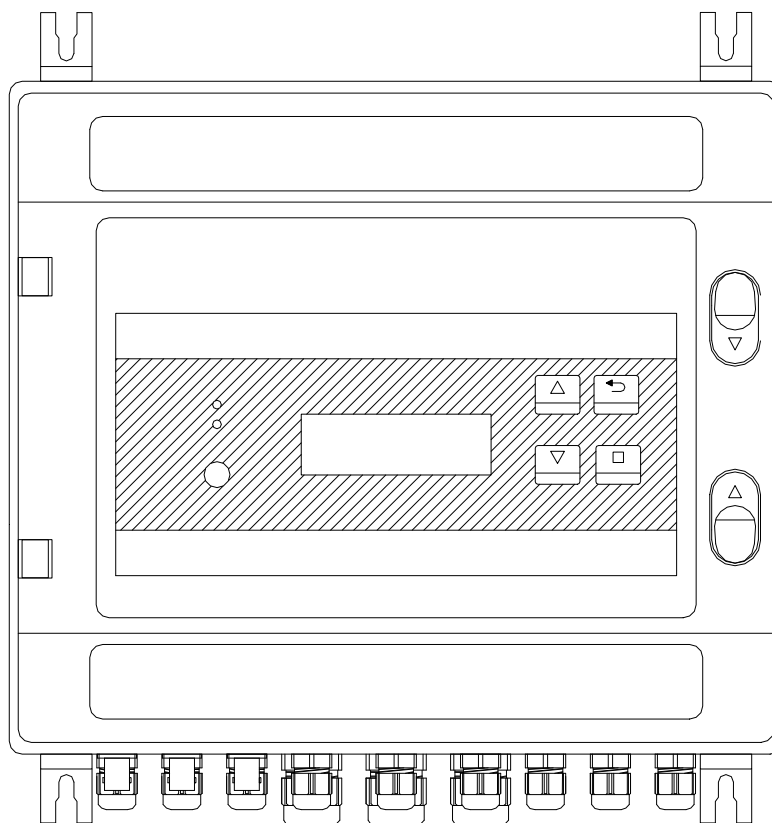# Instruction **Manual**

Instruction Manual for
Water Treatment Controller
Model: **DIGICHEM**® Plus⁺
(All software versions to 1.07)

Fill in serial
number here ⇨ [   ] Refer to
back page

Supplied by:

Convergent Water Controls Pty Ltd
2/4 Huntley Street, PO Box 7058
Alexandria NSW 2015

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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.

Table of Contents

1. Introduction

Primarily designed for cooling tower water treatment, the DIGICHEM Plus+ electronic controller incorporates the following key features:

- Conductivity bleed control
- pH Control
- ORP Control
- Dispersant pump dosing control
- Inhibitor pump dosing control
- Dual Biocide pump control (via 10 independent 28-day timer programs)
- On Board Data logging
- Tower circulating/condenser pump override facility with delay-off timer
- High and Low Conductivity, pH & ORP alarms with programmable trip delay
- Internet Connectivity

Mount the DIGICHEM Plus+ 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.

Please refer to the detailed installation instructions for the system you have ordered (supplied with system).

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 show the connections to the DIGICHEM Plus+ controller circuitry:
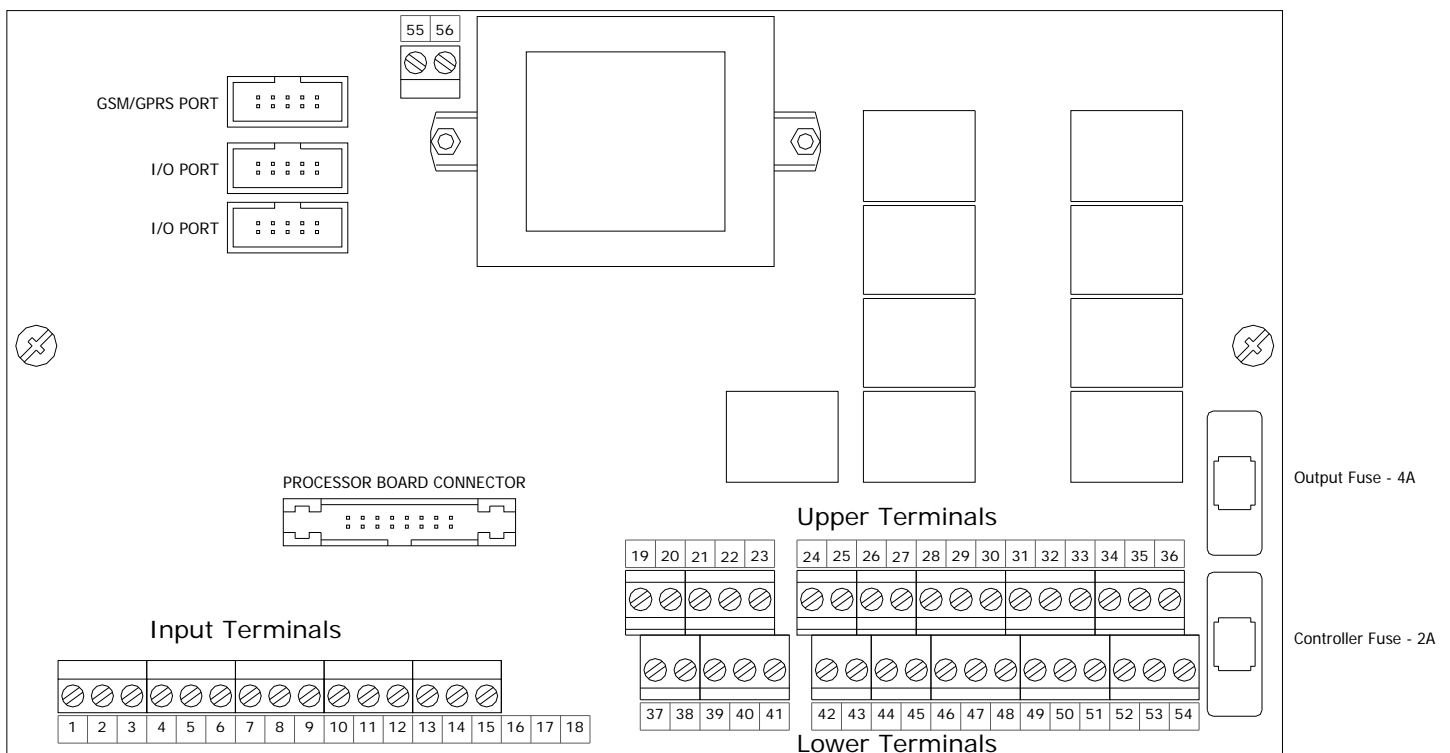
Terminal Number	Description
55	Mains Output Active (240VAC)
56	Mains Output Neutral

Earth Terminals Power Terminals

Input Terminals
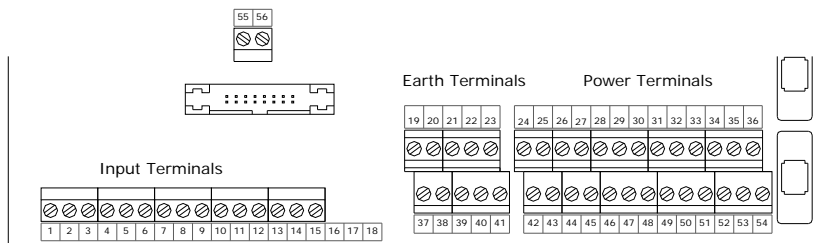
Terminal Number	Description
1	ORP Probe Signal (White)
2	ORP Probe Common (Green)
3	Ground Probe
4	pH Probe Signal (White)
5	pH Probe Common (Green)
6	Conductivity Probe PR+ (Red)
7	Conductivity Probe PR- (Yellow)
8	Conductivity Probe CM+ (Blue)
9	Conductivity Probe Screen (Grey)
10	Flow Switch
11	Flow Switch
12	Water Meter - Make Up
13	Water Meter - Make Up
14	Water Meter - Bleed
15	Water Meter - Bleed
16	Spare
17	Spare
18	Spare

Terminal Number	Description
19	Common Earth
20	Common Earth
21	Common Earth
22	Common Earth
23	Common Earth
24	Alarm N/C (Volt-Free)
25	Alarm N/O (Volt-Free)
26	Alarm Common
27	Auxiliary Output Active (240VAC)
28	Dispersant Output Active (240VAC)
29	pH Output Active (240VAC)
30	Biocide B Output Active (240VAC)
31	Biocide B Output Active (240VAC)
32	Biocide A Output Active (240VAC)
33	Inhibitor C Output Active (240VAC)
34	Solenoid Output Active (240VAC)
35	Mains Output Active (240VAC)
36	Mains Supply Active (240VAC)

Terminal Number	Description
37	Common Earth
38	Common Earth
39	Common Earth
40	Common Earth
41	Common Earth
42	Condenser Pump Common
43	Condenser Pump N/O (Volt-Free)
44	Auxiliary Output Neutral
45	Dispersant Output Neutral
46	pH Output Neutral
47	Biocide B Output Neutral
48	Biocide B Output Neutral
49	Biocide A Output Neutral
50	Inhibitor C Output Neutral
51	Solenoid Output Neutral
52	Mains Output Neutral
53	Mains Supply Neutral
54	Mains Earth

Fuses: Controller fuse: 2A/250VAC (M205, 20mm x 5mm diameter)
Output fuse: 4A/250VAC (M205, 20mm x 5mm diameter)

Notes on Alarm Relay Contacts :

1. Alarm relay is energised (ie. 25 connected to 26) during normal operation of the unit.
2. Alarm relay de-energises (ie. 24 connected to 26) 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 is required to be connected to terminals 10 & 11 (not polarity sensitive). The flow switch logic is programmable via the menu.

Notes on Water Meter Inputs:

Water meters with Volt-free pulse outputs (e.g. Reed switches) are required for Make-Up & Bleed water meter inputs.
For Mag-flow water meters with opto-coupled outputs, use terminals 12 & 14 for the +, and terminals 13 & 15 for the – inputs from the water meter.

NOTE: Terminals 55 & 56 may be omitted.

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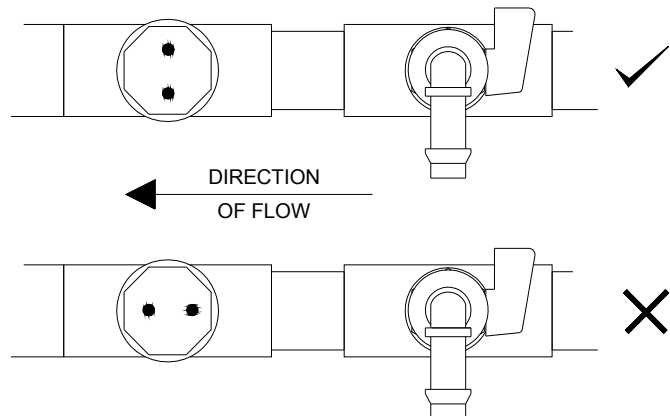
The probe's electrodes should periodically be cleaned to maintain accurate TDS measurements. The frequency of cleaning required will vary from one application to another. In a new installation, it is recommended that the probe be cleaned after 2 weeks of service.

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.

3.1 Menu Logic

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

- The menu structure is circular
- The relevant menu item, or programmed value flashes on the display, and is shown as bold letters or numbers when explained in this instruction manual.
- 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 BACK pushbutton can be pressed at any time to exit from a current menu to a previous menu screen, or to not save any edited settings
- The LCD is backlit

The MAIN MENU of the controller is illustrated as follows:
(Software ver 0.80 & later)

Main Menu
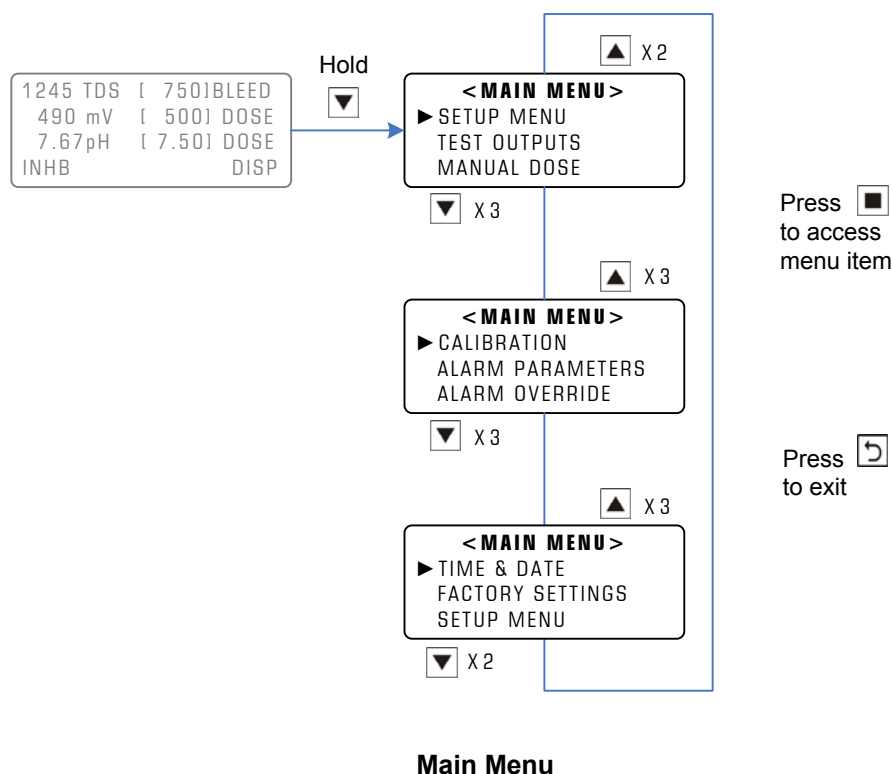
Note: If password protection is enabled, the controller will ask you to enter your password before allowing you to enter this menu.

3.2 Pushbuttons

The DIGICHEM Plus+ has 4 pushbuttons each of which have dual functions:

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

- 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.

- The **BACK** ↲ pushbutton allows you to exit from any menu, as well as to exit from any screen without saving values, should you have changed any values without pushing the ENTER pushbutton.

- 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:

```
1245 TDS  [ 750]BLEED
 490 mV   [ 500] DOSE
 7.67pH   [ 7.50] DOSE
      7 Jul 2008
```
alternates with
```
1245 TDS  [ 750]BLEED
 490 mV   [ 500] DOSE
 7.67pH   [ 7.50] DOSE
 Mon 14:47-53 Week1
```
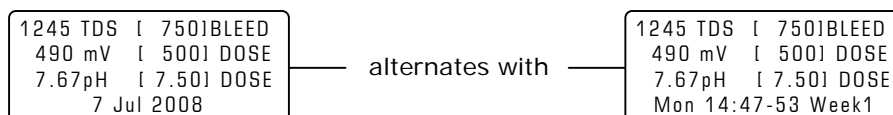
   NOTE:
   The Time & Date is programmable, but the Week No is automatically set. Hence, if you have multiple controllers in the field, the Week No will be the same on all (assuming the Time & Date are programmed correctly).

- To get into the menus of the DIGICHEM Plus+, hold down the Scroll DOWN (Main Menu) pushbutton. The display will count down until you access the menus. If password protection is enabled, the controller will ask you to enter your password before allowing you to enter this menu.

- 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 Controller Display Information

BLEED is displayed when power is applied to the bleed solenoid output of the controller. If the solenoid output is suspended due to a pause in the bleed cycle, 'pause' will be displayed here.

INHB is displayed when power is applied to the Inhibitor output of the controller. If the Inhibitor output is suspended due to no flow, the display will say NO FLOW.

```
1245 TDS  [ 750]BLEED
 475 mV   [  50]DOSE
7.17 pH   [7.50]pause
INHB BIOA BIOB
```

DOSE is displayed when power is applied continuously to the ORP output of the controller. If the ORP output is suspended due to a pause in the control cycle, 'pause' will be displayed here.

BIOA is displayed when power is applied to the Biocide A output of the controller.

If ORP control is disabled, BIOB is displayed here when power is applied to the Biocide B output of the controller.

'pause' is displayed when the pH output is suspended due to a pause in the control cycle. If the pH output is then energised due to the controller function, 'DOSE' will be displayed here.

If the pH or mV output is suspended due to the program being inactive in a 28 day time cycle, 'idle' will be displayed here.

If ORP control is enabled, then the Biocide B relay is used for the ORP output, and BIOB will not be displayed. DOSE will still be displayed next to the mV setpoint.

If pH or ORP control is disabled, 'off' will be displayed here.

Notes: (v0.91 or later)
- If a pulse from a make-up water meter is received, a '+' will be displayed momentarily
- If a pulse from a bleed water meter is received, a '-' will be displayed momentarily

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-USB-1, to perform a direct download to a pc or laptop via the USB port.

4. Commissioning

CAUTION: Refer to previous section before reading this section

4.1 Start-Up

Connect Power to 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).
Also displayed will be the measured pH, pH Setpoint within square brackets, measured ORP value, and the ORP Setpoint within square brackets.

Depending on the measured values, the controller may also display control functions of those illustrated in Section 3.3 for Controller Output Indication. An example of a start up screen is shown below:
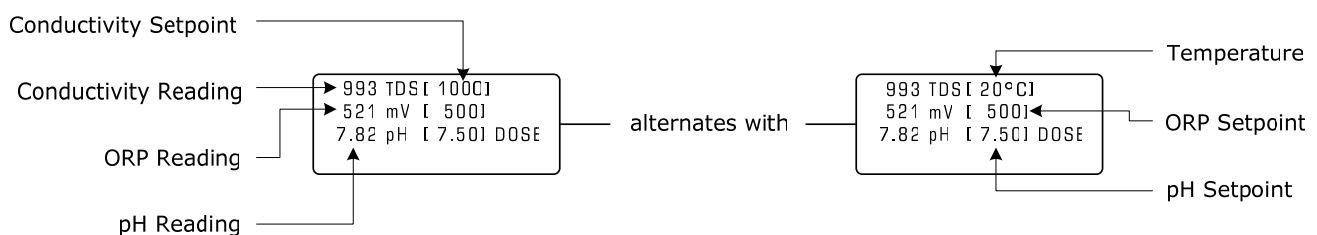
Other information that you may see on the display, which alternates with the display above:

- When an alarm is reported, the actual alarm message will be periodically displayed in the specific area on the main screen, for that alarm. Please see the example below:
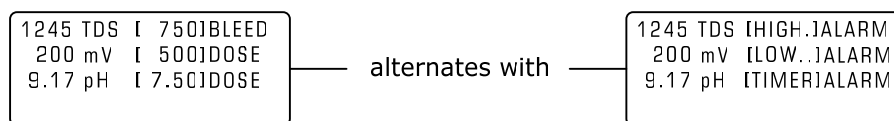
Example: Various Alarms for TDS, ORP and pH being displayed

- When a flow switch is connected to the controller, each output is suspended when there is no flow past the flow switch. The outputs that would be suspended are only those that are selected via the Flow Switch Menu.

```
1245 TDS [  750]pause
 200 mV  [  500]DOSE
9.17 pH  [ 7.50]DOSE
        NO FLOW
```
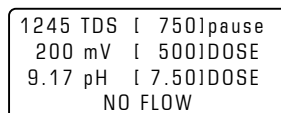
Example: No Flow Condition for Flow Switch Enabled on Bleed

4.1.1 Start-Up Delay

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

The Start-Up Delay feature is used to delay the operation of all control functions of the DIGICHEM Plus+ Controller upon initial power up.

This could be used if it was necessary for the system water to circulate adequately, for example to sufficiently mix chemicals in the water before controlling the pH, ORP or conductivity.
This would also ensure the readings of these variables to first stabilise before commencing control.

The example below illustrates setting the Start-Up Delay to 6 minutes (or 360 seconds).
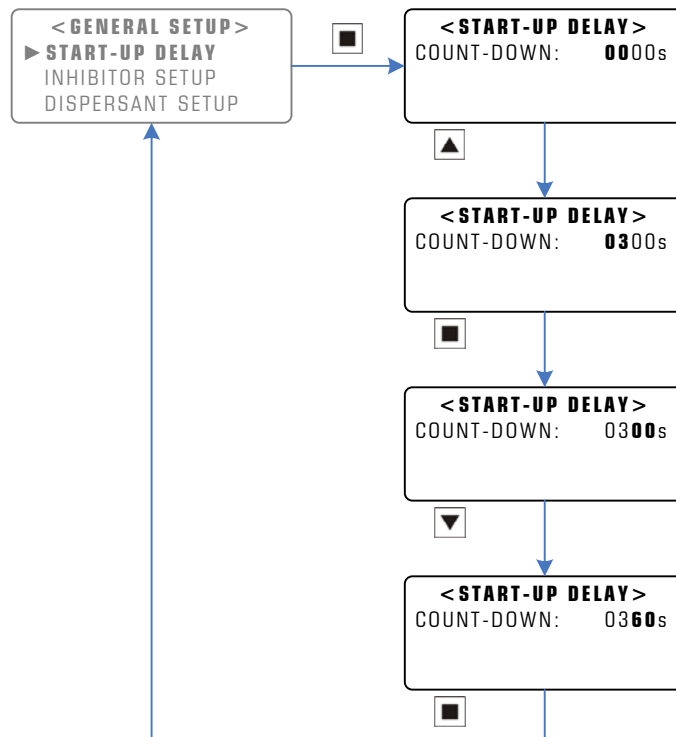
Example: Increasing the Start-Up Delay from 0 seconds to 360 seconds

NOTE: The Start-Up delay will also take effect upon resumption of flow.

4.2 Setting Time & Date

Main Menu > TIME & DATE

```
<MAIN MENU>          ■          <TIME & DATE>              Press ▼ or ▲ then ■
►TIME & DATE                    Time:      14:00           to alter hours and
 FACTORY SETTINGS               Date:    01 JAN 2007        minutes
 SETUP MENU

                                     ■

                                <TIME & DATE>              Press ▼ or ▲ then ■
                                Time:     15:30            to alter day, month
                                Date:   09 NOV 2007         and year

                                     ■
```
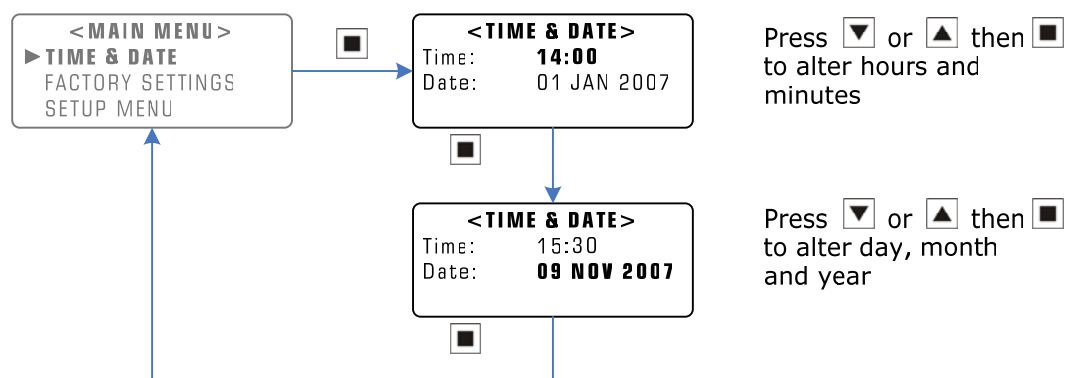
Example: Setting the Time and Date to 15:30 on the 9 Nov 2007

NOTE: The Week Number will be automatically set

4.3 Calibration

Main Menu > CALIBRATION

The Calibration menu has the following displays:

```
                                     ▲ X 2
<MAIN MENU>          ■          <CALIBRATION>
►CALIBRATION                    ►CALIBRATE μS/TDS          Press ■
 ALARM PARAMETERS                CALIBRATE ORP             to access
 TIME & DATE                     CALIBRATE pH              menu item
                                     ▼ X 2

                                     ▲ X 2
                                <CALIBRATION>              Press ↺
                                ►CALIBRATE pH              to return to
                                 CALIBRATE μS/TDS          main menu
                                 CALIBRATE ORP
                                     ▼ X 2
```
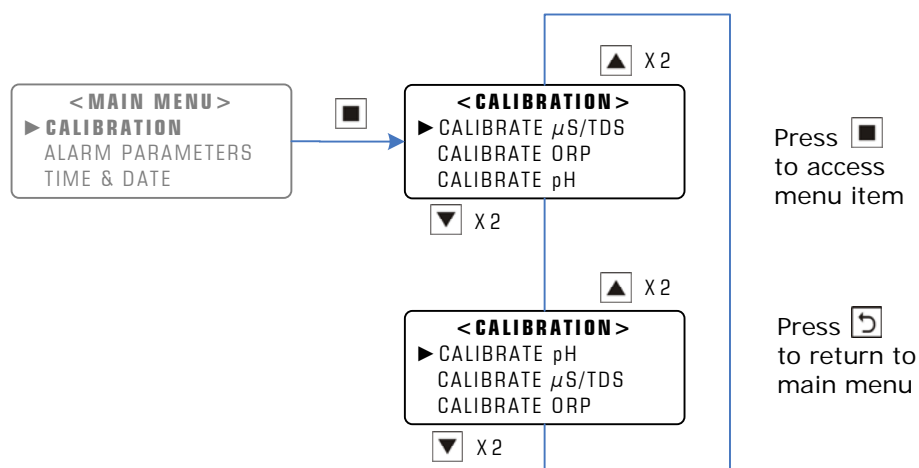
Calibration Menu

NOTE: Version 1.07 includes CALIBRATE °C for temperature calibration

4.3.1 Temperature (°C) Calibration - ver 1.07 and later

Main Menu > CALIBRATION > CALIBRATE °C

Measure the temperature of the water in the tower basin with an independent temperature sensor / thermometer. Simply adjust the temperature reading in the calibration menu to the desired temperature and press ENTER.

If the temperature sensor is faulty or the probe is not connected, an error message will be displayed.

4.3.2 Conductivity (TDS / µS) Calibration

Main Menu > CALIBRATION > CALIBRATE µs/TDS

IMPORTANT: Select the display in either µS or TDS before proceeding.
(Refer section 5.1.1)

Calibrating the TDS SLOPE

Main Menu > CALIBRATION > CALIBRATE µs/TDS > SLOPE CAL µS/TDS

Take a sample of water from the

```
<CALIBRATION>              ■      <CALIBRATE μS/TDS>
►CALIBRATE μS/TDS                 ►SLOPE CAL. μS/TDS
 CALIBRATE ORP                     ZERO CAL. μS/TDS
 CALIBRATE pH                      RESET μS/TDS CAL.
```

```
                                   ■
```

```
                                  <SLOPE CAL. μS/TDS>
                                  μS/TDS:          0845
```

```
                                   ▲
```

```
                                  <SLOPE CAL. μS/TDS>
                                  μS/TDS:          0945
```

```
                                   ■
```

```
                                  <SLOPE CAL. μS/TDS>
                                  μS/TDS:          0945
```

```
                                   ▼
```

```
                                  <SLOPE CAL. μS/TDS>
                                  μS/TDS:          0900
```

```
                                   ■
```

```
 900 TDS  [ 750]BLEED             Calibrating...
 495 mV   [ 500] DOSE
 7.52 pH  [ 7.50] DOSE
```

To main screen
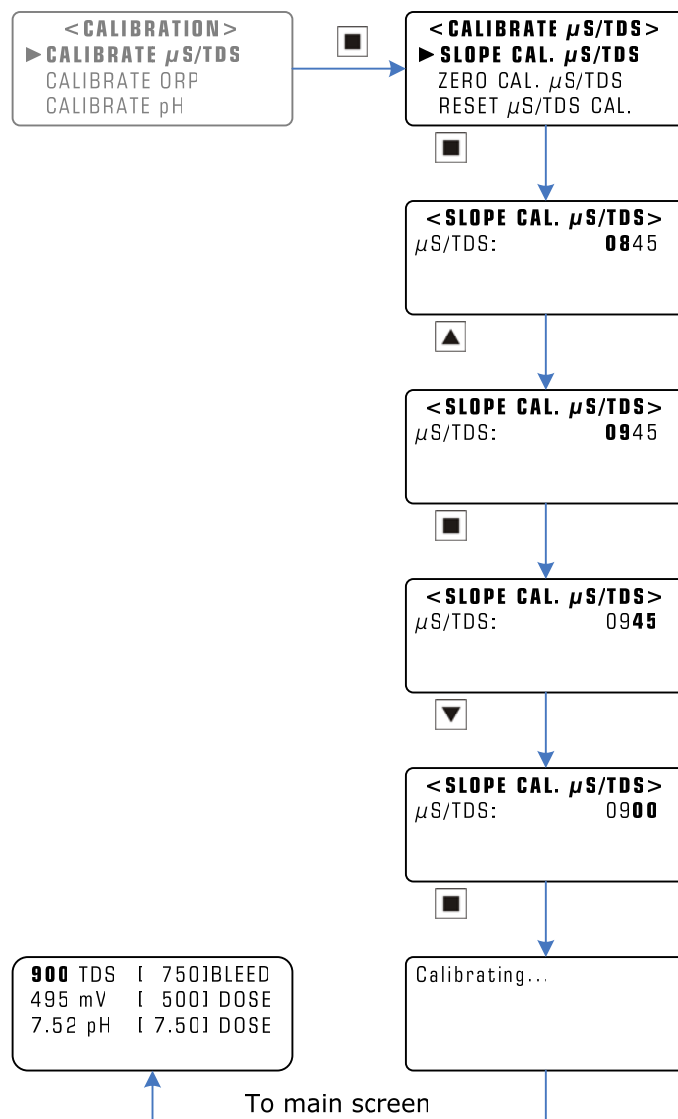
Example: Calibrating the Slope Value from 845 TDS to 900 TDS

Calibrating the µS/TDS ZERO

Main Menu > *CALIBRATION > ZERO CAL µS/TDS*

The zero is factory set so should not require calibration. However, if the display reads above zero with the conductivity probe disconnected, or with the probe dry, 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 to the Calibrate Menu and set the Zero Calibration (see next page).
5. Screw the probe back into the manifold.
6. Perform the SLOPE calibration again.

Alternative zero calibration procedure:

1. Disconnect the cable from the back of the probe.
2. 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.
3. Go to the Calibrate Menu and set the Zero Calibration (see below).
4. Re-connect the cable to the probe securely.
5. Perform the SLOPE calibration again.

```
<CALIBRATION>                    <CALIBRATE µS/TDS>
► CALIBRATE µS/TDS      ■       ► SLOPE CAL. µS/TDS
  CALIBRATE ORP                   ZERO CAL. µS/TDS
  CALIBRATE pH                    RESET µS/TDS CAL.
                                         ▼

                                 <CALIBRATE µS/TDS>
                                ► ZERO CAL. µS/TDS
                                  RESET µS/TDS CAL.
                                  SLOPE CAL. µS/TDS
                                         ■

                                 <ZERO CAL. µS/TDS>
                                 Confirm?        [NO ]

                                         ▼

                                 <ZERO CAL. µS/TDS>      Ensure cable is
                                 Confirm?        [YES]   disconnected from
                                                         probe, or the probe is
                                                         completely dry before
                                                         confirming
                                         ■

    0 TDS  [ 750]BLEED           Calibrating...
  495 mV   [ 500] DOSE
 7.52 pH   [ 7.50] DOSE


              To main screen
```
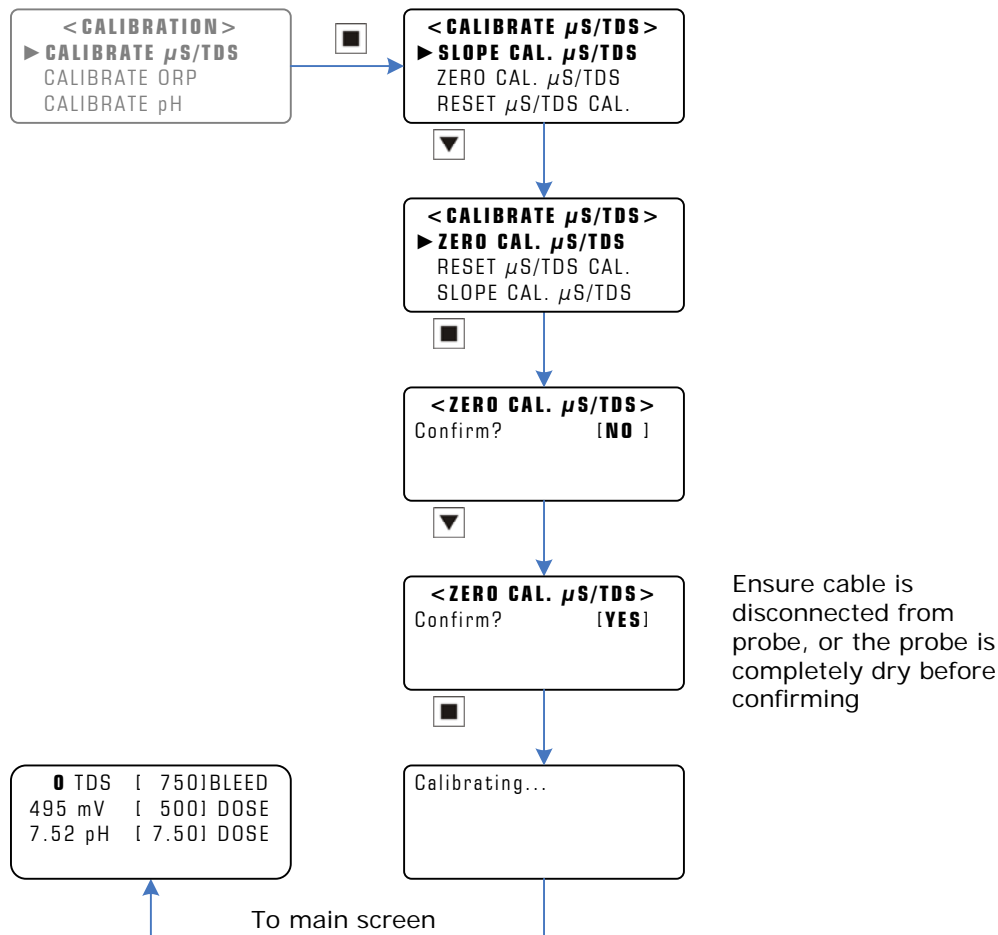
Calibrating the Zero for µS/TDS

Resetting the TDS CALIBRATION

Main Menu > CALIBRATION > RESET µS/TDS CAL.

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.

See diagram on the following page to reset the calibration:

```
<CALIBRATION>          ▣        <CALIBRATE µS/TDS>
►CALIBRATE µS/TDS               ►SLOPE CAL. µS/TDS
  CALIBRATE ORP                  ZERO CAL. µS/TDS
  CALIBRATE pH                   RESET µS/TDS CAL.

                                        ▼ X2

                                <CALIBRATE µS/TDS>
                                ►RESET µS/TDS CAL.
                                 SLOPE CAL. µS/TDS
                                 ZERO CAL. µS/TDS

                                        ▣

                                <RESET µS/TDS CAL.>
                                Reset?          [NO ]

                                        ▼

                                <ZERO CAL. µS/TDS>
                                Reset?          [YES]

                                        ▣

    0 TDS  [ 750]BLEED          Please Wait...
  495 mV   [ 500] DOSE
 7.52 pH   [ 7.50] DOSE


            To main screen
```
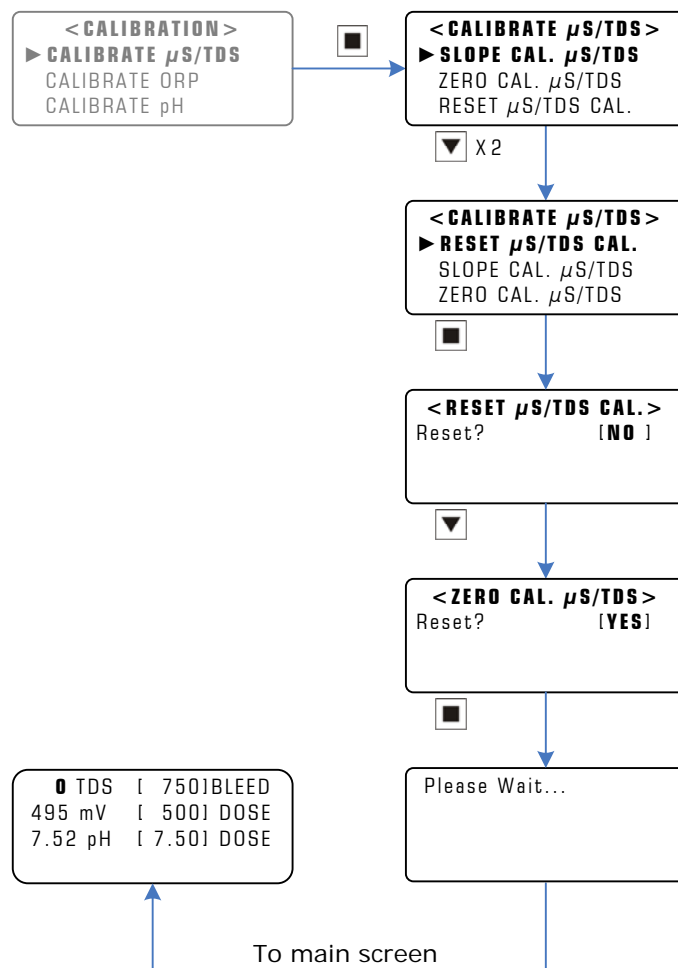
Resetting the µS/TDS Calibration

4.3 3 ORP mV Calibration

Main Menu > *CALIBRATION > CALIBRATE ORP*

NOTE: The DIGICHEM Plus+ 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:

Putting the controller into CALIBRATE mode automatically 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.
The ground probe is automatically enabled again when you exit ORP calibration.

Calibrating the ORP SLOPE

Main Menu > *CALIBRATION > CALIBRATE ORP > SLOPE CAL. ORP*

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.

```
<CALIBRATION>              ■        <CALIBRATE ORP>
►CALIBRATE ORP                      ►SLOPE CAL. ORP
 CALIBRATE pH                        ZERO CAL. ORP
 CALIBRATE µS/TDS                    RESET ORP CAL.
                                          ■
```

Ensure ORP probe is in standard solution before proceeding. Do not immerse ground probe in solution.

```
                           <SLOPE CAL. ORP>
                                517 mV
                           ENTER to Calibrate
                              BACK to Exit
                                   ■
```

Press ■ when reading stabilises or

Press ↩ to return to the main screen once reading has been calibrated

```
                           <SLOPE CAL. ORP>
                           ORP(mV)      0517
                                   ▼
```

```
                           <SLOPE CAL. ORP>
                           ORP(mV)      0417
                                   ■
```

To Calibration screen – display should now read 475 mV

```
                           <SLOPE CAL. ORP>
                           ORP(mV)      0417
                                   ▲
```

```
                           <SLOPE CAL. ORP>
                           ORP(mV)      0475
                                   ■
```

```
                           Calibrating...
```

Example: Calibrating the ORP Slope Value from 517mV to 475mV

Calibrating the ORP ZERO

Main Menu > *CALIBRATION > CALIBRATE ORP > ZERO CAL. ORP*

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.

```
<CALIBRATION>
►CALIBRATE ORP
 CALIBRATE pH
 CALIBRATE µS/TDS
```
[■]

```
<CALIBRATE ORP>
►SLOPE CAL. ORP
 ZERO CAL. ORP
 RESET ORP CAL.
```
[▼]

```
<CALIBRATE ORP>
►ZERO CAL. ORP
 RESET ORP CAL.
 SLOPE CAL. ORP
```
[■]

Only proceed if 0mV is applied at ORP BNC input connector

```
<ZERO CAL. ORP>
      --- mV
 ENTER to Calibrate
   BACK to Exit
```
[■]

--- mV Reading depends on current mV being measured

Press ↵
to return to main screen

To Calibration screen – display should now read 0 mV

```
Calibrating...
```
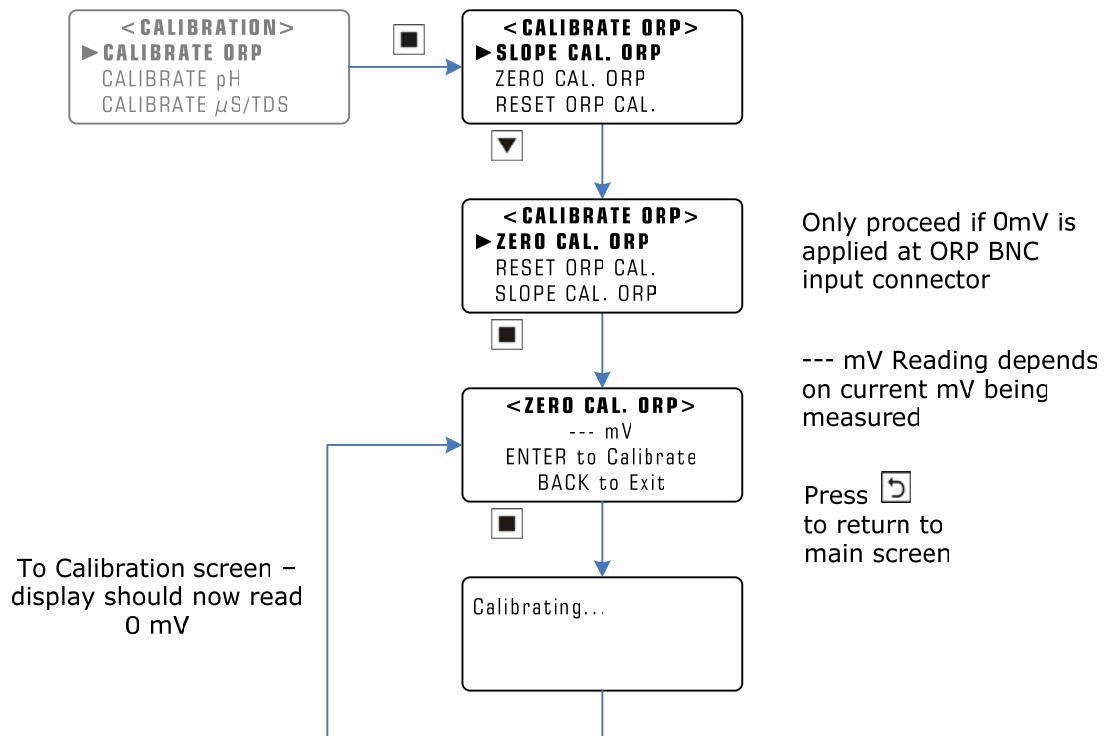
Calibrating the Zero for ORP

Resetting the ORP CALIBRATION

Main Menu > *CALIBRATION > CALIBRATE ORP > RESET ORP CAL.*

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.

```
 <CALIBRATION>          ■        <CALIBRATE ORP>
►CALIBRATE ORP                  ►SLOPE CAL. ORP
 CALIBRATE pH                    ZERO CAL. ORP
 CALIBRATE µS/TDS                RESET ORP CAL.

                                 ▼ X2

                                 <CALIBRATE ORP>
                                ►RESET ORP CAL.
                                 SLOPE CAL. ORP
                                 ZERO CAL. ORP

                                 ■

                                 <RESET ORP CAL.>
                                 Reset?        [NO ]

                                 ▼

                                 <RESET ORP CAL.>
                                 Reset?        [YES]

                                 ■

 850 TDS [ 750]BLEED             Please Wait...
   0 mV  [ 500] DOSE
 7.52 pH [ 7.50] DOSE
```

To main screen
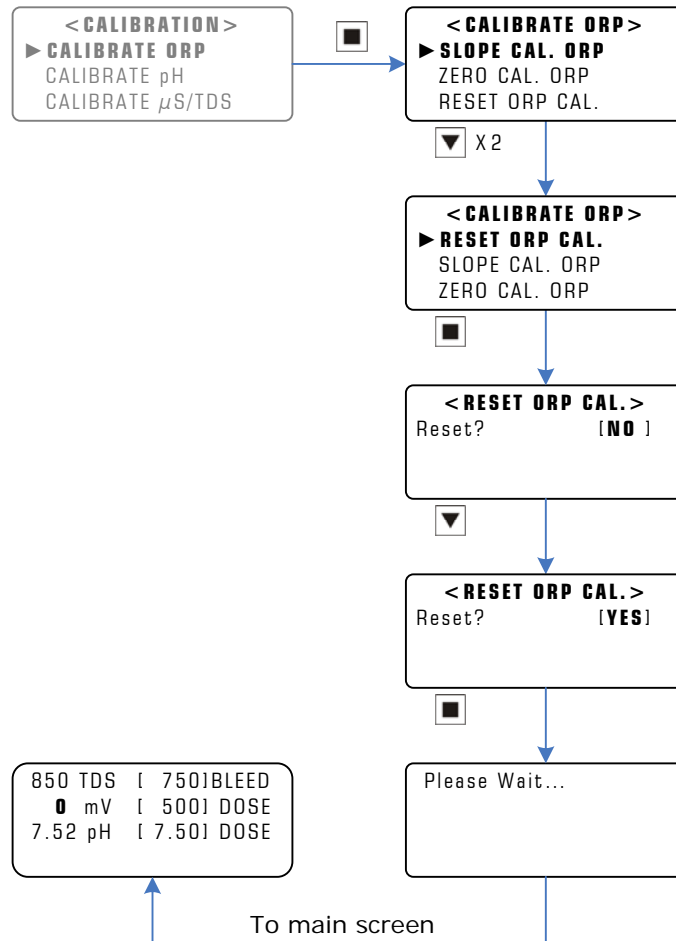
Resetting the ORP Calibration

4.3 4 pH Calibration

Main Menu > *CALIBRATION > CALIBRATE pH*

The controller should automatically detect what buffer you are using. If not, the pH sensor may be faulty, or the controller might require a calibration reset only or possibly a factory and calibration reset.

NOTE: When calibrating, if the measured pH still deviates from that of the buffer after pressing ENTER, then press the ENTER pushbutton again. This can be repeated until the reading becomes stable.

Please also note that if the ENTER button is not pressed after approximately 4 minutes, the controller will time-out and enter the main screen. Therefore if a lengthy duration of calibration is required, please make sure the ENTER button is pressed at least once within a 4 minute time interval.

Please note that a buffer of 7 must always be used as one of the 2 buffers when calibrating pH. The second buffer can be either 4, 9 or 10.

If the calibration is not done successfully, the controller will momentarily display:

```
CALIBRATE INCOMPLETE
```

The controller will then exit to the main screen.
If this is the case, then repeat the calibration procedure.

See an example of pH calibration on the following page:

```
<CALIBRATION>
►CALIBRATE pH
 CALIBRATE µS/TDS
 CALIBRATE ORP
```

■

```
<CALIBRATE pH>
►START CALIBRATION
 RESET pH CAL.
 .
```

■

```
<CALIBRATE pH>
Disconnect pH Probe
Put probe in BUFFER
Then Press ENTER
```

Follow the instructions on screen.

■

```
<CALIBRATE pH>
Re-connect pH Probe

ENTER to Calibrate
```

■

```
<CALIBRATE pH>
6.50 pH
pH BUFFER [ 7]
ENTER to Calibrate.
```

With pH probe in a pH buffer of 7, wait for reading to settle and auto-detect. Do not immerse ground probe in pH buffer solution.

Press ■
when the reading is stable

■

```
Calibrating...

```

```
<CALIBRATE pH>
7.00 pH
pH BUFFER [ 7]
ENTER to Calibrate.
```

Now Insert pH probe in a pH buffer of 10 and wait for reading to settle and auto-detect. Do not immerse ground probe in pH buffer solution.

```
<CALIBRATE pH>
9.92 pH
pH BUFFER [10]
ENTER to Calibrate.
```

Press ■
when the reading is stable

Note: Buffers of pH 4, or pH 9 can also be used.

■

```
Calibrating...

```

```
<CALIBRATE pH>
10.00 pH
pH BUFFER [10]
ENTER to Calibrate.
```

Press ↺
when calibration on 2 buffers is complete.

↺

```
850 TDS  [ 750]BLEED
450  mV  [ 500] DOSE
7.00 pH  [ 7.50] DOSE
```

```
CALIBRATE SUCCESSFUL

```

If the calibration is incomplete, redo this calibration procedure.

To Main Screen

Example: Calibrating the pH for a reading of 6.5 pH in a 7 pH Buffer Solution, and a 9.92 pH reading in a pH Buffer Solution of 10 pH

Resetting the pH CALIBRATION

Main Menu > *CALIBRATION > CALIBRATE pH > RESET pH CAL.*

NOTE: Once a pH Reset has been done, a pH calibration will be
required.
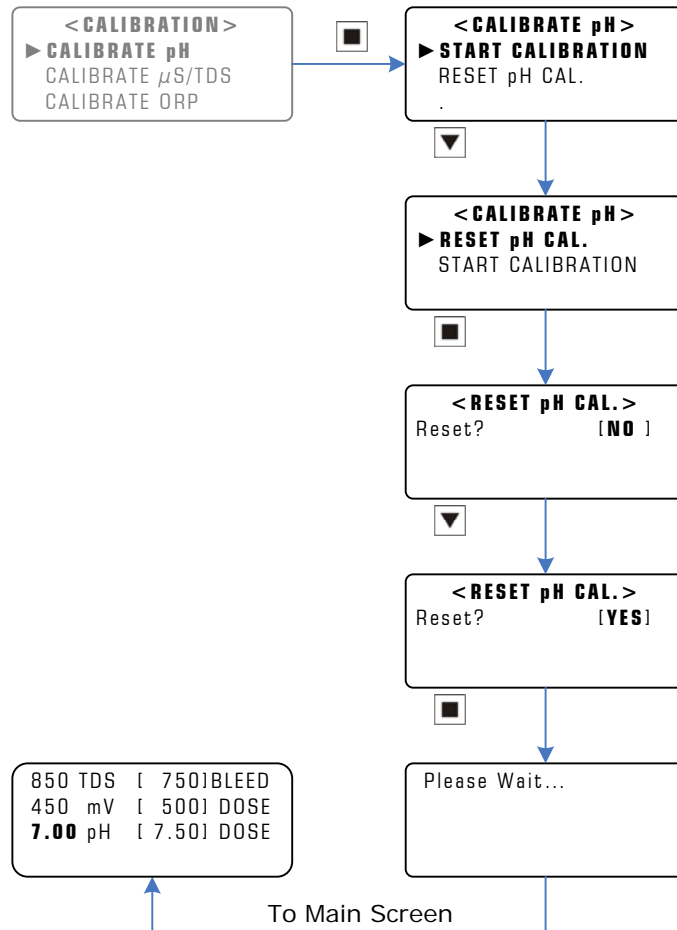
Resetting the pH Calibration

4.4 Testing Relay Outputs

Main Menu > *TEST OUTPUTS*

Please see the following page for testing outputs:

```
<MAIN MENU>
► TEST OUTPUTS
  MANUAL DOSE
  CALIBRATION
```

■

```
<TEST OUTPUTS>
► Test Bleed      [NO]
```

Press ▼ or ▲ to turn on

■

```
<TEST OUTPUTS>
► Test BIO 'A'    [NO]
```

Press ■
to move on to test the
next output

■

```
<TEST OUTPUTS>
► Test ORP        [NO]
```

Press ↺
to return to main
menu at any time

■

```
<TEST OUTPUTS>
► Test INHIBTR    [NO]
```

If ORP is disabled,
Test BIO 'B' will be
displayed

■

```
<TEST OUTPUTS>
► Test pH         [NO]
```

■

```
<TEST OUTPUTS>
► Test DISPER.    [NO]
```

■

```
<TEST OUTPUTS>
► Test AUX.       [NO]
```

(Ver. 0.83 and later)

■

```
<TEST OUTPUTS>
► Test Cond. PMP  [NO]
```

■

```
<TEST OUTPUTS>
► Test ALARM      [NO]
```

■

This test is only
displayed if remote
comms is enabled in
the advanced menu

```
<TEST OUTPUTS>
► Test MODEM      [NO]
```

■

Test Outputs

When any of the Outputs are activated, the Output relay switches, applying 240Vac power onto the output terminal, which activates the pump or solenoid valve wired to it.

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

If the MODEM is tested, the controller attempts to connect to the Internet if the MODEM is installed. If there is no modem installed, 'GPRS Fault' will be momentarily displayed at the bottom of the main screen, after the various MODEM status messages.

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 Cond. PMP relay rapidly ON and OFF, if powering the condenser pump of the cooling tower.
5. In units with firmware version 1.07 or later, the menu will read TEST OUTPUT/INPUT. If one of the INPUT card models is installed, you will be able to view the variables. Refer the instruction manual of DP-OPT-CARD-IP or DP-OPT-CARD-IP-mA-2 for more information on what is displayed. Please note that these will only be displayed if REMOTE COMMs is enabled (i.e. modem installed)

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) for any output.

NOTES:

- For any manual dose, the pump will dose even if there is no flow.
- The condenser pump will turn on automatically during any manual dose.
- To cancel a manual dose, press and hold the ENTER (Reset) pushbutton.

The Manual Dose Menu is shown on the following page:

<MAIN MENU>
►MANUAL DOSE
 CALIBRATION
 ALARM PARAMETERS

■

<MANUAL DOSE>
►Select C/P [BIO 'A']

<MANUAL DOSE>
►Select C/P [ORP   ]

Press ■
to access
menu item

<MANUAL DOSE>
►Select C/P [INHIBTR]

Press ↺
to return to
main menu

<MANUAL DOSE>
►Select C/P [pH   ]

<MANUAL DOSE>
►Select C/P [DISPER.]

<MANUAL DOSE>
►Select C/P [AUX.   ]

(Ver. 0.83 and later)
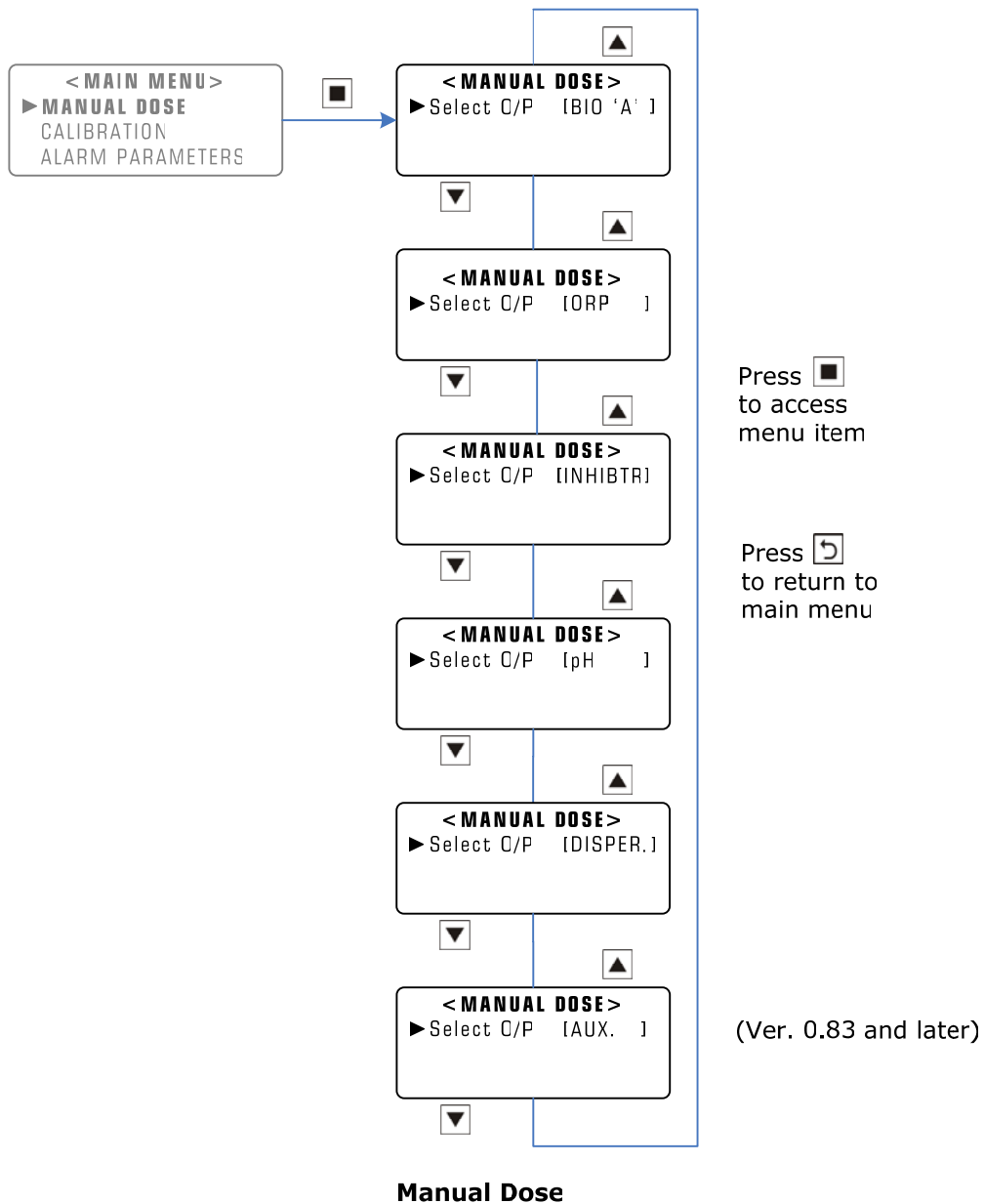
Manual Dose

An example of Manual Dosing the Inhibitor is shown on the following page:

```
        <MAIN MENU>                         <MANUAL DOSE>
     ► MANUAL DOSE          ■              ►Select O/P  [BIO 'A' ]
        CALIBRATION
        ALARM PARAMETERS
```

```
                            ▼
```

```
                                            <MANUAL DOSE>
                                           ►Select O/P   [ORP   ]
```

```
                            ▼
```

```
                                            <MANUAL DOSE>
                                           ►Select O/P  [INHIBTR]
```

```
                            ■
```

```
                                            <MANUAL DOSE>
                                           ►O/P on for:      00m
```

```
                            ▲ X5
```

```
                                            <MANUAL DOSE>
                                           ►O/P on for:      05m
```

```
                            ■
```

```
  1245 TDS  [ 750]BLEED      Please Wait...
   490 mV   [ 500] DOSE
  7.67pH    [ 7.50] DOSE
      INHIBTR – 05m
```

```
                            ■
```

To main screen
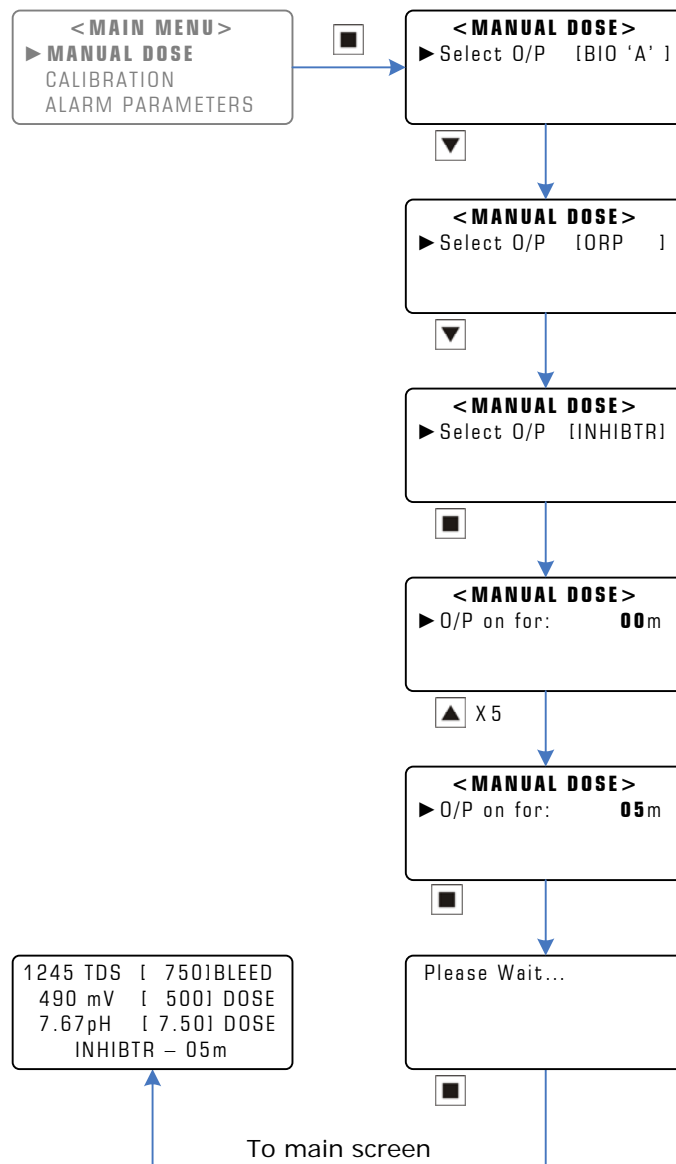
Example: Manual Dosing the Inhibitor for 5 minutes

NOTES: For any manual dose, the pump will dose even if there is no flow.
             The condenser pump will turn on automatically during any
             manual dose.
             To cancel a manual dose, press and hold the ENTER (Reset)
             pushbutton.
             When a manual dose is active the main screen will display the
             output and the time left for the relevant output at the bottom of
             the display, eg. "INH – 01m" if the Inhibitor output will be active
             for 1 minute.

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, as illustrated below:

```
1245 TDS [ 750]BLEED
 490 mV  [ 500] DOSE
7.67pH   [ 7.50] DOSE
INHB              DISP
```

Hold

Column 1:

```
<DIGICHEM PLUS+>
ID:         0830-03534
Bootloader:    Ver 2.00
SW S0200 Ver 0.54
```

```
<VIEW µS/TDS>
Display:          [TDS]
Setpoint:         1000
Hysteresis:        03%
```

```
<VIEW µS/TDS>
Bleed/Pause:    10/50s
```

```
<VIEW ORP>
Enable?:          [YES]
DOSE:        [Oxidant ]
Setpoint:         0500
```

```
<VIEW PH>
Enable?:          [YES]
DOSE:           [Acid  ]
Setpoint:         07.50
```

```
<VIEW ORP CTRL>
Control:        [On/Off]
Hysteresis:        05%
Dose/Pause:     10/40s
```

```
<VIEW PH CTRL>
Control:         [PROP]
Prop. Band:        50%
Cycle Time:       060s
```

```
<VIEW INHIBITOR>
Mode: [On Bleed    ]
ON Period:       0050s
OFF Period:      0050s
```

```
<VIEW DISPERSANT>
Mode: [24hr/day    ]
ON Period:       0000s
OFF Period:      0000s
```

Column 2:

```
<VIEW GENERAL>
Pre-Bleed: Setp - 15%
Lock-Out: Setp + 20%
Biocide dose  + 000m
```

```
<VIEW GENERAL>
STARTUP DELAY: 0000s
FLOW/SW:   [NORMAL ]
```

```
<DATA LOGGING>
LOG Every:        060m
```

```
<XTRA INHIBTR DOSE>
Start Time:       00:00
Duration:         0250s
```

```
<WATER VOL COUNTERS>
MakeUp Pulse/m³: 0002
Bleed Pulses/m³:  0002
```

```
<CYCLES OF CONCENT.>
Approx. Make-Up µS:
            0200µS
```

```
<CONTROLLER NAME>
[Westfield Tower 1    ]
```

```
<SITE NAME>
[Westfield Bondi Jnct ]
```

```
<REMOTE COMS.>
Enable Modem:?   [YES]
GSM Logon Every: 015m
```

Column 3:

```
<µS/TDS ALARMS>
High Alarm:       0000
Low Alarm:        0000
Max Bleed:        120m
```

```
<ORP ALARMS>
High Alarm:       0000
Low Alarm:        0000
Max Dose:         120m
```

```
<PH ALARMS>
High Alarm:      00.00
Low Alarm:       00.00
Max Dose:         120m
```

```
<GENERAL ALARMS>
NO FLOW ALARM:     [N]
Trip Delay:       3600s
Tmer Alarm Hyst:   3%
```

```
<DISINFECTION>
ORP (mV) Setpt:   0500
P01 - - - - - - - - - -
     00:00    D00h00
```

```
<BIOCIDE TIMERS>
T01 A  1-3-  -M-W-F-
     S13:30   D00h35
     P00h10   L01h00
```

```
<BIOCIDE TIMERS>
T10 - - - -  - - - - - -
     S00:00   D00h00
     P00h00   L00h00
```

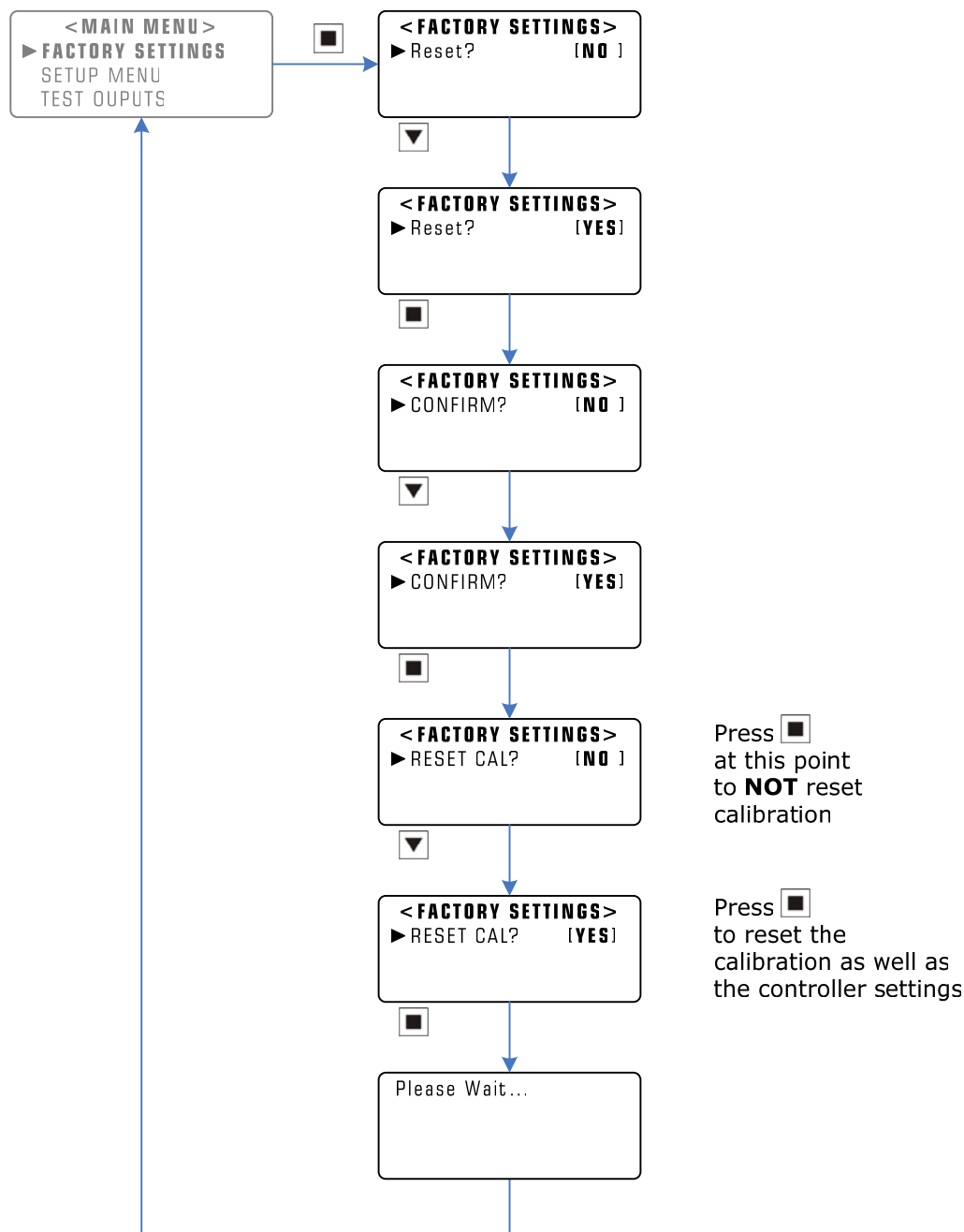**Note**: Timer Alarm Hysteresis displayed only for v0.91 or later.

View Settings Menu

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.

```
<MAIN MENU>           [■]        <FACTORY SETTINGS>
►FACTORY SETTINGS                ►Reset?        [NO ]
 SETUP MENU
 TEST OUPUTS
```

```
[▼]

<FACTORY SETTINGS>
►Reset?        [YES]
```

```
[■]

<FACTORY SETTINGS>
►CONFIRM?      [NO ]
```

```
[▼]

<FACTORY SETTINGS>
►CONFIRM?      [YES]
```

```
[■]

<FACTORY SETTINGS>
►RESET CAL?    [NO ]
```
Press [■] at this point to **NOT** reset calibration

```
[▼]

<FACTORY SETTINGS>
►RESET CAL?    [YES]
```
Press [■] to reset the calibration as well as the controller settings

```
[■]

Please Wait...
```

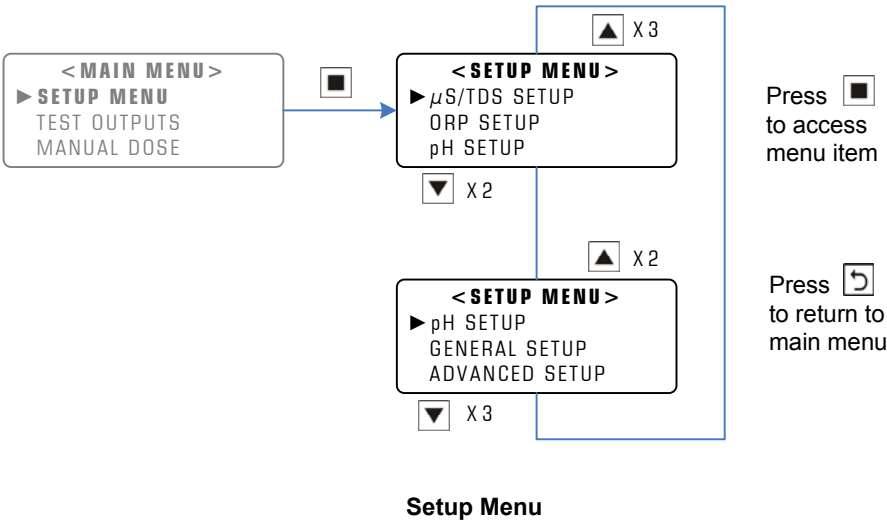**Factory and Calibration Reset**

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

5.1 µS/TDS Setup

Main Menu > *SETUP MENU > µS/TDS SETUP*
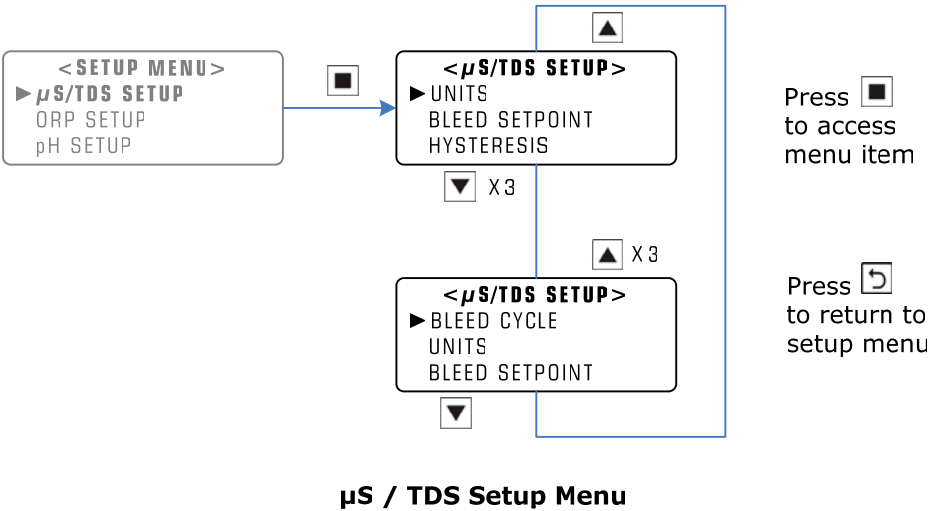
µS / TDS Setup Menu

5.1 1 Set Conductivity Units

Main Menu > *SETUP MENU > µS/TDS SETUP > UNITS*

Conductivity can be displayed in either:

- TDS (Total Dissolved Solids), or
- µS (Micro-siemens)
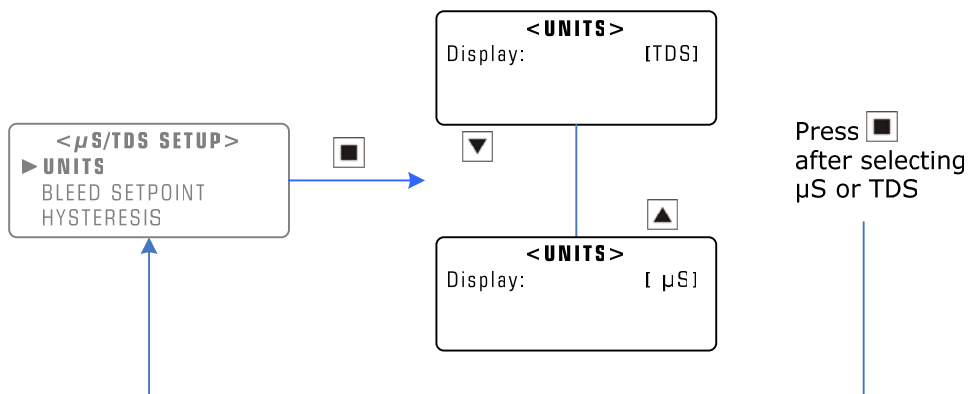
NOTE: The displayed units should be selected before performing any calibration or programming of the unit.

5.1.2 Set Bleed Setpoint

Main Menu > *SETUP MENU > µS/TDS SETUP > BLEED SETPOINT*

Example: Decreasing Setpoint from 1000 TDS to 950 TDS

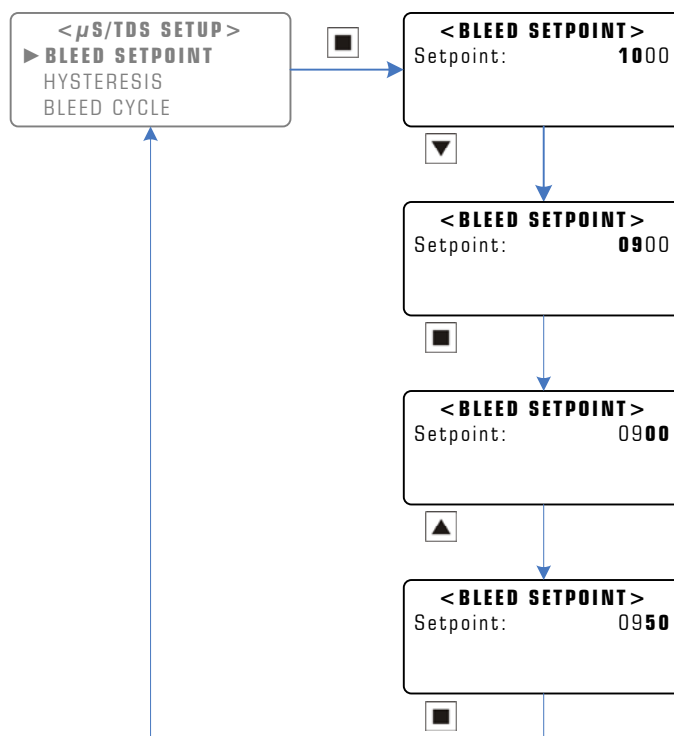The Bleed Setpoint is the desired conductivity value of the process (displayed in TDS or μS). When a solenoid valve is connected to the bleed output, the valve opens when the conductivity rises above the setpoint. When this occurs, the tower water is flushed to drain and fresh make-up water dilutes the 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.
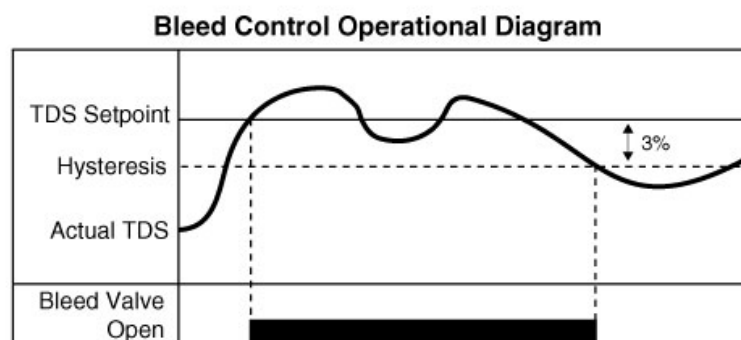
5.1.3 Set Conductivity Hysteresis

Main Menu *> SETUP MENU > μS/TDS SETUP > HYSTERESIS*
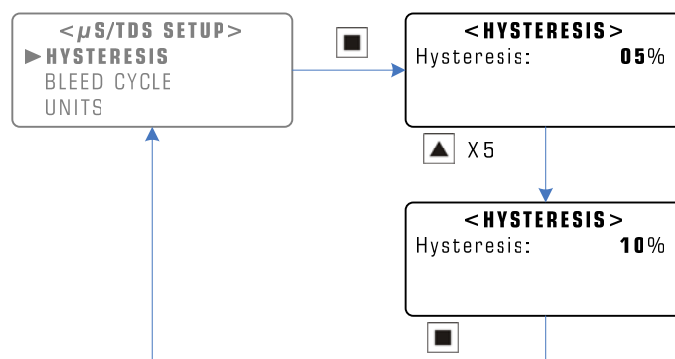
Example: Increasing Hysteresis from 5% to 10%

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.

NOTE: The maximum Hysteresis setting for the Conductivity, pH, and ORP is 20%.

5.1.4 Set Conductivity Bleed Cycle

Main Menu > *SETUP MENU > µS/TDS SETUP > 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 Pause Time to be programmed. The Pause 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.
Another benefit is to force more return water back to the tower basin when chemical is dosed into the tower manifold during a long bleed duration.

An example of a Bleed / Pause setup is shown below.
The solenoid bleeds 5 seconds during every 100 second cycle (ie 5 out of 100), which equates to a 5% bleed cycle.
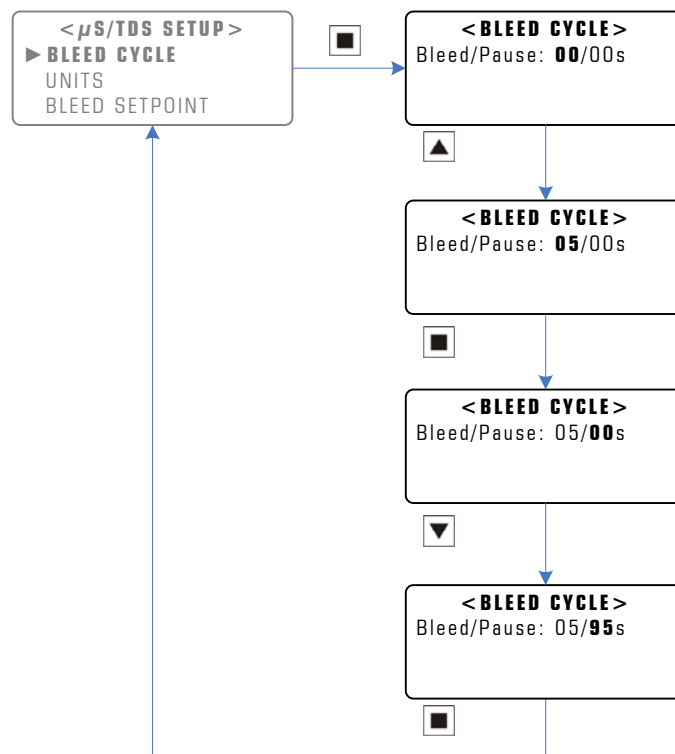
Example: Programming a bleed cycle of 5 seconds bleed, followed by a pause of 95 seconds

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

NOTES:

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.

If Inhibitor is set to "Dose on Bleed" mode, and an ON/OFF cycle for Inhibitor is programmed, then the Inhibitor ON/OFF cycle only occurs during the ON part of the Bleed Cycle. This means Inhibitor will only dose when the bleed valve is actually opened and passing water. During the OFF part of the Bleed Cycle, Inhibitor dosing is suspended.

5.2 ORP Setup

Main Menu > *SETUP MENU* > *ORP SETUP*

NOTE: For ORP Control Method Setup, please refer to section 5.4
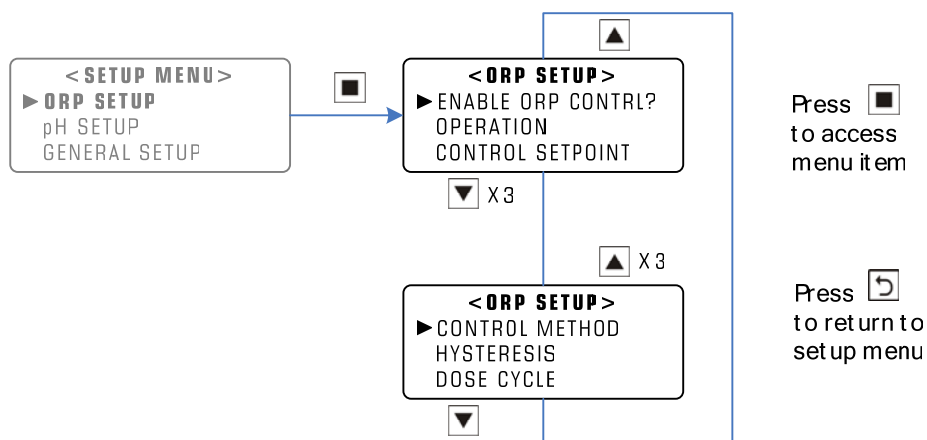
In the example above, if ORP control method is set to Proportional Control, then instead of Hysteresis and Dose Cycle being displayed, Proportional Band and Control Cycle will be displayed as the last two menu options.

5.2.1 Enable / Disable ORP Control

The DIGICHEM Plus+ can be programmed to have the ORP control function enabled, or disabled. See diagram below:

```
<ORP SETUP>          ■ →   <ENABLE ORP CONTROL?>
►ENABLE ORP CONTROL?        Enable?:        [YES]
 OPERATION
 CONTROL SETPOINT                                    Press ■
                                                     after selecting
                            ▼                        pH enable

                                    ▲
                            <ENABLE ORP CONTROL?>
                            Enable?:        [NO ]
```
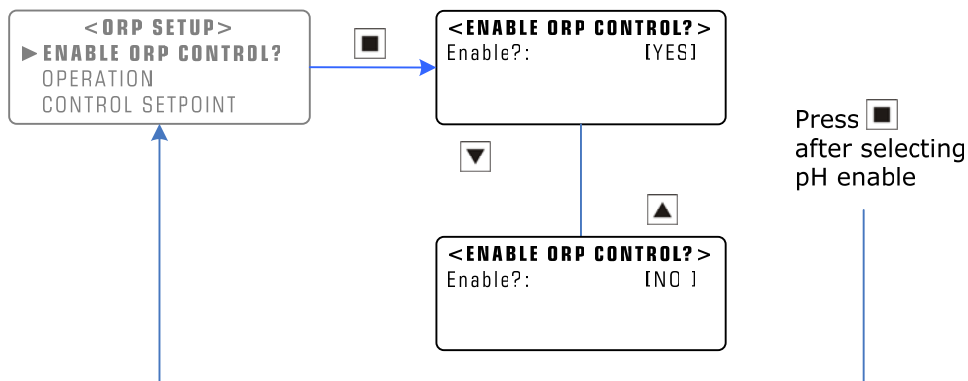
Important: High and Low ORP alarms are disabled when ORP control is Disabled (for software versions 0.86 and older)

5.2 2 Select ORP Operation

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

The DIGICHEM Plus+ 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. For cooling tower dosing applications, ORP control is always achieved by dosing Oxidant.

```
<ORP SETUP>          ■ →   <OPERATION>
►OPERATION                 DOSE:      [Oxidant  ]
 CONTROL SETPOINT
 ENABLE ORP CONTRL?                                  Press ■
                                                     after selecting
                            ▼                        operation

                                    ▲
                            <OPERATION>
                            DOSE:      [Reductant]
```

5.2.3 Set ORP Setpoint

Main Menu > *SETUP MENU > ORP SETUP > CONTROL SETPOINT*

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

```
<ORP SETUP>            ■      <CONTROL SETPOINT>
►CONTROL SETPOINT            ORP(mV)Setpt:  0500
 CONTROL METHOD
 HYSTERESIS
```

```
                        ▼

                              <CONTROL SETPOINT>
                             ORP(mV)Setpt:  0400

                        ■

                              <CONTROL SETPOINT>
                             ORP(mV)Setpt:  0400

                        ▲

                              <CONTROL SETPOINT>
                             ORP(mV)Setpt:  0450

                        ■
```

Example: Decreasing ORP Setpoint from 500mV to 450mV

5.3 pH Setup

Main Menu > *SETUP MENU > pH SETUP*

NOTE: For pH Control Method Setup, please refer to section 5.4

```
                                   ▲
<SETUP MENU>         ■       <pH SETUP>
►pH SETUP                   ►ENABLE pH CONTROL?      Press ■
 GENERAL SETUP               OPERATION               to access
 ADVANCED SETUP              CONTROL SETPOINT         menu item

                      ▼ X3

                      ▲ X3
                             <pH SETUP>              Press ↺
                            ►CONTROL METHOD          to return to
                             PROPORTIONAL BAND       setup menu
                             CONTROL CYCLE

                      ▼
```

pH Setup Menu for Proportional Control

In the example above, if pH control method is set to On/Off Control, then instead of Proportional Band and Control Cycle being displayed, Hysteresis and Dose Cycle will be displayed as the last two menu options.

5.3.1 Enable / Disable pH Control

Main Menu > *SETUP MENU > pH SETUP > ENABLE pH CONTROL?*

The DIGICHEM Plus+ can be programmed to have the pH control function enabled, or disabled. See diagram below:
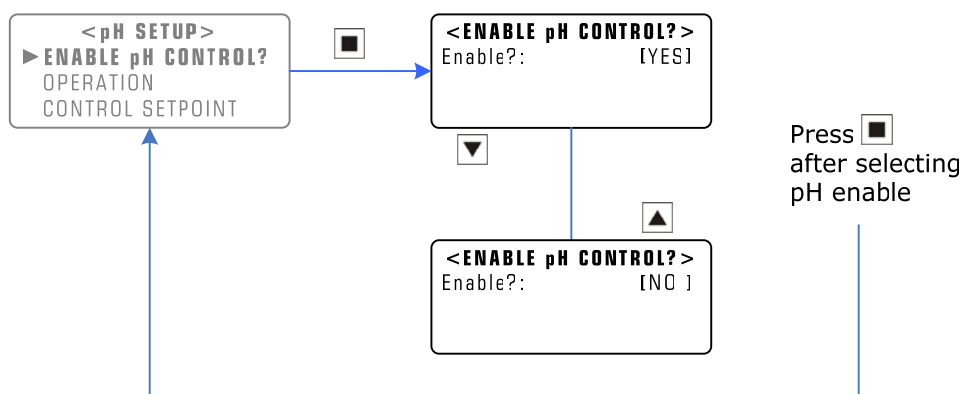
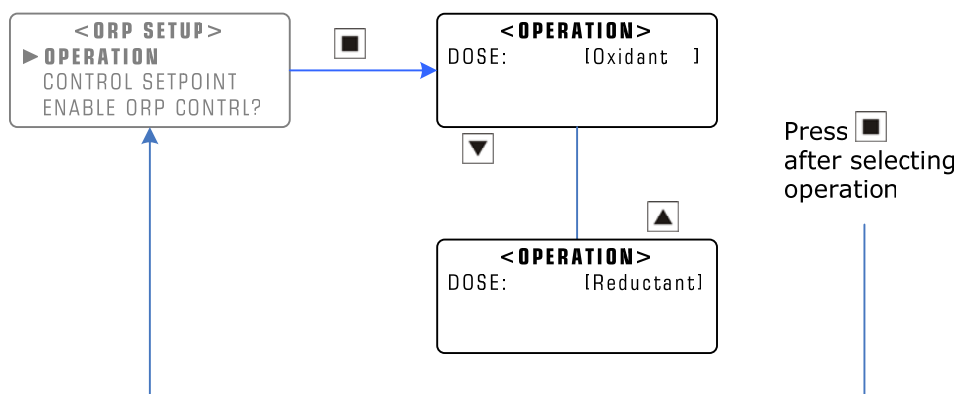**Important**:   High and Low pH alarms are disabled when ORP control is Disabled (for software versions 0.86 and older)

5.3.2 Select pH Operation
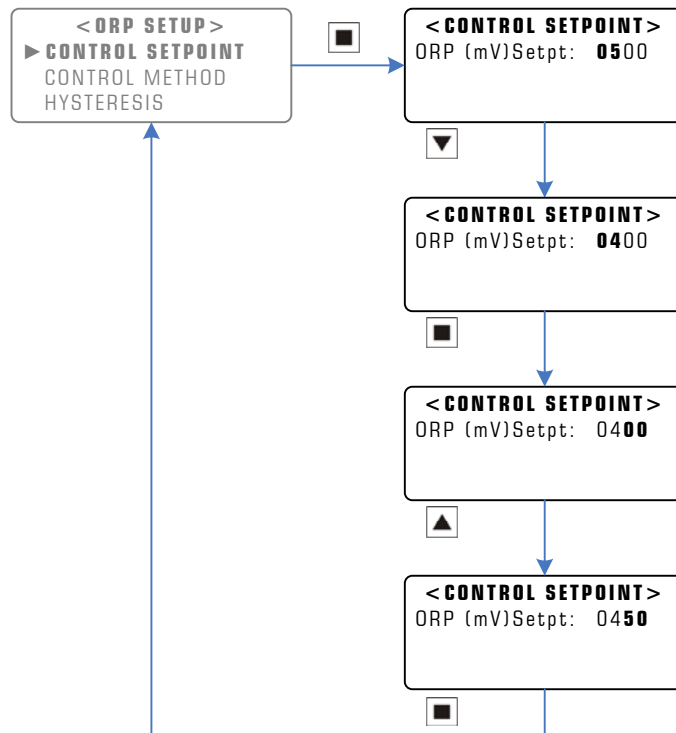
Main Menu > *SETUP MENU > pH SETUP > OPERATION*

The DIGICHEM Plus+ 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:
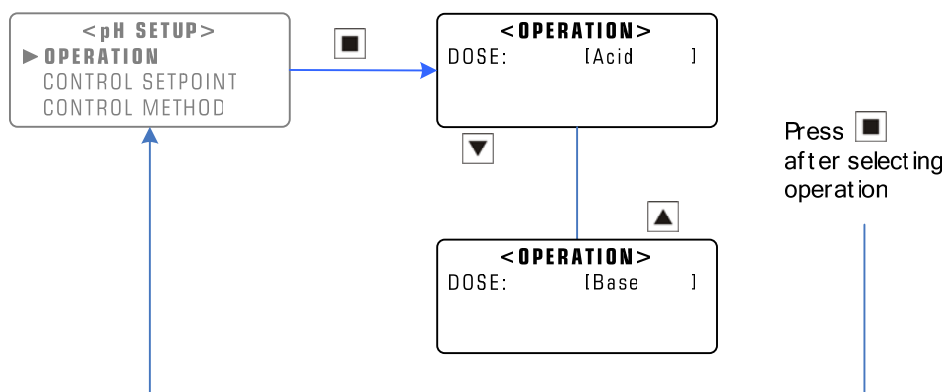
5.3.3 Set pH Setpoint

Main Menu > *SETUP MENU > pH SETUP > CONTROL SETPOINT*
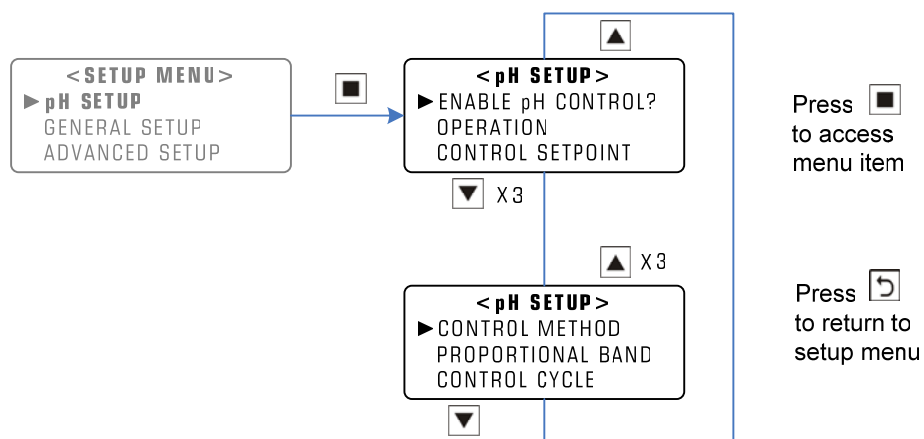
The pH Setpoint is the desired pH value of the process:

```
┌─────────────────────┐         ┌─────────────────────┐
│    <pH SETUP>        │   ■     │  <CONTROL SETPOINT>  │
│ ► CONTROL SETPOINT   │ ──────► │  pH Setpoint:  07.50 │
│   CONTROL METHOD     │         │                      │
│   PROPORTIONAL BAND  │         └─────────────────────┘
└─────────────────────┘              │  ▼
                                     ▼
                             ┌─────────────────────┐
                             │  <CONTROL SETPOINT>  │
                             │  pH Setpoint:  06.50 │
                             │                      │
                             └─────────────────────┘
                                 │  ■
                                 ▼
                             ┌─────────────────────┐
                             │  <CONTROL SETPOINT>  │
                             │  pH Setpoint:  06.50 │
                             │                      │
                             └─────────────────────┘
                                 │  ▲
                                 ▼
                             ┌─────────────────────┐
                             │  <CONTROL SETPOINT>  │
                             │  pH Setpoint:  06.25 │
                             │                      │
                             └─────────────────────┘
                                 │  ■
```
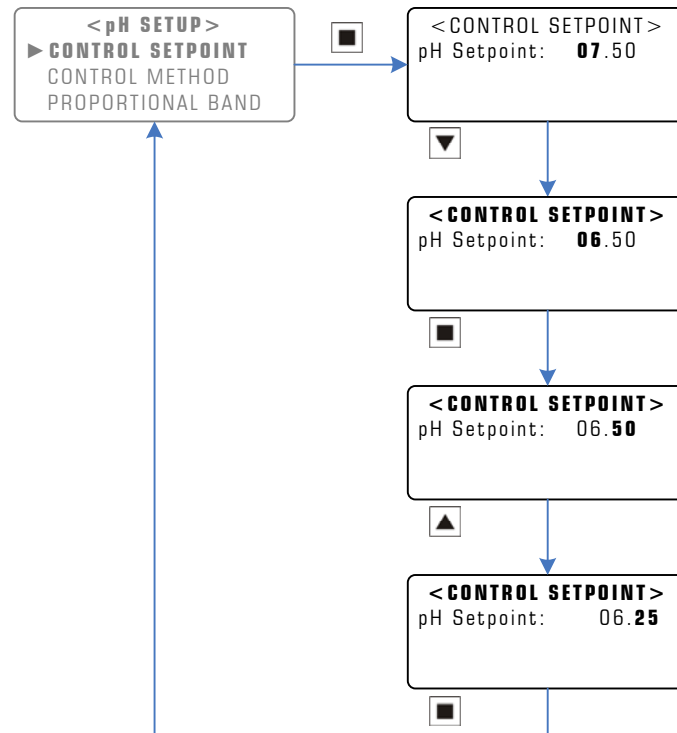
Example: Decreasing setpoint from 7.50pH to 6.25pH

5.4 pH and ORP Control Method Setup

Main Menu > SETUP MENU > ORP SETUP > CONTROL METHOD
or:
Main Menu > SETUP MENU > PH SETUP > CONTROL METHOD

The DIGICHEM Plus+ controls the pH and the ORP independently with On/Off or Proportional control methods.

These 2 methods of control will be discussed below, namely:

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

With **ON/OFF control**, the controller either turns the pump on continuously when correcting the pH/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 pH variation from the Setpoint. The further the pH / ORP is from the Setpoint, the shorter the OFF period is with respect to the ON period. The closer the pH/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 Setting the Control Method

Set the control method as follows:

Main Menu > SETUP MENU > ORP SETUP > CONTROL METHOD

```
<CONTROL METHOD>
Control:      [On/Off]
```

```
<ORP SETUP>
► CONTROL METHOD
  HYSTERESIS
  DOSE CYCLE
```

■   ▼

▲

```
<CONTROL METHOD>
Control:      [Prop. ]
```

Press ■
after selecting
control method
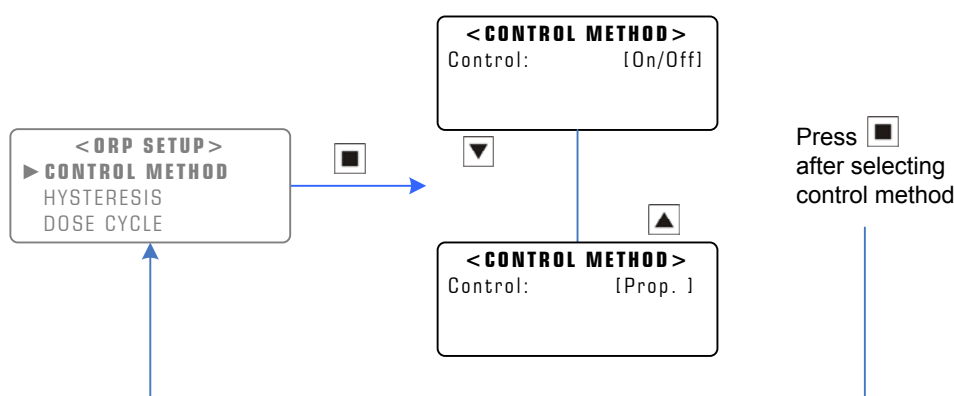
Example: Setting the ORP Control Method from On/Off to Proportional

5.4 2 On/Off Control

For On/Off Control, the menu structure will be different to that of Proportional Control. For the Control Method set to On/Off Control, the menu structure is shown below for the ORP setup:

Note: The same can be applied to the pH Setup menu.

```
<ORP SETUP>
► CONTROL METHOD
  HYSTERESIS
  DOSE CYCLE
```

Now set the Hysteresis of the controller:

NOTE: The maximum Hysteresis setting for the Conductivity, pH, and ORP is 20%.

Main Menu > SETUP MENU > ORP SETUP > HYSTERESIS

```
┌─────────────────────┐          ┌─────────────────────┐
│    <ORP SETUP>      │   ┌──┐    │    <HYSTERESIS>     │
│  ► HYSTERESIS       │───│■ │───→│  Hysteresis:   05%  │
│    DOSE CYCLE       │   └──┘    │                     │
│    ENABLE CONTROL   │          │                     │
└─────────────────────┘          └─────────────────────┘
                                        ┌──┐
                                        │▲ │ X5
                                        └──┘
                                  ┌─────────────────────┐
                                  │    <HYSTERESIS>     │
                                  │  Hysteresis:   10%  │
                                  │                     │
                                  │                     │
                                  └─────────────────────┘
                                        ┌──┐
                                        │■ │
                                        └──┘
```

Example: Increasing the ORP Hysteresis from 5% to 10%

Tip: Set the Hysteresis to 1% if a dose cycle is required..

Now set the Dose Cycle of the controller:

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

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

The menu asks for a Dose Time and a Pause Time to be programmed. The Pause Time follows the Dose Time, and the cycle is repeated until the Setpoints plus/minus Hysteresis is reached.   The diagram on the following page illustrates a dose cycle programmed for a 5 second dose followed by 10 second pause:

```
        ┌─────────────────────┐         ┌─────────────────────┐
        │    <ORP SETUP>      │    ■    │    <DOSE CYCLE>     │
        │  ▶ DOSE CYCLE       │ ──────▶ │ Dose/Pause:   00/00s│
        │    ENABLE ORP CONTROL?│       │                     │
        │    OPERATION        │         │                     │
        └─────────────────────┘         └─────────────────────┘
                                                 │
                                              ▲ X 5
                                                 ▼
                                        ┌─────────────────────┐
                                        │    <DOSE CYCLE>     │
                                        │ Dose/Pause:   05/00s│
                                        │                     │
                                        └─────────────────────┘
                                              ■
                                                 ▼
                                        ┌─────────────────────┐
                                        │    <DOSE CYCLE>     │
                                        │ Dose/Pause:   05/00s│
                                        │                     │
                                        └─────────────────────┘
                                              ▲ X 5
                                                 ▼
                                        ┌─────────────────────┐
                                        │    <DOSE CYCLE>     │
                                        │ Dose/Pause:   05/10s│
                                        │                     │
                                        └─────────────────────┘
                                              ■
```
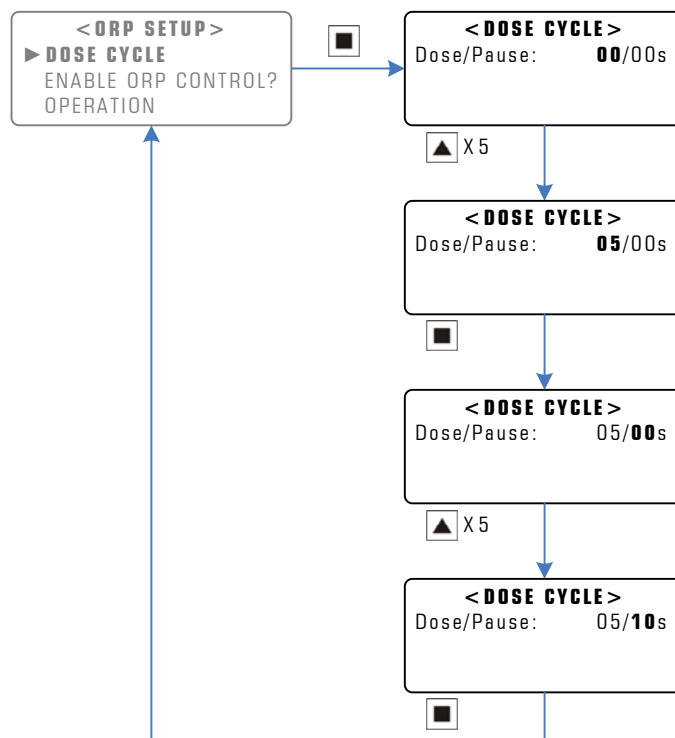
Example: Programming an ORP Dose cycle to Dose for 5 seconds, followed by a pause of 10 seconds

In the example above, the pump doses 5 seconds during every 15 second cycle (i.e. 5 out of 15 seconds), which equates to a 33% duty cycle.

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

Should the readout drift more than 25% away from the programmed Setpoint, the controller automatically doubles the Dose time and halves the Pause time to bring the ORP and/or pH within 25% of the Setpoint very quickly. As soon as the readout returns to within 25% of the Setpoint, normal pump duty cycle (ie. programmed Dose/Pause times) will resume. In the example above, the Dose and Pause times will temporarily be 5 seconds each, i.e. the pump(s) will dose for 5 seconds during every 15 second cycle, which equates to a 33% duty cycle.

If you wish to have the control output continuously active during dosing (rather than cycling ON and OFF), simply set the Dose/Pause times to 00/00s. However, it is recommended to then increase the Hysteresis to at least 5%.

5.4.3 Proportional Control

For Proportional Control, the menu structure will be different to that of On/Off Control. For the Control Method set to Proportional Control, the menu structure is shown below for the pH setup:
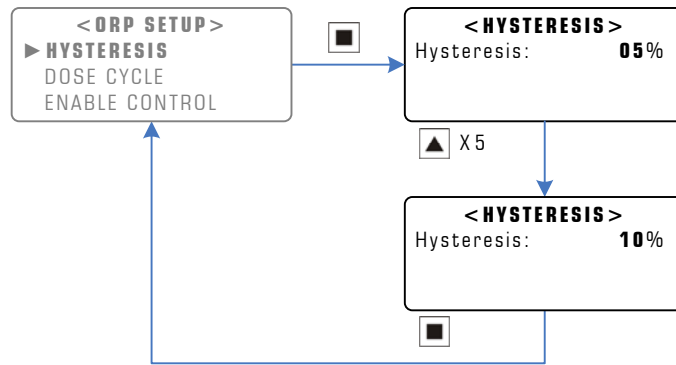
Note: The same cam be applied to the ORP Setup menu.

```
<pH SETUP>
► CONTROL METHOD
  PROPORTIONAL BAND
  CONTROL CYCLE
```

Now set the Proportional Band of the Controller:

Main Menu > SETUP MENU > pH SETUP > PROPORTIONAL BAND


```
<pH SETUP>              ■      <PROPORTIONAL BAND>
► PROPORTIONAL BAND            Prop. Band:      10%
  CONTROL CYCLE
  ENABLE PH CONTROL?

                        ▲ X 5

                               <PROPORTIONAL BAND>
                               Prop. Band:      15%

                               ■
```
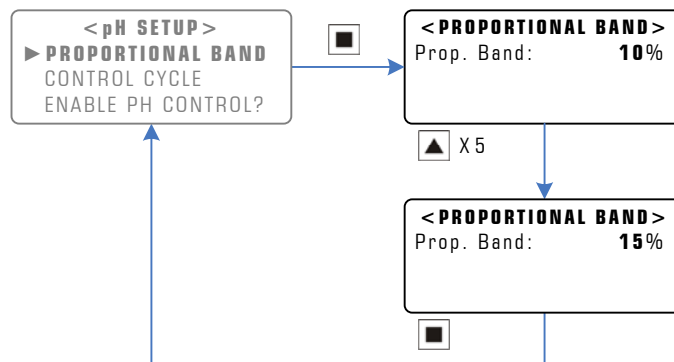
Example: Increasing pH Proportional Band from 10% to 15%

Now set the Control Cycle of the Controller:

Main Menu > SETUP MENU > pH SETUP > CONTROL CYCLE

Please see the diagram below for pH Control Cycle Setup:


```
<pH SETUP>              ■      <CONTROL CYCLE>
► CONTROL CYCLE                Cycle Time:     100s
  ENABLE pH CONTROL
  OPERATION

                        ▼ X 5

                               <CONTROL CYCLE>
                               Cycle Time:      50s

                               ■
```
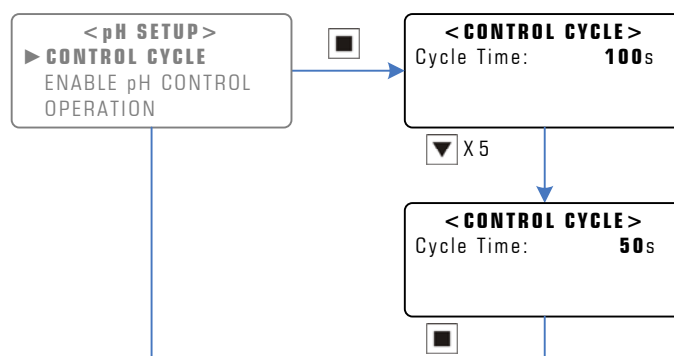
Example: Decreasing the pH Proportional Control Cycle time from 100s to 50s

Whilst dosing, if the pH and/or 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 pH and/or ORP.

Conversely, in a large system with a large volume of water, and a slow recirculation rate, the pH and/or 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 pH and/or ORP sensors.

5.4.4 Explanation of pH Control Methods

The DIGICHEM Plus+ features 2 methods of pH control:

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

On/Off pH Control Explanation:

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, is only applicable to ON/OFF control, and is usually only required to be greater than 1% if no dose cycle is programmed.

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).

Proportional pH Control Explanation:

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.

NOTE: (v0.71 or later) If using the pH Dose Timer Alarm operating in Proportional control, the timer will cancel if the measured pH reaches 97% of the pH Setpoint, rather than cancelling at the actual Setpoint itself.

5.4.5 Explanation of ORP Control Methods

The DIGICHEM Plus+ features 2 methods of ORP control:

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

On/Off ORP Control Explanation:

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). Cooling tower applications require dosing an Oxidant to increase the ORP.

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, is only applicable to ON/OFF control, and is usually only required to be greater than 1% if no dose cycle is programmed.

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).

Proportional ORP Control Explanation:

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.

NOTE: (Software v0.71 or later) If using the ORP Dose Timer Alarm operating in Proportional control, the timer will cancel if the measured ORP reaches 97% of the ORP Setpoint, rather than cancelled at the actual Setpoint itself.

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.

5.5 Alarm Parameters

Main Menu > ALARM PARAMETERS

```
          < M A I N   M E N U >         ■        < ALARM  PARAMETERS >        ▲ X 2
          ► A L A R M   P A R A M E T E R S             ► µS/TDS LEVEL ALRMS
            T I M E   &   D A T E                          ORP LEVEL ALARMS         Press ■
            F A C T O R Y   S E T T I N G S                pH LEVEL ALARMS         to access
                                                       ▼ X 3                        menu item

                                                                      ▲ X 3
                                                      < ALARM  PARAMETERS >
                                                      ► NO FLOW ALARM            Press ⤺
                                                        DELAY ON ALARM           to return to
                                                        BLEED TIMER ALARM        main menu
                                                       ▼ X 3

      < ALARM  PARAMETERS >                                          ▲ X 3
      ► ORP DOSE TIMER ALM            < ALARM  PARAMETERS >
        pH DOSE TIMER ALM             ► ORP DOSE TIMER ALM
        TIMER ALM HYSTERESIS            pH DOSE TIMER ALM
                                        µS/TDS LEVEL ALRMS
        Alternative Menu             ▼ X 2
        v0.91 or later
```

The controller has 8 programmable alarm functions as outlined above. If any of the alarms are activated and confirmed, the common alarm contact switches, and the Alarm message is displayed on the relevant position on the Main Menu of the LCD.

5.5.1 Conductivity Level Alarms

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.

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.

Please see the following page for an example of how to set the High and Low alarms for conductivity:
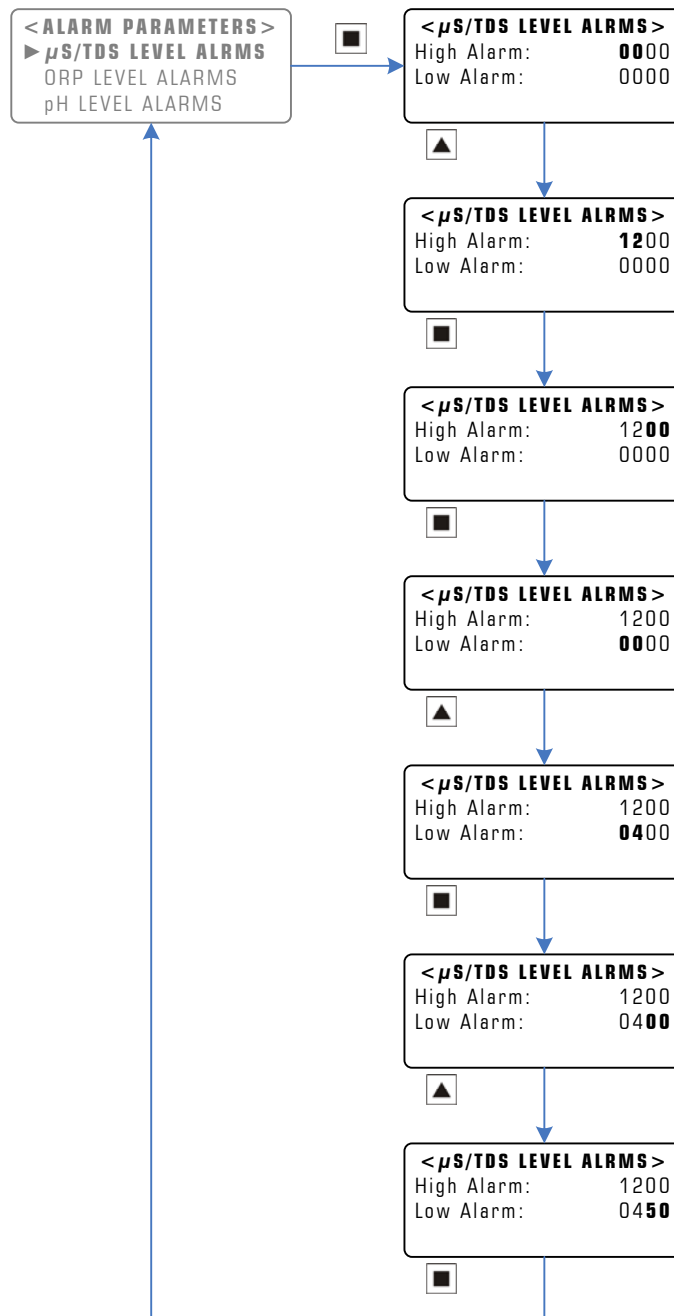
Example: Setting a High Alarm of 1200 TDS and a Low Alarm of 450 TDS

NOTE: Setting the High or Low Alarms to 0000 disables the Alarm.

5.5.2 ORP Level Alarms

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

```
<ALARM PARAMETERS>        ■          <ORP LEVEL ALARMS>
► ORP LEVEL ALARMS                   High Alarm:      0000
  pH LEVEL ALARMS                    Low Alarm:       0000
  NO FLOW ALARM
```

```
                                     ▲

                                     <ORP LEVEL ALARMS>
                                     High Alarm:      0600
                                     Low Alarm:       0000
```

NOTES:

1. During Disinfection, the HIGH ORP alarm is ignored, until the mV drops below the HIGH ORP alarm value (if programmed). This enables you to have the Disinfection Setpoint higher than the HIGH ORP Alarm, without generating an alarm during Disinfection.
(Software v0.83 or later)

```
                                     ■

                                     <ORP LEVEL ALARMS>
                                     High Alarm:      0600
                                     Low Alarm:       0000
```

```
                                     ▲

                                     <ORP LEVEL ALARMS>
                                     High Alarm:      0650
                                     Low Alarm:       0000
```

```
                                     ■

                                     <ORP LEVEL ALARMS>
                                     High Alarm:      0650
                                     Low Alarm:       0000
```

2. During No-Flow, the High and Low ORP alarms are disabled. However an alarm reported before a No-Flow condition is not affected and will remain in alarm during No-Flow, When flow returns, alarm is reset
(Software v0.91 or later)

```
                                     ▲

                                     <ORP LEVEL ALARMS>
                                     High Alarm:      0650
                                     Low Alarm:       0300
```

```
                                     ■

                                     <ORP LEVEL ALARMS>
                                     High Alarm:      0650
                                     Low Alarm:       0300
```

```
                                     ▲

                                     <ORP LEVEL ALARMS>
                                     High Alarm:      0650
                                     Low Alarm:       0350
```

```
                                     ■
```

Example: Setting a High Alarm of 650mV and a Low Alarm of 350mV

NOTE: Setting the High or Low Alarms to 0000 disables the Alarm.

5.5.3 pH Level Alarms

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

The Low pH Alarm is activated if the pH drops below the programmed setting, and automatically resets if the pH rises above the programmed setting again.
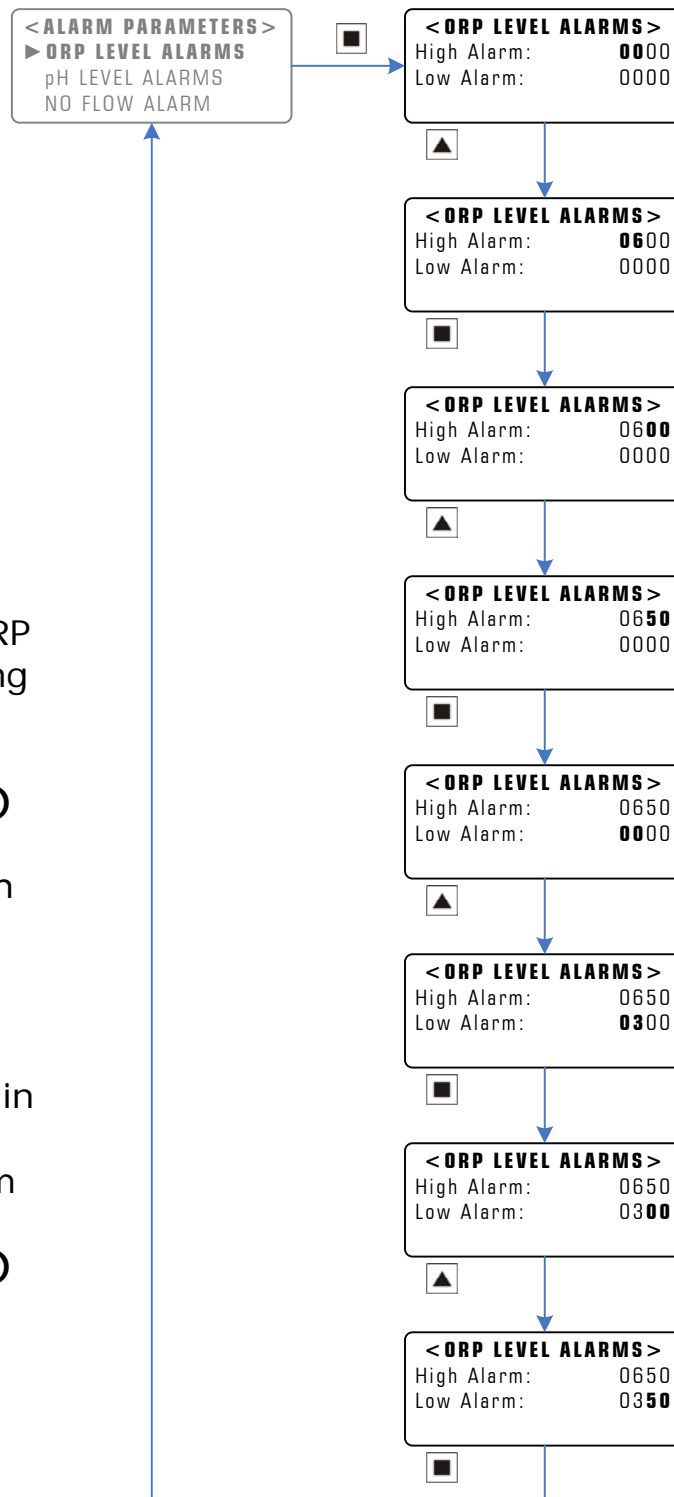
Main Menu > ALARM PARAMETERS >pH LEVEL ALARMS

```
<ALARM PARAMETERS>          ■          <pH LEVEL ALARMS>
►pH LEVEL ALARMS                       High Alarm:      00.00
 NO FLOW ALARM                         Low Alarm:       00.00
 DELAY ON ALARM
```

▲

```
<pH LEVEL ALARMS>
High Alarm:      09.00
Low Alarm:       00.00
```

■

```
<pH LEVEL ALARMS>
High Alarm:      09.00
Low Alarm:       00.00
```

▲

```
<pH LEVEL ALARMS>
High Alarm:      09.50
Low Alarm:       00.00
```

■

```
<pH LEVEL ALARMS>
High Alarm:      09.50
Low Alarm:       00.00
```

▲

```
<pH LEVEL ALARMS>
High Alarm:      09.50
Low Alarm:       05.00
```

■

```
<pH LEVEL ALARMS>
High Alarm:      09.50
Low Alarm:       05.00
```

▲

```
<pH LEVEL ALARMS>
High Alarm:      09.50
Low Alarm:       05.50
```

■

NOTES:

1. Setting the High or Low Alarms to 00.00 disables the Alarm.
(All Software versions)

2. During No-Flow, the High and Low ORP alarms are disabled. However an alarm reported before a No-Flow condition is not affected and will remain in alarm during No-Flow, When flow returns, alarm is reset
(Software v0.91 or later)
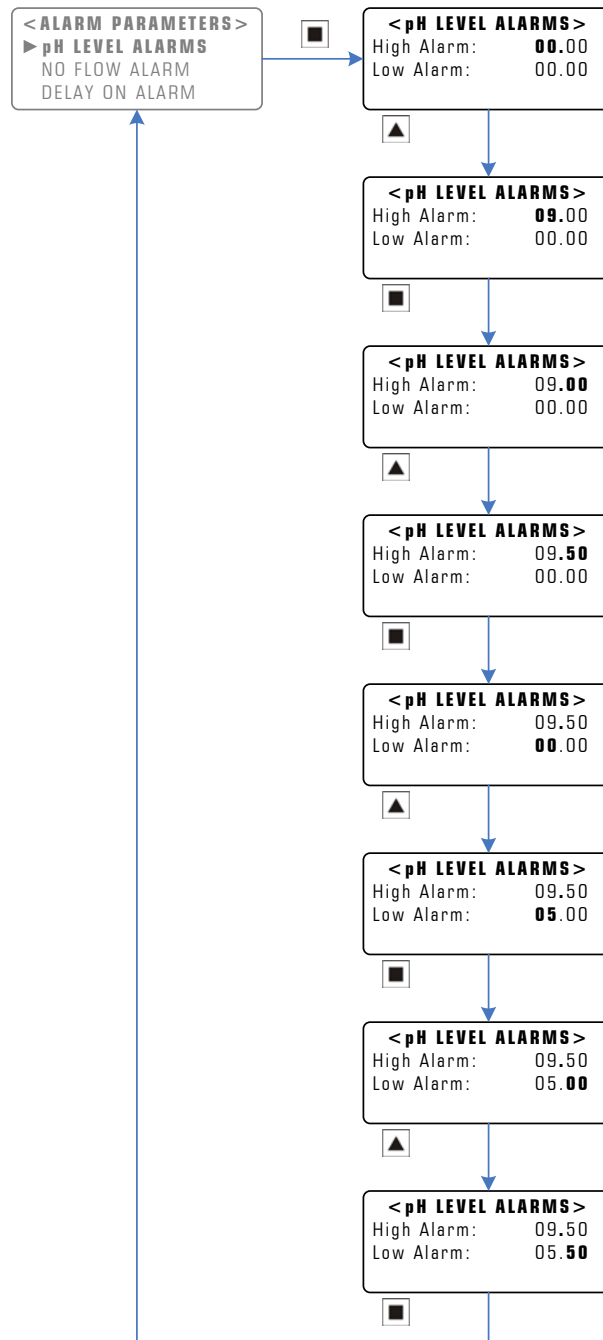
Example: Setting a High Alarm of 9.5 pH and a Low Alarm of 5.5 pH

5.5.4 No Flow Alarm

Main Menu > *ALARM PARAMETERS > NO FLOW ALARM*

```
            <NO FLOW ALARM>
            Enable?:        [NO ]



<ALARM PARAMETERS>                              Press ■
►NO FLOW ALARM                                  once selection
 DELAY ON ALARM                                 made
 BLEED TIMER ALARM
            <NO FLOW ALARM>
            Enable?:        [YES]
```
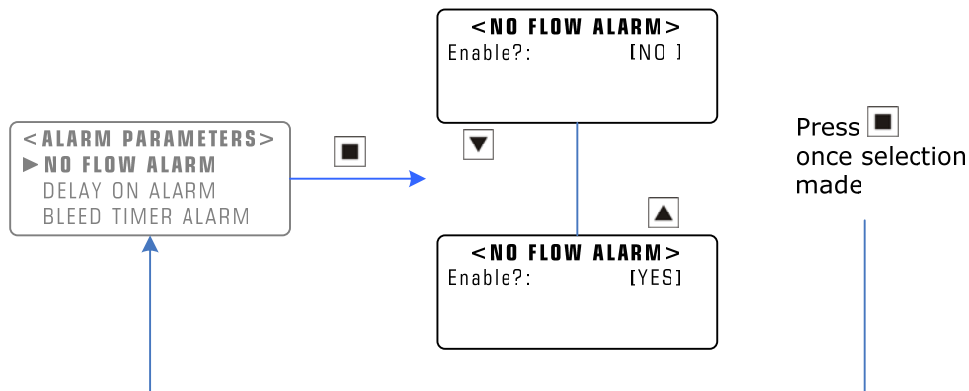
If the No Flow Alarm is enabled, the Alarm will activate when there is no flow detected by the optional flow switch.

NOTE: A flow switch is included with all dosing systems incorporating a DIGICHEM Plus+ Controller.
If the No Flow Alarm is left disabled, then the Alarm is unaffected by a no-flow condition.

5.5.5 Delay On Alarm

Main Menu > *ALARM PARAMETERS > DELAY ON ALARM*

```
<ALARM PARAMETERS>        ■       <DELAY ON ALARM>
►DELAY ON ALARM                   Trip Delay:     0008s
 BLEED TIMER ALARM
 ORP DOSE TIMER ALM
                                  ▲

                                  <DELAY ON ALARM>
                                  Trip Delay:     0108s

                                  ■

                                  <DELAY ON ALARM>
                                  Trip Delay:     0108s

                                  ▲

                                  <DELAY ON ALARM>
                                  Trip Delay:     0120s

                                  ■
```
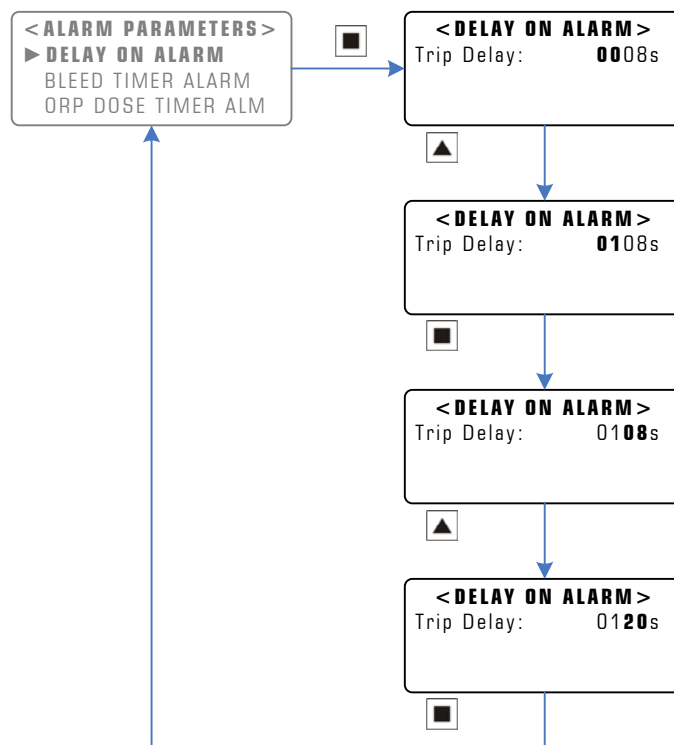
Example: Setting the Delay on Level Alarms to 2 minutes

When an alarm condition is detected, e.g. High Conductivity Alarm, the relay only trips immediately if the Trip Delay is set to 2 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, e.g. 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.

NOTE: The minimum alarm trip delay able to be set is 2 seconds.

5.5.6 Bleed Timer Alarm

Main Menu > *ALARM PARAMETERS > BLEED TIMER ALARM*
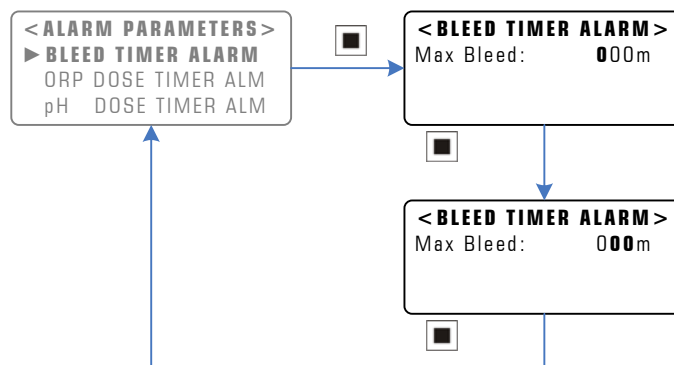
Example: Leaving the Bleed Timer Alarm Disabled

The 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.

5.5.7 ORP Dose Timer Alarm

Main Menu > *ALARM PARAMETERS > ORP DOSE TIMER ALM*
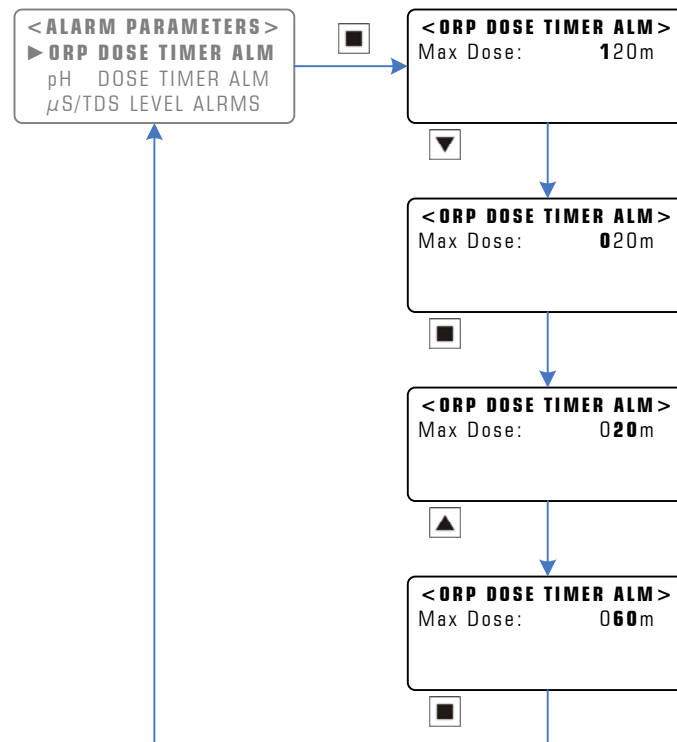
Example: Setting a Maximum Continuous ORP Dose Time of 60 minutes

The ORP Dose Timer Alarm is the maximum acceptable Dose time for the system to reach the ORP Setpoint (or 97% of the Setpoint, for software v0.71 or later). This alarm is designed to protect the system from excessive dosing in the event of a false reading from a faulty ORP probe, or if the controller itself is faulty.

To disable the ORP Dose Timer Alarm, program the timer setting to 000m.

If the system ORP reaches the Setpoint within the programmed time, (or 97% of the Setpoint for software v0.71 or later), the timer resets. However, if the timer times out before the ORP reaches this level, the ORP Dose Timer Alarm is raised and the pump switches off and remains disabled until the unit is manually reset by holding down the Reset pushbutton.

5.5.8 pH Dose Timer Alarm

Main Menu > *ALARM PARAMETERS > pH DOSE TIMER ALM*

```
<ALARM PARAMETERS>          ■        <pH DOSE TIMER ALM>
►pH   DOSE TIMER ALM                 Max Dose:        120m
  µS/TDS LEVEL ALRMS
  ORP LEVEL ALARMS
                                     ▼

                                     <pH DOSE TIMER ALM>
                                     Max Dose:        020m

                                     ■

                                     <pH DOSE TIMER ALM>
                                     Max Dose:        020m

                                     ▼

                                     <pH DOSE TIMER ALM>
                                     Max Dose:        000m

                                     ■
```
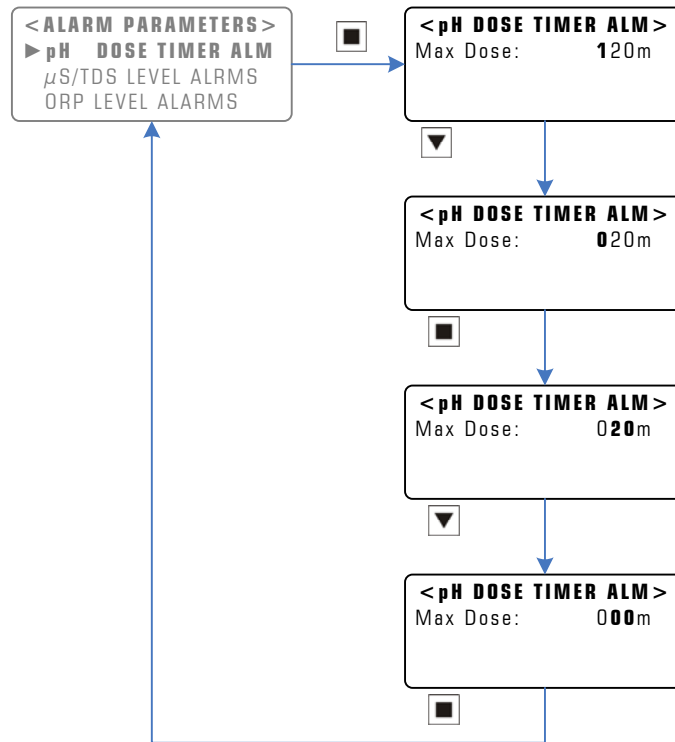
Example: Disabling pH Dose Timer Alarm

The pH Dose Timer Alarm is the maximum acceptable Dose time for the system to reach the pH Setpoint (or 97% of the Setpoint for software v0.71 or later). This alarm is designed to protect the system from excessive dosing in the event of a false reading from a faulty pH probe, or if the controller itself is faulty.

To disable the pH Dose Timer Alarm, program the timer setting to 000m.

If the system pH reaches the Setpoint within the programmed time (or 97% of the Setpoint for software v0.71 or later), the timer resets. However, if the timer times out before the pH reaches this level, the pH Dose Timer Alarm is raised and the pH Pump switches off and remains disabled until the unit is manually reset by holding down the Reset pushbutton.

5.5.9 Timer Alarm Hysteresis (Software ver 0.91 & later)

Main Menu > *ALARM PARAMETERS > TMR ALM HYSTERESIS*

```
<ALARM PARAMETERS>          ■          <TMR ALM HYSTERESIS>
►TIMER ALM HYSTERESIS                  Hysteresis:        3%
 µS/TDS LEVEL ALRMS
 ORP LEVEL ALARMS
                                                     X2 ▼

                                       <TMR ALM HYSTERESIS>
                                       Hysteresis:        5%

                                              ■
```
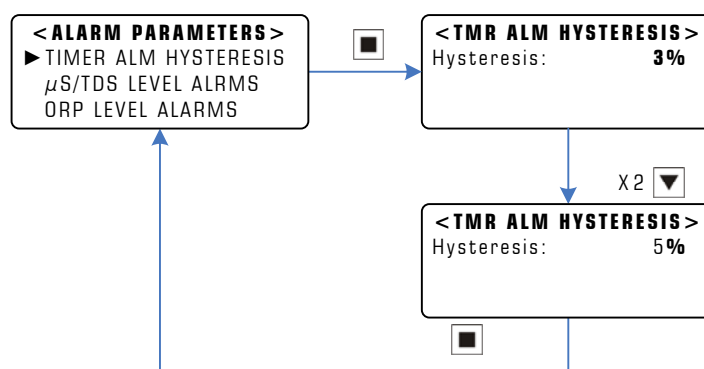
Example: Setting the Timer Alarm Hysteresis to 5%

Sections 5.5.7 & 5.5.8 explain how the Timer Alarms reset themselves if the pH or ORP reaches 97% of the setpoint (ie. A Timer Alarm Hysteresis of 100–97= 3%). For DIGICHEM Plus+ controllers with a software version 0.91 or later, this percentage is programmable from 1 to 20%. For instance, if you are happy if the ORP reaches 90% of setpoint (eg. 450mV, if setpoint is 500mV), then set Timer Alarm Hysteresis to (100–90= 10%), so that the ORP Timer Alarm cancels if the ORP is above 450mV.

5.5.10 Alarm Override (Software ver 0.80 & later)

Main Menu > *ALARM OVERRIDE*

```
<MAIN MENU>                 ■          <ALARM OVERRIDE>
►ALARM OVERRIDE                        Disable for: 00   hrs
 TIME & DATE
 FACTORY SETTINGS
                                              ▲ X3

                                       <ALARM OVERRIDE>
                                       Disable for: 03   hrs

                                              ■
```
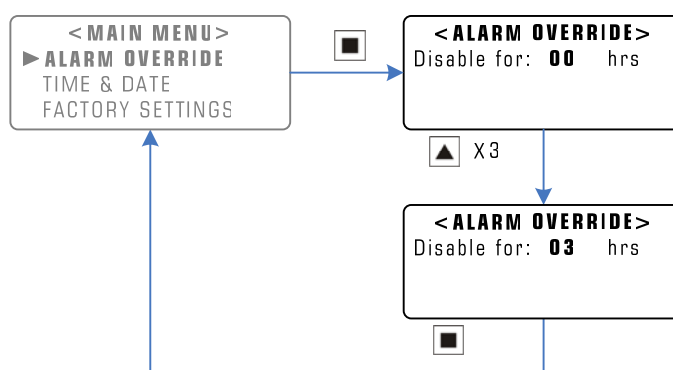
Example: Setting the Alarm Override to disable all alarms for 3 hours

The DIGICHEM Plus+ has the feature to disable all alarms temporarily. This is useful, for example, if you are performing a tower clean, where the ORP, pH or Conductivity levels may rise or fall above or below pre-programmed alarm parameters.

In this case you would not want the alarms to trigger, so therefore the alarm override feature locks out, or disables all alarms for a programmable time period (0 to 99 hours).

The Alarm Override is also logged as a percentage of the data logging interval in the controller's data log. For example, if the data logging interval is 120 minutes and the alarm override was active for 60 minutes during this time, the log would display 50%.

5.6 Inhibitor & Dispersant Setup

Main Menu > *SETUP MENU > GENERAL SETUP > INHIBITOR SETUP*

Main Menu > *SETUP MENU > GENERAL SETUP > DISPERSANT SETUP*

The above two features are identical, but work independently.
There are 5 Possible Inhibitor/Dispersant Feed Pump Modes to select from:

- Dose on a Cycle when the controller is bleeding (Mode: On Bleed)
- Dose on a Cycle for the same bleed time, but delayed until bleed is completed (Mode: After Bleed)
- Dose on a continuous Cycle (Mode: 24hr/day)
- Dose upon pulses received from a Make-up flow meter (Mode: MakeUp Pulses)
- Dose upon pulses received from a Bleed flow meter (Mode: Bleed Pulses)

In the examples to follow, it may be necessary to change the current Inhibitor mode. The screens will vary according to if you are in the mode that requires a change, or you are changing to a new mode.
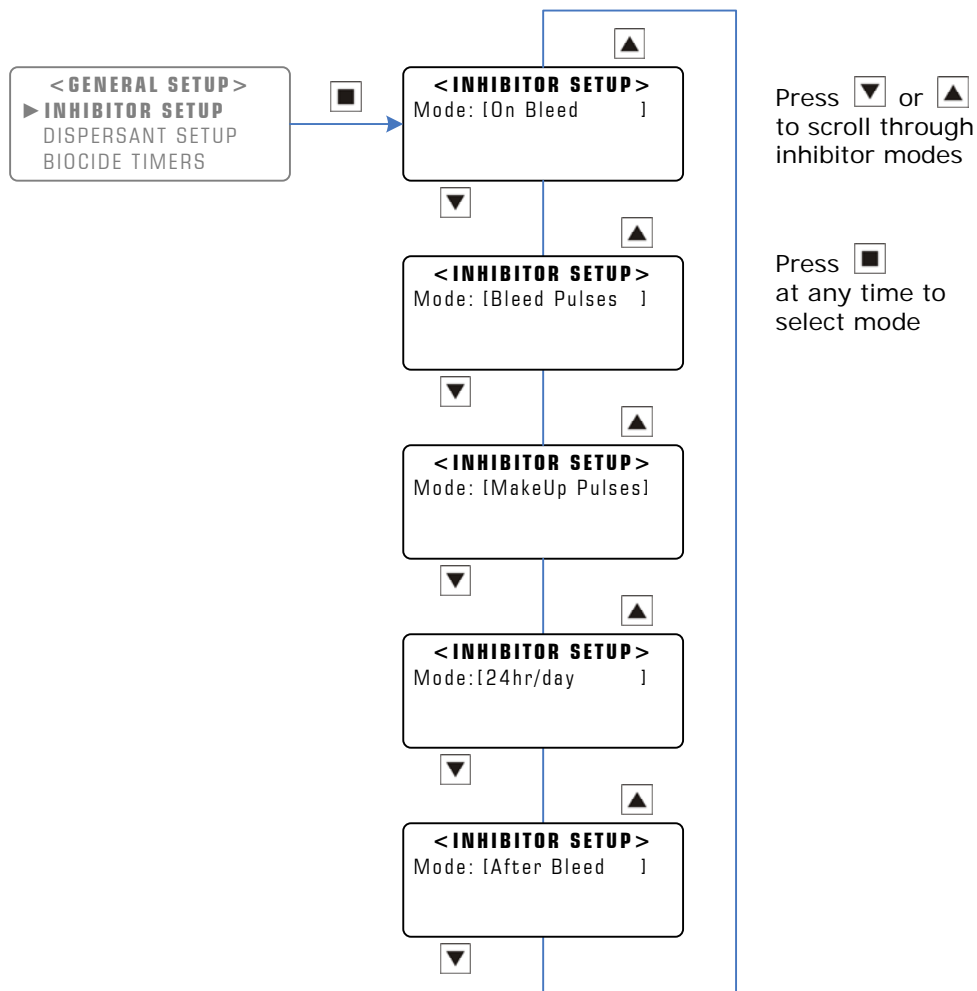
Inhibitor Setup Menu

5.6.1 Dose on Bleed Mode

In this mode, the Inhibitor Pump doses during bleed, on a programmable ON/OFF time cycle when the measured Conductivity is greater than the Conductivity Setpoint, as long as the Bleed Cycle is set to ON/OFF = 00/00s, i.e. Bleed continuously.

If Inhibitor is set to "Dose on Bleed" mode, and an ON/OFF cycle for Inhibitor is programmed, then the Inhibitor ON/OFF cycle only occurs during the ON part of the Bleed Cycle. This means Inhibitor will only dose when the bleed valve is actually opened and passing water. During the OFF part of the Bleed Cycle, Inhibitor dosing is suspended.

RECOMMENDATION: If dosing Inhibitor on bleed when a bleed cycle is programmed, it is recommended to program a longer Bleed Cycle ON time than the complete Inhibitor Cycle. For example, program the bleed cycle to 50s ON/ 80s OFF, and the Inhibitor cycle to 2s ON/ 10s OFF (Hence, the 2/10s cycle only operates during the Bleed 50s ON time period). The logic is that if you change the bleed cycle, the Inhibitor dosage as a proportion of the time the bleed solenoid is actually bleeding, does not change.

```
<GENERAL SETUP>          ■      <INHIBITOR SETUP>
▶INHIBITOR SETUP                Mode:   [Bleed Pulses]
 DISPERSANT SETUP
 BIOCIDE TIMERS                        ▲

                                <INHIBITOR SETUP>       ■      <INHIBITOR SETUP>
                                Mode:       [On Bleed]         Mode:        [On Bleed]
                                                                Change Mode?   [NO ]

                                                                       ▼

                                                                <INHIBITOR SETUP>
                                                                Mode:        [On Bleed]
                                                                Change Mode?   [YES]

                                                                       ■

                                                                <INHIBITOR SETUP>
                                                                Mode:        [On Bleed]
                                                                ON Period:     0050s
                                                                OFF Period:    0050s

                                                                       ■

                                                                <INHIBITOR SETUP>
                                                                Mode:        [On Bleed]
                                                                ON Period:     0050s
                                                                OFF Period:    0050s

                                                                       ▼

                                                                <INHIBITOR SETUP>
                                                                Mode:        [On Bleed]
                                                                ON Period:     0030s
                                                                OFF Period:    0050s

                                                                       ■

                                                                <INHIBITOR SETUP>
                                                                Mode:        [On Bleed]
                                                                ON Period:     0030s
                                                                OFF Period:    0050s

                                                                       ■

                                                                <INHIBITOR SETUP>
                                                                Mode:        [On Bleed]
                                                                ON Period:     0030s
                                                                OFF Period:    0050s

                                                                       ▲

                                                                <INHIBITOR SETUP>
                                                                Mode:        [On Bleed]
                                                                ON Period:     0030s
                                                                OFF Period:    0070s

                                                                       ■
```

Example: Changing Inhibitor from "Bleed Pulses" mode to "On Bleed" mode -
Decreasing Inhibitor pump duty cycle from 50% to 30%

In the previous example, some of the screens may not appear, if you are already in 'On Bleed' mode, and you enter to this menu again. See the example below:

<GENERAL SETUP>
► INHIBITOR SETUP
  DISPERSANT SETUP
  BIOCIDE TIMERS

■

<INHIBITOR SETUP>
Mode: [On Bleed]

■

<INHIBITOR SETUP>
Mode: [On Bleed]
ON Period: 0050s
OFF Period: 0050s

■

<INHIBITOR SETUP>
Mode: [On Bleed]
ON Period: 0050s
OFF Period: 0050s

▼

<INHIBITOR SETUP>
Mode: [On Bleed]
ON Period: 0030s
OFF Period: 0050s

■

<INHIBITOR SETUP>
Mode: [On Bleed]
ON Period: 0030s
OFF Period: 0050s

■

<INHIBITOR SETUP>
Mode: [On Bleed]
ON Period: 0030s
OFF Period: 0050s

▲

<INHIBITOR SETUP>
Mode: [On Bleed]
ON Period: 0030s
OFF Period: 0070s

■
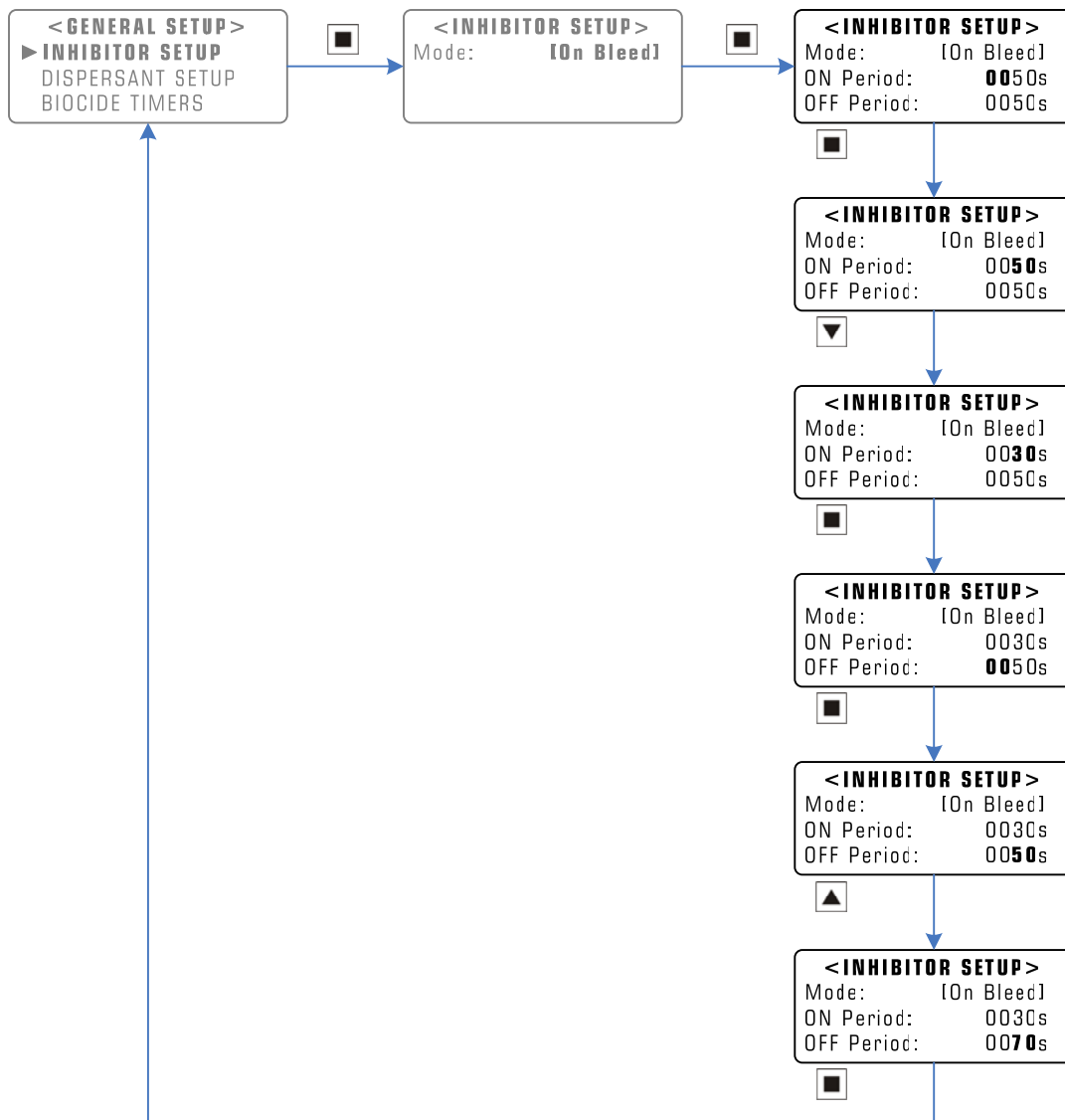
Example: With Inhibitor on Bleed mode currently set - Decreasing
Inhibitor pump duty cycle from 50% to 30%

NOTE: For most applications, it is recommended to work on a 100
second cycle. For any of the % of Time modes, you can use the
table on the follow page as a guide to set your Inhibitor or
Dispersant 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

5.6.2 After Bleed Mode

In After Bleed Mode, the Inhibitor Pump will dose for a proportional time based on the amount of time the bleed was on for.

For example, after a Bleed Cycle, if the total time bleed time (including pauses) was 15 minutes, then the Inhibitor will also dose on a programmable ON/OFF cycle for 15 minutes, commencing immediately after the 15 minute bleed cycle is complete.

The example on the following page explains programming an After Bleed ON/OFF cycle time:

NOTE: The Dispersant Setup screens are identical to that of the Inhibitor, but for purposes of illustration, the Inhibitor Setup is shown in the following diagrams:
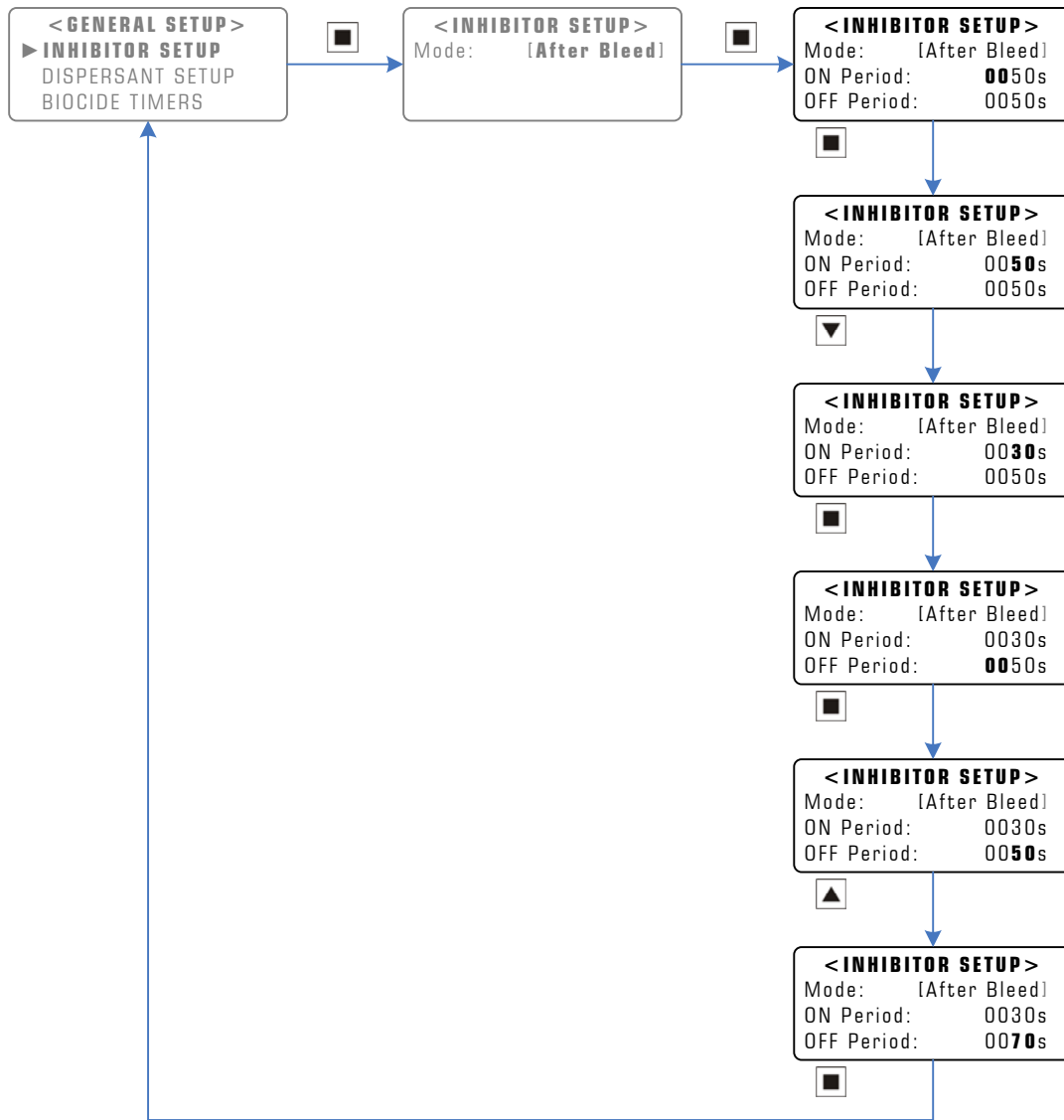
Example: With Inhibitor on 'After Bleed' mode currently set –
Decreasing Inhibitor pump duty cycle from 50% to 30%

5.6.3 Twenty Four Hour Per Day (24hr/day) Cycle

In this mode, the Inhibitor Pump will dose on a continuous duty cycle all day, every day. The Duty cycle is repeating ON / OFF times, eg ON=30sec, followed by OFF=570sec & repeating (i.e. 5% duty cycle).

An example of the 24hr/day cycle is shown on the following page:

```
┌─────────────────────┐      ┌─────────────────────┐      ┌─────────────────────┐
│ <GENERAL SETUP>     │  ■   │ <INHIBITOR SETUP>   │  ■   │ <INHIBITOR SETUP>   │
│ ►INHIBITOR SETUP    │ ───► │ Inhibitor: [24hr/day]│ ───►│ Inhibitor: [24hr/day]│
│  DISPERSANT SETUP   │      │                     │      │ On Period:     0050s │
│  BIOCIDE TIMERS     │      │                     │      │ Off Period:    0050s │
└─────────────────────┘      └─────────────────────┘      └─────────────────────┘
                                                                    ■
                                                                    │
                                                                    ▼
                                                          ┌─────────────────────┐
                                                          │ <INHIBITOR SETUP>   │
                                                          │ Inhibitor: [24hr/day]│
                                                          │ On Period:     0050s │
                                                          │ Off Period:    0050s │
                                                          └─────────────────────┘
                                                                    ▼
                                                                    │
                                                          ┌─────────────────────┐
                                                          │ <INHIBITOR SETUP>   │
                                                          │ Inhibitor: [24hr/day]│
                                                          │ On Period:     0030s │
                                                          │ Off Period:    0050s │
                                                          └─────────────────────┘
                                                                    ■
                                                                    │
                                                          ┌─────────────────────┐
                                                          │ <INHIBITOR SETUP>   │
                                                          │ Inhibitor: [24hr/day]│
                                                          │ On Period:     0030s │
                                                          │ Off Period:    0050s │
                                                          └─────────────────────┘
                                                                    ▲
                                                                    │
                                                          ┌─────────────────────┐
                                                          │ <INHIBITOR SETUP>   │
                                                          │ Inhibitor: [24hr/day]│
                                                          │ On Period:     0030s │
                                                          │ Off Period:    0650s │
                                                          └─────────────────────┘
                                                                    ■
                                                                    │
                                                          ┌─────────────────────┐
                                                          │ <INHIBITOR SETUP>   │
                                                          │ Inhibitor: [24hr/day]│
                                                          │ On Period:     0030s │
                                                          │ Off Period:    0650s │
                                                          └─────────────────────┘
                                                                    ▼
                                                                    │
                                                          ┌─────────────────────┐
                                                          │ <INHIBITOR SETUP>   │
                                                          │ Inhibitor: [24hr/day]│
                                                          │ On Period:     0030s │
                                                          │ Off Period:    0600s │
                                                          └─────────────────────┘
                                                                    ■
```

Example: With Inhibitor on "24hr/day" mode currently set – Setting the Inhibitor pump to repeat dose for 30 seconds followed by a 600 second off period

5.6.4 Make-Up Water Pulses

In this mode, the Inhibitor Pump doses proportional to pulses received from a water meter fitted in the Make-Up line. The DIGICHEM Plus+ 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?

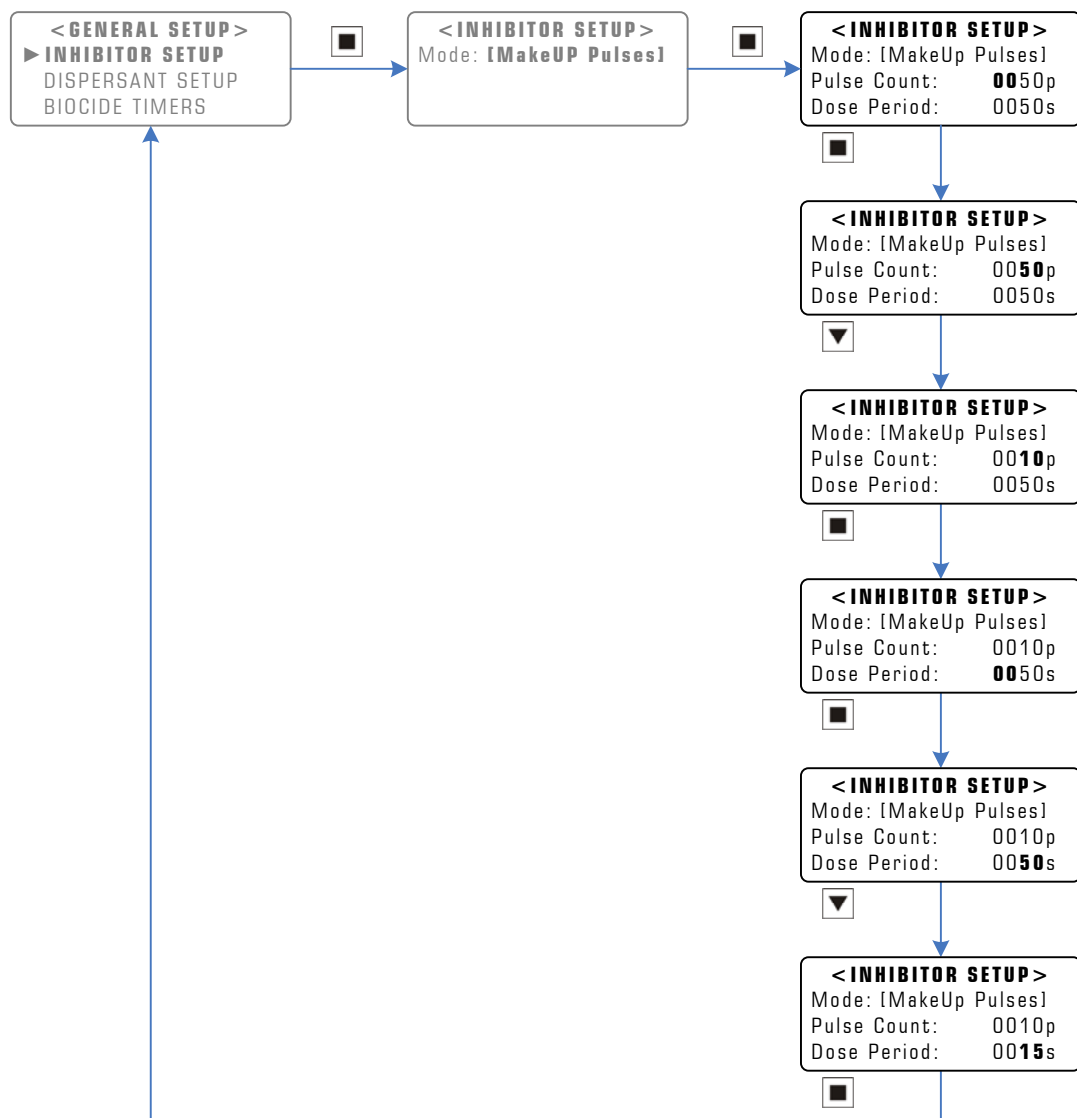**Pump dose rate** = 1300ml/hr = **0.36ml/sec**
Dose time = 10ml / 0.36ml/sec = **27.8 seconds** (i.e. approx. 30 sec)

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).

The example below explains setting up the pulse count and dose time:

Example: With Inhibitor on "Make-Up Pulses" mode currently set – Setting the Inhibitor pump to dose for 15 seconds after 10 pulses from a water meter

5.6.5 Bleed Water Pulses

In this mode, the Inhibitor Pump doses proportional to pulses received from a water meter fitted in the Bleed line. The DIGICHEM Plus+ activates the pump for a set time once a pre-determined number of pulses is counted.

Select the mode of "Bleed Pulses" in the Inhibitor Setup menu (Explained in Section 5.6) and see the example above from section 5.6.4 Make-Up Water Pulses.

Notes: (v0.91 or later) A '+' will be displayed on the LCD screen momentarily for a make-up pulse and a '-' will be displayed for a Bleed pulse.

5.7 Biocide Setup

Main Menu > SETUP MENU > GENERAL SETUP > BIOCIDE TIMERS

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/ORP) 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. If ORP control is enabled, Pre-Bleed and Bleed-Lockout are only applicable to Biocide A.

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/ORP. In other words, the programs can be allocated in any combination to either of the two biocide outputs, A and B/ORP.

For instance, if pump A is set up in 6 programs, pump B/ORP 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/ORP 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.**

NOTE: When a timer program is initially entered, the controller will control as per normal, until the end of the timer program. At the end of the timer program, the outputs will then go into an "Idle" state. The outputs will be in an "Idle" state until the Timer program is activated again.
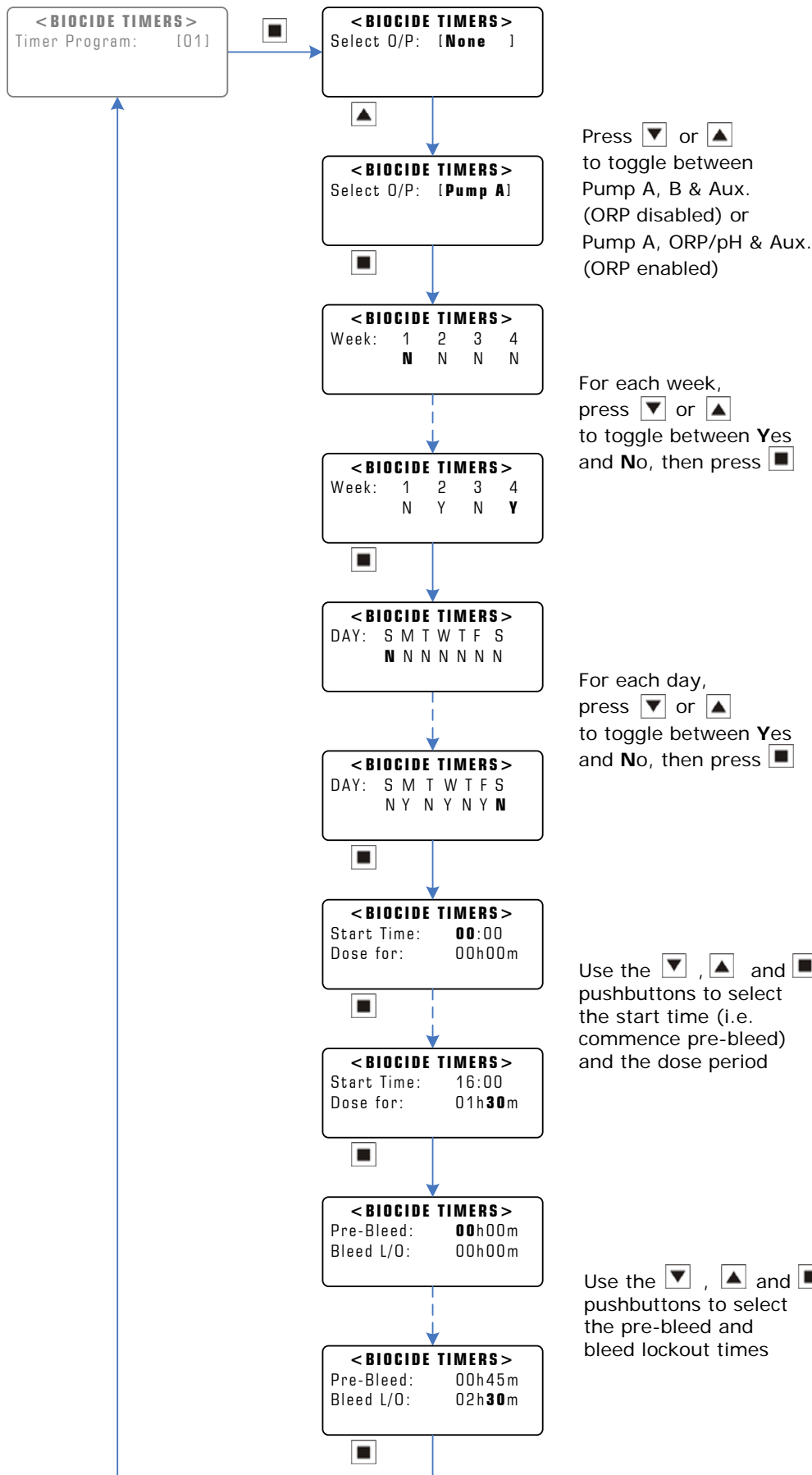
Main Menu > *SETUP MENU > GENERAL SETUP > BIOCIDE TIMERS*
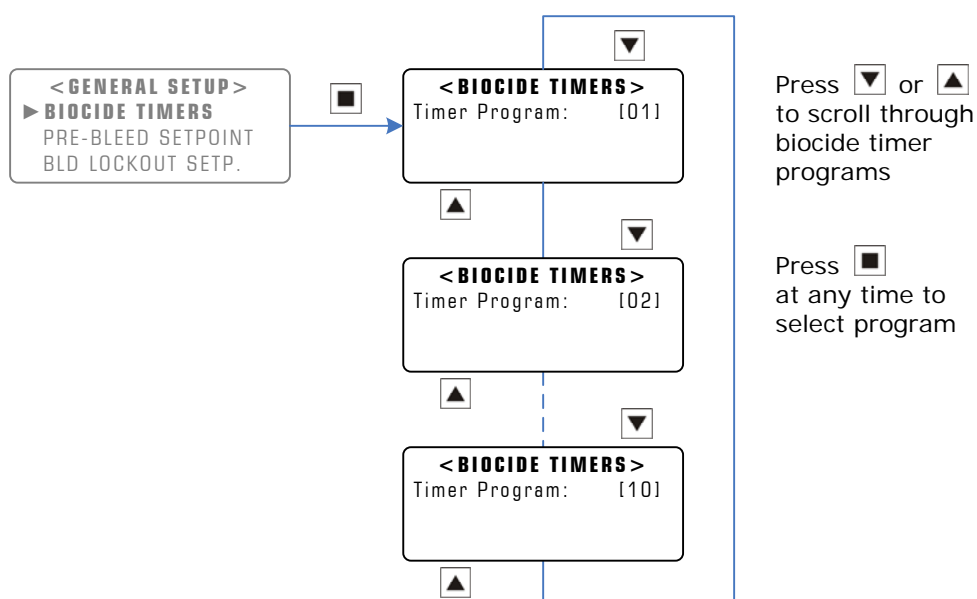
The example on the following page illustrates setting up Timer Program [01] for Pump A:

Note: If ORP is disabled, then Pump B will be displayed as an option. If ORP is enabled, then ORP/pH will be displayed as an option.

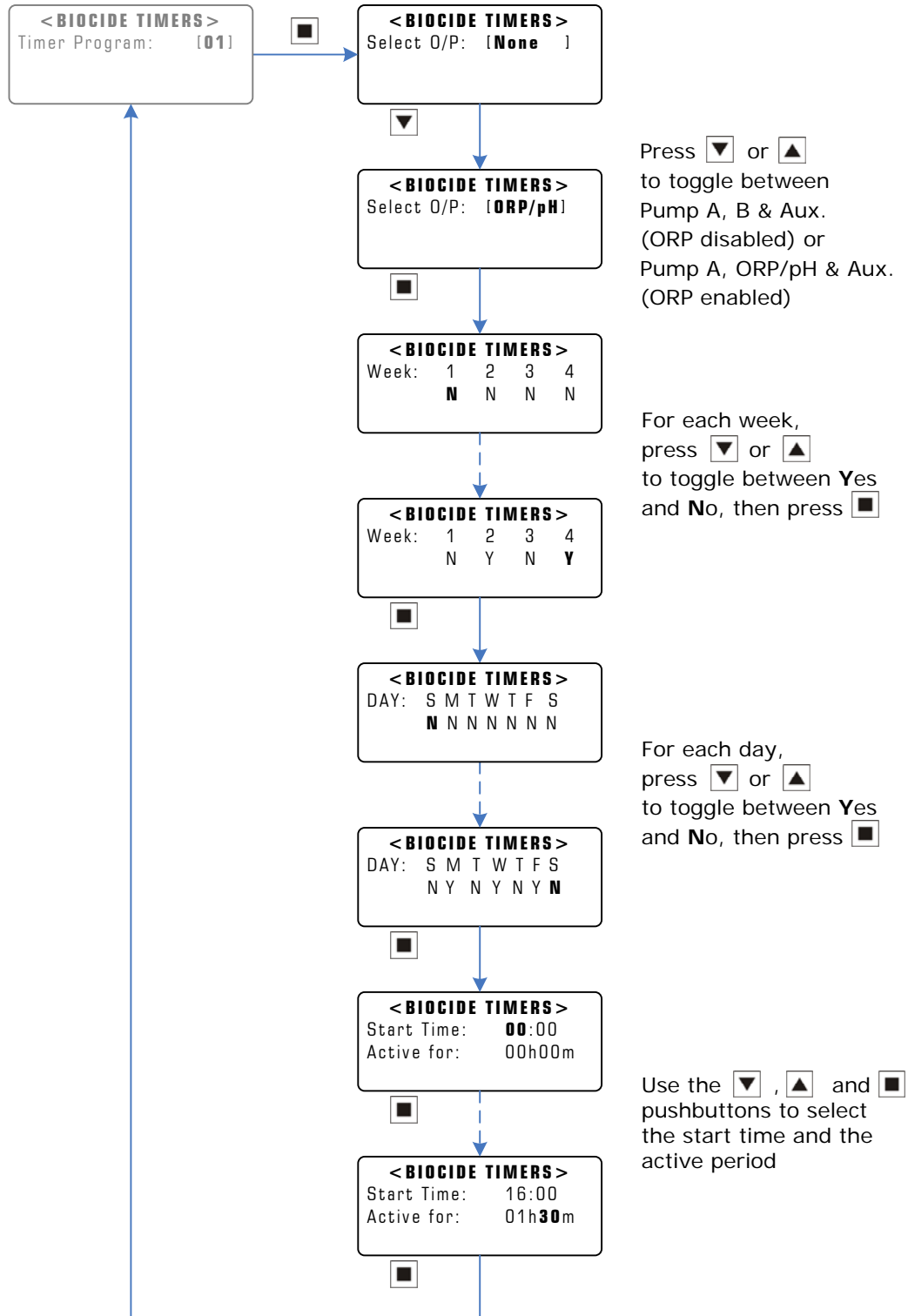***Main Menu >*** *SETUP MENU > GENERAL SETUP > BIOCIDE TIMERS > TIMER > PROGRAM [01]*

< BIOCIDE TIMERS >
Timer Program: [01]

< BIOCIDE TIMERS >
Select O/P: [**None**]

< BIOCIDE TIMERS >
Select O/P: [**Pump A**]

Press ▼ or ▲
to toggle between
Pump A, B & Aux.
(ORP disabled) or
Pump A, ORP/pH & Aux.
(ORP enabled)

< BIOCIDE TIMERS >
Week: 1   2   3   4
        N   N   N   N

< BIOCIDE TIMERS >
Week: 1   2   3   4
        N   Y   N   **Y**

For each week,
press ▼ or ▲
to toggle between **Y**es
and **N**o, then press ■

< BIOCIDE TIMERS >
DAY: S M T W T F S
      N N N N N N N

< BIOCIDE TIMERS >
DAY: S M T W T F S
      N Y N Y N Y **N**

For each day,
press ▼ or ▲
to toggle between **Y**es
and **N**o, then press ■

< BIOCIDE TIMERS >
Start Time: **00**:00
Dose for: 00h00m

< BIOCIDE TIMERS >
Start Time: 16:00
Dose for: 01h**30**m

Use the ▼ , ▲ and ■
pushbuttons to select
the start time (i.e.
commence pre-bleed)
and the dose period

< BIOCIDE TIMERS >
Pre-Bleed: **00**h00m
Bleed L/O: 00h00m

< BIOCIDE TIMERS >
Pre-Bleed: 00h45m
Bleed L/O: 02h**30**m

Use the ▼ , ▲ and ■
pushbuttons to select
the pre-bleed and
bleed lockout times

Example: Selecting Biocide Program 1, for pump A to dose on Mon, Wed, Friday in Weeks 2 & 4, with a 45m pre-bleed starting at 16h00, thereafter dosing for 1h30m, with an additional bleed lockout of 2h30m

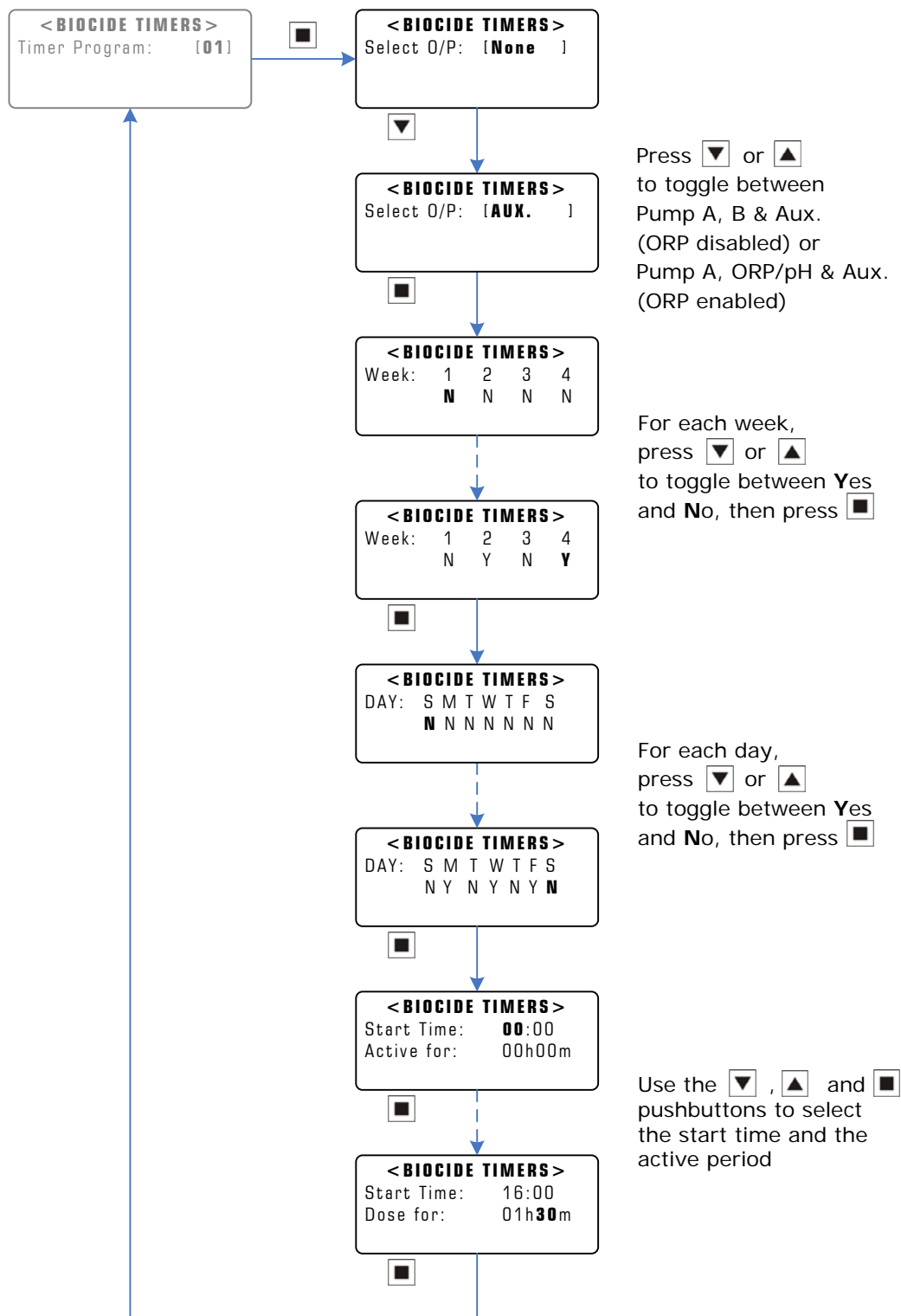However, this menu will change, if ORP is enabled.

The example below shows the menu structure using the previous example, where instead of Pump A, the ORP/pH Output will be activated:

NOTE: For this selection, Pre-Bleed and Bleed Lockout will not appear in the menu, or the Main screen when the controller is inside or outside of an active period.

```
<BIOCIDE TIMERS>                 <BIOCIDE TIMERS>
Timer Program:    [01]    ■  →   Select O/P: [None   ]
```

```
▼
```

```
<BIOCIDE TIMERS>
Select O/P:  [ORP/pH]
```
Press ▼ or ▲ to toggle between Pump A, B & Aux. (ORP disabled) or Pump A, ORP/pH & Aux. (ORP enabled)

```
■
```

```
<BIOCIDE TIMERS>
Week:   1   2   3   4
        N   N   N   N
```
For each week, press ▼ or ▲ to toggle between **Y**es and **N**o, then press ■

```
<BIOCIDE TIMERS>
Week:   1   2   3   4
        N   Y   N   Y
```

```
■
```

```
<BIOCIDE TIMERS>
DAY:  S M T W T F S
      N N N N N N N
```
For each day, press ▼ or ▲ to toggle between **Y**es and **N**o, then press ■

```
<BIOCIDE TIMERS>
DAY:  S M T W T F S
      N Y N Y N Y N
```

```
■
```

```
<BIOCIDE TIMERS>
Start Time:    00:00
Active for:    00h00m
```
Use the ▼ , ▲ and ■ pushbuttons to select the start time and the active period

```
■
```

```
<BIOCIDE TIMERS>
Start Time:    16:00
Active for:    01h30m
```

```
■
```

Example: Selecting Biocide Program 1, for the ORP & pH control functions to be active on Mon, Wed, Friday in Weeks 2 & 4, active for 1h30m, commencing at 16h00. Therefore the ORP & pH control only occur betweeen 16h00 and 17h30 on the days selected.

The Auxiliary (Aux.) output can also be switched from a timer, as per the example below:

```
<BIOCIDE TIMERS>          ■
Timer Program:    [01]
```

```
<BIOCIDE TIMERS>
Select O/P: [None   ]
```
▼

```
<BIOCIDE TIMERS>
Select O/P: [AUX.   ]
```

Press ▼ or ▲
to toggle between
Pump A, B & Aux.
(ORP disabled) or
Pump A, ORP/pH & Aux.
(ORP enabled)

■

```
<BIOCIDE TIMERS>
Week:   1   2   3   4
        N   N   N   N
```

```
<BIOCIDE TIMERS>
Week:   1   2   3   4
        N   Y   N   Y
```

For each week,
press ▼ or ▲
to toggle between Yes
and No, then press ■

■

```
<BIOCIDE TIMERS>
DAY:  S M T W T F S
      N N N N N N N
```

```
<BIOCIDE TIMERS>
DAY:  S M T W T F S
      N Y N Y N Y N
```

For each day,
press ▼ or ▲
to toggle between Yes
and No, then press ■

■

```
<BIOCIDE TIMERS>
Start Time:    00:00
Active for:    00h00m
```

```
<BIOCIDE TIMERS>
Start Time:    16:00
Dose for:      01h30m
```

Use the ▼ , ▲ and ■
pushbuttons to select
the start time and the
active period

■

Example: Selecting Biocide Program 1, for the Aux. control function to be active on Mon, Wed, Friday in Weeks 2 & 4, active for 1h30m, commencing at 16h00.

NOTE: Aux. output is only available from software version 0.83 and later. When the Aux. output is activated, the main screen will display "AUX." at the bottom.

5.8 Pre-Bleed Setpoint

Main Menu > *SETUP MENU > GENERAL SETUP > PRE-BLEED SETPOINT*
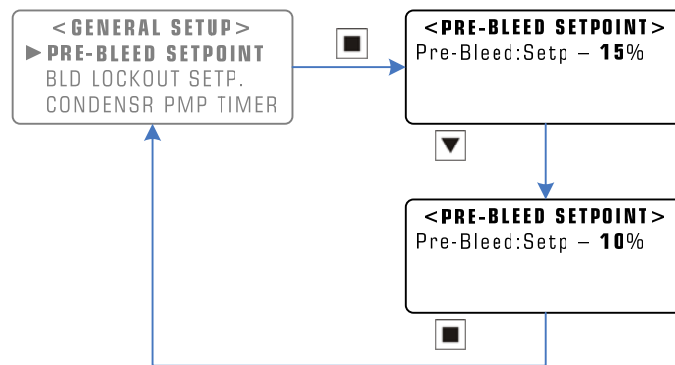
Example: Decreasing the Pre-Bleed Setpoint from Setpoint -15% to Setpoint -10%

In the example above, the Pre-Bleed setpoint is set as the Normal Conductivity Setpoint less 15%. Hence, during the Pre-bleed time (ie. Immediately before biocide dosing), the normal conductivity setpoint is reduced by 15%, 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 > GENERAL SETUP > BLD LOCKOUT SETP.*
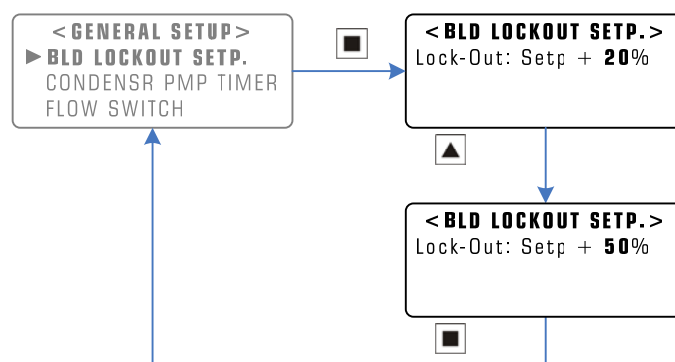
Example: Increasing Lockout Setpoint from Setpoint +20% to Setpoint +50%

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 Condenser Pump Timer

Main Menu > *SETUP MENU > GENERAL SETUP > CONDENSR PMP TIMER*


```
<GENERAL SETUP>
► CONDENSR PMP TIMER
  FLOW SWITCH
  START-UP DELAY
```

■

```
<CONDENSR PMP TIMER>
Biocide dose + 000m
```

▲

```
<CONDENSR PMP TIMER>
Biocide dose + 015m
```

■
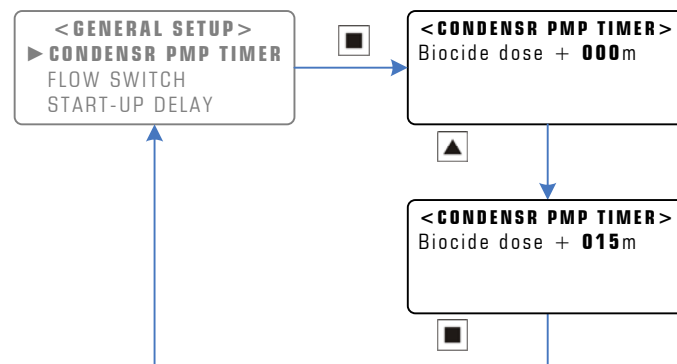
Example: Setting the Condenser Pump Timer for 15 minutes

Often when biocides are dosed into the manifold of the DIGICHEM Plus+ 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 Plus+ 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 (i.e. volt free) so it 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 Plus+.
Do NOT connect a Condenser pump or Re-circulation pump directly to this output.

When either biocide pump starts dosing (except Biocide B if set to dose on ORP), 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.
The time that the pump runs AFTER a biocide dose, is programmed here as the Condenser Pump Timer.

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
Condenser Pump Timer	=	30m (i.e. delay off time after A dose)
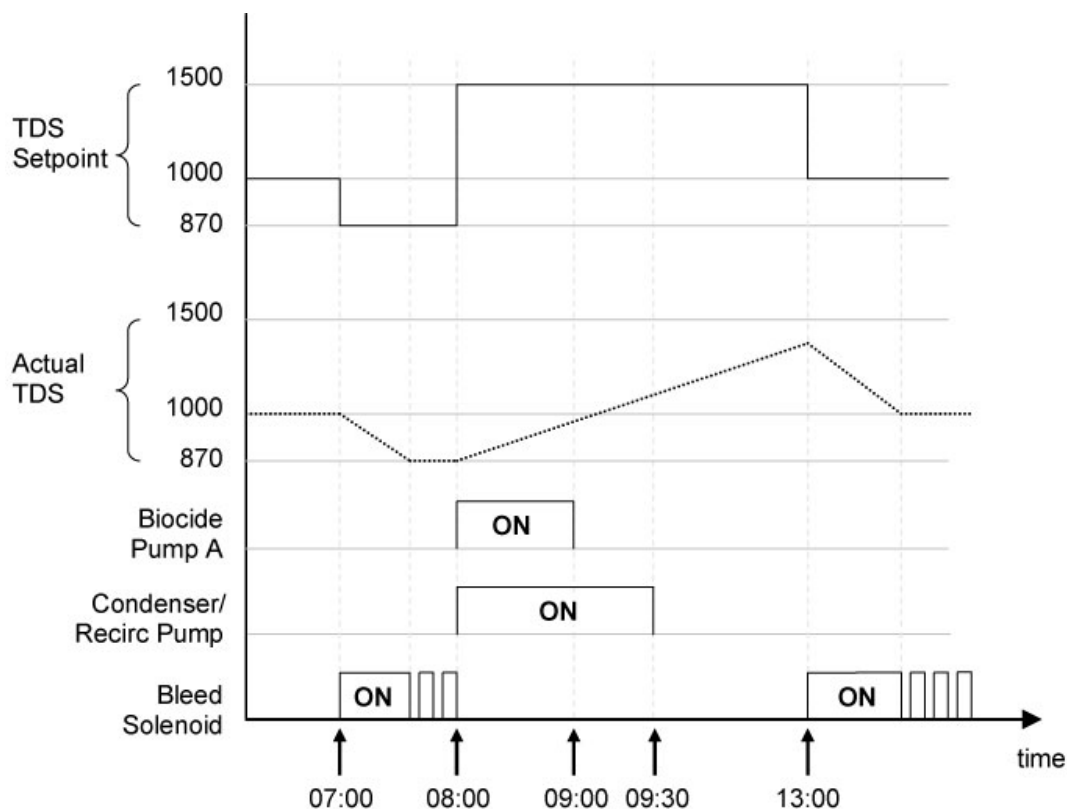
5.11 Flow Switch

Main Menu > SETUP MENU > GENERAL SETUP > FLOW SWITCH

With a flow switch 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 logic:

- DISABLE: All outputs active when required, regardless of flow or no flow
- NORMAL: Enabled outputs activate when required, only if the flow switch input is shorted
- REVERSE: Enabled outputs activate when required, only if the flow switch input is open circuit
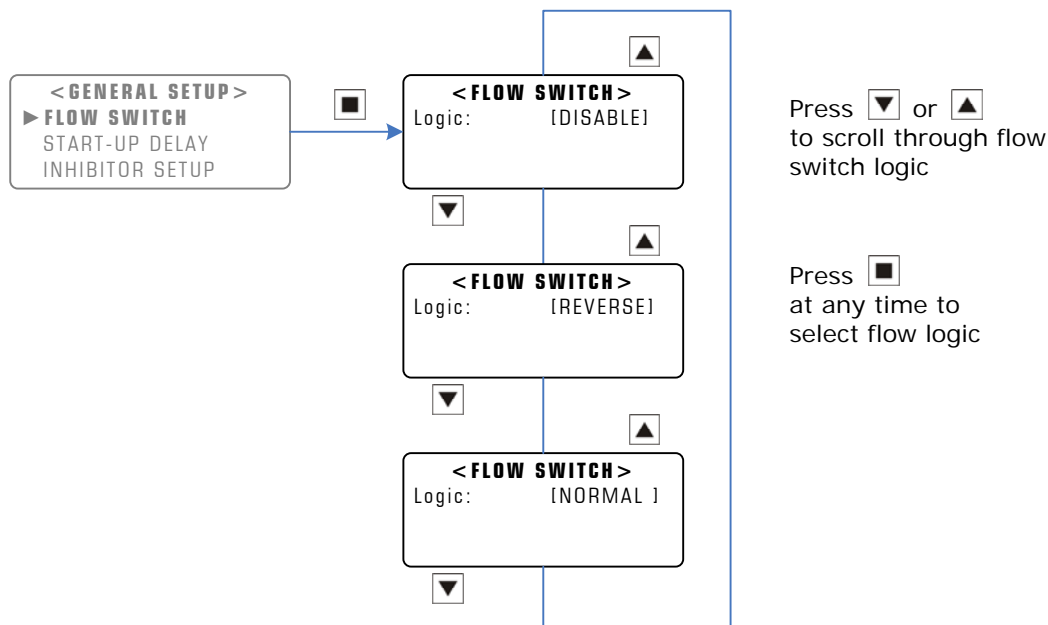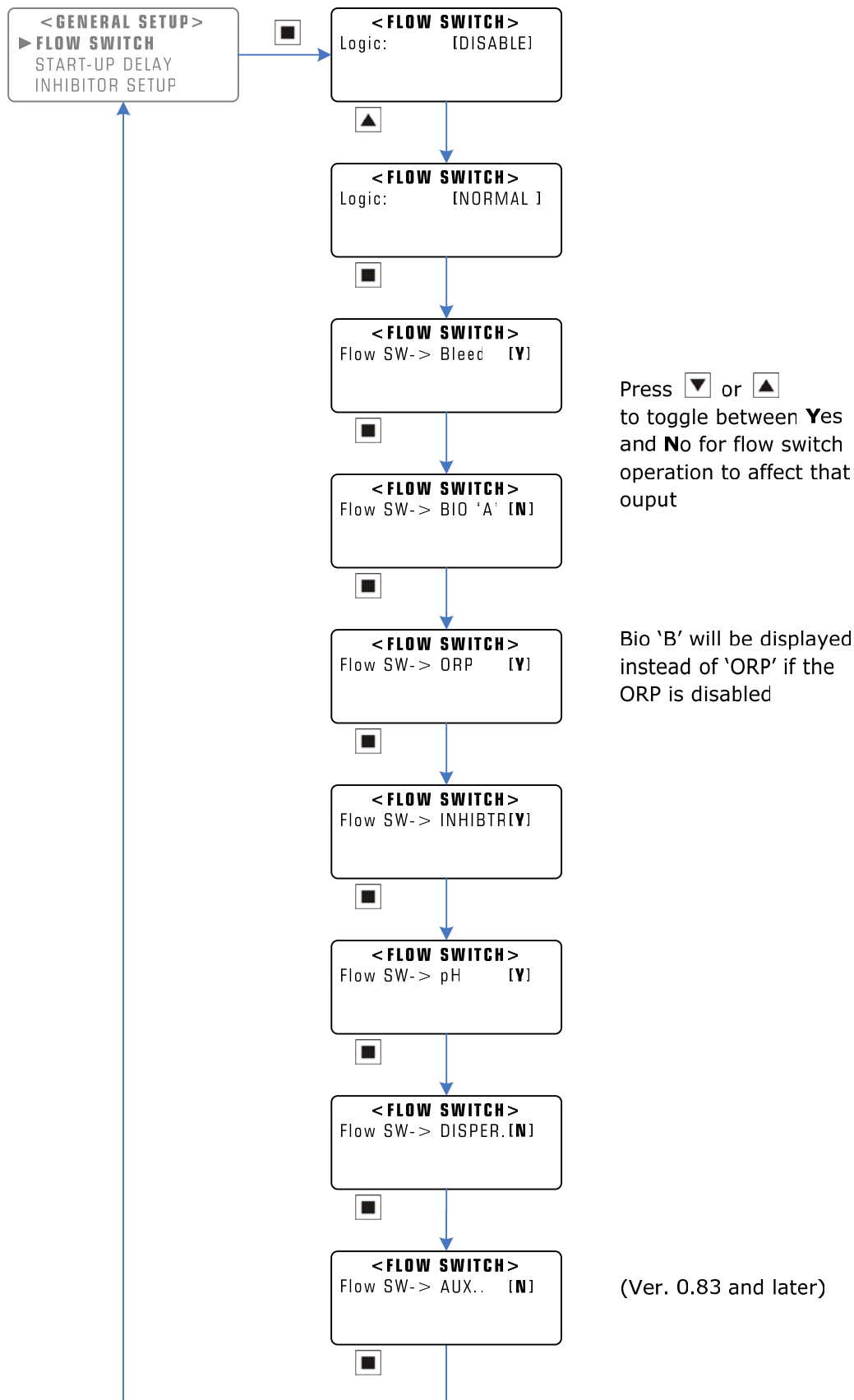

Flow Switch Setup Menu

The Flow Switch can disable either one or any combination of the 6 outputs if there is no flow. Typically, the Bleed, Inhibitor, pH & ORP outputs are disabled if there is no flow and the Non-Oxidising 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.

NOTE: Upon resumption of flow, if a Start-Up delay time has been programmed, the controller will only start controlling after this time. See Section 4.1.1 – pg 12 for Start-Up delay programming.

Please see the example on the following page demonstrating the enabling of the flow switch for various outputs:

```
<GENERAL SETUP>
►FLOW SWITCH
 START-UP DELAY
 INHIBITOR SETUP
```
[■]

```
<FLOW SWITCH>
Logic:      [DISABLE]
```
[▲]

```
<FLOW SWITCH>
Logic:      [NORMAL ]
```
[■]

```
<FLOW SWITCH>
Flow SW-> Bleed   [Y]
```
[■]

Press [▼] or [▲] to toggle between **Y**es and **N**o for flow switch operation to affect that ouput

```
<FLOW SWITCH>
Flow SW-> BIO 'A' [N]
```
[■]

```
<FLOW SWITCH>
Flow SW-> ORP     [Y]
```
[■]

Bio 'B' will be displayed instead of 'ORP' if the ORP is disabled

```
<FLOW SWITCH>
Flow SW-> INHIBTR[Y]
```
[■]

```
<FLOW SWITCH>
Flow SW-> pH      [Y]
```
[■]

```
<FLOW SWITCH>
Flow SW-> DISPER.[N]
```
[■]

```
<FLOW SWITCH>
Flow SW-> AUX..   [N]
```
(Ver. 0.83 and later)

[■]

Example: Setting the Flow Switch to operate for Bleed, ORP, Inhibitor, and pH Functions

Should the flow switch be disabled altogether, please see example on the following page:
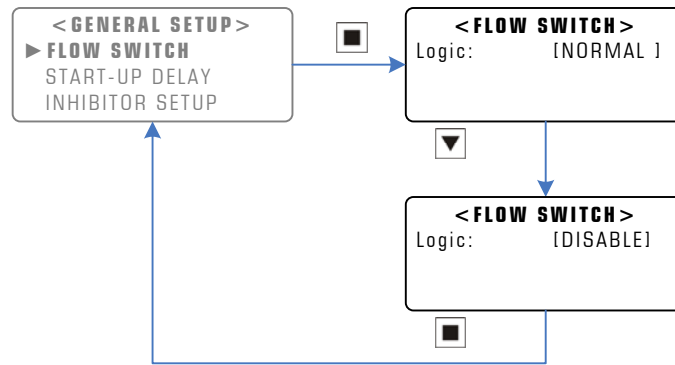
**Example:** Disabling Flow Switch Operation from Normal Logic

---

5.12 Advanced Setup Menu

Main Menu > *SETUP MENU > ADVANCED SETUP*

The Advanced Setup Menu has the following features:

- Data Logging – Log Process Variables on a time basis
- Disinfection – Program a weekly slug dose
- Extra Inhibitor Dose – Additional Inhibitor Dose to decrease scaling
- Water Volume Counters – Log Make-Up and Bleed Water Volumes
- Cycles of Concentration – Measured Conductivity / Make-Up Conductivity
- Password Setup – Setup Access Rights to Controller
- Controller Name – Assign a unique name to the controller
- Site Name – Assign a unique name to the site where the controller is installed
- Remote Coms – Enable GSM/GPRS Modem if fitted
- LCD Contrast – Adjust the intensity of the LCD screen display (Software ver 0.80 & later)
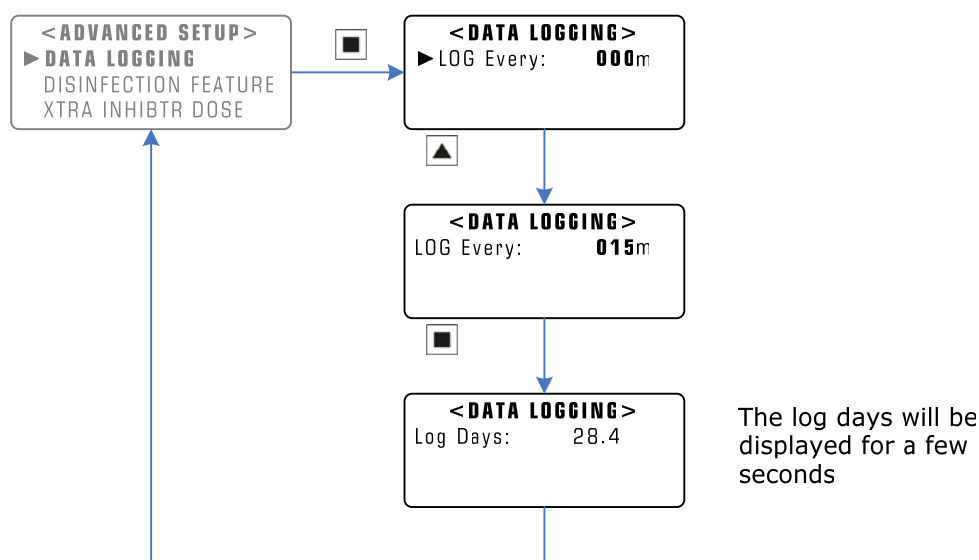
The diagram on the following page illustrates how to navigate through the Advanced Setup Menu:
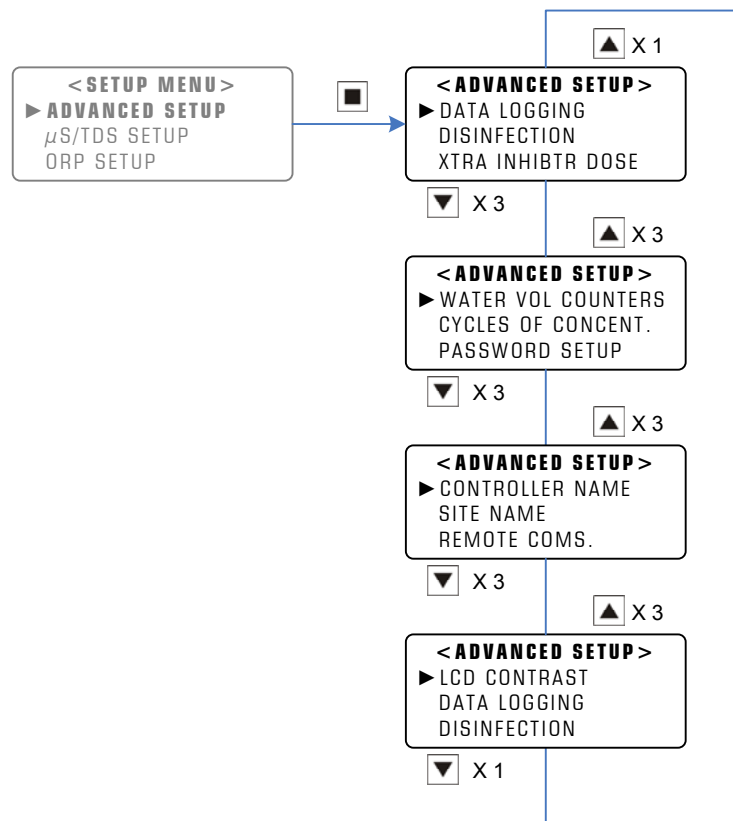
Advanced Setup Menu

5.12.1 Data Logging

Main Menu > *SETUP MENU > ADVANCED SETUP > DATA LOGGING*

Example: Increasing Data Logging times from 0min to Log every 15min

IMPORTANT: If the Logging Interval is changed, all previous Logs will be erased. (Software v0.91 or later will warn you of this when changing)

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

Name	Description	Range	Example
Date	Date stamp of log	N/A	08/07/2008
Time	Time stamp of log	N/A	12:45
Conductivity	Conductivity/TDS of water	0 – 10000	1024
Temperature	Temperature of water in °C	0 – 100	20
pH	pH of water	0.01 – 13.99	7.40
ORP	mV of water	0 – 999	606
Auxiliary Input1	Spare Analogue input (4-20mA)	0.0 – 10000	125
Auxiliary Input2	Spare Analogue input (4-20mA)	0.0 – 10000	125
Cycles of Concentration	The cooling water conductivity divided by the makeup water conductivity	0 – 1000	5.1
MakeUp water	Volume of water makeup in litres	0 – 20000	5400
Bleed water	Volume of bleed water in litres	0 – 20000	200
Evaporation & Losses	Volume of water lost due to evaporation and other losses	0 – 9999	1234
Bleed%	Percentage of the log period the Bleed output being active for	0 – 100	0
Inhibitor%	Percentage of the log period the Inhibitor output being active for	0 – 100	20
BioA%	Percentage of the log period the Biocide 'A' output being active for	0 – 100	0
BioB%/ORP	Percentage of the log period the Bio 'B' or ORP output active for	0 – 100	45
pH%	Percentage of the log period the pH output being active for	0 – 100	20
Dispersant%	Percentage of the log period the dispersant output being active for	0 – 100	10
Aux% (**SW ver 0.83 and later**)	Percentage of the log period the Aux. output being active for	0 – 100	0
Alarm%	Percentage of the log period the Alarm output being active for	0 – 100	0
Flow%	Percentage of the log period the flow switch was being active for	0 – 100	0
Alarm Override	Boolean 1 for true or 0 for false.	0 or 1	0
Tank 1: Inhib. Level LOW	Boolean 1 for true or 0 for false.	0 or 1	0
Tank 2: Bio A Level LOW	Boolean 1 for true or 0 for false.	0 or 1	0
Tank 3: Bio B/ CL2 Level LOW	Boolean 1 for true or 0 for false.	0 or 1	0
Tank 4: Bromine Level LOW	Boolean 1 for true or 0 for false.	0 or 1	0
Tank 5: pH Level LOW	Boolean 1 for true or 0 for false.	0 or 1	0
Tank 6: Dispersant Level LOW	Boolean 1 for true or 0 for false.	0 or 1	0

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 overwrites the oldest information first, and continues to overwrite the next memory location of the earliest information originally stored.
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.

If the optional GSM/GPRS Modem is installed and enabled, the logged information can be viewed remotely via the internet.

5.12.2 Disinfection

Main Menu > SETUP MENU > ADVANCED SETUP > DISINFECTION
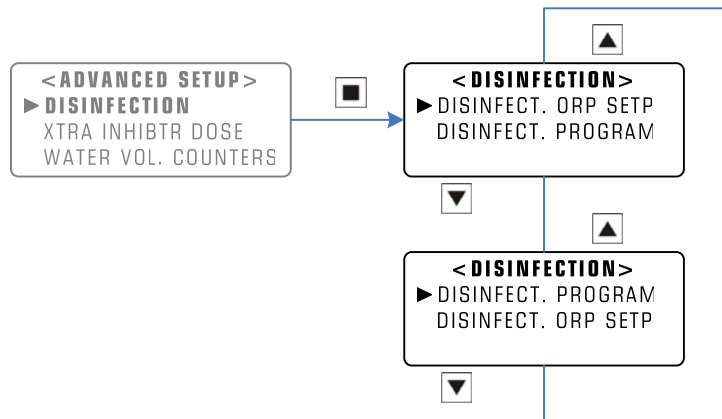
Disinfection Feature Setup Menu

The Disinfection Feature initiates a higher dose of Oxidising Biocide, to achieve an efficient disinfection of the system.
This is achieved by temporarily running the ORP control at a higher ORP Setpoint for a programmable amount of time.

The Disinfection ORP Setpoint Menu is shown on the following page:

```
<DISINFECTION>          ■          <DISINFECT ORP SETP>
► DISINFECT ORP SETP                ORP (mV)Setpt:  0000
  DISINFECT PROGRAM


                        ▲          <DISINFECT ORP SETP>
                                    ORP (mV)Setpt:  0700


                        ■          <DISINFECT ORP SETP>
                                    ORP (mV)Setpt:  0700


                        ▲          <DISINFECT ORP SETP>
                                    ORP (mV)Setpt:  0750


                        ■
```

Example: Increasing the Disinfection ORP Setpoint from 500mV to 750mV

NOTES: The disinfection ORP Setpoint must be set at a higher ORP mV than the regular programmed ORP Setpoint.
If the Disinfection ORP Setpoint = 0000, then the function is disabled.
During Disinfection, the HIGH ORP alarm is ignored, until the mV drops below the HIGH ORP alarm value (if programmed). This enables you to have the Disinfection setpoint higher than the HIGH ORP alarm, without generating an alarm during Disinfection.
(Software ver 0.83 and later)

To Select the Weeks, Days and Time, that the Disinfection Program is active for, please see the diagram on the following page:

Please note that only one start time & duration for all the programmed days can be selected for the Disinfection program, and this will be the only time, and duration that is programmable.

```
┌─────────────────────────┐                  ┌─────────────────────────┐
│  <DISINFECTION>         │      ■            │ <DISINFECT PROGRAM>     │
│ ►DISINFECT PROGRAM       │ ──────────────►  │ Week:  1   2   3   4    │
│  DISINFECT ORP SETP     │                  │        N   N   N   N    │
└─────────────────────────┘                  └─────────────────────────┘
```

For each week,
press ▼ or ▲
to toggle between **Y**es
and **N**o, then press ■

```
┌─────────────────────────┐
│ <DISINFECT PROGRAM>     │
│ Week:  1   2   3   4    │
│        N   Y   N   Y    │
└─────────────────────────┘
          ■
```

```
┌─────────────────────────┐
│ <DISINFECT PROGRAM>     │
│ DAY:  S M T W T F S     │
│       N N N N N N N     │
└─────────────────────────┘
```

For each day,
press ▼ or ▲
to toggle between **Y**es
and **N**o, then press ■

```
┌─────────────────────────┐
│ <DISINFECT PROGRAM>     │
│ DAY:  S M T W T F S     │
│       N Y N Y N Y N     │
└─────────────────────────┘
          ■
```

```
┌─────────────────────────┐
│ <DISINFECT PROGRAM>     │
│ Start Time:     00:00   │
│ Active for:     00h00m  │
└─────────────────────────┘
          ■
```

Use the ▼ , ▲ and ■
pushbuttons to select
the start time and the
active period

```
┌─────────────────────────┐
│ <DISINFECT PROGRAM>     │
│ Start Time:     16:00   │
│ Active for:     01h30m  │
└─────────────────────────┘
          ■
```

Example: Activating the Disinfection Program to start at 16h00 on Mon, Wed, & Friday in Weeks 2 & 4, for 1h30m (i.e. program cancels at 15h30 on those days)

5.12.3 Extra Inhibitor Dose

Main Menu > SETUP MENU > ADVANCED SETUP > XTRA INHIBTR DOSE

An Extra Inhibitor Dose is available with the DIGICHEM Plus+ which occurs once a day. This dose is useful to cater for any uncontrolled losses that the cooling water system may have. A start time and duration is programmable as per the diagram on the following page:

If the Start Time and Duration are both set to 00:00, and 0000s respectively, the Extra Inhibitor Dose is disabled.

```
<ADVANCED SETUP>          ▣        <XTRA INHIBTR DOSE>
►XTRA INHIBTR DOSE                 Start Time:    00:00
 WATER VOL. COUNTERS               Duration:      0000s
 CYCLES OF CONCENT.

                          ▲                           ▲

                                   <XTRA INHIBTR DOSE>
                                   Start Time:    01:00
                                   Duration:      0000s

                          ▣

                                   <XTRA INHIBTR DOSE>
                                   Start Time:    01:00
                                   Duration:      0000s

                          ▲

                                   <XTRA INHIBTR DOSE>
                                   Start Time:    01:30
                                   Duration:      0000s

                          ▣

                                   <XTRA INHIBTR DOSE>
                                   Start Time:    01:30
                                   Duration:      0000s

                          ▲

                                   <XTRA INHIBTR DOSE>
                                   Start Time:    01:30
                                   Duration:      0200s

                          ▣

                                   <XTRA INHIBTR DOSE>
                                   Start Time:    01:30
                                   Duration:      0200s

                          ▣
```
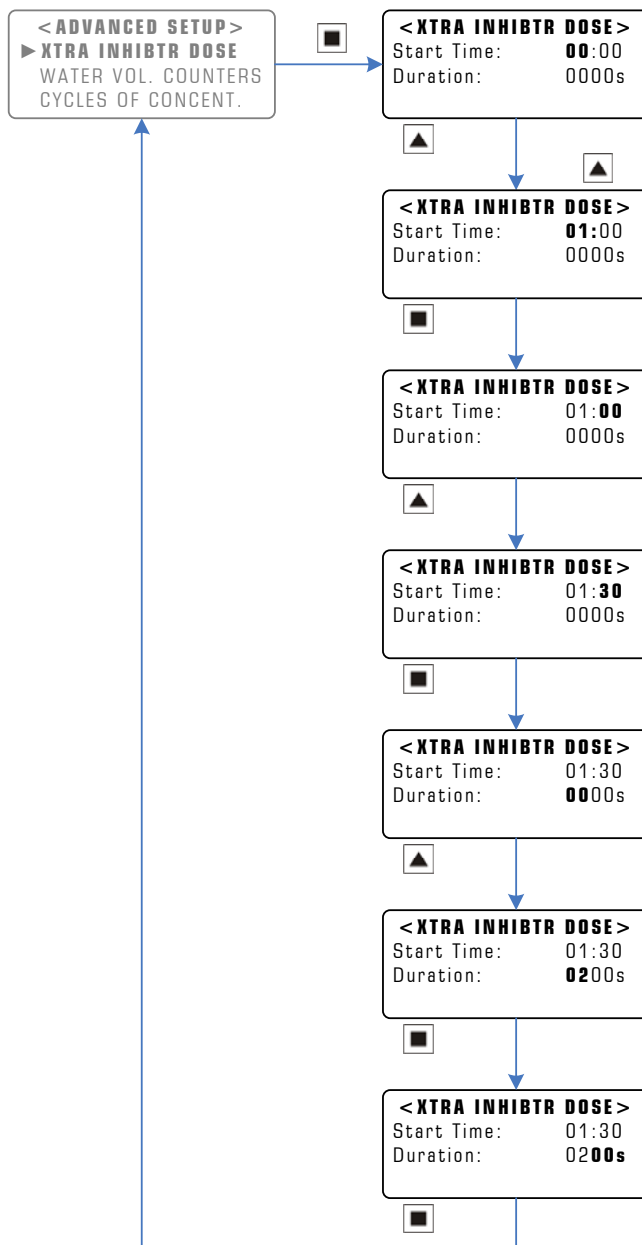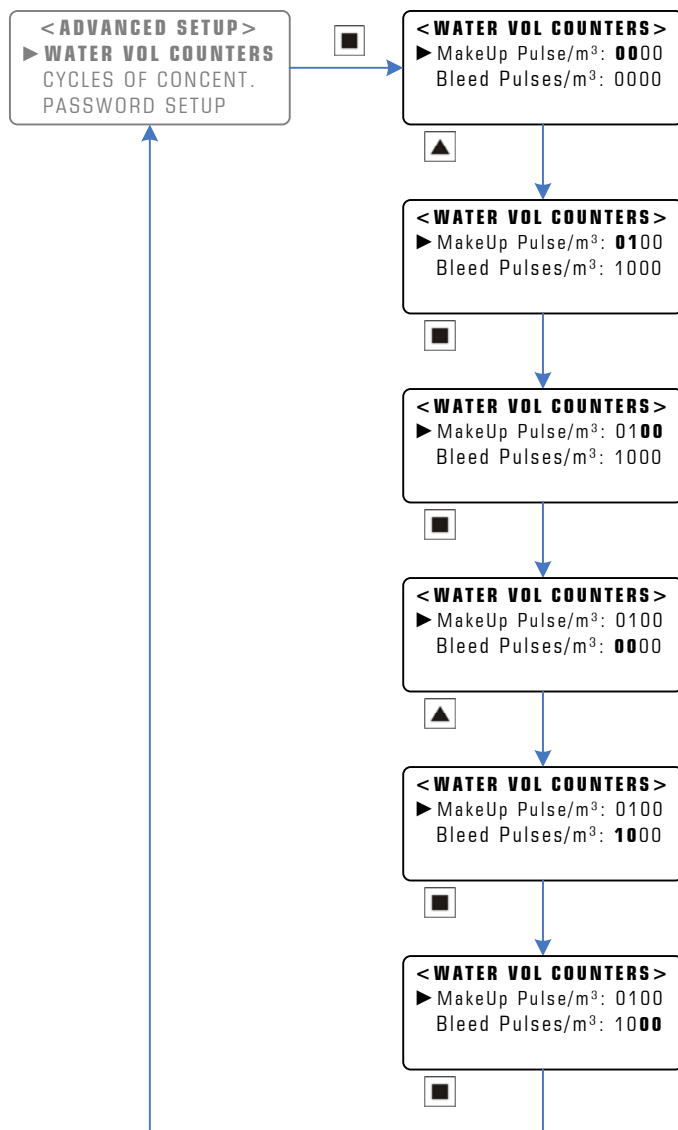
Example: Setting up an Extra Inhibitor dose, starting at 1:30, dosing for 200 seconds

5.12.4 Water Volume Counters

Main Menu > *SETUP MENU > ADVANCED SETUP >*
WATER VOL COUNTERS

The Water Volume Counters enable the DIGICHEM Plus+ to count pulses from water meters on the Make-Up and Bleed lines. This enables logging of the Make-Up volume and Bleed Water volume, in order to inform the user of how much water is being depleted from the system down the drain, as well as how much water is being used by the system for Make-Up. Subtracting the Bleed Water volume from the Make-Up water volume, allows a calculation of how much water is evaporating and being lost from the system. The number of pulses per m^3 must be entered for the counter totalise correctly.

Please see the diagram below to set the Water Volume Counters:

```
┌─────────────────────┐        ┌─────────────────────────┐
│ <ADVANCED SETUP>    │  [■]   │ <WATER VOL COUNTERS>    │
│ ► WATER VOL COUNTERS│ ────►  │ ► MakeUp Pulse/m³: 0000 │
│   CYCLES OF CONCENT. │        │   Bleed Pulses/m³: 0000 │
│   PASSWORD SETUP     │        └─────────────────────────┘
└─────────────────────┘                   [▲]
                                           │
                                           ▼
                               ┌─────────────────────────┐
                               │ <WATER VOL COUNTERS>    │
                               │ ► MakeUp Pulse/m³: 0100 │
                               │   Bleed Pulses/m³: 1000 │
                               └─────────────────────────┘
                                           [■]
                                           │
                                           ▼
                               ┌─────────────────────────┐
                               │ <WATER VOL COUNTERS>    │
                               │ ► MakeUp Pulse/m³: 0100 │
                               │   Bleed Pulses/m³: 1000 │
                               └─────────────────────────┘
                                           [■]
                                           │
                                           ▼
                               ┌─────────────────────────┐
                               │ <WATER VOL COUNTERS>    │
                               │ ► MakeUp Pulse/m³: 0100 │
                               │   Bleed Pulses/m³: 0000 │
                               └─────────────────────────┘
                                           [▲]
                                           │
                                           ▼
                               ┌─────────────────────────┐
                               │ <WATER VOL COUNTERS>    │
                               │ ► MakeUp Pulse/m³: 0100 │
                               │   Bleed Pulses/m³: 1000 │
                               └─────────────────────────┘
                                           [■]
                                           │
                                           ▼
                               ┌─────────────────────────┐
                               │ <WATER VOL COUNTERS>    │
                               │ ► MakeUp Pulse/m³: 0100 │
                               │   Bleed Pulses/m³: 1000 │
                               └─────────────────────────┘
                                           [■]
```

Example: Setting Make Up Pulses to 100 pulses / m³ (1P/10L), and Bleed Pulses to 1000 pulses m³ (1P/L)

If no water meters are wired into the controller, then leave the setting at 0000.

The following table explains the various settings for the pulses:

Water Meter Pulse Output	Pulses / m³
1p/L (1 pulse per litre)	1000
1p/10L (1 pulse per 10 litres)	100
1p/100L (1 pulse per 100 litres)	10
1p/1000L (1 pulse per 1000 litres)	1
No Pulse	0000

Notes: (v0.91 or later): A '+' will be displayed on the LCD screen momentarily for a make-up pulse, a '-' will be displayed for a Bleed pulse.

5.12.5 Cycles of Concentration

Main Menu > *SETUP MENU > ADVANCED SETUP > CYCLES OF CONCENT.*

A Cycle of Concentration is the ratio between the conductivity of the cooling water system, and the conductivity of the Make-Up Water. For example if the conductivity of the cooling tower water is running at 500µS, and the Make-Up Water has a Conductivity of 250µS, the cycle of concentration is 500/250 = 2.

The higher the Cycles of Concentration, the more chance there is of scaling conditions, however water will be saved, as less will be drained from the system to maintain that Cycle of Concentration.

To Log the Cycles of Concentration, the Make-Up Water conductivity is required to be entered into the system, as per the diagram below:

Please note that if the Make-Up Conductivity is set to 0000 µS, then the Cycles of Concentration will not be logged.

If the unit of conductivity is set to TDS, then 'TDS' will be displayed as the Make-Up Conductivity variable, instead of 'µS'.

NOTE: The logged cycles of concentration will only be accurate if the Make-Up water conductivity remains constant.
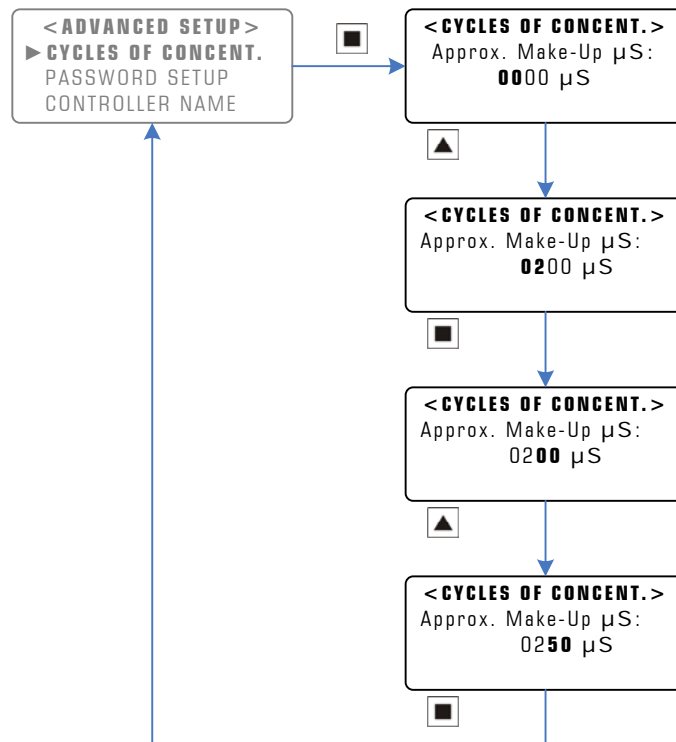
Example: Entering a Make Up Water Conductivity of 250 µS
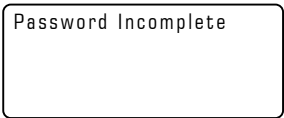
5.12.6 Password Setup

Main Menu > *SETUP MENU > ADVANCED SETUP > PASSWORD SETUP*

The Password Setup allows a protection feature for the DIGICHEM Plus+ Controller. The password is required to be entered twice for verification purposes.
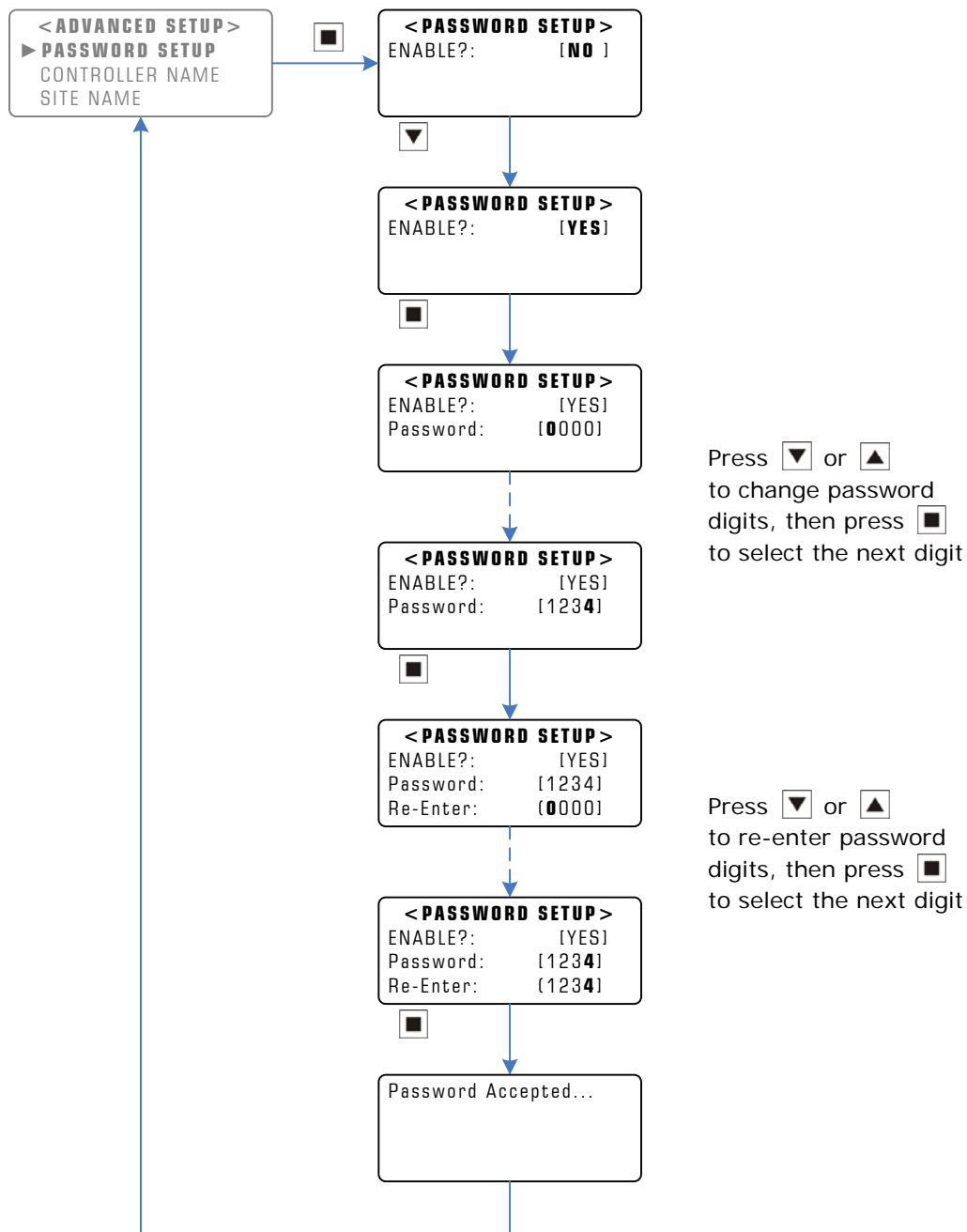
The Password feature will protect the process from any settings being changed by an un-authorised person.

If the password is entered incorrectly, the display will show the following for a brief period:

```
Password Incomplete
```

It is now necessary to enter the Password Setup menu again, re-enter the Password. An example of this is shown on the following page:

```
<ADVANCED SETUP>              ■          <PASSWORD SETUP>
► PASSWORD SETUP                          ENABLE?:        [NO ]
  CONTROLLER NAME
  SITE NAME
                              ▼
                                         <PASSWORD SETUP>
                                          ENABLE?:        [YES]

                              ■
                                         <PASSWORD SETUP>
                                          ENABLE?:        [YES]
                                          Password:       [0000]         Press ▼ or ▲
                                                                         to change password
                                                                         digits, then press ■
                                                                         to select the next digit
                                         <PASSWORD SETUP>
                                          ENABLE?:        [YES]
                                          Password:       [1234]

                              ■
                                         <PASSWORD SETUP>
                                          ENABLE?:        [YES]
                                          Password:       [1234]
                                          Re-Enter:       [0000]         Press ▼ or ▲
                                                                         to re-enter password
                                                                         digits, then press ■
                                                                         to select the next digit
                                         <PASSWORD SETUP>
                                          ENABLE?:        [YES]
                                          Password:       [1234]
                                          Re-Enter:       [1234]
                              ■
                                         Password Accepted...
```

Example: Entering an Access Password of 1234

NOTE: If the password feature is enabled, the password will be required
to enter the main menu. However, the user will be able to view
the controller settings without the password.

5.12.7 Controller Name

Main Menu > *SETUP MENU > ADVANCED SETUP > CONTROLLER NAME*

A unique name can be assigned to individual DIGICHEM Plus+ units to distinguish them from other similar units in the field.
Please note that the controller name is limited to 16 Characters. An example of naming a unit is shown below:
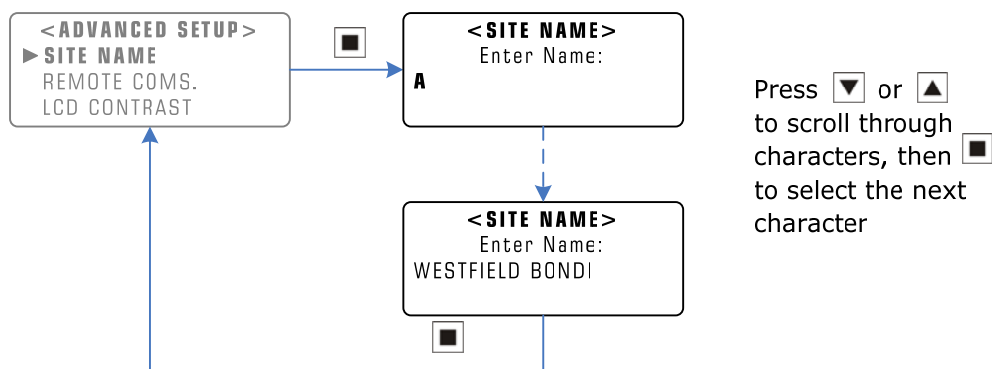
```
<ADVANCED SETUP>
► CONTROLLER NAME
  SITE NAME
  REMOTE COMS.
```

```
<CONTROLLER NAME>
   Enter Name:
A
```

Press ▼ or ▲
to scroll through
characters, then ■
to select the next
character

```
<CONTROLLER NAME>
   Enter Name:
WESTFLD TOWER #1
```
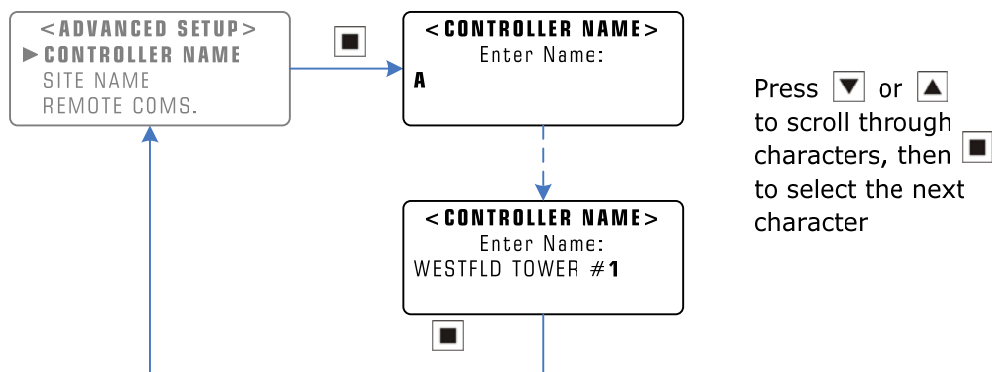
Example: Changing the Controller's name to WESTFLD TOWER #1

5.12.8 Site Name

Main Menu > *SETUP MENU > ADVANCED SETUP > SITE NAME*

A Site name can be assigned to a group of DIGICHEM Plus+ units to distinguish them from other geographical sites in different areas.
Please note that the Site name is limited to 16 Characters. An example of naming a site is shown below:

```
<ADVANCED SETUP>
► SITE NAME
  REMOTE COMS.
  LCD CONTRAST
```

```
<SITE NAME>
 Enter Name:
A
```

Press ▼ or ▲
to scroll through
characters, then ■
to select the next
character

```
<SITE NAME>
 Enter Name:
WESTFIELD BONDI
```

Example: Changing the Site Name to WESTFIELD BONDI

5.12.9 Remote Communications

Main Menu > *SETUP MENU > ADVANCED SETUP > REMOTE COMS.*

The DIGICHEM Plus+ can communicate with a remote server via a GSM/GPRS modem, which can be supplied or retrofitted as an option. Web based software is available as a user interface to access the DIGICHEM Plus+ from any computer which has an Internet connection.

The default GSM Logon cycle time to the remote server is once every 15 minutes. This time can only be altered via the web based software, and cannot be edited from the DIGICHEM Plus+ controller.

Below is an example of how to implement this feature on the DIGICHEM Plus+:
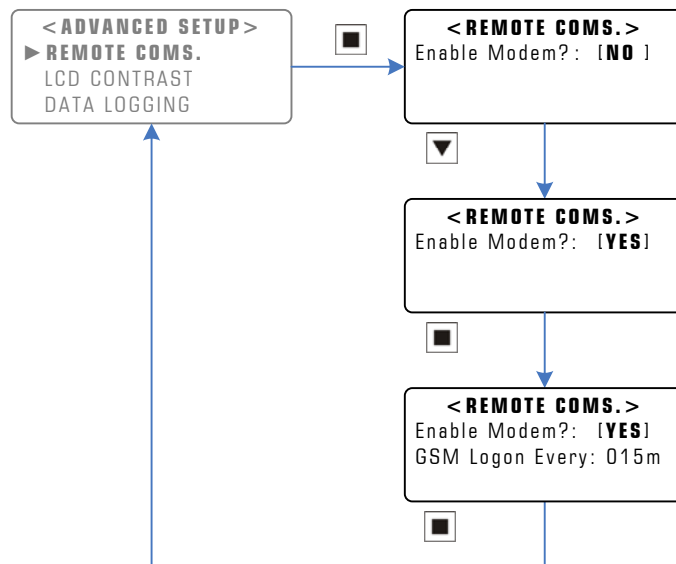
Example: Enabling the Remote Communications

Notes:

- This feature is only available with DIGICHEM Plus+ systems which have been ordered with the GSM/GPRS Modem as an option.
- If Remote Comms is enabled, then the Controller Name and Site Name will not be editable from the DP+ menu, only from the Web-server interface.

Once logged on, the server looks at the variables in the DIGICHEM Plus+ and updates the information on the server. If alarm conditions exist, the various contact people set up in the web based software would be contacted via SMS, and/or e-mail depending on the software's setup parameters.

Please contact your supplier for this service should you require.

5.12.10 LCD Contrast (Software ver 0.80 & later)

Main Menu > *SETUP MENU > ADVANCED SETUP > LCD CONTRAST*

The LCD screen display intensity can be adjusted which will affect all text displayed on the LCD screen. The diagram below illustrates this feature:
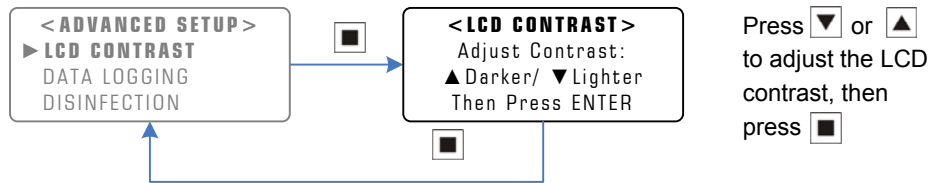
Changing the Display Contrast

By holding the Up arrow key, the display will gradually become darker, and by holding the Down arrow key, the display will gradually become lighter.

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 (0060s for v0.91 or later)
Conductivity Units	TDS (i.e. ppm Total Dissolved Solids)
Bleed Setpoint	1000 ppm TDS
Hysteresis	3% (max 20% allowable)
Bleed/Pause Cycle	Bleed/Pause = 00s/00s (ie. Disabled)
pH Operation	Enabled - Dose Acid
pH Control Setpoint	7.50pH
pH Dose Timer Alarm	Max Dose: 120m
ORP Operation	Enabled - Dose Oxidant
ORP Control Setpoint	500mV
ORP Dose Timer Alarm	Max Dose: 120m
pH & ORP Control Method	Proportional
pH & ORP Proportional Band	50%
pH & ORP Control Cycle	60s
Ground Probe	Enable? [Yes]
High Alarms	0000 for all (ie. Disabled)
Low Alarms	0000 for all (ie. Disabled)
No Flow Alarm	Enable? [No]
Alarm Trip Delay	3600s
Bleed Timer Alarm	Max Bleed: 000m (ie. Disabled)
Timer Alarm Hysteresis	3% (Feature only available for v0.91 or later)
Inhibitor Mode	On bleed
Inhibitor Duty Cycle	ON/OFF = 0050s/0050s (ie. On Bleed Only)
Dispersant	24hr/day, ON/OFF = 0000s/0000s (i.e. Disabled)
Biocide Programs	All programs disabled
Pre-Bleed Setpoint	Setpoint -15%
Bleed Lockout Setpoint	Setpoint +20%
Condenser Pump Timer	Biocide Dose + 000m
Flow Switch	Logic [Normal]
Outputs disabled with no flow	Bleed, Inhibitor, pH & ORP
Data Logging	LOG Every: 060m
Disinfection ORP Setpoint	0000mV i.e. disabled
Extra Inhibitor Dose Start Time	00:00
Extra Inhibitor Dose Duration	0000s i.e. disabled
Water Volume Counters	All Set to 0000p/m^3 i.e. disabled
Cycles of Concentration	Set to 0001
Password Setup	Enable?: [No]
Controller Name	--------
Site Name	--------
Remote Coms.	Enable Modem?: [No]

Item	Specification
Power Supply	220-240VAC, 50/60Hz
Power Consumption	10W max (with no loads on outputs)
Inputs	Conductivity Probe ORP Probe Solution Ground Probe (SS) pH Probe Flow Switch (Volt-free contact) Water meter Make-Up volt-free contact Water meter Bleed volt free contact
Mains Output	240VAC continuous (4A fused)
Control Outputs – Switched 240Vac	6A/240VAC resistive (4A fused)
Auxiliary Output – Switched 240Vac	6A/240VAC resistive (4A fused)
Alarm Relay Output	N/O & N/C Volt-free (6A/250VAC resistive) (4A fused)
Condenser Pump Relay Output	N/O Volt-free (6A/250VAC resistive) (4A fused)
Measured Conductivity Resolution	1µS / 1 ppm TDS
Conductivity Accuracy	0.5% of measured range
Conducitivity Repeatability & drift	1.0% of measured range
Measured ORP Resolution	1 mV
ORP Accuracy	0.4% of measured range
ORP Repeatability & drift	0.8% of measured range
Measured pH Resolution	0.01 pH
pH Accuracy	0.4% of measured range
pH Repeatability & drift	0.8% of measured range
Data retention	100 years
Battery backup	1 year (approx)
Battery type	CR2032 (3Vdc)
Enclosure rating	IP65
Operating Temperature	0 - 50°C

8. Maintenance Schedule

The suggested maintenance schedule provides for a guideline as to the maintenance and replacement of parts on a DIGICHEM Plus+ control system. This schedule is based on relatively clean water in a cooling tower, with no adverse conditions or phenomenon occurring.

The DIGICHEM Plus+ Maintenance schedule is suggested as follows:

Item:	Description:	Suggested Maintenance:
SP-SK-01A-BK	Squeeze Tube for SEKO PE-1.3 & PE-0.4 Pumps	Check quarterly, replace after 12 Months
SP-DCON-P10AT-P	Conductivity Probe (old style)	Clean monthly, replace after 2 Years +
SP-DCON-PB10AT-P	Conductivity Probe (new style)	Clean monthly, replace after 2 Years +
IONODE IH40-01M	pH Probe (smooth body)	Clean monthly, replace after 1 Year +
WA OPF10-NNN-1.5m	pH Probe (threaded body)	Clean monthly, replace after 1 Year +
IONODE IH30-01M	ORP Probe (smooth body)	Clean monthly, replace after 1 Year +
WA OPF10-PBN10-1.5m	ORP Probe (threaded body)	Clean monthly, replace after 1 Year +
SP-SOL-1/2-S	Solenoid Valve	Manually test monthly, replace as required
SP-SK-03A	Injection Valve	Replace as required
SP-TB0604B-020	Black Discharge Tubing	Replace as required
SP-TB0604N-PVC	Clear Suction Tubing	Replace as required

9. Optional Extras

The following options can be fitted to the DIGICHEM Plus+ Systems:

DOSING PUMP OPTIONS

DP-OPT-PUMP-PH   Add pH Pump (Acid or Base) to DP-CAPH-RXB or DP-CAPH-RXPP, incl. extra manifold fittings

DP-OPT-PUMP-PH-CAB   Add pH Pump (Acid or Base) to DP-CAPH-RXB-CAB or DP-CAPH-RXPP-CAB, incl. extra manifold fittings

DP-OPT-PUMP-DIS   Add Dispersant pump to any PVC mounted DIGICHEM Plus+ System, incl. extra manifold fittings

DP-OPT-PUMP-DIS-CAB   Add Dispersant pump to any Cabinet mounted DIGICHEM Plus+ System, incl. extra manifold fittings

PVDF (KYNAR) MIXING CHAMBER OPTIONS FOR CHLORINE/BROMINE DOSING

DP-OPT-MIX-PVDF   Add PVDF (Kynar) Mixing chamber for neat mixing of Chlorine & Bromine to return neat via tube to tower basin

DP-OPT-MIXS-PVDF   Add PVDF (Kynar) Mixing chamber to go in-line with manifold outlet

INPUT & OUTPUT PLUG-IN CARDS

DP-OPT-CARD-IP   Input card to monitor 6 tank levels with optional low level tank switches

DP-OPT-CARD-IP-mA-2   Input card to monitor 6 tank levels with optional low level tank switches, plus to monitor two 4-20mA signals from 3rd party devices, such as corrosion transmitters.
(NOTE: DP-OPT-CARD-3G or DP-OPT-CARD-GPRS modem required with connection plan).

DP-OPT-CARD-OP   Output card for BMS/DDC incl. 4 x 4-20mA outputs, 9 x logic outputs for each pump & solenoid valve status, and for flow, alarm & power status
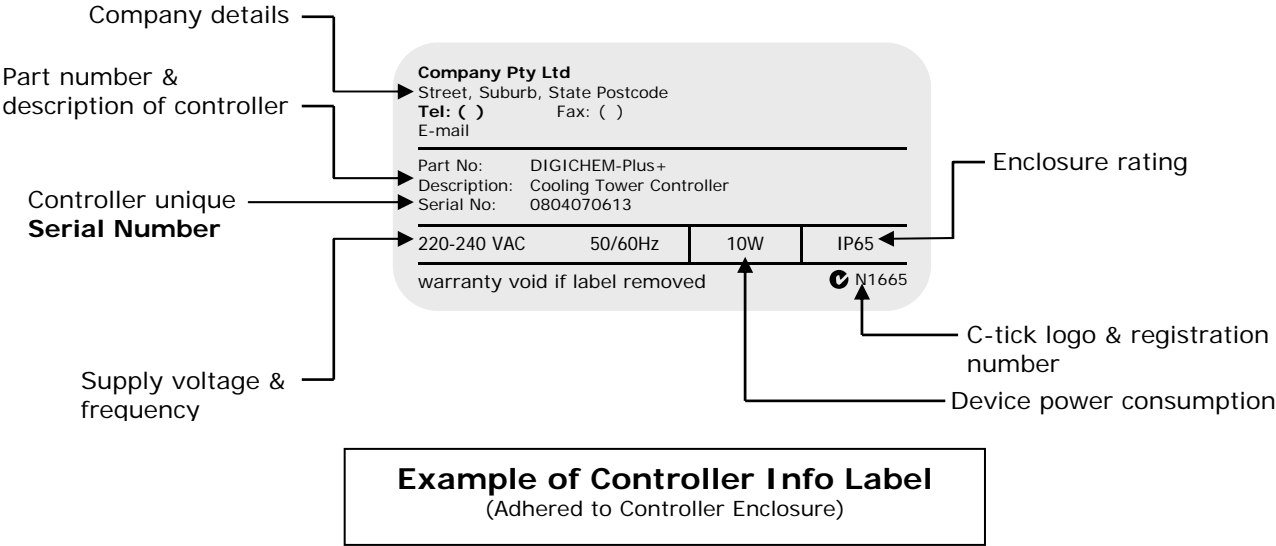
REMOTE COMMUNICATION OPTIONS

DP-OPT-CARD-GPRS   GSM/GPRS Modem card to enable full remote connectivity via the Internet (Excludes Access Fees - see options below)

DP-OPT-CARD-3G   3G Modem card to enable full remote connectivity via the Internet (Excludes Access Fees - see options below)

DP-OPT-WEB-PRO-RATA   New activation of DIGICHEM Plus+ Internet connection. Includes server connection setup, e-mail & SMS charges billed pro-rata to JUNE. (Fair use policy of data & SMS notifications applies - see www.cwc.com.au/home/fairuse.html) Excludes SIM Card.

DP-OPT-WEB-SIM-V-PRO-RATA   New activation of DIGICHEM Plus+ Internet connection with Vodafone. Includes SIM, server connection setup, e-mail & SMS charges billed pro-rata to JUNE. (Fair use policy of data & SMS notifications applies - see www.cwc.com.au/home/fairuse.html)

DP-OPT-WEB-SIM-T-PRO-RATA   New activation of DIGICHEM Plus+ Internet connection with Telstra. Includes SIM, server connection setup, e-mail & SMS charges billed pro-rata to JUNE. (Fair use policy of data & SMS notifications applies - see www.cwc.com.au/home/fairuse.html)

Please see the detailed assembly diagrams (included with purchase) for how the above parts are mounted with the various systems.

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)