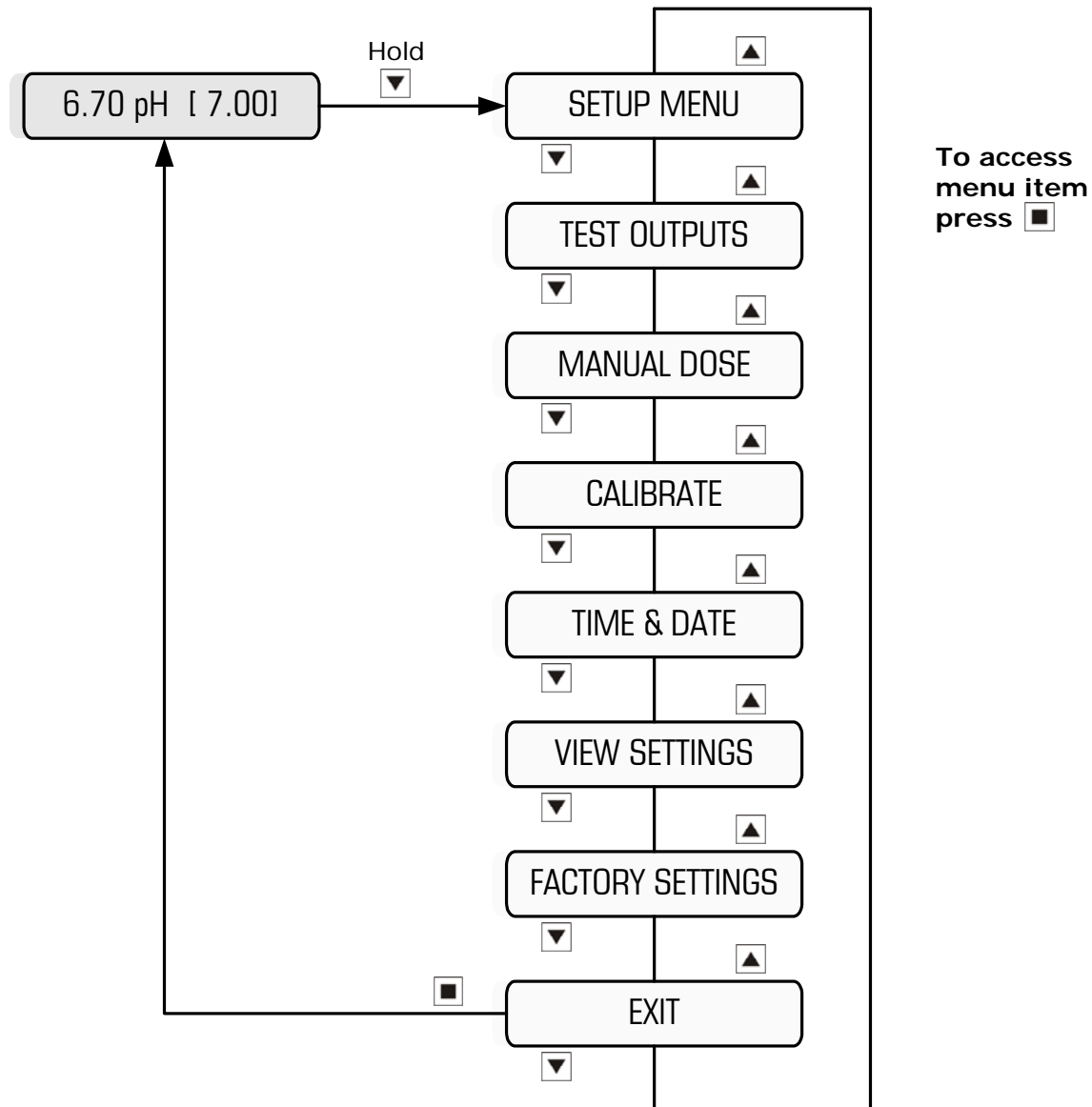
3. Controller Functionality

3.1 Menu Logic

The PH-XP2 has an advanced but very user-friendly menu system:

- The menu structure is circular
- The relevant menu item, or programmed value flashes
- Up and Down arrow pushbuttons allow you to scroll through the menu items, and to increase/decrease programmed settings
- The MAIN MENU expands to several levels of SUB MENUS when pressing ENTER on various menu items
- The LCD is backlit

The MAIN MENU of the controller is illustrated as follows:



3.2 Pushbuttons

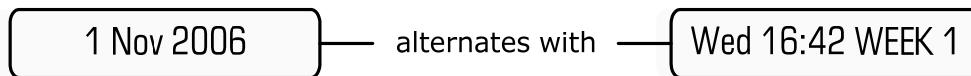
The PH-XP2 has 3 pushbuttons which each have dual functions:

1. Scroll UP (Time & Date)
2. Scroll DOWN (Main Menu)
3. ENTER (Reset)

- The **Scroll UP** and **DOWN** pushbuttons allow you to scroll in both directions in the circular menus. Once a menu item has been selected and there is a value to program, the Scroll pushbuttons allow you to increase or decrease the number programmed.
- The **ENTER** pushbutton allows you to enter a part of the program that you have selected. It also accepts any numbers programmed with the Scroll pushbuttons.

- If the Scroll UP (Time & Date) pushbutton is pressed momentarily in NORMAL MODE (explained in section 4.1), the time and date is displayed. To revert back to NORMAL MODE, press the pushbutton momentarily again.

The time and date is displayed as follows:



NOTE:

The Time & Date is programmable, but the Week No is automatically set. Hence, if you have multiple controllers in the field, the Week No will be the same on all (assuming the Time & Date are programmed correctly).

- To get into the menus of the PH-XP2, hold down the Scroll DOWN (Main Menu) pushbutton. The display will count down until you access the menus.
- If you wish to cancel an alarm or any timers activated, press and hold the ENTER (Reset) pushbutton until the display says:

Resetting ...

3.3 LED Indication

There are 3 LEDs on the front face of the PH-XP2:

- Power (green): illuminates continuously when power is applied to the controller
- Control (amber): illuminates continuously when power is applied to the control output of the controller. If the control output is suspended due to a pause in the control cycle, the LED will flash on and off.
- Alarm (red): illuminates when the alarm relay switches. If the alarm delay is timing before the alarm condition is confirmed, the LED will flash on and off.

3.4 Comms Port

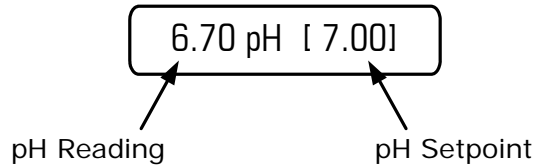
There is a Comms port on the front panel of the controller next to the LCD. This is used to download data from the controller, and can also used to upload new software versions should they be required. (An optional cable for downloading data is required, P/N SP-XP2-COMCABLE-1)

4. Commissioning

CAUTION: Refer to previous section before reading this section

4.1 Start-Up

Power up the controller after installation. After a start-up sequence, the controller automatically goes into NORMAL MODE. The display should read the measured pH as well as the pH Setpoint within square brackets, as follows:



Other information that you may see on the display, which alternates with the display above:

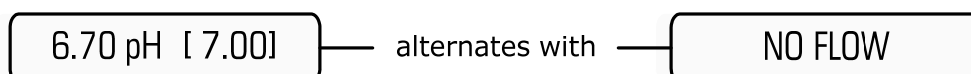
- When an alarm is reported, the actual alarm message will be periodically displayed.

A diagram showing a rectangular display box containing the text "ALARM!! [HIGH.]".

- The controller has a programmable timer which is activated on start-up or when flow is resumed (assuming the flow switch function is enabled in the SETUP menu). This timer times down to zero, during which time pH control is suspended. This gives the system time for the water to circulate and for the pH reading to settle down.

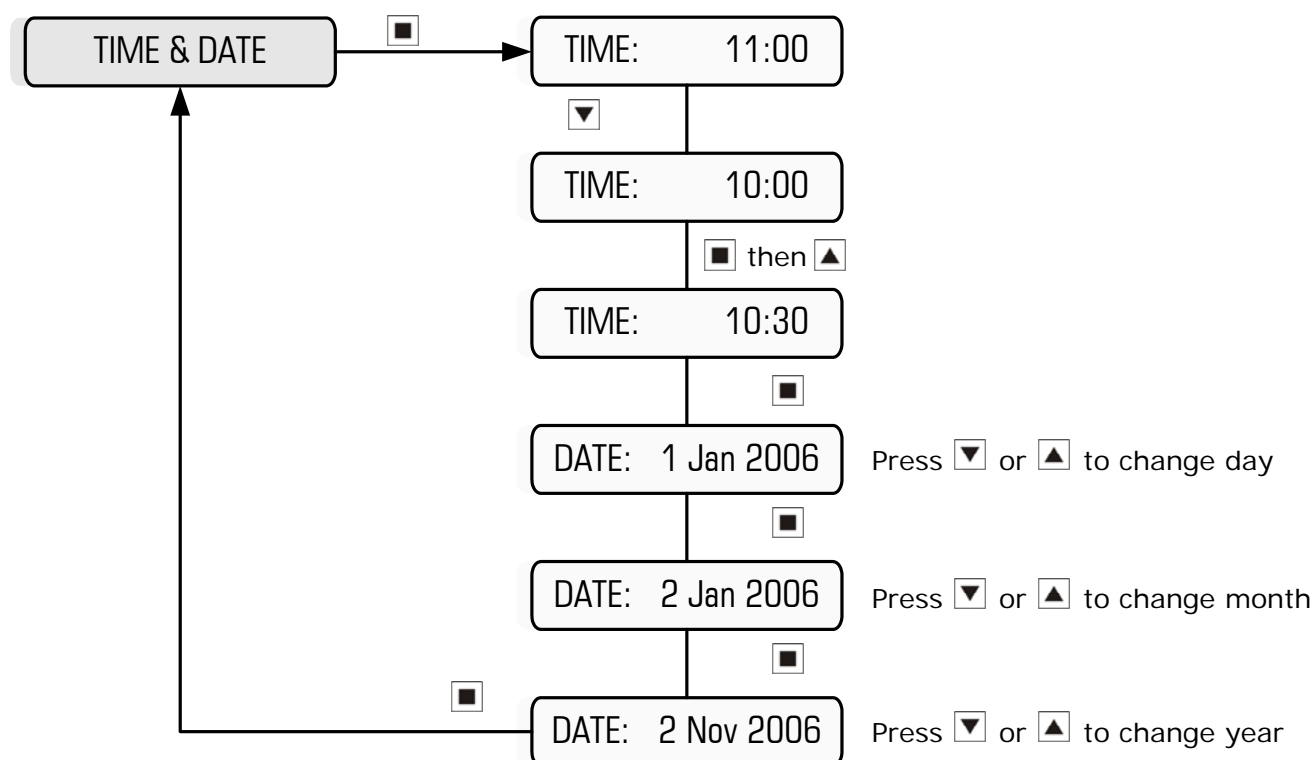
A diagram showing a rectangular display box containing the text "DELAY - 12".

- When a flow switch is connected to the controller, pH control is suspended when there is no flow past the flow switch. This function is enabled in the SETUP menu.



4.2 Setting Time & Date

Main Menu > TIME & DATE



Example: Setting time & date to 10:30 on 2 Nov 2006

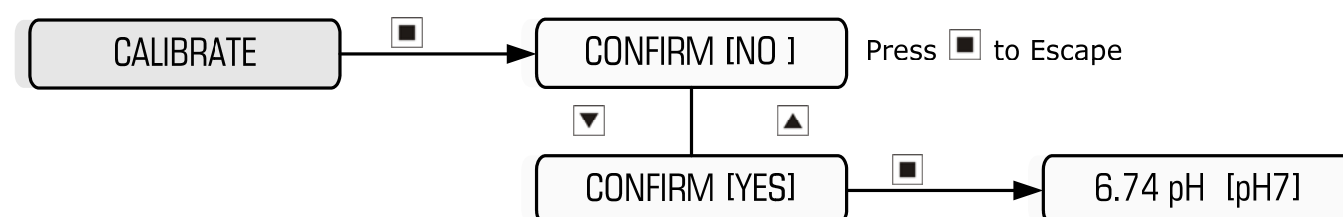
NOTE: The Week No will be automatically set

4.3 Calibration

Step 1

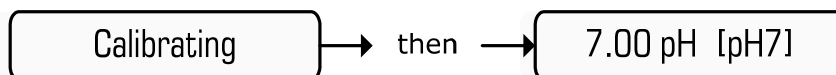
Insert the pH Sensor in pH7 buffer solution

Main Menu > CALIBRATE



Step 2

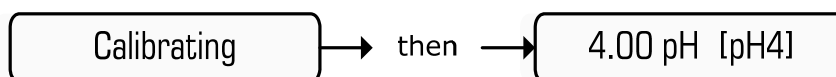
Wait for the measured pH reading to stabilise and check if the flashing pH value within the square brackets corresponds to the buffer solution. Only press the ENTER pushbutton if the buffer reading in brackets is correct, and the measured pH reading is stable (The controller should automatically detect what buffer you are using. If not, the pH sensor may be faulty, or the controller might require a factory and calibration reset). The display briefly shows:



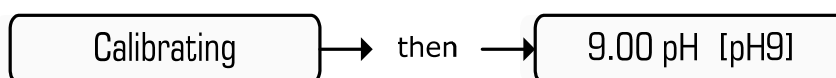
Note: If the measured pH still deviates from that of the buffer, press the ENTER pushbutton again and repeat Step 2.

Step 3

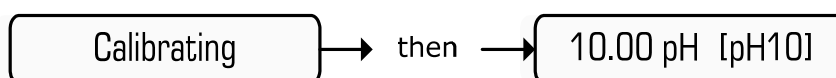
Insert the pH Sensor in pH4, pH9 or pH10 buffer solution. Repeat Step 2. The display briefly shows:



OR



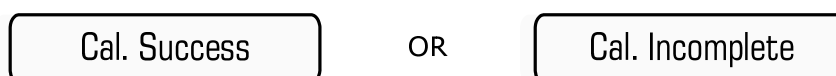
OR



Note: If the measured pH still deviates from that of the buffer, press the ENTER pushbutton. This can be repeated until the reading is stable.

Step 4

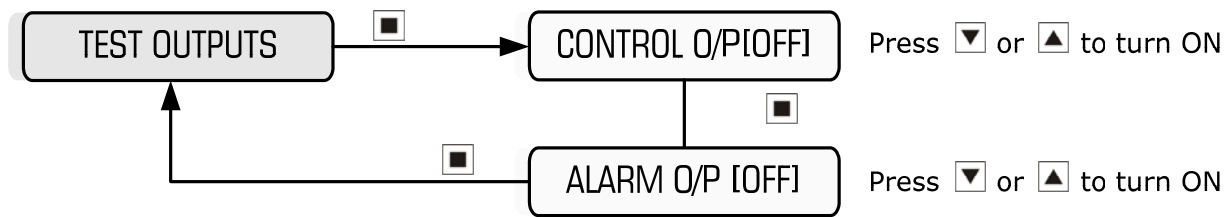
Once calibration has been completed, press either the SCROLL UP or DOWN pushbutton. The display briefly shows the following before reverting to the NORMAL DISPLAY:



Note: If Cal. Incomplete is shown, the calibration process needs to be repeated.

4.4 Testing Control Output Relay and Alarm Relay

Main Menu > TEST OUTPUTS



When the Control Output is activated, the amber Control LED illuminates and the Control relay switches, putting 240VAC power onto the output terminal, which activates the pump or solenoid valve wired to it.

When the Alarm Output is activated, the red Alarm LED illuminates and the relay de-energises, switching the Common from the Normally Open Contact to the Normally Closed contact of the Alarm relay.

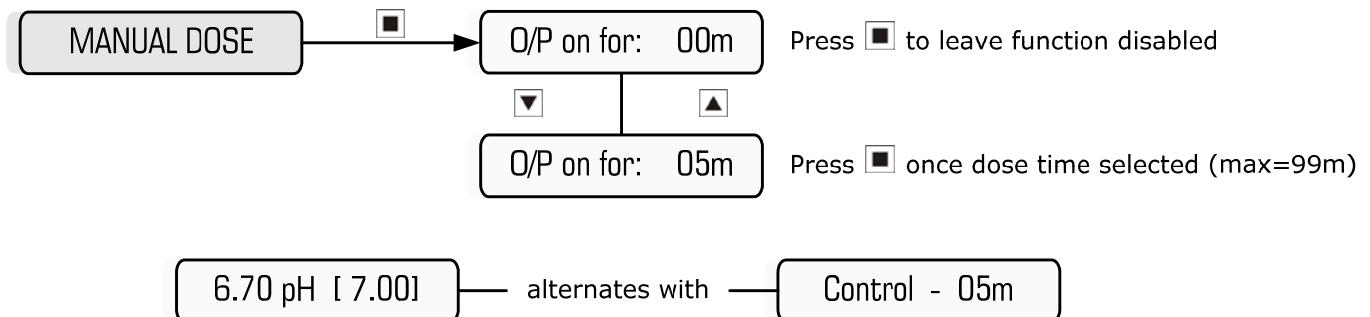
NOTES:

1. If either output is activated manually without reverting back to the de-activated state, the controller will automatically turn the output off 2 minutes after no pushbutton activity.
2. If you wish to drive the control output for longer than 2 minutes, activate the MANUAL DOSE function within the MAIN MENU
3. The outputs should all switch on when tested, regardless of the flow condition.

4.5 Manual Dose

Main Menu > MANUAL DOSE

To perform an unattended slug dose of chemical, simply program the dose time (up to 99 minutes, in 1 minute increments) as follows:



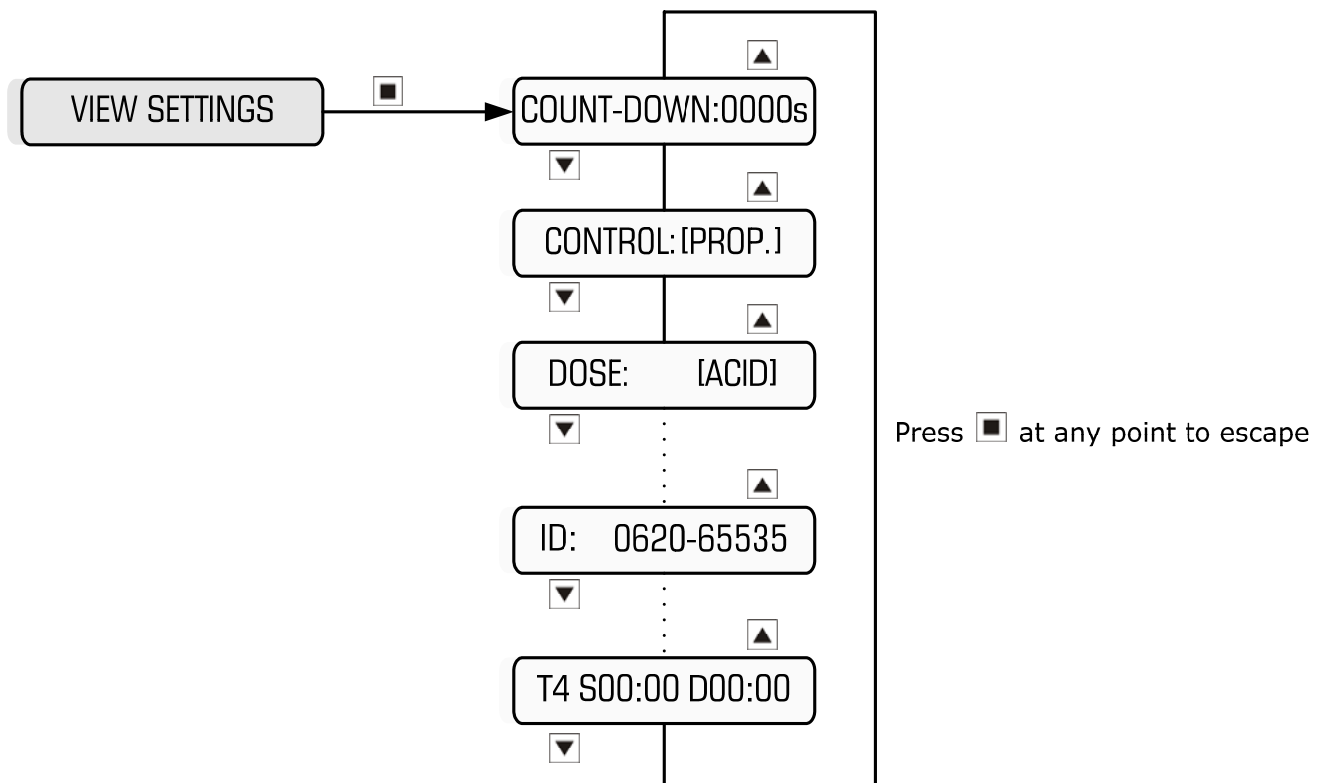
Example: Setting Control Output to dose for 5 minutes

Note: The pump will not dose if there is no flow

4.6 View Settings

Main Menu > VIEW SETTINGS

To view all the settings you have programmed into the controller without going into the menus themselves, you can simply scroll up and down to view them all:

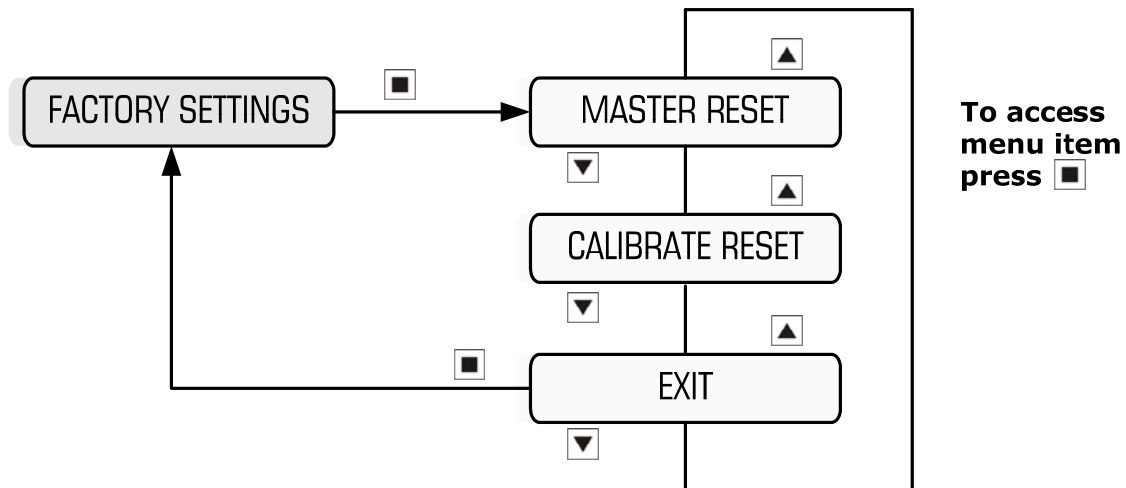


4.7 Factory Settings

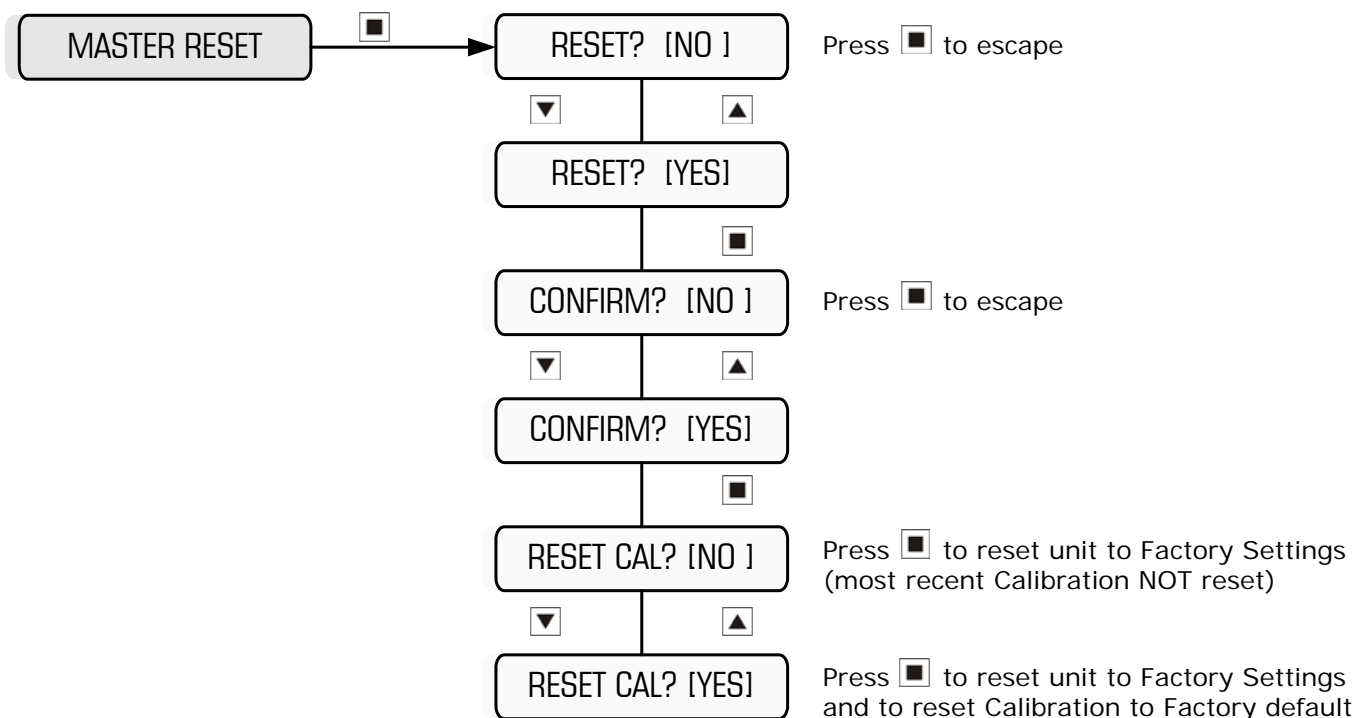
Main Menu > FACTORY SETTINGS

CAUTION:

- Enter this part of the program ONLY if you wish to erase your program settings.
- The default settings most likely will not suit your application, so it will be necessary to reprogram the controller with your desired settings.
- This menu gives the option of resetting the calibration as well.



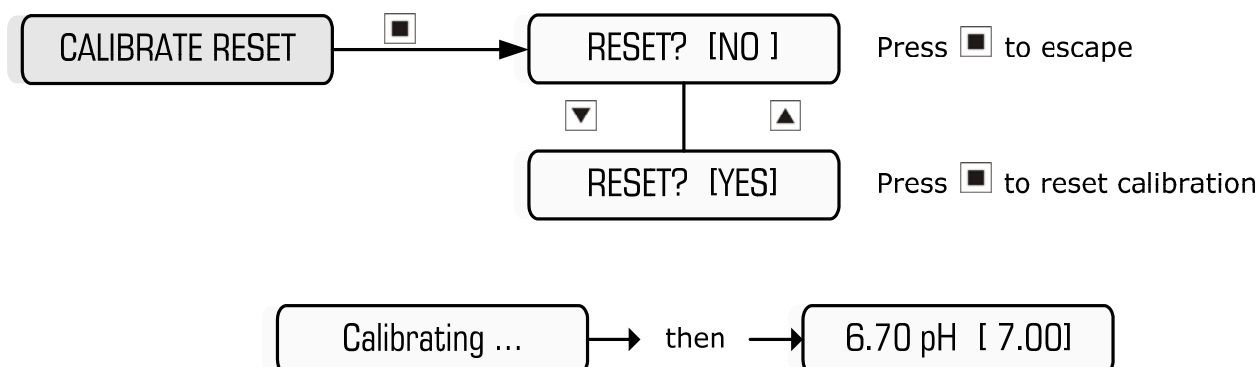
Main Menu > **FACTORY SETTINGS** > **MASTER RESET**



Main Menu > FACTORY SETTINGS > CALIBRATE RESET

To reset the pH calibration of the unit without resetting other settings, access the Factory Settings Menu option, select Calibrate Reset and follow the prompts.

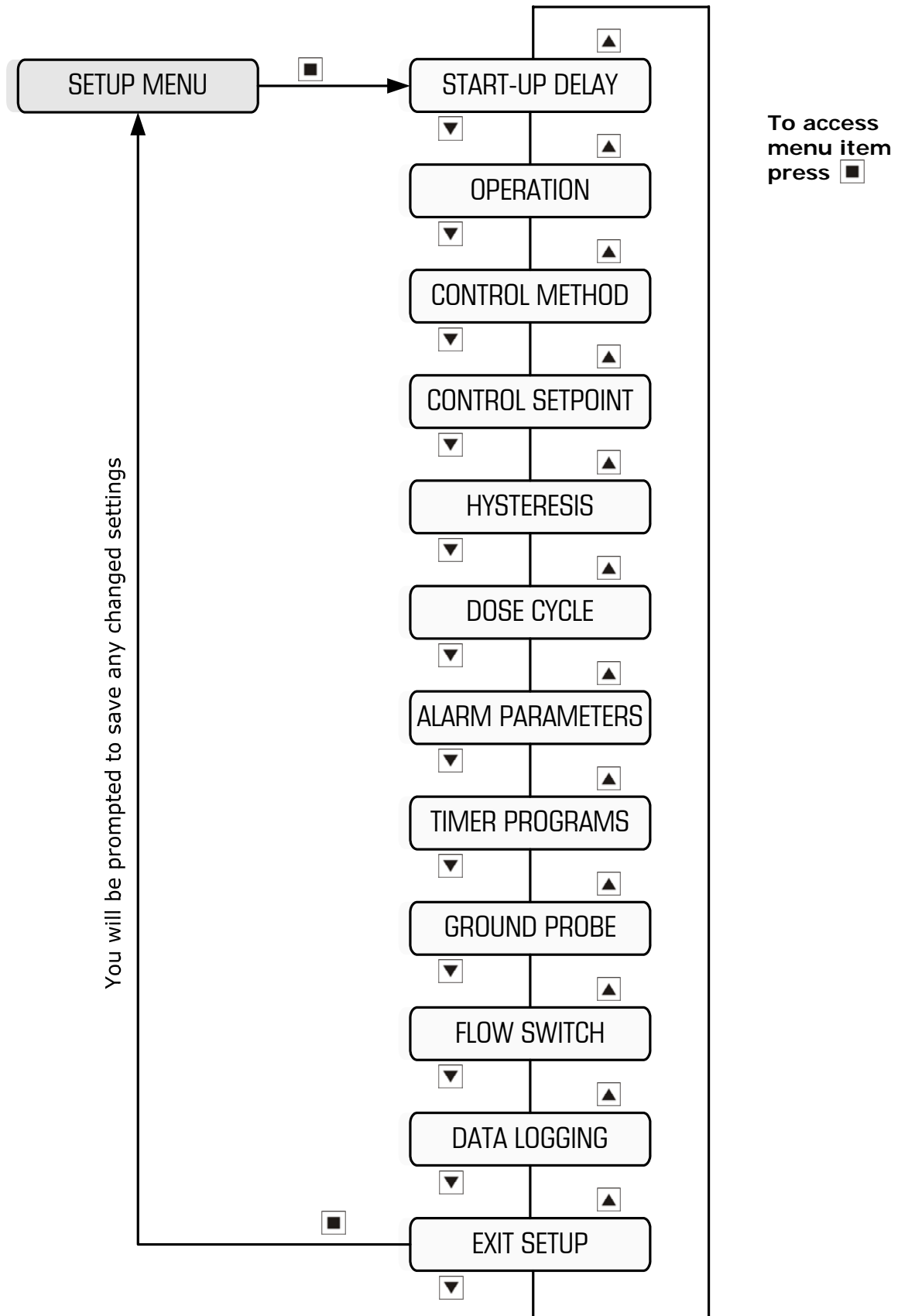
NOTE: Once the calibration has been reset, you will need to re-calibrate the pH sensor (see section 4.3).



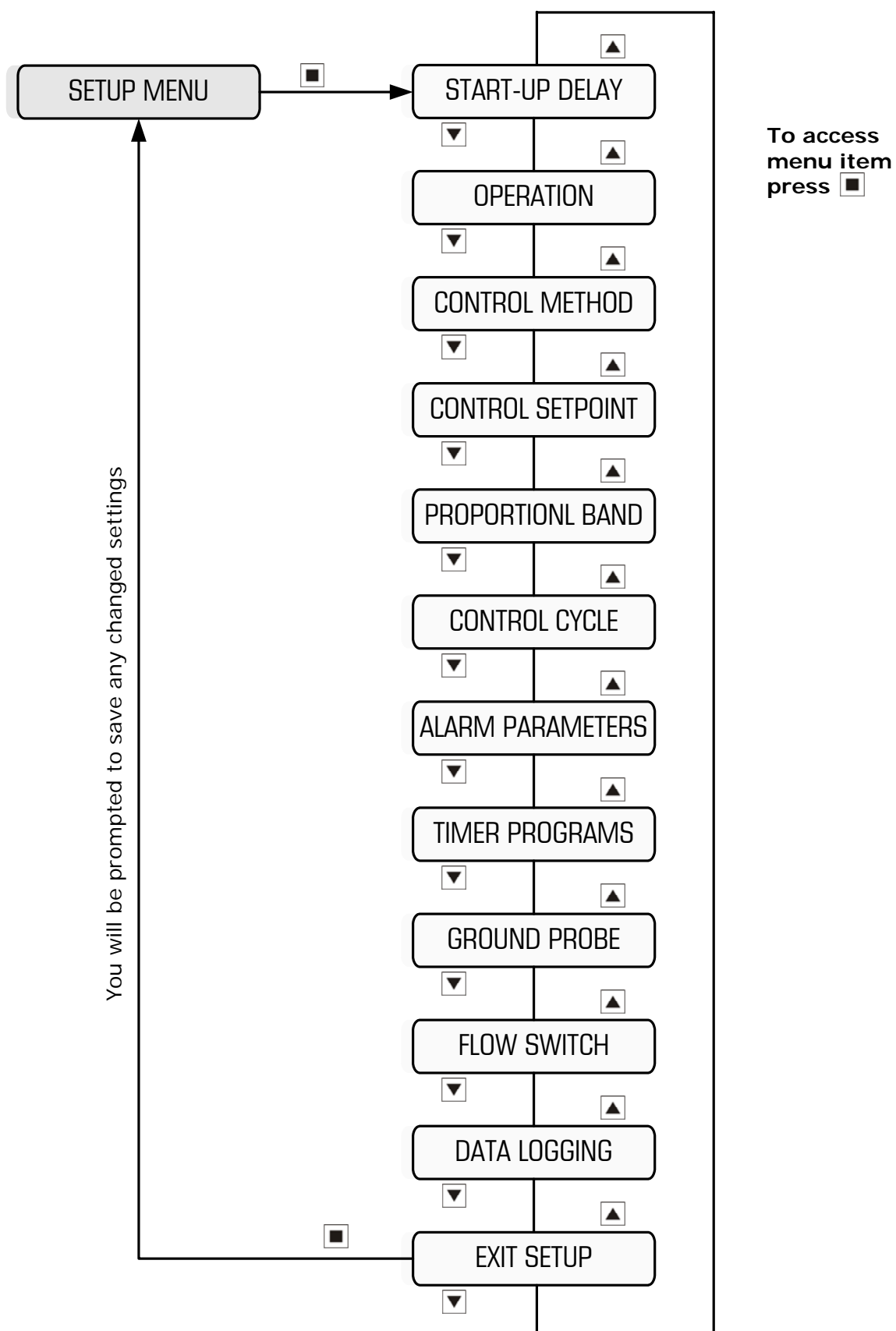
5. Programming Setup Menu

IMPORTANT:

- Once settings are changed, it is necessary to exit the SETUP MENU in order to save your settings.
- Depending on the Control Method selected (i.e. ON/OFF or PROPORTIONAL – as outlined in section 5.4), the Setup Menu will change – both Menu Structures illustrated as follows:



Setup Menu when ON/OFF Control Method Selected

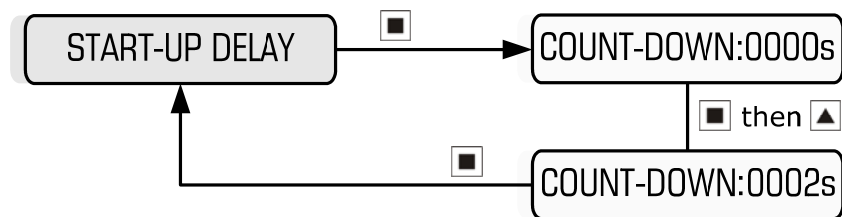


Setup Menu when Proportional Control Method Selected

5.1 Program Start-up Delay

Main Menu > **SETUP MENU** > **START-UP DELAY**

The start-up delay is a timer that starts timing when the unit is powered up, or flow resumes after a “no-flow” condition. During this time, the control output is disabled. Only once the time counts down to zero, does the control output become active if the unit calls for dosing. The purpose of this timer is to allow the system water to mix and circulate effectively before dosing commences. If this feature is not required, then simply program the start-up delay to zero. When timing, the start-up delay can be cancelled by holding down the ENTER (Reset) pushbutton.

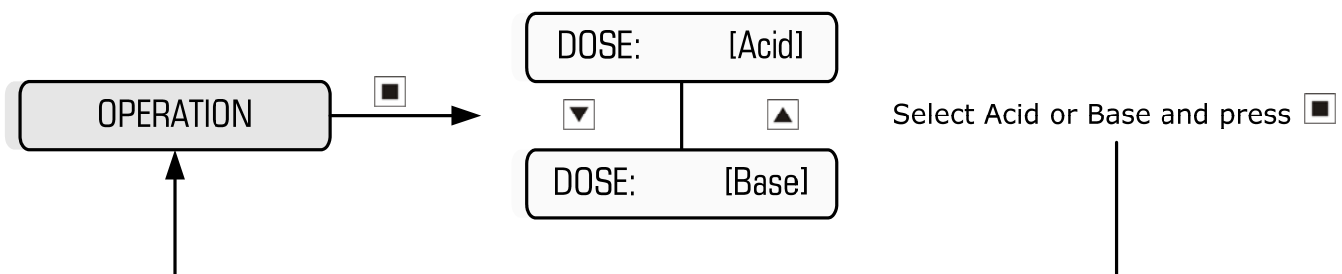


Example: Setting Start-Up Delay of 2 seconds

5.2 Select Operation

Main Menu > **SETUP MENU** > **OPERATION**

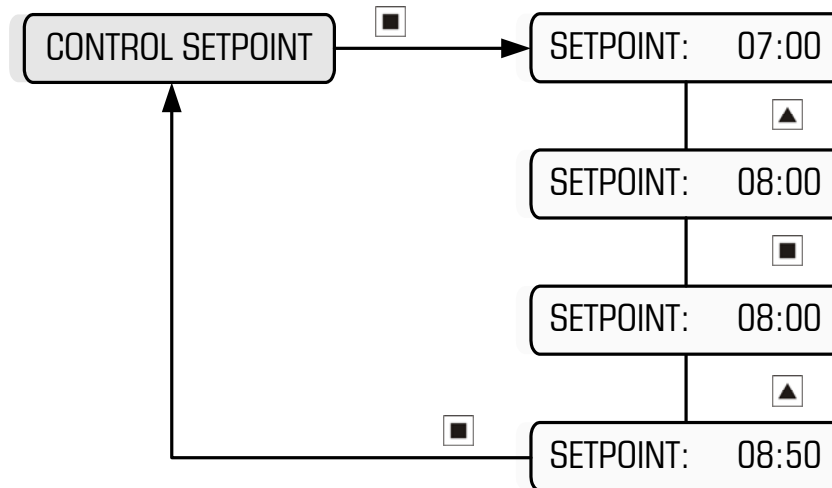
The PH-XP2 controller can dose either an Acid (eg. Sulphuric Acid) to lower the pH, or a Base (eg. Sodium Hydroxide) to increase the pH. Only one or the other can be selected:



5.3 Set pH Setpoint

Main Menu > SETUP MENU > CONTROL SETPOINT

The pH Setpoint is the desired pH value of the process.



Example: Increasing setpoint from 7.00pH to 8.50pH

5.4 Set Control Method

Main Menu > SETUP MENU > CONTROL METHOD

The PH-XP2 features 2 methods of pH control:

- **ON/OFF control** with programmed Dose Cycle (ie modulation), or
- **PROPORTIONAL control** via automatically varying duty cycle

With **ON/OFF control**, the controller either turns the pump on continuously when correcting the pH or modulates the pump by turning the pump ON and OFF during the dosing period. The On period and Off periods are programmable.

With **proportional control**, the dosing algorithm modulates the pump based on a percentage pH variation from the Setpoint. The further the pH is from the Setpoint, the shorter the OFF period is with respect to the ON period. The closer the pH is to the Setpoint, the longer the OFF period is with respect to the ON period. The control cycle and the proportional band are programmable.

5.4.1 ON/OFF Control

If **dosing acid**, the pump will dose when the pH readout rises above the pH SETPOINT . Dosing will stop once the readout drops below the pH SETPOINT minus a percentage. (This percentage is the hysteresis value and is a percentage of the SETPOINT).

If **dosing base**, the pump will dose when the pH readout drops below the pH SETPOINT . Dosing will stop once the readout rises above the pH SETPOINT plus the hysteresis percentage

Hysteresis prevents rapid switching of the pump on and off when the system pH hovers around the Setpoint. Hysteresis is the difference between the two pH points at which the pump starts and the pump stops. Hysteresis is programmed as a percentage of the Setpoint, and is only applicable to ON/OFF control

For example, if the SETPOINT is 7.00pH and the hysteresis value is 5%, then the calculated hysteresis value is 0.35 pH.

If dosing acid, the pump will be activated when the pH rises above 7.00pH and will stop when the pH drops to 6.65 pH (ie. 7.00pH minus 0.35pH).

If dosing base, the pump will be activated when the pH drops below 7.00pH and will stop when the pH rises above 7.35 pH (ie. 7.00pH plus 0.35pH).

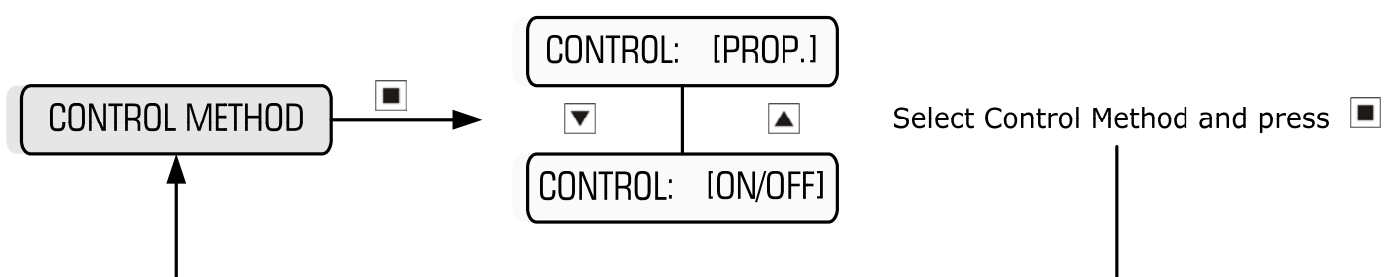
Once the Setpoint is programmed for ON/OFF control, 2 parameters are required to be programmed:

- Hysteresis, and
- Dose Cycle

Step 1:

Select the ON/OFF Control Method

Main Menu > **SETUP MENU** > **CONTROL METHOD**

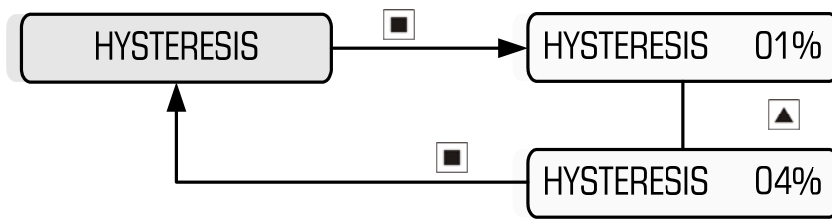


Step 2:

Program the Hysteresis

(**Note:** This menu item will only appear if ON/OFF control is selected first)

Main Menu > **SETUP MENU** > **HYSTERESIS**



Example: Increasing Hysteresis from 1% to 4%

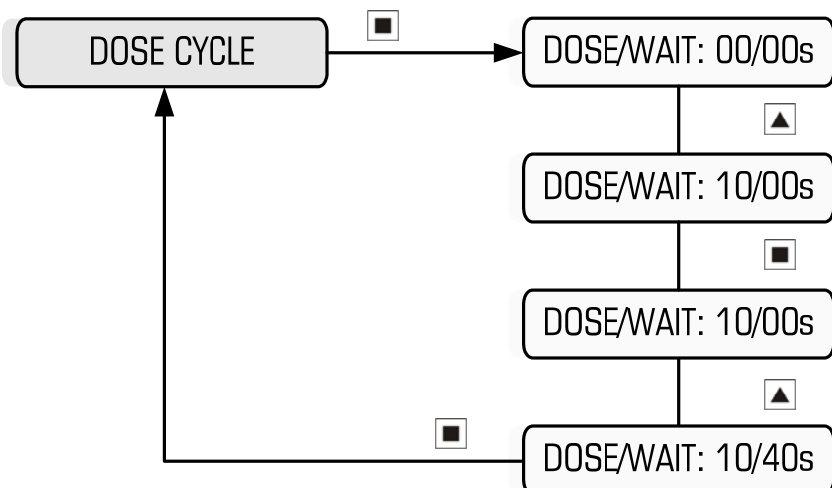
Step 3:

Program the Dose Cycle

Main Menu > **SETUP MENU** > **DOSE CYCLE**

When the controller calls for dosing, the pump can be programmed to dose continuously or on a cycle until it reaches the pH Setpoint. A cycle is recommended to reduce overshoot, and to preserve the life of the pump.

The menu asks for a Dose Time and a Wait Time to be programmed. The Wait Time follows the Dose Time, and the cycle is repeated until the Setpoint plus/minus hysteresis is reached. The following diagram illustrates a dose cycle programmed for a 10 second dose followed by 40 second wait:



Example: Programming a dose cycle for 10s, followed by a wait period of 40s

In the example above, the pump doses 10 seconds during every 50 second cycle (ie 10+40), which equates to a 20% duty cycle.

The function of the dose cycle is to assist in reducing overshoot by achieving pH change more slowly. In a large system, there is often a lag after dosing until the pH sensor realises a change in pH. The lag time estimated should be programmed as the Wait time.

Should the pH readout drift more than 25% away from the programmed Setpoint the controller automatically doubles the Dose time and halves the Wait time to bring the pH within 25% of the Setpoint very quickly. As soon as the pH readout comes back to within 25% of the Setpoint, normal pump duty cycle (ie. programmed Dose/Wait times) will resume. In the example above, the Dose and Wait times will temporarily be 20 seconds each, i.e. the pump will dose for 20 seconds during every 40 second cycle, which equates to a 50% duty cycle.

If you wish to have the control output continuously active during dosing (rather than cycling ON and OFF), simply set the Dose/Wait times to 00/00s

5.4.2 PROPORTIONAL Control

With proportional control, the controller will always attempt to keep the pH as close as possible to the Setpoint. For proportional control to work, the controller requires the Setpoint as well as 2 other parameters to be programmed:

- The Proportional Band, and
- The Control Cycle

The **Proportional Band**, set as a percentage of the Setpoint, is the band in which proportional control takes place. For example if the Setpoint = 7.00 pH, and the Proportional band is 10%, then proportional control takes place between 7.00 pH and 7.70 pH (dosing acid) or between 7.00 pH and 6.30 pH (dosing base).

Once the Setpoint is reached, the control output is OFF continuously. Outside of the proportional band on the opposite end, the control output is ON continuously.

Proportional control, which takes place within the proportional band is explained as follows:

Assuming a pump is connected to the control output, the controller will modulate the power supply to the dosing pump proportionally. This modulation is an ON/OFF cycle (called the Control Cycle) where the

ON/OFF ratio reduces the closer the pH is to the Setpoint (i.e. The ON time is much shorter than the OFF time). Conversely, if the pH starts drifting away from the Setpoint (but still within the proportional band), the ON time starts getting longer with respect to the OFF time.

The **Control Cycle** is the other parameter to be programmed. Whilst dosing, if the pH reading on the LCD changes very quickly, the Control Cycle will need to be as short as possible, eg 10 seconds. This will reduce overshoot, as the controller will be able to adjust its dose rate very quickly in responding to a rapidly changing pH.

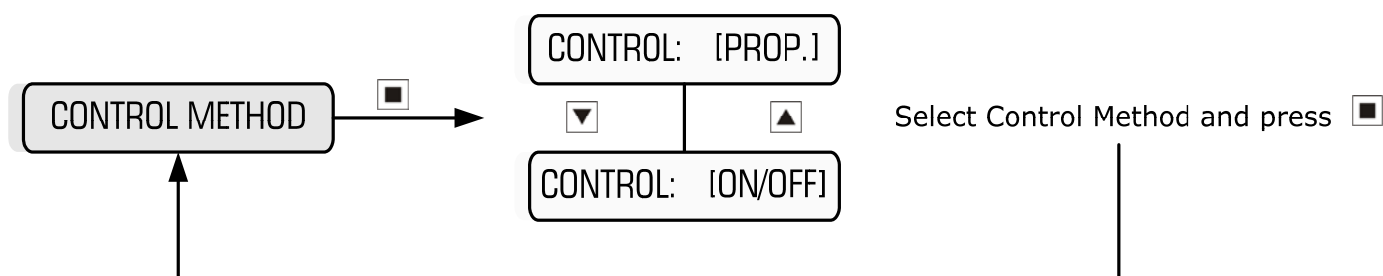
Conversely, in a large system with a large volume of water, and a slow recirculation rate, the pH reading may take a long time to change after dosing occurs. In this case, it is better to have a longer Control Cycle, eg 100 seconds, to allow for the pH reading to change, before further dosing takes place.

If unsure, set the control cycle to your best estimate of the time it takes for the water where the chemical is injected into, to get back to the pH sensor.

Step 1:

Select the Proportional Control Method

Main Menu > **SETUP MENU** > **CONTROL METHOD**

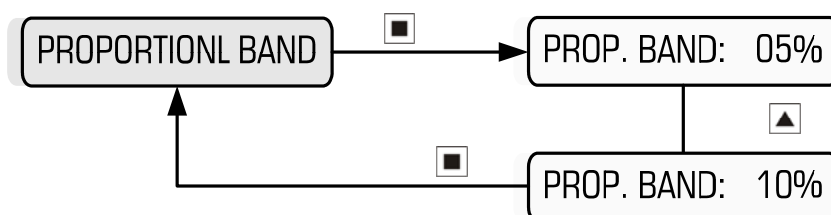


Step 2:

Program the Proportional Band

(**Note:** This menu will only appear if PROP. control is selected first)

Main Menu > **SETUP MENU** > **PROPORTIONAL BAND**

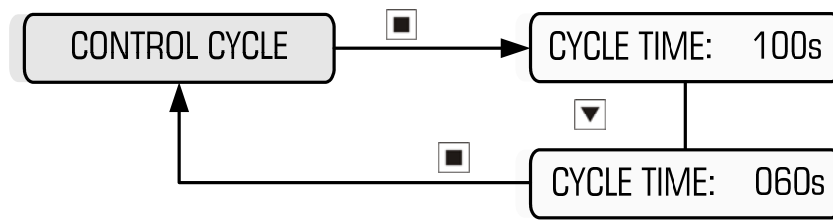


Example: Increasing proportional band from 5% to 10%

Step 3:

Program the Control Cycle

Main Menu > **SETUP MENU** > **CONTROL CYCLE**



Example: Decreasing cycle time from 100 sec to 60 sec

Example of Operation:

- Operation = Dosing Acid
- Setpoint = 7.5 pH
- Proportional Band = 10% (i.e. 7.50 pH to 8.25 pH)
- Control Cycle = 20 seconds

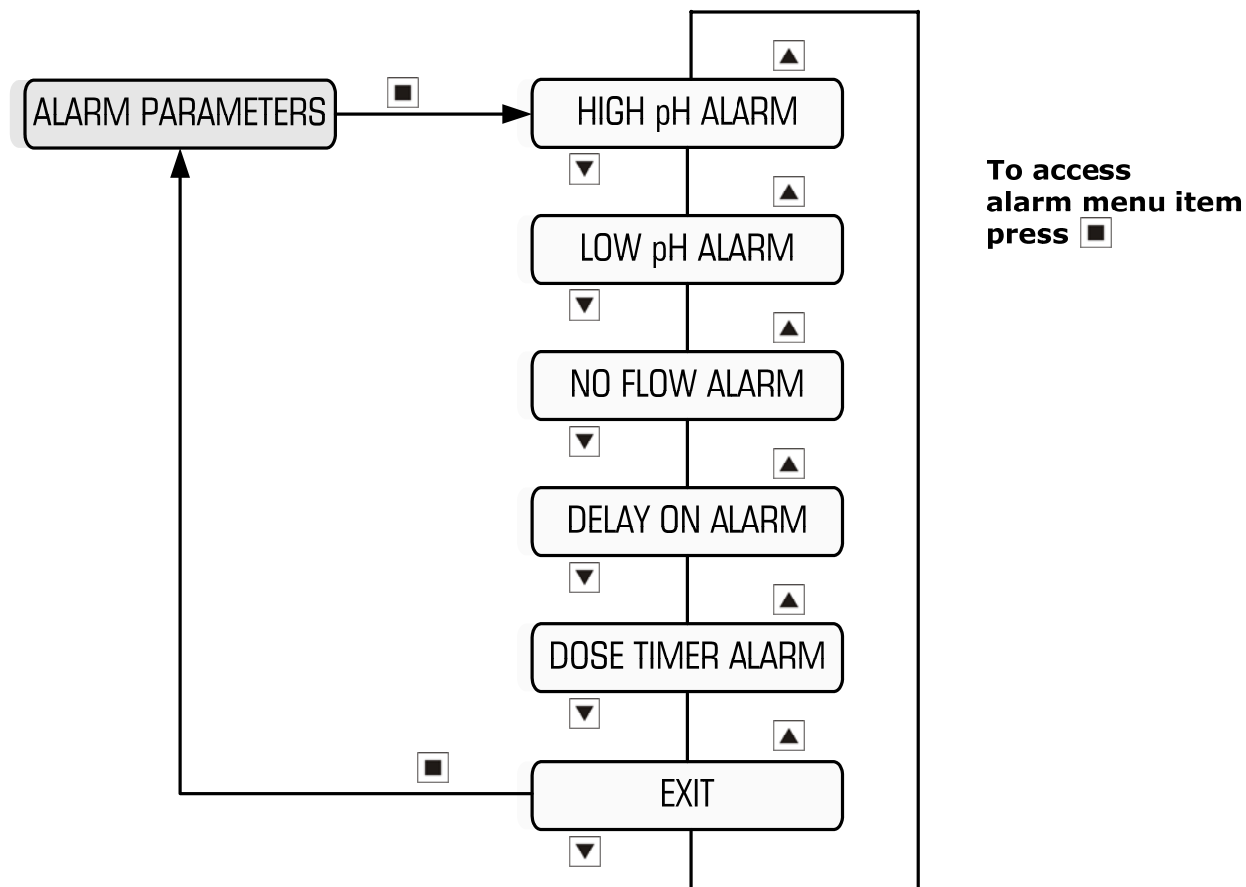
Below 7.50 pH, the pump is OFF continuously.

As the pH rises above 7.50pH, the pump starts dosing for 1 second every 20 seconds (ie. ON/OFF cycle = 1s/19s). If the pH reaches 7.80 pH, the pump will dose for 8 seconds every 20 seconds (ie. ON/OFF cycle = 8s/12s). As the dose rate increases, ie ON/OFF ratio increases, the pH should start dropping again with the aim of getting as close to the Setpoint as possible.

5.5 Alarm Parameters

The controller has 5 programmable alarm functions as outlined below. If any of the alarms are activated and confirmed, the common alarm contact switches, the red Alarm LED illuminates, and the Alarm message is displayed on the LCD.

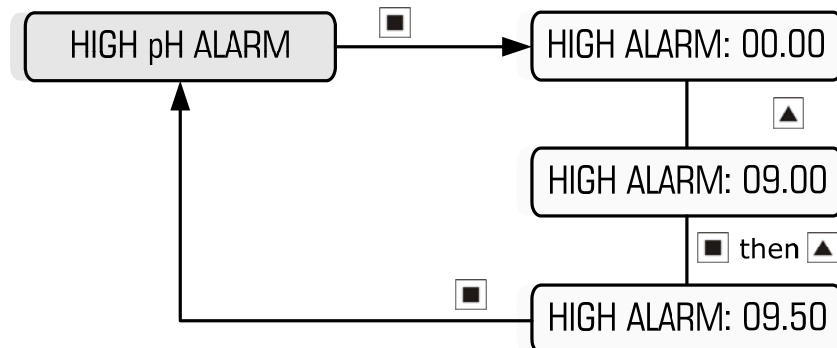
Main Menu > **SETUP MENU** > **ALARM PARAMETERS**



5.5.1 High pH Alarm

The High pH Alarm is activated if the pH rises above the programmed setting.

Main Menu > *SETUP MENU* > *ALARM PARAMETERS* > *HIGH pH ALARM*

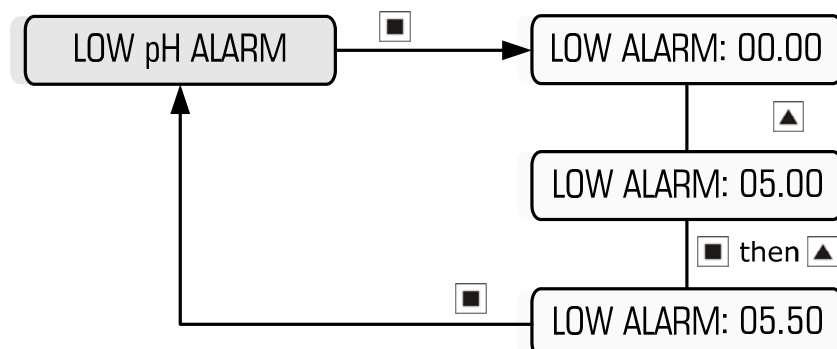


Example: Setting a High Alarm of 9.5pH

5.5.2 Low pH Alarm

The Low pH Alarm is activated if the pH drops below the programmed setting.

Main Menu > *SETUP MENU* > *ALARM PARAMETERS* > *LOW pH ALARM*

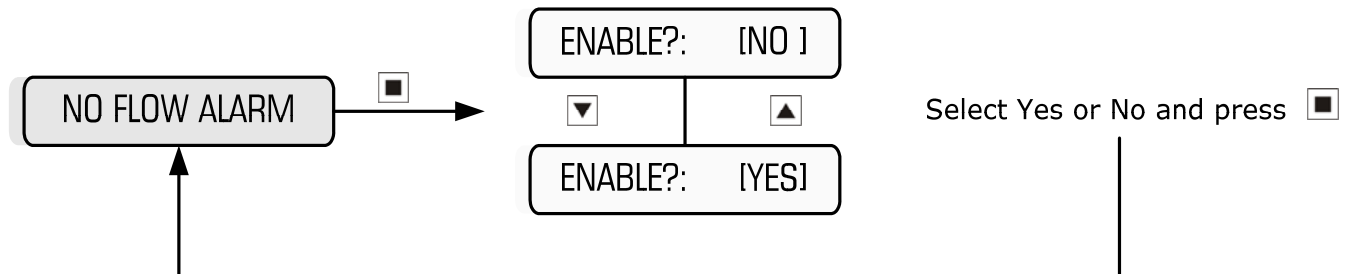


Example: Setting a Low Alarm of 5.5pH

5.5.3 No Flow Alarm

If the No Flow Alarm is enabled, the Alarm will activate when there is no flow detected by the optional flow switch. If the No Flow Alarm is left disabled, then the Alarm is unaffected by a no-flow condition.

Main Menu > **SETUP MENU** > **ALARM PARAMETERS** > **NO FLOW ALARM**



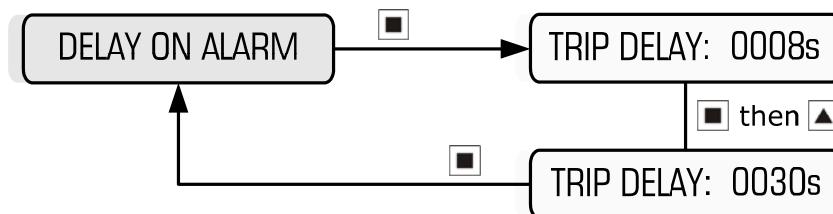
5.5.4 Delay On Alarm

When an alarm condition is detected, eg High pH Alarm, the relay only trips immediately if the Trip Delay is set to 0 seconds. However, if alarms do not become immediately critical, it is better to program a delay on the alarm to prevent "nuisance trips".

If a Trip Delay, eg. 120s, is programmed, the alarm relay will only trip if the High pH condition exists continuously for 120 seconds. However, if the pH drops to below the High pH Alarm level before the 120 seconds times out, the Alarm condition will reset.

Whilst the Trip Delay is timing, the red Alarm LED will flash. If the alarm condition still exists after the time delay, the LED will illuminate continuously until the alarm cancels, at which point, the LED goes off.

Main Menu > **SETUP MENU** > **ALARM PARAMETERS** > **DELAY ON ALARM**



Example: Setting alarm delay of 30 seconds

5.5.5 Dose Timer Alarm

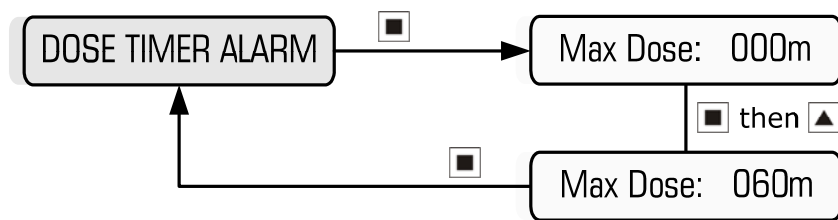
The Dose Timer Alarm is the maximum acceptable dose time to reach the Setpoint. This alarm is designed to protect the system from overdosing in the event of a false reading from a faulty pH sensor, a dry sensor, a disconnected sensor, or if the controller itself is faulty.

If programmed to dose acid (/base), the pH reading on the controller could be high (/low) when in fact the actual pH of the system is much lower (/higher), resulting in dosing when there should be no dosing. The Timer Alarm stops this false dosing condition as soon as the Timer Alarm times out.

To leave the alarm in its disabled state, the programmed setting is 000m.

If the system pH reaches the Setpoint within the programmed time, the timer resets. However, if the timer times out before the pH reaches the Setpoint, the pump switches off and remains disabled until the unit is manually reset by holding down the Reset pushbutton.

Main Menu > **SETUP MENU** > **ALARM PARAMETERS** > **DOSE TIMER ALARM**

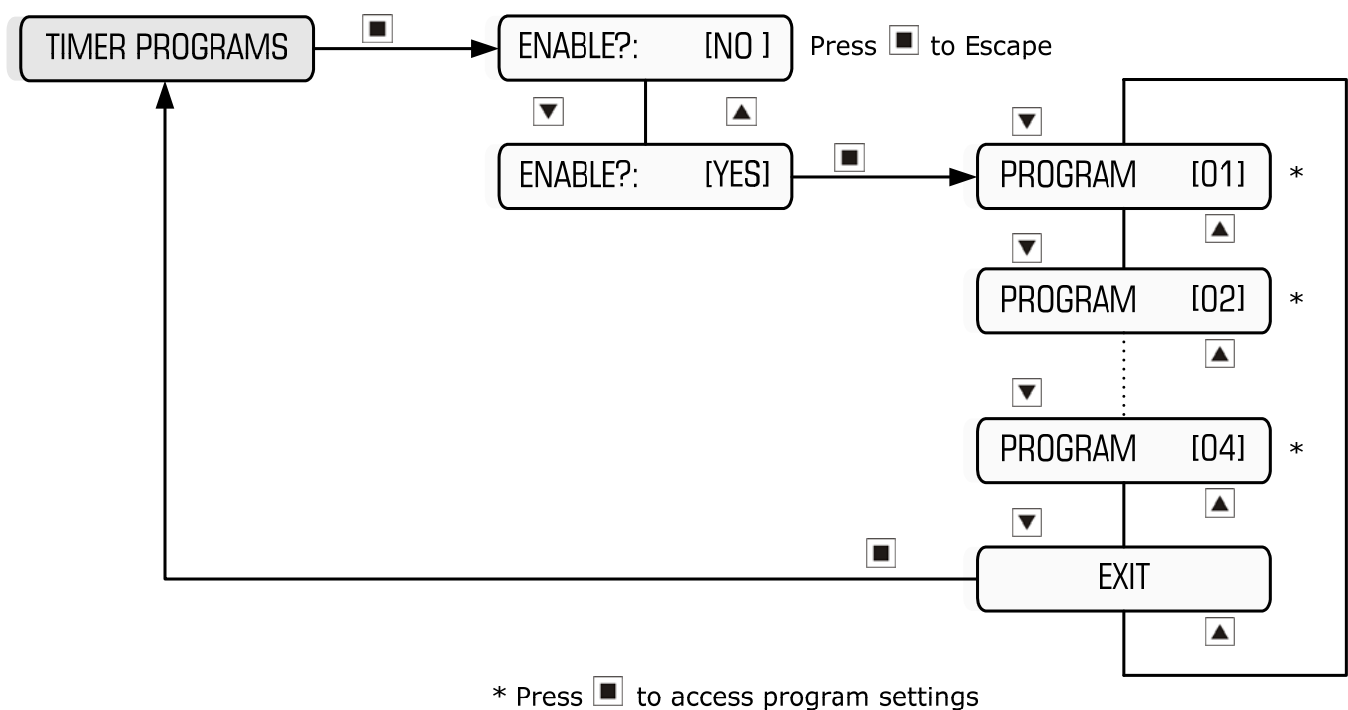


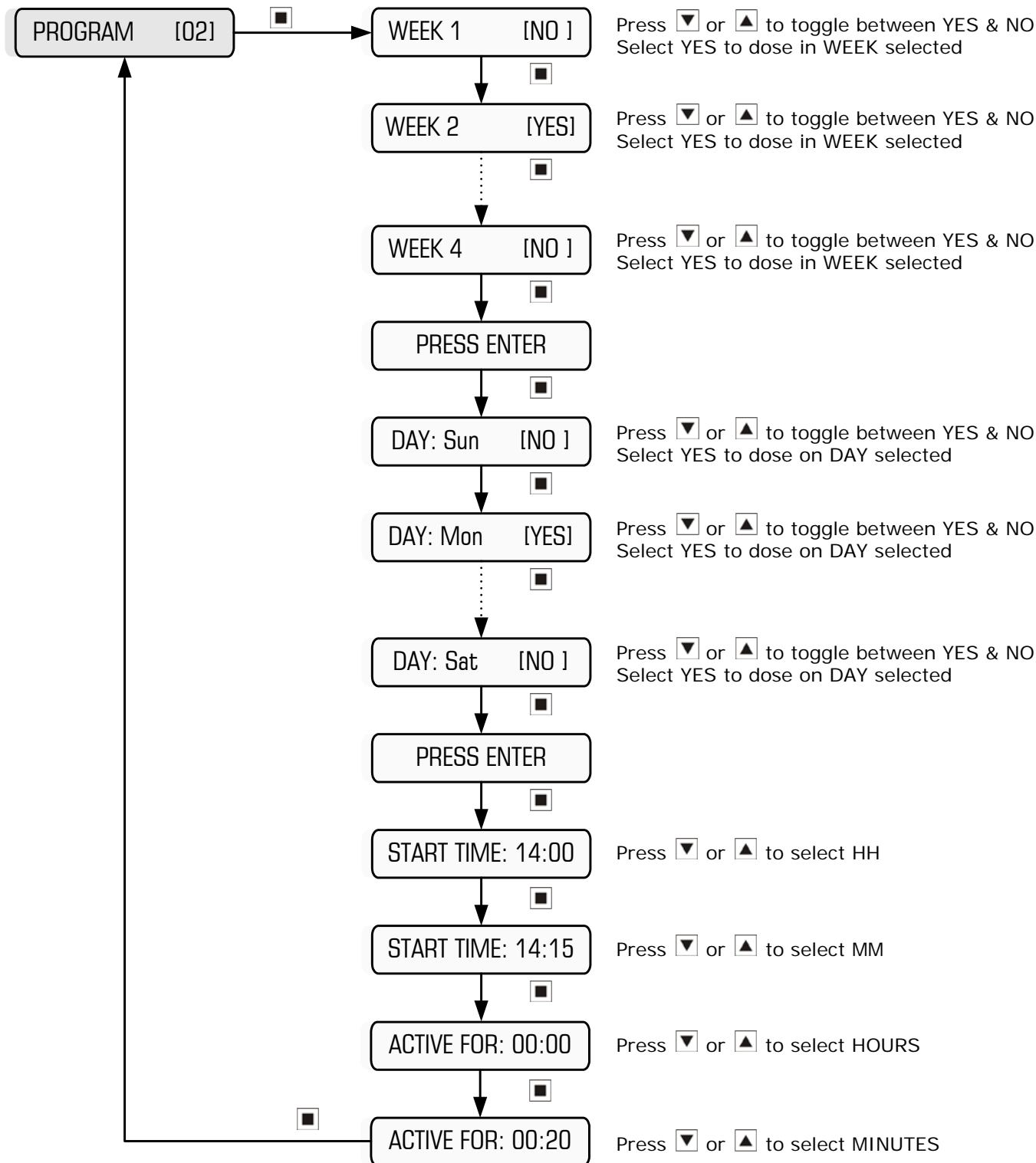
Example: Setting maximum dose time of 60 min

5.6 Timer Programs

If the timer programs are left in the disabled state, the controller will activate the control output when the control algorithm calls for dosing. However, if the timer programs are set up, the control function will only be active when the timer programs are active. During a Timer Program, if dosing is required, the pump will dose. However, if the controller calls for dosing outside of a Timer Program, the pump will remain idle. An example of where the Timer Programs are useful, is if you only want pH control to occur during certain time periods, eg. Process operating times.

Main Menu > SETUP MENU > TIMER PROGRAMS



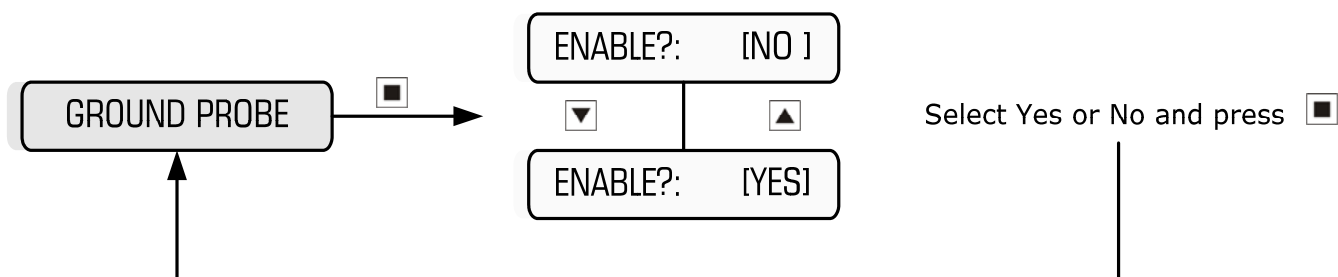


Example: Setting pH Control to be active for 20 minutes, beginning at 14:15 on Monday in Week 2 using Program 2.
pH Control will become inactive outside of this time period even if the pH needs to be corrected.

5.7 Ground Probe

The optional Solution Ground Probe (code DCON-CMR) is only required in processes (eg. Electroplating) where currents in the process solution cause interference of the pH measurement. If required, the ground probe cable must be connected inside the instrument to terminal L5, and the Stainless Steel tip must be inserted into the same water as the pH sensor. Furthermore, the function must be enabled via the menu as follows.

Main Menu > SETUP MENU > GROUND PROBE



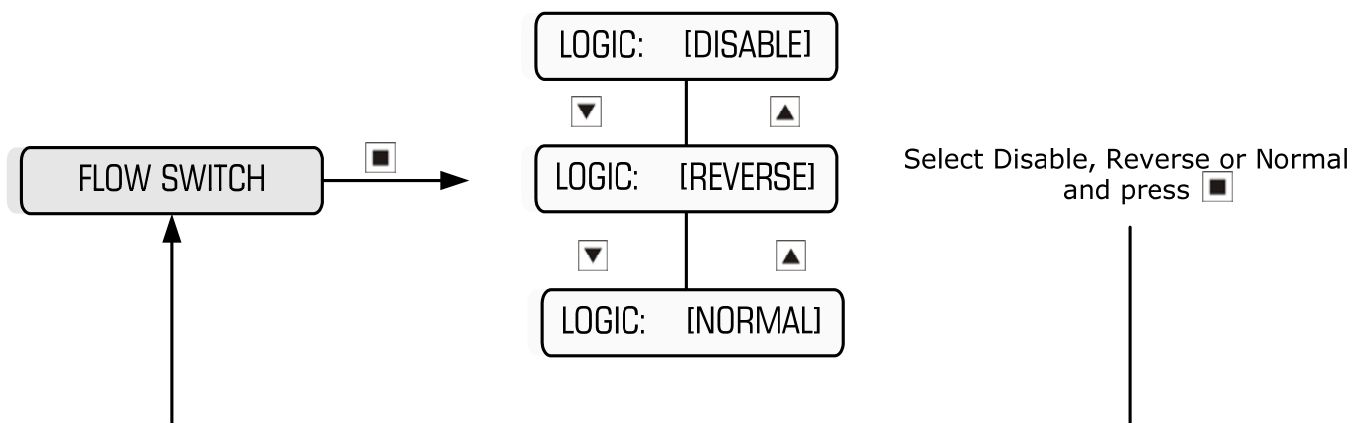
If a ground probe is not used, it is important to leave the function in its disabled state.

5.8 Flow Switch

If an optional flow switch is connected to the controller, pH control will only occur if there is flow. When dosing, the pump will stop immediately if no flow is detected. There are 3 possible settings in the menu for the flow switch:

- **DISABLE:** pH Control occurs regardless of flow or no flow
- **NORMAL:** pH Control only occurs when the flow switch input is shorted
- **REVERSE:** pH Control only occurs when the flow switch input is open circuit.

Main Menu > SETUP MENU > FLOW SWITCH



5.9 Data Logging

The controller has the facility to log the following items at the pre-programmed intervals:

- Date
- Time
- pH reading
- % of time the pH control output is active
- Status of the flow input
- % of time the common alarm is activated

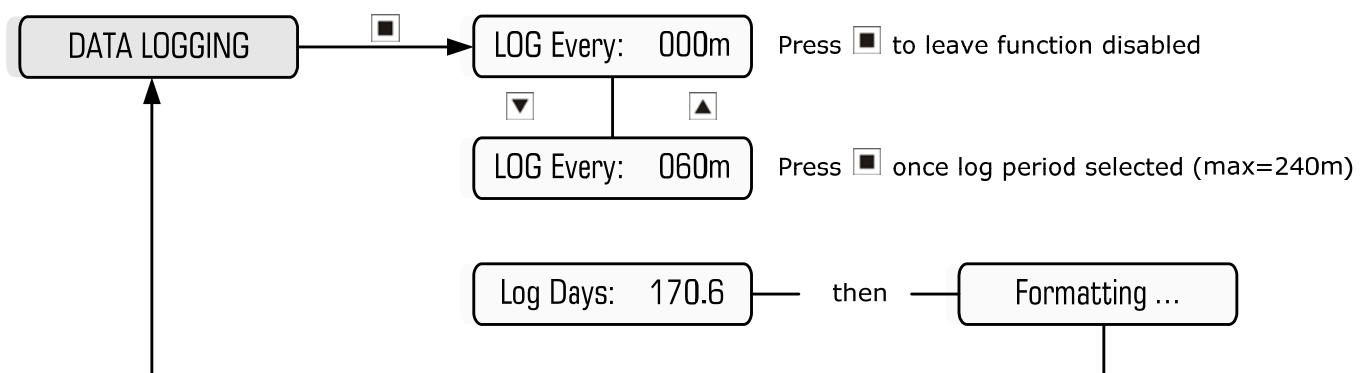
The pre-programmed intervals are 5, 10, 15, 30, 60, 120 or 240 minutes. If the controller is set to log every 0 minutes, then logging is disabled.

Each logged entry takes up memory, so the longer the interval, the longer the time can be between downloads. For example, the controller will have enough memory to store data for 14 days for a log taken every 5 minutes, or for 682 days for a log taken every 240 minutes.

Once the memory is full, the data logger loses the oldest information first.

The data is downloaded via the Comms port on the front panel of the controller. (An optional cable is required, P/N SP-XP2-COMCABLE-1)

Main Menu > SETUP MENU > DATA LOGGING



Example: Setting the controller to log every 60 min

6. Factory Settings

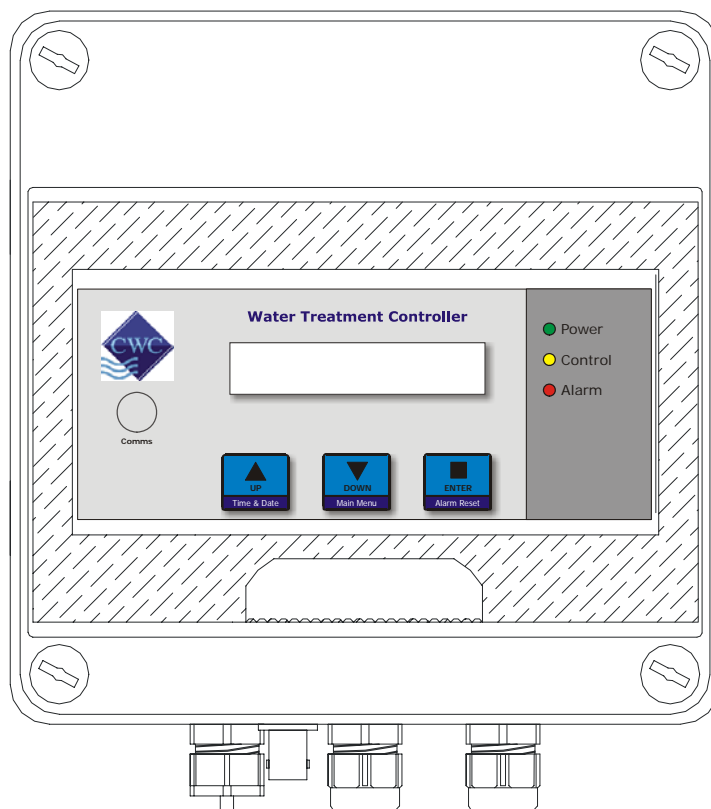
The default factory settings are outlined below. These are the settings programmed when a manual Factory Reset is initiated via the menu.

Menu Setting/Item	Default
Start-Up Delay	Count-Down: 0000s
Operation	Dose Acid
Control Method	Proportional
Control Setpoint	7.5pH
Proportional Band	10%
Control Cycle	100s
High pH Alarm	00.00 pH
Low pH Alarm	00.00 pH
No Flow Alarm	Enable? [No]
Delay on Alarm	Trip Delay: 0008s
Dose Timer Alarm	Max Dose: 120m
Timer Programs	Enable? [No]
Ground Probe	Enable? [No]
Flow Switch	Logic: [Normal]
Data Logging	LOG Every: 000m

7. Specifications

Item	Specification
Power Supply	220-240VAC, 50/60Hz
Power Consumption	10W max (with no load on control output)
Inputs	pH Sensor (optional) Ground probe (optional) Flow switch (optional)
Auxiliary Mains Output	240VAC continuous (2A fused)
Control Output	2A/250VAC (fused)
Alarm Relay Output	N/O & N/C (10A/250VAC resistive)
Flow Switch Repeat Output	N/O (10A/250VAC resistive)
Optional Outputs	4-20mA (P/N AF09B) 4-20mA plus events (P/N AF10B)
Measured pH Resolution	0.01 pH
Accuracy	0.4% of measured range
Repeatability & drift	0.8% of measured range
Logged Items	Date, Time, pH, pH%, Flow, Alarm%
Data retention	100 years
Battery backup	1 year (approx)
Enclosure rating	IP55
Operating Temperature	0 - 50°C

ORP (mV) Controller Model: ORP-XP2



Supplied by:

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Manufacturer: Convergent Water Controls Pty Ltd, Sydney Australia.

Note: On-going product development at Convergent Water Controls may lead to changes in the specifications of this product.

Warranty: This product is guaranteed for a period of 12 months from installation date or 18 months from Invoice date (whichever occurs first). The warranty applies to manufacturing or component defects which may cause the unit to malfunction under specified conditions. The guarantee does not cover damage due to abuse, tampering or improper installation.

Disclaimer: Convergent Water Controls will not be held liable for any consequential damage or loss arising resulting from product malfunction.

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1. Introduction

The ORP-XP2 measures and controls the ORP as read by an ORP sensor and can be programmed to dose either an oxidant or reductant. If unstable readings are experienced, the unit can measure ORP with respect to an optional solution ground probe (model DCON-CMR) using its differential input amplifier.

When oxidant is dosed, it causes an increase in ORP (mv increases). Similarly, when a reductant is dosed, it causes a decrease in ORP (mV drops).

The ORP-XP2 features 2 methods of ORP control: **ON/OFF** or **proportional**. With ON/OFF control, the controller either turns the pump on continuously when correcting the ORP or modulates the pump by turning the pump ON and OFF during the dosing period. (These ON and OFF times are programmable). For more accurate control, the proportional dosing algorithm modulates the pump based on a percentage ORP variation from the Setpoint. The further the ORP is from the Setpoint, the shorter the OFF period is. The closer the ORP is to the Setpoint, the longer the OFF period is.

Other useful features of the ORP-XP2 are the programmable alarms, 7-day timer programs and data-logging facility.

2. Installation

Mount the ORP-XP2 on a flat vertical surface away from extreme heat, humidity or areas where temperature variations are extreme, ideally at eye-level to allow good visibility of the LCD display. Also ensure that a 240VAC mains power point is located nearby.

2.1 Electrical Wiring

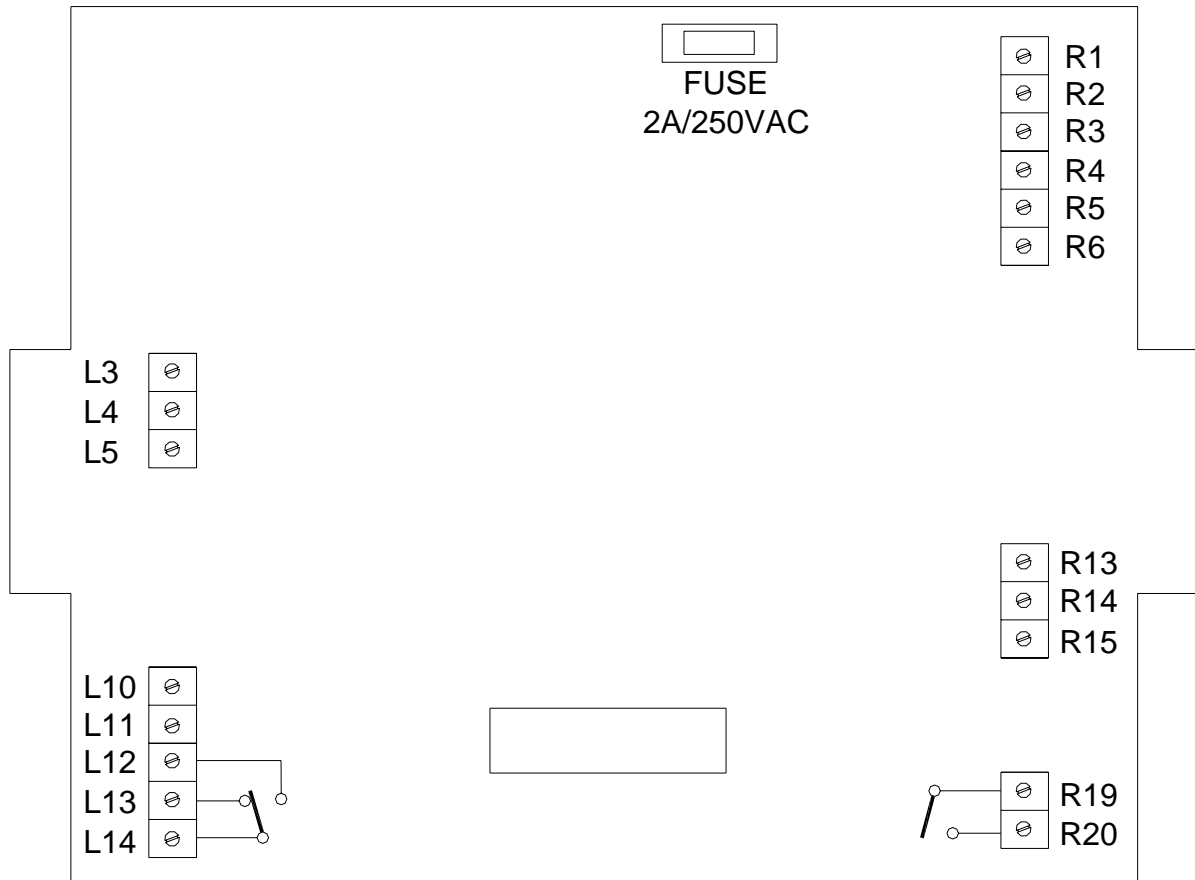
CAUTION: If opening the controller, pull the lid away from the base slowly to ensure you do not impose any strain on the interconnecting cable, which easily unplugs from the motherboard.

NOTES:

1. The BNC connector for the ORP sensor is panel mounted in the bottom of the enclosure
2. The solution ground probe connection point is via a screw terminal on the circuit board (terminal L5)
3. The N/O output R19 & R20 is used as a flow-switch repeat contact to be able to daisy-chain multiple controllers together with one flow switch. When

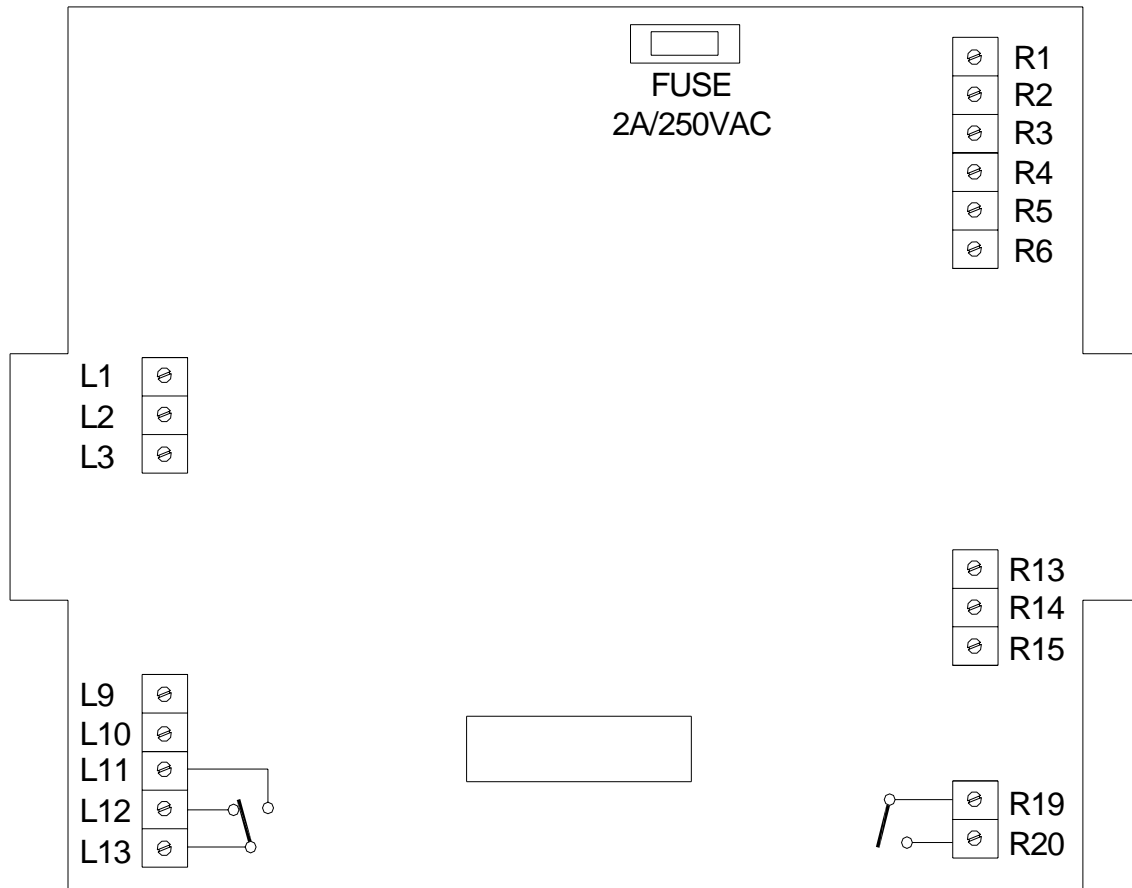
connected to the flow switch input of another controller, one flow switch will disable both controllers on no-flow.

The diagrams below show the connections to the ORP-XP2 controller circuitry (release 1 & release 2):



Release 1

L3:	BNC - ORP Signal (White)
L4:	BNC - common (Green)
L5:	Solution Ground Probe
L10:	Flow Switch In
L11:	Flow Switch Common
L12 + L14:	Alarm Relay N/O volt-free (10A/250VAC res)
L13 + L14:	Alarm Relay N/C volt-free (10A/250VAC res)
R1:	Mains Active 240VAC (power supply)
R2:	Mains Neutral
R3:	Auxiliary Continuous Active 240VAC (2A fused)
R4:	Auxiliary Neutral
R5:	Control Output Active 240VAC (2A fused) for connecting dosing pump or solenoid valve
R6:	Control Output Neutral
R13 - R15:	Common Earth
R19:	Flow Switch Repeat common
R20:	Flow Switch Repeat N/O volt-free (10A/250VAC res)



Release 2

L1:	BNC - ORP Signal (White)
L2:	BNC - common (Green)
L3:	Solution Ground Probe
L9:	Flow Switch In
L10:	Flow Switch Common
L11 + L13:	Alarm Relay N/O volt-free (10A/250VAC res)
L12 + L13:	Alarm Relay N/C volt-free (10A/250VAC res)
R1:	Mains Active 240VAC (power supply)
R2:	Mains Neutral
R3:	Auxiliary Continuous Active 240VAC (2A fused)
R4:	Auxiliary Neutral
R5:	Control Output Active 240VAC (2A fused) for connecting dosing pump or solenoid valve
R6:	Control Output Neutral
R13 - R15:	Common Earth
R19:	Flow Switch Repeat common
R20:	Flow Switch Repeat N/O volt-free (10A/250VAC res)

2.2 Sensor Installation

Consider carefully the type and location of the ORP sensor. Your instrument supplier should be able to advise the correct sensor type for your application.

Plan the installation such that the ORP sensor is as close as possible to the controller. If the sensor needs to be located further away from the controller, an extension cable must be obtained. The further the sensor is away from the controller, the greater the effect of electrical interference will be. This may degrade the signal from the sensor and causes incorrect readings. Never attempt to extend the sensor cable by means of a terminal block or soldered connection. This will leave the connection open to interference or moisture, which will affect the accuracy of the system. Always have the connection (when using an extension cable) in a waterproof junction box. A maximum sensor cable length of 25 metres is recommended, however, in a good environment, up to 50 metres is likely to be acceptable.

The Solution Ground Probe, if used, must be inserted into the same solution as the ORP sensor. The controller uses common mode rejection technology to eliminate any electrical interference on the ORP sensor. This function must be enabled in the SETUP MENU of the controller. Solution ground probes are recommended if there is an unacceptable level of fluctuation in the ORP readout on the controller.

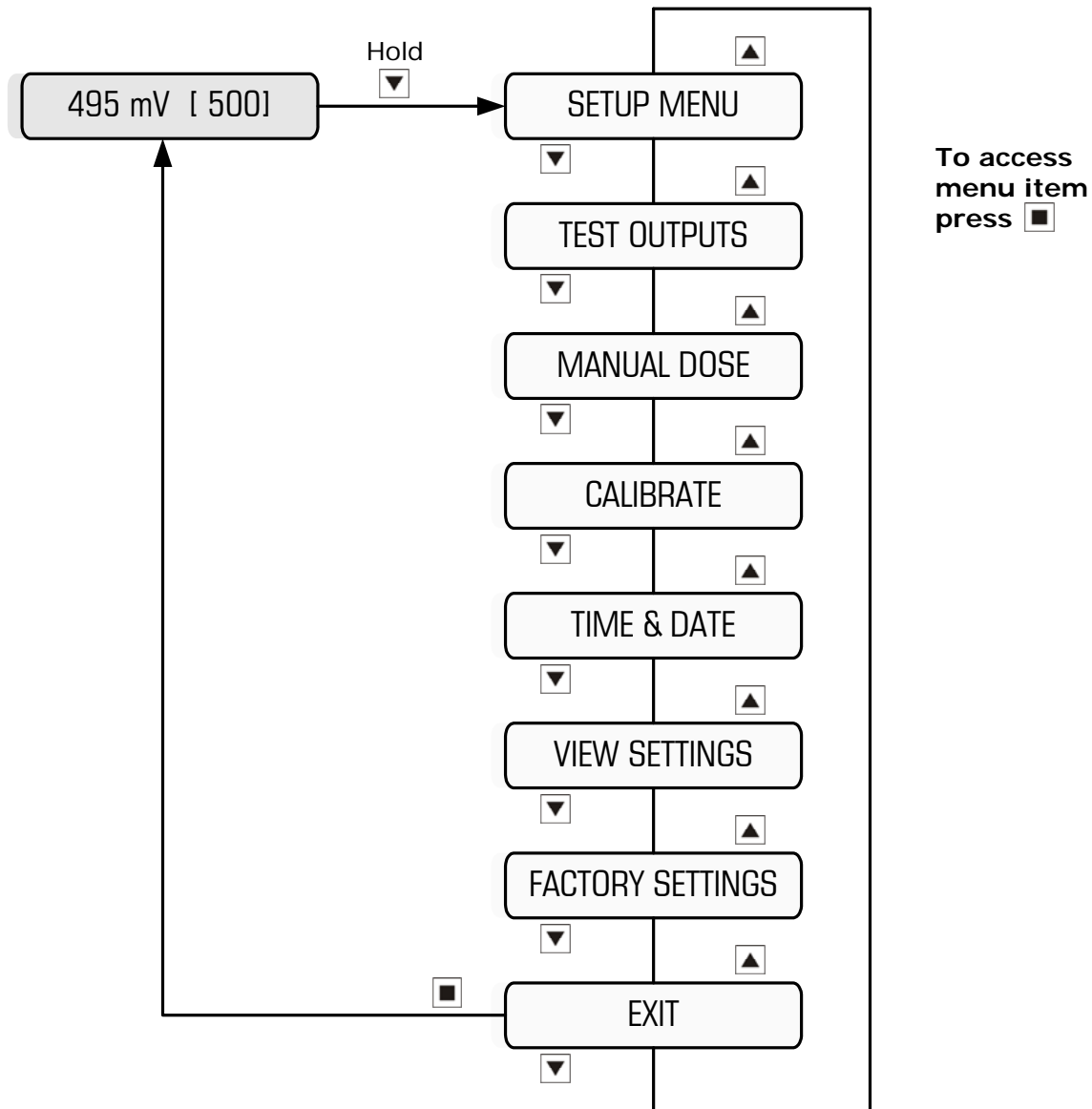
3. Controller Functionality

3.1 Menu Logic

The ORP-XP2 has an advanced but very user-friendly menu system:

- The menu structure is circular
- The relevant menu item, or programmed value flashes
- Up and Down arrow pushbuttons allow you to scroll through the menu items, and to increase/decrease programmed settings
- The MAIN MENU expands to several levels of SUB MENUS when pressing ENTER on various menu items
- The LCD is backlit

The MAIN MENU of the controller is illustrated as follows:



3.2 Pushbuttons

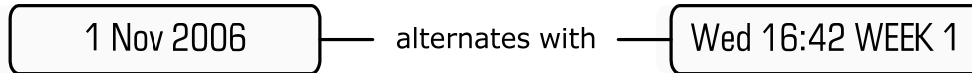
The ORP-XP2 has 3 pushbuttons which each have dual functions:

1. Scroll UP (Time & Date)
2. Scroll DOWN (Main Menu)
3. ENTER (Reset)

- The **Scroll UP** and **DOWN** pushbuttons allows you to scroll in both directions in the circular menus. Once a menu item has been selected and there is a value to program, the Scroll pushbuttons allow you to increase or decrease the number programmed.
- The **ENTER** pushbutton allows you to enter a part of the program that you have selected. It also accepts any numbers programmed with the Scroll pushbuttons.

- If the Scroll UP (Time & Date) pushbutton is pressed momentarily in NORMAL MODE (explained in section 4.1), the time and date is displayed. To revert back to NORMAL MODE, press the pushbutton momentarily again.

The time and date is displayed as follows:



NOTE:

The Time & Date is programmable, but the Week No is automatically set. Hence, if you have multiple controllers in the field, the Week No will be the same on all (assuming the Time & Date are programmed correctly).

- To get into the menus of the ORP-XP2, hold down the Scroll DOWN (Main Menu) pushbutton. The display will count down until you access the menus.
- If you wish to cancel an alarm or any timers activated, press and hold the ENTER (Reset) pushbutton until the display says:

Resetting ...

3.3 LED Indication

There are 3 LEDs on the front face of the ORP-XP2:

- Power (green): illuminates continuously when power is applied to the controller
- Control (amber): illuminates continuously when power is applied to the control output of the controller. If the control output is suspended due to a pause in the control cycle, the LED will flash on and off.
- Alarm (red): illuminates when the alarm relay switches. If the alarm delay is timing before the alarm condition is confirmed, the LED will flash on and off.

3.4 Comms Port

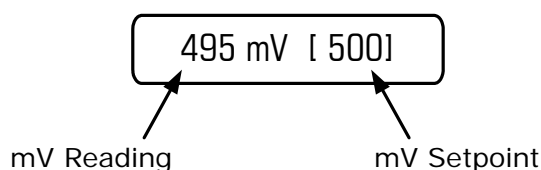
There is a Comms port on the front panel of the controller next to the LCD. This is used to download data from the controller, and can also be used to upload new software versions should they be required. (An optional cable for downloading data is required, P/N SP-XP2-COMCABLE-1)

4. Commissioning

CAUTION: Refer to previous section before reading this section

4.1 Start-Up

Power up the controller after installation. After a start-up sequence, the controller automatically goes into NORMAL MODE. The display should read the measured ORP as well as the ORP Setpoint within square brackets, as follows:



Other information that you may see on the display, which alternates with the display above:

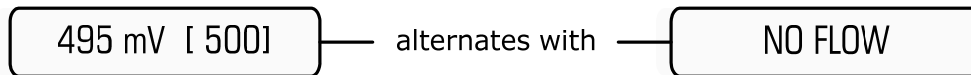
- When an alarm is reported, the actual alarm message will be periodically displayed.

ALARM!! [HIGH.]

- The controller has a programmable timer which is activated on start-up or when flow is resumed (assuming the flow switch function is enabled in the SETUP menu). This timer times down to zero, during which time ORP control is suspended. This gives the system time for the water to circulate and for the ORP reading to settle down.

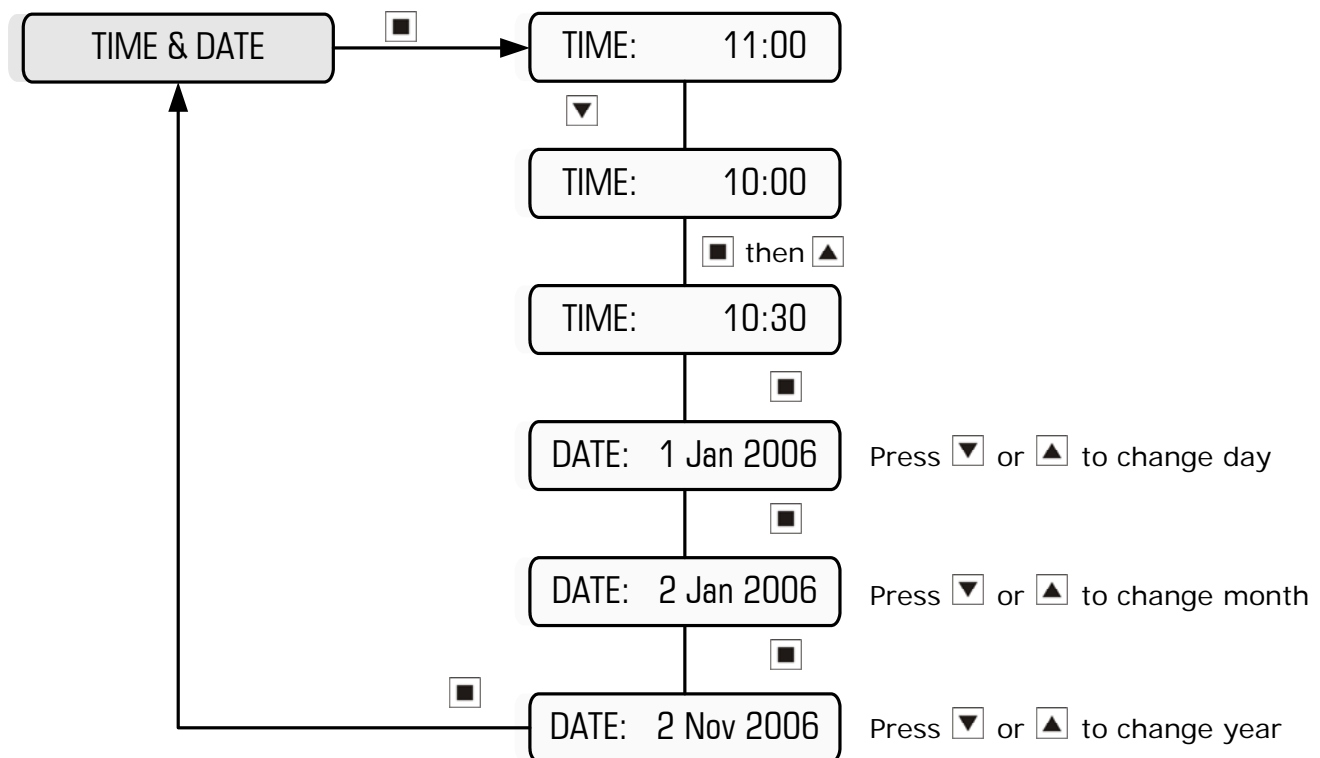
DELAY - 12

- When a flow switch is connected to the controller, ORP control is suspended when there is no flow past the flow switch. This function is enabled in the SETUP menu.



4.2 Setting Time & Date

Main Menu > TIME & DATE



Example: Setting time & date to 10:30 on 2 Nov 2006

NOTE: The Week No will be automatically set

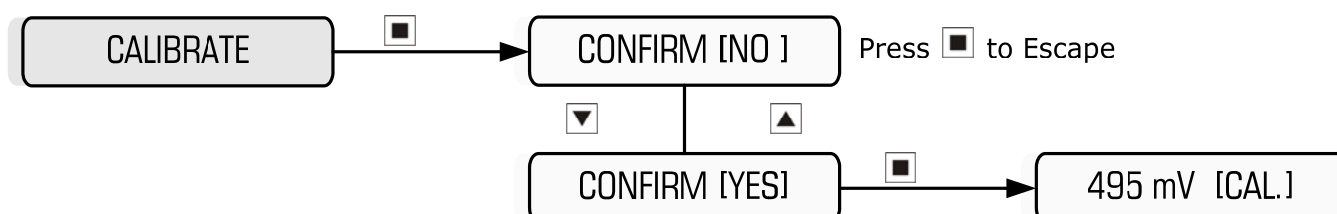
4.3 Calibration

NOTE: The ORP-XP2 is factory calibrated, so under normal circumstances, calibration is not required. However, if you need to calibrate, or verify the reading in buffer solutions, proceed as follows:

Step 1 – Put the controller into CALIBRATE Mode

Putting the controller into CALIBRATE mode bypasses the solution ground probe. This enables you to use a mV simulator connected to the controller, or enables you to insert the ORP sensor in a buffer solution without the solution ground probe. This ensures you get an accurate reading on the controller.

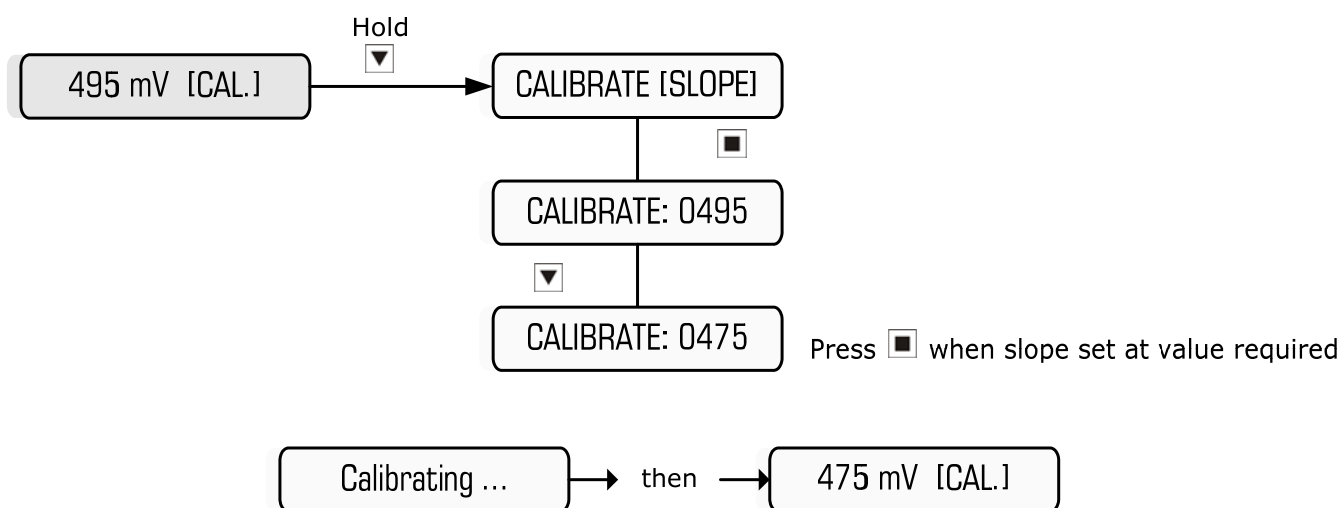
Main Menu > CALIBRATE



Step 2a – Calibrate the SLOPE

Before you proceed, set the mV simulator to the desired setting, or put the ORP sensor in the buffer solution.

IMPORTANT: Wait for the measured mV reading to stabilise before proceeding.



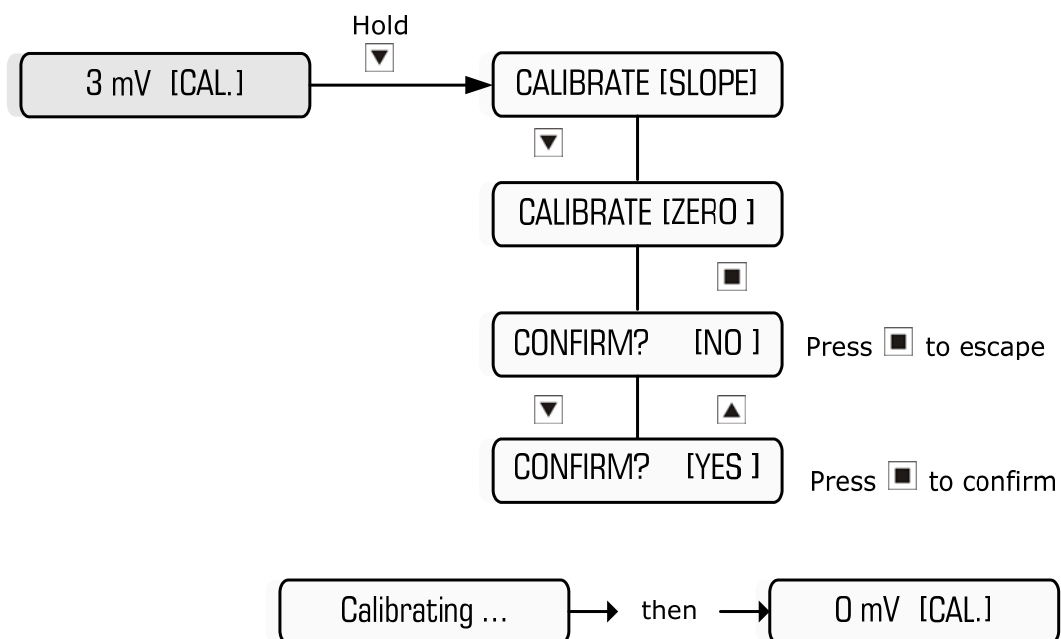
Example: Calibrating Slope value to 475 mV

Step 2b – Calibrate the ZERO

The zero is factory set so should not require calibration. However, if you want to set the zero, you will require a mV simulator with a 0mV or pH7 setting. Alternatively, you can short circuit the BNC input for this procedure.

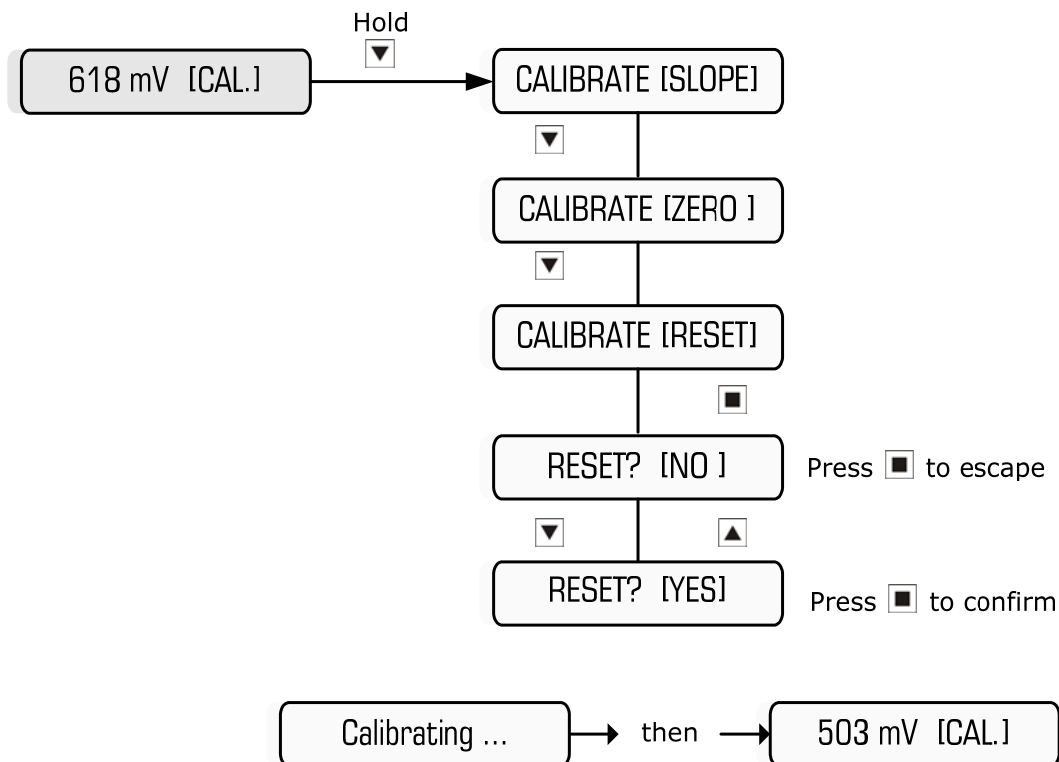
Before you proceed, set the mV simulator to the zero setting (pH7 setting = 0mV)

IMPORTANT: Wait for the measured mV reading to stabilise before proceeding. This reading should be very close to zero.



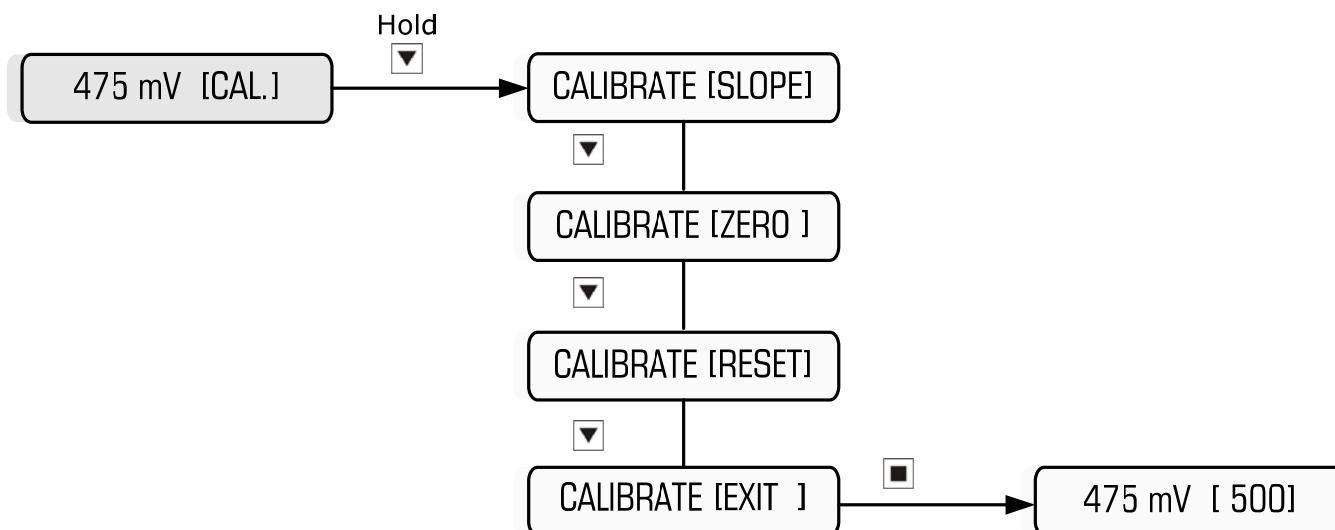
Step 2c – Reset the CALIBRATION

If you inadvertently calibrate the zero and/or slope to the incorrect values, and you cannot recover by repeating the normal calibration procedure, then you can reset the calibration and start again.



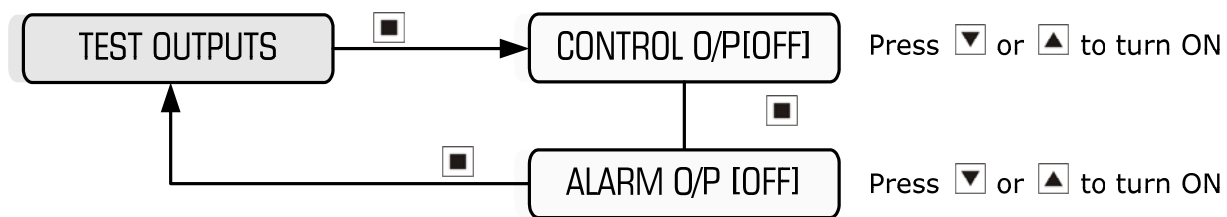
Step 3 – Exit CALIBRATE mode

Once calibration is complete, or you have finished verifying your ORP measurements in buffer solutions or with a mV simulator, you will need to exit CALIBRATE mode in order for the solution ground probe to become active again. Proceed as follows or simply leave the controller and it will revert back to NORMAL mode after a few minutes.



4.4 Testing Control Output Relay and Alarm Relay

Main Menu > *TEST OUTPUTS*



When the Control Output is activated, the amber Control LED illuminates and the Control relay switches, putting 240VAC power onto the output terminal, which activates the pump or solenoid valve wired to it.

When the Alarm Output is activated, the red Alarm LED illuminates and the relay de-energises, switching the Common from the Normally Open Contact to the Normally Closed contact of the Alarm relay.

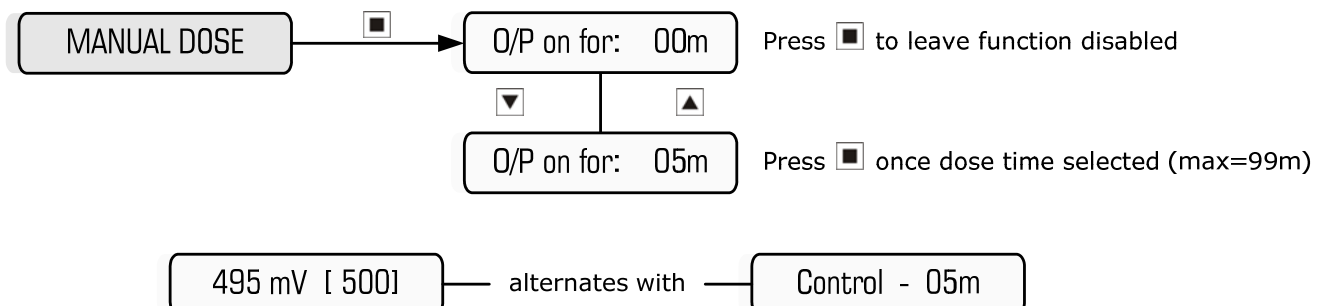
NOTES:

1. If either output is activated manually without reverting back to the de-activated state, the controller will automatically turn the output off 2 minutes after no pushbutton activity.
2. If you wish to drive the control output for longer than 2 minutes, activate the MANUAL DOSE function within the MAIN MENU
3. The outputs should all switch on when tested, regardless of the flow condition.

4.5 Manual Dose

Main Menu > *MANUAL DOSE*

To perform an unattended slug dose of chemical, simply program the dose time (up to 99 minutes, in 1 minute increments) as follows:



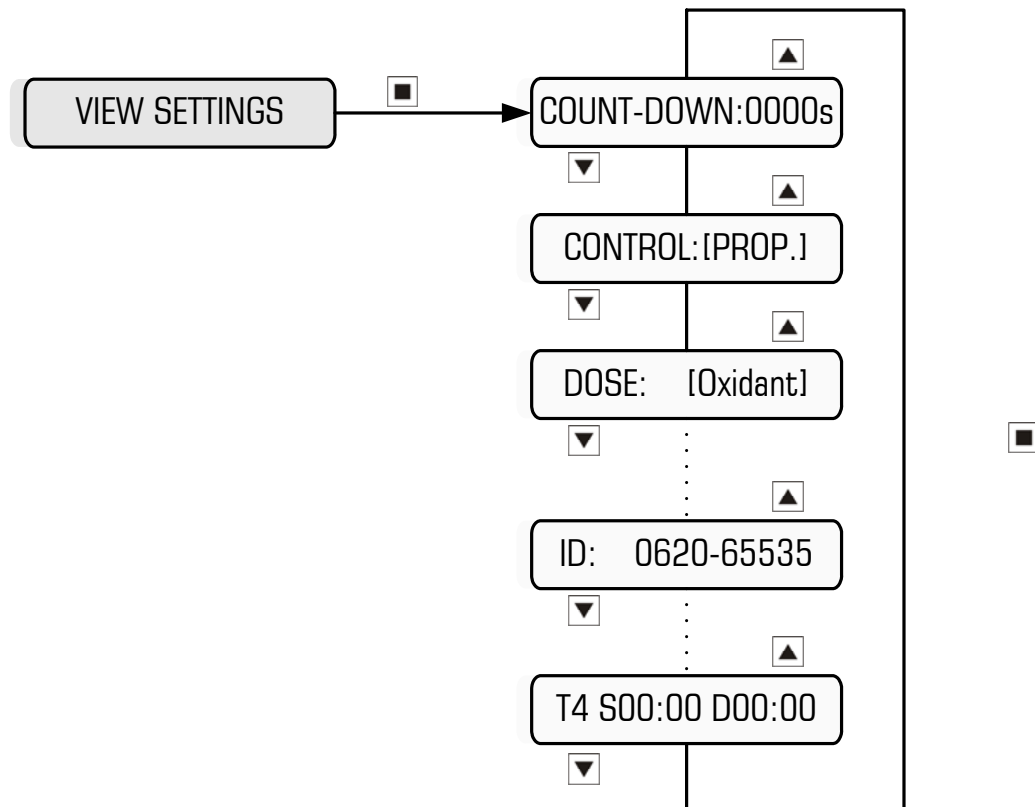
Example: Setting Control Output to dose for 5 minutes

Note: The pump will not dose if there is no flow
To cancel a manual dose, press and hold the ENTER (Reset)
pushbutton

4.6 View Settings

Main Menu > VIEW SETTINGS

To view all the settings you have programmed into the controller without going into the menus themselves, you can simply scroll up and down to view them all:

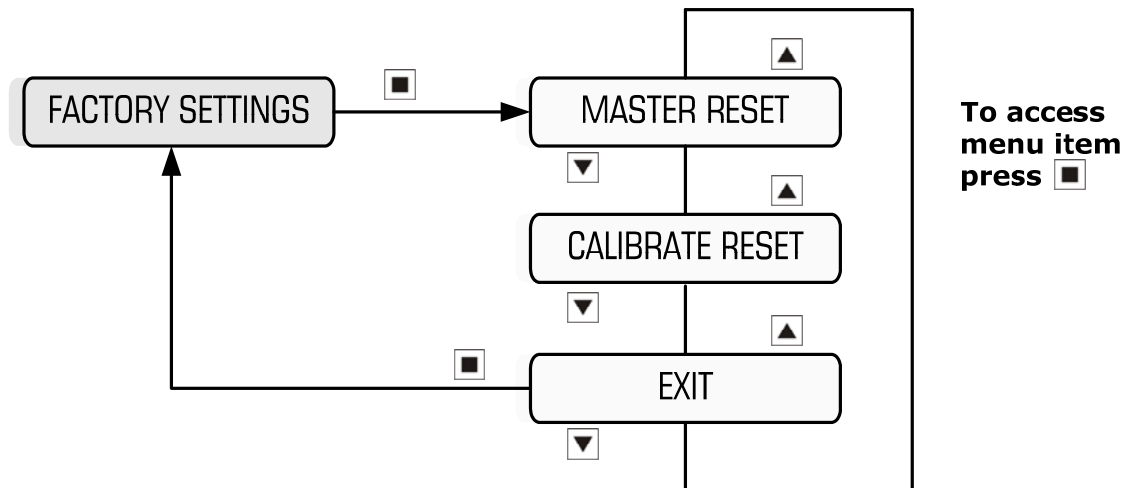


4.7 Factory Settings

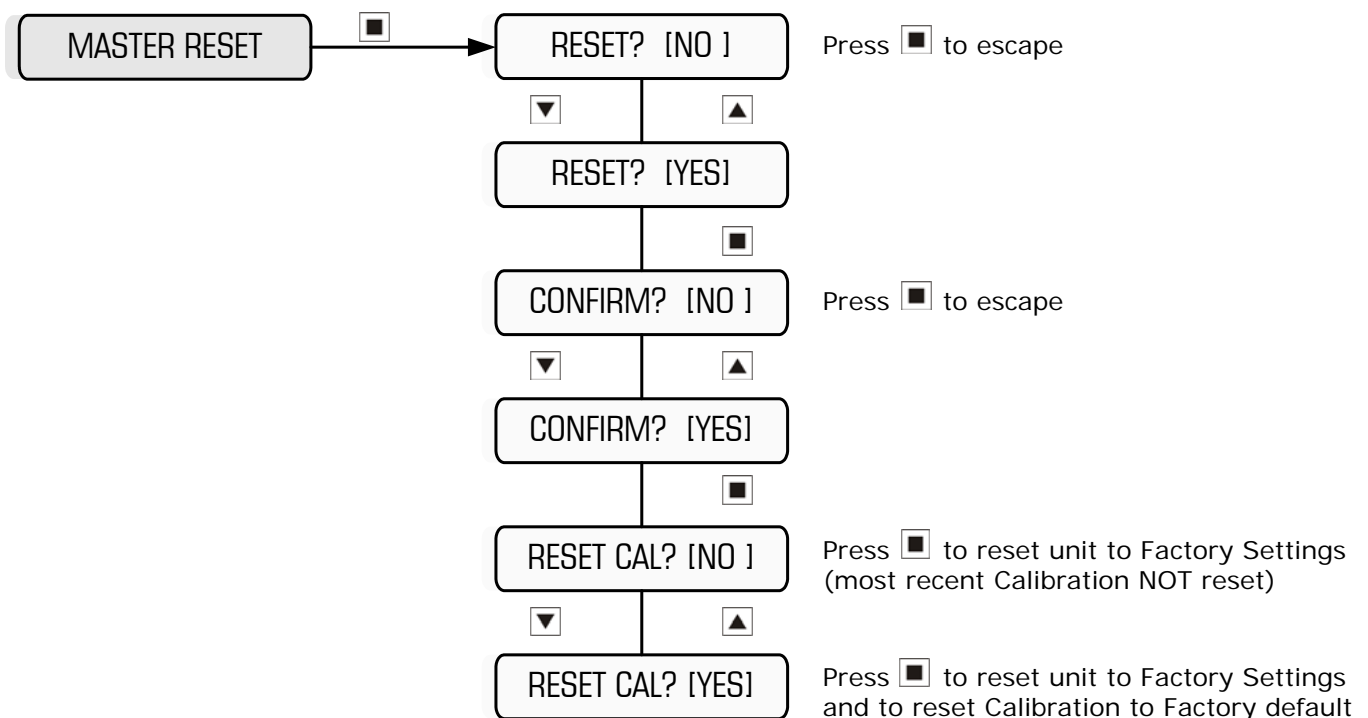
Main Menu > FACTORY SETTINGS

CAUTION:

- Enter this part of the program ONLY if you wish to erase your program settings.
- The default settings most likely will not suit your application, so it will be necessary to reprogram the controller with your desired settings.
- This menu gives the option of resetting the calibration as well.



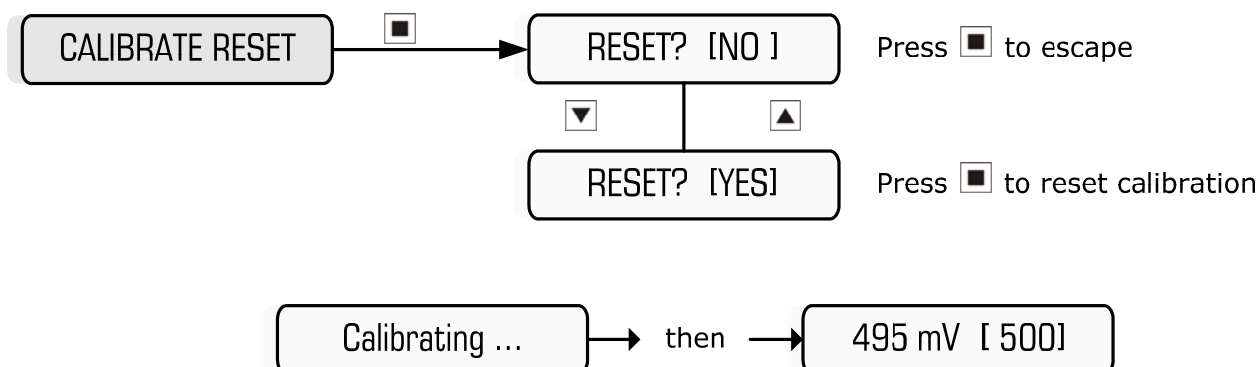
Main Menu > FACTORY SETTINGS > MASTER RESET



Main Menu > FACTORY SETTINGS > CALIBRATE RESET

To reset the ORP calibration of the unit without resetting other settings, access the Factory Settings Menu option, select Calibrate Reset and follow the prompts.

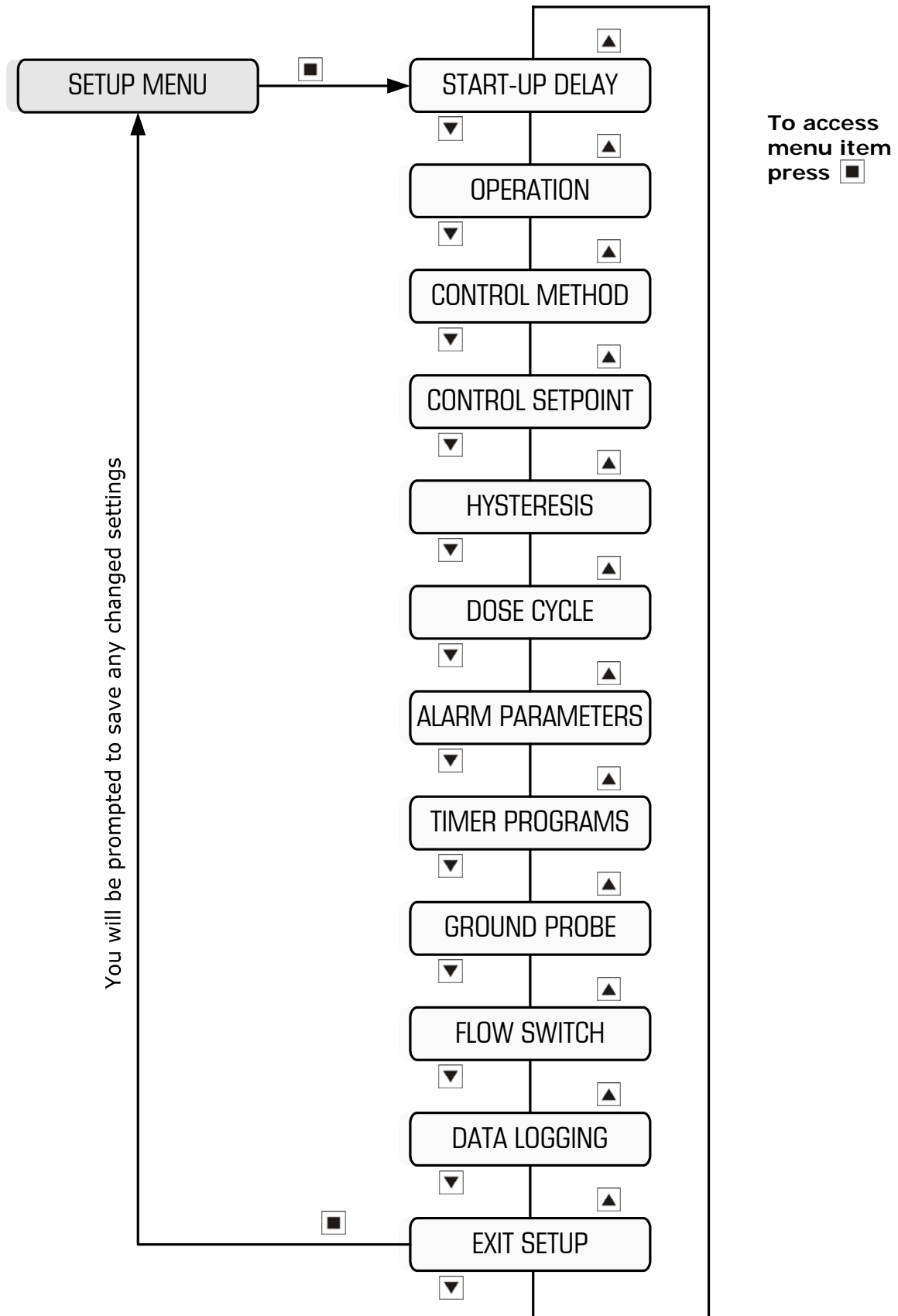
NOTE: Once the calibration has been reset, you will need to re-calibrate the ORP sensor (see section 4.3).



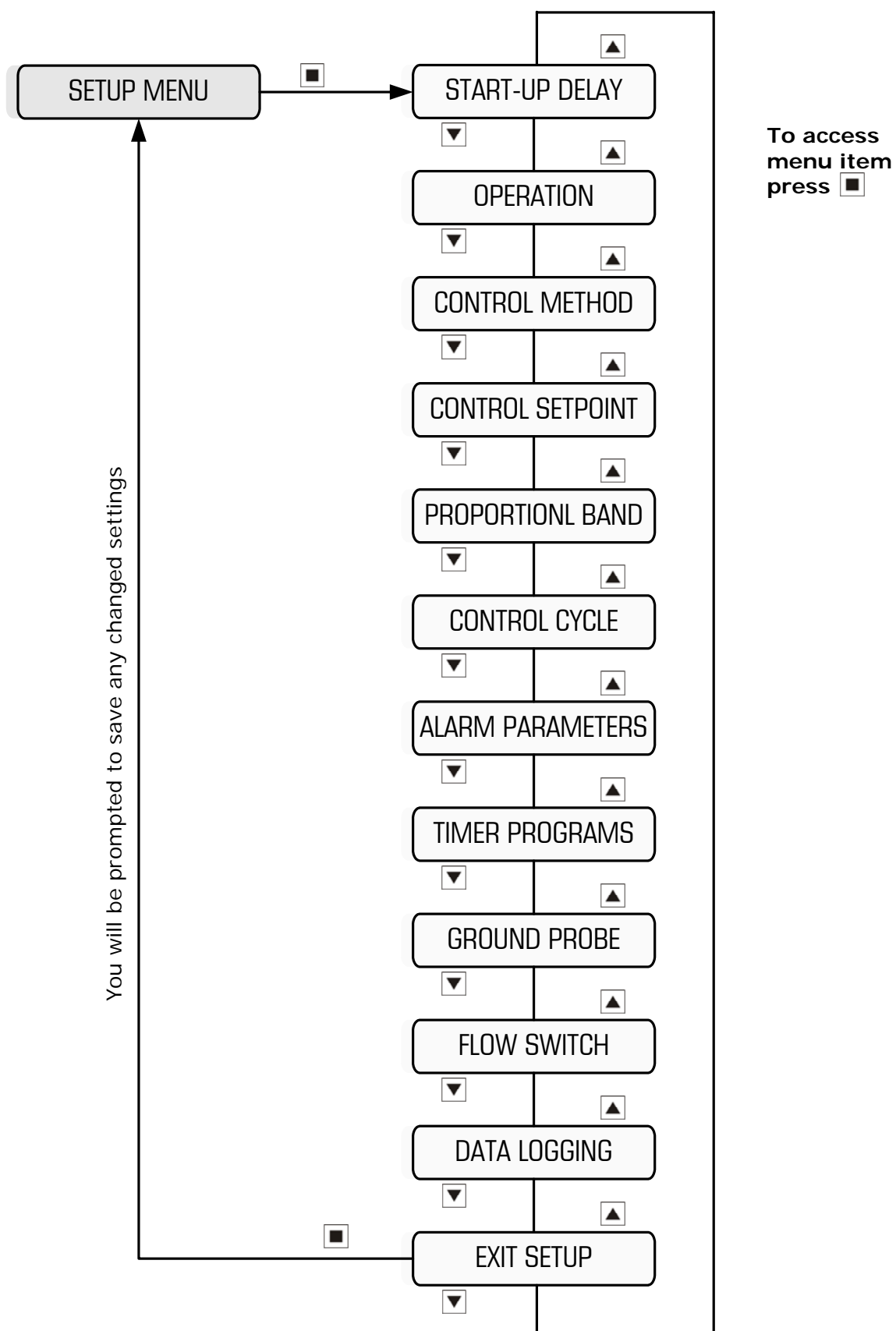
5. Programming Setup Menu

IMPORTANT:

- Once settings are changed, it is necessary to exit the SETUP MENU in order to save your settings.
- Depending on the Control Method selected (i.e. ON/OFF or PROPORTIONAL – as outlined in section 5.4), the Setup Menu will change – both Menu Structures illustrated as follows:



Setup Menu when ON/OFF Control Method Selected

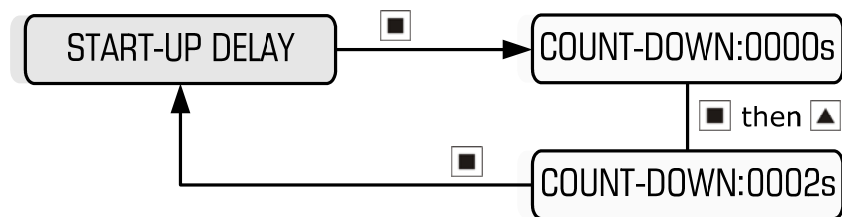


Setup Menu when Proportional Control Method Selected

5.1 Program Start-up Delay

Main Menu > **SETUP MENU** > **START-UP DELAY**

The start-up delay is a timer that starts timing when the unit is powered up, or flow resumes after a “no-flow” condition. During this time, the control output is disabled. Only once the time counts down to zero, does the control output become active if the unit calls for dosing. The purpose of this timer is to allow the system water to mix and circulate effectively before dosing commences. If this feature is not required, then simply program the start-up delay to zero. When timing, the start-up delay can be cancelled by holding down the ENTER (Reset) pushbutton.

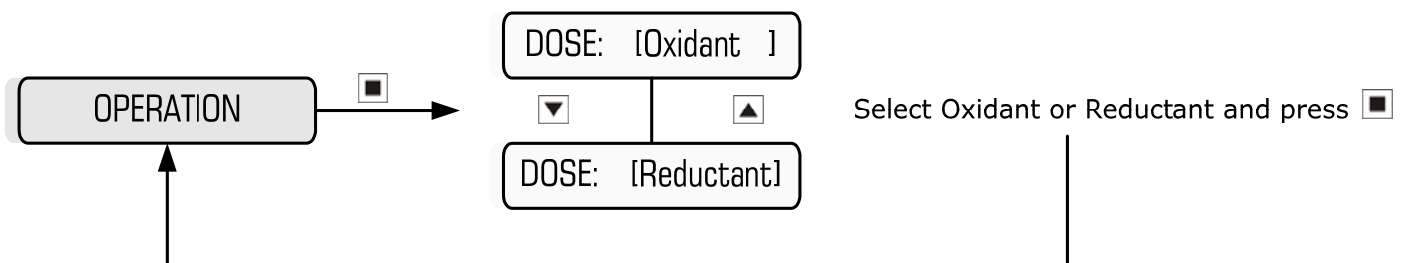


Example: Setting Start-Up Delay of 2 seconds

5.2 Select Operation

Main Menu > **SETUP MENU** > **OPERATION**

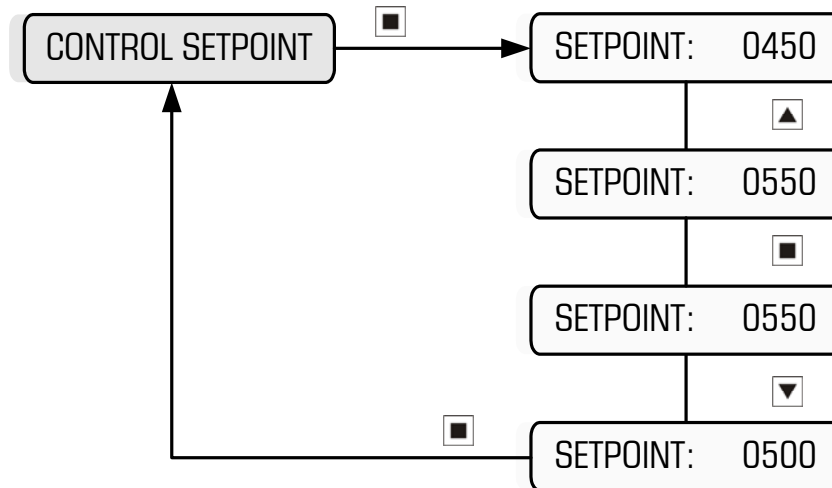
The ORP-XP2 controller can dose either an oxidant (eg.) to increase the ORP, or a reductant (eg.) to decrease the ORP. Only one or the other can be selected:



5.3 Set ORP Setpoint

Main Menu > SETUP MENU > CONTROL SETPOINT

The ORP Setpoint is the desired ORP value of the process (displayed in mV).



Example: Increasing setpoint from 450mV to 500mV

5.4 Set Control Method

Main Menu > SETUP MENU > CONTROL METHOD

The ORP-XP2 features 2 methods of ORP control:

- **ON/OFF control** with programmed Dose Cycle (ie modulation), or
- **PROPORTIONAL control** via automatically varying duty cycle

With **ON/OFF control**, the controller either turns the pump on continuously when correcting the ORP or modulates the pump by turning the pump ON and OFF during the dosing period. The On period and Off periods are programmable.

With **proportional control**, the dosing algorithm modulates the pump based on a percentage ORP variation from the Setpoint. The further the ORP is from the Setpoint, the shorter the OFF period is with respect to the ON period. The closer the ORP is to the Setpoint, the longer the OFF period is with respect to the ON period. The control cycle and the proportional band are programmable.

5.4.1 ON/OFF Control

If **dosing oxidant**, the pump will dose when the ORP readout drops below the ORP SETPOINT . Dosing will stop once the readout rises above the ORP SETPOINT plus the hysteresis percentage. (This percentage is the hysteresis value and is a percentage of the SETPOINT).

If **dosing reductant**, the pump will dose when the ORP readout rises above the ORP SETPOINT . Dosing will stop once the readout drops below the ORP SETPOINT minus a percentage. (This percentage is the hysteresis value and is a percentage of the SETPOINT).

Hysteresis prevents rapid switching of the pump on and off when the system ORP hovers around the Setpoint. Hysteresis is the difference between the two mV points at which the pump starts and the pump stops. Hysteresis is programmed as a percentage of the Setpoint, and is only applicable to ON/OFF control.

For example, if the SETPOINT is 500 mV and the hysteresis value is 5%, then the calculated hysteresis value is 25 mV.

If dosing oxidant, the pump will be activated when the ORP drops below 500 mV and will stop when the ORP rises above 525 mV (i.e. 500 mV plus 25 mV).

If dosing reductant, the pump will be activated when the ORP rises above 500 mV and will stop when the ORP drops to 475 mV (i.e. 500 mV minus 25 mV).

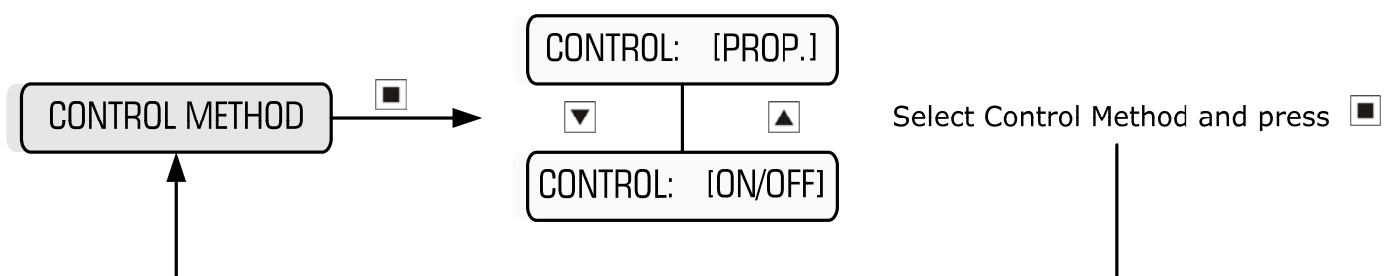
Once the Setpoint is programmed for ON/OFF control, 2 parameters are required to be programmed:

- Hysteresis, and
- Dose Cycle

Step 1:

Select the ON/OFF Control Method

Main Menu > **SETUP MENU** > **CONTROL METHOD**

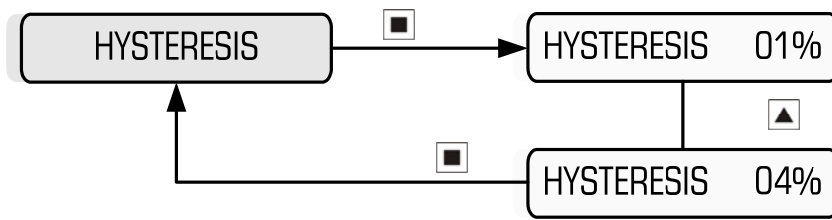


Step 2:

Program the Hysteresis

(**Note:** This menu item will only appear if ON/OFF control is selected first)

Main Menu > **SETUP MENU** > **HYSTERESIS**



Example: Increasing Hysteresis from 1% to 4%

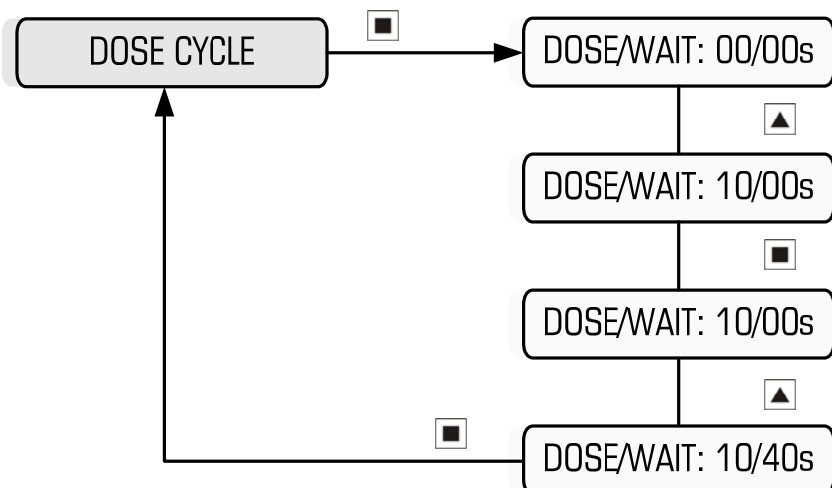
Step 3:

Program the Dose Cycle

Main Menu > **SETUP MENU** > **DOSE CYCLE**

When the controller calls for dosing, the pump can be programmed to dose continuously or on a cycle until it reaches the ORP Setpoint. A cycle is recommended to reduce overshoot, and to preserve the life of the pump.

The menu asks for a Dose Time and a Wait Time to be programmed. The Wait Time follows the Dose Time, and the cycle is repeated until the Setpoint plus/minus hysteresis is reached. The following diagram illustrates a dose cycle programmed for a 10 second dose followed by 40 second wait:



Example: Programming a dose cycle for 10s, followed by a wait period of 40s

In the example above, the pump doses 10 seconds during every 50 second cycle (ie 10+40), which equates to a 20% duty cycle.

The function of the dose cycle is to assist in reducing overshoot by achieving an ORP change more slowly. In a large system, there is often a lag after dosing until the ORP sensor realises a change in ORP. The lag time estimated should be programmed as the Wait time.

Should the ORP readout drift more than 25% away from the programmed Setpoint the controller automatically doubles the Dose time and halves the Wait time to bring the ORP within 25% of the Setpoint very quickly. As soon as the ORP readout comes back to within 25% of the Setpoint, normal pump duty cycle (ie. programmed Dose/Wait times) will resume. In the example above, the Dose and Wait times will temporarily be 20 seconds each, i.e. the pump will dose for 20 seconds during every 40 second cycle, which equates to a 50% duty cycle.

If you wish to have the control output continuously active during dosing (rather than cycling ON and OFF), simply set the Dose/Wait times to 00/00s

5.4.2 PROPORTIONAL Control

With proportional control, the controller will always attempt to keep the ORP as close as possible to the Setpoint. For proportional control to work, the controller requires the Setpoint as well as 2 other parameters to be programmed:

- The Proportional Band, and
- The Control Cycle

The **Proportional Band**, set as a percentage of the Setpoint, is the band in which proportional control takes place. For example if the Setpoint = 500 mV, and the Proportional band is 10%, then proportional control takes place between 500 mV and 550 mV (dosing reductant) or between 500 mV and 450 mV (dosing oxidant).

Once the Setpoint is reached, the control output is OFF continuously. Outside of the proportional band on the opposite end, the control output is ON continuously.

Proportional control, which takes place within the proportional band is explained as follows:

Assuming a pump is connected to the control output, the controller will modulate the power supply to the dosing pump proportionally. This modulation is an ON/OFF cycle (called the Control Cycle) where the

ON/OFF ratio reduces the closer the ORP is to the Setpoint (i.e. The ON time is much shorter than the OFF time). Conversely, if the ORP starts drifting away from the Setpoint (but still within the proportional band), the ON time starts getting longer with respect to the OFF time.

The **Control Cycle** is the other parameter to be programmed. Whilst dosing, if the ORP reading on the LCD changes very quickly, the Control Cycle will need to be as short as possible, eg 10 seconds. This will reduce overshoot, as the controller will be able to adjust its dose rate very quickly in responding to a rapidly changing ORP.

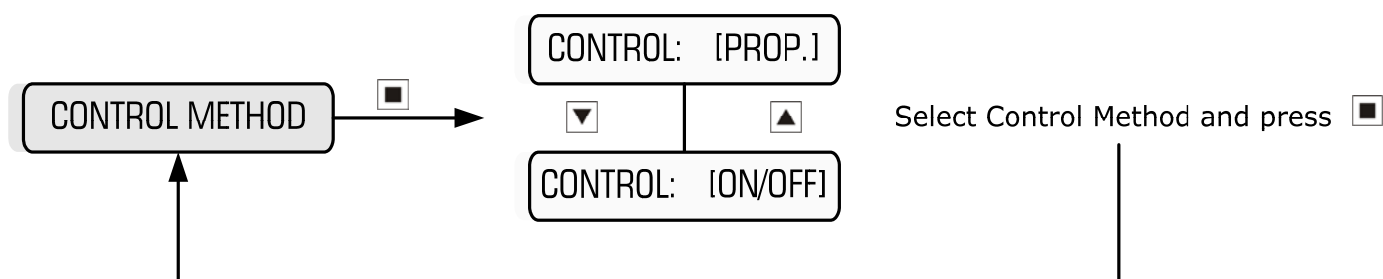
Conversely, in a large system with a large volume of water, and a slow recirculation rate, the ORP reading may take a long time to change after dosing occurs. In this case, it is better to have a longer Control Cycle, eg 100 seconds, to allow for the ORP reading to change, before further dosing takes place.

If unsure, set the control cycle to your best estimate of the time it takes for the water where the chemical is injected into, to get back to the ORP sensor.

Step 1:

Select the Proportional Control Method

Main Menu > **SETUP MENU** > **CONTROL METHOD**

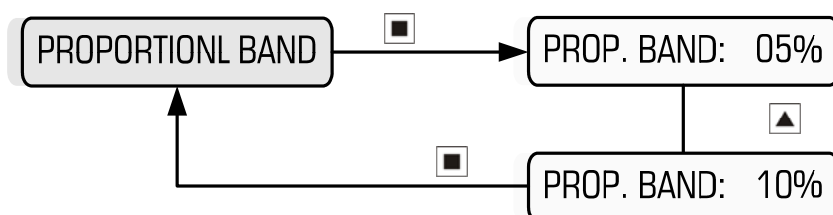


Step 2:

Program the Proportional Band

(**Note:** This menu will only appear if PROP. control is selected first)

Main Menu > **SETUP MENU** > **PROPORTIONAL BAND**

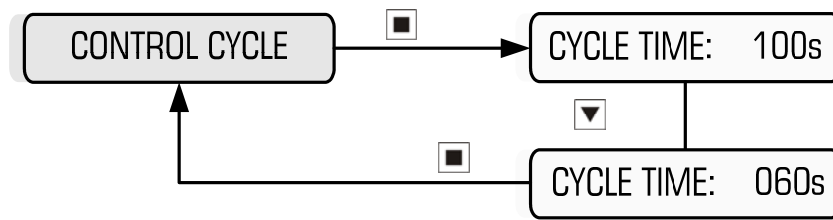


Example: Increasing proportional band from 5% to 10%

Step 3:

Program the Control Cycle

Main Menu > **SETUP MENU** > **CONTROL CYCLE**



Example: Decreasing cycle time from 100 sec to 60 sec

Example of Operation:

- Operation = Dosing Oxidant
- Setpoint = 500 mV
- Proportional Band = 10% (i.e. 450 mV to 500 mV)
- Control Cycle = 20 seconds

Above 500 mV, the pump is OFF continuously.

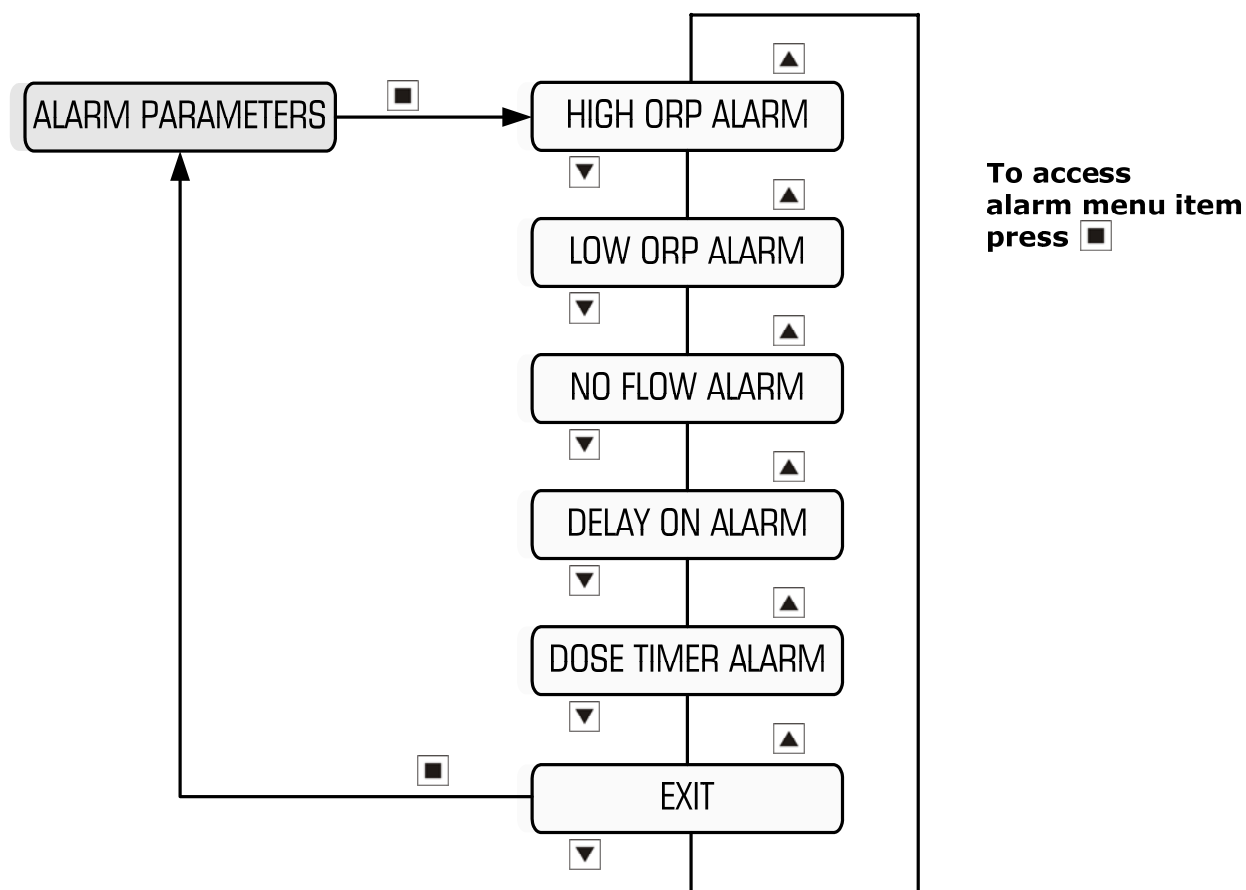
As the ORP drops below 500 mV, the pump starts dosing for 1 second every 20 seconds (ie. ON/OFF cycle = 1s/19s). If the ORP drops to 480 mV, the pump will dose for 8 seconds every 20 seconds (ie. ON/OFF cycle = 8s/12s). As the dose rate increases, ie ON/OFF ratio increases, the ORP mV reading should start rising again with the aim of getting as close to the Setpoint as possible.

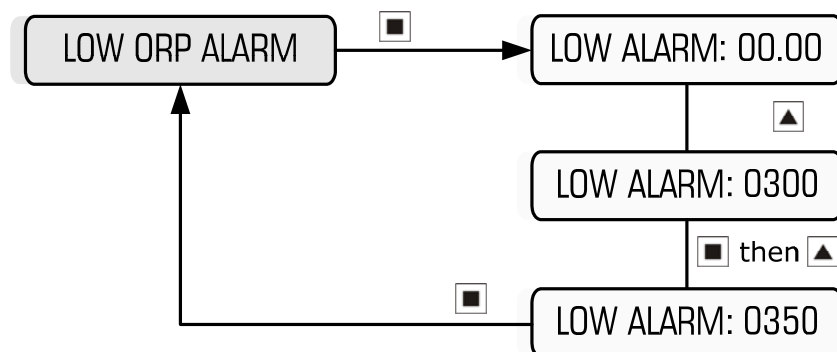
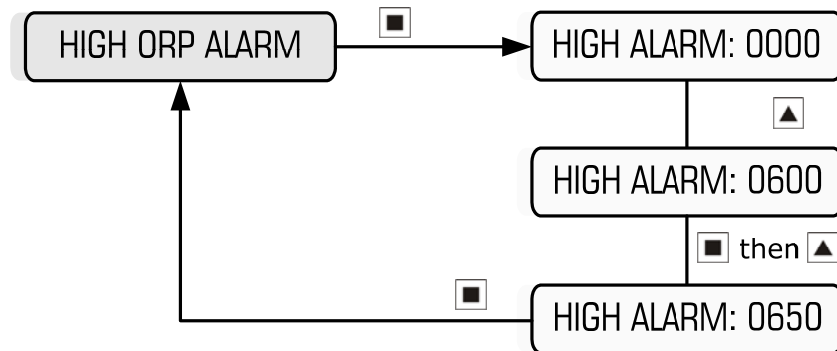
On start-up, the pump will dose continuously until the ORP reading rises to 450mV. Above 450mV the pump will start cycling ON and OFF, with a very short OFF time initially. As the ORP continues to rise above 450mV, the pump will slow down (ie. OFF time will increase). If the mV reading reaches the setpoint of 500 mV, the pump will stop altogether.

5.5 Alarm Parameters

The controller has 5 programmable alarm functions as outlined below. If any of the alarms are activated and confirmed, the common alarm contact switches, the red Alarm LED illuminates, and the Alarm message is displayed on the LCD.

Main Menu > **SETUP MENU** > **ALARM PARAMETERS**

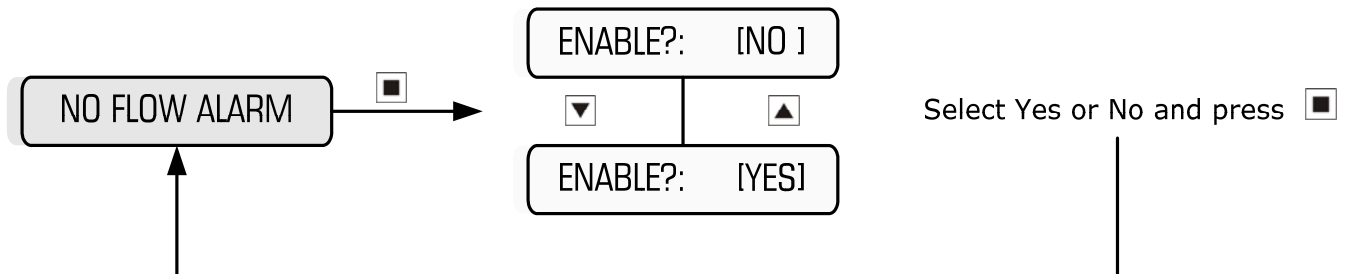




5.5.3 No Flow Alarm

If the No Flow Alarm is enabled, the Alarm will activate when there is no flow detected by the optional flow switch. If the No Flow Alarm is left disabled, then the Alarm is unaffected by a no-flow condition.

Main Menu > **SETUP MENU** > **ALARM PARAMETERS** > **NO FLOW ALARM**



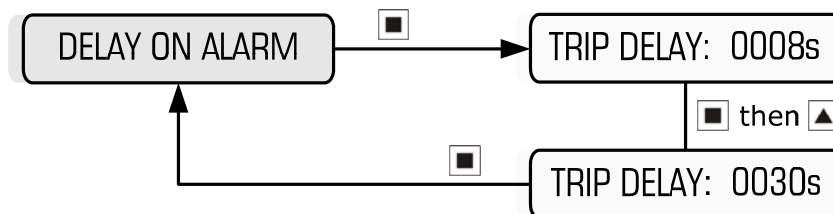
5.5.4 Delay On Alarm

When an alarm condition is detected, eg High ORP Alarm, the relay only trips immediately if the Trip Delay is set to 0 seconds. However, if alarms do not become immediately critical, it is better to program a delay on the alarm to prevent "nuisance trips".

If a Trip Delay, eg. 120s, is programmed, the alarm relay will only trip if the High ORP condition exists continuously for 120 seconds. However, if the ORP drops to below the High ORP Alarm level before the 120 seconds times out, the Alarm condition will reset.

Whilst the Trip Delay is timing, the red Alarm LED will flash. If the alarm condition still exists after the time delay, the LED will illuminate continuously until the alarm cancels, at which point, the LED goes off.

Main Menu > **SETUP MENU** > **ALARM PARAMETERS** > **DELAY ON ALARM**



Example: Setting alarm delay of 30 seconds

5.5.5 Dose Timer Alarm

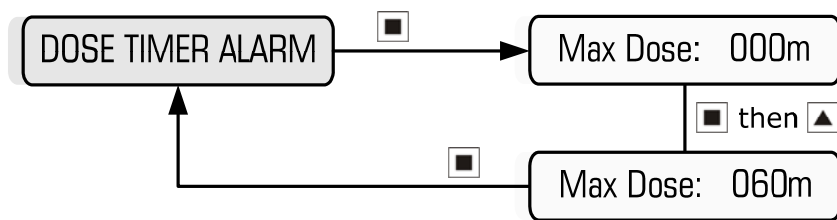
The Dose Timer Alarm is the maximum acceptable dose time to reach the Setpoint. This alarm is designed to protect the system from overdosing in the event of a false reading from a faulty ORP sensor, a dry sensor, a disconnected sensor, or if the controller itself is faulty.

If programmed to dose oxidant (/reductant), the ORP reading on the controller could be low (/high) when in fact the actual ORP of the system is much higher (/lower), resulting in dosing when there should be no dosing. The Timer Alarm stops this false dosing condition as soon as the Timer Alarm times out.

To leave the alarm in its disabled state, the programmed setting is 000m.

If the system ORP reaches the Setpoint within the programmed time, the timer resets. However, if the timer times out before the ORP reaches the Setpoint, the pump switches off and remains disabled until the unit is manually reset by holding down the Reset pushbutton.

Main Menu > SETUP MENU > ALARM PARAMETERS > DOSE TIMER ALARM

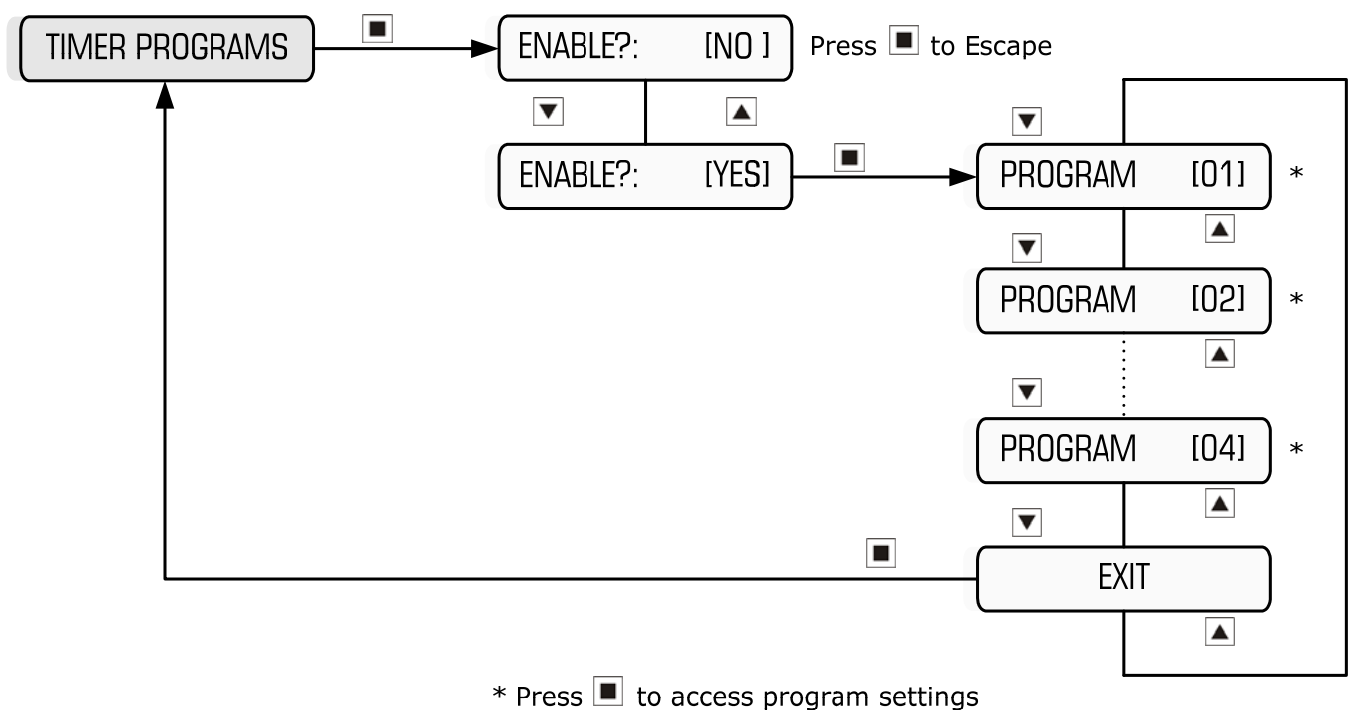


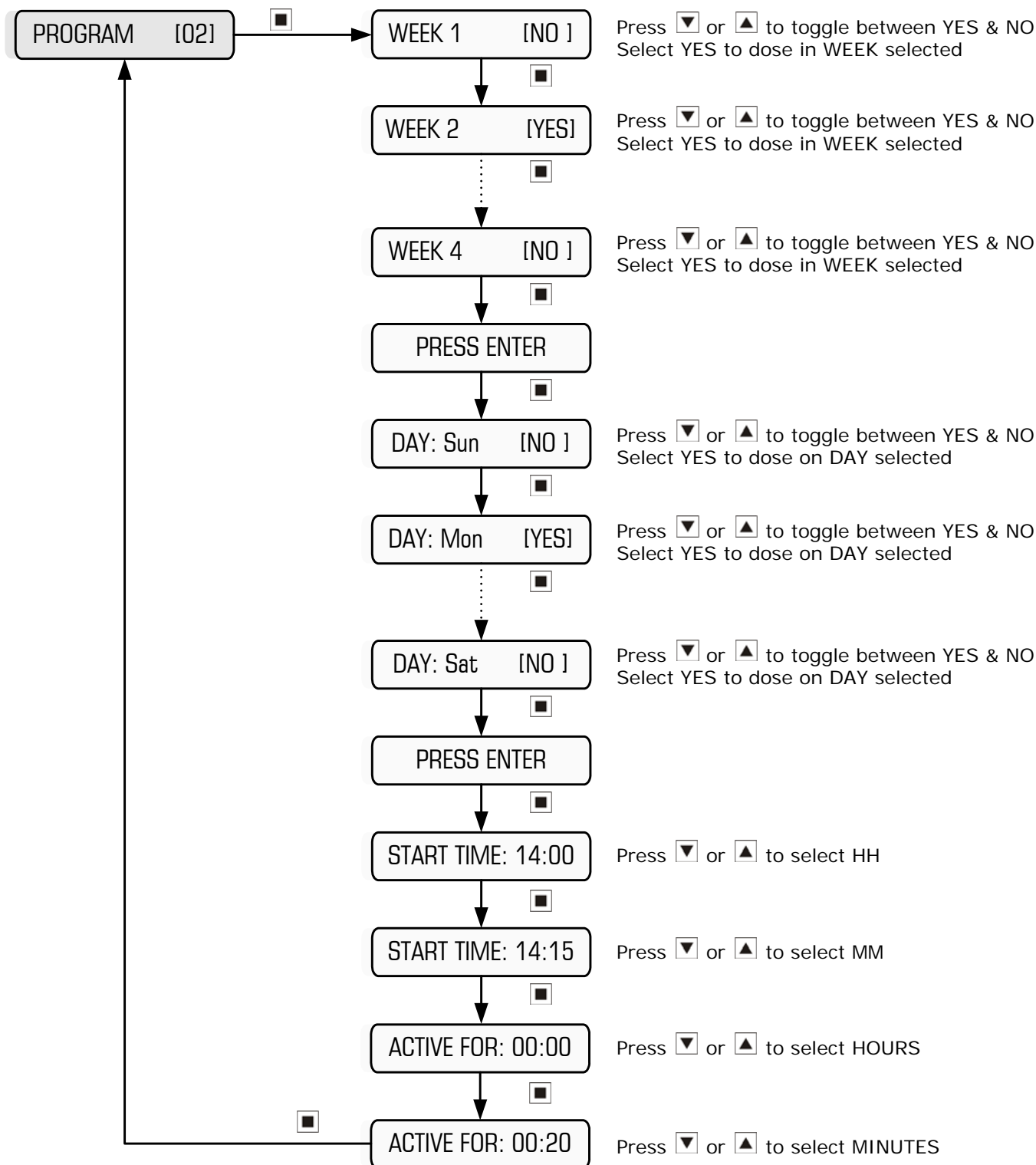
Example: Setting maximum dose time of 60 min

5.6 Timer Programs

If the timer programs are left in the disabled state, the controller will activate the control output when the control algorithm calls for dosing. However, if the timer programs are set up, the control function will only be active when the timer programs are active. During a Timer Program, if dosing is required, the pump will dose. However, if the controller calls for dosing outside of a Timer Program, the pump will remain idle. An example of where the Timer Programs are useful, is if you only want ORP control to occur during certain time periods, eg. Process operating times.

Main Menu > **SETUP MENU** > **TIMER PROGRAMS**



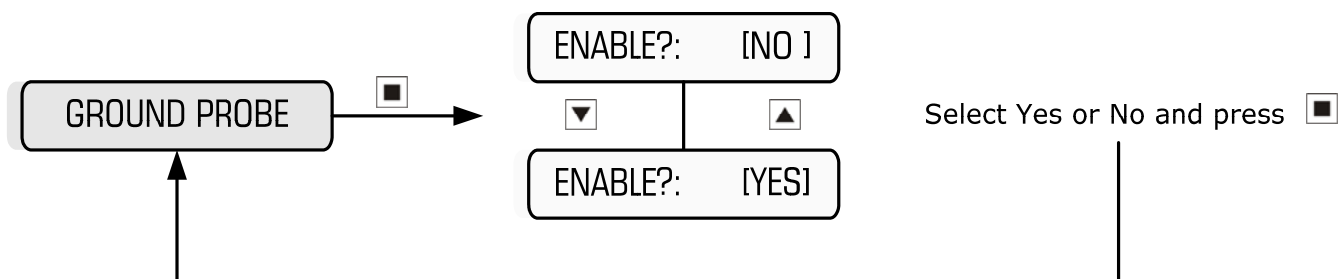


Example: Setting ORP Control to be active for 20 minutes, beginning at 14:15 on Monday in Week 2 using Program 2. ORP Control will become inactive outside of this time period even if the ORP needs to be corrected.

5.7 Ground Probe

The Solution Ground Probe (code DCON-CMR), or any other metal in contact with the water close to the ORP sensor, is usually required to ensure a stable reading where currents in the process solution can cause interference of the ORP measurement. Any metal in contact with the water near the ORP sensor will suffice as a ground probe, as long as a wire/cable can be reliably connected to the metal. The ground probe cable must be connected inside the instrument to terminal L5, and the Stainless Steel tip must be inserted into the same water as the ORP sensor. Furthermore, the function must be enabled via the menu as follows.

Main Menu > SETUP MENU > GROUND PROBE



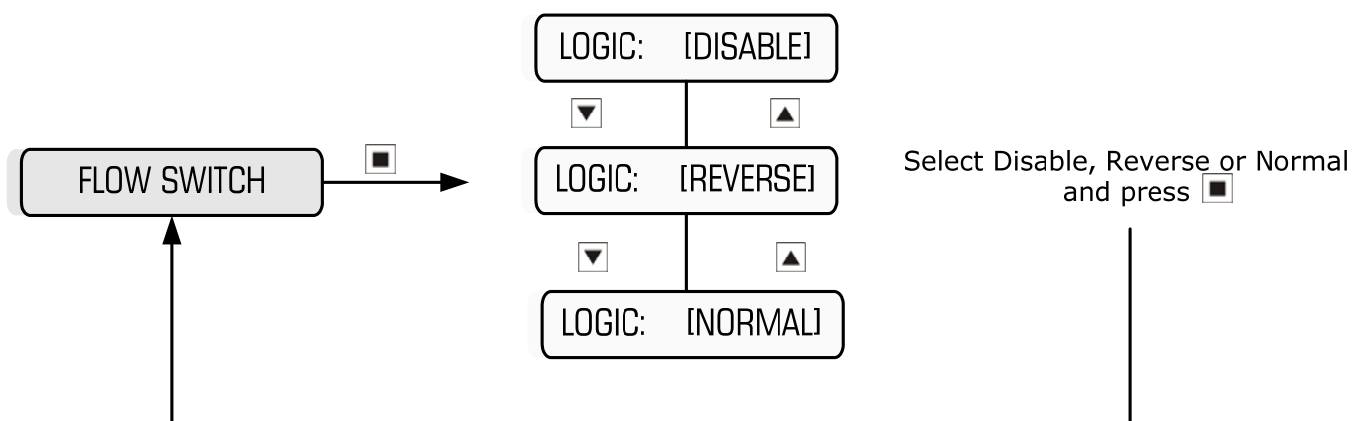
IMPORTANT: If a ground probe is not used, it is important to leave the function in its disabled state.

5.8 Flow Switch

If an optional flow switch is connected to the controller, ORP control will only occur if there is flow. When dosing, the pump will stop immediately if no flow is detected. There are 3 possible settings in the menu for the flow switch:

- **DISABLE:** ORP Control occurs regardless of flow or no flow
- **NORMAL:** ORP Control only occurs when the flow switch input is shorted
- **REVERSE:** ORP Control only occurs when the flow switch input is open circuit.

Main Menu > SETUP MENU > FLOW SWITCH



5.9 Data Logging

The controller has the facility to log the following items at the pre-programmed intervals:

- Date
- Time
- ORP reading (in mV)
- % of time the ORP control output is active
- Status of the flow input
- % of time the common alarm is activated

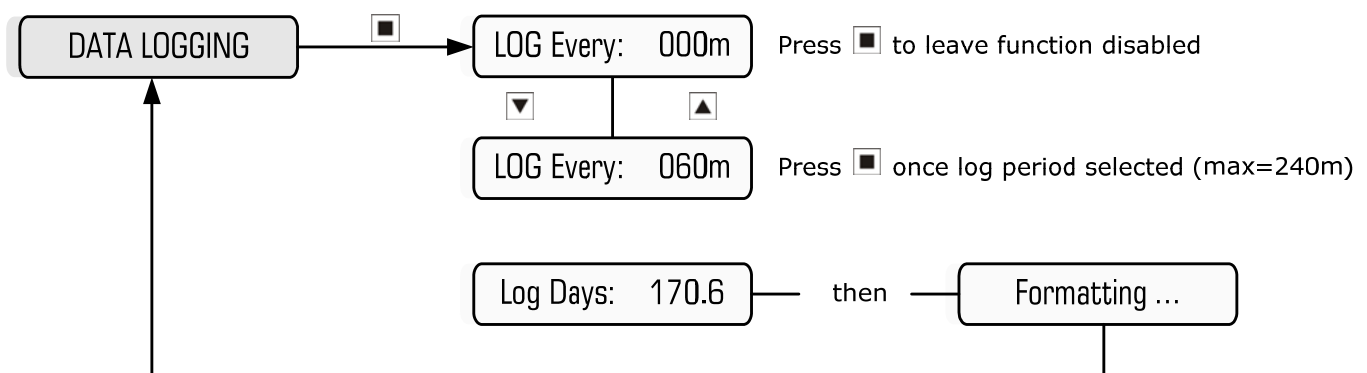
The pre-programmed intervals are 5, 10, 15, 30, 60, 120 or 240 minutes. If the controller is set to log every 0 minutes, then logging is disabled.

Each logged entry takes up memory, so the longer the interval, the longer the time can be between downloads. For example, the controller will have enough memory to store data for 14 days for a log taken every 5 minutes, or for 682 days for a log taken every 240 minutes.

Once the memory is full, the data logger loses the oldest information first.

The data is downloaded via the Comms port on the front panel of the controller. (An optional cable is required, P/N SP-XP2-COMCABLE-1)

Main Menu > SETUP MENU > DATA LOGGING



Example: Setting the controller to log every 60 min

6. Factory Settings

The default factory settings are outlined below. These are the settings programmed when a manual Factory Reset is initiated via the menu.

Menu Setting/Item	Default
Start-Up Delay	Count-Down: 0000s
Operation	Dose Oxidant
Control Method	Proportional
Control Setpoint	500 mV
Proportional Band	10%
Control Cycle	100s
High ORP Alarm	0000 mV
Low ORP Alarm	0000 mV
No Flow Alarm	Enable? [No]
Delay on Alarm	Trip Delay: 0008s
Dose Timer Alarm	Max Dose: 120m
Timer Programs	Enable? [No]
Ground Probe	Enable? [Yes]
Flow Switch	Logic: [Normal]
Data Logging	LOG Every: 000m

7. Specifications

Item	Specification
Power Supply	220-240VAC, 50/60Hz
Power Consumption	10W max (with no load on control output)
Inputs	ORP Sensor (optional) Ground probe (optional) Flow switch (optional)
Auxiliary Mains Output	240VAC continuous (2A fused)
Control Output	2A/250VAC (fused)
Alarm Relay Output	N/O & N/C (10A/250VAC resistive)
Flow Switch Repeat Output	N/O (10A/250VAC resistive)
Optional Outputs	4-20mA (P/N AF09A) 4-20mA plus events (P/N AF10A)
Measured ORP Resolution	1 mV
Accuracy	0.4% of measured range
Repeatability & drift	0.8% of measured range
Logged Items	Date, Time, ORP, ORP%, Flow, Alarm%
Data retention	100 years
Battery backup	1 year (approx)
Enclosure rating	IP55
Operating Temperature	0 - 50°C