



# CHEMTRAC

## HydroAct 4 User Manual

Chemtrac, Inc

Firmware Version: 1.19

November 15, 2017

Copyright © 2017 Chemtrac, Inc

All rights reserved. No part of this publication may be reproduced, distributed, or transmitted in any form or by any means, including photocopying, recording, or other electronic or mechanical methods, without the prior written permission of the publisher, except in the case of brief quotations embodied in critical reviews and certain other noncommercial uses permitted by copyright law.

<http://www.chemtrac.com>

# Contents

<b>1</b>	<b>Introduction</b> .....	<b>5</b>
<b>1.1</b>	<b>Safety Precautions</b>	<b>5</b>
1.1.1	Warnings used in this manual .....	5
1.1.2	Qualification and Training of Personnel .....	6
1.1.3	Important Safety Instructions .....	6
1.1.4	Safe Operation .....	7

## I

## Analyzer

<b>2</b>	<b>Overview</b> .....	<b>11</b>
<b>2.1</b>	<b>Safety Precautions</b>	<b>12</b>
2.1.1	Installation, Maintenance and Inspection .....	12
2.1.2	Unauthorized Modification .....	12
2.1.3	Impermissible Modes of Operation .....	12
2.1.4	Chemicals .....	12
<b>2.2</b>	<b>Technical Data</b>	<b>12</b>
<b>2.3</b>	<b>Installation</b>	<b>13</b>
2.3.1	Site Selection .....	13
2.3.2	Unpacking .....	14
2.3.3	Mounting .....	14
2.3.4	Electrical Connections .....	17
<b>2.4</b>	<b>Operation</b>	<b>18</b>
2.4.1	User Interface .....	18

2.4.2	Main Menu . . . . .	18
2.4.3	Home Screens . . . . .	19
2.4.4	User Authentication . . . . .	19
2.4.5	Analyzer Options . . . . .	20
2.4.6	Logs . . . . .	29

## II Options

<b>3</b>	<b>Sensors . . . . .</b>	<b>35</b>
<b>3.1</b>	<b>PC3 Particle Counter</b>	<b>35</b>
3.1.1	General Information . . . . .	35
3.1.2	Theory of Operation . . . . .	36
3.1.3	Installation . . . . .	38
3.1.4	Commissioning . . . . .	43
3.1.5	Operation . . . . .	44
3.1.6	Maintenance . . . . .	51
3.1.7	Troubleshooting . . . . .	52
<b>4</b>	<b>Outputs . . . . .</b>	<b>55</b>
<b>4.1</b>	<b>Analog Outputs</b>	<b>55</b>
4.1.1	General Information . . . . .	55
4.1.2	Technical Data . . . . .	55
4.1.3	Commissioning . . . . .	56
4.1.4	Operation . . . . .	56
<b>4.2</b>	<b>Relay Output</b>	<b>61</b>
4.2.1	General Information . . . . .	61
4.2.2	Technical Data . . . . .	61
4.2.3	Operation . . . . .	61

## III Documentation

<b>5</b>	<b>Warranty . . . . .</b>	<b>75</b>
<b>6</b>	<b>Returns . . . . .</b>	<b>77</b>
<b>6.1</b>	<b>Contact Details</b>	<b>77</b>

# 1. Introduction

This manual has been generated to accompany the serial number of the instrument as recorded on the front of this manual. It is specific to that serial number. Information regarding options or accessories that do not apply to this instrument do not appear in this manual. If you upgrade your firmware or your hardware please ask for a new manual to be generated for you.

This manual contains basic information to be noted during installation, operation and maintenance. It is therefore essential that this manual be read by the contractor before installing and commissioning the HydroAct 4, as well as by the relevant operating personnel/owner of the unit. It must remain available for reference at all times.

In addition to the general safety instructions under the main heading Safety Precautions, the special safety precautions outlined in other sections must also be observed.

This manual has been supplied electronically. A hard copy is available on request from hardware-support@chemtrac.com.

## 1.1 Safety Precautions

- Before attempting to unpack, set up, or operate this instrument, please read this entire manual.
- Make certain the unit is disconnected from the power source before attempting to service or remove any component.
- Make certain the unit is disconnected from other sources of force or pressure (for example, pneumatic or hydraulic), before attempting to service or remove any component.
- Failure to follow these precautions could result in personal injury and damage to the equipment.

### 1.1.1 Warnings used in this manual

This manual contains vital information relating to the safety of people and the environment, the analyzer and any equipment attached. These statements are identified by the following markings:

**Refers to an imminent danger or a potential hazardous situation. Non-compliance can lead to death or extremely serious injury.**

**Refers to a potential hazardous situation. Non-compliance can lead to injury or property damage.**

**Draws attention to supplementary information to make the work easier and ensure trouble-free operation. May also appear in conjunction with safety instructions which may endanger the analyzer and its operation if disregarded.**

## 1.1.2 Qualification and Training of Personnel

The personnel employed for installation, operation, inspection, and maintenance, must be suitably qualified for this work. The areas of responsibility, competence and supervision of the personnel must be precisely defined by the owner. Personnel who do not have the required know-how must be trained and instructed. If required, this can also be undertaken by the manufacturer/supplier on behalf of the owner.

In addition, the owner of the system must ensure that the relevant personnel are fully familiar with and have understood the contents of this manual.

## 1.1.3 Important Safety Instructions

When installing and using this electrical equipment, basic safety precautions should always be observed, including the following:

**Read and follow all instructions. Save these instructions.**

**To reduce the risk of injury, do not permit children to use this product.**

**Risk of electric shock. Connect only to a suitable isolated, hard wired electrical outlet. It is recommended that the outlet is protected by an RCD (Residual Current Detector) or is in any event in compliance with all local electrical regulations. Do not bury the electrical supply cable.**

**To reduce the risk of electric shock, replace damaged electrical cable immediately.**

**To reduce the risk of electric shock, do not use an extension cable to connect the unit to an electric supply; provide a properly located outlet.**

### 1.1.3.1 Hazards due to non-compliance

Failure to comply with the safety instructions may endanger not only people, but also the environment and the unit. The following hazards in particular may arise:

- Failure of major unit functions.
- Failure of specified methods for maintenance and repair.
- Danger to people due to electrical, mechanical and chemical effects.

#### **1.1.4 Safe Operation**

The safety instructions contained in this manual must be observed. The owner is responsible for ensuring compliance with local safety regulations.







# Analyzer

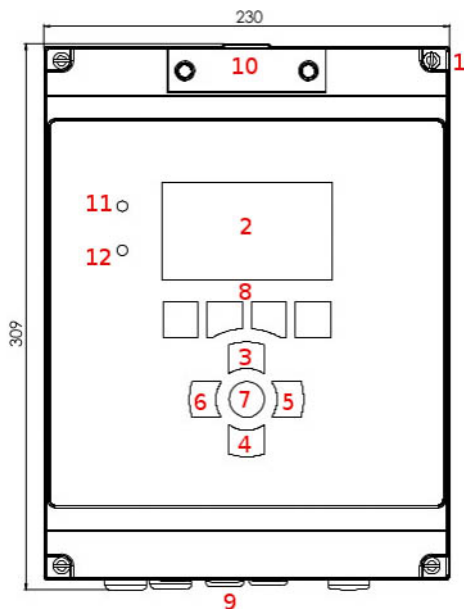
<b>2</b>	<b>Overview .....</b>	<b>11</b>
2.1	Safety Precautions	
2.2	Technical Data	
2.3	Installation	
2.4	Operation	



## 2. Overview

The HydroAct 4 is a compact electronic communication and control system. It is designed for use with many different measuring sensors. Any use other than the one described here compromises the safety of persons and the entire measuring system and is, therefore, not permitted. The manufacturer is not liable for damage caused by improper or non-designated use.

Every analyzer is carefully checked before leaving the factory. If for any reason, you are unhappy with your purchase, please contact the organization that you purchased the analyzer from or Chemtrac, Inc directly.



### HydroAct 4 Overview

1. Front panel screws (×4)
2. Display
3. Up button
4. Down button
5. Right button
6. Left button
7. Enter/Select button
8. Soft keys
9. Cable glands
10. Micro SD access
11. Power lamp
12. Indication lamp

## 2.1 Safety Precautions

### 2.1.1 Installation, Maintenance and Inspection

The owner must ensure that all maintenance, inspection and installation work is undertaken by authorized and duly qualified personnel who have also studied this manual.

- The HydroAct 4 must always be isolated before starting any work.
- Please be aware that the HydroAct 4 may be controlling chemical dosing and as such shutting down the HydroAct 4 without due regard to the systems it is controlling can lead to chemical release.

### 2.1.2 Unauthorized Modification

The device may only be modified or converted in consultation with the manufacturer. Genuine spare parts and accessories authorized by the manufacturer ensure greater safety.

### 2.1.3 Impermissible Modes of Operation

Usage other than as described in this manual will lead to the immediate cancellation of the warranty and any other manufacturer's liability.

### 2.1.4 Chemicals

Should the sensors attached to the HydroAct 4 be in contact with hazardous chemicals, great care must be taken when handling the sensors.

**Fire hazard. No parts are suitable for use in a hazardous rated area.**

**When working with this equipment, the accident prevention regulations applicable on site must be observed and the specified personal protective equipment worn.**

**Please unpack the equipment and ordered accessories carefully in order not to miss small parts. Immediately compare the scope of delivery to the delivery note. If there are any discrepancies, contact your supplier.**

## 2.2 Technical Data

**Power** 100-240VAC/0.25 A or 12VDC/0.8 A

**Fuse** 2A (100-240VAC)

**Display** 4.3" 480x272 24-bit color

**Inputs** Up to 4 configurable sensor inputs; 4-20mA, 4-20mA loop-powered, 0-2 VDC, +/- 2000 mV for pH, ORP, or ISEs, PT100, potentiometric, pulse and Modbus. Expandable to 16 inputs. Up to 8 digital inputs, expandable to 32

**Outputs** Up to 16 dedicated configurable analog outputs: 0-20mA, 4-20mA, 0-1 VDC, 0-10 VDC, 1-10 VDC. Unused inputs can be used as outputs allowing up to 32 output channels. Up to 32 SPST electromechanical relays rated 10A at 125 VAC, 3A at 250 VAC, 5A at 30 VDC

**Communication (Optional)** Modbus ASCII/RTU (RS485), Profibus DP, Modbus TCP (Ethernet), 2G/3G Modem

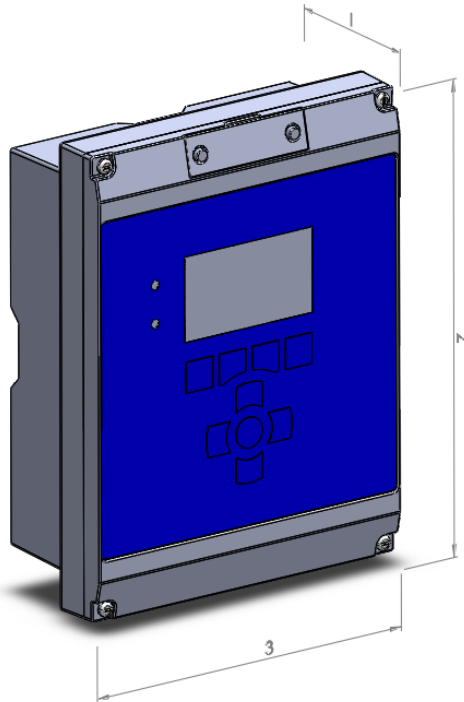
**Status Log** Over 1 million records

**Data Log** Internal - Single parameter data log or status message log over 1 million records

**Weight** 2kg

**IP Rating** IP65, Nema 4X

**Enclosure Material** ABS flame retardant  
**Seals** EPDM



#### HydroAct 4 Dimensions

1. 103mm
2. 309mm
3. 230mm

## 2.3 Installation

**As with all instrumentation the installation and commissioning of this instrument is crucial to its safe and effective operation. This instrument must only be used for its purpose as outlined in this manual. It must be installed and commissioned in accordance with this manual and by trained, qualified personnel.**

### 2.3.1 Site Selection

Please choose a suitable location for the installation of the electronics. The choice of installation point on any site is a compromise and is best undertaken by an experienced installation engineer. The following is a list of the factors that need to be taken into consideration. This list is not intended as a check-list, neither is it implied that the list is complete.

- Ensure that the mounting allows access to all serviceable parts.
- Try to mount the electronics in a position where they are not habitually hosed down in a cleaning process.
- The electronics enclosure should be mounted away from sources of heat or direct sunlight.
- Consider the length of wiring runs when mounting the instrument.
- Try to keep the electronics away from substations, motors or other large EMI emitters.
- Consider whether the sample will be representative and well mixed.
- Consider sample line run times.
- Consider sample return points.
- In a plastic run, with a low conductivity liquid sample, consider earthing the sample.
- If the instrument is controlling a dosing pump, size the pump appropriately.

## 2.3.2 Unpacking

Please have a copy of your order with you when you unpack your instrument. All orders are checked when they leave the factory. Please check that you have all the parts that were ordered as soon as you open the box. If anything is missing, or damaged, please contact your supplier immediately. If the instrument needs to be returned for any reason please follow the return instructions given in this manual (refer to section 6).

**Please dispose of the packing in an environmentally responsible manner and in compliance with local regulations.**

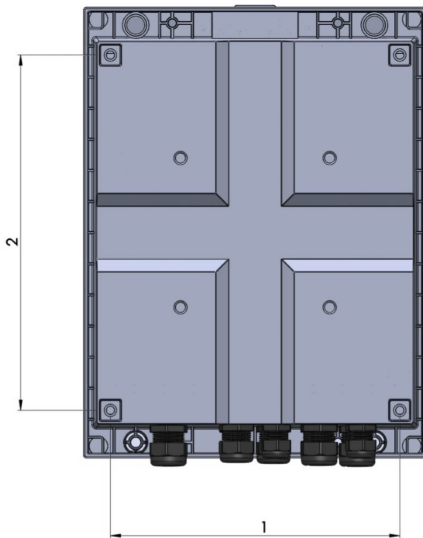
## 2.3.3 Mounting

The HydroAct 4 enclosure is very versatile and can be wall mounted, panel mounted or mounted on a handrail or pole<sup>1</sup>. The HydroAct 4 electronics should be mounted so that:

- it is away from sources of heat or direct sunlight,
- it is vertical,
- there is sufficient clearance above to allow the enclosure compartment to be opened and removed,
- it is away from sources of vibration, and
- it will not be hosed down.

### 2.3.3.1 Wall Mounting

The analyzer enclosure can be screwed directly onto the wall. Mark and drill the holes as per the drawing below. Insert wall plugs and secure with appropriate screws (not supplied).



#### HydroAct 4 Wall Mounting

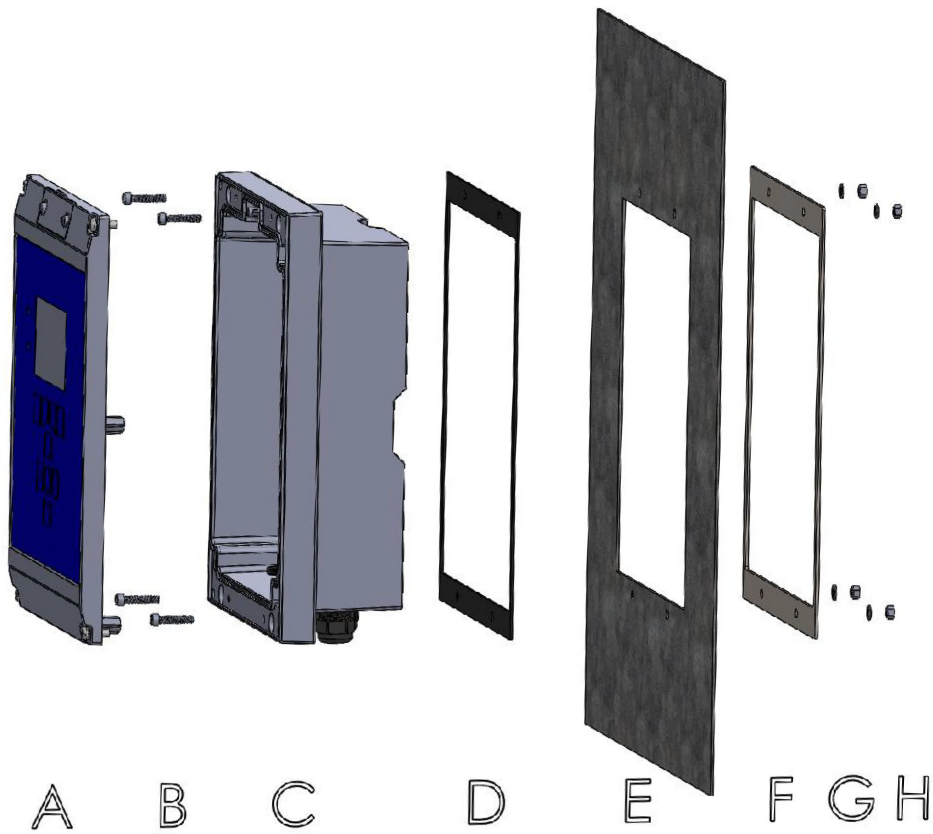
1. 194mm
2. 238mm

### 2.3.3.2 Panel Mounting

The analyzer enclosure can be panel mounted using the optional panel mount kit. The support bracket can be used as a template for cutting and drilling the panel.

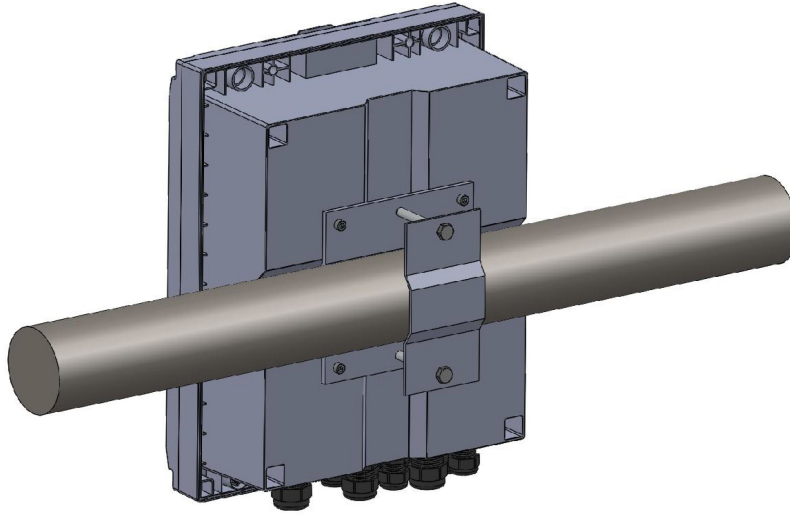
<sup>1</sup>For panel or handrail mounting the enclosure requires optional mounting kits that can be ordered from Chemtrac.

### HydroAct 4 Panel Mounting

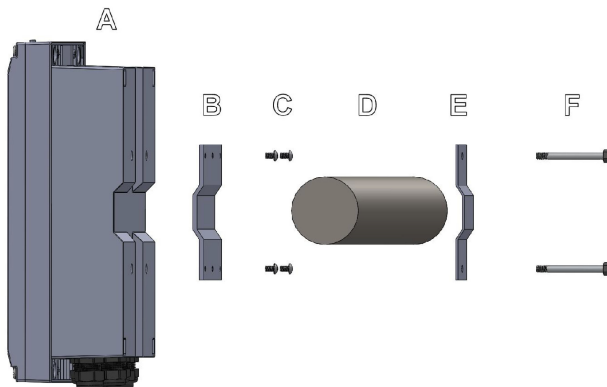


A - HydroAct 4 front section, B - Four M5 bolts, C - HydroAct 4 rear section, D - Rubber gasket, E - Panel, F - Support bracket, G - Four M5 washers, H - Four M5 nuts.

### 2.3.3.3 Handrail Mounting

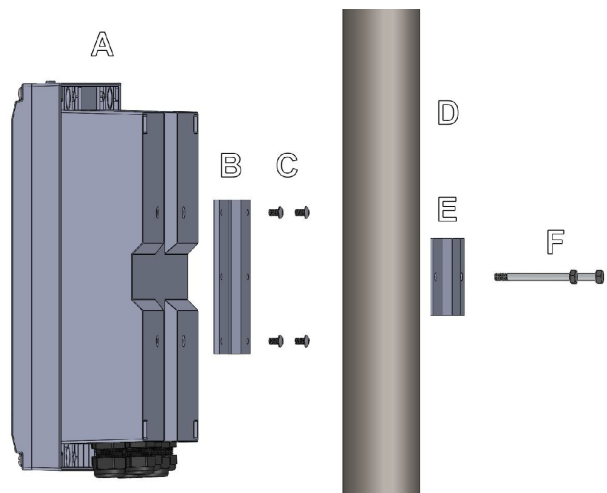


The analyzer enclosure can be handrail mounted using the optional handrail mount kit. By turning the brackets through 90° the analyzer can also be pole mounted.



#### HydroAct 4 Handrail Mounting

- A HydroAct 4
- B Large bracket
- C Four M5×8mm bolts
- D Handrail
- E Small bracket
- F Two M6 bolts

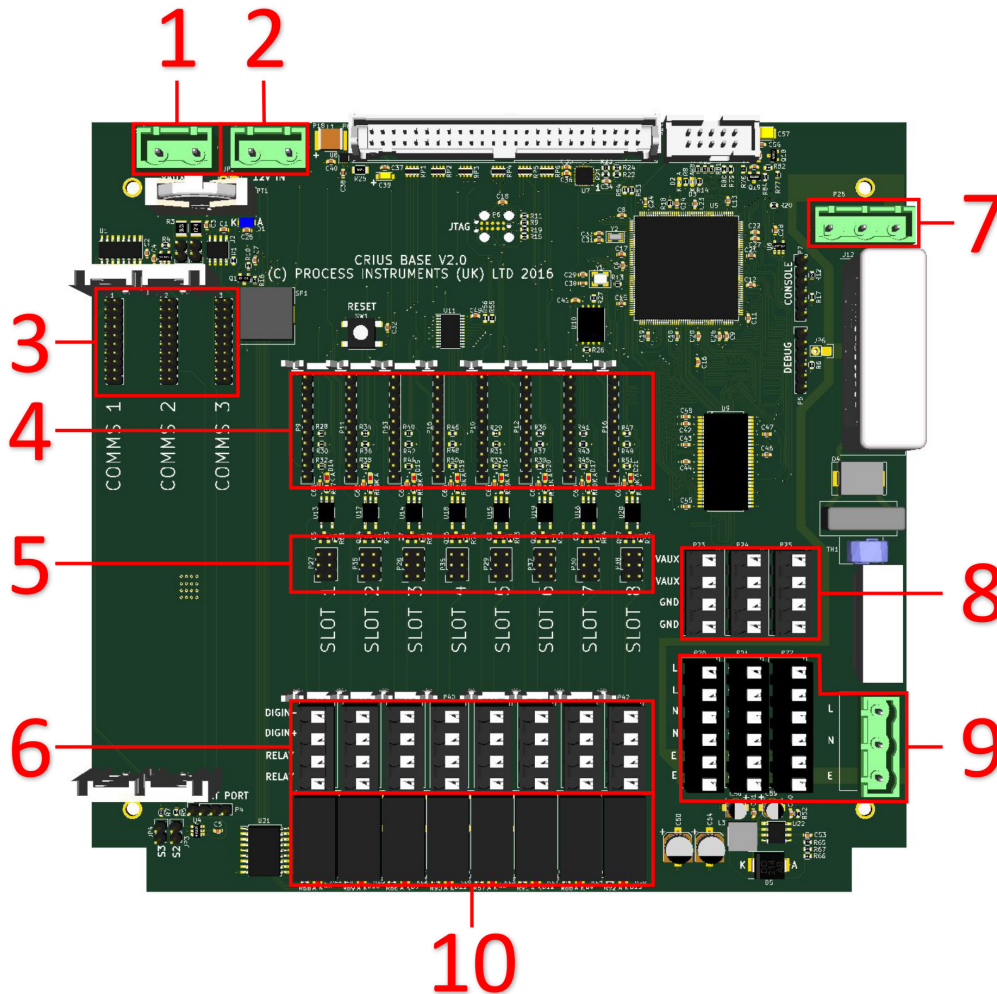


#### HydroAct 4 Pole Mounting

- A HydroAct 4
- B Large bracket
- C Four M5×8mm bolts
- D Pole
- E Small bracket
- F Two M6 bolts



### 2.3.4 Electrical Connections



1. Auxiliary power from secondary PSU
2. 12V input from main PSU
3. Communication card slots
4. Sensor and output card slots
5. Digital input configuration jumpers
6. Relay and digital input connectors
7. AC Power to main PSU
8. Auxiliary power out<sup>2</sup>
9. AC power connectors
10. Electromechanical relays

The connections are made via press to open connectors or screw terminals. An insulated screw-driver can be used to operate the connector. Each instrument has a large number of possible wiring combinations depending on which sensors, inputs, outputs or communications are selected at the time of purchase. This is achieved by the use of expansion electronics cards specific to each role. These expansion cards are fitted to “Slots”.

The connections for sensors, inputs, outputs and communication cards are detailed in Part II of this

<sup>2</sup>If secondary PSU is not fitted, these connectors are linked to the main 12V PSU.

manual.

## 2.4 Operation

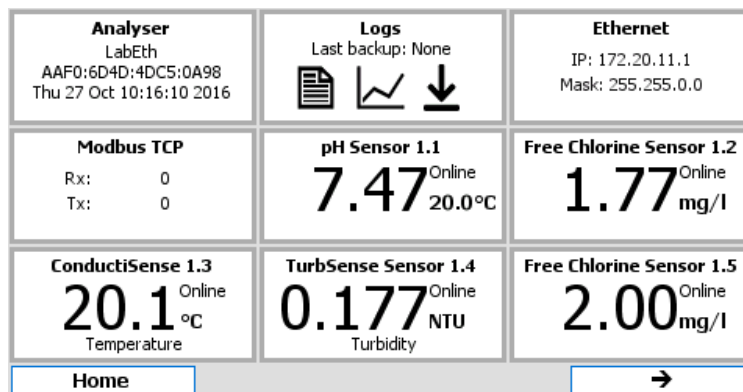
### 2.4.1 User Interface

The HydroAct 4 display is a 4.3", 480 × 272, 24-bit color display and is best viewed from directly in front. The user interface is accessed via nine buttons embedded in the membrane overlay. There are also two status LEDs, showing power and alarm status, and an audible buzzer.

The buttons all have a tactile feedback response. Holding the buttons in will inject multiple key presses of increasing speed until the button is released. In some cases holding a button will provide access to a different function. These are highlighted in the manual. The four buttons along the bottom of the screen, are defined for each screen by the legend above the button. The navigation and Select buttons below the display are always for navigation of the display. The Up and Down, Left and Right buttons are used for moving the "Select" target around the display.

The screen displayed once the system is started is either the default "Home" screen (see section 2.4.3), if configured, or the Main Menu.

### 2.4.2 Main Menu



**Example Main Menu**

The Menu screen is a standard display in your HydroAct 4 and is a tile based display of all the different parts or "devices" that make up your analyzer. By using the Up, Down, Left, Right and Select button it is possible to navigate to any part of the analyzer by highlighting the icon and selecting it. Devices are firmware modules that control a physical device, such as a sensor, or a purely software construct, such as a PID control calculation. Some hardware devices have multiple device tiles associated with them. For example, an Ethernet communications card will add an "Ethernet" tile which allows physical interface to be configured and a "Modbus TCP" tile allowing access to the main communications protocol used on the interface.

There are two standard device tiles available on all analyzers, regardless of configuration. The "Analyzer" tile gives access to information and configuration options for the unit, e.g., selecting the language and setting the time and date. The "Logs" tile allows access to the status and data logs stored on the unit.

Selecting a device tile from the menu will open an overview or set up screen. The overview display gives the user key information for that device and may allow the entering of commonly changed variables. For example, an overview for a chlorine sensor will display the chlorine reading and sensor maintenance information, and offer the user a shortcut to calibrate the sensor.

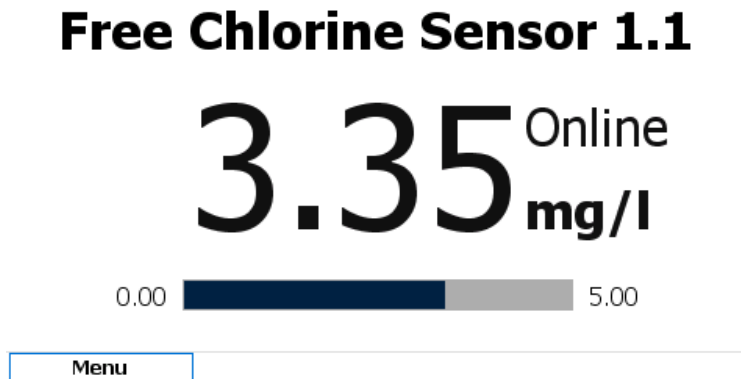
Many screens will have an "Options" button. Pressing this button will produce a pop-up menu on the display. Some of the items on this menu will have a ► next to them indicating that there are further

menus accessible by highlighting the menu item and either pressing the Select button or the Right button.

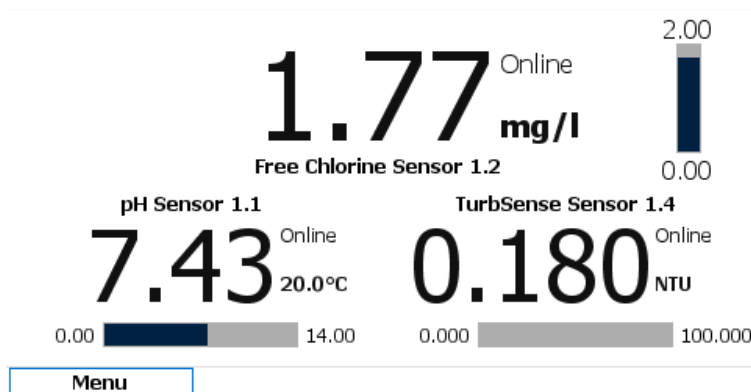
### 2.4.3 Home Screens

Home screens are used to display information from more than one source on a single display. They are accessed by pressing “Home” from any screen displaying the soft-key and then by pressing the Left or Right button to scroll through the available Home Screens. On any Home Screen pressing Up and Down will highlight different aspects of the display which can then be accessed by pressing the “Select” button.

Home screens can simply show information about a single sensor:



or several sensors readings and control outputs:

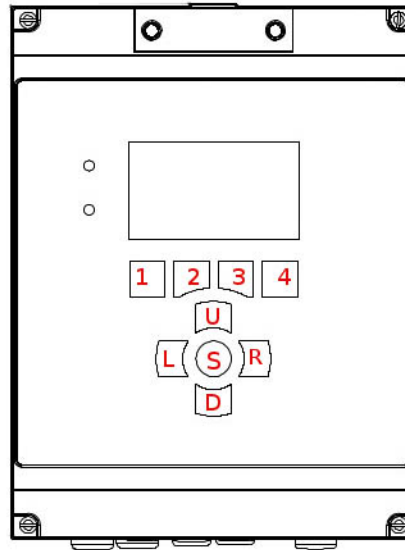


For details of how home screens are defined and configured see section 2.4.5.3.

### 2.4.4 User Authentication

When attempting to access a function that requires authentication you will be taken to the log in screen, where a user is selected and security code entered. Use the “Select” key to open the user drop down list, Up/Down to highlight the desired user and “Select” to move to the next step, the first box for the six digit security code entry will now be highlighted.

When entering a security code, all buttons except the fourth soft-key (top right) can be used for code entry. If the correct code is entered you will be presented with the tile requested. To indicate which user, if any, is currently logged in to the instrument, the user name will appear in the top right of the display. See section 2.4.5.4 for configuration of security options.



**HydroAct 4 Button Layout**

The analyzer is preconfigured with a default user called “user1” who has full access to the analyzer, with the default password of:

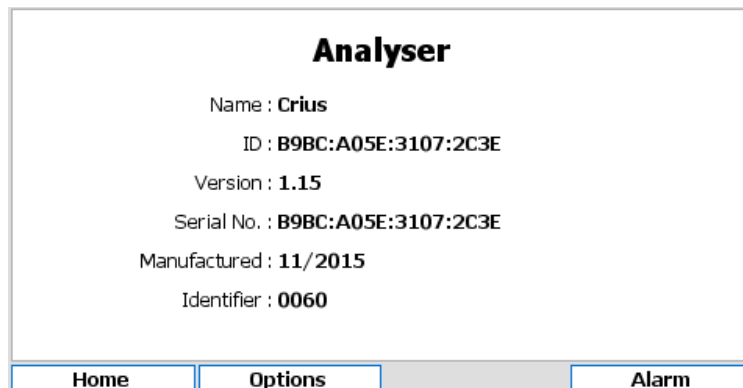
1, 1, 1, 1, 1, 1

From the button layout above.

To force a user to log out, press and hold the “Home” or “Menu” button for a few seconds until “Logout” is displayed. If default security access is enabled (see section 2.4.5.4) and different security access is required, press and hold the select button on the desired device tile in the main menu for a few seconds. The login screen will appear. Select the desired user and enter the password.

## 2.4.5 Analyzer Options

Selecting the Analyzer tile on the main menu will take you to the Analyzer Overview (below). From here you can access settings that relate to the analyzer setup. These typically do not affect the sensors, communications or control functions.



**Analyzer Overview**

### 2.4.5.1 Analyzer Setup

The date and time are used in the data logs and status logs of your controller and it is therefore important that they are set correctly. To modify the analyzer labels, time and date settings or language go to:

Options → Setup → Analyzer

**Analyser Setup**

Name  Time  :  :

ID  Date

Language

Time Zone

**Name & ID** The Name and ID details allows the user to name the instrument in various ways. These tags are used to identify the instrument, e.g., when an instrument sends a text alarm, the Name and ID details are used to inform the recipient as to which instrument is in alarm. The Name would typically be the site name and the ID would typically refer to a specific analyzer.

**Language** The user interface of the HydroAct 4 can be set to any supported language. Use the drop down list to select the language of choice.

**Time Zone** Select the required time zone. The internal clock stores the time in UTC format. Therefore changing the time zone will change the current time. Daylight savings, if applicable for the selected time zone, will automatically be followed.

**Time** Set the required time by modifying the values using the up/down buttons

**Date** Select the date using the calendar widget that will appear when the date entry box is selected.

### 2.4.5.2 User Interface

Configuration options that affect the user interface are presented in tabbed windows. Use the keys marked “←” and “→” to move between tabs. The configuration is accessible by selecting:

Options → Setup → User Interface

**User Interface**

Buzzer  Enabled

Backlight Timeout  Enabled  
 :  :

Home Button  Home  
 Menu

Blink highlighted  Enabled

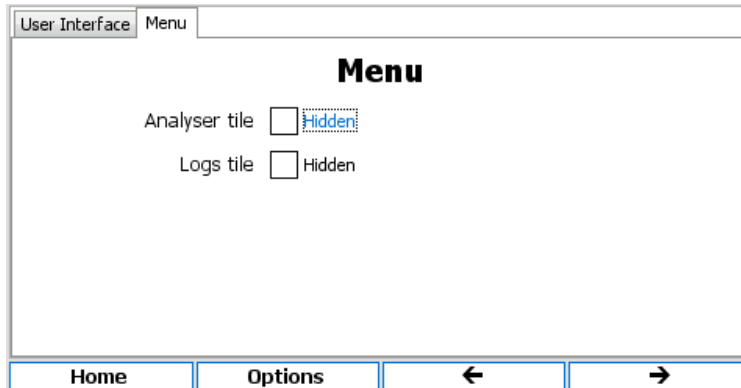
**Buzzer** The buzzer will sound when a key is pressed or to indicate that the analyzer is in alarm. Use the checkbox to enable or disable the buzzer sounding.

**Backlight Timeout** In order to extend the life of the display a timeout can be set. At the end of the timeout the display will go dark. Any button press will turn the screen back on. Use the checkbox to enable or disable the backlight timeout and set the desired timeout using the up/down buttons. The timeout is in HH:MM:SS format.

**Home Button** On most displays the left button under the display can be set to take the user to the “Home” screen or the “Menu” screen.

**Blink highlighted** If this option is enabled, the element the user needs to look at blinks between two colors to attract attention.

#### 2.4.5.2.1 Menu



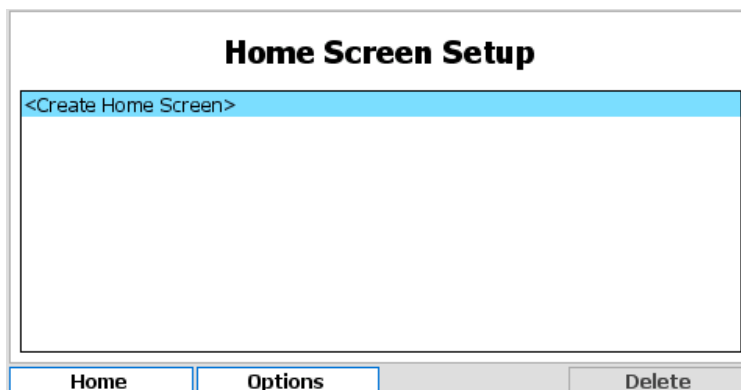
**Analyzer tile** If the checkbox is ticked then the Analyzer tile will be hidden as default on the main menu.

**Logs tile** If the checkbox is ticked then the Logs tile will be hidden as default on the main menu.

#### 2.4.5.3 Home Screens

The HydroAct 4 has the capability to have multiple home screens which give the user options as to how the display provides information (see section 2.4.3). To set up a new home screen, edit or delete an existing home screen, select:

Options → Setup → Home Screen



To delete a home screen highlight the home screen name with the up/down buttons and press “Delete”. Pressing and holding the “Delete” key will make the “Delete All” function available. A confirmation message box will appear before all home screens are deleted. To edit the home screen, again select the name, and press the select button. To create a new home screen, select “Create Home Screen” and press select.

**Create Home Screen**

Select home screen type and press Create

Type

Select the home screen type from the drop down list. Generic home screens allow up to 4 devices to be displayed in a variety of formats. Other home screen types are application-dependent and are described below, if applicable. For this example, select “Generic” and press “Create”.

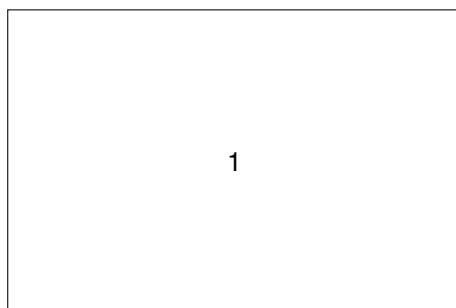
**Home Screen Setup**

Name

Layout

1

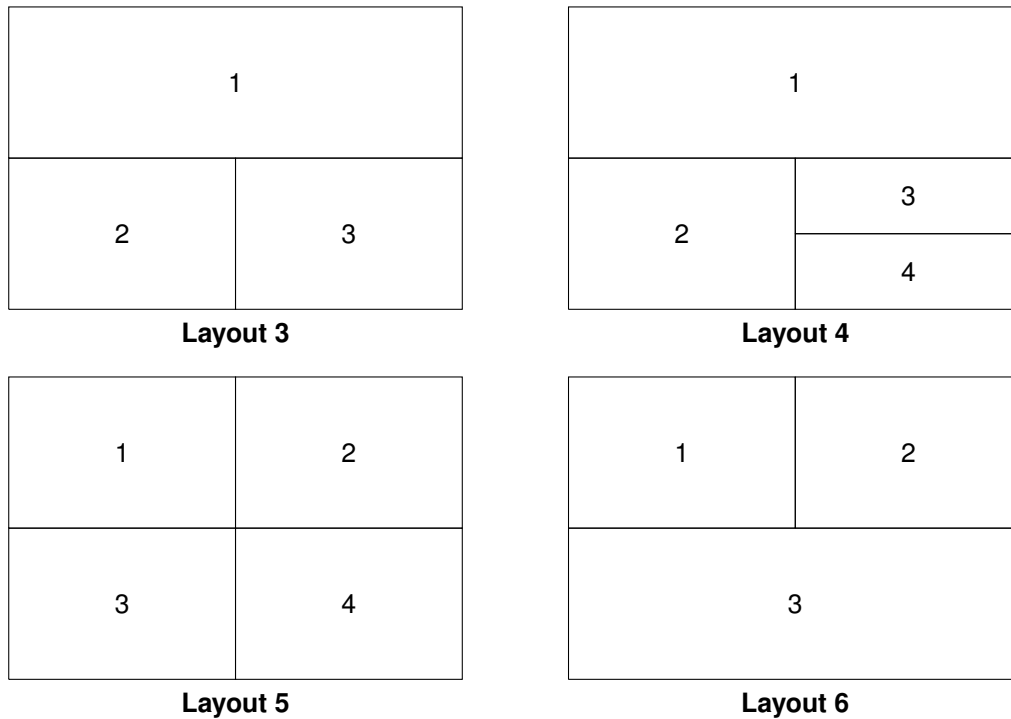
Editing an existing Generic home screen or creating a new Generic home screen will display the above form. Select the desired layout as shown in the diagram below the layout selection box. The layout is made up of a series of windows that display selected information. The possible window arrangements for the layouts are as follows:



**Layout 1**



**Layout 2**



Each window can display information about a device or a data log graph. To select what is displayed in each window of a particular layout, move the selection to highlight the window and press the select button.

**Edit Window**

Select a module and window type to occupy home screen section

Type

Device

Home
Options
Done

**Type** Select the type of information to display in the selected window. Options are “Device” or “Data Log”.

**Data Log** If “Data Log” is selected in the type field, this option will be available. Select the data log to display.

**Device** If “Device” is selected in the Type field above, this option will be available. Select the device to display in the selected window.

**Window** If the device selected above has multiple types of display possible for this type of window, then this option will be available. Select the type of information to display.

#### 2.4.5.4 Security

To access the security setup options, select:

Options → Setup → Security



**Security Setup**

Login timeout 00 : 02 : 00

Default access  Enabled

System Advanced

Sensor Advanced

Signal Advanced

Output Advanced

Control Advanced

Event Advanced

Home Options

**Login Timeout** If no user activity is detected within this given time period while the main menu or home screen is displayed, then the current user will be logged out. The time is in HH:MM:SS format.

**Default Access** If enabled, then no user authentication will be attempted when accessing a device tile or using a quick access function from the home screen. Instead the user will be allowed access at the security level set out in the boxes below it.

#### 2.4.5.4.1 Security access levels

Access to many of the analyzer functions is secured using password protection. To allow flexible security profiles the HydroAct 4 is split into six access areas:

**System** Controls access to analyzer-specific settings and communication options.

**Sensor** Controls access to sensor devices.

**Signal** Controls access to signal devices, such as digital inputs.

**Output** Controls access to output devices, such as relays and analog outputs.

**Control** Controls access to control devices, such as PID.

**Event** Controls access to event devices, such as timers and schedulers.

With each of these areas, operations have been assigned to four security levels:

**None** No access to the assigned area is enabled.

**Basic** Users with this access level can see information and perform basic maintenance tasks. Users generally can not change any settings with this access level.

**Intermediate** Users with this access level can perform routine maintenance tasks and change common settings.

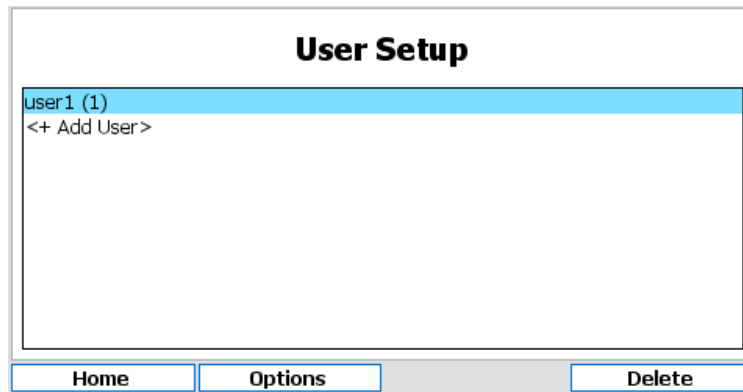
**Advanced** Users with this access level can perform all available actions.

Using this security model it is possible to assign specific tasks to individual users. For example, It is possible to allow a user to calibrate sensors (intermediate access for sensors), but not change PID settings (no access for controls). Access to restricted functions will require the entry of the operator's security password.

#### 2.4.5.5 Users

To add, remove users or modify access rights, select:

Options → Setup → Users



To add a user, highlight “<+ Add User>” and press the select button. Enter the desired user name and access rights. To set the password, press “Password” and follow the on screen prompts. To delete a user, highlight the user name and press “Delete”<sup>3</sup>. To modify a user account, highlight the user name and press the select button. The user name and security access rights will then be editable.

A user can change their own password by selecting the following and following the on screen prompts.

Options → Change Password

#### 2.4.5.6 Analyzer Information

Information regarding the analyzer hardware and software setup is useful for diagnosing problems and correctly configuring the analyzer. To access the hardware map, i.e., information about the hardware installed in the analyzer, select:

Options → Information → Hardware Map

Node	Type	Version	Serial No.
1	Base	1.15.00	B9BC:A05E:3107:2C3E
3	Undefined	0.00.00	0000:0000:0000:0000

Information given for each Node<sup>4</sup> includes board number, board type, firmware version number and unique serial number. Each enclosure in a system contains a base board. These boards are numbered 1, 5, 9 and 13. Board 1 is the master board with the screen and keypad attached. Each base board has three slots for communication boards, whose node number increments from the base board they are installed on. For example, the master board, or node 1, has communication slots with nodes numbered 2, 3 and 4.

Highlighting a base board and pressing the “Select” key will open a further information screen showing the I/O plugin cards installed, their location and hardware and software version numbers.

<sup>3</sup>A user can not delete their own user account. This prevents the possibility of having no privileged user accounts and effectively leaving an instrument in an unusable state.

<sup>4</sup>The mainboards and communication boards in an analyzer communicate over a CANBUS network. Each board has a unique Node number for identification on this network.

Node 1 - Base			
Slot	Type	Hardware Version	Software Version
1	pH Card	1.01.00	1.02.00
2	Analogue Input Card	1.01.00	1.03.00
8	Analogue Output Card	1.00.00	1.03.00

Home Options Back

The HydroAct 4 makes use of several internal read-only file systems as well as the micro SD card. Information regarding the file system usage can be viewed by selecting:

Options → Information → File Systems

File Systems		
Name	Used	Total
/bin	0.79MB	0.79MB
/opt	0.50MB	0.50MB
/usr	2.43MB	2.43MB
/var	0.00MB	1.73MB
config	0.00MB	0.12MB
/mnt	20.44MB	1914.62MB

Home Options

All entries other than “/mnt” are internal read-only file systems and the information may be useful for technical support inquiries. The “/mnt” file system refers to the micro SD card and a total size of 0.00MB indicates that the card is missing or not detected.

The device list shows which software modules are installed and active on the analyzer. To access this information, select:

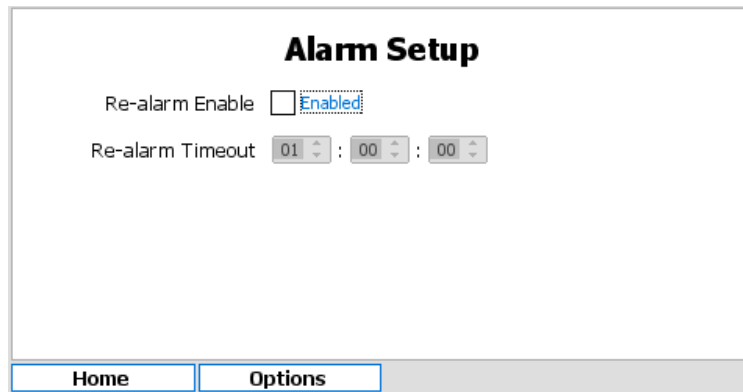
Options → Information → Device List

Each installed device is listed. Use the Up and Down keys to scroll through the list.

#### 2.4.5.7 Alarm Settings

When the analyzer detects an error condition, it will enter an alarm state. This will be indicated on the screen and sounded using the buzzer. To access the alarm configuration, select:

Options → Alarm → Setup



The “re-alarm” feature can be enabled and the timeout set. If the analyzer is in alarm and that alarm is acknowledged (see below), then the analyzer will return to the alarm state after the timeout has expired if the error condition has not been rectified. The exact reason for the active alarm is shown by selecting:

Options → Alarm → Message

When the analyzer is in alarm, the message shows the time and date of when the message was updated and an “Ack” button silences the alarm and prevents any further alarm SMS messages<sup>5</sup> being generated. The alarm message will change to indicate the alarm has been acknowledged.

#### 2.4.5.8 Service Options

Service options are used to gather information for technical support personnel. Other options allow firmware upgrades and factory reset of configuration information. Operations in this menu should only be accessed when requested by a service engineer.

#### 2.4.5.9 Device Codes

Device codes enable firmware modules. Adding new hardware or software features usually requires adding device codes. Devices codes can be entered directly using the user interface or imported from a MicroSD card. Technical support will provide instructions should this need to be done outside of the factory.

#### 2.4.5.10 Backup, Clone and Restore Configuration

##### 2.4.5.10.1 Backup

To create an analyzer backup navigate to:

Analyzer → Options → Backup → Backup

Select an existing file to overwrite or select “+New File” and select “Next”. If creating a new file, enter the desired filename (by default the date is included in the filename). Then select “Next”. When notified that the backup file has been created select “OK”.

##### 2.4.5.10.2 Restore/Clone

To begin a restore/clone operation navigate to:

Analyzer → Options → Backup → Restore

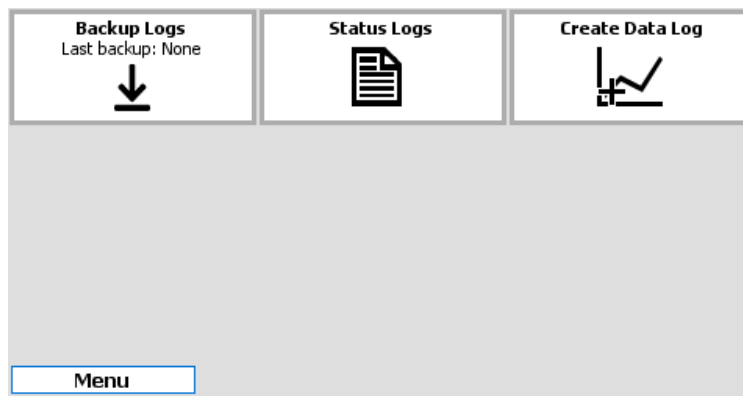
Select the file to restore/clone from and select “Next” and then “OK”. If this is the analyzer on which the backup file was created a restore operation will occur. If this is a different analyzer a clone operation will occur.

<sup>5</sup>Available if a 2G/3G Modem option is installed

Configuration Files	Restore	Clone
Analyzer Settings (Name, Alarm, Users, etc)	Yes	Yes
Communications Card Settings <sup>6</sup>	Yes	Yes
Data Logs Setup <sup>7</sup>	Yes	No
Home Screens	Yes	No
Device Codes	Yes	No <sup>8</sup>
Device Settings	Yes	Yes
Modbus Maps	Yes	Yes

## 2.4.6 Logs

Selecting the log tile from the main menu will display a secondary logs menu. These available options are; Backup Logs, Status Log and Create Data Log.



If any data logs are defined, each will be displayed as its own file.

### 2.4.6.1 Backup Logs

Logs can be backed up by selecting this tile. The screen will display the last time logs were successfully backed up. With a SD card inserted in to the analyzer, press the "Backup" button to begin. Log entries since the last successful backup will be written to the SD card. A progress bar will display the backup task progress and a message displayed to indicate the result.

### 2.4.6.2 Status Log

Selecting the Status Log tile will display the Status Log messages. These will include important information such as recording when calibrations are performed, users log in and any error messages:

<sup>6</sup>Communication cards must be present in the same order for restore/clone to function.

<sup>7</sup>All data log data will be cleared

<sup>8</sup>Same device codes must already be present on the analyzer for device configurations to be cloned successfully.

Status Logs		
ID	Time	Message
2351	24/02/2017 12:55:51 GMT	pH Sensor 1.2 error: Sensor failed to read input signal
2350	24/02/2017 12:55:51 GMT	Free Chlorine Sensor 1.1 error: Sensor failed to read input s
2349	24/02/2017 12:52:07 GMT	Login by user user1
2348	24/02/2017 11:10:28 GMT	User logged out
2347	24/02/2017 06:21:22 GMT	Login by user user1
2346	24/02/2017 06:19:12 GMT	pH Sensor 1.2 error: Sensor failed to read input signal
2345	24/02/2017 06:19:12 GMT	Free Chlorine Sensor 1.1 error: Sensor failed to read input s
2344	24/02/2017 06:16:02 GMT	Login by user user1
2343	24/02/2017 05:40:59 GMT	User logged out
2342	24/02/2017 05:38:54 GMT	Login by user user1
2341	20/02/2017 07:24:58 GMT	User logged out

Home    Back    Clear    Download

Use the arrow keys to scroll up, down, left and right. Press “Clear” to delete the current status log messages and truncate the status log. Press “Download” to save the status log to SD card.

### 2.4.6.3 Data Logs

#### 2.4.6.3.1 Creating a Data Log

To create a new data log, select “Create Data Log”.

New Data Log	
Name	<input type="text" value="New Data Log"/>
Interval	<input type="text" value="30 Minutes"/>

Back    Next

Enter the name to identify the data log and the log interval. Available options are 1, 2, 5, 10, 15, 20, 30 minutes or 1 hour. Press “Next” to continue.

Items Logged	
<input type="checkbox"/>	Free Chlorine Sensor 1.1 (Free Chlorine)
<input type="checkbox"/>	pH Sensor 1.2 (pH)
<input type="checkbox"/>	PID Controller 1.1 (Primary Output)

Back    None    All    Done

Select from a list of available parameters, signal inputs and control outputs to populate the data log. Highlight the desired measurements or press “All” to highlight all available measurements. Up to the first 4 measurements selected will be displayed on the data log graph. Press “Done” when finished. The data log will be created and data collected.

**2.4.6.3.2 Viewing a Data Log**

Each data log configured will be displayed as a tile in the Logs menu. Select the data log of interest to view the data.

### Overview

Name

Interval

Items Logged

Free Chlorine Sensor 1.1 - Free Chlorine

pH Sensor 1.2 - pH

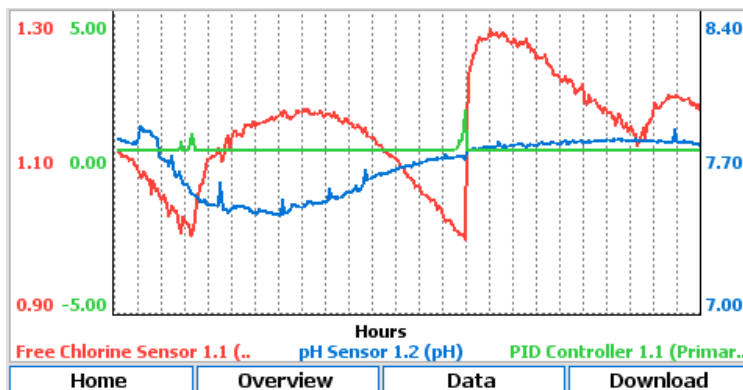
PID Controller 1.1 - Primary Output

The overview allows the renaming of the log and changing of the log interval. The “Delete” button will remove the log completely and prevent any further data logs being collected. The “Clear” button will truncate the data log and remove any historic data. The "Download" button allows the data log to be saved to SD card as comma-separated values.

### Default

ID	Time	Free Chlorine Sensor 1.1 (Free Chlorine) [1/3]
82073	21/03/2017 14:45:00 GMT	1.06
82072	21/03/2017 14:30:00 GMT	1.06
82071	21/03/2017 14:15:00 GMT	1.08
82070	21/03/2017 14:00:00 GMT	1.09
82069	21/03/2017 13:45:00 GMT	1.08
82068	21/03/2017 13:30:00 GMT	1.10
82067	21/03/2017 13:15:00 GMT	1.12
82066	21/03/2017 13:00:00 GMT	1.11
82065	21/03/2017 12:45:00 GMT	1.13
82064	21/03/2017 12:30:00 GMT	1.14
82063	21/03/2017 12:15:00 GMT	1.14
82062	21/03/2017 12:00:00 GMT	1.16

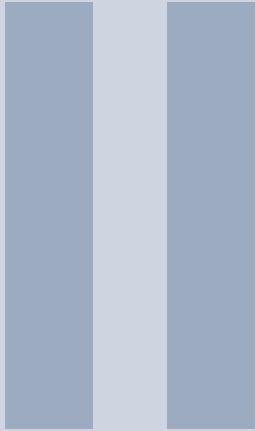
To view the data log values collected, press the “Data” button. A table of recorded values will be displayed. Use the arrow keys to scroll up, down, left and right.



To view the data log graph, press the “Graph” button. The legend shows the line style for each measurement and axis.







# Options

<b>3</b>	<b>Sensors</b> .....	<b>35</b>
3.1	PC3 Particle Counter	
<b>4</b>	<b>Outputs</b> .....	<b>55</b>
4.1	Analog Outputs	
4.2	Relay Output	



## 3. Sensors

### 3.1 PC3 Particle Counter

#### 3.1.1 General Information

The PC3 Particle Counter is designed to detect particles in the 2 to 750  $\mu\text{m}$  range (upper limit defined by flow cell size) and size particles in the 2 to 127  $\mu\text{m}$  range (any particles larger than 127  $\mu\text{m}$  will be sized as  $>127 \mu\text{m}$  and added to the total counts value). The sensor can sort the detected particles into up to 3 size channels (e.g. 2-5, 5-10, 10-100  $\mu\text{m}$ ). The PC3 Particle Counter uses a light blockage method to determine particle size and count. The light source is an infrared laser diode.

The sensor features an entirely external sampling and measurement system which prevents a sample leak from damaging sensitive electronic components. The 750 x 750  $\mu\text{m}$  flow cell is easy to access and clean. The constant head flow control weir ensures stable, reproducible flow and accurate particle counts. The PC3 Particle Counter connects over a RS485 connection to the HydroAct 4 which allows the user to see the individual size ranges and particle counts in multiple size ranges. The HydroAct 4 controller provides an indication of the sensor's cleanliness and allows the user to know when cleaning is necessary. Another unique feature of the PC3 Particle Counter is its ability to perform Automatic Sizing Calibration via the HydroAct 4 user menu. No software or computer is required to calibrate the PC3 Particle Counter sensor.

#### 3.1.1.1 Health and Safety

**The PC3 Particle Counter is equipped with a class 3R laser and should not be tampered with in any way.**

In order to provide maximum user safety the PC3 Particle Counter particle counter was designed with the following issues in mind.

- All circuitry is enclosed with a protective non-conductive housing.
- No user serviceable parts.
- No user replaceable parts.
- No access to laser.

Please ensure that the user reads the manual before starting installation.

- Do not attempt to disassemble the unit.
- Keep enclosure sealed tight, water must not be allowed to enter the housing of the unit.
- Use a mild non-abrasive cleanser when cleaning the unit.
- Do not drop or jar the unit.
- Do not modify any internal electrical wiring or electronics.

**Risk of electric shock. Connect only to suitable isolated, hard wired electrical outlet. It is recommended that the outlet is protected by an RCD (Residual Current Detector) or is in any event in compliance with all local electrical regulations. Do NOT bury electrical supply cable.**

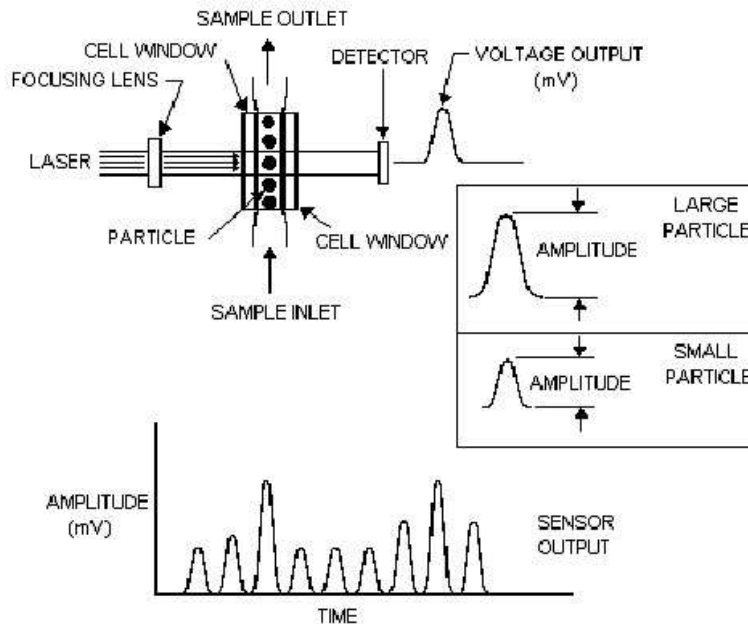
### 3.1.1.2 Environmental Considerations

The sensor contains electronics, sapphire, aluminum, delrin, kynar and polycarbonate. Inside the sensor there are electronics. Please use this product in a manner sensitive to the environment and at the end of its life dispose or recycle in a manner appropriate at that time in compliance with local regulations.

### 3.1.2 Theory of Operation

The PC3 Particle Counter is designed to count particles 2 to 750 $\mu\text{m}$  in diameter and size (i.e. sort by size) particles ranging from 2 to 127 $\mu\text{m}$  in diameter. Particles larger than 127 $\mu\text{m}$  will be sized as >127 $\mu\text{m}$  particles. Particles are divided into size ranges and the number of particles counted in each of these ranges is reported as counts per milliliter, counts per 100 milliliters, or raw counts.

The PC3 Particle Counter consists of an optical sensor and counting electronics. The sensor consists of a 780 nm infrared laser diode, a light detector, and two sapphire windows. The detector converts light energy into electrical voltage. The laser light is directed through both windows and onto the detector. Sample flow passes between the windows, so that any particles in the sample will pass through the laser beam. Each particle will block a small percentage of the light that hits the detector, changing the electrical output of the detector. Since the particles are moving rapidly, each particle will produce a short electrical pulse at the output of the detector. The amplitude of the pulse correlates to the size of the particle. The output of the sensor is a stream of pulses of varying amplitude, each corresponding to a particle. This type of device is known as a light blocking or light extinction sensor, see the following diagram.



The amount of light blocked from the detector is the sum of the light absorbed by the particle and the light scattered or reflected by the particle. The size, composition, color, refractive index, light scattering coefficient, etc of each particle will determine how much light is scattered and how much is absorbed. The orientation of the particle as it passes through the light beam will also affect how much light is blocked. These factors need to be taken into consideration when determining how data from the particle counter should be interpreted. It is important to keep in mind that there are no absolutes with any type of optical measurement that is done with light scatter or light blocking techniques. With that said, having size data which is relatively indicative of the actual particle sizes in the sample is very useful in categorizing the performance of a filter or determining how much relative volume of particulate contamination exist in a given sample. The sensor output is fed into the counter electronics where the particles are counted and sorted into size channels according to their pulse amplitude. These pulses are compared to a calibration curve that was generated using PSL Spheres and this is how the size of the particles is determined.

### 3.1.2.1 Parts Supplied

Keep the packaging for the sensor. In case of repair or warranty return the sensor in this package. Check that the delivery is intact. In case of damage please contact your supplier. Check that the delivery is complete by comparing with the list of parts below.

- Flow control weir
- 2 Weir clamps
- 1 Sample drain cup
- Overflow tubing
- Weir inlet & drain cup tubing
- Sensor tubing
- 400 Micron in-line strainer (Optional: Recommended for Raw Water)
- Cleaning brush
- Optional communications cable

### 3.1.2.2 Technical Data

#### 3.1.2.2.1 Sensor

**Laser Type** Solid-state Laser Diode (780nm)

**Flow Cell Dimensions** 750 x 750  $\mu\text{m}$

**Cell Material** Nituff™ coated aluminum, (PEEK plastic, Optional)

**Viewing Windows** Sapphire

**Detection Range** 2 - 750  $\mu\text{m}$

**Size Channels** Up to 3, user selectable size ranges.

**Sizing Range** 2..127  $\mu\text{m}$

**Flow Rate** 75 ml/min

**Laser Diode Life** greater than 75000 hours at 55 °C

**Measurement Type** Volumetric, counts/ml, counts/100ml.

**Operating Temperature** 0..50 °C

**Enclosure Dimensions** 262mm (w) x 120 mm (h) 90mm (d)

**Weight** 3.2kg

**Sample temperature** 0°- 50 °C, non-freezing

**Sample Head** 762mm minimum (30 in.)

**Calibration frequency** Annual

### 3.1.3 Installation

#### 3.1.3.1 Site Selection

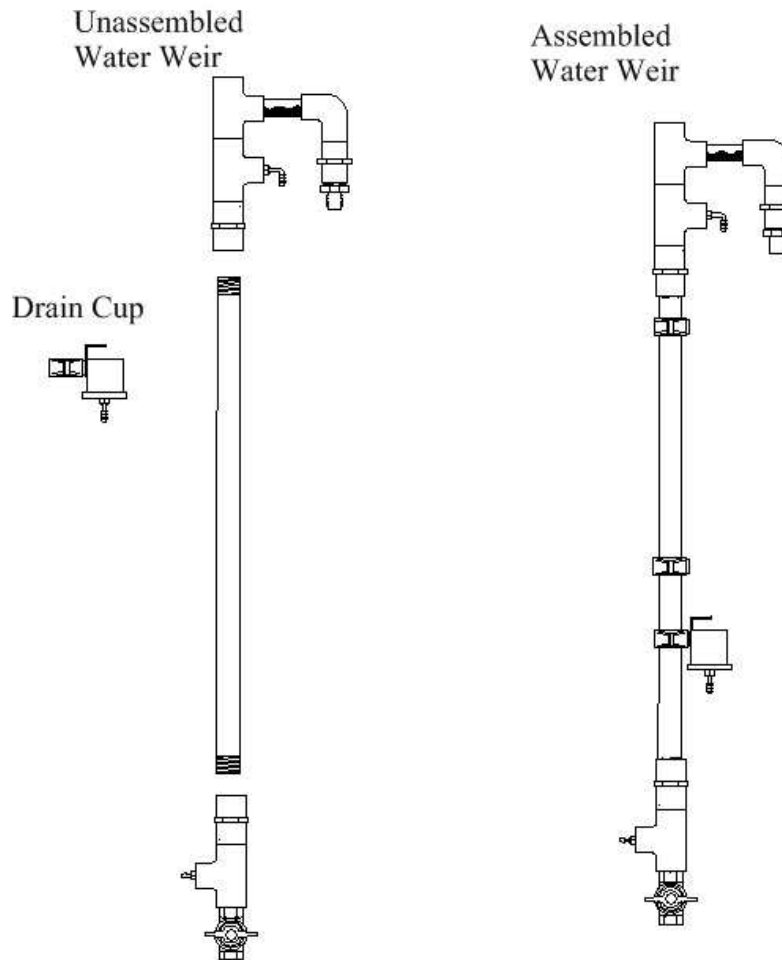
Please choose a suitable location for the installation of the electronics. The choice of installation point on any site is a compromise and is best undertaken by an experienced installation engineer. The following is a list of the factors that need to be taken into consideration. This list is not intended as a check-list neither is it implied that the list is complete.

- Ensure that the mounting allows access to all serviceable parts.
- Try to mount the electronics in a position where they are not habitually hosed down in a cleaning process.
- The electronics enclosure should be mounted away from sources of heat or direct sunlight.
- Consider the length of wiring runs when mounting the instrument.
- Try to keep the electronics away from substations, motors or other large EMI emitters.
- Consider whether the sample will be representative and well mixed.
- Consider sample line run times.
- Consider sample return points.
- In a plastic run, with a low conductivity liquid sample, consider earthing the sample.
- If the instrument is controlling a dosing pump, size the pump appropriately.

**While installing the PC3 Particle Counter sensor, avoid excessive vibration, dropping or banging on the unit. The optics inside the sensor can be knocked out of alignment if the unit is improperly handled.**

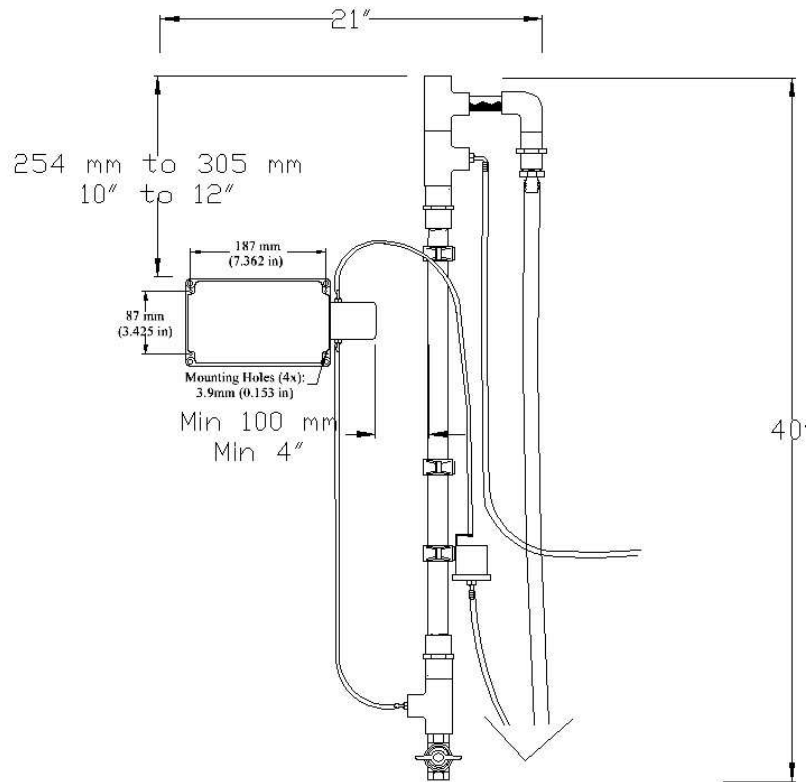
#### 3.1.3.2 Weir Assembly

Prior to mounting the PC3 Particle Counter sensor it will be necessary to assemble the weir. The weir comes unassembled in four pieces. Those four pieces are simply screwed together to look like the weir shown in the following diagram.



### 3.1.3.3 Mounting

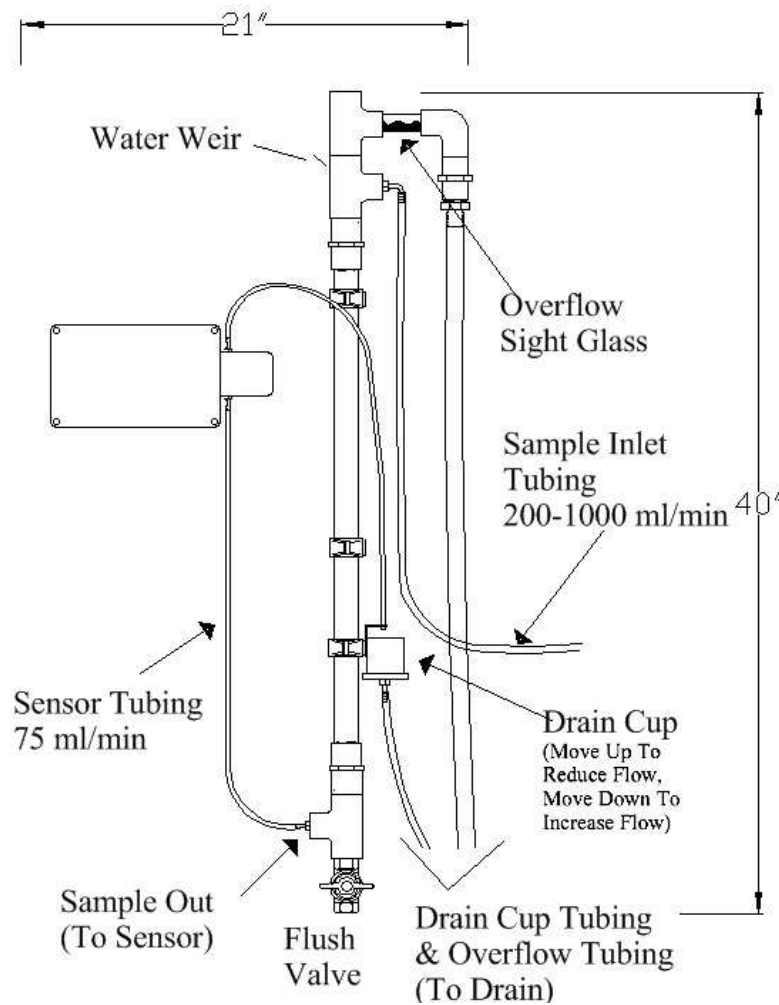
The total space needed to mount the PC3 Particle Counter sensor is an area 533mm (21 in.) wide and 1016mm (40 in.) tall. The PC3 Particle Counter should be permanently mounted to a flat, vertical surface, such as a wall or support column, in an upright position using the 4 mounting holes located on the enclosure. The mounting hole dimensions are 187 mm (width) and 87mm (height) and the mounting holes have a diameter of 3.9mm. The weir should be mounted as shown next to the PC3 Particle Counter, utilizing the mounting clamps, with the weir height adjusted so that the top of the weir is approximately 254mm to 305mm ( 10 - 12 in.) above the top of the PC3 Particle Counter. The weir assembly and PC3 Particle Counter should be mounted at an elevation sufficient to achieve overflow at minimum source pressure. A ball valve can be used to regulate the flow into the weir assembly.



### Important Note on Weir Installation

1. Make sure the clear horizontal pipe at the top of Weir is higher than the top of the PC3 Particle Counter by 254mm to 305mm (10 - 12 in.). This ensures flow will start reliably through the sensor. If the Weir is mounted too low, the flow may not re-start reliably through the sensor if flow was ever lost for any reason.
2. Mount the Weir to the right of the unit (as shown in the following diagram) and ensure there is a minimum of 100mm between the Weir and the sensor (the sensor protrudes from the right side of the enclosure). The cap on the sensor may need to be removed at some point for maintenance and mounting the Weir too close to the sensor will make it impossible to remove the cap without first removing the weir. Once the PC3 Particle Counter and Flow Control Weir are mounted, the tubing can be attached to the Weir and Sensor as detailed in the following diagram. Make sure that the sensor tubing going between the sensor and drain cup is long enough to reach the drain cup allowing it to slide all the way down on the weir. It is also recommended to leave a little extra tubing on the bottom of the drain cup. Final adjustment to the drain cup position and tubing lengths will be discussed in section 3.1.4.3.





### 3.1.3.4 Wiring

Connect the RS485 Cable from the analyzer to the RS485 terminals shown in the following diagram. Ensure shielding is connected to ground at one end. The PC3 Particle Counter may connect to different RS485 inputs based on the instrument's setup. Please see the Menu option below for wiring instructions for the RS485 wiring in the HydroAct 4. Select "Menu" then select the appropriate PC3 Particle Counter menu tile. To see an image of where the RS485 cable should be connected within the HydroAct 4 select:

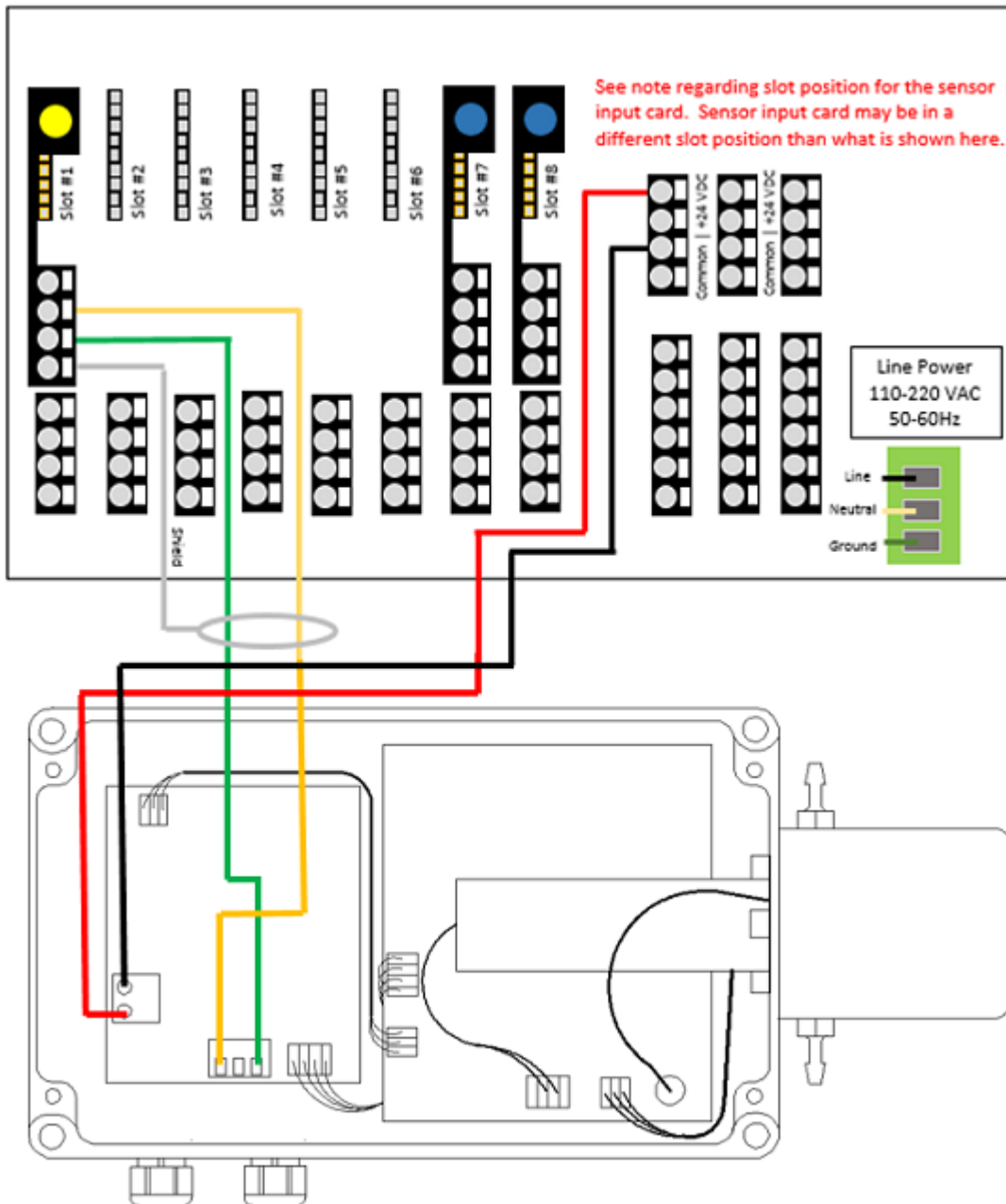
Options → Connections

The PC3 Particle Counter sensor requires input power in the range of 9 to 36 VDC. Most commonly the sensor will be connected to the HydroAct 4 auxiliary power source. The power connection is shown in the following diagram. When power to the sensor is to be provided by the HydroAct 4, the appropriate voltage is available on connectors J18, J19 and J20 within the HydroAct 4. The connectors are labeled VAUX and GND.

#### Note regarding sensor card slot position:

If the analyzer is only equipped to work with a single sensor (as evident by there only being one plugin card installed in slots 1 and slots 2 to 4 being empty) then the RS-485 sensor input card for the sensor will be in the "Slot #1" position as shown in this diagram. Otherwise, if additional plugin cards are installed in slots 2 to 4 it will be necessary to power up the HydroAct 4 and check the sensor

name and/or connections diagram under the sensor menu to determine the correct slot position for the sensor input card. There will be numbers appearing at the end of the sensor name like PC 1.1 or PC 1.2. A designation of 1.2 indicates the sensor input card is located in slot #2, whereas a designation of 1.3 indicates slot #3. If the numbers which appear begin with 5 (e.g. PC 5.1), then it means the sensor input card is located in slot #1 of the expansion module. The slot position in which the sensor input card is located can also be verified by going to the connections diagram under the sensor menu as described in the Connections section of this manual.



## 3.1.4 Commissioning

### 3.1.4.1 Sample Considerations

The high sensitivity of the particle counter makes sample handling and delivery critical for proper operation. Poor sample point selection and/or improper sample line installation can result in a substantial loss of accuracy. It is important to ensure that the sample is properly representative of the process stream. There are three common ways in which the sample can be distorted:

1. Adding particles to the sample stream. Choosing an improper location for the sample tap, such as the bottom of a pipe where sediment can accumulate, or an open sample point where particles can be introduced from outside the process usually causes this. Disturbances in sample flow to the weir, or disturbing the sample tubing, will also cause particles to shed from the sample tubing and result in large spikes in the reading which are not representative of the process. To minimize this affect, keep sample tubing as short as possible, use smaller diameter tubing so flow velocity is high (keeping tubing clean), and mount sample tubing away from locations where it is likely to be disturbed.
2. Losing particles from the sample stream. Long sample lines can cause particle dropout, especially at low flow rates. If the sample line must be long (more than 3m) then it will be important to keep the sample flowing swiftly (i.e. 1.22m per second) to prevent particulate from settling out in the tubing. The higher flow rate will also help keep the tubing cleaner and thereby help minimize particle shedding which can be caused by fluctuations in flow.
3. Altering the particle distribution. Sample pumps can chop up larger particles creating more small particles. "T" fittings can cause larger particles to miss the sample line because they can't make the sharp right angle "turn". Having a sample tap that points into the sample stream is the most ideal way to sample.

### 3.1.4.2 Initial Start Up

It is very important to flush out all taps and valves before connecting the PC3 Particle Counter. Sometimes newly installed taps or valves, or those that haven't been used for years, can contain debris that may clog the sensor. Prior to connecting the sample line to the sensor, allow the sample to flow to drain for at least 5 minutes.

Once installation is complete and the sample is hooked up to the sensor, the sample line may still be somewhat dirty and not truly representative of the actual particle concentration at the sample point. Typically the sample lines will sufficiently flush and stabilize within 15 to 30 minutes. If the particle counter output is being recorded, it is easy to tell when the lines have been sufficiently flushed, as the data will level out.

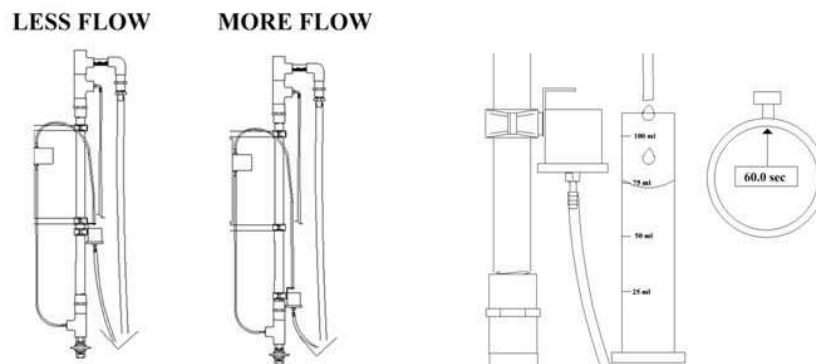
Once the counts have appeared to stabilize, a quick test can be done to verify the PC3 Particle Counter sensor is not experiencing any sort of noise issue that can arise due to issues with poor electrical grounding. Simply pinch the tubing coming off the top of the sensor (which is the tubing going to the drain cup). Pinching this tubing will stop flow through the sensor. If the flow is stopped and the tubing held stationary, the counts should drop to zero within 1 to 2 minutes providing the sample is filter effluent (use DI water if filter effluent is not available or has a turbidity higher than 0.3 NTU).

With water flowing through the sensor, a check should be performed to make sure the PC3 Particle Counter sensor does not have a cell condition alarm reporting on the HydroAct 4. If there is an alarm, try cleaning the sensor as detailed in section 3.1.6.1. Contact your supplier for assistance if the cell condition alarm does not clear after cleaning.

**Both Laser and Cell condition are temperature dependent, so water and/or air temps near freezing or above 35°C can cause these readings to change. The PC3 Particle Counter sensor is working properly as long as the laser and cell condition reading are not in alarm when water and air temps are in the 4 to 32°C range.**

### 3.1.4.3 Setting proper flow rate

Since all particle count data must be based on a sample volume, flow control is crucial for accurate and repeatable performance. The simplest and most effective way to achieve constant flow is to utilize a flow control weir. The flow control weir assembly is designed to deliver constant flow to the sensor despite changes in source pressure. Overflow (as seen through the clear horizontal pipe) must be maintained to ensure that full flow is achieved. The clear horizontal pipe at the top of the assembly gives an indication of the amount of overflow. If the level in this pipe reaches the top, or if there is no overflow at all, the flow to the sensor will be affected. It is best to keep the overflow at the midpoint in this pipe to allow for variations in source pressure. An inlet flow to the weir of at least 200 ml/min and not greater than 1000 ml/min should be delivered to the weir to ensure proper flow through the sensor. The flow rate through the sensor is adjusted by moving the drain cup up or down the vertical pipe of the weir assembly until a 75 ml per minute flow is achieved, as shown in the following diagram. Measure the flow rate using a 100 ml graduated cylinder and a stopwatch. Once the flow is set, the flow will remain stable as long as some amount of overflow is maintained at the top of the weir. As part of the regular maintenance cycle, periodic checks should be made to the flow rate. Changes in water temperature, as well as the sensor and tubing getting dirty, may affect the flow rate. If the flow rate is found to be low, try replacing the sensor tubing if it looks dirty and clean the sensor as outlined in the maintenance section. If this maintenance action does not achieve the proper flow rate, then adjust the drain cup up or down the weir to obtain the proper flow rate of 75 ml/min.



### 3.1.4.4 Calibration

Manual Calibration, Automatic Calibration and size threshold Interpolation are all available in the Maintenance menu. However, prior to making any change to the factory calibration, please keep the following in mind:

- Calibration should only be performed by trained personnel.
- Any adjustment to the existing threshold values will affect the instrument's calibration.
- Consult the factory prior to attempting calibration for the first time.
- This manual does not provide an overview of the calibration procedure. Request a calibration procedure from your supplier if you intend to calibrate yourself.

## 3.1.5 Operation

When selecting the PC3 Particle Counter tile from main menu, the sensor overview screen will be displayed. This shows the current reading, alarm state and maintenance information. The buttons allow access to the sensor options, quick access to the calibration functions and manual control of the sensor hold feature.

### Particle Counter 1.1 Overview

2 -- 5 $\mu\text{m}$ :	0 /ml	
5 -- 10 $\mu\text{m}$ :	0 /ml	
>= 10 $\mu\text{m}$ :	0 /ml	
Total: 0 /ml		
Sampling	Cell: 99 %	Laser: 99 %

Maintenance	Last	Due
Calibration	Never	Disabled

Home
Options

**Laser Condition** Percentage readout reflecting changes in laser operating current. This value is provided for diagnostic information only. Laser current will change as a function of laser temperature and age. The laser percentage will increase over the lifetime of the laser and also when ambient air or water temperature increases. With yearly calibrations, a laser percentage between 90 to 110% is considered normal.

**Cell Condition** Percentage readout reflecting the cleanliness of the sensor. The sensor should be cleaned after there has been a 10% decrease following the previous cleaning. Note: Changes in temperature which affect the laser percentage will also have an effect on the cell percentage. When the laser percentage drops as a function of cooler temperatures, a corresponding drop in the cell percentage is to be expected. With yearly calibrations, a cell percentage between 90% to 110% after cleaning is considered normal.

The following sections describe the functionality found in the pop-up menu that appears when selecting “Options”.

#### 3.1.5.1 Sensor Setup

Sensor settings are accessed by selecting:

Options → Setup → Sensor Setup

Name	<input type="text" value="Particle Counter 1.1"/>
Display	<input checked="" type="radio"/> Show      Enabled <input checked="" type="radio"/> Yes <input type="radio"/> Hide <input type="radio"/> No
Flow Signal	<input type="text" value="&lt;Disabled&gt;"/>
Flush Signal	<input type="text" value="&lt;Disabled&gt;"/>
Process Signal	<input type="text" value="&lt;Disabled&gt;"/>
Hold Delay	<input type="text" value="00"/> : <input type="text" value="00"/> : <input type="text" value="00"/>

Home
Options

**Name** Edit the sensor name used to identify the sensor. Up to 25 characters.

**Display** Options are “Show” or “Hide”. This relates to whether the tile for this sensor will show on the Menu screen.

**Enabled** Options are “Yes” or “No”. If “No” is selected the sensor will not update and will not generate alarms.

**Flow Signal** Allows a flow switch to be associated with a sensor. Options are “Disabled” or selectable from a list of available digital inputs.

**Flush Signal** Allows an external flush signal to be associated with a specific sensor. The flush signal will notify the sensor that an automatic cleaning operation is underway. Options are “Disabled” or selectable from a list of available digital inputs.

**Process Signal** Allows an external process signal to be associated with a specific sensor and allows the external signal to enable or disable a sensor. Options are “Disabled” or selectable from a list of available digital inputs.

**Hold Delay** The Sensor hold delay is used following a flush event to allow the sensor reading to recover. Time entered in HH:MM:SS format.

### 3.1.5.2 Sample Setup

Options → Setup → Sample Setup

### Sample Setup

Period

Frequency

Flow Rate

Units

Advanced Setup

**Update values and press 'Save' to apply changes.**

Home
Options
Exit
Save

**Period** The number of seconds over which a measurement is made. Range of values available 4 to 998 seconds. Please note that the “Period” must be less than or equal to the “Frequency”.

**Frequency** The number of seconds between measurements. Range of values available 5 to 999 seconds. Please note that the “Frequency” must be greater than or equal to “Period”.

**Flow Rate** Value can be changed from the factory default setting of 75ml/min to match the actual flow rate through the sensor in order to achieve accurate count/ml or count/100ml readings.

**Particle sizing may not be accurate if the unit has not been calibrated at the flow rate being used. It is recommended to leave the flow rate at 75 ml/min unless changes to this setting have been previously discussed with Chemtrac.**

**Units** Options are “Raw”, “per ml” or “per 100 ml”. If “Raw” is selected, the particle count data will represent all particles that passed through the sensor during the sample period. The data will not be normalized to a particular volume. If “per ml” is selected, the particle count data will be normalized to the average number of particles per ml of sample. If “per 100 ml” is selected, the particle count data will be normalized to the average number of particles per 100 ml or sample. This setting can be particularly useful when analyzing very clean samples.

**Advanced Setup** Composite of Differential. This allows the user to choose between using Composite or Differential Size Range settings. Composite size ranges can not overlap. In “Composite” mode, if 5  $\mu\text{m}$  is the “To” value in Bin 1 then it must also be the “From” Value in Bin 2. In “Differential” mode the bins can overlap.

### 3.1.5.3 Size Ranges

To set the size ranges the PC3 Particle Counter allocates individual particles to, select:

Options → Setup → Size Ranges

	From	To
Bin 1	2	5
Bin 2	5	15
Bin 3	15	0

Update values and press 'Save' to apply changes.

Home Options Exit Save

There are up to 3, known as “bins”, with user selectable size ranges. Both the “To” and the “From” values can be changed by selected the appropriate box. If “Composite” mode has been selected in Advanced Setup only the Bin 1 “From” Value is configurable. Changes will not be applied unless the “Save” button is pressed.

#### 3.1.5.4 Modbus Setup

Modbus settings can be accessed by selecting:

Options → Setup → Modbus Setup

Slave Address: 001

Mode: RTU

Baud Rate: 19200

Parity: Even

Stop Bits: 1

Termination Enabled

Byte Swap

Word Swap

Home Options

**Slave Address** Enter the Modbus slave address of the sensor. This is unlikely to change from 1.

**Mode** Select the Modbus serial mode. Options are “ASCII” or “RTU”.

**Baud Rate** Select the RS485 baud rate. Options are standard baud rates between 1200 and 115200.

**Parity** Select the RS485 parity bit option. Options are “Odd”, “Even”, or “None”

**Stop Bits** Select the number of stop bits. Options are 1 or 2.

**Termination Enabled** Use the checkbox to enable the use of a termination resistor.

**Byte Swap** To support different microprocessors that store data in different formats, the HydroAct 4 can alter the data it sends and receives to match the format expected by the sensor. The byte swap option allows the order of bytes in the 16-bit registers to be reversed.

**Word Swap** When two 16-bit registers are combined for larger data types, e.g., floating-point number representations, this option reverses the order of the two 16-bit words to match the format expected by the sensor.

#### 3.1.5.5 Maintenance Setup

The PC3 Particle Counter comes equipped with proactive maintenance alerts. These take the form of a verification warning. In effect the user determines how long after the verification event occurs they

would like to be reminded that the next verification is due again. When an alert occurs, the color of the parameter display will change and a parameter flag is set.

The maintenance requirements can be enabled or disabled and frequencies entered into simple forms. To configure the maintenance warnings, select:

Options → Maintenance → Setup

### 3.1.5.6 Calibration

The calibration procedure is described in section 3.1.4.4.

### 3.1.5.7 Modbus Statistics

To access the Modbus statistics diagnostic information, select:

Options → Diagnostics → Modbus Statistics

	Rx	Tx
Packets	3501	3501
Bytes	108519	28008

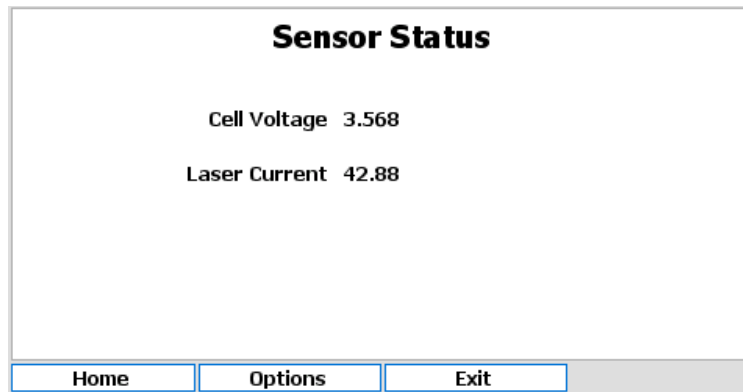
Errors	Exceptions	Timeout	Checksum
	0	0	0

Received and transmitted byte and packet counts are displayed along with error counters. Error counters for packets received with checksum errors, timeouts and exception packets generated are recorded. Counters are unsigned 32-bit and will overflow back to 0 if they reach 4,294,967,295. Alternatively, all counters can be manually reset by pressing the “Reset” button.

### 3.1.5.8 Sensor Status

Options → Diagnostics → Sensor Status





This option displays a live updating reading (approximately every 5-10 seconds) of the sensor cell voltage and laser current). This information can be valuable for troubleshooting purpose should a problem arise with the PC3 Particle Counter.

### 3.1.5.9 Alarms and Thresholds

Alarms are the means by which values obtained from sensors cause visible, audible or physical actions to occur. Alarms are not to be confused with relays. An alarm in a HydroAct 4 unit will create a visible bar across the top of the screen and sound a buzzer. One flow alarm per sensor and two data alarms per parameter are available.

Thresholds are similar to alarms except that they are events that are supposed to occur and therefore will not cause the instrument to go into "Alarm". Thresholds are most frequently used to trigger relays to cause something to happen when a parameter reaches a value.

To access the alarm and threshold configuration select:

Options → Alarms & Thresholds → *Parameter Name*

The display has a tab for each alarm and threshold. Navigate to the tab using the right and left buttons indicated on the bottom of the display or navigate through the settings using the up and down arrows. Options are:

**Enabled** Selecting this option turns the alarm/threshold on or off.

**Set** The *Value* is used to trigger the alarm or threshold<sup>1</sup>. The *Delay* is the amount of time the value has to exceed the set value before the alarm/threshold is triggered.

**Reset** The *Value* is used to clear the alarm or threshold. The *Delay* is the amount of time the value has to exceed the reset value before the alarm/threshold is cleared.

### 3.1.5.10 Status Flags

The status flags show the state of a device. These flags can either be active or not. To see the state of these status flags, select:

Options → Device Flags → Status Flags

Flags that are active are shown in black text on a white background, those that are not active are grayed out. Available flags are:

**Display on main menu** When active the device tile is displayed on the main menu. If inactive, the tile is hidden in the default view.

**Sensor enabled** This flag is enabled if the sensor is enabled.

**Sensor on-line** This flag is enabled if the sensor is on-line.

**Sensor reading in warm up** If the sensor reports that the current reading is not ready, then this flag is set.

<sup>1</sup>A set value above a reset value will result in a rising alarm. A set value below a reset value will result in a falling alarm.

**Sensor reading in hold** This flag is enabled when the sensor output value is held, usually during, or just after, self-cleaning or periods of maintenance.

**Sensor process stopped** If the sensor is off-line due to a process stop signal, this flag is set.

**Sensor flush active** This flag is set when the sensor is self-cleaning.

**Sensor calibration warning reached** If the calibration is due and the maintenance warning is enabled, then this flag is set

**Sensor maintenance period x warning reached** If the maintenance warning is enabled and the due date has passed, then this flag is set. The exact type of maintenance is sensor-specific.

### 3.1.5.11 Error Flags

The error flags show any problems causing an error for a device. These flags can either be active or not. To see the state of these error flags, select:

Options → Device Flags → Error Flags

Flags that are active are shown in black text on a white background, those that are not active are grayed out. Available flags are:

**I/O card fault detected** If set, this flag indicates that a low-level hardware fault has occurred. Report to your supplier.

**Incorrect I/O card found** If set, this flag indicates that the I/O card fitted is of the wrong type.

**I/O card in use** This flag is set when two devices are attempting to use the same I/O card.

**Sensor connection error** This flag is set when the sensor hardware detects a physical connection fault.

**Sensor failed to read input signal** If set, the sensor has failed to read the state of the flow, flush or process signal.

**Sensor flow alarm active** This flag is set if a low/no flow condition is reported by the flow signal.

**Sensor data alarm active** When the sensor readings trigger a data alarm, this flag is set.

**I/O card configuration failed** This flag is set if the I/O plugin card fails to respond correctly. Contact your supplier for advice.

**Modbus communications error** This flag is set when a Modbus exception, timeout or checksum failure occurs. If clear, communication with the sensor is normal.

**Device identifier mismatch** If set, this flag indicates that the sensor connected to the Modbus input is not responding as expected. Check that the correct sensor is connected.

### 3.1.5.12 Parameter Flags

The parameter flags show the state of an individual parameter of a particular sensor. These flags can either be active or not. To see the state of these parameter flags, select:

Options → Device Flags → *Parameter Name*

Flags that are active are shown in black text on a white background, those that are not active are grayed out. Available flags are:

**Alarm 1 active** The first parameter data alarm is active and triggered.

**Alarm 2 active** The second parameter data alarm is active and triggered.

**Averaging enabled** The value displayed for this parameter is averaged.

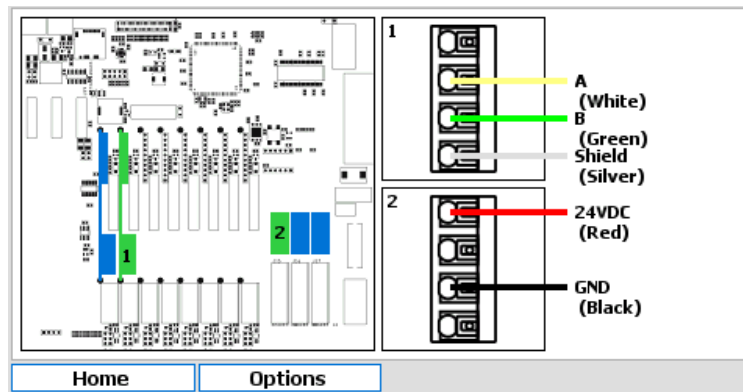
**Threshold 1 active** The first parameter threshold is active and triggered.

**Threshold 2 active** The second parameter threshold is active and triggered.

### 3.1.5.13 Connections

As the HydroAct 4 is a modular system the exact wiring details will be specific to each order. Electrical connections required can be viewed by selecting:

Options → Connections



In the image above, the left side shows the position of the connector. The right side shows the connections required on the marked connectors.

**Disconnect the power before making or breaking electrical connections.**

### 3.1.6 Maintenance

It is important that a consistent flow rate be maintained since the data produced by the particle counter is based on the sample volume. As the tubing and flow cell become dirty, flow will be restricted. Therefore it is necessary that a proper maintenance schedule be followed to ensure the flow rate is not adversely impacted from fouling. If adequate sample pressure is available, the constant head flow through the control weir will maintain an accurate flow rate through the sensor. Flow problems will only be caused by fouling of the flow cell and fouling of the tubing and barb fittings. Obviously, the more turbid the sample, the more likely clogging or fouling will occur. If raw water is being sampled, it is recommended that a small 40 mesh strainer be placed in line before the sensor to catch debris. Cleaning of the flow cell should be performed on a regular basis. How often the flow cell should be cleaned will vary depending on water quality. It is possible to set a cell condition alarm or threshold to alert users to clean the flow cell as the cell condition falls below the set value. Any standard laboratory cleaner can be used to clean the flow cell. If iron or manganese build up is a problem, vinegar, or another mildly acidic liquid, can be used. The cleaner can be flushed through the flow cell, or applied using the cleaning brush. The sapphire window and the external flow cell design make brush cleaning a safe and effective method for removing tough contaminants.

Several methods may be used to clear a blocked flow cell. One of the most effective tools is a small can of compressed air. Remove the tubing from both sides of the flow cell and blow the air through the flow cell from the top of the flow cell (opposite direction from the flow). If compressed air is not available run the liquid sample in from the top of the flow cell and increase the flow rate. The flow cell windows are sapphire, which is scratch resistant, but it is not recommended that pieces of wire or other objects be used to clear blockages. Once the blockage is removed, a light can be shone through the sensor to allow visual inspection. The flow cell opening is large enough to see through when clear.

**The particle counter can still count particles with a dirty flow cell, but the accuracy may be diminished.**

#### 3.1.6.1 Syringe Cleaning

Fill a large syringe with cleaner (diluted to manufacturer's recommendation) and attach it to the top flow cell barb with a short piece of tubing as shown in the following diagram. Squeeze the syringe to introduce the cleaner into the sensor and let it sit for a few minutes and then inject some more and let that stand a few more minutes. Finally, force the remaining cleaner rapidly through the flow cell. The rapid flow should remove most buildup that has occurred in the sensor and bring the cell condition

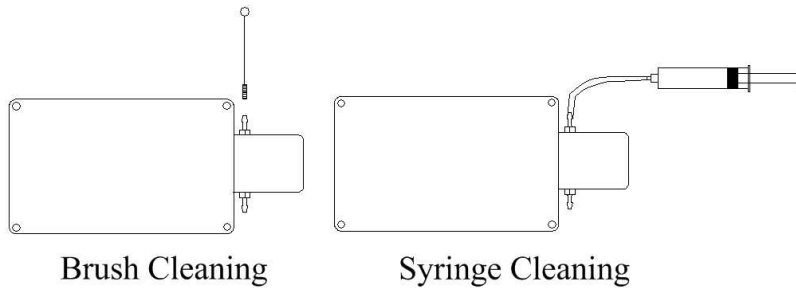
back up to an acceptable level. Non-brush cleaning is not a replacement for occasionally cleaning with a brush.

### 3.1.6.2 Brush Cleaning

Remove the tubing from the sensor's fittings. Insert brush from top of sensor until it rests snugly in the flow cell as shown in the following diagram. Move the brush in and out of the flow cell using short strokes. Brush again from the other side of the sensor. Once cleaning has been performed, reattach flow lines and allow a minute or so for the flow cell to flush out. Verify that the cell condition indicator is back in the 90% range. If it is not, repeat the procedure.

**The small size of the brush makes it easy to bend or damage. Do not force the brush into the flow cell. It should fit into the flow cell with light pressure.**

The cell condition indicator is not valid if the sensor is not full of water and clear of air bubbles.



### 3.1.6.3 Replacing Tubing

As the tubing becomes dirty, it will restrict flow through the sensor and can also contribute to higher counts (especially if the tubing is disturbed), so sensor tubing should be replaced as it becomes visibly fouled. It is not necessary to replace the Flow Control Weir drain tubing or the drain tubing on the bottom of the Drain Cup. Weir Inlet tubing should be replaced occasionally to help reduce the potential for vibration or any kind of movement on the tubing to release particles. Ensure that sample flow has been stopped, any pressure build up has dissipated and liquid has drained prior to disconnecting any tubing. It is reasonable to expect some liquid spillage when disconnecting tubing so be certain that no sensitive electronics or live circuits are exposed.

## 3.1.7 Troubleshooting

### 3.1.7.1 Cell Condition Low

Possible cause	Possible solution
Flow cell dirty.	Clean sensor flow cell.
No flow through sensor.	Ensure proper flow to sensor.
Laser output low.	Verify Laser % between 90-110%

### 3.1.7.2 Sensor Communication Error

Possible cause	Possible solution
Signal wires not properly installed.	Verify signal and power wiring to sensor.

Possible cause	Possible solution
No power to sensor.	

**3.1.7.3 Particle counts appear excessive**

Possible cause	Possible solution
Contaminated sample.	Verify with known particle free water source.
Air bubbles in sample.	Improve sample delivery.

**3.1.7.4 Always displays zero particle counts**

Possible cause	Possible solution
Loss of sample flow.	Ensure proper flow to sensor.
Failed laser.	Check cell and Laser % on "Sensor Overview" screen, return for service if necessary.



## 4. Outputs

Outputs are the means by which values from measuring sensors, control outputs or system status are transmitted to another device. For example to a SCADA<sup>1</sup> for data acquisition or to a pump for dosing control. The two types of output used by HydroAct 4 are the analog output<sup>2</sup> and relay<sup>3</sup>.

In order to utilize the full capability of the instrument it is necessary to link the signal/value and an output device, such as an alarm, threshold or control options for the relays or analog outputs.

Chemtrac utilizes the latest in firmware and electronic innovations and as such analog outputs and relays are extremely flexible, and are not tied to individual sensors. In the past outputs were typically fixed to a specific sensor or control and the range was also the same as the range of the sensor. More recently the capability of the analog output to be more flexible has come about with advances in electronics.

### 4.1 Analog Outputs

#### 4.1.1 General Information

Analog outputs are typically a current output varying between 4mA and 20mA (although other options are available), and are proportional to a varying signal of interest generated by the instrument. Analog outputs are installed by plugging in a small output board into one of the available slots. Other output options in addition to 4..20 mA are shown below.

#### 4.1.2 Technical Data

**Supported modes** 0..20mA, 4..20mA, 0..1V, 0..10V, 1..10V

**Maximum voltage output** 15V DC (0/4..20mA only)

<sup>1</sup>Supervisory Control and Data Acquisition, a central data logging and control system

<sup>2</sup>A current or voltage output, proportional to a signal generated in the instrument

<sup>3</sup>A mechanical or electronic device mounted on the electronics within the instrument that can switch. The number and type of relays is specified at the time of order

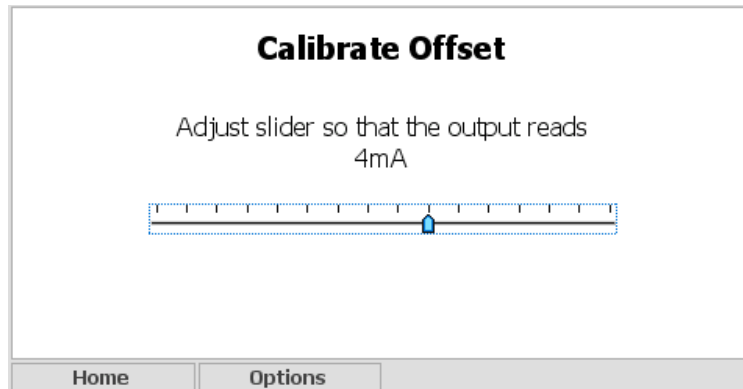
### 4.1.3 Commissioning

When cables attach to analog outputs the instrument is forced to drive into different resistances. This can result in the analog range being slightly affected. For example a 4-20mA output at the analyzer could end up being 3.95mA to 19.9mA at the end of the cable. The HydroAct 4 has the capability to drive more or less current to account for this resistance so that the analog output is exactly that required at the end of the cable. This is achieved by calibrating the zero (offset) and span (top of the scale) of the analog output.

#### 4.1.3.1 Calibrate Offset

This configuration screen is accessed by navigating via the Options Menu:

Options → Maintenance → Calibrate Offset

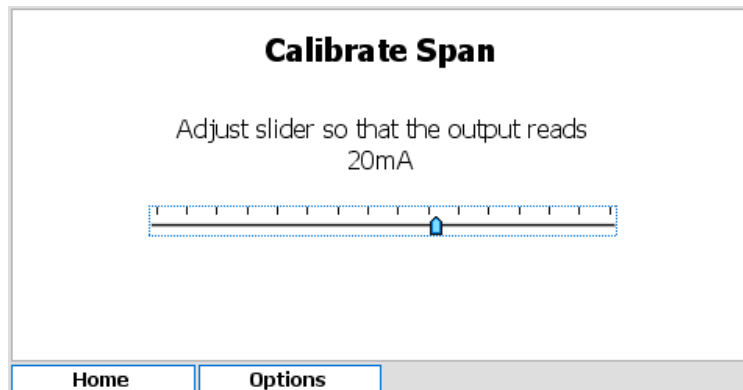


Select the slider and then use the Left and Right buttons to adjust the zero.

#### 4.1.3.2 Calibrate Span

This configuration screen is accessed by navigating via the Options Menu:

Options → Maintenance → Calibrate Span



Select the slider and then use the Left and Right buttons to adjust the span.

### 4.1.4 Operation

To access the analog output setup and maintenance options, select the relevant device tile in the main menu and press “Select”. The output setup screen will be displayed initially, though other functions are available by pressing the “Options” button.



#### 4.1.4.1 Setup

The setup of the analog output is split into three sections. Later sections can be accessed separately from the menu or by selecting “Next” from any of the previous pages. To access the analog output setup:

Options → Setup → Output Setup

**Name** Device name to identify the control in menus. Text can be up to 25 characters long.

**Display** Options are to “Show” or “Hide” the device tile on the menu screen.

**Enabled** Options are “Yes” or “No”.

**Mode Options** Options are “Manual” which allows the user to manually set an output value; “Data Output” which maps the output to an analog data source such as a parameter; and “Control Output” which maps the output to an analyzer generated control signal.

The “Next” button is a shortcut to the following configuration screen.

#### 4.1.4.2 Options for Manual Mode

##### 4.1.4.2.1 Map Output

This configuration screen is accessed by pressing “Next” from the Output Setup configuration screen or navigating via the Options Menu.

Options → Setup → Map Output

##### 4.1.4.2.2 Configuration

This configuration screen is accessed by pressing “Next” from the Map Output above screen or navigating via the Options Menu.

Options → Setup → Configuration

**Configuration**

Type

Manual Value  %

**Type** Choose the type of analog output from the drop down box. See technical data for a list of supported output types. See section 4.1.2.

**Manual Value** Enter the manual value of the output as a percentage. For example if 4..20mA output type is selected a manual value of 50% will force the current output to 12mA.

#### 4.1.4.3 Options for Data Output Mode

##### 4.1.4.3.1 Map Output

This configuration screen is accessed by pressing “Next” from the Output Setup screen or navigating via the Options Menu.

Options → Setup → Map Output

**Map Output**

Sensor

Parameter

**Sensor** Select the appropriate sensor from the drop down list.

**Parameter** Choose the appropriate parameter from the drop down list. If the selected sensor has only one parameter this option may not be available.

The “Next” button is a shortcut to the following configuration screen.

##### 4.1.4.3.2 Configuration Setup

This configuration screen is accessed by pressing “Next” from the Map Output screen or navigating via the Options Menu.

Options → Setup → Configuration

**Type** Choose the type of analog output from the drop down box. See the technical data in section 4.1.2 for a list of supported outputs.

**Minimum** Enter the parameter value that translates to a minimum output of e.g. 4mA if “type” is set to 4..20mA.

**Maximum** Enter the parameter value that translates to a maximum output of e.g. 20mA if “type” is set to 4..20mA.

The minimum and maximum values can be anywhere within the range of a parameter. For example the data output for a chlorine sensor with a range of 0..10ppm, the output could be ranged 0..10ppm (common) but could be ranged, for example 2.4..5.3ppm.

#### 4.1.4.4 Options for Control Output Mode

##### 4.1.4.4.1 Map Output

This configuration screen is accessed by pressing “Next” from the Output Setup screen or navigating via the Options Menu.

Options → Setup → Map Output

**Control** Select from a list of available control devices.

**Output** If the control selected above has more than one output value, this option will be available.

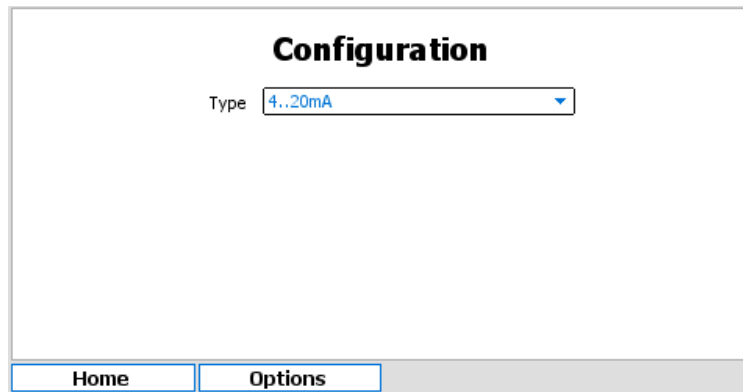
Select the appropriate output value.

The “Next” button is a shortcut to the following configuration screen.

##### 4.1.4.4.2 Configuration

This configuration screen is accessed by pressing “Next” from the Map Output screen or navigating via the Options Menu.

Options → Setup → Configuration



**Type** Choose the type of analog output from the drop down box. See the technical data in section 4.1.2 for a list of supported outputs.

#### 4.1.4.5 Status Flags

The status flags show the state of a device. These flags can either be active or not. To see the state of these status flags, select:

Options → Device Flags → Status Flags

Flags that are active are shown in black text on a white background, those that are not active are grayed out. Available flags are:

**Display on main menu** When active the device tile is displayed on the main menu. If inactive, the tile is hidden in the default view.

**Output calibrating offset** This flag is set when calibrating the analog output offset.

**Output calibrating span** This flag is set when calibrating the analog output span.

#### 4.1.4.6 Error Flags

The error flags show any problems causing an error for a device. These flags can either be active or not. To see the state of these error flags, select:

Options → Device Flags → Error Flags

Flags that are active are shown in black text on a white background, those that are not active are grayed out. Available flags are:

**Output mapping error** This indicates that one of the outputs is mapped incorrectly e.g., mapped to a sensor or control that no longer exists.

**I/O card fault detected** If set, this flag indicates that a low-level hardware fault has occurred. Report to Chemtrac.

**Incorrect I/O card found** If set, this flag indicates that the I/O card fitted is of the wrong type.

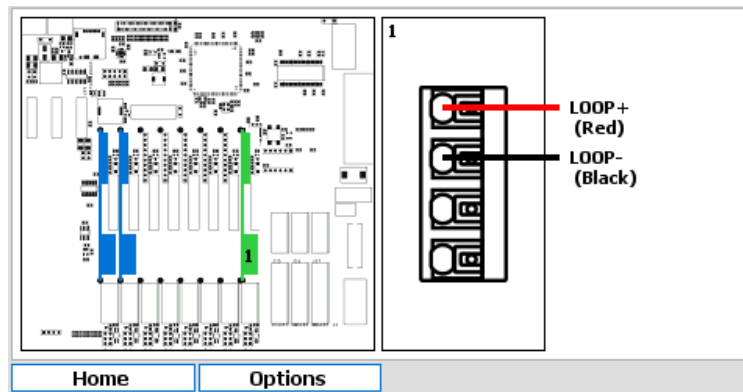
**I/O card in use** This flag is set when two devices are attempting to use the same I/O card.

**I/O card configuration failed** This flag is set if the I/O plugin card fails to respond correctly. Contact Chemtrac for advice.

#### 4.1.4.7 Connections

This screen is accessed by navigating via the Options Menu:

Options → Connections



The image above is for an output with the types selected as 0..20mA or 4..20mA. The connections will reflect the configuration of the device and differ between current and voltage outputs.

## 4.2 Relay Output

### 4.2.1 General Information

Relay outputs, typically mechanical reed relays are installed at time of manufacture. A relay is a mechanical or electronic device mounted on the electronics within the instrument that can switch. The number and type of relays must be specified at time of order. In order to take advantage of the full capability of modern electronics, it is necessary to “map”<sup>4</sup> the various alarms, thresholds and other options to the relays.

### 4.2.2 Technical Data

**Maximum Current** 10A at 125 VAC, 3A at 250 VAC, 5A at 30 VDC

### 4.2.3 Operation

To access the relay output setup and maintenance options, select the relevant device tile in the main menu and press “Select”. The output setup screen will be displayed initially, though other functions are available by pressing the “Options” button.

#### 4.2.3.1 Setup

The setup of the analog output is split into three sections. Later sections can be accessed separately from the options or by selecting “Next” from any of the previous sections.

To access the relay output setup:

Options → Setup → Output Setup

<sup>4</sup>This describes the link between a signal/value generated by the instrument and an output device (relay or analog).

**Name** Device name to identify control in menus. Text can be up to 25 characters long.

**Display** Options are “Show” or “Hide” the device tile on the menu screen.

**Enabled** Options are “Yes” or “No”. This option must be enabled for the option to function.

**Mode Options** Options are “Manual” which sets a relay to manual output; “Control Output” which maps a relay to a control output and allows the setup of either pulse width modulation or pulse frequency modulation; “Data Output” which outputs a pulse for each set increment of a sensor parameter value; “Device Status Flags” which allows the mapping of a relay to activate if the status of a device changes; “Device Error Flags” which allows the mapping of a relay to activate if a device goes into error; “Parameter Flags” which allows the mapping of a relay to activate on selected parameter flags and “System Flags” which allows the mapping of a relay to activate on a system alarm state.

#### 4.2.3.2 Options for Manual Mode

##### 4.2.3.2.1 Map Output

This configuration screen is accessed by pressing “Next” from the Output Setup configuration screen or navigating via the Options Menu.

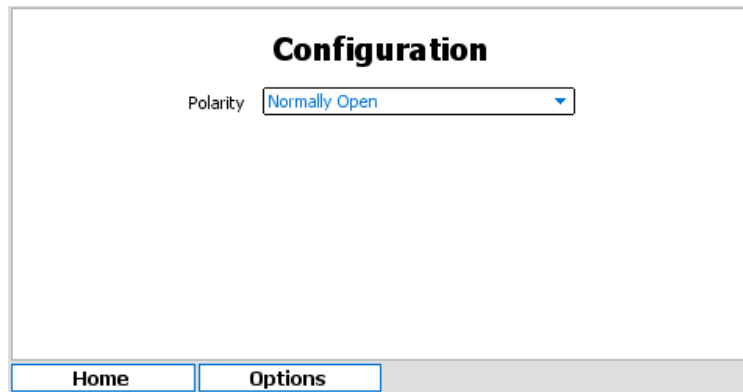
Options → Setup → Map Output

The “Next” button is a shortcut to the following configuration screen.

##### 4.2.3.2.2 Configuration

This configuration screen is accessed by pressing “Next” from the Map Output screen or navigating via the Options Menu.

Options → Setup → Configuration



The screenshot shows a configuration window titled "Configuration". Inside the window, there is a label "Polarity" followed by a dropdown menu that currently displays "Normally Open". At the bottom of the window, there are two buttons: "Home" and "Options".

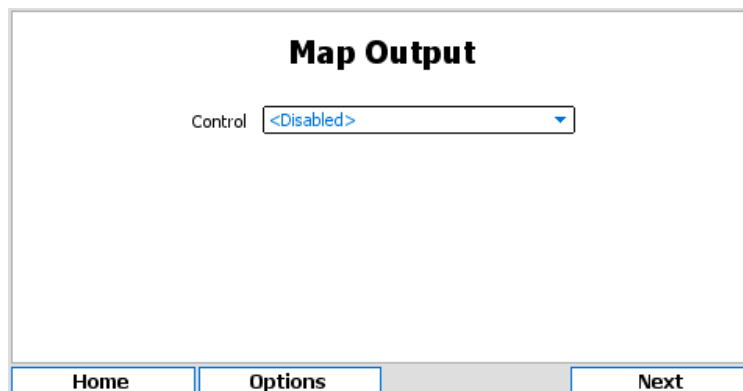
**Polarity** Options are “Normally Open” and “Normally Closed”.

#### 4.2.3.3 Options for Control Output Mode

##### 4.2.3.3.1 Map Output

This configuration screen is accessed by pressing “Next” from the Output Setup configuration screen or navigating via the Options Menu.

Options → Setup → Map Output



The screenshot shows a configuration window titled "Map Output". Inside the window, there is a label "Control" followed by a dropdown menu that currently displays "<Disabled>". At the bottom of the window, there are three buttons: "Home", "Options", and "Next".

**Control** Choose from a list of available controls to output the control value.

The “Next” button is a shortcut to the following configuration screen.

##### 4.2.3.3.2 Configuration

This configuration screen is accessed by pressing “Next” from the Map Output configuration screen or navigating via the Options Menu.

Options → Setup → Configuration

The screenshot shows a configuration window titled "Configuration". It contains the following settings:

- Polarity: Normally Open (dropdown menu)
- Mode: Pulse Width Modulation (dropdown menu)
- Pulse Width: 02 : 06 (two spinners)
- Deadband: 02 s (spinner)

At the bottom of the window are two buttons: "Home" and "Options".

In all cases the polarity and output mode of the relay will need to be configured. Pulse width modulation outputs a repeated pulse with a fixed width. The control signal is output by increasing the proportion of time the relay is active in any pulse as the value increases. Pulse frequency modulation outputs pulses of a fixed activated width, but increases the frequency of the pulses in respect of the control output value.

**Polarity** Options are "Normally Open" and "Normally Closed".

**Mode** Options are "Pulse Width Modulation" or "Pulse Frequency Modulation".

**When "Pulse Width Modulation" is selected further options are:**

**Pulse Width** Define the maximum pulse width in MM:SS. The relay will energize for a proportion of this time based on the control output value.

**Deadband** Defines the minimum pulse width that would be output. This can be used to avoid relay chatter due to a small control output value.

The screenshot shows a configuration window titled "Configuration". It contains the following settings:

- Polarity: Normally Open (dropdown menu)
- Mode: Pulse Frequency Modulation (dropdown menu)
- Pulse Width: 0000 ms (spinner)
- Maximum Frequency: 0.00 Hz (spinner)

At the bottom of the window are two buttons: "Home" and "Options".

**When "Pulse Frequency Modulation" is selected further options are:**

**Pulse Width** Define the length of pulses output. Options are between 0..5000 ms.

**Maximum Frequency** As the control output value increases, the frequency of pulses outputs increase. This setting defines the maximum frequency of pulse outputs.

#### 4.2.3.4 Options for Data Output Mode

##### 4.2.3.4.1 Map Output

This configuration screen is accessed by pressing "Next" from the Output Setup screen or navigating via the Options Menu.

Options → Setup → Map Output



**Map Output**

Sensor

Parameter

**Sensor** Select the appropriate sensor from the drop down list.

**Parameter** Choose the appropriate parameter from the drop down list. If the selected sensor has only one parameter this option may not be available.

The “Next” button is a shortcut to the following configuration screen.

#### 4.2.3.4.2 Configuration Setup

This configuration screen is accessed by pressing “Next” from the Map Output screen or navigating via the Options Menu.

Options → Setup → Configuration

**Configuration**

Polarity

Frequency  m<sup>3</sup>

Pulse Width  ms

Pulse Gap  ms

**Polarity** Options are “Normally Open” and “Normally Closed”.

**Frequency** Set the pulse frequency as a desired increase in parameter value.

**Pulse Width** Set the pulse width. The values are in milliseconds and increment in steps of 200ms.

**Pulse Gap** Set the minimum pulse gap. The values are in milliseconds and increment in steps of 200ms.

#### 4.2.3.5 Options for Device Status Flags

##### 4.2.3.5.1 Map Output

This configuration screen is accessed by pressing “Next” from the Output Setup configuration screen or navigating via the Options Menu.

Options → Setup → Map Output

**Map Output**

Device

**Device** Choose from a list of available devices.

The “Next” button is a shortcut to the following configuration screen.

#### 4.2.3.5.2 Configuration

This configuration screen is accessed by pressing “Next” from the Map Output configuration screen or navigating via the Options Menu.

Options → Setup → Configuration

**Configuration**

Polarity

Mode

Pulse Width  :

Deadband  s

**Polarity** Options are “Normally Open” and “Normally Closed”. The device status flags available depend on the device mapped above. See the status flag descriptions for that device for details.

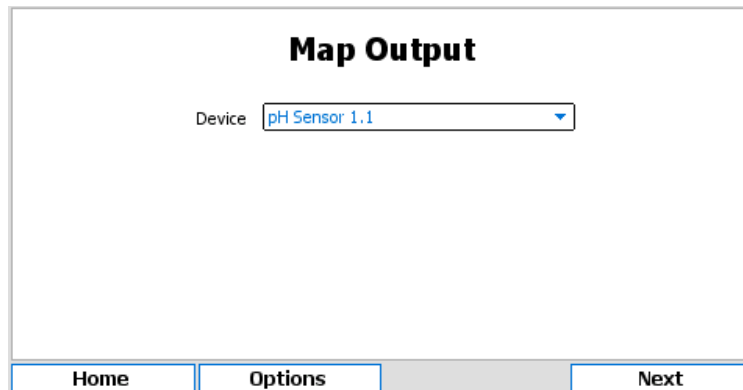
Press the “Next” button to select the device status flags used to activate the relay.

#### 4.2.3.6 Options for Device Error Flags

##### 4.2.3.6.1 Map Output

This configuration screen is accessed by pressing “Next” from the Output Setup screen or navigating via the Options Menu.

Options → Setup → Map Output



**Map Output**

Device

Home Options Next

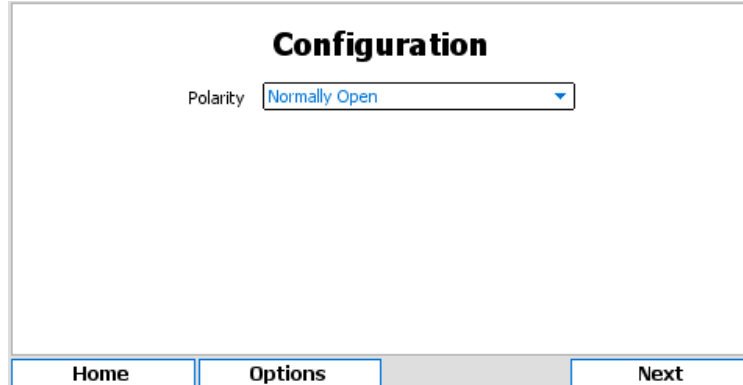
**Device** Choose from a list of available devices.

The “Next” button is a shortcut to the following configuration screen.

#### 4.2.3.6.2 Configuration

This configuration screen is accessed by pressing “Next” from the Map Output screen or navigating via the Options Menu.

Options → Setup → Map Configuration



**Configuration**

Polarity

Home Options Next

**Polarity** Options are “Normally Open” and “Normally Closed”. The device error flags available will depend on the device mapped above. See that device description for details.

Press the “Next” button to select the device error flags used to activate the relay.

#### 4.2.3.7 Options for Parameter Flags

##### 4.2.3.7.1 Map Output

This configuration screen is accessed by pressing “Next” from the Output Setup screen or navigating via the Options Menu.

Options → Setup → Map Output

**Map Output**

Sensor

Parameter

**Sensor** Choose the appropriate sensor from the drop down list.

**Parameter** Choose the appropriate parameter from the drop down list.

The “Next” button is a shortcut to the following configuration screen.

#### 4.2.3.7.2 Configuration

This configuration screen is accessed by pressing “Next” from the Map Output screen or navigating via the Options Menu.

Options → Setup → Configuration

**Configuration**

Polarity

**Polarity** Options are “Normally Open” and “Normally Closed”.

The “Next” button is a shortcut to the following configuration screen.

#### 4.2.3.7.3 Relay Selection

This configuration screen is accessed by pressing “Next” from the Configuration screen.

**Relay 1.1**

Flag Selection

Alarm 1 active

Alarm 2 active

Averaging enabled

Threshold 1 active

Threshold 2 active

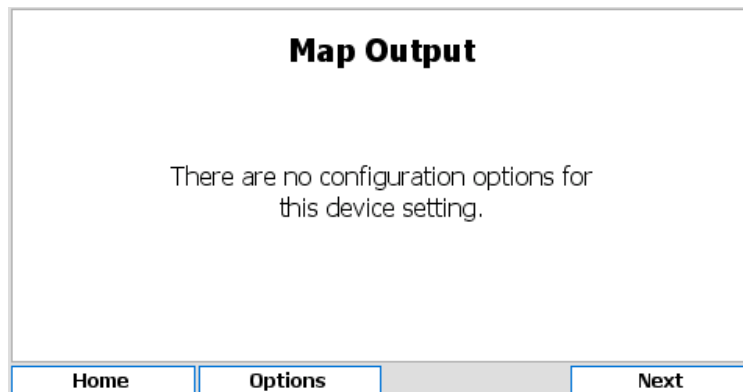
Flags that are active are shown in black text on a white background, those that are not active are grayed out. Selecting the flag will cause the relay to activate if that parameter flag becomes active.

### 4.2.3.8 Options for System Status

#### 4.2.3.8.1 Map Output

This configuration screen is accessed by pressing “Next” from the Output Setup configuration screen or navigating via the Options Menu.

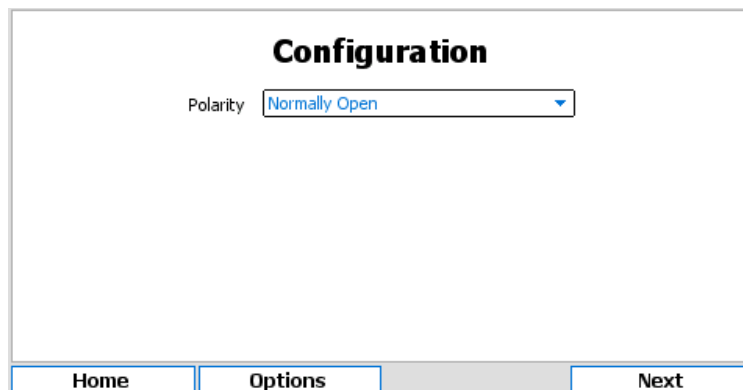
Options → Setup → Map Output



#### 4.2.3.8.2 Configuration

This configuration screen is accessed by pressing “Next” from the Output Setup configuration or navigating via the Options Menu.

Options → Setup → Configuration

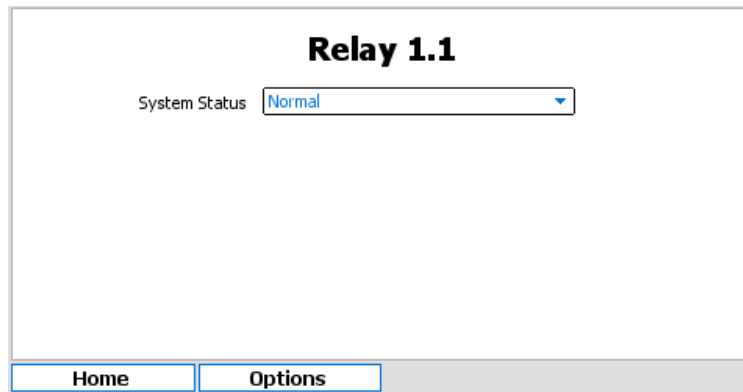


**Polarity** Options are “Normally Open” and “Normally Closed”. The “Next” button is a shortcut to the following configuration screen.

#### 4.2.3.8.3 Relay Selection

This configuration screen is accessed by pressing “Next” from the Configuration screen.

The system status show the state of the device.



**System Status** Options are “Normal”, “Alarm Active” or “Alarm Acknowledged”

#### 4.2.3.9 Status Flags

The status flags show the state of a device. These flags can either be active or not. To see the state of these status flags, select:

Options → Device Flags → Status Flags

Flags that are active are shown in black text on a white background, those that are not active are grayed out. Available flags are:

**Display on main menu** When active the device tile is displayed on the main menu. If inactive, the tile is hidden in the default view.

**Relay polarity** This reflects the relay polarity, if set the relay is normally closed.

**Relay output state** This reflects the relay activation state. Taken together with the relay polarity above, it is possible to determine if the relay is open or closed.

#### 4.2.3.10 Error Flags

The error flags show any problems causing an error for a device. These flags can either be active or not. To see the state of these error flags, select:

Options → Device Flags → Error Flags

Flags that are active are shown in black text on a white background, those that are not active are grayed out. Available flags are:

**Output mapping error** This indicates that one of the outputs is mapped incorrectly e.g., mapped to a sensor or control that no longer exists.

#### 4.2.3.11 Test Output

It is possible to test a relay. The relays polarity and active state can be manually changed. Leaving this configuration screen will return the relay to its previous state. To do this navigate to:

Options → Test Output

### Relay 1.1

Polarity  Normally Open  
 Normally Closed

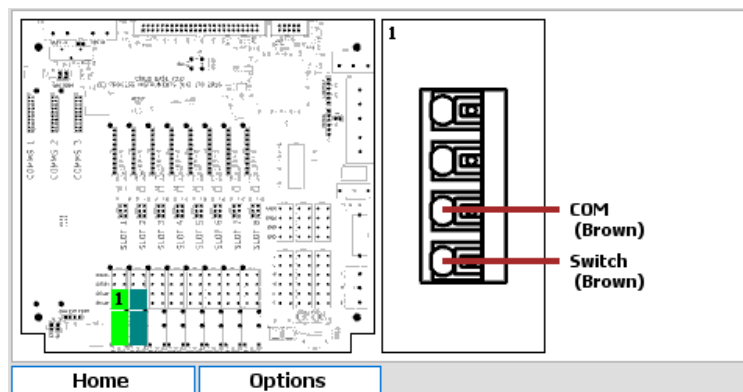
Active  No  
 Yes

Home
Options

Options are  
**Polarity** Options are “Normally Open” or “Normally Closed”  
**Active** Options are “No” or “Yes”

#### 4.2.3.12 Connections

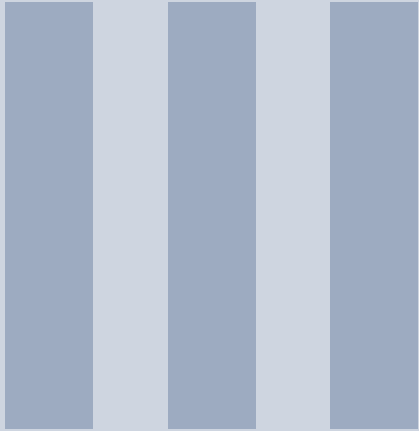
Options → Connections



This screen identifies the terminals to use for electrical connections for this relay. The left hand pane identifies the terminal block and the right hand pane the connectors on the terminal block.







# Documentation

<b>5</b>	<b>Warranty</b> .....	<b>75</b>
<b>6</b>	<b>Returns</b> .....	<b>77</b>
6.1	Contact Details	



## 5. Warranty

Chemtrac, Inc warrants its product to be free of defects in material and workmanship for a period of one year from date of shipment to the original customer unless specifically agreed elsewhere. Upon receipt of written notice from the customer, Chemtrac shall issue a returns form for the defective product and, upon its receipt, shall repair or replace (at the discretion of Chemtrac) the defective equipment or components. Chemtrac assumes no responsibility for equipment damage or failure caused by:

1. Improper installation, operation, or maintenance of the equipment.
2. Abnormal wear and tear on moving parts caused by some processes.
3. Acts of nature (i.e. lightning, flooding, etc.).

This warranty represents the exclusive remedy of damage or failure of the equipment. Under no circumstances shall Chemtrac be liable for any special, incidental, or consequential damage, such as loss of production, profits or product quality. The warranty cannot be guaranteed if the customer fails to service and maintain the equipment in accordance with Chemtrac written instructions and policies, as stated in the Operations Manual.

Any costs associated with this warranty, such as the cost of returning the products to Chemtrac or the cost of returning a repaired unit to the customer lies with the customer. Any warranty replacements will be covered by the warranty, with the same terms and conditions as the original.



## 6. Returns

If the analyzer has to be repaired, please return it cleaned to your local service organization or Chemtrac, Inc at the address below. To return your equipment for repair:

- Contact Chemtrac support, open a service ticket and request a returns form.
- Complete the returns form, including the contaminant declaration.
- Enclose the completed returns form with the packaging and shipping documents.
- Address the package to “The Service Department” at the address below and mark the box with the service ticket number to ensure the package is dealt with as efficiently as possible.
- Please use the original packaging, if possible.

**No repair can be undertaken without a returns form with a completed contaminant declaration. This is required to comply with our Health and Safety responsibilities.**

### 6.1 Contact Details

#### Address

Chemtrac, Inc  
1555 Oakbrook Drive  
Suite 100  
Norcross, GA 30093

**Email** [hardwaresupport@chemtrac.com](mailto:hardwaresupport@chemtrac.com)

**Phone** 800 442 8722