Instruction **Manual**

Cooling Water Treatment Controller
Model: DIGICHEM-XP2
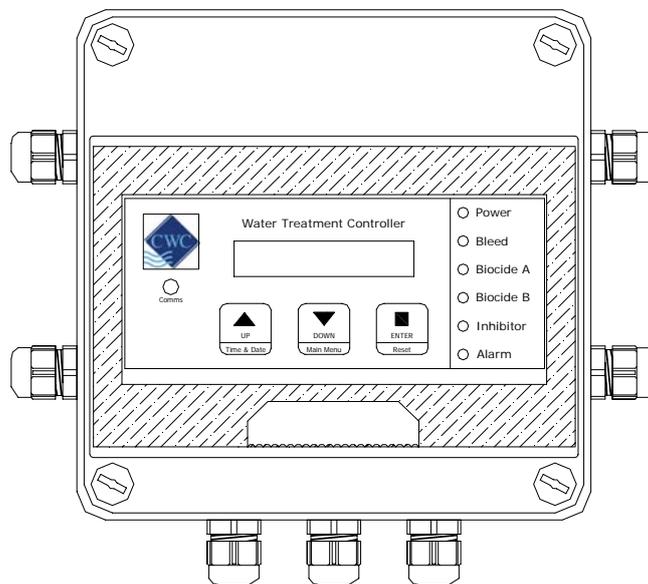
Fill in serial number here ➡ [   ]   Refer to back page

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.

Table of Contents

1. Introduction

Designed for cooling tower water treatment, the DIGICHEM-XP2 electronic controller incorporates the following key features:

- Conductivity bleed control
- Inhibitor pump dosing control
- Dual Biocide pump control (via 10 independent 28-day timer programs)
- Data logging
- Tower circulating/condenser pump override facility with delay-off timer
- High and Low Conductivity alarms with programmable delay-off timer

2. Installation

Mount the DIGICHEM-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.

The diagrams below shows the connections to the DIGICHEM-XP2 controller circuitry (release 1 & release 2).
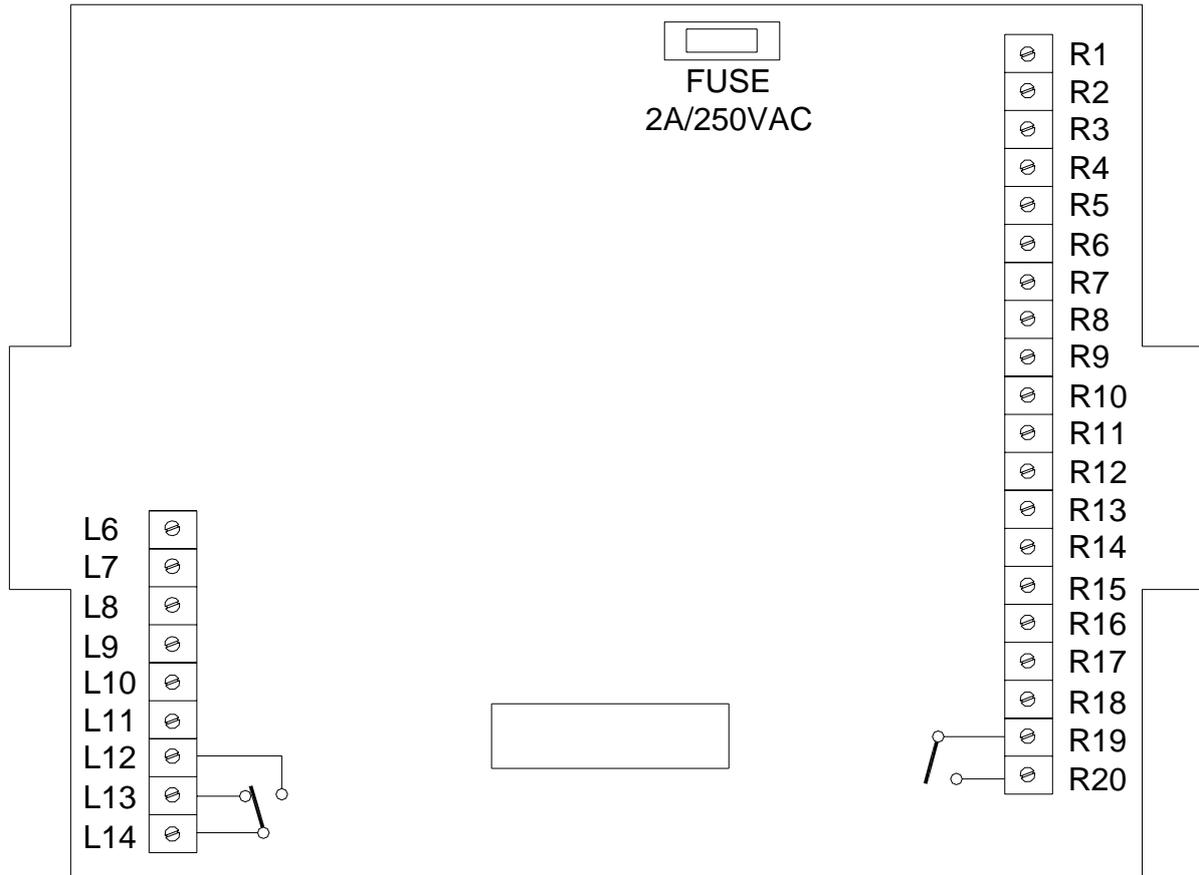
Release 1

L6:   Conductivity Probe PR+ (Brown or Red)
L7:   Conductivity Probe PR- (Yellow)
L8:   Conductivity Probe CM+ (Blue)
L9:   Water Meter In
L10:   Flow Switch In
L11:   Flow Switch Common / Water Meter Common / Probe
                Cable Screen (Grey)
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:   Solenoid Valve Active 240VAC (2A fused)
R6:   Solenoid Valve Neutral
R7:   Inhibitor Pump Active 240VAC (2A fused)
R8:   Inhibitor Pump Neutral
R9:   Biocide 'A' Active 240VAC (2A fused)
R10:   Biocide 'A' Neutral

R11:	Biocide 'B' Active 240VAC (2A fused)
R12:	Biocide 'B' Neutral
R13 - R18:	Common Earth
R19:	Condenser Pump Relay common
R20:	Condenser Pump Relay N/O volt-free (10A/250VAC res)

Fuse: 2A/250VAC (M205, 20mm x 5mm diameter)

Notes on Alarm Relay Contacts :

1. Alarm relay is energised (ie. L14 connected to L12) during normal operation of the unit.
2. Alarm relay de-energises (ie. L14 connected to L13) when an alarm condition is confirmed or when the unit loses power.

Notes on Flow Switch:

A flow switch with N/O or N/C volt-free contacts are required to be connected to terminals L10 & L11 (not polarity sensitive). The flow switch logic is programmable via the menu.
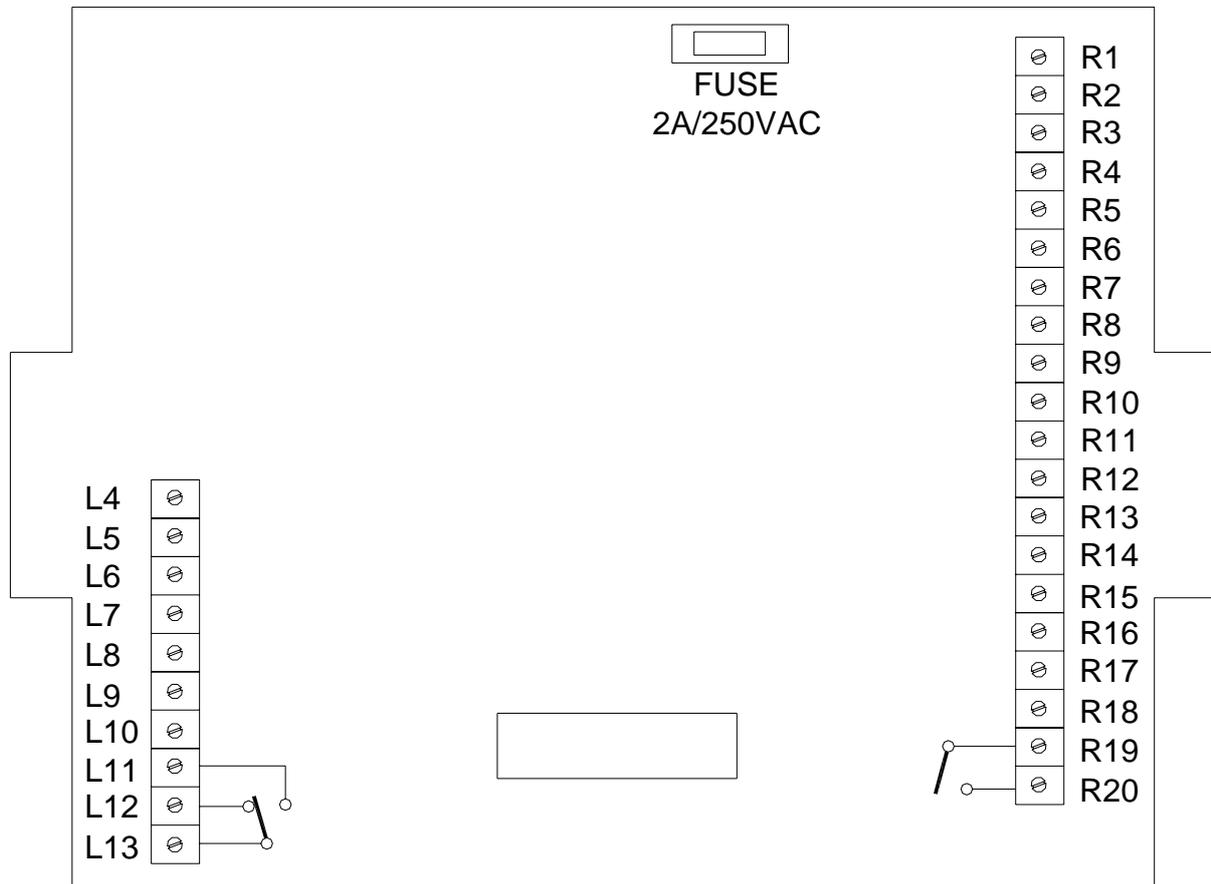
Release 2

L4:	Conductivity Probe Cable Screen (Grey)
L5:	Conductivity Probe PR+ (Brown or Red)
L6:	Conductivity Probe PR- (Yellow)
L7:	Conductivity Probe CM+ (Blue)
L8:	Water Meter In
L9:	Flow Switch In
L10:	Flow Switch Common / Water Meter Common / Probe Cable Screen (Grey)
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:	Solenoid Valve Active 240VAC (2A fused)
R6:	Solenoid Valve Neutral
R7:	Inhibitor Pump Active 240VAC (2A fused)
R8:	Inhibitor Pump Neutral
R9:	Biocide 'A' Active 240VAC (2A fused)
R10:	Biocide 'A' Neutral
R11:	Biocide 'B' Active 240VAC (2A fused)

R12: Biocide 'B' Neutral
R13 - R18: Common Earth
R19: Condenser Pump Relay common
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Fuse: 2A/250VAC (M205, 20mm x 5mm diameter)

Notes on Alarm Relay Contacts :

1. Alarm relay is energised (ie. L13 connected to L11) during normal operation of the unit.
2. Alarm relay de-energises (ie. L13 connected to L12) when an alarm condition is confirmed or when the unit loses power.

Notes on Flow Switch:
A flow switch with N/O or N/C volt-free contacts are required to be connected to terminals L9 & L10 (not polarity sensitive). The flow switch logic is programmable via the menu.

2.2 Conductivity Probe Installation & Maintenance

The probe is supplied screwed into a PVC Tee piece such that the electrode tips are submerged in the water flowing through the manifold in which the tee is usually fitted. The probe should be positioned with the black markers on the probe aligned with the black markers on the manifold Tee. This ensures that the 2 electrodes of the probe are positioned symmetrically with respect to the direction of water flow. See the photograph and diagrams below:

DIRECTION
OF FLOW
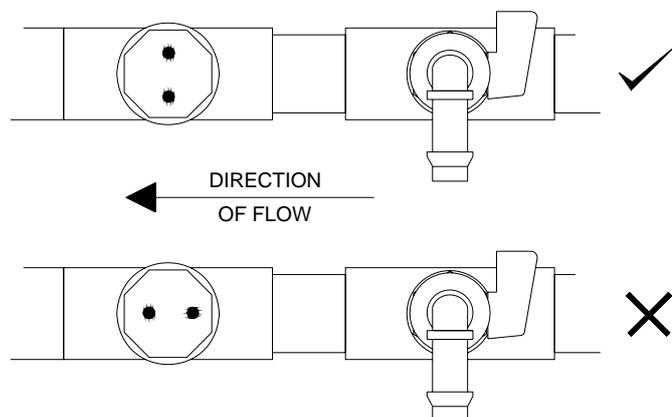
The probe's electrodes should periodically be cleaned to maintain accurate TDS measurements. The frequency of cleaning required will vary from one application to another. In a new installation, it is recommended that the probe be cleaned after 2 weeks of service.

To clean the probe, first unplug the probe lead and unscrew the probe from the manifold. The probe can normally be cleaned using a cloth or paper towel. Occasionally the probe's carbon electrodes may be coated with substances which requires more vigorous cleaning (this coating may not always be visible). To clean a coated electrode, use a fine grit abrasive, such as emery paper.

After cleaning, apply more Teflon$^{®}$ tape to the probe thread and screw back into the manifold. The controller should always be calibrated after probe cleaning.

3. Controller Functionality

3.1 Menu Logic

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

- The menu structure is circular
- The relevant menu item, or programmed value flashes
- Up & 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 (see next page):

```
                    Hold                    ▲
  ┌─────────────────┐   ▼    ┌──────────────────┐
  │  995 TDS [1000] │───────▶│    SETUP MENU    │        To access
  └─────────────────┘        └──────────────────┘        menu item
         ▲                      ▼      ▲                  press  ■
         │                   ┌──────────────────┐
         │                   │   TEST OUTPUTS   │
         │                   └──────────────────┘
         │                      ▼      ▲
         │                   ┌──────────────────┐
         │                   │   MANUAL DOSE    │
         │                   └──────────────────┘
         │                      ▼      ▲
         │                   ┌──────────────────┐
         │                   │    CALIBRATE     │
         │                   └──────────────────┘
         │                      ▼      ▲
         │                   ┌──────────────────┐
         │                   │   TIME & DATE    │
         │                   └──────────────────┘
         │                      ▼      ▲
         │                   ┌──────────────────┐
         │                   │  VIEW SETTINGS   │
         │                   └──────────────────┘
         │                      ▼      ▲
         │                   ┌──────────────────┐
         │                   │ FACTORY SETTINGS │
         │                   └──────────────────┘
         │                      ▼      ▲
         │            ■      ┌──────────────────┐
         └───────────────────│       EXIT       │
                             └──────────────────┘
                                ▼
```
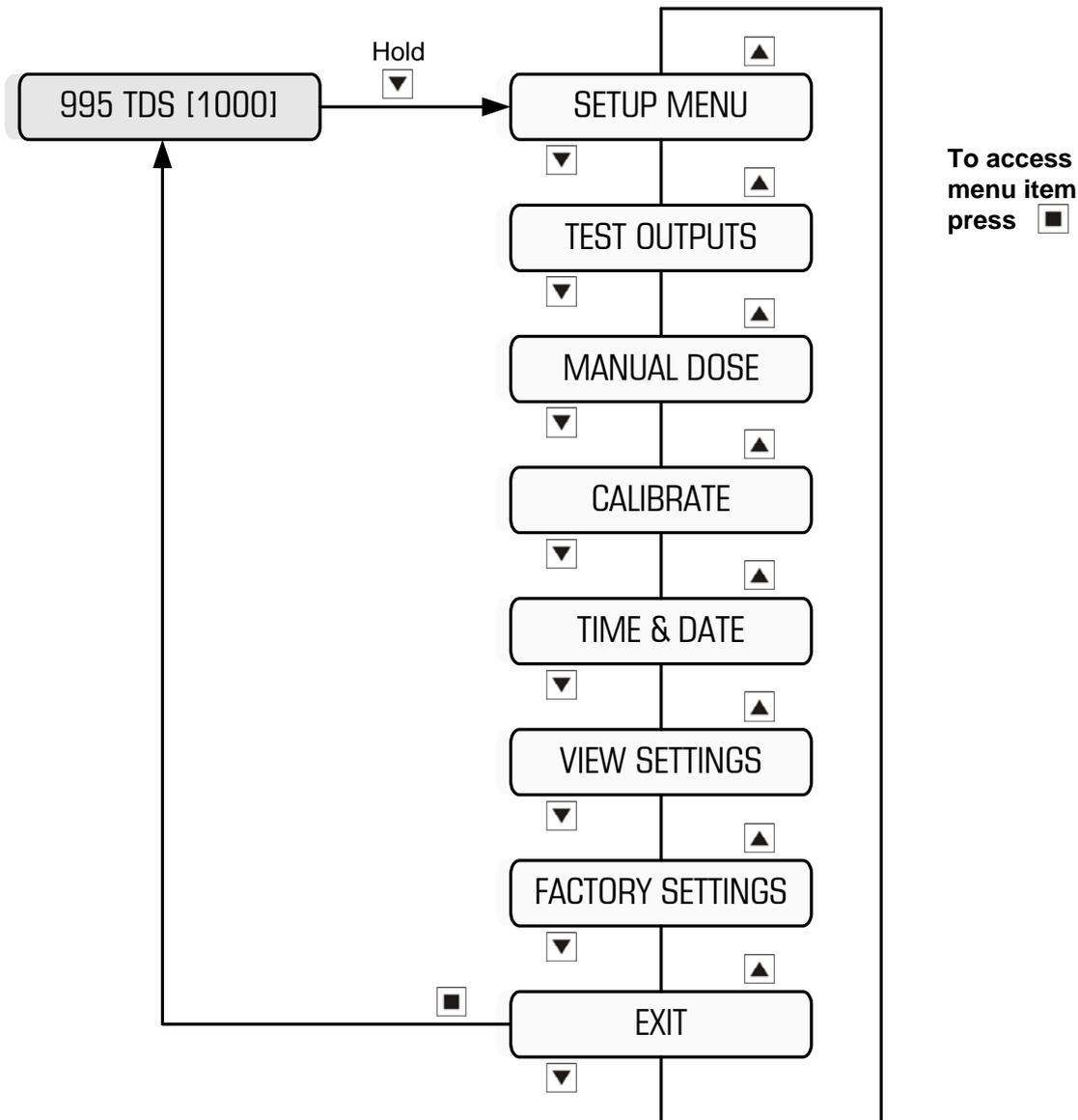
3.2 Pushbuttons

The DIGICHEM-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:

  | 1 Nov 2006 | —— alternates with —— | Wed 16:42 WEEK 1 |

  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 DIGICHEM-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 6 LEDs on the front face of the DIGICHEM-XP2:

- Power (green): illuminates continuously when power is applied to the controller

- Bleed (amber): illuminates continuously when power is applied to the solenoid output of the controller. If the solenoid output is suspended due to a pause in the bleed cycle, the LED will flash on and off.

- Biocide A (amber): illuminates continuously when power is applied to the Biocide A output of the controller.

- Biocide B (amber): illuminates continuously when power is applied to the Biocide B output of the controller.

- Inhibitor (amber): illuminates continuously when power is applied to the Inhibitor output of the controller. If the Inhibitor output is suspended due to no flow, the LED will flash on and off during the ON cycle.

- 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.

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, to perform a direct download to a pc or laptop.

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 conductivity as well as the conductivity Setpoint within square brackets (which alternates with the temperature as measured by the conductivity probe), as follows:

Water Meter Pulse → * 995 TDS [1000]   alternates with   995 TDS [28°C]

Conductivity Reading   Conductivity Setpoint   Conductivity Reading   Temperature
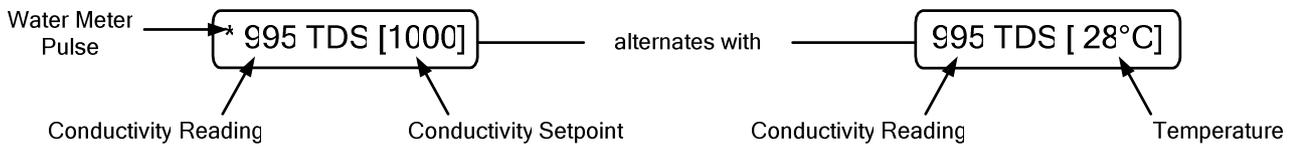
NOTE: An asterisk '*' flashes on the screen when the controller receives a pulse from an optional water meter (Software version 2.0 and above). The asterisk '*' may appear on the LHS of the display or within the square brackets just before the Conductivity Setpoint or Temperature.

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, e.g.

ALARM!!   [HIGH.]

- When a flow switch is connected to the controller, each output is suspended when there is no flow past the flow switch, if the output is selected via the Flow Switch Menu.

995 TDS [1000]   alternates with   NO FLOW

4.2 Setting Time & Date

Main Menu > TIME & DATE

```
┌──────────────────┐   ▣    ┌──────────────────────┐
│  TIME & DATE     │ ──────▶│ TIME:       11:00    │
└──────────────────┘        └──────────────────────┘
        ▲                        │ ▼
        │                   ┌──────────────────────┐
        │                   │ TIME:       10:00    │
        │                   └──────────────────────┘
        │                        │ ▣ then ▲
        │                   ┌──────────────────────┐
        │                   │ TIME:       10:30    │
        │                   └──────────────────────┘
        │                        │ ▣
        │                   ┌──────────────────────┐
        │                   │ DATE:   1 Jan 2006   │   Press ▼ or ▲ to change day
        │                   └──────────────────────┘
        │                        │ ▣
        │                   ┌──────────────────────┐
        │                   │ DATE:   2 Jan 2006   │   Press ▼ or ▲ to change month
        │                   └──────────────────────┘
        │          ▣             │ ▣
        │                   ┌──────────────────────┐
        └───────────────────│ DATE:   2 Nov 2006   │   Press ▼ or ▲ to change year
                            └──────────────────────┘
```
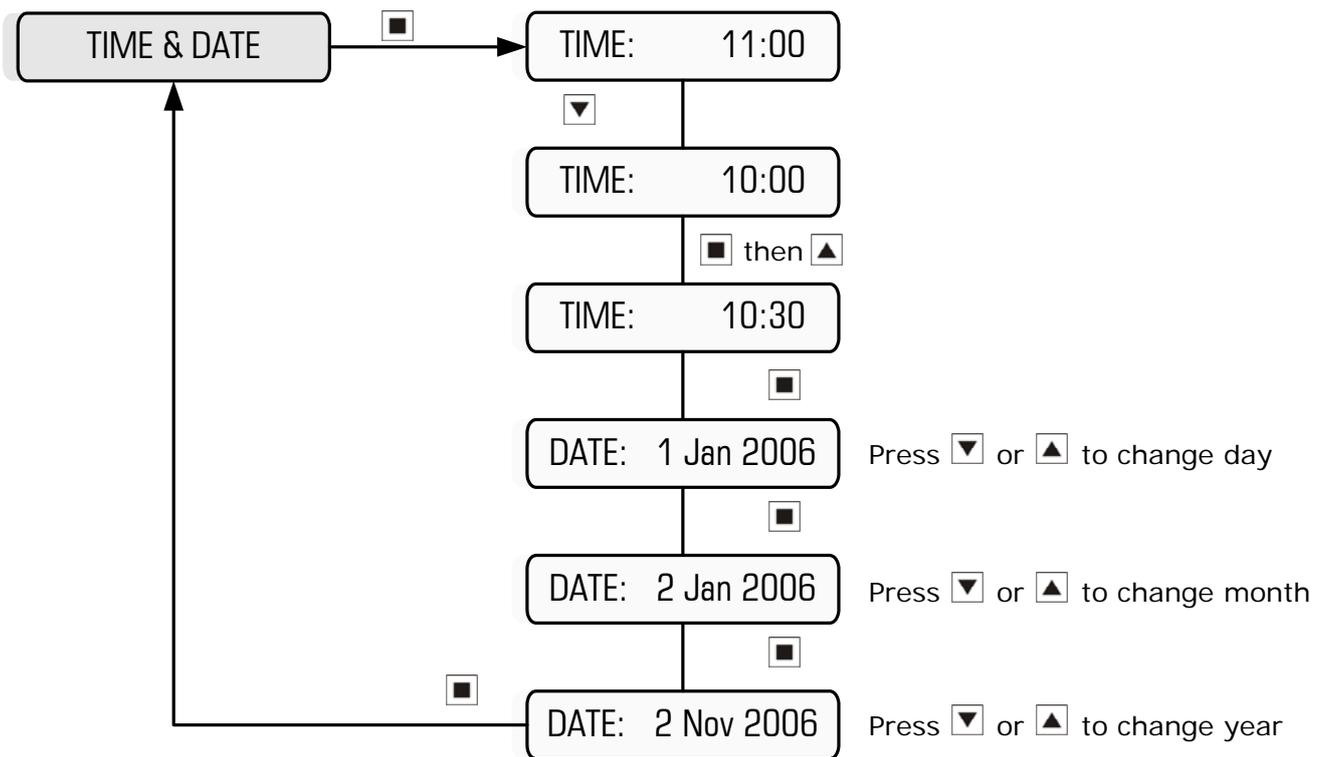
Example: Setting time & date to 10:30 on 2 Nov 2006

NOTE: The Week No will be automatically set

4.3 Calibration

IMPORTANT: Select the display in either µS or TDS before proceeding.
(Refer section 5.1)

Calibrating the SLOPE

Main Menu > *CALIBRATE*

Take a sample of water from the sample valve on the manifold and
measure the conductivity with a hand-held conductivity meter.
Alternatively, insert the Conductivity probe in a buffer solution of known
conductivity. Should the conductivity readout on the display differ from
the sample taken, calibrate the controller as follows:

*Adjust the current reading via the Calibration Menu to the desired
reading.*

CALIBRATE ▪ → CALIBRATE [SLOPE]

▪

CALIBRATE: 0945   Press ▼ or ▲ to change reading

▲

CALIBRATE: 0995   Press ▪ when slope set at value required

Calibrating … → then → 995 TDS [1000]
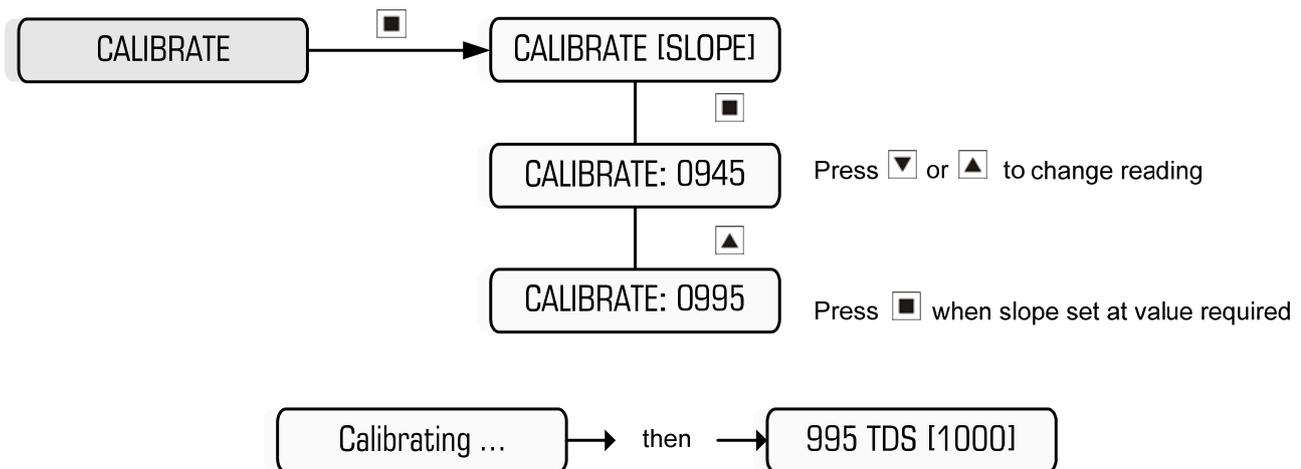
Example: Calibrating Slope value to 995 TDS

Calibrating the ZERO

The zero is factory set so should not require calibration. However, if the display reads above zero with the conductivity probe disconnected, recalibrate the zero as follows:

1. Remove the probe from the manifold.
2. Dry the electrodes of the probe, so that there is zero (or minimal) conductivity between the electrodes.
3. Wait until the reading on the LCD is stable. If the reading does not settle to exactly 0, wait until it does not drop any further.
4. Go into the Calibrate Menu and set the Zero Calibration (see below).
5. Screw the probe back into the manifold.
6. Perform the SLOPE calibration again.
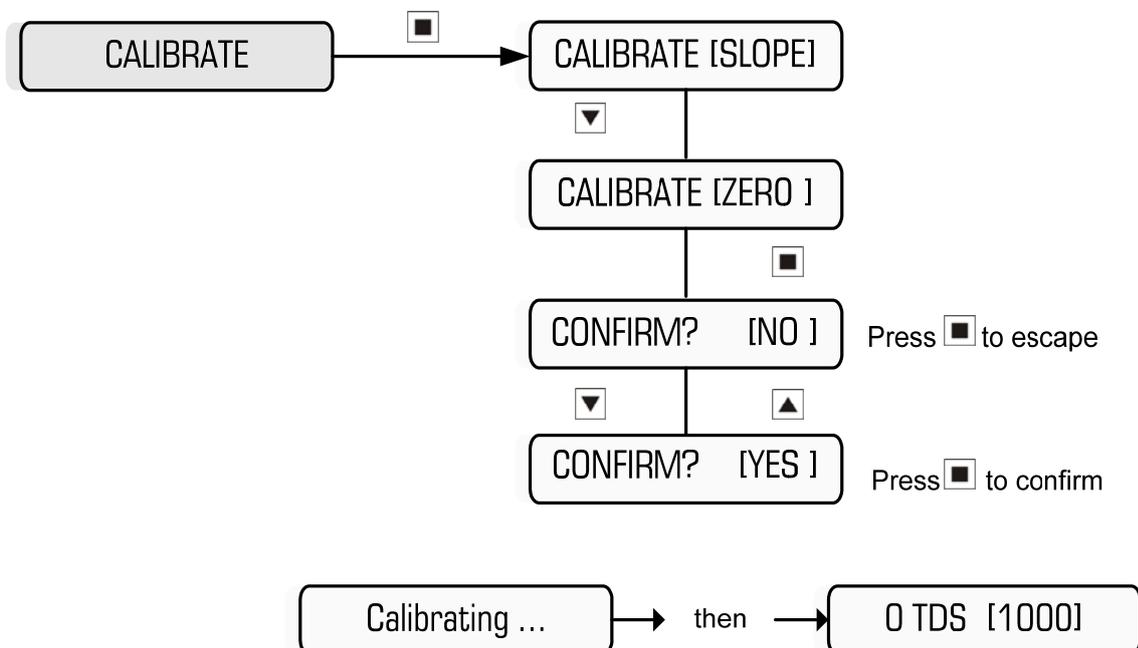
Resetting the CALIBRATION

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.

CALIBRATE	■ →	CALIBRATE [SLOPE]

▼

CALIBRATE [ZERO]

▼

CALIBRATE [RESET]

■

RESET? [NO]   Press ■ to escape

▼   ▲

RESET? [YES]   Press ■ to confirm

Please Wait …   →   then   →   995 TDS [1000]
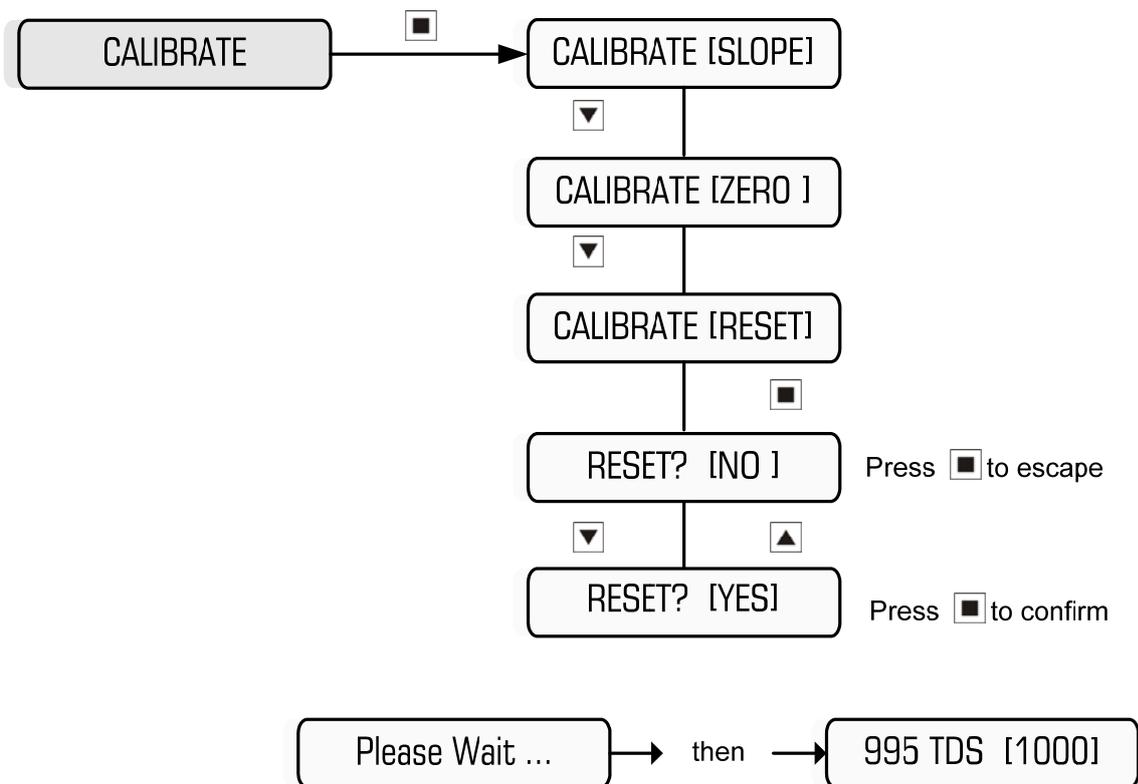
4.4 Testing Relay Outputs

Main Menu > TEST OUTPUTS

TEST OUTPUTS	■ →	Bleed O/P[OFF]	Press ▼ or ▲ to turn ON
		■	
		BIO 'A' O/P [OFF]	Press ▼ or ▲ to turn ON
		■	
		BIO 'B' O/P [OFF]	Press ▼ or ▲ to turn ON
		■	
		INHIBTR O/P [OFF]	Press ▼ or ▲ to turn ON
		■	
		AUX. O/P [OFF]	Press ▼ or ▲ to turn ON
		■	
	■	ALARM O/P [OFF]	Press ▼ or ▲ to turn ON
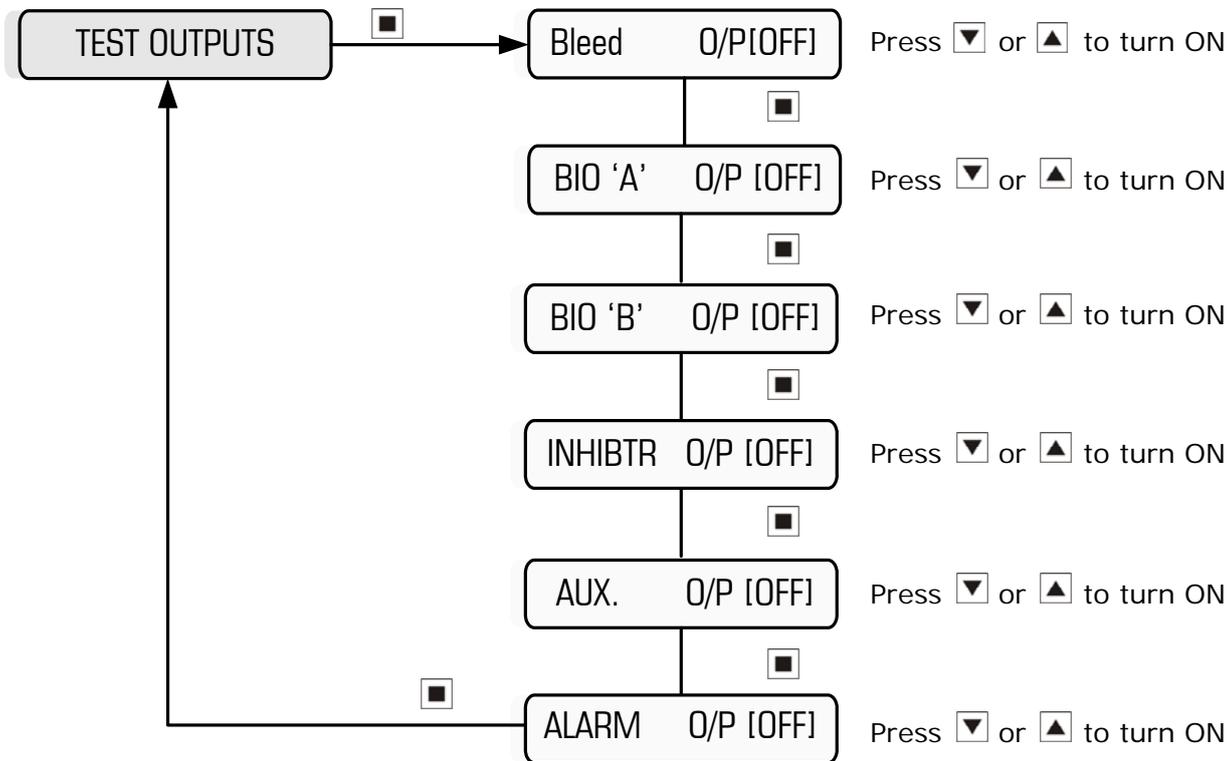
When any of the Outputs is activated, the respective Output LED illuminates and the Output relay switches, putting 240VAC power onto the output terminal, which activates the pump or solenoid valve wired to it.

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 any 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 an 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. Do not switch the Aux O/P On relay rapidly ON and OFF, if powering the condenser pump of the cooling tower.

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:

MANUAL DOSE → ■ → Sel O/P [BIO 'A']	Press ▼ or ▲ to select Bio 'A', Bio 'B' or Inhibtr
O/P on for: 00m	Press ■ to escape
O/P on for: 05m	Press ■ once dose time selected (max=99m)

995 TDS [1000] —— alternates with —— Bio 'A' - 05m
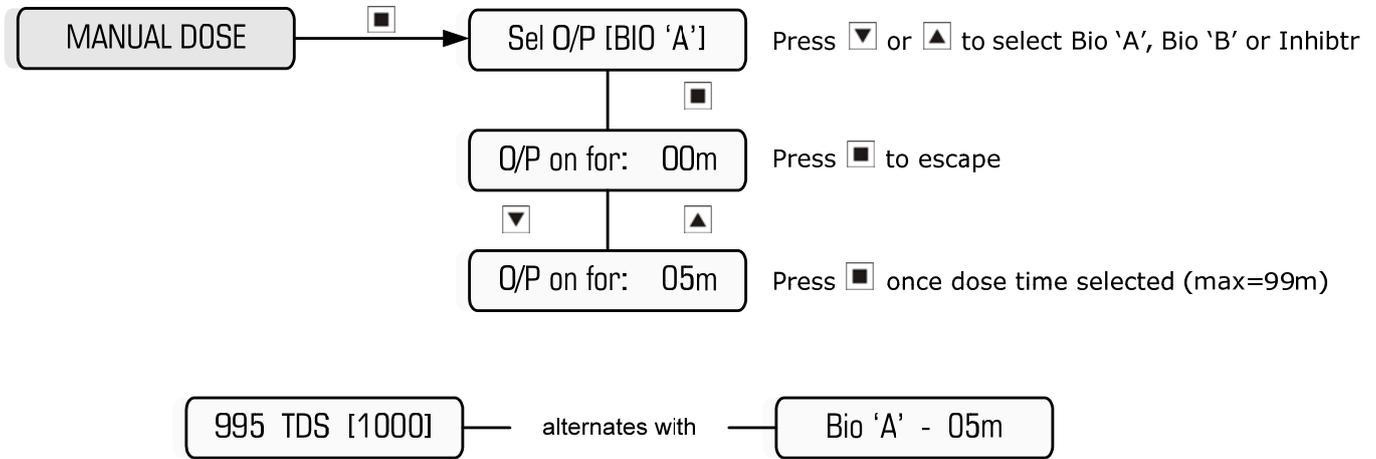
Example: Setting Biocide 'A' to dose for 5 minutes

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:

VIEW SETTINGS → ▪

Display: [TDS]

SETPOINT: 1000

HYSTERESIS   10%

ID: 0620-65535

10 P00h00 L00h00

Press ▪ at any point to escape
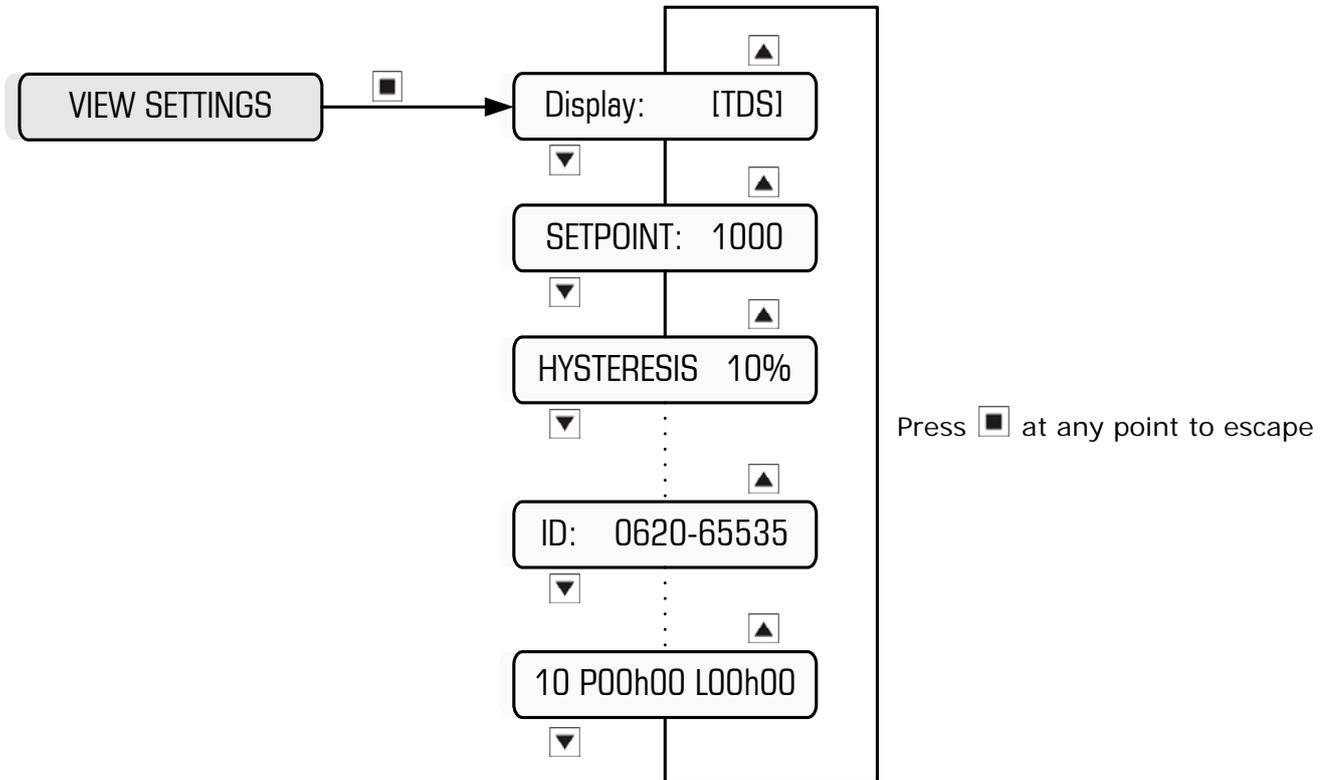
4.7 Factory Settings

Main Menu > *FACTORY SETTINGS*

CAUTION:

- Enter this part of the program ONLY if you wish to erase your program settings.
- The default settings (listed in Section 6 of this manual) 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.

```
┌─────────────────────┐    ▣        ┌──────────────────────┐
│  FACTORY SETTINGS   │────────────▶│   RESET?  [NO ]      │   Press ▣ to escape
└─────────────────────┘             └──────────────────────┘
                              ▼              ▲
                            ┌──────────────────────┐
                            │   RESET?  [YES]      │
                            └──────────────────────┘
                                             ▣
                            ┌──────────────────────┐
                            │  CONFIRM?  [NO ]     │   Press ▣ to escape
                            └──────────────────────┘
                              ▼              ▲
                            ┌──────────────────────┐
                            │  CONFIRM?  [YES]     │
                            └──────────────────────┘
                                             ▣
                            ┌──────────────────────┐
                            │  RESET CAL?  [NO ]   │   Press ▣ to reset unit to Factory Settings
                            └──────────────────────┘       (most recent Calibration NOT reset)
                              ▼              ▲
                            ┌──────────────────────┐
                            │  RESET CAL?  [YES]   │   Press ▣ to reset unit to Factory Settings
                            └──────────────────────┘       and to reset Calibration to Factory default
```
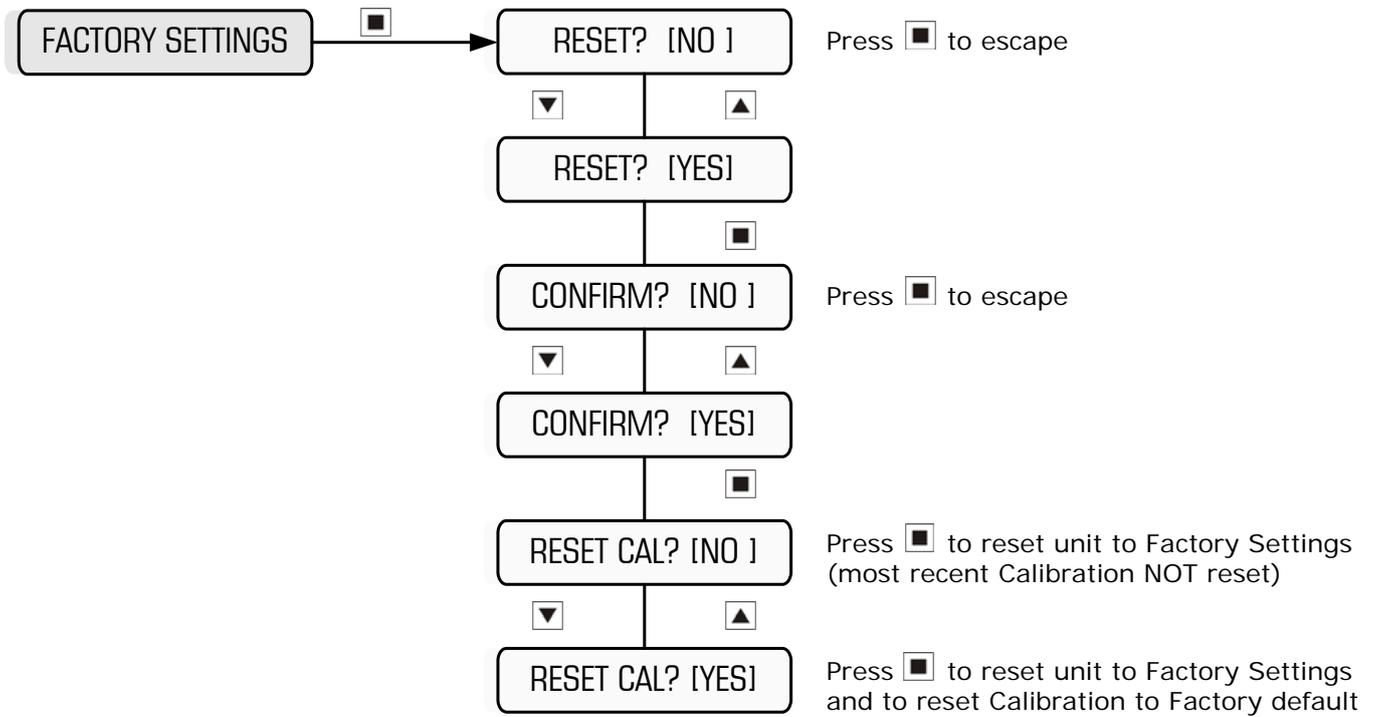
5. Programming Setup Menu

Main Menu > *SETUP MENU*

IMPORTANT:

- Once settings are changed, it is necessary to exit the SETUP MENU in order to save your settings.
- Setup Menu Structure illustrated as follows:

```
┌─────────────────┐                          ┌──▲──┐
│  SETUP MENU     │──────■──────────────────▶│  ▲  │
└─────────────────┘                          │ UNITS │
                                             └──▼──┘
                                             ┌──▲──┐        To access
                                             │ BLEED SETPOINT │   menu item
                                             └──▼──┘        press ■
                                             ┌──▲──┐
                                             │ HYSTERESIS │
                                             └──▼──┘
                                             ┌──▲──┐
                                             │ BLEED CYCLE │
                                             └──▼──┘
                                             ┌──▲──┐
                                             │ ALARM PARAMETERS │
                                             └──▼──┘
                                             ┌──▲──┐
                                             │ INHIBITOR SETUP │
                                             └──▼──┘
                                             ┌──▲──┐
                                             │ BIOCIDE SETUP │
                                             └──▼──┘
                                             ┌──▲──┐
                                             │ PRE-BLD SETPOINT │
                                             └──▼──┘
                                             ┌──▲──┐
                                             │ LOCKOUT SETPOINT │
                                             └──▼──┘
                                             ┌──▲──┐
                                             │ AUX O/P ON TIMER │
                                             └──▼──┘
                                             ┌──▲──┐
                                             │ FLOW SWITCH │
                                             └──▼──┘
                                             ┌──▲──┐
                                             │ DATA LOGGING │
                                             └──▼──┘
                                             ┌──▲──┐
                                ■            │ EXIT SETUP │
                                             └──▼──┘
```

You will be prompted to save any changed settings
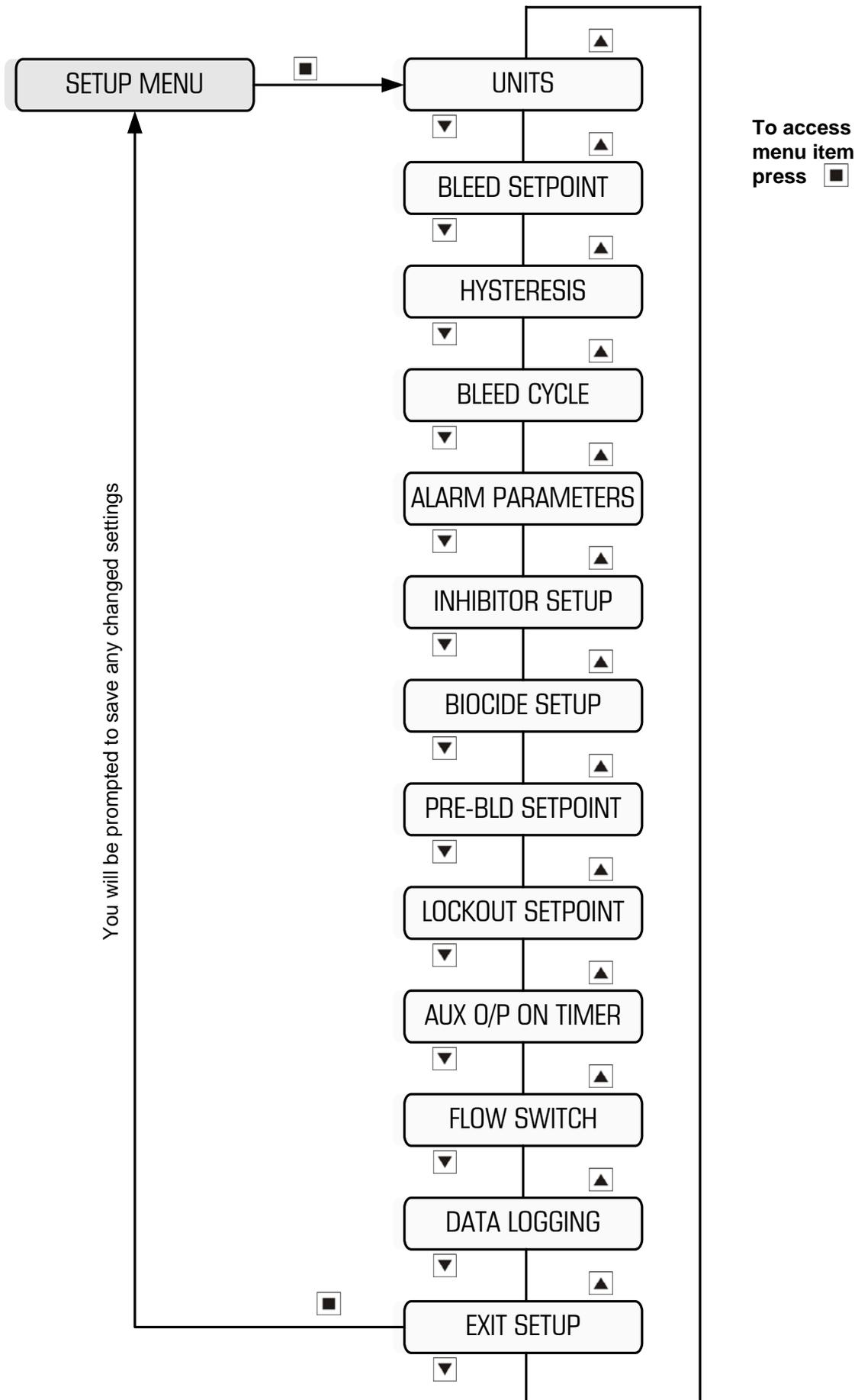
Setup Menu

5.1 Set Units

Main Menu > *SETUP MENU > UNITS*

Conductivity can be displayed in either:
- TDS (Total Dissolved Solids), or
- μS (Microsiemens)

Note: The displayed units should be selected before performing any calibration or programming of the unit.
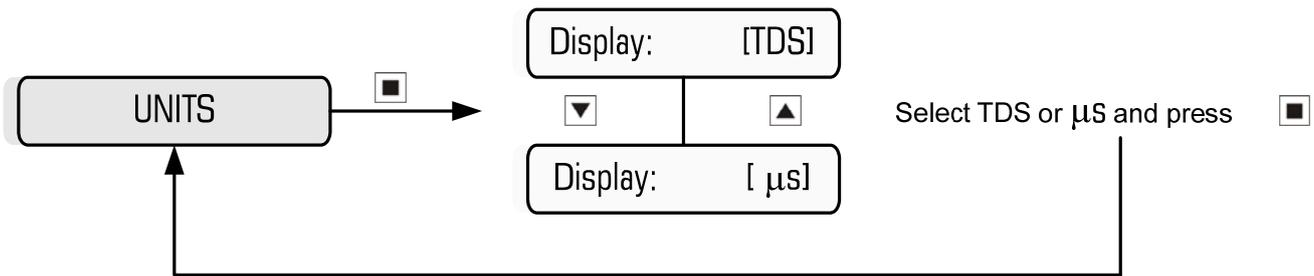
5.2 Set Bleed Setpoint

Main Menu > *SETUP MENU > BLEED SETPOINT*
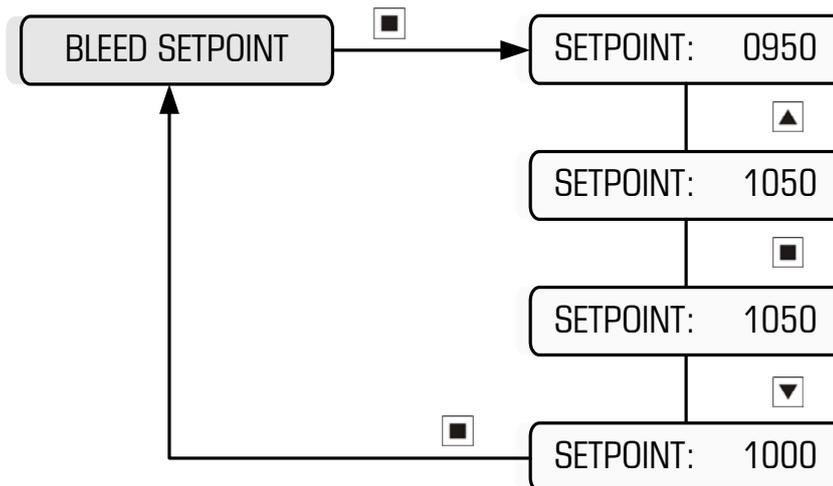
Example: Increasing setpoint from 950 TDS to 1000 TDS

The Bleed Setpoint is the desired conductivity value of the process (displayed in TDS or μS). When a solenoid valve is connected to the bleed output, the

valve opens when the conductivity rises above the setpoint. When this occurs, the tower water is flushed to drain and fresh make-up water dilutes the system, thus lowering the conductivity of the tower water. The valve shuts when the conductivity drops to the hysteresis value (explained in the next section). The cycle repeats.

Bleed Control Operational Diagram
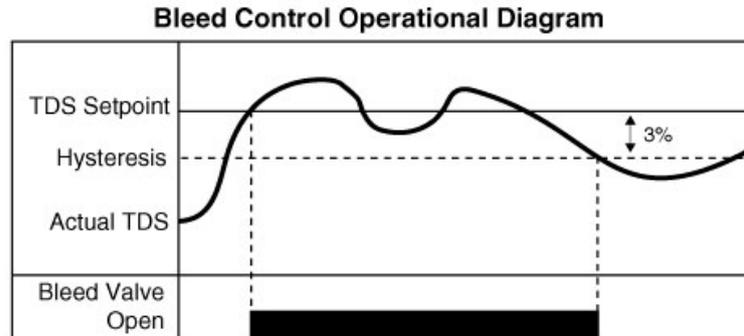
5.3 Set Hysteresis

Main Menu > *SETUP MENU* > *HYSTERESIS*
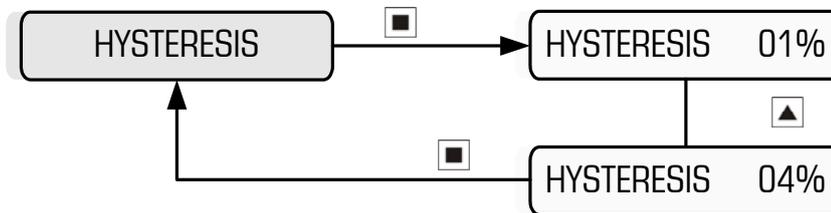
Example: Increasing Hysteresis from 1% to 4%

Hysteresis is the deadband between the two conductivity points at which the solenoid valve opens and closes. The solenoid valve opens when the conductivity rises above the programmed setpoint and shuts when it drops to a level below the setpoint. This level is called Hysteresis and is a % of the setpoint.

5.4 Set Bleed Cycle

Main Menu > *SETUP MENU* > *BLEED CYCLE*

When the controller calls for bleed, the solenoid valve can be programmed to bleed continuously or on a cycle until it reaches the Conductivity Setpoint. To leave the Bleed Cycle in its disabled state, proceed to the next section. If you wish to program a bleed cycle, then proceed as follows:

The menu asks for a Bleed Time and a Wait Time to be programmed. The Wait Time follows the Bleed Time, and the cycle is repeated until the Setpoint minus hysteresis is reached.

A bleed cycle can prevent excessive tower drainage in a very small system and allows the make-up to efficiently mix with the cooling tower water.

The ability to cycle is also useful because it prevents flooding by slowing down the bleed flow rate into a blocked drain.

The following diagram illustrates a bleed cycle programmed for a 10 second bleed off followed by 40 second wait:
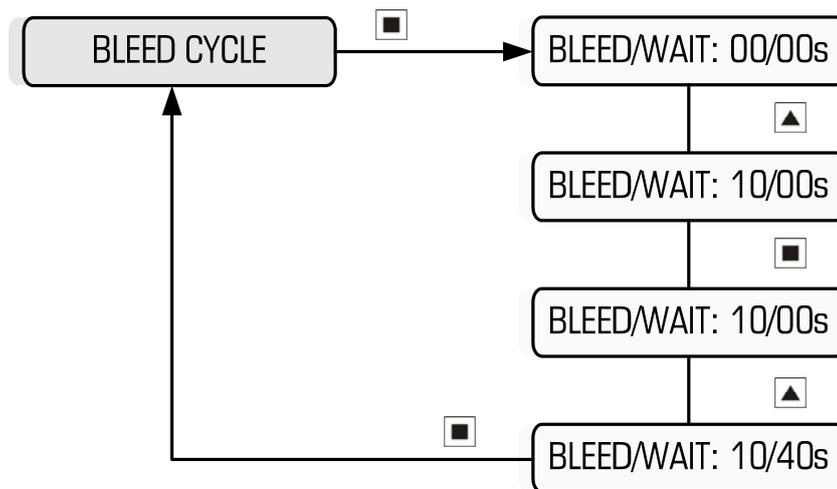
Example: Programming a bleed cycle for 10s, followed by a wait period 40s

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

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

> **Note:** If the conductivity is greater than 25% above the programmed setpoint, then the controller automatically adjusts the ON/OFF bleed cycle to bring it to setpoint more quickly.

5.5 Alarm Parameters

Main Menu > *SETUP MENU > ALARM PARAMETERS*

```
ALARM PARAMETERS  ■→   HIGH  ALARM        ▲
                        ▼
                              LOW  ALARM   ▲
                        ▼
                           NO FLOW ALARM   ▲
                        ▼
                          DELAY ON ALARM   ▲
                        ▼
                         BLD TIMER ALARM   ▲
                        ▼
                    ■         EXIT         ▲
                        ▼
```

**To access
alarm menu item
press ■**
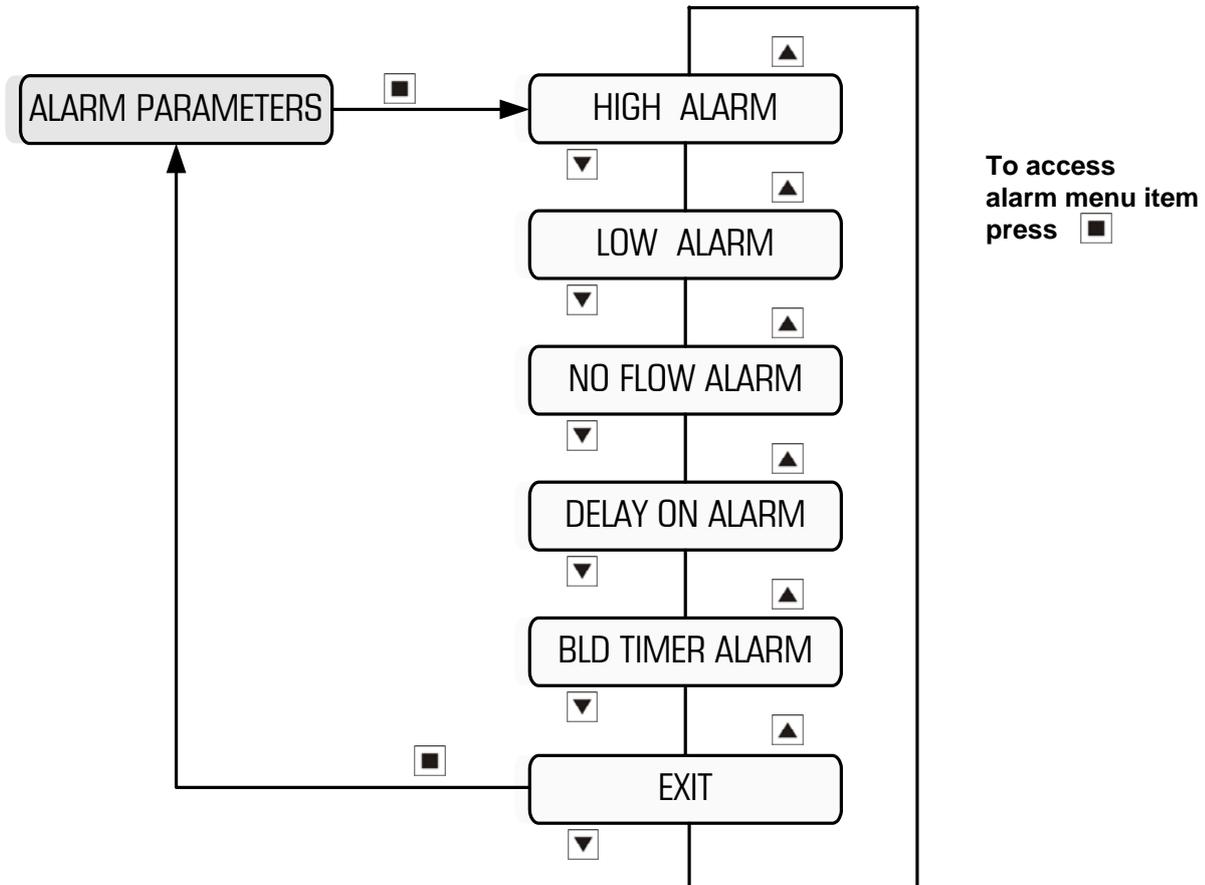
The controller has 5 programmable alarm functions as outlined above. If any
of the alarms are activated and confirmed, the common alarm contact
switches, the red Alarm LED illuminates, and the Alarm message is displayed
on the LCD.

5.5.1 High Conductivity Alarm

The High Conductivity Alarm is activated if the Conductivity rises above the programmed setting, and automatically resets if the Conductivity drops below the programmed setting again.

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

```
┌─────────────────┐   [■]    ┌──────────────────────┐
│   HIGH  ALARM   │ ───────▶ │  HIGH ALARM: 0000    │
└─────────────────┘          └──────────────────────┘
         ▲                              │  [▲]
         │                   ┌──────────────────────┐
         │                   │  HIGH ALARM: 1400    │
         │                   └──────────────────────┘
         │                              │  [■] then [▲]
         │          [■]      ┌──────────────────────┐
         └───────────────────│  HIGH ALARM: 1450    │
                             └──────────────────────┘
```
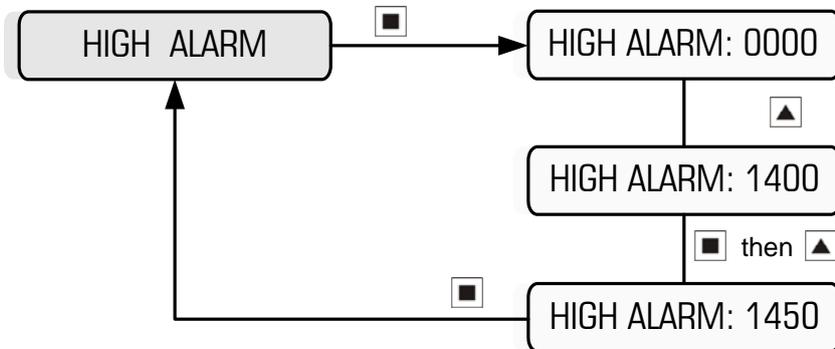
Example: Setting a High Alarm of 1450 TDS

Note: A setting of 0000 means the High Alarm is disabled.

5.5.2 Low Conductivity Alarm

The Low Conductivity Alarm is activated if the Conductivity drops below the programmed setting, and automatically resets if the Conductivity rises above the programmed setting again.

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

```
┌─────────────────┐   [■]    ┌──────────────────────┐
│   LOW  ALARM    │ ───────▶ │  LOW ALARM: 00.00    │
└─────────────────┘          └──────────────────────┘
         ▲                              │  [▲]
         │                   ┌──────────────────────┐
         │                   │  LOW ALARM: 0700     │
         │                   └──────────────────────┘
         │                              │  [■] then [▲]
         │          [■]      ┌──────────────────────┐
         └───────────────────│  LOW ALARM: 0750     │
                             └──────────────────────┘
```
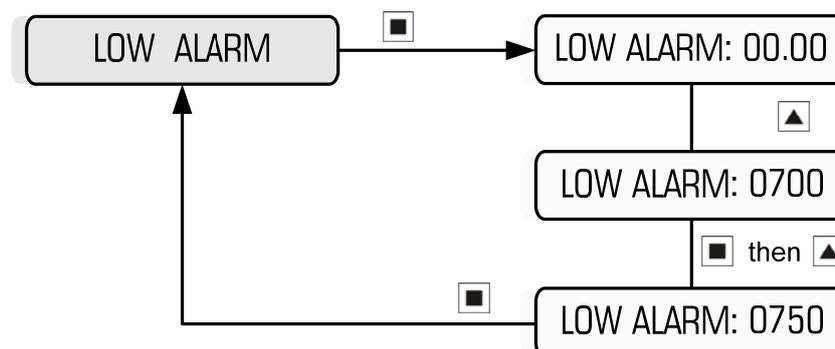
Example: Setting a Low Alarm of 750 TDS

Note: A setting of 0000 means the Low Alarm is disabled.

5.5.3 No Flow Alarm

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

```
                         ┌─────────────────┐
                         │ ENABLE?:   [NO ]│
  ┌──────────────┐  ◼    └─────────────────┘
  │ NO FLOW ALARM│ ───►    ▼          ▲       Select Yes or No and press ◼
  └──────────────┘       ┌─────────────────┐
         ▲               │ ENABLE?:   [YES]│
         │               └─────────────────┘
         └─────────────────────────────────────────┘
```
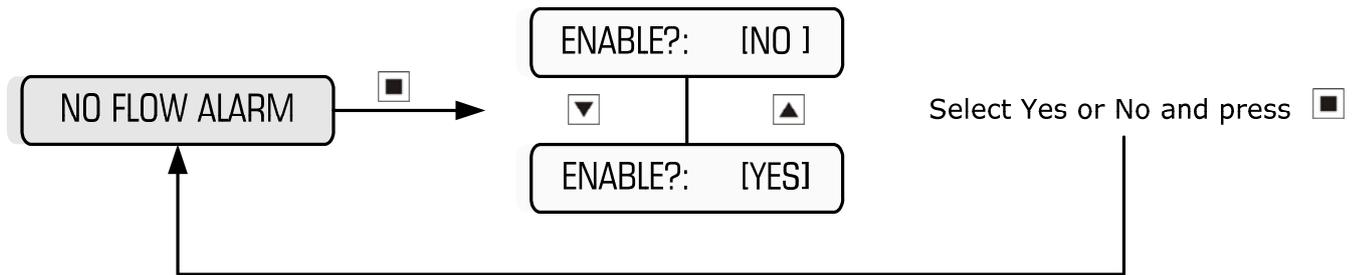
If the No Flow Alarm is enabled, the Alarm will activate when there is no flow detected by the optional flow switch. If the No Flow Alarm is left disabled, then the Alarm is unaffected by a no-flow condition.

5.5.4 Delay On Alarm

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

```
  ┌──────────────┐  ◼      ┌────────────────────┐
  │ DELAY ON ALARM│ ───►   │ TRIP DELAY:  0008s │
  └──────────────┘         └────────────────────┘
         ▲                        ◼ then ▲
         │              ◼   ┌────────────────────┐
         └──────────────────│ TRIP DELAY:  0030s │
                            └────────────────────┘
```
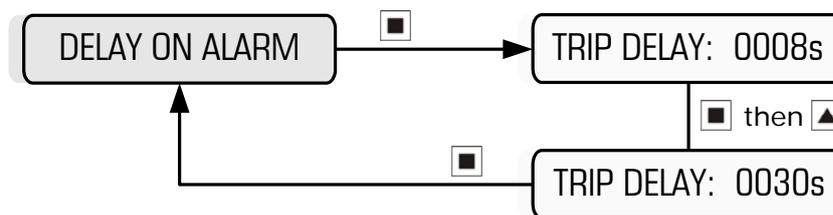
Example: Setting alarm delay of 30 seconds

When an alarm condition is detected, eg High Conductivity 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 Conductivity condition exists continuously for 120 seconds. However, if the Conductivity drops to below the High Conductivity 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.

5.5.5 Bld Timer Alarm

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

```
┌─────────────────┐   ■      ┌─────────────────┐
│ BLD TIMER ALARM │─────────▶│ Max Bleed: 000m │
└─────────────────┘          └─────────────────┘
        ▲                              │
        │                         ■ then ▲
        │              ■        ┌─────────────────┐
        └───────────────────────│ Max Bleed: 060m │
                                └─────────────────┘
```
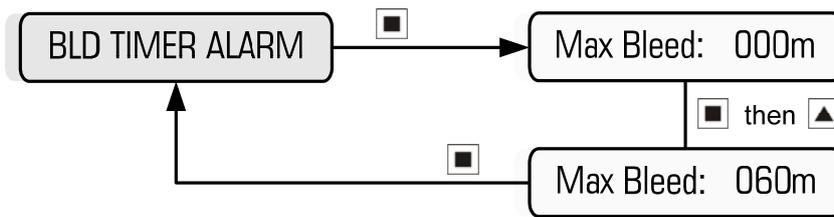
Example: Setting maximum bleed time of 60 min

The Bld (Bleed) Timer Alarm is the maximum acceptable bleed time for the system to reach the Setpoint. This alarm is designed to protect the system from excessive bleeding in the event of a false reading from a faulty Conductivity probe, or if the controller itself is faulty.

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

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

5.6 Inhibitor Setup

Main Menu > *SETUP MENU > INHIBITOR SETUP*

There are 4 Possible Inhibitor Feed Pump Modes to select from:

- Continuous on Bleed
- % of Time on Bleed
- % of Time on Flow (24 hrs/day) – [**Note:** Optional Flow Switch required]
- Water Meter Pulse

```
                                          ▼
  ┌─────────────────┐      ■        ┌──────────────────┐
  │ INHIBITOR SETUP │ ──────────▶   │ Inhib:  [On Bleed]│  *
  └─────────────────┘               └──────────────────┘
         ▲                                    ▲
         │                          ▼
         │                      ┌──────────────────┐
         │                      │ Inhib:  [ Pulses] │  *
         │                      └──────────────────┘
         │                                    ▲
         │                          ▼
         │              ■       ┌──────────────────┐
         └──────────────────    │ Inhib:  [24hr/day]│  *
                                └──────────────────┘
                                           ▲
```
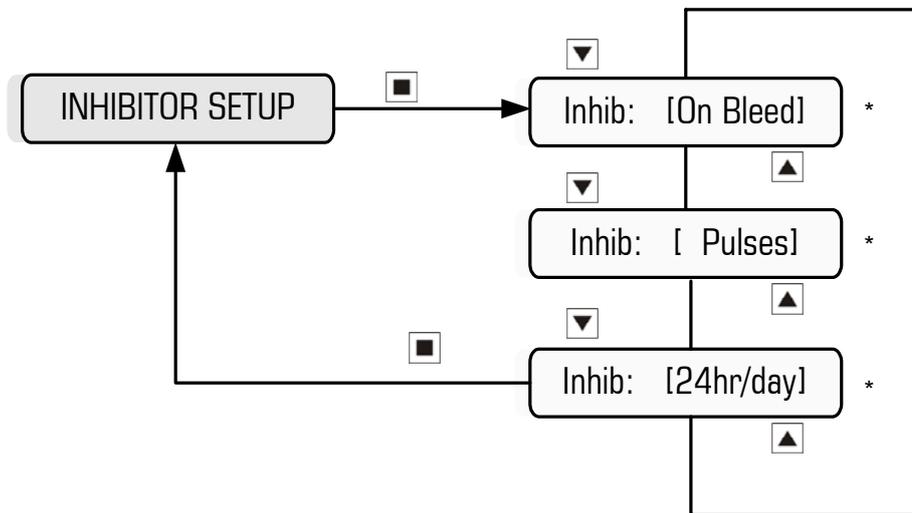
Press ■ to access settings

Continuous on bleed:

Pump doses continuously when measured Conductivity > Setpoint, regardless of any bleed cycle programmed.

% of Time on Bleed:

Pump doses on a duty cycle when measured Conductivity > Setpoint, independent from any bleed cycle programmed. Duty cycle is repeating ON and OFF times, eg ON=30sec, followed by OFF=30sec & repeating (ie. 50% duty cycle).

Main Menu > SETUP MENU > INHIBITOR SETUP

```
  ┌─────────────────┐     ■        ┌──────────────────┐
  │ Inhib: [On Bleed]│ ─────────▶  │ ON Period:  0000s │
  └─────────────────┘              └──────────────────┘
         ▲                                   │ ■ then ▲
         │                         ┌──────────────────┐
         │                         │ ON Period:  0010s │
         │                         └──────────────────┘
         │                                   │ ■
         │                         ┌──────────────────┐
         │                         │ OFF Period:  0000s│
         │                         └──────────────────┘
         │                                   │ ■ then ▲
         │            ■            ┌──────────────────┐
         └───────────────────     │ OFF Period:  0040s│
                                   └──────────────────┘
```
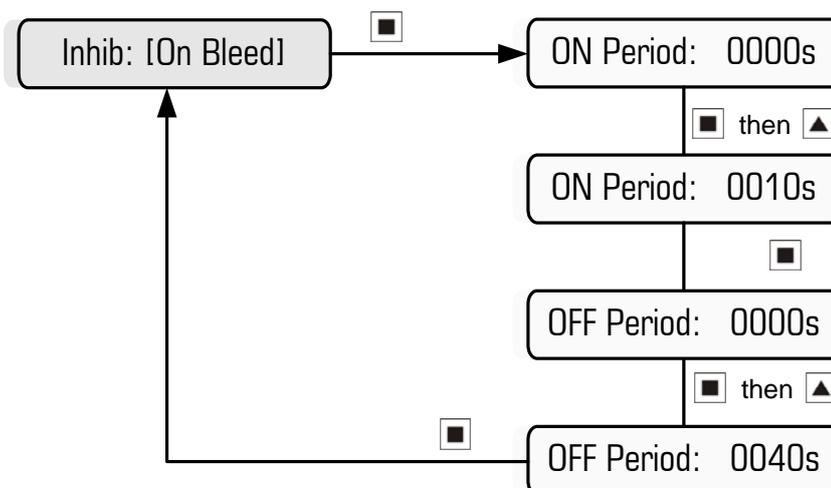
Example: Setting a 10s on period followed by a 40s off period

% of Time on Flow (24 hours/day):

Pump doses on a continuous duty cycle. Duty cycle is repeating ON and OFF times, eg ON=20sec, followed by OFF=60sec & repeating (ie. 25% duty cycle). If there is not continuous flow through the manifold at all times, flow switch option AF04 should be fitted.

Main Menu > *SETUP MENU > INHIBITOR SETUP*
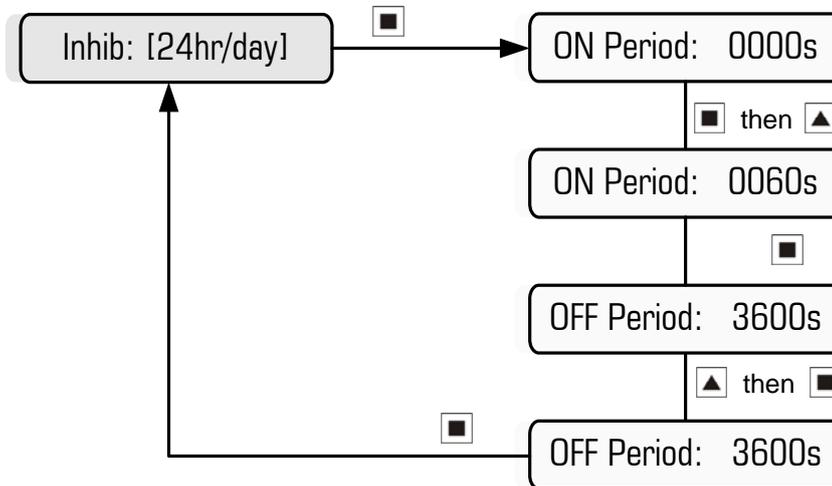
Example: Setting a 60s on period followed by a 3600s
(i.e. 1 hr) off period

For any of the % of Time modes above, you can use the following table as a guide to set your Inhibitor pump duty cycle:

Dosing Pump Turn-down required	ON Period	OFF Period
10% of maximum dose rate	0010s	0090s
20% of maximum dose rate	0020s	0080s
30% of maximum dose rate	0030s	0070s
40% of maximum dose rate	0040s	0060s
50% of maximum dose rate	0050s	0050s
60% of maximum dose rate	0060s	0040s
70% of maximum dose rate	0070s	0030s
80% of maximum dose rate	0080s	0020s
90% of maximum dose rate	0090s	0010s
100% of maximum dose rate	0000s	0000s

Water Meter Pulse:

Pump doses proportional to pulses received from a water meter fitted in the make-up line. The DIGICHEM-XP2 activates the pump for a set time once a pre-determined number of pulses is counted, explained further in the following example:

Water meter pulse rate = 1 pulse / litre
Desired concentration = 100 p.p.m.

[100 p.p.m. = 10ml chemical / 100 litres flow = 10ml chemical / 100 pulses]

Hence, we require the pump to dose 10ml every 100 pulses counted.

How long does the pump need to dose to deliver 10ml?
Pump dose rate = 1300ml/hr = **0.36ml/sec**
Dose time = 10ml / 0.36ml/sec = **27.8 seconds** (i.e. approx. 30 sec)

Set PULSE COUNT   = 100
Set DOSE PERIOD   = 30 seconds

In the example above, the pump doses for 30 seconds (i.e. programmed dose time) every 100 litres of make-up water (i.e. programmed pulse count of 100).

Main Menu > *SETUP MENU > INHIBITOR SETUP*
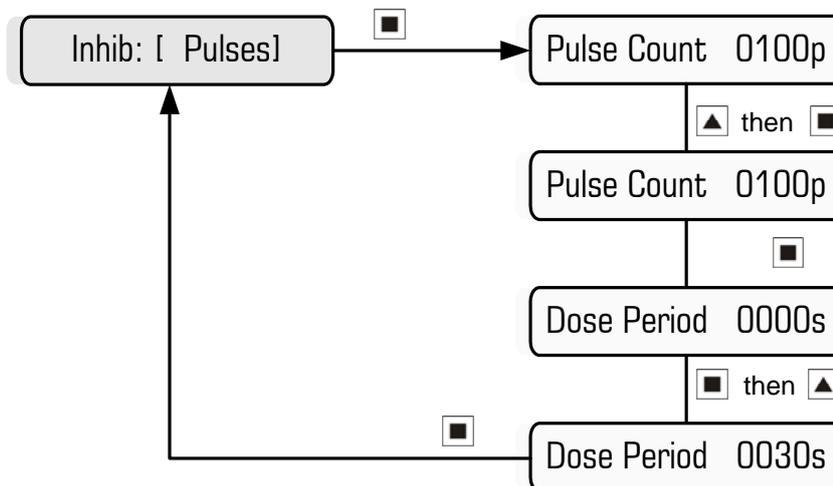
Example: Setting Inhibitor to dose for 30s every 100 pulses
from water meter

Notes: (v2.0 or later) An '*' will be displayed on the LCD screen momentarily for each water meter pulse received.

5.7 Biocide Setup

Main Menu > *SETUP MENU > BIOCIDE SETUP*

Biocide is dosed according to **28 day timer programs** set up by the user. There are 10 independent programs which can be programmed to operate daily, once per week, or on any number of days per week, fortnightly or once a month. A typical biocide program, which will operate at the same time on the specified days of the week, consists of 3 consecutive time durations:

1. Pre-bleed
2. Biocide Dosing
3. Bleed Lock-out

1. Pre-bleed
This reduces the system conductivity to a lower temporary setpoint (eg. 85% of setpoint) prior to biocide dosing in order to allow for a longer Bleed Lock-out duration without the risk of entering scaling conditions. Pre-bleed duration is programmable from 1 minute up to 23 hours. (Note: The Pre-Bleed Setpoint of 85%, ie. Setpoint -15% is fully programmable, and is explained further in section 5.8).

2. Biocide dosing
The biocide pump (Pump A or Pump B) doses chemical, typically into a manifold.   Dose duration is programmable from 1 minute up to 23 hours and commences immediately after Pre-Bleed. Bleed-off is disabled (ie. locked out) during dosing provided the Bleed Lock-out setpoint is not exceeded.

3. Bleed Lock-out
After biocide dosing, bleed-off continues to be disabled for the lock-out duration, programmable from 1 minute up to 23 hours, provided the Bleed Lock-out setpoint is not exceeded. (Note: The default Bleed Lock-out Setpoint of Setpoint +20% is fully programmable, and is explained further in section 5.9).

By preventing bleed-off during and after biocide dosing, the system is ensured of receiving maximum benefit from the dosed biocide, as no biocide will be lost during this time via bleed-off. Furthermore, because the conductivity is reduced during Pre-Bleed, the system has a longer retention period. As a result, a highly effective "kill" is achieved without resulting in high scaling conditions.

Each of the 10 Biocide Dosing programs can be set up to operate Biocide pump A or Biocide pump B. In other words, the programs can be allocated in any combination to either of the two biocide outputs, A and B.

For instance, if pump A is set up in 6 programs, pump B can only have up to 4 programs controlling it. Not all of the programs need to be allocated. If only two of the programs are required, then the other 8 will remain disabled. Pump A and Pump B work totally independently and each program has its own START TIME, followed by its own consecutive PRE-BLEED, BIOCIDE DOSING and BLEED LOCK-OUT durations. **However, biocide programs should not overlap.**

Main Menu > SETUP MENU > BIOCIDE SETUP
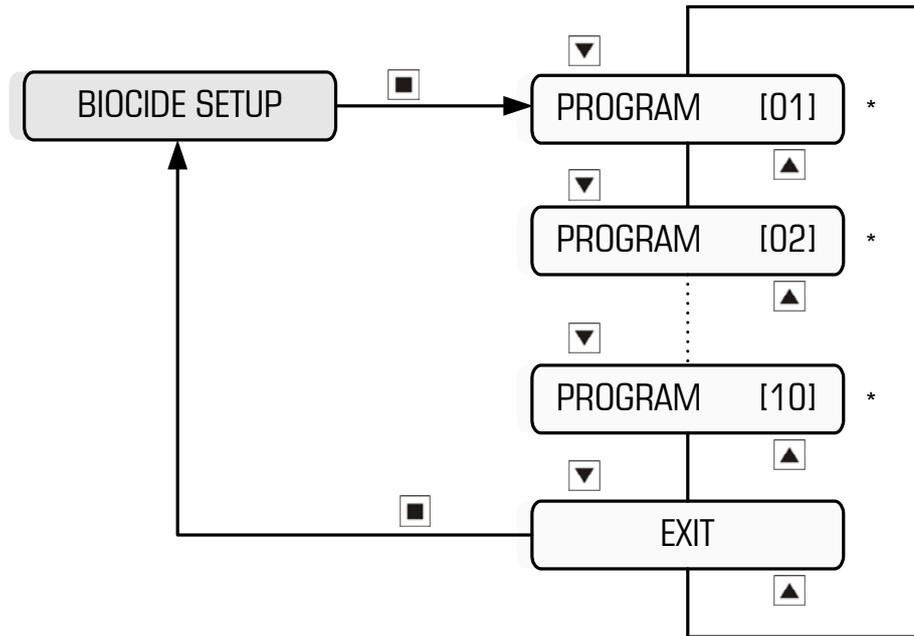
* Press ■ to access program settings

Main Menu > SETUP MENU > BIOCIDE SETUP > PROGRAM [02]

(see next page)

PROGRAM [02] ■ →	

Select Pump   [---]   Press ▼ or ▲ to toggle between -A- or -B-
      ■   (--- indicates inactive program)

WEEK 1   [NO]   Press ▼ or ▲ to toggle between YES & NO
      ■   Select YES to dose in WEEK selected

WEEK 2   [YES]   Press ▼ or ▲ to toggle between YES & NO
      ■   Select YES to dose in WEEK selected

WEEK 4   [YES]   Press ▼ or ▲ to toggle between YES & NO
      ■   Select YES to dose in WEEK selected

PRESS ENTER
      ■

DAY: Sun   [NO]   Press ▼ or ▲ to toggle between YES & NO
      ■   Select YES to dose on DAY selected

DAY: Mon   [YES]   Press ▼ or ▲ to toggle between YES & NO
      ■   Select YES to dose on DAY selected

DAY: Sat   [NO]   Press ▼ or ▲ to toggle between YES & NO
      ■   Select YES to dose on DAY selected

PRESS ENTER
      ■

START TIME: 14:00   Press ▼ or ▲ to select HH
      ■

START TIME: 14:15   Press ▼ or ▲ to select MM
      ■

Pre-Bleed: 00h00m   Press ▼ or ▲ to select HOURS
      ■

Pre-Bleed: 00h45m   Press ▼ or ▲ to select MINUTES
      ■

Dose for: 00h00m   Press ▼ or ▲ to select HOURS
      ■

Dose for: 00h30m   Press ▼ or ▲ to select MINUTES
      ■

Bleed L/O: 04h00m   Press ▼ or ▲ to select HOURS
      ■

Bleed L/O: 04h00m   Press ▼ or ▲ to select MINUTES

Example: Setting a Biocide Dosing Program (i.e. 2) to take place in Week 2 and Week 4, on a Monday beginning at 14:15. Biocide will be dosed for 30 minutes after a pre-bleed time of 45 minutes, after which bleed lockout will occur for 4 hours.

5.8 Pre-Bleed Setpoint

Main Menu > *SETUP MENU > PRE-BLD SETPOINT*

```
┌─────────────────┐        ■
│ PRE-BLD SETPOINT │ ──────────────►  ┌─────────────────────┐
└─────────────────┘                   │ PreBLD: Setp − 15% │
        ▲                             └─────────────────────┘
        │                                        │      ▼
        │                                        │
        │               ■                        ▼
        └──────────────────────────  ┌─────────────────────┐
                                      │ PreBLD: Setp − 10% │
                                      └─────────────────────┘
```
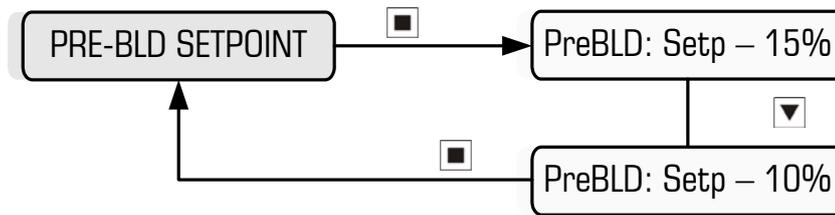
Example: Decreasing Pre-bleed Setpoint from Setpoint - 15% to Setpoint - 10%

In the example above, the Pre-Bleed setpoint is set as the Normal Conductivity Setpoint less 10%. Hence, during the Pre-bleed time (ie. Immediately before biocide dosing), the normal conductivity setpoint is reduced by 10%, and the controller will try to maintain this reduced setpoint until biocide dosing commences. The objective of pre-bleed is to allow for a longer Bleed Lock-out duration without the risk of entering scaling conditions.

5.9 Bleed Lock-out Setpoint

Main Menu > *SETUP MENU > LOCKOUT SETPOINT*

```
┌─────────────────┐        ■
│ LOCKOUT SETPOINT │ ──────────────►  ┌─────────────────────┐
└─────────────────┘                   │ Lock/O: Setp + 20% │
        ▲                             └─────────────────────┘
        │                                        │      ▲
        │                                        │
        │               ■                        ▼
        └──────────────────────────  ┌─────────────────────┐
                                      │ Lock/O: Setp + 50% │
                                      └─────────────────────┘
```
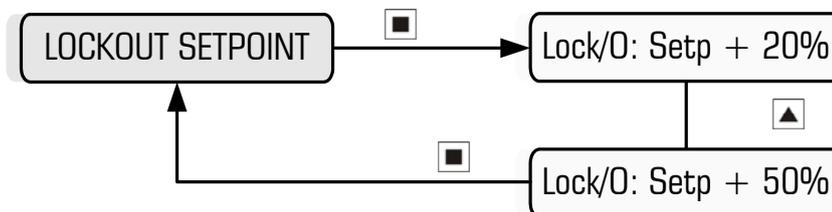
Example: Increasing Lockout Setpoint from Setpoint + 20% to Setpoint + 50%

In the example above, the Lockout setpoint is set as the Normal Conductivity Setpoint plus 50%. Hence, during Biocide Dosing and during the Lockout time (ie. Immediately after biocide dosing), the normal conductivity setpoint is increased by 50%, and the controller will try to maintain this increased setpoint until the Lockout Period expires. By preventing bleed-off during and after biocide dosing, the system is ensured of receiving maximum benefit from the dosed biocide, as no biocide will be lost during this time via bleed-off. Furthermore, because the conductivity is reduced during Pre-Bleed, the system has a longer retention period. As a result, a highly effective "kill" is achieved without resulting in high scaling conditions.

5.10 Auxiliary Output On Timer

Main Menu > *SETUP MENU > AUX O/P ON TIMER*

```
┌──────────────────┐    ■      ┌──────────────────┐
│ AUX O/P ON TIMER │──────────▶│ Biocid dose + 000m │
└──────────────────┘           └──────────────────┘
        ▲                                 │    ▲
        │              ■                  │
        │    ┌──────────────────┐         │
        └────│ Biocid dose + 015m │◀──────┘
             └──────────────────┘
```
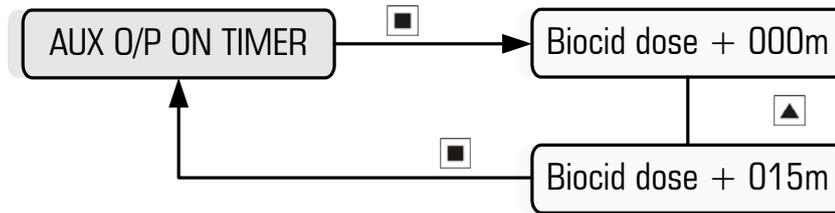
Example: Setting Auxiliary Output Timer to 15 minutes

Often when biocides are dosed into the manifold of the DIGICHEM-XP2 systems, the circulating/ condenser pump of the cooling tower is not running. This can cause problems of clogging and corrosion in the manifold, as well as biocide not being dosed into the cooling tower water.

The DIGICHEM-XP2 controller has an on-board relay contact (N/O) which can be wired into the condenser pump contactor (see wiring diagram in section 2.1). The contact provided is a dry contact so can be connected in series with the condenser pump contactor circuit, or any other circuit as required. Alternatively, the relay contact can power the contactor by looping 240VAC active to the common of the relay contact and connecting the N/O contact to the coil of the contactor. Note: In this instance, the contactor must have a 240VAC coil and must be normally powered from the same 240VAC mains circuit as the DIGICHEM-XP2.

When either biocide pump starts dosing, the N/O contact closes, powering the contactor which in turn starts the condenser pump. The condenser pump will continue to run while the biocide is dosing, as well as for a period of time after biocide dosing. This ensures continuous water circulation and effective mixing of the biocide chemical.

This time that the pump runs AFTER a biocide dose, is programmed here as the Auxilliary Output ON Time.

IMPORTANT: If this feature is used, it is not recommended to switch the condenser pump on and off rapidly using the output test feature, explained in section 4.4

The following is another example of a biocide program set to dose on a weekly cycle:

Start time:	07:00
Pre-Bleed:	00h60m (ie. 07h00 to 08h00)
Dose for:	00h60m (ie. 08h00 to 09h00)
Bleed L/O:	04h00m (ie. 09h00 to 13h00)

Other Program Settings

Setpoint	=	1000 TDS
Pre Bleed Setpoint	=	Setpoint – 13% (ie. 870 TDS)
Bleed Lock-out Setpoint	=	Setpoint + 50% (ie. 1500 TDS)
Program	=	01
Pump	=	A
Auxiliary Output On Timer	=	30m (i.e. delay off time after A dose)
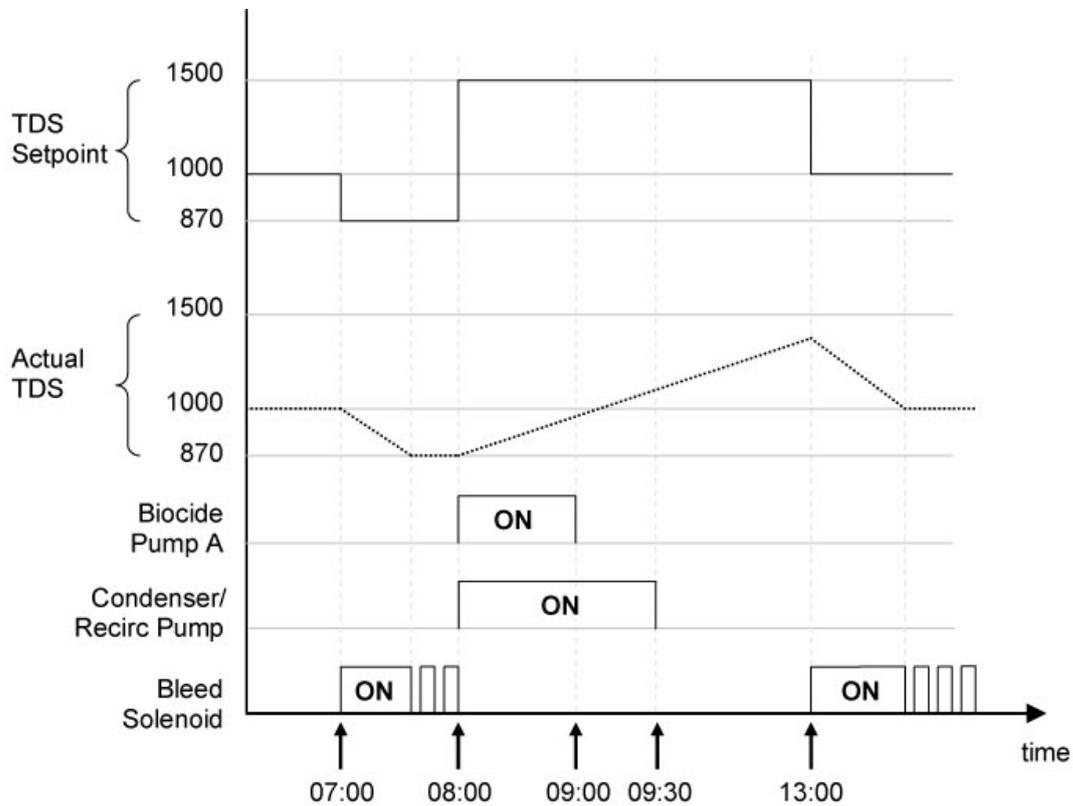
5.11 Flow Switch

Main Menu > *SETUP MENU > FLOW SWITCH*

If an optional flow switch (eg. AF04) is connected to the controller, any or all of the outputs can be disabled when there is no flow. An output, when selected via this menu for flow detection, will stop immediately if no flow is detected. For example, when bleeding, the solenoid valve will close immediately if no flow is detected.

There are 3 possible settings in the menu for the flow switch:

- DISABLE: All outputs activate if required, regardless of flow or no flow
- NORMAL: Enabled outputs activate if required, only if the flow switch input is shorted
- REVERSE: Enabled outputs activate if required, only if the flow switch input is open circuit
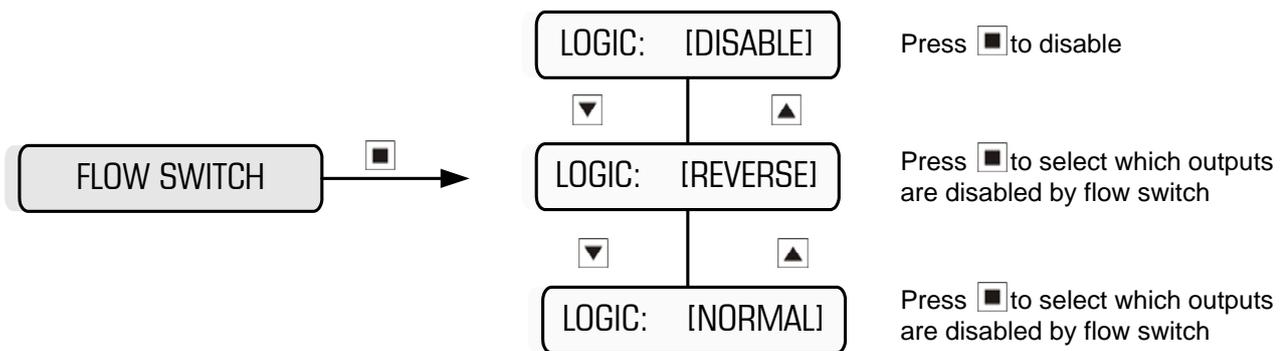
None, one, two, three or all four of the outputs can be selected to be disabled if there is no flow. Typically, the Bleed output and Inhibitor output are disabled if there is no flow and the Biocides dose during their programs regardless of the flow status. However, either or both of the Biocide outputs can be set to be disabled if there is no flow.

LOGIC: [NORMAL]	■ → F/S -> Bleed [Y]	Press ▼ or ▲ to toggle between Y & N Select Y to disable bleed on no flow
	■ F/S -> Bio 'A' [N]	Press ▼ or ▲ to toggle between Y & N Select Y to disable Biocide 'A' on no flow
	■ F/S -> Bio 'B' [N]	Press ▼ or ▲ to toggle between Y & N Select Y to disable Biocide 'B' on no flow
	■ F/S -> Inhibtr [Y]	Press ▼ or ▲ to toggle between Y & N Select Y to disable Inhibitor on no flow

Example: Disabling Bleed & Inhibitor outputs on no flow.
Biocide 'A' and Biocide 'B' dose irrespective of flow.

5.12 Data Logging

Main Menu > *SETUP MENU > DATA LOGGING*

DATA LOGGING	■ → LOG Every: 000m	Press ■ to leave function disabled
	▼ ▲ LOG Every: 060m	Press ■ once log period selected (max=240m)
	Log Days: 113.7 — then — Formatting …	
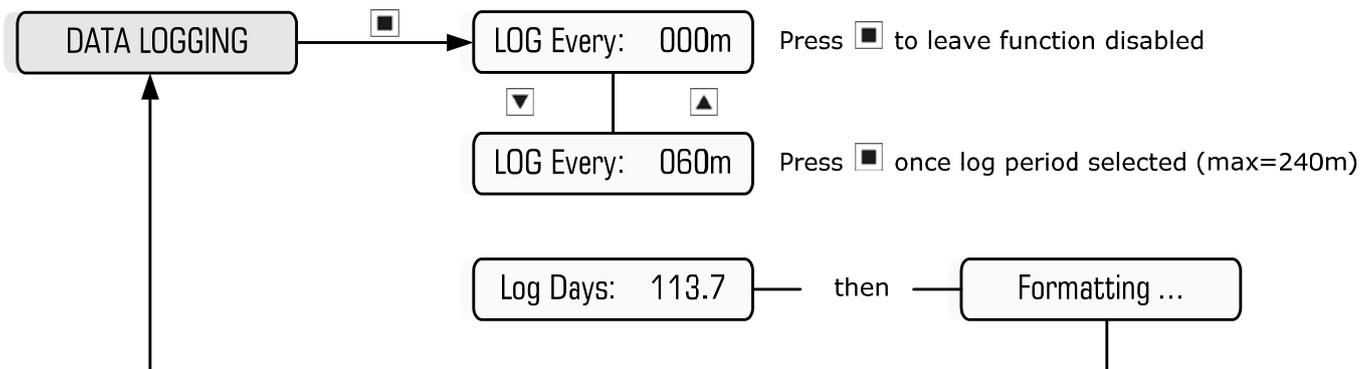
Example: Setting the controller to log every 60 min

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

- Date
- Time
- Conductivity reading (in TDS or µS)
- Temperature
- Percentage of time the Flow Switch was registering flow
- Percentage of time the Bleed Output was active
- Percentage of time the Inhibitor Pump was dosing
- Percentage of time the Biocide A Pump was dosing
- Percentage of time the Biocide B Pump was dosing
- Percentage of time the Common Alarm was 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 9.4 days for a log taken every 5 minutes, 56.8 days for a log taken every 30 minutes, or for 455 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, to perform a direct download to a pc or laptop.

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
Units	TDS (ie ppm Total Dissolved Solids)
Bleed Setpoint	1000 ppm TDS
Hysteresis	3%
Bleed Cycle	ON/OFF = 00s/00s (ie. Disabled)
High Conductivity Alarm	0000 ppm TDS (ie. Disabled)
Low Conductivity Alarm	0000 ppm TDS (ie. Disabled)
No Flow Alarm	Enable? [No]
Delay on Alarm	Trip Delay: 0008s
Bleed Timer Alarm	Max Bleed: 000m (ie. Disabled)
Inhibitor Mode	On bleed
Inhibitor Duty Cycle	ON/OFF = 0050s/0050s (ie. On Bleed Only)
Biocide Programs	All programs disabled
Pre-Bleed Setpoint	Setpoint -15%
Bleed Lockout Setpoint	Setpoint +20%
Aux O/P On Timer	Biocide Dose + 000m
Flow Switch Logic	Disabled (ie no flow switch fitted)
Outputs disabled on no flow *	Bleed & Inhibitor
Data Logging	LOG Every: 000m (ie. Logging disabled)

* only if flow switch fitted and flow switch logic enabled

Item	Specification
Power Supply	220-240VAC, 50/60Hz
Power Consumption	10W max (with no loads on outputs)
Inputs	Conductivity Probe (incl.) Water meter volt-free contact (optional) Flow switch (optional, code AF04)
Auxiliary Mains Output	240VAC continuous (2A fused)
Control Output	2A/250VAC (fused)
Alarm Relay Output	N/O & N/C (10A/250VAC resistive)
Condenser Pump (Aux) Relay Output	N/O (10A/250VAC resistive)
Optional Outputs	4-20mA (P/N AF09) 4-20mA plus events (P/N AF10) 4mA = 0 µS/TDS, 20mA = 5000 µS/TDS
Measured Conductivity Resolution	1µS / 1 ppm TDS
Accuracy	0.5% of measured range
Repeatability & drift	1.0% of measured range
Logged Items	Controller Model, Software version, No of log entries, Controller ID No, Date, Time, Conductivity, Temperature, Flow %, Bleed %, Inhibitor %, Biocide A %, Biocide B %, Alarm %
Data retention	100 years
Battery backup	1 year (approx)
Enclosure rating	IP55
Operating Temperature	0 - 50°C

Important: Please note the serial number and product/system part number before calling for assistance.

Company details ———

Part number &
description of controller ———

Controller unique
Serial Number ———

Company Pty Ltd
Street, Suburb, State Postcode
Tel: ( )   Fax: ( )
E-mail

Part No: DIGICHEM-Plus+
Description: Cooling Tower Controller
Serial No: 0804070613

220-240 VAC	50/60Hz	10W	IP65

warranty void if label removed   N1665

——— Enclosure rating

——— C-tick logo & registration number

——— Device power consumption

Supply voltage &
frequency ———

Example of Controller Info Label
(Adhered to Controller Enclosure)

Note:
1. Controllers incorporated in a system, have the same serial numbers as the system itself.
2. The First 6 digits of serial is the date of manufacture (yymmdd)