

DULCOMETER® Slimflex 5 Cooling Tower or Boiler Controller

Use your Tablet or Smartphone. I'm WiFi ready!



Please carefully read these operating instructions before use! - Do not discard this manual! The operator shall be responsible for any damage caused by installation or operating errors! Technical changes reserved.

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General non-discriminatory approach

In order to make it easier to read, this document uses the male form in grammatical structures but with an implied neutral sense. It is aimed equally at both men and women. We kindly ask female readers for their understanding in this simplification of the text.

Supplementary information

Read the following supplementary information in its entirety!

The following are highlighted separately in the document:

Safety Information

Safety information is provided with detailed descriptions of the hazardous situation. Refer to Section 4 [Safety and Responsibility](#).

Information

This type of box provides important information either relating to the correct operation of the system, or is intended to make your work easier.

1 Operating Concept

From the factory, your Slimflex 5 controller will be configured as a Cooling Tower or as a Boiler controller. It can be converted to the opposite type by returning it to the factory. The purpose of this manual is to explain how to use the controller keypad to access the configuration menus of all the inputs and outputs as well as Ethernet and WiFi communications including how to program the unit via a PC, tablet or Smartphone.



Figure 1 The Front Panel

1.1 The Front Panel

The SLIMFLEX 5 uses an OLED (Organic LED) text display to indicate real time values of up to 6 sensors on the main display, one multicolored Status LED to indicate alarms and unusual

conditions and 5 multicolored LEDs to indicate output On/Off/Alarm status.

Status LED

In the event of an alarm, the controller's status LED at the upper right corner of the keypad changes from blue to flashing red. If one of the relays is set to manual STOP, the status LED will be solid red.



Figure 2 Status LED

Menu Navigation

The communication indication panel is located at the bottom center of the controller face. A green light indicates the function is available. If the port is in use, the green light blinks.



Figure 3 Communication Status LEDs

1.2 Functions of the keys

Key	Function
	Confirmation in the menus: Confirms and saves any changes.
	Back to the HOME display or to the previous menu.
	Enables direct access to all of the controller's setting menus.
	Enables direct access to the controller's calibration menu from the HOME display.
	Start/Stop all control outputs from any display. (4-20mA = 4mA). Front panel LED is solid red.
	(Up Arrow) Increases a displayed number value or moves upwards in the menus.
	(Right Arrow) Moves the cursor to the right.
	(Down Arrow) Decreases a displayed number value or step down in the menus.
	(Left Arrow) Moves the cursor to the left.

Table 1 Function of the keys

1.3 Changing the Operating Language

The operating language is set at the factory. Contact ProMinent for a list of current available languages.

1.4 Keypad Lock

The controller has an available keypad lock. If the keypad lock is enabled, access requires a passcode. The keypad password is the same as the password used in the Ethernet or Wi-Fi browser connection. See [11.2.2 Keypad Passwords On/Off](#).

2 Navigating the [Menu] display

Name of menu item	Jump to chapter
[Home]	↪ Return to the default display (See examples below)
[Adjust Set-points]	↪ Chapter 10.4.5 Feed Based on a Sensor
[Prime, Force ON]	↪ Chapter 10.12 Prime, (Force On) a Relay
[Water Meter Setup]	↪ Chapter 9.8.1 Configure a Digital Input as a Water Meter
[Adjust Alarms]	↪ Chapter 9.6.1 Analog Alarm Configuration
[Biotiming, Events]	↪ Chapter 10.5 Configuring an Event-Other relay
[Set Feed Mode]	↪ Chapter 10.4 Configuring Cooling Tower Relays
[Set Blowdown Mode]	↪ Chapter 10.4.4 Sensor Controlled Blowdown
[I/O Setup]	↪ Chapter 9.1 Analog and Digital Inputs
[I/O Status]	↪ Chapter 10 Programming the Control Outputs Use this menu choice to monitor the I/O
[System]	↪ Chapter 11 System Menu

Table 2 Main Menu lookup

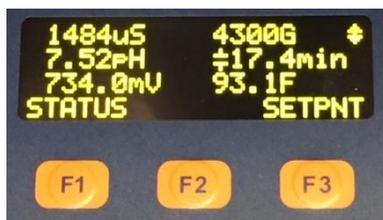


Figure 4 Typical default screen

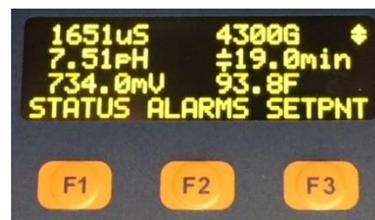


Figure 4A Screen if any alarm present

The default display exhibits up to six current sensor values, and STATUS, ALARMS and SETPNT buttons. The sensor choices can be changed or rearranged. See section [2.2 Modifying the Displays 'Home' Screen](#). The STATUS button (F1) is explained in section [2.1 Input/Output Status](#). The Alarm button (F2) allows the user to view and/or clear the latest alarms for all I/O points. See also section [9.6.1 Analog Alarm Configuration](#), for more information on alarms.

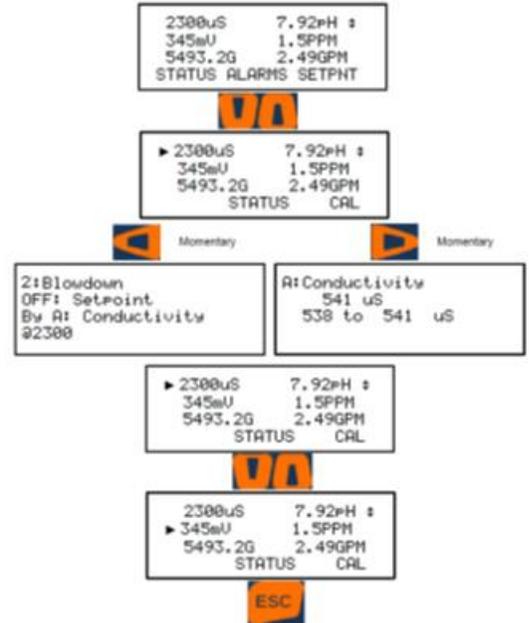
The SETPNT button (F3) allows the user to edit the set-point of any enabled relay that is using set-point control.

Menu Navigation

2.1 Input/Output Status [momentary display]

The Home screen, shown here with 6 I/O signal values, has a momentary display in addition to the three F key choices. The momentary display shows the status of the input in the same manner as the status key except that it is only viewed for as long as you hold down the right arrow.

- 1- From main display press Down arrow key to invoke a cursor, then continue with the down arrow to select a desired sensor
- 2- Use Right arrow key to momentarily see sensor information
- 3- Use Left arrow key to momentarily see any output that is tied to the selected input
- 4- Use ESC key to Exit
- 5- Note: The momentary information will remain on the display as long as you hold down the arrow key

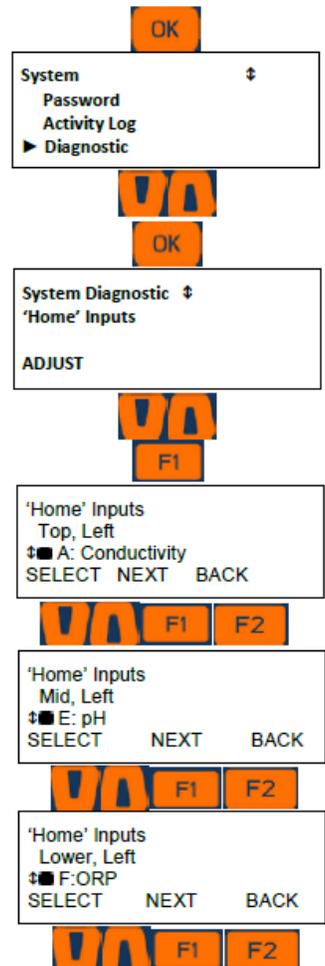


Open Loop Warning

Choose a 4-20mA output and press the right arrow. If the loop is not properly wired, you will see an Open Loop error

2.2 Modifying the Displays 'Home' Screen

- 1- To set (modify) the Home Screen press MENU
- 2- Press the Up Arrow to navigate to System then press OK
- 3- Scroll down to Diagnostic then press OK
- 4- Scroll to 'Home' inputs then press F1, adjust
- 5- Use UP/Down Arrow keys to select what to display on Top, Left OLED Screen (maximum of six parameters can be displayed on OLED) then press F1 SELECT, you should see a square box ■ appear in front of your selection.
- 6- Press F2, NEXT. "Mid, Left" should appear on the screen, use UP/Down Arrow keys to select what to display in the middle row, left position, then press F1, NEXT, you should see a square box ■ appear in front of your selection
- 7- Continue the process for the four remaining choices, if desired.
- 8- Press ESC (Escape) when done.



3 Identcode

The Slimflex 5 model identcode is available through customer service or the e-quote website.

4 Safety and Responsibility

4.1 Explanation of the safety information

Introduction

These operating instructions provide information on the technical data and functions of the product, as well as detailed safety information and are provided as guidance for the installer and operator.

The safety information and notes are categorized according to the following scheme. A number of different symbols are used to denote different situations.

The symbols shown here serve only as examples.



Denotes hints on use and other useful information.

NOTICE

Denotes a possibly damaging situation. If this is disregarded, the product or an object near it could be



DANGER

Hazardous voltages cause severe injury or death.
Disconnect all sources of power before servicing.
(Multiple and/or remote sources of power may be present).



DANGER!

Denotes an immediate threatening danger. If this is disregarded, it will result in very serious or fatal injuries.



WARNING!

Denotes a hazardous situation. If this is disregarded, it could result in very serious or fatal injuries.



CAUTION!

Denotes a possibly hazardous situation. If this is disregarded, it could result in slight or minor injuries. May also be used as a warning about equipment damage.

4.2 General Safety Notes

- ❖ Measure: Before opening the enclosure or before carrying out installation work, ensure the devices are voltage-free.
- ❖ Disconnect damaged, defective or modified devices from the power supply.

 **WARNING!**
Live parts!
Possible consequence: very serious or fatal injuries

NOTICE

Correct sensor operation

Damage to the product or its surroundings.

- Correct measuring and metering is only possible if the sensors are working correctly.
- Check, clean and calibrate the sensors regularly
- Investigate all alarm conditions.

 **WARNING!**
Danger from hazardous substances!
Possible consequence: Fatal or very serious injuries.

Please ensure when handling hazardous substances that you have read the latest safety data sheets provided by the manufacture of the hazardous substance. The actions required are described in safety data sheets.

Check safety data sheets regularly and replace, if necessary, as the hazard potential of a substance can be re-evaluated at any time based on new findings.

The system operator is responsible for ensuring that up to date safety data sheets are available, as well as for producing an associated hazard assessment for the workstations affected.

 **WARNING!**
Operating faults!
Possible consequence: Fatal or very serious injuries.

The unit should only be operated by adequately qualified and technically expert personnel

Please also observe the operating instructions for sensors and fittings and any other units which may be installed, such as sample water pumps

The operator is responsible for ensuring that personnel are qualified.

 **DANGER**
Hazardous voltages cause severe injury or death.
Disconnect all sources of power before servicing.
(Multiple and/or remote sources of power may be present).

 **CAUTION!**

Read all installation and operating instructions completely before installing and operating this equipment

4.3 Intended Use

The device is intended for measuring and regulating liquid media in industrial and municipal water treatment applications.

Only use the device in accordance with the technical data and specifications outlined in these operating instructions and in the operating instructions for the individual components (such as sensors, fittings, calibration devices, metering pumps, etc.).

Any other uses or modifications may void the ProMinent warranty.



CAUTION!

If the equipment supplied is used in a manner not specified in these instructions, protection provided by the equipment may be impaired.



CAUTION!

The pertinent accident prevention regulations, as well as all other generally acknowledged safety regulations, must be adhered to!

4.4 Warranty Guide

As of this date, the physical controller is warranted for 2 years from the date of purchase as explained in the complete ProMinent warranty. The complete warranty is found in the ProMinent catalog introduction and is available online at www.proMinent.us. Changes to this warranty may not be shown in this manual.

Sensors are typically warranted for 8 months.

The warranty does not apply to goods that become defective for the reason of:

- a) Unsuitable or unreasonable use
- b) Faulty assembly, installation or servicing by the purchaser or any third party
- c) Faulty or careless handling

4.5 Users' Qualifications



WARNING!

Danger of injury to inadequately qualified personnel!

The operator of the plant / device is responsible for ensuring that the qualifications are fulfilled.

If inadequately qualified personnel work on the unit or loiter in the hazard zone of the unit, this could result in dangers that could cause serious injuries and material damage.

All work on the unit should therefore only be conducted by qualified personnel.

CAUTION!



Symbol will be applied beside each MAINS socket outlet and identifying that the maximum total output current rating on all relays should not exceed 5A

4.5.1 Training

Training	Definition
Instructed personnel	An instructed person is a person who has been instructed and, if required, trained in the tasks assigned to him/ her and possible dangers that could result from improper behavior, as well as having been instructed in the required protective equipment and protective measures.
Trained user	A trained user is a person who fulfills the requirements of an instructed person and who has also received additional training specific to the system from ProMinent or another authorized distribution partner.
Trained qualified personnel	A qualified employee is deemed to be a person who is able to assess the tasks assigned to him and recognize possible hazards based on his/her training, knowledge and experience, as well as knowledge of pertinent regulations. The assessment of a person's technical training can also be based on several years of work in the relevant field.
Electrician	<p>Electricians are deemed to be people, who are able to complete work on electrical systems and recognize and avoid possible hazards independently based on his/her technical training and experience, as well as knowledge of pertinent standards and regulations.</p> <p>Electricians should be specifically trained for the working environment in which they are employed and know the relevant standards and regulations. Electricians must comply with the provisions of the applicable statutory directives on accident prevention.</p>
Customer Service department	Customer Service department refers to service technicians, who have received proven training and have been authorized by ProMinent to work on the system.

Table 4 Training Definitions

5 Functional Description

The DULCOMETER® SLIMFLEX 5 is a Multi-parameter control and analysis platform from ProMinent. In the remainder of this document, the term ‘controller’ is consistently used for the DULCOMETER® SLIMFLEX 5. The controller has been developed for continuous measurement and control of liquid analysis parameters in water treatment processes in industry. The controller can operate together with conventional analog and digital sensors and actuators. The controller is also equipped to communicate with some sensors using a proprietary serial bus. (CTFS – Conductivity/Temperature/Flow switch/Serial sensor)

The controller relays may be used with solenoids, chemical metering pumps and related water treatment equipment, not to exceed 1 amp each. (Typical)

Typical applications:

- Cooling water treatment
- Boiler water treatment

Standard Features:

- One serial input channel for use with CTFS (Conductivity/ Temperature/Flow switch Serial) sensor.
- Six multi-purpose digital inputs for turbine meters, contact water meters and limit switches.
- Temperature used for compensation of conductivity sensor signals.
- Output Relays:
R1: **Cooling Tower** - Inhibitor based on meter, % time or bleed relay.
Boiler – Blowdown based on a water meter, sensor or % time.
R2: Blowdown based on a sensor, phantom, water meter or % time.
R3, 4 and 5: Feed based on a sensor, meter, blowdown relay, % time, alarm or timed event schedule.
- Currently, 2 operating languages (German)
- Saving and transfer (cloning) of controller configuration via USB.
- Upgrading of the firmware function using USB Flash Drive
- Ethernet LAN connection for remote operation or configuration
- Data-logging all I/O at a 5 minute rate for 1 month.

Optional accessories:

- Up to 2 dual sensor input/output driver cards including:
Dual pH/ORP, Boiler Conductivity, Conductivity/Temperature or a Dual 4-20mA Output.
- Wi-Fi and WLAN web access



I/O Naming structure

The Slimflex 5 controller inputs are assigned letters and the outputs are assigned numbers as part of the programming scheme. This allows, for example, output relay 3 to be controlled by input sensor E, pH. The pH sensor must be input on E and the acid pump must be plugged into R3. 4-20mA outputs are the only outputs that do not follow this plan. They are also assigned letters.

5.1 Temperature Inputs

The Slimflex 5 controller accepts four types of temperature sensors;

- 1) The serial conductivity sensor (CTFS pn 7761529) includes a conductivity, temperature and flow switch signals is received through serial communication port on input A. [See section 6.3.5.1 Inputs on the Main Board.](#)
- 2) The LM335 type SGT (solution ground temperature) (grey cable with part number 1051505) sensor and the standard conductivity/temperature sensors (7761452, 7760200 and 7760191) which have a 10V/degree Kelvin rating. See section [6.3.7 Dual CT Conductivity/Temperature Driver](#)
- 3) The PT1000 type RTD (resistance temperature device) (black cable with part number 1002856). A PT100 will also work. Use on the pH/ORP with Temperature and the Dual CT driver. See sections [6.3.8 and 6.3.7](#) respectively. Does not include a ground.



Wiring Temperature Sensors

The SGT sensor is polarity sensitive. White is always + and Green is always -. The PT100/PT1000 sensors are not polarity sensitive.

6 Mounting and Installation

User qualification, mechanical installation: trained qualified personnel, see [Chapter 4.5 Users' qualifications](#).



CAUTION!

Controller must be installed in a manner that the power plug can be pulled out easily or the power disconnect switch can be reached easily.



Mounting position

- Install the Slimflex 5 at eye level to make operation easiest
- The controller is wall-mounted as standard.
- Always install the controller horizontally, so that the cable entries are facing downwards.
- Leave sufficient free space for cables and access to any sensors or sample plumbing mounted below.

NOTICE

Mounting position and conditions

The controller is rated for IP 65 liquid protection, and is equivalent to NEMA 4X (indoor) for air tightness. These standards are only achieved if all seals and threaded connectors are correctly rated and installed.

Electrical installation should only be performed after mechanical installation.

Ensure that there is unimpeded access for operation

Secure, low-vibration installation

Avoid direct sunlight

Permissible ambient temperature of the controller at the installation location: -20 to 60°C (-4 to 140°F) at max. 95% relative air humidity (non-condensing)

Take into consideration the permissible ambient temperature of the connected sensors and other components.

The controller is only suitable for operation in closed rooms. If operated outside, the controller must be protected against the environment by a suitable protective enclosure

All above conditions apply at or below an altitude of 2,000 meters.

6.1 Scope of supply

The following components are included as standard:

Description	Quantity
Controller SF5	1
Assembly material, complete	2
Operating Manuals on Flash Drive	1
General safety notes	1

6.2 Mechanical installation

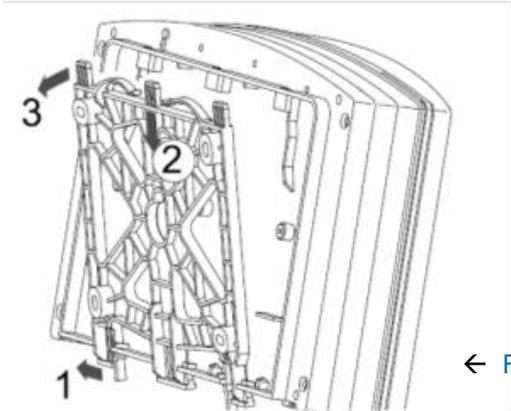
6.2.1 Wall mounting

Mounting materials (contained in the scope of supply)

- 1 x wall bracket
- 4 x PT screws 5 x 35 mm
- 4 x washers 5.3
- 4 x wall anchors Ø 8 mm, plastic

Wall mounting

1. Remove the wall bracket from the housing
2. Press the two snap hooks (1) outwards
 - ⇒ The wall bracket snaps slightly downwards.
3. Push the wall bracket downwards (2) to clear the housing and tilt it out (3)
4. Use the wall bracket as a drilling template to mark the positions of 4 drill holes.
5. Drill the holes: Ø 8mm (5/16”), depth = 50mm (1.96”)



← Figure 6 Removing the wall Bracket

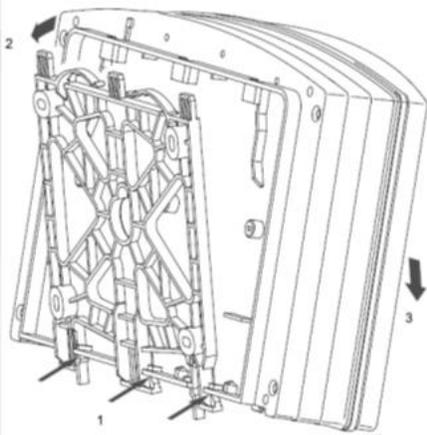
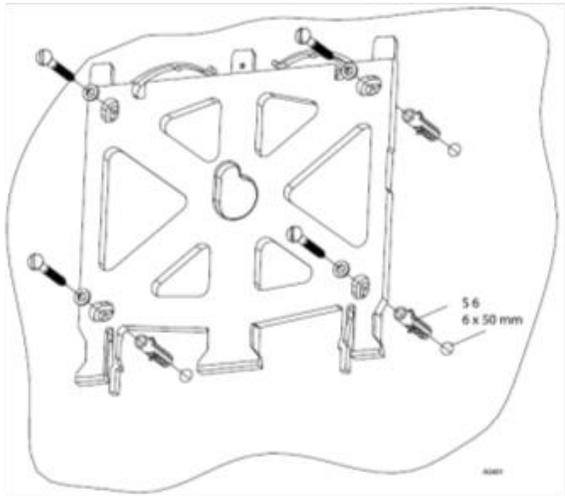


Figure 5 Attaching the wall Bracket

1. Screw the wall bracket into position using the washers provided. If needed, use the wall anchors provided.
2. Hook the bottom of the housing (1) into the wall bracket
3. Lightly press the housing at the top (2) against the wall bracket
4. Then check that the housing is hooked in at the top and press down (3) until it clicks into place.



↑ Figure 7 Mounting the Wall Bracket

6.3 Electrical Installation

User qualification, electrical installation Electrical technician, see ↗ Chapter [4.5 Users' qualifications](#)

NOTICE

Moisture at the contact points

It is important that you use suitable measures to protect plugs, cables and terminals from moisture and potential corrosion. Moisture at the contact points can interfere with the operation of the controller.



WARNING!

Safe operating status

Both hardware and software safety precautions must be taken to ensure that the Slimflex 5 adopts a safe operating condition in the event of a fault.

Use limit switches, mechanical locks, and other appropriate safety devices.

During installation the device must not be electrically live.

The installation must only be carried out by technically trained personnel.

6.3.1 Specification of the cable grips and conduit entries

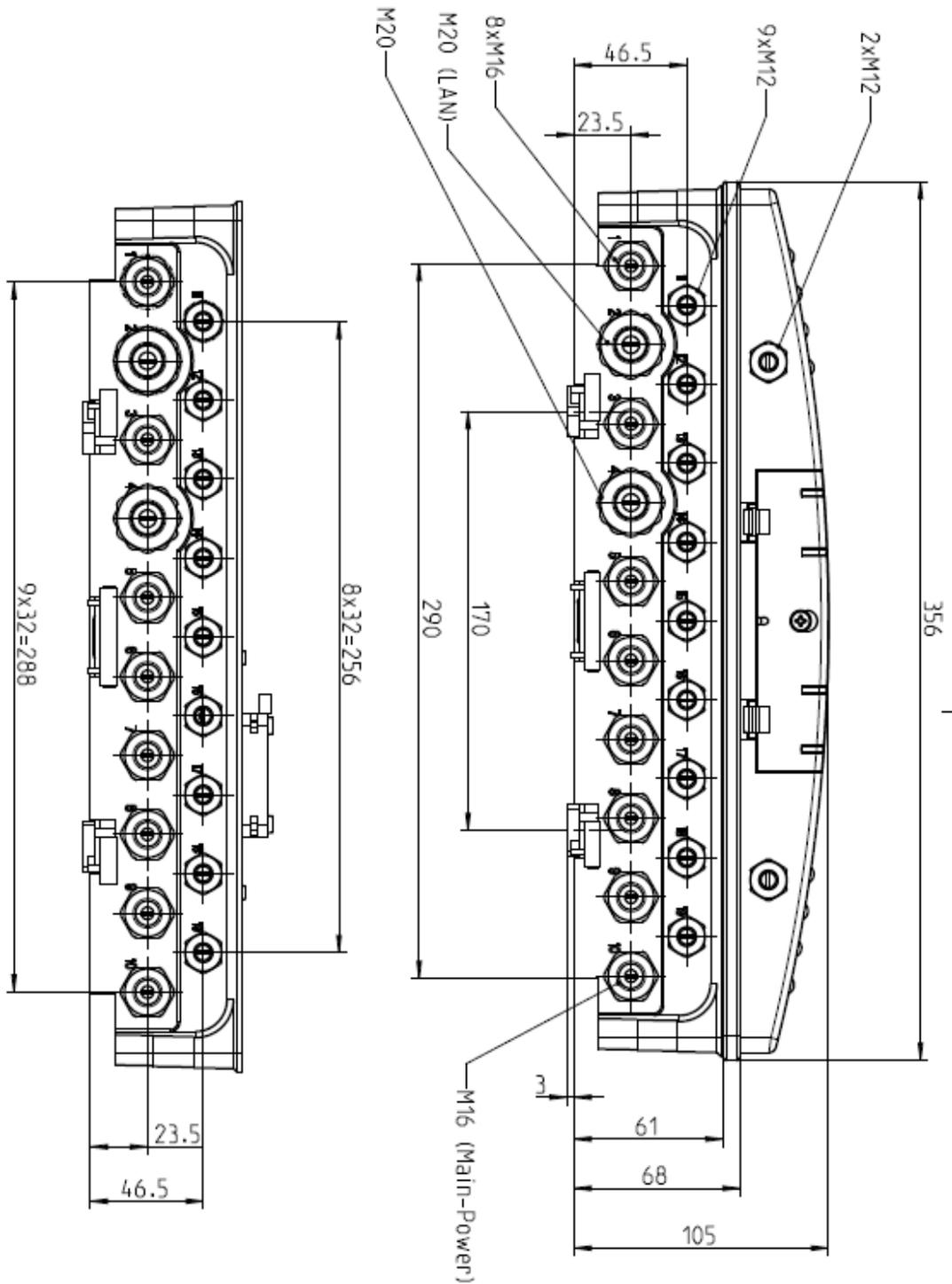


Figure 8 All Dimensions in millimeters (mm)

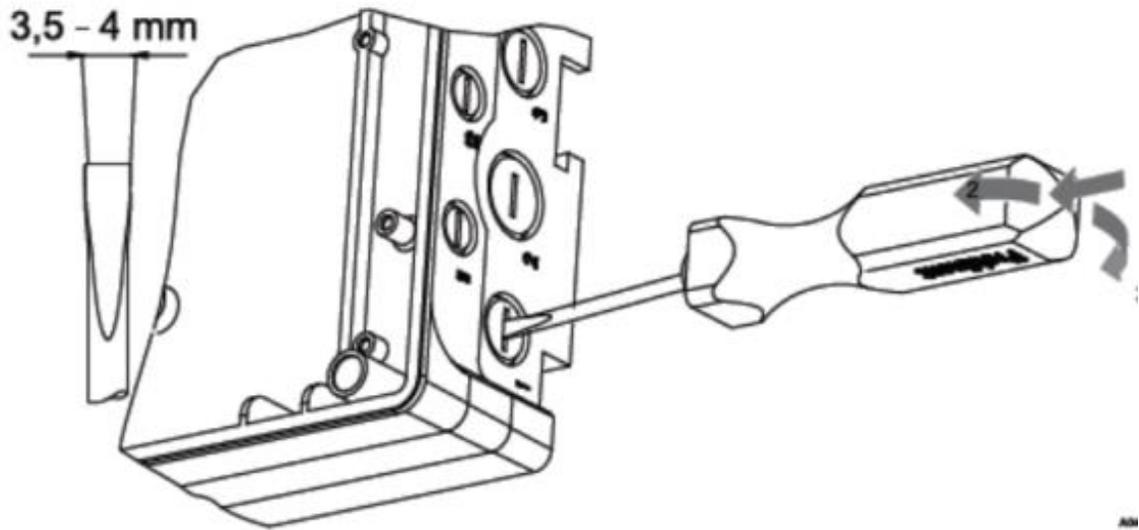


Figure 9 Use a screwdriver to break open a sealed enclosure entrance

Sensor Seals and Termination Procedure

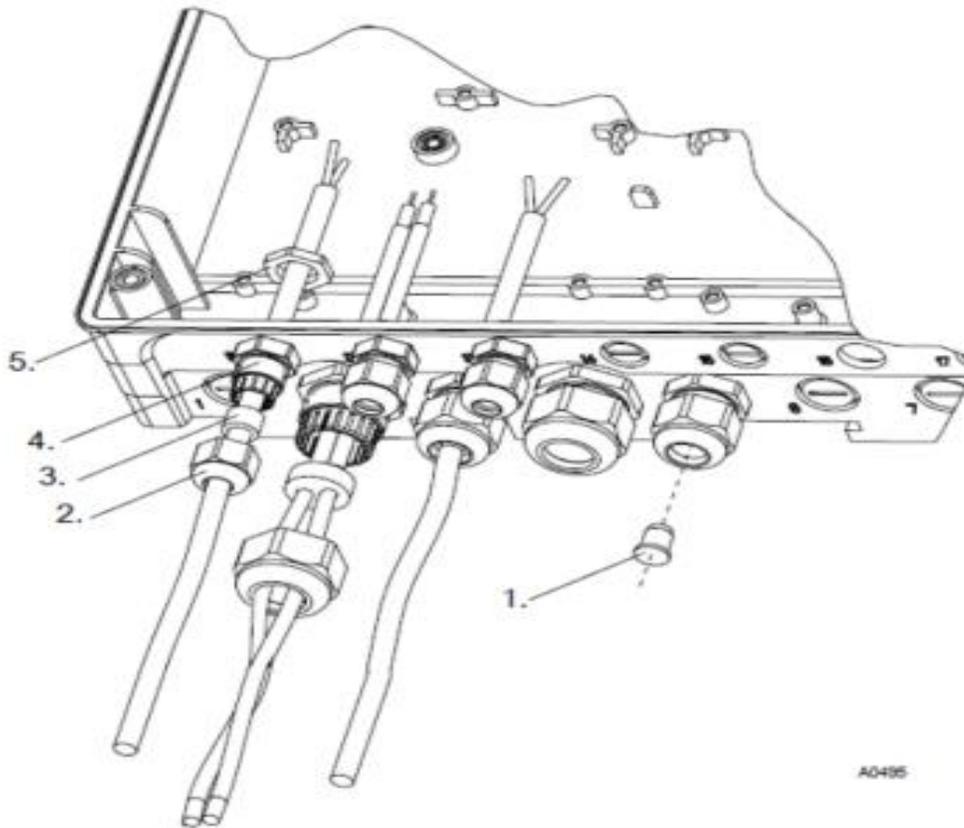


Figure 10 Examples of cable gland assembly.
1. Plug, 2. Cap, 3. Gland, 4. Connector Body, 5. Nut

Select the correct fitting seals for the controller's cable openings. Seal the open holes with blanking plugs in the cord glands as shown. This is the only way to ensure an acceptable air and moisture seal. Non-sealing dust caps are not effective for preventing non-warranty damage from moisture, corrosion or insects.

6.3.2 Parking the Hood

The hood or cover of the Slimflex 5 enclosure can be ‘parked’ so that access to the internal wiring and all of the display indications are accessible simultaneously as shown below. To park the hood, loosen the four captive screws until the hood can be carefully pulled straight out from the enclosure base. Note the plastic brackets attached to both sides of the lower portion of the hood, and the slots they were removed from. Notice identical slots higher on the base that the hood can be inserted into. Carefully insert the brackets into the slots until they click and seat.

- Guide the cable into the controller.
- Connect the cable as indicated on the terminal diagram
- Tighten the clamping nuts of the threaded connections so that they are properly sealed
- Place the upper section of the housing onto the lower section of the housing. Check for wires on the perimeter
- Manually tighten the housing screws
- Check once again that the seal is properly fitted. The degree of protection IP 65 can only be assured if the cover mounting is correct.



Figure 11 Hood in the parked position



Ensure that wires are not under tension when wiring is completed.

NOTICE

As with most electronic devices, moisture in the controller can lead to operational abnormalities and damaging corrosion. Note the instructions on the terminal diagrams provided.

6.3.3 General Layout and Terminal Diagrams

Figures 12 through 15 show general position of electronic components and wiring terminations.

Figure 12 shows the position of the internal relay indicators for each relay R1 through R5. The lights, marked 1 through 5 are on when the corresponding relay is energized. These lights are repeated on the controller cover.

Figures 16 and 17 are electrical schematics of the I/O.

Section 6.3.4 Power In and Relay Output Terminations which depicts wiring rules and examples.

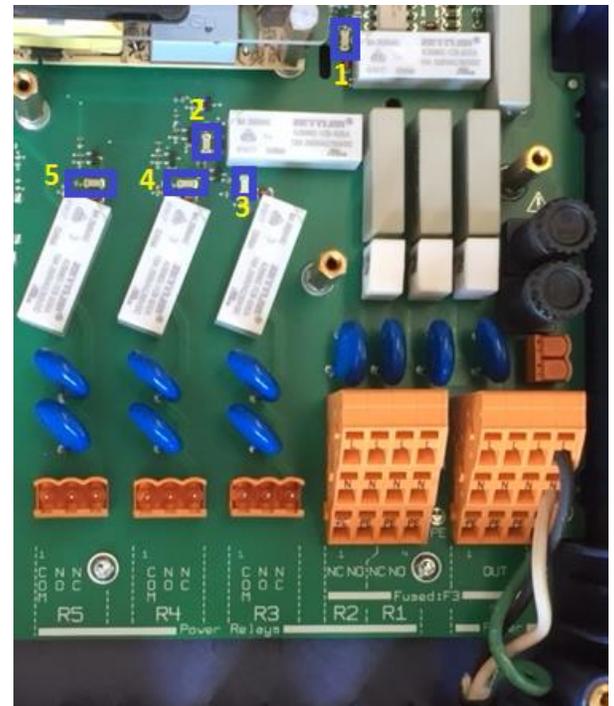


Figure 12 Internal Relay Indicator LEDs

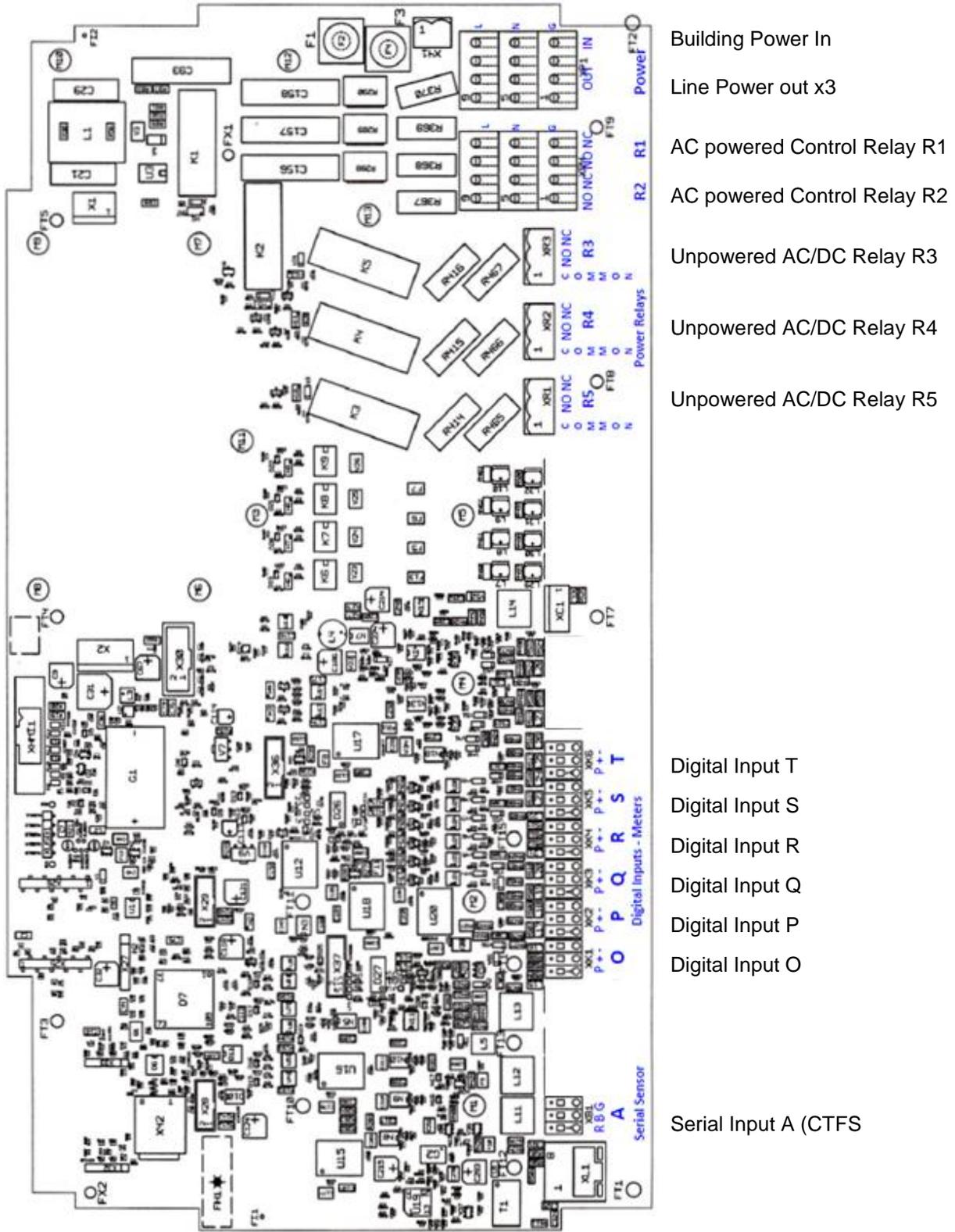


Figure 13 I/O Terminal Arrangements and Callouts

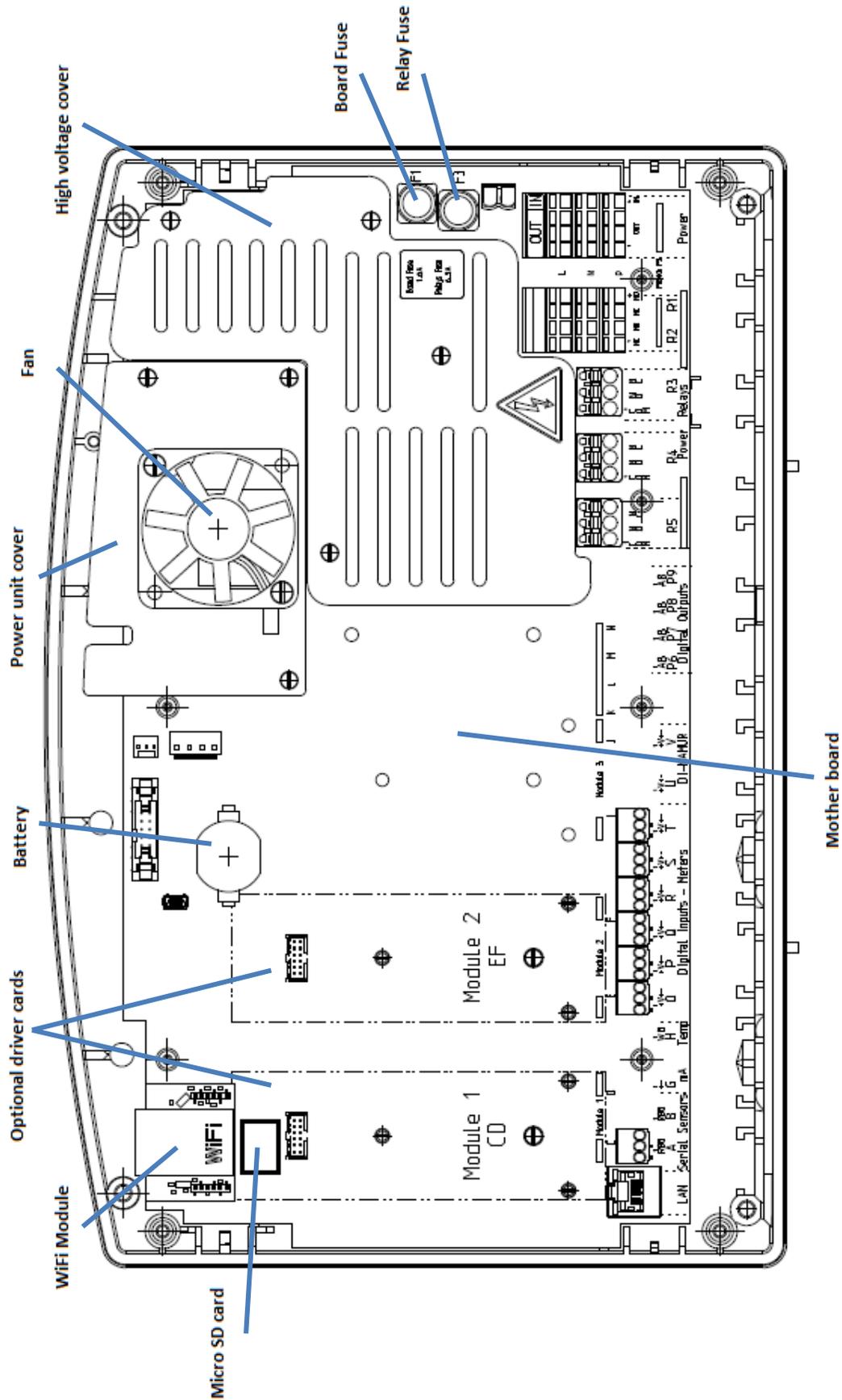


Figure 14 Slimflex 5 overall location of major components

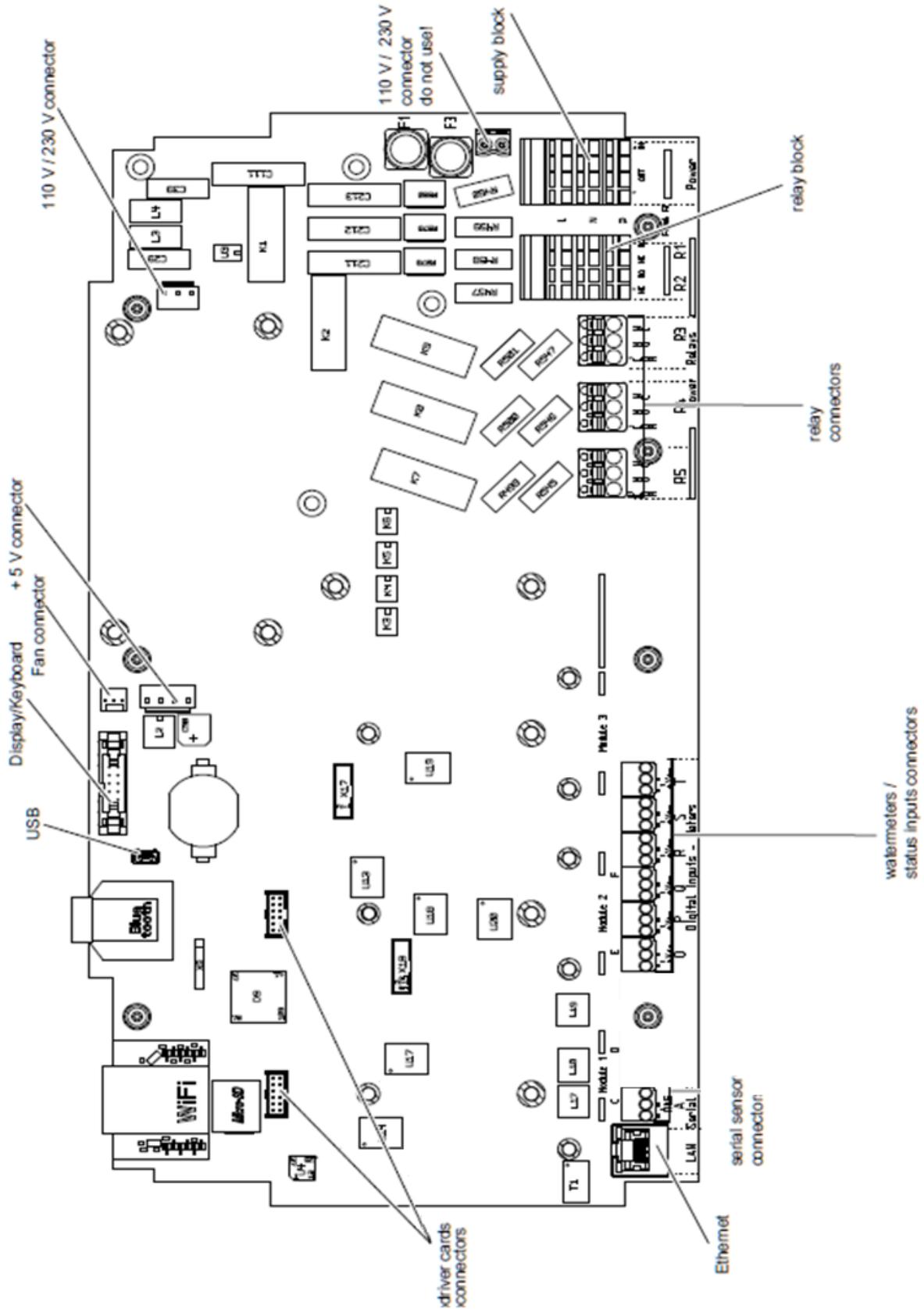


Figure 15 Slimflex 5 motherboard general arrangement

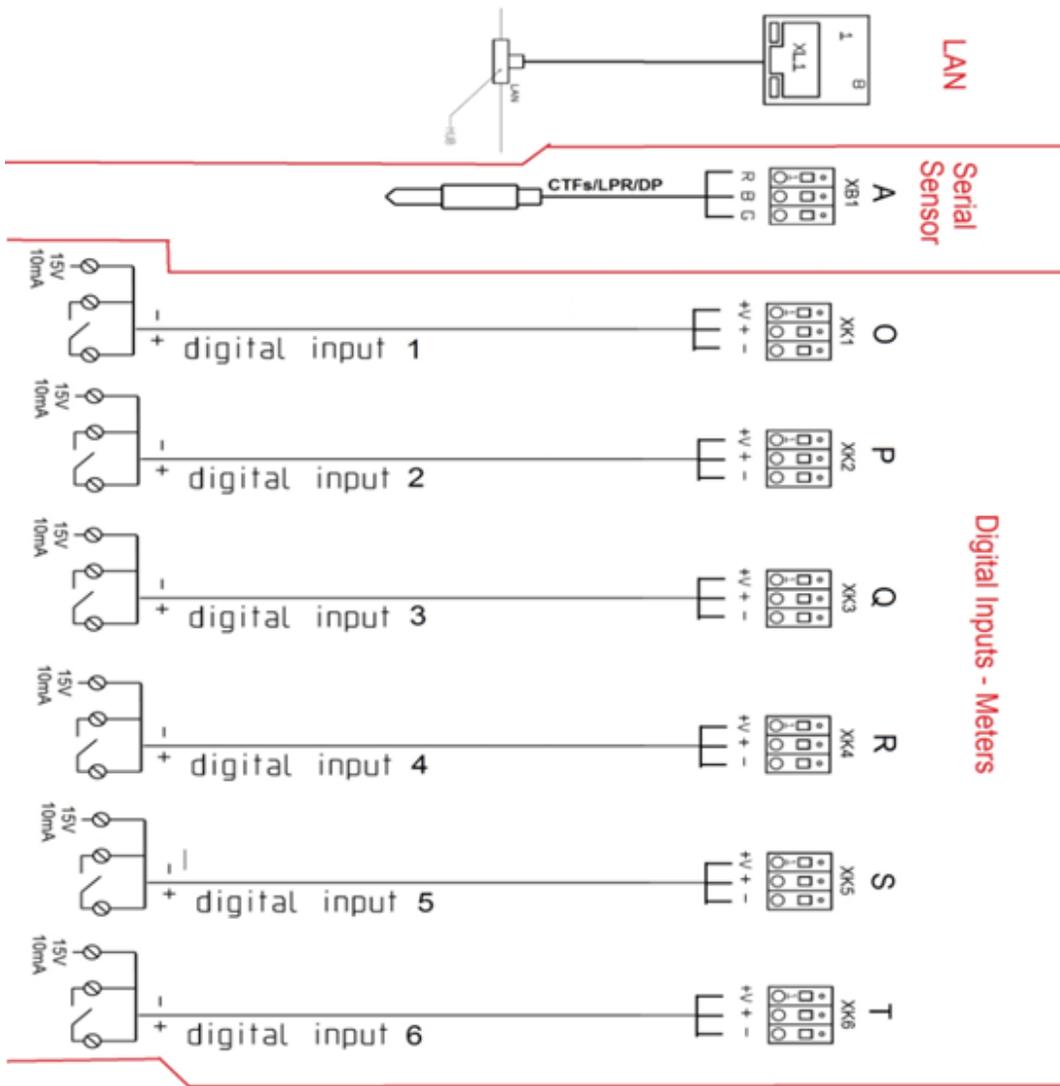


Figure 16 Main PC board Input Wiring diagram

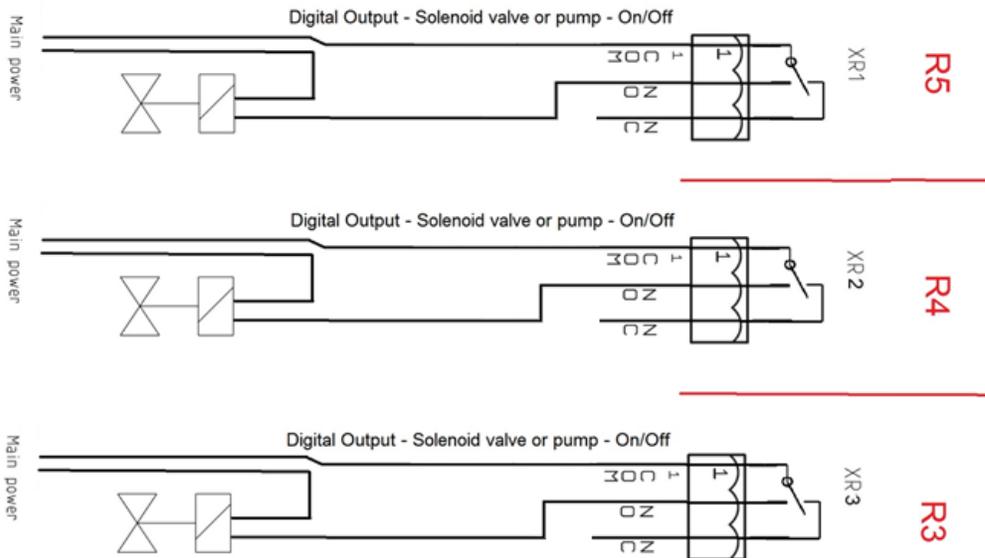


Figure 17A Main PC board Output Wiring diagram; Part 1: Relays R3 through R5

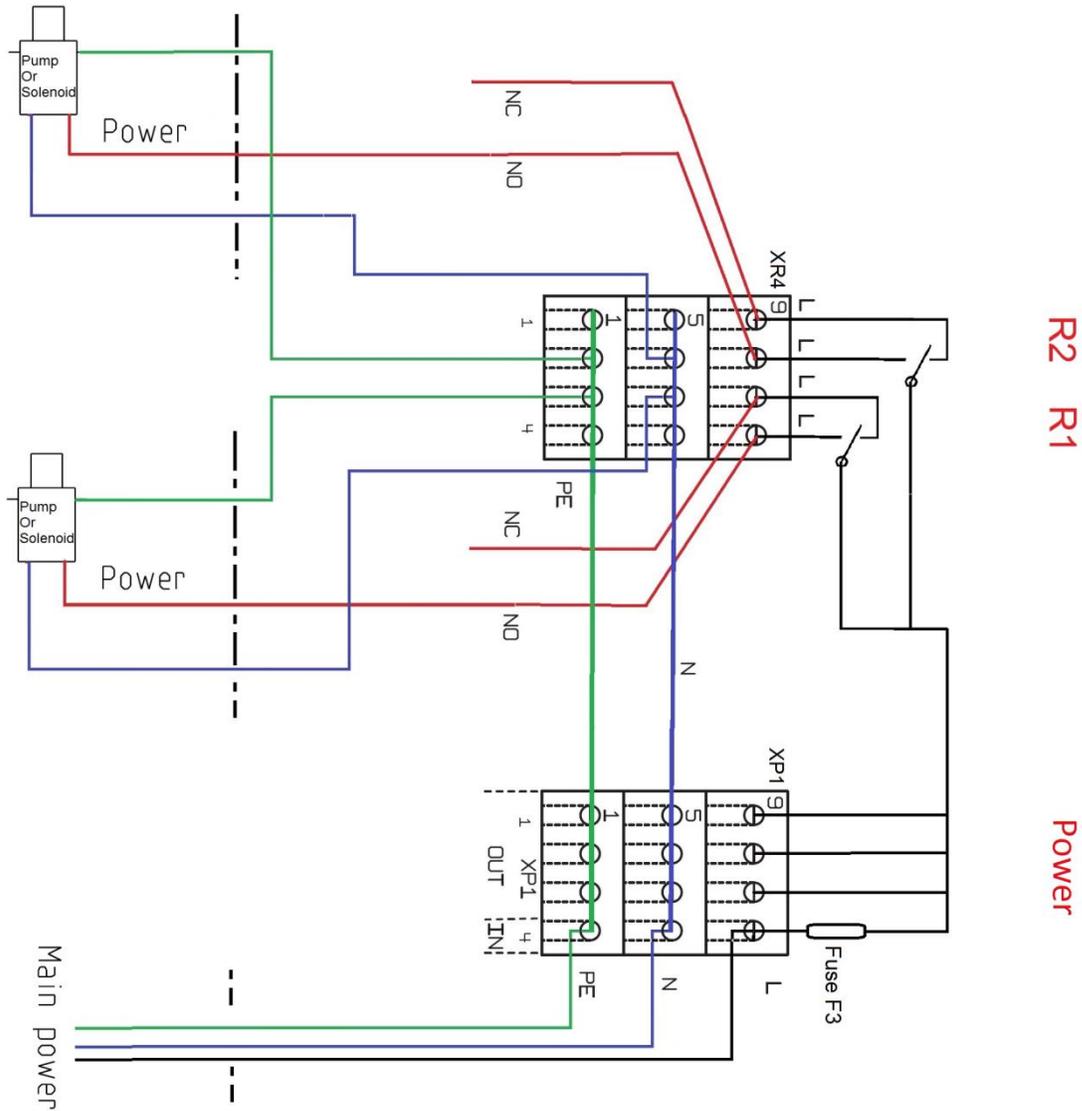


Figure 17B Main PC board Output Wiring diagram; Part 2: Relays R1, R2 and the Power block

The ground and neutral connections are all tied together through the printed circuit board as shown in the schematic 17B. The hot (Line) wire does not link with the other L terminals until after it passes through the main fuse F3.

Main power is terminated on the bottom rung of the Power block marked IN in [figure 17C](#).

See section [6.3.4 Power In and Relay Output Termination](#)

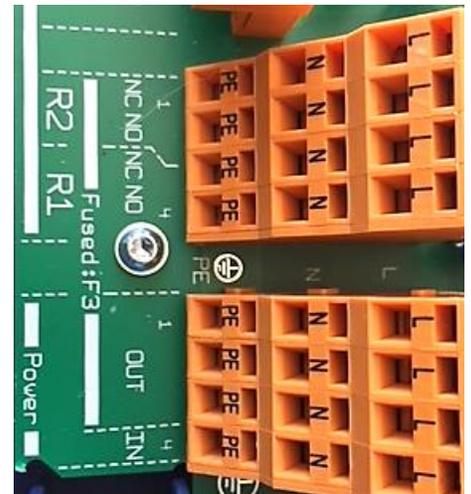


Figure 17C Relays R1, R2 and the Power

6.3.4 Power In and Relay Output Termination

6.3.4.1 Overview

All electrical wiring shall be performed by a licensed electrician, in accordance with local and national electric codes.



The following wiring diagrams and information show typical configurations, but not all possible combinations of this versatile controller.

The power/relay section of the controller is shown in [Figure 18](#) without wiring. Here we can see the labels on the controller circuit board indicating (from **right to left**) power in, power out and relays R1 through R5. See also [figures 17B and 17C](#).

The two large orange terminal blocks on the right each have 3 levels; Line, Neutral and Ground (PE). Input power is connected to the right most row of this block. See Figure 20.

In the USA, this connection is prewired in the factory for use with 120VAC. However, the input power supply will accommodate 100 to 230VAC at 50 to 60 Hz. No controller adjustment is required. Use wire/cables/plugs that are matched to the power you are using. See also [6.3.4.7 Connecting a Power Cord](#).

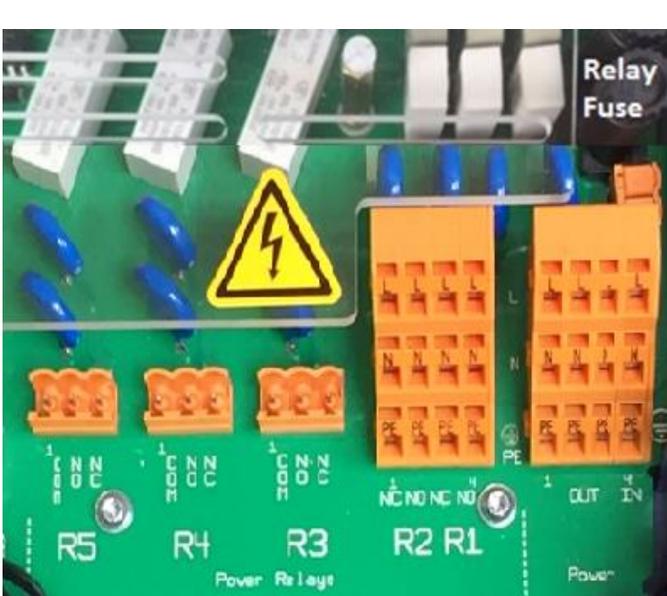


Figure 18 Power/Relay section

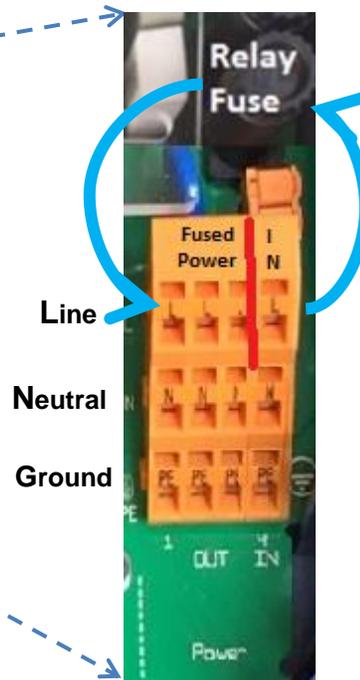


Figure 19 Power Block



Figure 20 Factory Installed Power

Note: The terminal connectors have been removed from relays R3, 4 and 5 for clarity. See them in [Figure 23](#).

Input power is fed through the circuit board to the Relay Fuse located above the Power block, then back to the Power block's three output terminals. (See the blue arrows in [Figure 19](#)) The main circuit board under the Power block ties all 4 Neutrals together and all 4 PE (ground) terminals together. (See [figure 17B](#))

The three fuse powered outputs can be used to power the dry contacts on relays R3, R4 and R5. See also [figure 25](#).

Fused power is also connected to the common tips of R1 and R2. These relays are 'powered' relays. See [Figure 17B](#)

The relays can be used for pumps and solenoids as well as motor operated valves (MOV). MOV terminations are explained in sections [6.3.4.3 Wiring Relays R1 and R2 for a Motor Operated Valve](#) and section [6.3.4.6 Wiring Motor Operated Valves \(MOV\) to Relays R3 – R5](#).

Mounting and Installation

To enter wires into the terminal blocks, (see [figure 22](#)) insert a small screwdriver or similar, into the spring box opening as shown, then push up on the driver handle. This will force the spring loaded metal slider downwards and open the wire grip below.



These blocks accept a maximum of 14 gauge wire.



Figure 22 Open the terminals

To enter wires into the digital inputs and digital outputs, depress the spring loaded tab. See [figure 21](#)



The orange output terminals accept a maximum of 12 gauge wire.

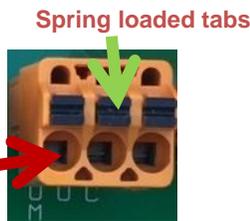


Figure 21 Spring loaded terminals

6.3.4.2 Wiring Relays R1 and R2



CAUTION!

All electrical wiring shall be performed by a licensed electrician, in accordance with local and national electric codes.

[Figure 23](#) shows relays R1 and R2 wired to outlet plugs. (Plugs not shown).

Notice that the black, white and green wires for R1 are in the right most column of the terminal block, the NO column. Relay R2 also utilizes the NO column. These plugs will supply power when the controller turns them on.

Powered relays R1 and R2 are designed to operate pumps and solenoids with a 1 amp rating or less. Relays R3, R4 and R5 can drive 5 amp devices. This requires an external fused source. See section [6.3.4.5 Wiring Relays R3 – R5 Using an External Power Source](#)



Figure 23 Terminating R1 & R2

6.3.4.3 Wiring Relays R1 and R2 for a Motor Operated Valve

Motor Operated valves typically have two hot wires, a neutral and a ground. The two hot wires will be terminated on the NO and NC terminals. The NO terminal will open the valve when the controller turns on the output relay. The NC terminal will close the MOV when the controller turns off the output.

[Figure 24](#) shows an MOV terminated on R1. The red wire is connected to R1 NO and the black wire is connected to R1 NC. See also section [6.3.4.6 Wiring Motor Operated Valves \(MOV\) to Relays R3 - R5](#)



Figure 24 R1 MOV Wiring example

6.3.4.4 Wiring Relays R3 – R5 Using On-board Power

Terminal connectors for R3, R4 and R5 can be removed from the PCB by pulling them up and off the pins on the PC board to make wiring easier, if you choose. Relays R1, R2 and the power block cannot be removed.



CAUTION!

The unpowered (DRY) relays R3, R4, and R5 are not fused and any external connection to these relay terminals will require additional circuit protection provided by the installer at the time of installation.

Failure to protect these circuits can cause non-warranty equipment damage and could pose a safety hazard.

Relays R3, R4 and R5 have Dry Contact terminals. Unlike R1 and R2, they have no power. This allows the user to supply power from a remote source or use power from the Output side of the power block.

In **Figure 25**, we show a jumper wire from the Fused Power output block Line terminal to the Com input on R3 – the left terminal. The NO terminal is used to power the outlet plug – Center terminal, also black wire. This wire joins the Neutral and Ground wires coming from the power block.



Figure 25 Wiring R3 using on-board fused power

6.3.4.5 Wiring Relays R3 – R5 Using an External Power Source



CAUTION!

The unpowered (DRY) relays R3, R4, and R5 are not fused and any external connection to these relay terminals will require additional circuit protection provided by the installer at the time of installation.

Failure to protect these circuits can cause non-warranty equipment damage and could pose a safety hazard.

An external power source can be used on relays R3, R4 and R5. **Figure 26** illustrates an external voltage connected to relay R5 at the COM terminal (black wire). A second wire (red) on the NO terminal is the switched output to a pump, solenoid, alarm light, etc. The neutral and ground wires are not terminated in the controller.

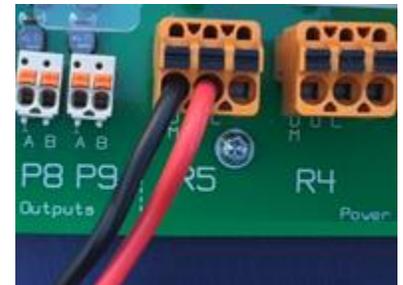


Figure 26 Using external power



CAUTION!

All electrical wiring shall be performed by a licensed electrician, in accordance with local and national electric codes.

6.3.4.6 Wiring Motor Operated Valves (MOV) to Relays R3 - R5

Motor Operated valves typically have two hot wires, a neutral and a ground. The two hot wires will be terminated on the NO and NC terminals. The NO terminal will open the valve when the controller turns on the output relay.

Figure 27 shows internal power used on R3 and external power used on R5 to control an MOV.

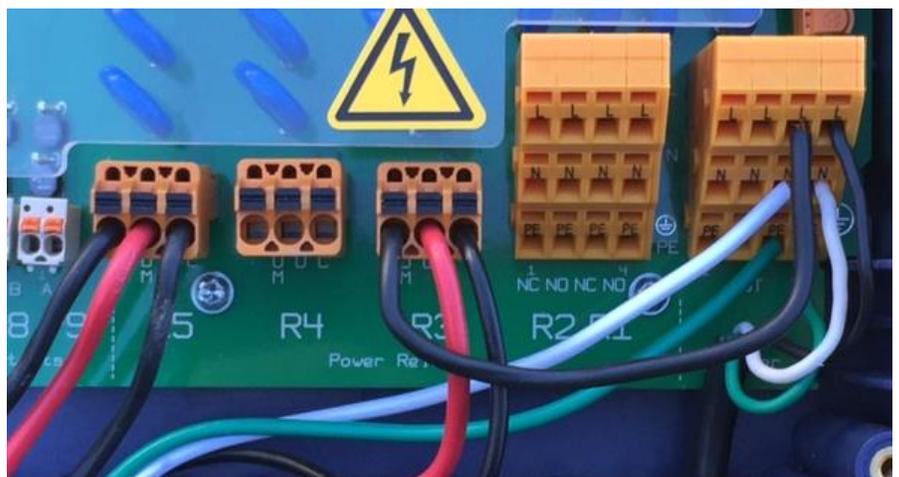


Figure 27 Motor Operated Valves wired to R3 and R5

6.3.4.7 Connecting a Power Cord

Remove a knock-out from the bottom of the controller and install the cord using a NEMA4/IP66 cord grip as shown in [figure 28](#). See also [Figures 9 and 10](#).

Terminate the line, neutral and ground wires as shown in [figure 28](#). See also [figure 22 Open the Terminals](#) in the overview section to open the terminations.



Figure 28 Power cord

6.3.5 Wiring sensors to the controller

NOTICE

Poor electrical connection may cause incorrect measurements. Once a wire is terminated, tug gently on the wire to ensure it is not loose.



Figure 38 CTFS sensor (Conductivity/Temperature/Flow switch/Serial)

Signal inputs to the controller attach to the main printed circuit board (PCB) or to expansion driver cards. Each input signal is assigned a letter, A through Z, for program identification. Analog outputs (4-20mA) are assigned letters as well. Digital (relay) outputs are assigned numbers 1 through 5.

In this way, outputs may be programmed to operate based on the status of specified inputs. Relay 3, for example, might be energized when sensor E reaches a programmed setpoint. Analog outputs (4-20mA) can be programmed to vary proportionally to an analog input in a forward or reverse direction. Refer to the Aegis Browser manual for programming detail.

6.3.5.1 Inputs on the Main Board

The main PCB inputs are shown in [Figure 31](#).

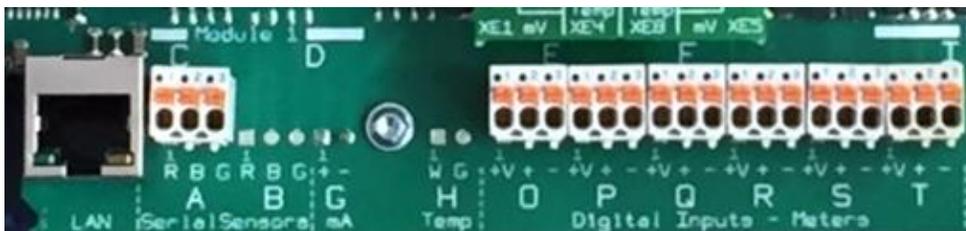


Figure 31 Main board inputs

Input A is for ProMinent serial sensor. The serial sensor is a CTFS (**C**onductivity, **T**emperature, **F**low **s**witch – **S**erial). This sensor has 3 wires; transmit, receive and common. Do not connect other probes to these inputs. Notice the color code of the wires is stenciled on the main board.

NOTICE

The **CTFS** sensor is not the same as a **CTF** sensor. The **CTF** sensor is **not** serial and has 6 wires. **The Slimflex 5 uses the 3 wire CTFS sensor on the A input.**

6.3.5.2 Digital Inputs O through T

Inputs O through T are digital inputs. They expect to monitor dry contact signals from contact head and paddlewheel water meters or any dry contact switch or relay tip. See figure 34. Wire the input between the + and – terminals. See figure 34. Black is on + and white is on -. +V is not used in this example.

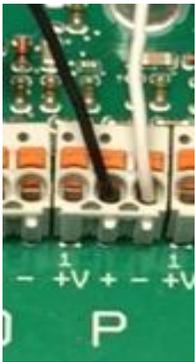


Figure 34 Digital Input wiring

Each input has a 15 volt (+V), 10mA terminal available as a power source for the sensor or input device.

Digital water meters that use these terminals must not supply a sine wave or powered signal. If the meter uses a ‘hall effect’, ‘open collector’ or ‘dry contact’ output, you can connect to these inputs. For additional water meter information and termination examples, refer to ProMinent publication “Industrial Water meters - Contact Head and Paddlewheel Specification A7”. This document can be downloaded from the ProMinent.us web site. Enter ‘water meter’ in the search box and press enter. Click on the document to download it.

NOTICE

Various types of water meters use the V+ terminal. The color and purpose of the wires does not adhere to a standard. Some meters use black for power and red for the signal. Check the water meter manual for wiring instructions.

6.3.6 Sensor Driver Cards

The following sections identify wiring diagrams of the sensor driver cards. There are two available expansion slots as shown in section 6.3.3 General Layout and Terminal Diagram.

NOTE: The drawings show the location of connections and are meant to be used with the adjoining tables which provide additional information for wiring connections.

The two expansion slots are shown in figure 35 and figure 14.

Note the letter designations in yellow. Inputs on these cards will be identified in the program by these letters for clarity. There are currently three expansion cards to choose from. Each is described in detail in the following sections.

Cooling Tower controller options:

- Dual CT (Conductivity/Temperature)
- Dual pH-ORP-Temp Driver
- Dual 4-20mA Output Driver

Boiler controller options:

- Dual CT (Conductivity/Temperature)
- Dual 4-20mA Output Driver

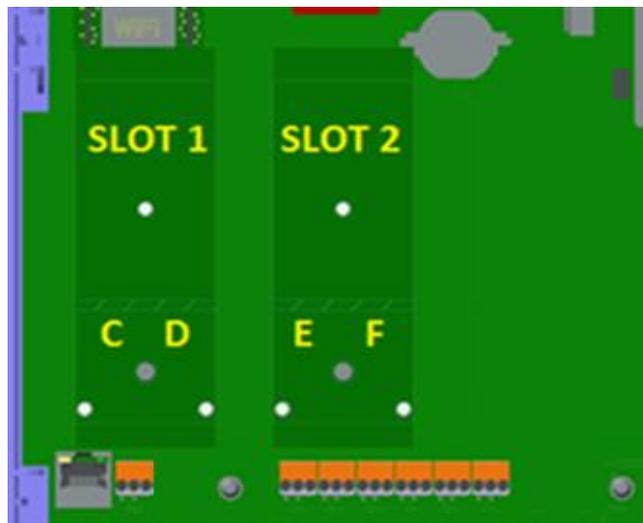


Figure 35 Expansion Card Slots and Letter Designations

6.3.7 Dual CT (Conductivity/Temperature) Driver

The inputs can be any combination of the following ProMinent sensors; 2-wire boiler conductivity, 4-wire cooling conductivity, 4-wire condensate conductivity, LM335² (10mV/°K), Pt100 or Pt1000 temperature sensors.

No other conductivity sensors will match the input circuitry.

Temperature can be used for display, control or compensation.

Do not exceed 30 meters, 100 feet, of cable length.

FOOTNOTE 2: LM335 is our SGT sensor, pn 1051507

Assignment Variants 734223

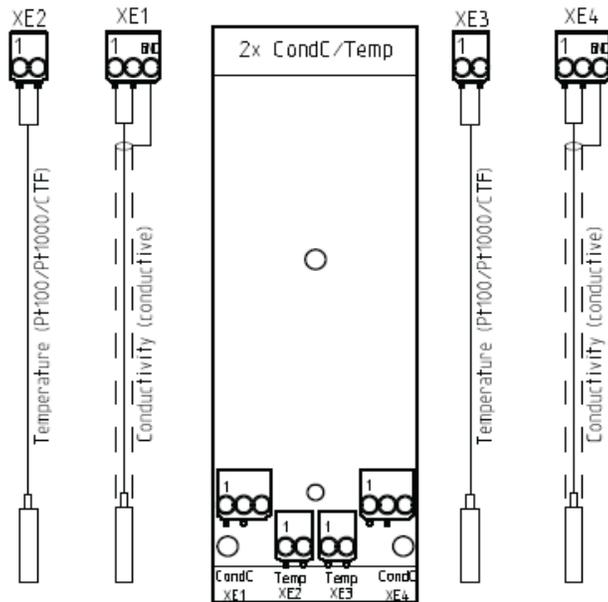


Figure 39 Dual Cond/Temp input Driver Connections

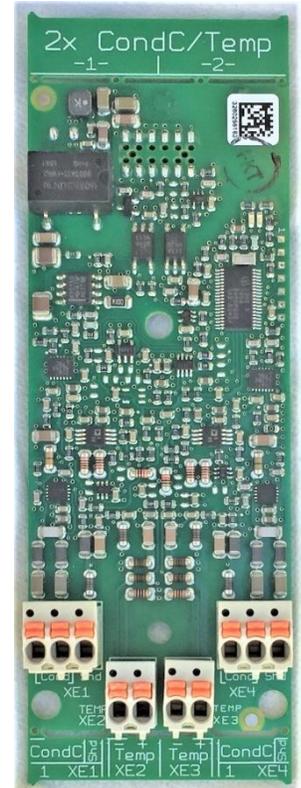


Figure 40 Dual Conductivity Driver

2 x Cond/Temp			
HW Version: 734223 Rev. 2A			
Connector	Pins	Description	
Channel 1	XE1	1	Conductivity sensor 1 - Not polarity sensitive
		2	
		3	
	XE2	1	(-) Temperature sensor 1 (LM335, Green or Pt 100, Pt1000)
2		(+) Temperature sensor 1 (LM335, White or Pt 100, Pt1000)	
Channel 2	XE3	1	(-) Temperature sensor 2 (LM335, Green or Pt 100, Pt1000)
		2	(+) Temperature sensor 2 (LM335, White or Pt 100, Pt1000)
	XE4	1	shield
		2	Conductivity sensor 2 - Not polarity sensitive
		3	

Table 6 Dual Conductivity Temperature Connections

Typical conductivity card connections:

The 2-Wire boiler conductivity probe connects to XE1 or XE4, pins 1 and 2. This sensor is **not** polarity sensitive.



Figure 41 Two Wire Boiler Probe on XE1



Figure 42 Two Wire Boiler Probe

The 4-Wire condensate conductivity probe connects to XE1 and XE2 or XE3 and XE4 as shown. Wires on XE1 and XE4 are not polarity sensitive. The temperature input on XE2 and XE3 must be connected as shown. The green is – and the white is +.



Figure 43 Four Wire Condensate Probe On XE2



Figure 44 Four Wire Condensate Conductivity Probe

6.3.8 Dual pH-ORP-Temp Driver

Two inputs; can both be pH or both be ORP, or one of each.

Any 2-wire pH sensor will work if the mV/pH is ~59.1

Any 2-wire ORP will work if mV is in the range of +/- 1,000mV

The pH, ORP or temperature (Pt100 or Pt1000 only) sensors can be extended a maximum of 10 meters/30 feet from the controller. For longer distances, use a 4-20mA sensor transducer and a 4-20mA input card.

The temperature input sensor can be either a 100Ω or 1000Ω RTD.

Temperature can be used for display, control or compensation.

If an electrical potential exists in the water, it should be removed. If it cannot be removed, a potential equalization electrode (also called “liquid potential” or “solution ground”) connection can be used.

If a potential equalization electrode is used, the default wire jumper(s) on XE3 and XE7 must be removed before connecting the potential equalization electrode to input XE3:2 and/or XE7:2. If not using a potential equalization electrode, leave the default jumpers in place on XE3 and XE7.

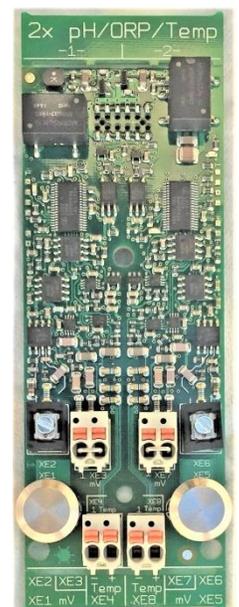


Figure 45 Dual pH/ORP Driver

Assignment Variants 734131

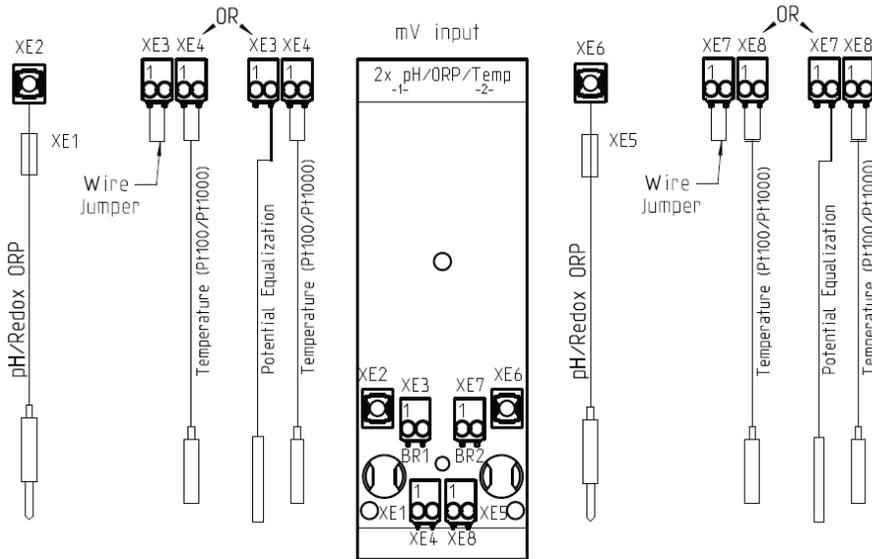


Figure 46 Dual pH/ORP input Driver Connections

Dual pH/ORP with Temp Input HW Version: 734131 Rev.3				
	Connector	Pins	Description	
Channel 1	XE1	-	Reference electrode (Shield)	
	XE2	-	Measurement signal (glass electrode)	
	Without liquid potential	XE3	1	Short circuit using jumper
		XE3	2	
	With liquid potential	XE3	1	Liquid potential
		XE3	2	
XE4	XE4	1	Temperature sensor (Pt100 or Pt1000)	
		2	Temperature sensor (Pt100 or Pt1000)	
Channel 2	XE5	-	Reference electrode (Shield)	
	XE6	-	Measurement signal (glass electrode)	
	Without liquid potential	XE7	1	Short circuit using jumper
		XE7	2	
	With liquid potential	XE7	1	Liquid potential
		XE7	2	
XE8	XE8	1	Temperature sensor (Pt100 or Pt1000)	
		2	Temperature sensor (Pt100 or Pt1000)	

Table 7 Dual pH-ORP-Temp Connections

Ready-made coaxial cable

Whenever possible, only use ready-made coaxial cables that you can select from the ProMinent catalog.

Coaxial cable 0.8 m-SN6 (31.5"), ready- made, order no. 1024105

Coaxial cable 2 m-SN6 (6.5'), ready- made, order no.1024106

Coaxial cable 5 m-SN6 (16.4'), ready- made, order no. 1024107

Figure 46 Ready-made coax



When is potential equalization (Solution Ground) used?

Potential equalization (also called “liquid potential” or “solution ground”) is used if the pH/ORP measurement is interfered with by disturbance potential (millivoltage) from the measurement media. For example, a disturbance potential can be caused by electric motors with incorrect interference suppression or due to insufficient galvanic insulation of electrical conductors etc. Potential equalization does not remove this disturbance voltage, however it does reduce its effect on the measurement. Therefore it is ideal to remove the source of the disturbance potential.

NOTICE

Jumper and potential equalization (liquid potential or solution ground).

If a liquid potential equalization electrode is not connected, the jumper must be inserted. With neither jumper not sensor, the main channel input signal will not be valid.

6.3.8.1 Attaching the pH/ORP coax cable

Once the cable has been prepared, [Figure 26](#) attach it to the pH/ORP driver card. Remove the shield grounding nut, XE1, and loosen the center conductor screw, XE6, as shown in [Figure 47](#).

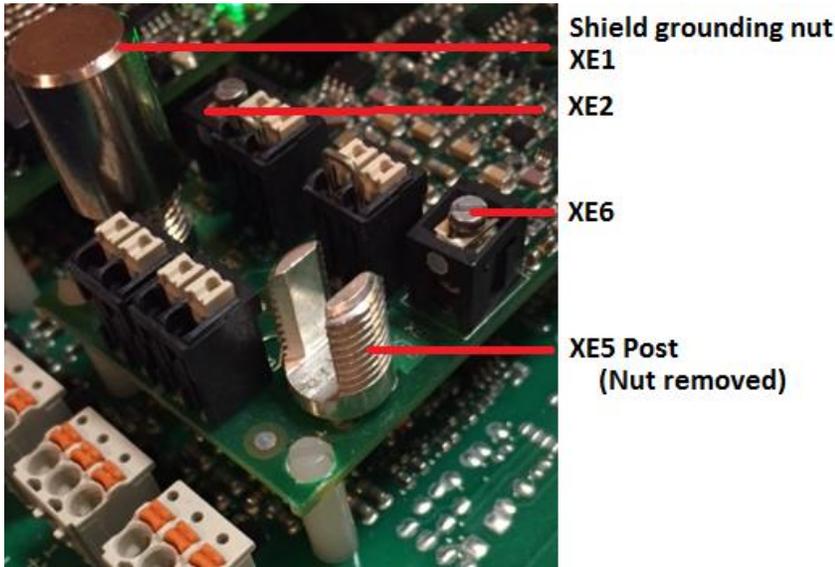


Figure 47 pH/ORP driver card coax connection

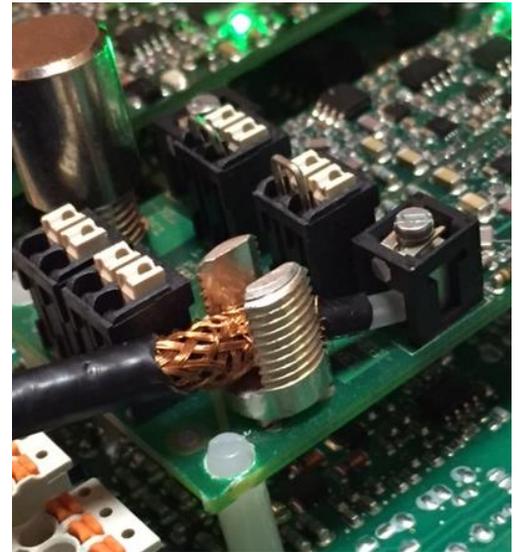
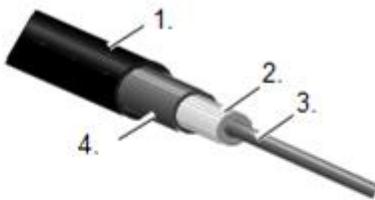


Figure 48 Coax placement

Insert the coax center conductor into the XE2 or XE6 terminal and tighten. Place the shield grounding nut on the post, screw down and tighten. This nut is smooth for a reason. Do not over-tighten!



Outer conductor (4)~10mm
Insulation (2)~7mm
Inner conductor (3)~7mm

- 1. Protective Outer Sleeve
- 2. Insulation
- 3. Inner Conductor
- 4. Outer Conductor and braided shielding

Figure 48 Coaxial Cable Construction



Figure 50A Coax cable preparation with conductive sleeve (wrong)



Figure 50B Coax cable preparation with black conductive sleeve removed

Coax cables accompany pH and ORP sensors. If you shorten them, be sure to create an end that is a good fit for the card termination.

Remove the black plastic layer from the inner coaxial cable. See [Figures 50A and B](#). This is present on all types of cable. In doing so, ensure that individual threads of the bare wire shielding do not come into contact with the inner conductor.



Figure 52 ProMinent Industrial ORP and pH sensors

6.3.9 Dual 4-20mA Output Driver

Two outputs fully isolated from each other and from the mother board.

Output open loop alarm; Maximum load of 450ohm @ 21.5mA, 480 ohm @20.5mA. Drive voltage maximum; 18VDC open circuit. We recommend a maximum length of 1,000 feet using 22 AWG wire or larger. Twisted, shielded, stranded cable is best for long distances.

Does not have a passive output. The loop is powered by the driver card.
Scale to any engineering units, forward or backward.

Examples:

4mA = 200 GPM and 20mA = 0 GPM

4mA = 32° F and 20mA = 212° F

4mA = -500mV and 20mA = 500mV

Can be used for proportional control of a pump or analog valve.

Can be used as a process variable to a DCS or chart recorder.

2 x mA Outputs HW Version 734143		
Connector	Pins	2 wire mA output
XA1	1	(-) mA output -
Channel 1	2	(+) mA output +
XA2	1	(-) mA output -
Channel 2	2	(+) mA output +

Table 11 Dual mA Output Connections

Assignment Variants 734143

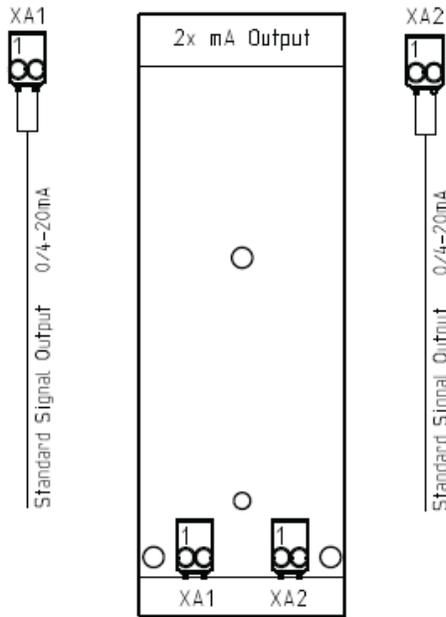


Figure61 Dual mA Output Connections

The dual 4-20mA output driver is equipped with onboard power which is used to power or excite, the output loops. Therefore, the input device must not power the loop. mA loops cannot be powered from two sources!



Figure 60 Dual 4-20mA Output driver

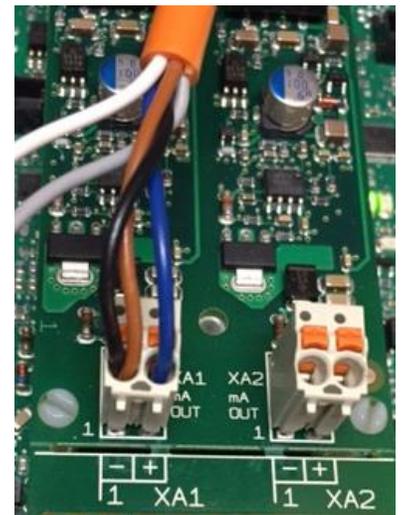


Figure 62 Dual mA Output with ProMinent Universal Control Cable on output 1.

7 Communication

7.1 Diagram of the Communication Modules

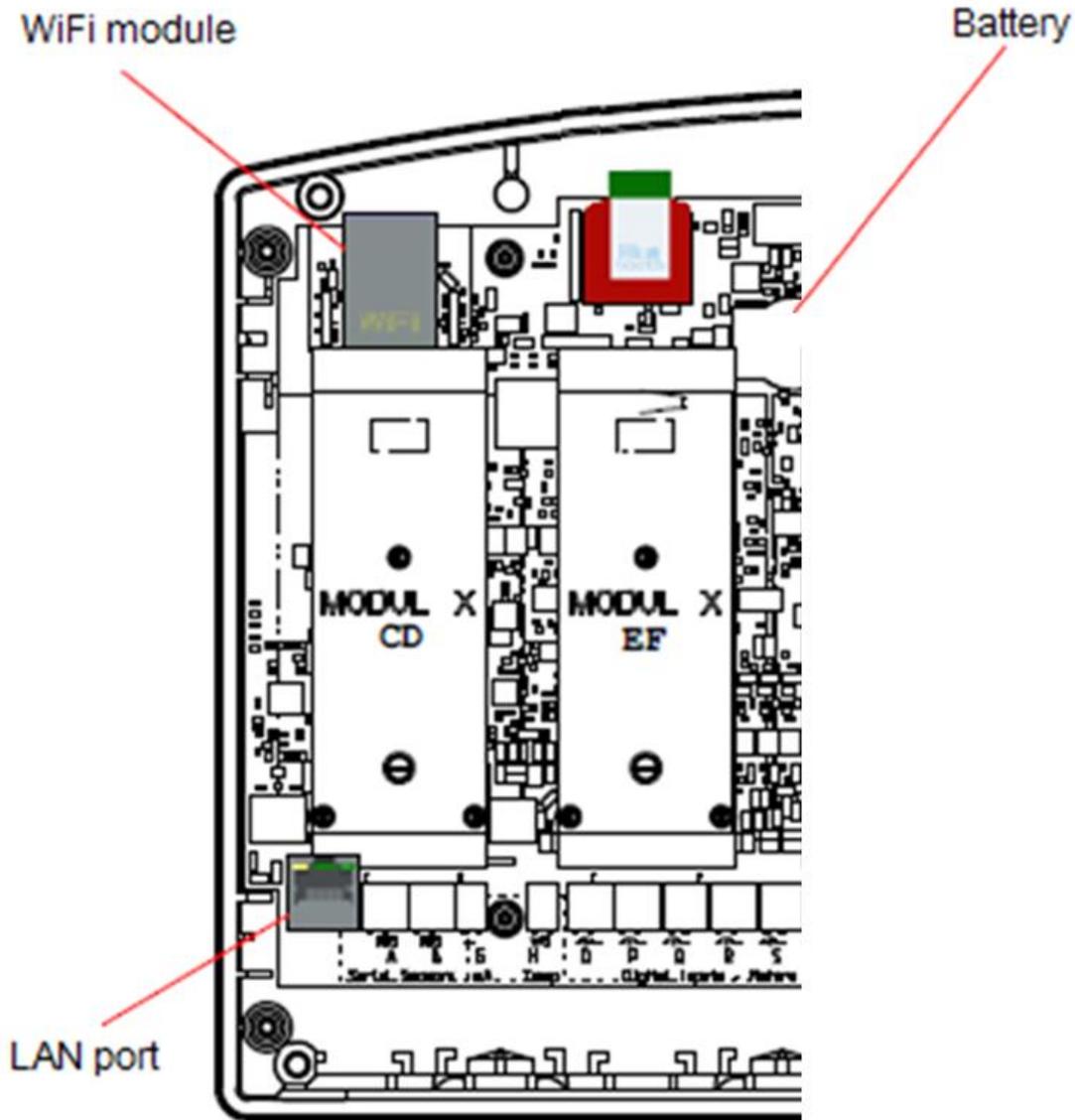


Figure 63 Illustration of the various communication ports and modules

8 Commissioning

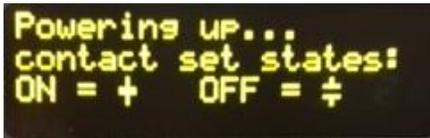
User qualification: trained user, see ↪ [Chapter 4.5 Users' qualifications](#)'.

After mechanical and electrical installation, turn on the sample stream, check for leaks and purge any trapped air.

8.1 Switch-on behavior during commissioning

Switching On - First Steps

Power up sequence will first show the 4 line x 20 character LED display for 3 seconds:



Followed by the "Home" screen of up to 6 sensor readings with the bottom line reserved for labels above the 3 dynamic keys F1, F2 and F3.



9 Programming the Inputs

This section will depict the keystrokes necessary to edit the program, calibrate sensors or find information.



CAUTION!

Installation and function control

Check that all the electrical connections have been made correctly
Ensure that the supply voltage matches the voltage range indicated on the data plate

NOTICE

For a faster and easier initial configuration, ProMinent recommends that general configuration of the controller, especially during commissioning, be performed using a portable computing device like a laptop or a tablet computer. Refer to the Slimflex 5 Browser manual for WiFi and Ethernet connection information.

The keypad interface instructions in this manual are intended to show an operator how these individual tasks can be performed from the keypad.

Factory programming of sensor inputs is based on your specific order. This may include controlling relays for pumps and solenoids. Some inputs require further setup.

9.1 Analog and Digital Inputs

9.1.1 Enable an Analog or Digital Input:

This includes all analog and digital inputs other than the CTFS sensor. See section [9.1.2 Enable a CTFS Sensor](#).

1. Press the MENU key.
2. Use the Up and Down ARROW keys to find and point to the **System** choice and press **OK**.
3. The display will change to the System menu. Scroll up or down through the choices until the arrow points to **Enable I/O** then press **OK**
4. Using the arrow keys, scroll through the disabled I/Os until the you see the input you wish to enable
5. Press ENABLE [F3] key.
6. Press ESC (Escape) to exit

Note: If you enable a Serial Conductivity sensor (CTFS), the temperature and flow switch need to have input letters assigned to them **at that time**. This is done at the factory when CTFS sensors are ordered with the controller. If you add a second CTFS in the field, use the 'Enable CTFS Sensor' instructions below.

9.1.2 Enable a CTFS [Conductivity, Temp, Flow, Serial] Sensor

- 1- Press the **MENU** key.
- 2- Use the Up and Down ARROW keys to find and point to the **System** choice and press OK.
- 3- Scroll down to **Enable I/O** and press **OK**
- 4- Scroll down to the **CTFS** sensor you wish to enable and press **F3** (Enable) Note the letter assigned to this sensor! It will be used in steps 7 and 9 below.
- 5- From the **Enable I/O line**, press **OK**
- 6- Scroll down to an unused analog input (A through N) and press **F3** to ENABLE it.
- 7- Scroll up until you see the temperature assignment for the new CTFS. (A1 in this example. It will have the first letter from step 4 above.) Press **F3**.
- 8- From the **Enable I/O** line, scroll down until you find an unused digital input, (O through Z) and press **F3**, ENABLE.
- 9- Scroll up until you find the Contact Set assigned to the sensor in step 4 above. A2 in this example. Press **F3** to SELECT.
- 10- Press **ESC** (Escape) to go back

9.2 Changing a Descriptor

Once you have enabled an input or output, naming is helpful in avoiding programming mistakes. Choose a name that describes the sensor so that when multiple sensors of the same type are on the same controller or process, it is easy to tell them apart. An abbreviation of the application is recommended. (e.g. pH Tower 2)

This procedure is the same for all I/O points; Inputs and Outputs, digital and analog and includes 4-20mA points. When you name an input, you are changing the "descriptor". This is how it is done:

- 1- Press **MENU**.
- 2- Scroll down to **I/O Setup**. Press **OK**.
- 3- Scroll down to the relay you chose to name and press **OK**. If your relay is not listed, it is not enabled. See [10.1, Determine if a Relay is Enabled](#).
- 4- Press **OK** to edit the "descriptor" of the relay.
- 5- Notice the **F2** key represents the word 'alpha'. You have three choices, ALPHA (upper case letters), alpha, (lower case letters), and NUMBERS, 0 through 9. Since the lower case
- 6- 'alpha' is seen, please realize that this is a choice, not the current selection.
- 7- The default choice is upper case so use the up and down arrows to change the R in Relay to B for Blowdown or A for acid, etc.
- 8- Use the right arrow to move to the second position. Press the **F2** key to choose **alpha**, lower case letters. Notice that the F2 choice now shows NUMBERS. That would be the next choice.
- 9- Use the arrows to change the 'e' to 'l' and continue until your word is spelled.
- 10- **When finished, press OK to save.**



Available Sensors

Sensor availability in the menus is dependent upon the installed driver cards. All sensors possible for each of the driver cards are made available at bootup. A sensor will probably need to be enabled after the driver card and sensor(s) are installed, and the controller is rebooted.

9.3 Selecting an Analog Sensor Type

Sensor types are set at the factory based on the identcode created during the ordering process. The choices made at that time cannot be changed via the keypad. Consult the Browser manual for computer or smart phone connections which allow sensor editing.

9.4 Analog Sensor Cleaning and Calibration

9.4.1 General remarks

Combination probes for the measurement of pH and redox-ORP potential consist of a measuring electrode – a glass electrode for pH, a platinum or gold electrode for redox measurement and a reference electrode, arranged concentrically around the measuring electrode.

9.4.2 Sensor Commissioning

Before putting into operation, the protective cap or case must be removed from the glass or metal electrode. The glass or metal electrode must be free from oil, grease and other contaminations. Likewise, the diaphragm of the reference electrode must be free from scale deposits, dirt or crystallized matter. For these reasons, electrodes should never be touched by hand. If contaminations are present refer to section **9.4.4. Cleaning and Servicing Probes**.

9.4.3 Calibrating and checking probes

9.4.3.1 Calibrating pH probes

Zero calibration: since pH probes are subject to certain manufacturing tolerances, they must be tuned to the pertinent pH transmitter. The adjustment intervals depend on relevant operating conditions. They can vary from a few days to up to 8 weeks.

Having connected the probe to the transmitter by means of the probe cable (taking care that connectors and cable remain absolutely dry), dip the probe into a pH 7 standardizing solution and adjust transmitter exactly to read this value.

Remove the probe, rinse it with water, preferably distilled water, and dry it by swabbing it with soft, lint free tissue paper.

Immerse the probe in a buffer solution differing by a least 2 pH from pH 7 and calibrate after the value on the display has stabilized. If within 30 seconds a steady-state value is not produced or calibration has proved impossible, clean probe as described in Section 4 and repeat calibration. If again unsuccessful, replace probe with a new one.

9.4.3.2 Checking redox/ORP probes

With the probe connected to the controller by means of the probe cable (taking care that connectors and cable remain absolutely dry), dip the probe into a redox-ORP standard solution, e.g. of 465 mV.

The reading should reach or exceed this value within not more than 30 seconds. If the reading rises rather sluggishly or falls short more than 20 mV, clean the probe as described in Section 4 and repeat check. If again unsuccessful, replace the probe with a new one, or adjust the ORP set-point accordingly.

NOTICE

A calibration of the transmitter or ORP input driver card will not normally be required. This procedure serves as a probe check only.



ORP sensors measure more than just chlorine.

The only acceptable calibration is to a calibrated mV source, not an oxidant residual. ProMinent recommends testing the probe for movement and adjusting the set-points if necessary, to reach the desired oxidation control range.

9.4.4 Cleaning and Servicing Probes

All pH and ORP probes should regularly (once a month) undergo a visual check and be cleaned if necessary.



CAUTION!

Do not rub

This might cause damaging static electricity and false readings.

If deposits on the glass electrode withstand cleaning with a soft, moistened cloth, or a soft toothbrush the following cleaning agents may be used:

Kind of deposit	Agent and duration of application
General deposits	Non-abrasive household cleaner like Dawn [®] or 409 [®]
Scale or metal hydroxides	Diluted hydrochloric acid (approx. 0.1-3 %, 1-5 minutes)
Oil, grease	Solvents, like alcohol
Biofouling	Mixture of diluted hydrochloric acid and pepsin, several hours. Solvents (e.g. acetone) must not be used to clean electrodes as they can damage the plastic

Table 13 Glass electrode cleaning agents

It is essential that the probes are rinsed thoroughly after cleaning or using a buffer solution.

If the laterally arranged ceramic diaphragm of the reference electrode is blocked, it may be cleaned like the glass electrode. In addition it may be cleaned by cautious scraping with a finger nail, a razor blade or a fine file, but care must be taken that the diaphragm is not scratched.

9.4.4.1 Storage

The pH and redox-ORP combination probes may only be stored wet. For this purpose, pour a little 3-molar KCl solution into the protective cap or case and slide or screw on to the sensor.

Ensure by a visual check that the pH probes are free from entrapped air bubbles. If air bubbles are present, remove them by vigorously shaking the

probe downward (like an old-school mercury fever thermometer).

9.4.4.2 Service life

Probes are subject to natural ageing even if handled correctly. Depending on the application, a service life of between 6 months and maximum of several years may be expected.

In individual cases, particularly when extreme service conditions are involved, their lifetime may be reduced to a matter of days.

*Subject to technical alterations.

9.4.5 Calibration Notes

Temperature Compensation: Conductivity sensors should always be temperature compensated, with the exception of the 2 wire boiler conductivity probes. In the Slimflex 5 controller, the conductivity temperature compensation can use either an internally integrated temperature sensor or a temperature sensor external to the conductivity sensor. **Note:** If the temperature reading is off by more than 3°F, you may have a failed probe or wiring problem. After any temperature calibration, test the temperature sensor with an ice bath.

If the calibration was not successful (more than +/- 50mV offset) it will display "Sensor fault Overrange".



CAUTION!

pH and redox-ORP electrodes have a limited shelf life, which is why we do not recommend storing them for more than three months.

Do not use distilled water for soaking, since this will lead to premature ageing and damage to the reference system.

9.5 General Sensor Calibration

the previously saved calibration.

All analog sensors can be calibrated directly based on a wet test, or using a 2-point method. You can reset the input to factory default calibration as well.

9.5.1 Single Point Sensor Calibration

1. Press the **CAL** button to start either method.
2. Use the Up and Down arrows to locate the sensor you wish to calibrate and press **OK**.
3. Notice the underline in the current value on the next screen. That is the cursor. In this single point calibration screen, the up and down arrows will adjust this digit. The right and left arrows will move the cursor to a different decimal digit allowing you to edit all digits so as to match your wet test. Pressing **F1 SAVE** completes the single point calibration adjustment.

9.5.2 Two Point Sensor Calibration or Factory Reset

1. Press the **CAL** button to start either method.
2. Use the Up and Down arrows to locate the sensor you wish to calibrate and press **OK**.
3. Press F3 More for Factory Reset or scroll down for the 2 point calibration
4. Press F1 Select
5. Place the sensor into a known value sample or pH buffer (i.e. 7.00 pH buffer). Adjust the reading until it is equal to the wet test or buffer. Press F1 to continue to the NEXT buffer.
6. Place the sensor in the second buffer (10.00 pH) or known sample and edit as before. Press **F1** to SAVE and finish or **F3** or **ESC** to CANCEL.

The controller may accept the value and show the Sensor Calibrated screen.

If the value entered is too far from what the controller has calculated as valid, based on the input signal, a fault message will be displayed. Then you will be given 3 choices on how to proceed.

Press **F1** to RE_CAL-*ibrate* the sensor [try again, maybe you forgot to put the sensor in the buffer?].

Press **F2** to IGNORE the fault and keep the current calibration even though it is not generally advisable. The controller will perform the math to make the display match your entry. The ability to track changes may be marginal or not possible if the sensor is faulty.

Press **F3**, RESET to cancel this calibration and return to

9.6 Analog Sensor Alarms

Analog inputs have high and low alarms, to alert the operator if a measured value is out of the normal operating range. All alarms in the Slimflex 5 are latching alarms. Latching alarms do not reset themselves if the parameter recovers back into the acceptable range. The operator must acknowledge the alarm for the alarm light and relay to reset to the OFF mode.

Latching alarms are especially helpful for remote installations where the operator checks on the system a few times a day or less. Under certain circumstances, if there is a control or feed problem and the alarm does not latch, the operator would not know there is an issue.

The Slimflex 5 also has an option to delay the alarm before alerting the operator. This feature is most helpful in applications where trapped air or other conditions cause the sensor reading to spike occasionally, but it is normal operation for that process. Without the delay the controller would have frequent nuisance alarms that would require acknowledgement by the operator. This option is in minutes and adjustable from the alarms menu. See below.

Alarm settings for all Inputs and outputs work in the same way. There are 3 types of settings for the alarms on any I/O.

- Adjust Alarms changes the High and Low alarm limits.
- Delay on Alarm adjusts the time the Slimflex 5 will wait before activating and latching an alarm,
- Clear Alarms, as implied will clear all alarms. Follow the steps below to alter the Alarm limit settings for any alarm.

9.6.1 Analog Alarm Configuration

- 1- Press **MENU**
- 2- Scroll down to **Adjust Alarms** and press **OK**
- 3- Scroll down until you locate your sensor and press **OK**

Note the underline in the high alarm value. This is the cursor.

You now have 3 choices; Edit the High and Low values, (**F1 OTHER** toggles between the Hi and Low alarm adjustment setting), **F2 ALMOFF** (turn the alarm off) or **F3 DELAY** (adjust the delay time).

The delay time postpones the controller from reporting an alarm unless the sensor is in the alarm state for the number of delay minutes you choose.

To adjust the High and Low values:

- 1- Use arrows to adjust the high alarm value as needed. Press **F1 OTHER** to switch to the low alarm.
- 2- Use the arrows to adjust the low alarm and press **OK** to save.

To turn the alarm off, press **F2 ALMOFF**

If you wish to edit the delay, press **F3 DELAY**

Use the arrows to edit the time in minutes and seconds and press **F1** to **SAVE**.

9.7 Analog Sensor Diagnostics

- 1- Press **MENU**
- 2- Scroll up to I/O Status and press **OK**.
- 3- Use the arrows to find the I/O point you wish to evaluate.
- 4- Press **F3 MORE**, to see the first Diagnostic for this sensor.
- 5- Press the down arrow to scroll through the remaining Diagnostic screens.

List of typical sensor Diagnostics:

- Sensor Type
- Raw Sensor input value
- Gain Multiplier
- Offset Adjustment
- Last alarm
- Current Status

A CTFS sensor will then show the current temperature of the sample water, and if flow is on or off. This page also shows a voltage representing the amount of flow and at what point above which flow is considered ON.

Driver cards have a list of other items that are used for factory tracking and troubleshooting.



HINT

To see Diagnostic information of any I/O from main display, Press [F1] (STATUS) then scroll to any I/O and use [F3] MORE to scroll through its parameters

Programming the Outputs

9.7.1 pH-ORP Driver card Diagnostics

- To see diagnostic press **F1**
- Use Up/Down Arrow keys to navigate to desired pH-ORP input then press **F3**
- Diagnostic 1: sensor Type pH Sensor
- Diagnostic 2: Raw sensor value
- Diagnostic 3: Gain will change based on calibration
- Diagnostic 4: Offset will change based on calibration
- Diagnostic 5: reports any type of Alarm
- Diagnostic 6: Driver Type, Dual pH or ORP
- Diagnostic 7: Factory Use
- Diagnostic 8: Factory Use (Driver Type and Product Code)
- Diagnostic 9: Driver card Serial Number
- Diagnostic 10: Factory Use
- Diagnostic 11: Driver card Firmware version for example "01.00.02.00"

9.7.2 CT (Conductivity, Boiler Cond., Condensate and Temperature) Driver card Diagnostics

- To see diagnostic press **F1**
- Use Up/Down Arrow keys to navigate to desired Analog Conductivity input then press **F3**
- Diagnostic 1: sensor Type (Conductivity, Boiler Cond., Condensate)
- Diagnostic 2: Raw sensor value
- Diagnostic 3: Gain will change based on calibration
Sensor Value = Raw x GAIN + OFFSET, for example $999 \times 0.16 + 0 = 1599 \mu\text{S}$
- Diagnostic 4: Offset will change based on calibration
- Diagnostic 5: reports any type of Alarm
- Diagnostic 6: Driver Type, Dual conductivity
- Diagnostic 7: Factory Use
- Diagnostic 8: Factory Use (Driver Type and Product Code)
- Diagnostic 9: Driver card Serial Number
- Diagnostic 10: Factory Use
- Diagnostic 11: Driver card Firmware version for example "01.00.00.02"
- Diagnostic 19: Temperature Input Value

9.7.3 The 4-20mA output Driver Card Diagnostics

- To see diagnostic press **F1**
- Use Up/Down Arrow keys to navigate to desired 4-20mA output I/O then press **F3**
- Diagnostic 1: sensor Type 4-20mA output
- Diagnostic 3: Gain will change based on calibration
- Diagnostic 4: Offset changes based on calibration
- Diagnostic 5: reports any type of Alarm
- Diagnostic 6: Driver Type, Dual 4-20mA Output
- Diagnostic 7: Factory Use
- Diagnostic 8: Factory Use (Driver Type and Product Code)
- Diagnostic 9: Driver card Serial Number
- Diagnostic 10: Factory Use
- Diagnostic 11: Driver card Firmware version for example "00.00.00.01"

9.7.4 Serial Sensor (CTFs) Input A Diagnostics

- To see diagnostic press **F1**
- Use Up/Down Arrow keys to navigate to desired I/O then press **F3**
- Diagnostic 1: sensor Type (Conductivity)
- Diagnostic 2: sensor Raw value
- Diagnostic 3: Gain, changes based on calibration
- Diagnostic 4: Offset,
- Diagnostic 5: reports any Alarm
- Diagnostic 12: if sensor connected it will display (Sensor OK Connected) if no sensor connected to terminals (Sensor disabled Disconnected)
- Diagnostic 13: will display phantom input Temperature value and also if the Thermal flow switch is ON/OFF.
- In this example Flow value should be higher than 960 to display Flow ON.

*Note: Sensor Value = Raw x GAIN + OFFSET
For example = $235 \times 8.5 + 0 = 1998 \mu\text{S}$ about $2000 \mu\text{S}$*

9.8 Configuring Digital Inputs

9.8.1 Configure a Digital Input as a Water Meter:

NOTE: All digital inputs O-T can be configured for a pulsing water meter

- 1- To Enable and Set a digital input press **MENU**
- 2- Scroll to **System** and press **OK**
- 3- Scroll to Enable I/O and press **OK**
- 4- Scroll to select the desired input (O through T) and press **F3**
- 5- Press **F3** again to switch from METER to CONTACT if necessary, then press **OK**

Once enabled, continue the configuration if needed:

- 1- Press **MENU**
- 2- Scroll to Water Meter Setup then press **OK**
- 3- Scroll down to your meter, then press **OK**
- 4- Use **F3** to switch to Vol/Contact if necessary, then use Up/Down and Left/Right arrow keys to set gallon per contact or to adjust the K factor, then press **F1** to SAVE.

Note: See [9.2 Changing a Descriptor](#) to rename the I/O point.

9.8.2 Link a Water Meter to a Feed Relay

Relays must be configured for Feed mode, See section [10.4 Configuring Cooling Tower Relays](#)

- 1- Press **MENU**
- 2- Scroll to **Set Feed Mode** then press **OK**
- 3- Scroll to the desired relay. Press **OK**
- 4- Select the Feed Mode type: Water Meter and press **OK**
- 5- Scroll to select the meter and press **F1** to Select and then **OK**
- 6- Use arrow keys to edit the measure value
- 7- Press the **F1** key, OTHER, to move to the Feed volume value.
- 8- Set the relay ON time in seconds.
- 9- Press **OK** to save

9.9 Disable an Analog or Digital Input

- 1- Press **MENU**
- 2- Scroll down to **I/O Setup** and press **OK**
- 3- Scroll down until you locate your sensor analog or digital, and press **OK**. (This example shows an analog input)
- 4- Scroll down to **Configure** and press **OK**
- 5- If the sensor is not currently being used to control a relay, you can disable it. Scroll down to **Disable** and press **OK**.
- 6- If the sensor is in use by a relay, scroll down to **Used by I/O** to see which relay is using the sensor. Press **ESC** (Escape).

Inputs linked to outputs cannot be disabled until unlinked.

If necessary, use the next sections to unlink the output, then return to this menu to disable the input.

Programming the Outputs

9.9.1 Changing or Unlinking an Analog Input Tied to an Output Relay

Inputs linked to outputs must be un-linked prior to being disabled.

To Unlink a sensor:

- 1- Press **MENU**
- 2- Scroll down to Set Feed Mode or Set Blowdown Mode. Press **OK**
- 3- Scroll down to the relay indicated in the 'IN USE' menu seen in step 6 on the previous page if necessary. Press **OK**.
- 4- Make any change to the program and press **OK** to unlink a sensor.

The sensor can now be disabled. See Section [9.9 Disable and Analog or Digital Input](#).

To change the analog sensor in the control scheme, start above and skip step 4.

- 5- Scroll up or down to the new sensor and press **OK**
- 6- Press **F1**, 'Select' to save this choice.
- 7- Press **ESC**, Escape

Return to the [9.9 Disable an Analog or Digital Input](#) menu, to finish.

9.9.2 Changing or Unlinking Analog Inputs Tied to a 4-20mA Output:

Relay outputs are designated by their number, 1 through 5. 4-20mA outputs can be letters C, D, E or F. This procedure can be used to change the input that the mA output represents, or you can choose 'None'.

Inputs linked to outputs must be un-linked prior to being disabled.

- 1- Press **MENU**
- 2- Scroll down to I/O Setup and press **OK**
- 3- Scroll down to the 4-20mA output letter and press **F2**, 'NEXT'.
- 4- Use the up or down arrows to choose another input, or choose 'None' and press **OK**.
- 5- Press **ESC** (Escape).

If unlinking an analog input so as to disable it, return to the [9.9 Disable an Analog Input](#), to finish.

9.9.3 Changing or Unlinking a Digital Input Tied to a Digital Output

If a digital input is used as an interlock for a relay, it must be unlinked prior to being disabled.

- 1- Press **Menu**
- 2- Scroll down to I/O Setup and Press **OK**
- 3- Scroll down to the relay where the interlock is being used. Press **OK**.
- 4- Scroll down to Interlock and press **OK**
- 5- Press **F1** (Remove) to unlink the digital input from this output.
- 6- Choose a new interlock or press **OK** to save the change. If more than one interlock, use the arrows to see them and remove as needed. Escape will void all changes.

See also [10.8 Interlocks](#)

Return to [9.9 Disable an Analog or Digital Input](#) to finish

9.9.4 Changing or Unlinking a Digital Input Tied to a 4-20mA Output

If a digital input is used as an interlock for a relay, it must be unlinked prior to being disabled.

- 1- Press **MENU**
- 2- Scroll down to I/O Setup and Press **OK**
- 3- Scroll down to the 4-20mA Output where the interlock is being used. Press **OK**.
- 4- Press **F2** Next two times to get to the Interlocks
- 5- Press **F1** (Remove) to unlink the digital input from this output.
- 6- Choose a new interlock or press **OK** to save the change. If more than one interlock, use the arrows to see them and remove as needed. **ESC**, Escape will void all changes.

See also [10.8 Interlocks](#)

Return to [9.9 Disable an Analog or Digital Input](#).

9.10 Phantom Inputs

The Slimflex 5 has a maximum of 5 wired analog inputs, A, C, D, E and F. The first 14 letter of the alphabet, A through N, are assigned to the analog group. I, J, K, M and N can be phantom inputs. These letters cannot be assigned to any wired input. They have no terminals. These are phantom or virtual analog inputs.

The most common use of a phantom is to display the input of a sensor that has more than one sensor value. The CTFS sensor has conductivity, temperature and a flow switch in one sensor using only the A terminals. The value for conductivity is the A input. The temperature must use an analog phantom and the flow switch a digital phantom. See 9.1.2 Enable a CTFS

Digital Inputs are lettered from O to Z. Wired inputs are labeled from O to T. Input designators U, V, W, X, Y and Z can be used as phantom digital inputs.

In some cases it is advantageous to create a phantom sensor to duplicate an existing hardware sensor. Another use is to assign a phantom “virtual” input to show and data log a temperature sensor or flow switch that is an integral part of another sensor.

Any analog input, including Phantom's, can be used as a manual input to data log operator test data. If you test the water each turn, you can log that value into this controller. It will be time stamped and is part of the complete historical database with all sensors, phantoms and relays.

Analog phantoms can be programmed to be used in control outputs in the same manner as any sensor input.

10 Programming the Control Outputs (Relay and 4-20mA)

This section will describe how to configure relays to control a process and 4-20mA outputs for control or as an indication of an analog input. Relay outputs can be energized based on a sensor with ON/OFF set-points, a timed event, an ORP sensor that controls during an event, bleed and feed, bleed then feed or a percent timer. These can include interlocking with digital inputs, blocks from other relays and a few special controls. Special Controls include the boiler captured sample routine, timed cycling and time modulation.

The part number and identification code on the order placed with ProMinent will determine the sensors and outputs that were configured as default at the factory. Some sensors may have been pre-wired, (pH and ORP coaxial cables, some conductivity and temperature sensors for example). Other sensors like water meters and chemical feeders may have been configured, but will have to be field installed, wired, enabled and possibly re-configured during commissioning.

The B'DOWN (Blowdown) choice means that the relay must be linked to a conductivity sensor. The output will turn on and off based on set-points.

The Events-Other and Feed choices require further programming as well. These steps are explained in detail later.

Note: When an output is disabled and then re-enabled, the control is reset and all user control settings removed. This action puts the relay control into a defined state prior to reconfiguring.

A sensor input can be used as an analyzer or monitor, but to be able to control a feeder or a valve, it needs to be linked to an output. Linking is achieved in the configuration process. See Section [10.4 Configuring Cooling Tower Relays](#)

Note: this setup is done during the enabling of the output.

Output relays, once configured, must be disabled and re-enabled if you need to change their type. See section [10.2 Enable and Configure a Relay](#).

10.1 Determine if a Relay is Enabled:

- 1- From the Home display, press the **F1 STATUS** key.
- 2- Scroll through the enabled I/O. If you **do not see** your relay, it is disabled.

10.2 Enable and Configure a Relay

- 1- Press the MENU key
- 2- Use the ARROW keys to scroll to System then press OK.
- 3- Scroll up to Enable I/O then press OK
- 4- Scroll through the disabled I/Os until you see your relay.
- 5- Once the output is selected, press F3 ENABLE key.
- 6- The relays have the following control choices:

10.2.1 Cooling Tower controller relays:

Relay 1: Feed chemical based on a water meter volume, Bleed and Feed, Bleed then Feed, or percent time.

Relay 2: Is a blowdown relay using simple setpoint control or the captured sample routine. Use the setpoint routine with in reverse mode to feed inhibitor to a closed loop.

Relays 3, 4 and 5: Can be configured in the same manner as relay 1, and additionally to control by a sensor or a timed event. These relays can choose to feed an oxidant based on ORP during an event. They can also be configured as an alarm relay.

10.2.2 Boiler Controller relays:

Relay 1: Control blowdown based on a sensor, a water meter or percent time, as a percent of each five minutes.

Relay 2: Blowdown as relay 1 plus all options available on relays 3, 4 and 5 below.

Relays 3, 4 and 5: Sensor control including timed cycling and time modulate, Timed event, percent time, water meter

At this time, we recommend naming the relay to avoid confusion during programming. Be advised, this allows for one space to be changed at a time, unlike the ease of typing on a PC or your phone. See the Browser manual for more information. Once named, we will set up the remaining relay attributes.



Please note the F2 key functionality:

The name edit has three choices, **ALPHA** (upper case letters), **alpha**, (lower case letters), and **NUMBERS**, 0 through 9. When the lower case 'alpha' is seen, please realize that this is a choice, not the current selection.

Use the up and down arrows to determine which mode you are currently using. Press the F2 key to move to the mode seen on the screen.

10.3 Naming the Output

In section 10.2, we showed how to enable a relay. Regardless of the type of relay you choose, the next step is to name it.

Pick a name that identifies the relay for you or your customer; Blowdown, Acid, LJ25X, Amine, etc.

- 1- Press Menu.
- 2- Scroll down to I/O Setup. Press OK.
- 3- Scroll down to the relay you chose to name and press OK. If your relay is not listed, it is not enabled.

See **10.1, Determine if a Relay is Enabled.**

- 1- Press OK to edit the description of the relay.
- 2- Use the right arrow to move to the second position. Press the F2 key to choose alpha, lower case letters. Notice that the F2 choice now shows NUMBERS. That would be the next choice.
- 3- Use the arrows to change the next letter/space and continue until your word is spelled.
- 4- When finished, press OK to save.

10.4 Configuring Cooling Tower Relays

A Slimflex 5 controller set for a cooling tower application will have some relays preconfigured from the factory. You can change some of these configurations.

Here are the possible configuration choices for each cooling tower relay. Each type is explained in detail following this list.

- **Relay 1 Control Type: Feed**
 - **Feed**
 - **Mode = Water meter w/setpoint in gallons then seconds**
 - **Mode = Bleed then Feed**
 - **Mode = Bleed and Feed**
 - **Mode = Percent Time**

- **Relay 2 Control Types: Blowdown**
 - **Blowdown.**
 - **Mode = Water meter w/setpoint in gallons then seconds,**
 - **Mode = Sensor – Control By:**
 - Cond - Simple SP
 - Phantom – Simple SP
 - **Mode = Percent Time**

- **Relays 3, 4 and 5 Control Types: Feed, Events Other**
 - **Feed**
 - **Mode = Water meter w/setpoint in gallons then seconds**

- **Mode = Sensor – Control By:**
 - Conductivity, pH, Temperature
 - Simple SP
 - Timed Cycling
 - Time Modulation
 - ORP
 - Simple SP
 - Timed Cycling
 - Time Modulation
 - Events with Event Control
 - Digital Input with Deadtime
- **Mode = Bleed then Feed**
- **Mode = Bleed and Feed**
- **Mode = Percent Time**
- **Events-Other**
 - Special Control –
 - Alarm Output
 - Pre-Bleed Lockout
 - Events

Programming the Outputs

10.4.1 Feed Based on a Water Meter

A water meter feed lets you choose how long to run a pump or feeder based on a particular number of gallons or liters accumulated on a meter. Change the set-points anytime to adjust the amount of chemical feed.

Prior to these program steps, you need to enable a water meter input. See [9.1.1 Enabling an Analog or Digital Input](#) and [10.4 Configuring Cooling Tower Relays](#).

- 1- Press **MENU**, then
- 2- Scroll down to Set Feed Mode. Press **OK**
- 3- Scroll down to the relay you wish to configure and press **OK**.
- 4- Scroll down to Water Meter and Press **OK**.
- 5- Scroll down to the water meter you will be basing the feed upon and press **F1**, (Select). A box will appear on the display to the left of the input. Press **OK**.
- 6- Use the arrows to edit the number of gallons needed to start the feed timer, then edit the feed time value. Use the **F1 OTHER** key to toggle between these values.
- 7- Press **OK** to save.

10.4.2 Feed Based on Bleed and/or Feed

The Slimflex 5 has two feed modes based on how long the bleed valve is open. The Feed relay in the **Bleed then Feed** program will wait until the Bleed is complete, then calculate how long to feed based on the percentage selected.

Prior to configuring these program steps, you need to enable a Blowdown relay. See section [10.4.4 Sensor Controlled Blowdown](#). If you have not enabled the Feed relay, see section [10.4 Configuring Cooling Tower Relays](#)

10.4.2.1 Bleed then Feed

- 1- Press **MENU**.
- 2- Scroll down to Set Feed Mode. Press **OK**
- 3- Scroll down to the relay you wish to use to control the pump. Press **OK**.
- 4- Scroll down to the Bleed then Feed choice and press **OK**.
- 5- Scroll down to the blowdown valve you will be using and press the **F1**, **Select**.
- 6- Press the **F2**, **SETPNT** key.
- 7- Use the arrows to edit the % value per the above explanation. Press **OK** to save.
- 8-

A **pulse relay** will feed X milliliters per minute

10.4.2.2 Bleed and Feed

The Slimflex 5 has two feed modes based on how long

the bleed valve is open.

The Feed relay in the **Bleed and Feed** program is based on a 5 minute time frame. The controller calculates how long the feed pump should be on based on 300 seconds X the percentage entered and starts to feed when the remainder of the 300 second bleed equals this calculated amount. Example: If the percent is 80, the controller calculates 80% of 300 or 240 seconds, then starts the feed when the bleed count down reaches 240 seconds. Both relays will count down to zero. The feed relay will stop. The bleed will reset to 300 seconds and continue counting down.

When the bleed stops, the feed stops and the counters are reset.

Prior to configuring these program steps, you need to enable a Blowdown relay. See section [10.4.4 Sensor Controlled Blowdown](#). If you have not enabled the Feed relay, see section [10.4 Configuring a Cooling Tower Relay](#)

- 1- Press **MENU**.
- 2- Scroll down to Set Feed Mode. Press **OK**.
- 3- Scroll down to the relay you wish to use to control the pump. Press **OK**.
- 4- Scroll down to the Bleed then Feed choice and press **OK**.
- 5- Scroll down to the blowdown valve you will be following and press the **F1**, **Select** key.
- 6- Press the **F2**, **Set-point** key.
- 7- Use the arrows to edit the % value per the above explanation. Press **OK** to save.

10.4.3 Feed Based on Percent Time

This method applies to the first 5 relays and the pulse relays when programmed for ON/OFF mode.

The Percent Time program is based on a 5 minute time frame. The controller calculates the percent of 300 seconds and will turn on the feed relay for that calculated time. Each 5 minutes, the calculated time is again applied to the feed relay.

If you have not enabled the Feed relay, see section [10.6 Configuring a Feed Relay](#).

- 1- Press **MENU**
- 2- Scroll down to Set Feed Mode and press **OK**.
- 3- Scroll down to your feed relay and press **OK**.
- 4- Scroll down to Percent Time and press **OK**.
- 5- Use the arrows to edit the percentage and press **OK** to save and exit.

10.4.4 Sensor controlled blowdown

A blowdown relay requires the use of a conductivity sensor. See section [9.1.1 Enable an Analog or Digital Input](#).

Simple blowdown:

- 1- Press **MENU** and scroll down to **Set Blowdown Mode**. Press **OK**.
- 2- Scroll down to **Sensor Control**. Press **OK**
- 3- Scroll down to your conductivity sensor, if necessary, and press **OK** to select it.
- 4- Enter the ON and OFF set-points. Use the UP and DOWN arrows to edit the underlined digit. Use the RIGHT and LEFT arrows to move between the digits. Press **F1 OTHER** to switch between the ON and OFF set-points.
- 5- Press **OK** to save and exit. Use the I/O Setup screen to set [interlocks](#) and [blocks](#). See [10.8](#) and [10.9](#).

10.4.5 Feed Based on a Sensor

(See also [10.5.3 Feed Based on a Sensor with Event Control](#))

A sensor based relay will turn on a pump or valve depending on the ON and OFF set-points you set for this relay. Prior to these program steps, you need to enable an analog sensor input. See [9.1 Analog and Digital Inputs](#) and [10.2 Enable and Configure a Relay](#).

- 1- Press **MENU**.
- 2- Scroll down to Set Feed Mode and press **OK**
- 3- Scroll down to the relay you wish to use and press **OK**.
- 4- Scroll down to Sensor Control and press **OK**.
- 5- Scroll down to the sensor you wish to use and press F1, Select.
- 6- Use the arrows to edit the On set-point. Press **F1**, OTHER to toggle between the On and Off values.
- 7- Press **OK** to save.

10.4.6 Timed Cycling:

Note: Special Control for Feed type relay. These instructions work with relays 3, 4 and 5.

Often there is a long time delay between adding a chemical and measuring its effect at a sensor. This causes set-point overshoot and poor control.

Examples: Pumping acid into a large process tank or adding bleach to a cooling system with a large sump volume.

Timed Cycling feeds for a user defined **ON Time** then waits for a user defined time before feeding again, allowing the system to respond to the fed chemical. During the **ON Time**, ON-OFF pumps feed on set-point control.

The **On Time** and **Period** are adjustable. The Off Time is the difference between the two.

If the **Period** is 50 seconds and the **On Time** is 10 seconds, the Off Time will be 40 seconds.

The '**Chemical 123**'**Diagnostic** display counts down the time in the **ON Time** and **OFF Period**.

Selecting a **Special Control** automatically sets typical default times or sensor values.

Adjust the default values for your site's application.

- 1- To Set and adjust the Timed Cycling press MENU
- 2- Scroll to the I/O Setup selection and press OK
- 3- Scroll to select the desired relay (2:Chlorine Pump) and press OK
- 4- Scroll to Special Control and press OK
- 5- Scroll to Timed Cycling and press F1
- 6- Use Up/Down and Left/Right Arrow keys to Edit the Period value then press F2. In this example the default **900 second Period**.
- 7- Use Up/Down and Left/Right Arrow keys to Edit the ON Time then press F2. In this example the default is **120 second ON Time**.
- 8- Relay 2 is now ON for 120 seconds and OFF for 780 seconds in each 900 second Period.
- 9- Press ESC Escape to save and exit.



SPECIAL CONTROL TIP:

When using Timed Cycling, Time Modulate or PID control, best results for tuning the loop are achieved if you only change one variable at a time and wait for two or three cycles to observe the effect of this change. This would include changing the stroke % of the pump and any setting in the special control program.

Programming the Outputs

10.4.7 Time Modulate

Note1: Time Modulate is a Special Controls selection for Feed type relay

Time modulate has adjustable turn on and turn off set-points, a period and a direction, Increasing or Decreasing the variable. Example of Increasing: A chlorine pump will increase the ORP reading. Example of Decreasing: A acid pump will decrease pH.

When using Time Modulate on an increasing control loop, the Turn On set-point will be lower than the Turn Off set-point. When the ORP is below the Turn On set-point, the output relay is on constantly. When ORP is above the Turn Off set-point, the output relay is off constantly. In either case, Time Modulate is not operating until the ORP is between the set-points. It is on in proportion to the ORP value with respect to the range between the set-points.

Example: Period=100 seconds, ORP **Turn ON** set-point = 400mV and ORP **Turn OFF set-point** = 500mV, current ORP = 450mV. 450mV is half way between 400 and 500 so the pump will be on for 50% of the period time or in this example $100 \times 50\% = 50$ seconds and off for 50% or 50 seconds. If the ORP drops to 430, the pump will be on for 70% and off for 30% of the 100 second period.

- 1- To Set and adjust the Time Modulate press MENU
- 2- Scroll to the I/O Setup selection and press OK
- 3- Scroll to select the desired relay (2:Chlorine Pump) and press OK
- 4- Scroll to Special Control and press OK
- 5- Scroll to Time Modulate and press F1
- 6- Use Up/Down and Left/Right Arrow keys to Edit the Period value then press F2 in this example the default Period is set to **120 second**
- 7- Use ESC key to Exit

Use the Adjust setpoints menu as needed.

10.5 Configuring an Event-Other Relay

10.5.1 Schedules, Prebleeding, Lockout and With a Sensor

Events are typically used to feed biocides on a pre-determined schedule with weekly or daily schedules being the most popular.

A weekly example might be; Every Monday feed biocide A for 20 minutes at 7 AM, then feed biocide B every Thursday, for 25 minutes at 7 AM. (This requires two relays, one for each pump).

Choose a daily schedule if you wish to feed the exact same schedule every day.

You can choose a 28 day cycle to accommodate feeding every other week or once every 4 weeks. Enter events in the first and third weeks and they will repeat every 4 weeks giving you feed times every odd week.

Schedules generally do not follow a calendar. Daily choices repeat every day. If you choose the 28 day cycle, the next screen will tell you which week you are in, 1, 2, 3 or 4. Weekly entries match a weekly calendar. Sunday is day 1 and Saturday is day 7.

Any event has an option to configure prebleeding and/or lockout to maximize the effect of the product. The idea of locking the bleed valve during and after feeding a non-oxidizing biocide improves effectiveness by increasing contact time.

Programming a prebleed ensures that the tower not cycle up above the blowdown set-point avoiding a scaling situation. The prebleed setup will open the bleed valve until a timer has expired or a low conductivity set-point is reached. The biocide feed start time is delayed by this action.

The lockout time is used to ensure the blowdown valve is closed during and after the feed event. Be sure to choose a lockout time that is the sum of both the feed time and post feed lockout. If you feed for 20 minutes and wish to keep the bleed valve closed an additional 60 minutes, you need a lockout time of 80 minutes!

If you have not enabled the Feed relay, see section [10.4 Configuring Cooling Tower Relays](#)

Use an event in conjunction with a sensor to limit ON time during the event. See [10.5.3 Feed Based on a Sensor with Event Control](#)

10.5.2 Add, Remove, Edit Events

Once a relay is enabled as an Event – Other output, you can add, remove or edit events.

The first step is to choose a cycle.

10.5.2.1 Choosing a Cycle

- 1- Press **MENU**. Scroll down to Biotiming, Events and press **OK**
- 2- Scroll down until you see your relay and press **OK**. If you do not see your relay, it is not enabled. See [10.2 Enable and Configure a Relay](#)
- 3- If you do not have any events, you can choose to add an event or configure the relay. Press **F3** CONFIG to configure the relay.
- 4- The configure menu allows you to set up a Prebleed, a Lockout and the Cycle. Scroll down to Event Cycle and press **F1** to SELECT. We will cover Prebleed and Lockout in the next section; [10.5.1 Schedules, Prebleeding, Lockout and With a Sensor](#)
- 5- Use the right and left arrows to pick Daily, Weekly or 28 day cycles. Press **F1** to Select.
Continue with the event setup by selecting **F3 Back**.

Depending on the cycle chosen, you will see slightly different screens.

- 1- The Add screen presents a default day, (unless in a daily cycle), start time and pump ON time. Use the arrows to edit these values and press F1 to save the changes. Use the Add function to create as many events as you wish during the cycle. The maximum number of events per cycle is 28.
- 2- Use the left/right arrows to choose a frequency. ONCE will enter only the event you set. It will repeat each cycle. (Once a day, once a week or once every 4 weeks.)
- 3- Press F1, **Add** to enter another event for this relay, or F2, **Adjust** to edit or delete an event or F3, **Config** to re-configure the relay.

Add a Prebleed/Lockout time to the event if desired. See [10.5.2.2 Prebleed/Lockout](#)

Finish the programming. Use [10.3 Naming the Output](#), [10.8 Interlocks and](#), [10.9 Blocks](#), or [10.5.2 Add, Remove or Edit Events](#)

10.5.2.2 Prebleed/Lockout

NOTE: In addition to a feed relay, this procedure requires the use of a blowdown relay. See section [10.4.4 Sensor Controlled Blowdown](#)

1. Press **MENU**. Scroll down to Biotiming, Events and press **OK**
2. Scroll down until you see your relay and press **OK**. If you do not see your relay, it is not enabled. See [10.2 Enable and Configure a Relay](#)

3. If you do not have any events, you can choose to add an event or configure the relay. Press **F3** CONFIG to configure the relay.
4. Press **F1**, Select to choose Prebleed
5. Scroll down to find the blowdown relay and press **F1** to SELECT it
6. Scroll down to find the Conductivity sensor and press **F1** to SELECT it.
7. Press **F3** to return to the Configuration menu and **F1** to Select Prebleed again.
8. Use the arrows to adjust the Prebleed time. Press **F1** to SAVE
9. Press **F3**, Config.
10. Press **F1** to choose Lockout
11. Use the arrows to edit the lockout time. This value should include the feed time of the pump. It is not the length of time after the pump stops.
12. Press **F1** to Save.

Finish the programming. Use [10.3 Naming the Output](#), [10.8 Interlocks and](#), [10.9 Blocks](#), or [10.5.2 Add, Remove or Edit Events](#)

10.5.3 Feed Based on a Sensor with Event Control

Relays in Feed mode based on an ORP sensor can have an Event Control whereby the relay will control based on a sensor but only during the event time.

Use section [10.5 Configuring an Event-Other Relay](#).

10.6 Configuring Boiler Controller Relays

A Slimflex 5 controller set for boiler applications will have some relays preconfigured from the factory. You can change some of these configurations.

Here are the possible configuration choices for each boiler controller relay. Each type is explained in detail in previous and following sections to follow.

- **Relay 1 Control Type: Blowdown.**
 - **Blowdown**
 - **Mode = Water meter w/setpoint in gallons then feed seconds**
 - **Mode = Sensor – Control By:**
 - Boiler Conductivity - Captured Sample or Simple SP
 - Conductivity - Simple SP
 - Condensate Conductivity – Simple SP
 - **Mode = Percent Time**
- **Relay 2 Control Types: Feed, Blowdown, Events Other**
 - **Feed**
 - **Mode = Water meter w/setpoint in gallons then feed seconds**
 - **Mode = Sensor – Control By:**
 - Conductivity, pH, Temperature
 - Simple SP
 - Timed Cycling
 - Time Modulation
 - ORP
 - Simple SP
 - Timed Cycling
 - Time Modulation
 - Events with Event Control
 - Digital Input with Deadtime
 - **Mode = Bleed then Feed**
 - **Mode = Bleed and Feed**
 - **Mode = Percent Time**
 - **Blowdown**
 - **Mode = Water meter w/setpoint in gallons then feed seconds**
 - **Mode = Sensor – Control By:**
 - Boiler Cond- Captured Sample or Simple SP
 - Cond - Simple SP
 - Condensate – Simple SP
 - Phantom – Simple SP
 - **Mode = Percent Time**
- **Events-Other**
 - Special Control – Alarm Output
 - Events
- **Relays 3, 4 and 5 Control Types: Feed, Events Other**
 - **Feed**
 - **Mode = Water meter w/setpoint in gallons then feed seconds**
 - **Mode = Sensor – Control By:**
 - Conductivity, pH, Temperature
 - Simple SP
 - Timed Cycling
 - Time Modulation
 - ORP
 - Simple SP
 - Timed Cycling
 - Time Modulation
 - Events with Event Control
 - Digital Input with Deadtime
 - **Mode = Bleed then Feed**
 - **Mode = Bleed and Feed**
 - **Mode = Percent Time**
 - **Events-Other**
 - Special Control – Alarm Output
 - Events

10.7 Boiler Blowdown:

Blowdown valves and solenoids typically require 120VAC or line voltage.

10.7.1 Continuous Boiler Blowdown

Continuous Boiler blowdown is common on larger, high pressure boilers and routes a continuous low flow stream through a sample cooler upstream of the thermally compensated conductivity sensor. (4-wire probe) The blowdown valve is installed on a parallel line to the flash tank.

Continuous blowdown control is configured like a cooling tower bleed and is therefore not detailed in this section of the manual. See [10.4.4 Sensor Controlled Blowdown](#)

10.7.2 Captured Sample Blowdown

Captured Sample is the preferred method for smaller and medium sized boilers because it does not require a continuous sample, sample cooler or cooling water supply. A continuous sample on a small boiler would drop the conductivity too quickly. Controlling the conductivity level would be extremely difficult, wasting water that has been treated with chemicals, filtered and heated.

The 2-wire conductivity sensor used in the Captured Sample method is not thermally compensated since by design, boilers maintain a reasonable constant temperature and pressure. Therefore, the Measure sequence requires a reading from a steady temperature sensor. Flashing is disruptive to this method, so plumbing is critical to a proper reading.

Refer to [Figure 64 Boiler Blowdown Diagram](#)

A sample from the skimmer in the drum is passed by the sensor, a motorized valve or solenoid, then MOST IMPORTANTLY, a needle valve or small orifice. The object of the restriction is to ensure that the flashing, (high pressure, high temperature water 'flashes' when subjected to a much lower pressure) is limited to a point after the motorized valve. The restriction divides the high and low pressure whereby the flashing takes place after the restriction, not near the sensor. In this way, the electronic valve operates in a constant bath of liquid with no air or gas present. Air bubbles are the number 1 reason for failure to correctly read the boiler conductivity!

Therefore, be certain that all valves upstream of the sensor are 100% open and restrictions minimized. Flashing must be limited to the needle valve.

The **sample routine** has 4 steps; Sample, Measure, Blowdown, and Resample.

The Sample time should be set for a long enough period that ensures a fresh sample has passed the sensor.

The Measure time is 60 seconds. This cool down period increases accuracy of the reading as well as adding to the life of the probe. Typically, this value is not adjusted.

Blowdown defaults to 120 seconds, a good starting point.

Resample is the wait time between sample cycles.

After the resample time has elapsed, the valve opens and takes a new sample to start over.

Basic operation:

At the start of a captured sample routine, the blowdown valve opens for the **Sample** period. The pipe at the sensor should be hot before the valve closes.

The **Measure** stage holds the valve closed for 1 minute to cool the sample and get a steady reading. The controller uses the sensor value at the end of the measure period. This sensor reading is converted to a conductivity value and compared with the set-points. If too high, a blowdown step is started. If below the turn off set-point, the blowdown step is skipped.

The **Blowdown** valve is now opened for the set time and closed. A second measure time is started, allowing the sample to cool as before, read the sensor and compare it to the set-points. As long as it is above the turn off point, the controller will oscillate between the measure and blowdown steps.

Once the conductivity low level is reached, the **Resample** timer holds the valve closed until the next cycle starts.

NOTICE:

If the routine is not keeping the boiler conductivity within the preferred range, consider these adjustments;

Conductivity rises: 1) If the conductivity rises too much between samples, decrease the resample delay time (Run the routine more often).

2) If the measure/blowdown steps are repeating without stop, lengthen the blowdown time or open the restriction to allow more flow.

Remember, opening the restriction moves you closer to

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losing control of the flashing. Adjust in small amounts and monitor 2 or 3 cycles before approving the change. Pay close attention to the plumbing layout in Figure 64. The direction of the pipes is not as important as having the flashing controlled beyond the sensor and blowdown valve!

Choosing the captured sample routine and setting the timers;

- 1- Press MENU
- 2- Scroll down to I/O Setup and press OK
- 3- Scroll down to your blowdown valve and press OK
- 4- Scroll down to Special Control and press OK
- 5- Scroll down to Captured Sample and press F1 SELECT.
- 6- Use the arrows to adjust the value if necessary then press F2 Save when done.
- 7- Adjust the Measure, blowdown and resample values as needed. Press F2 Save to continue.

The routine is set. Continue to use this menu to edit the relay name, engineering units, decimal digits, interlocks and blocks.

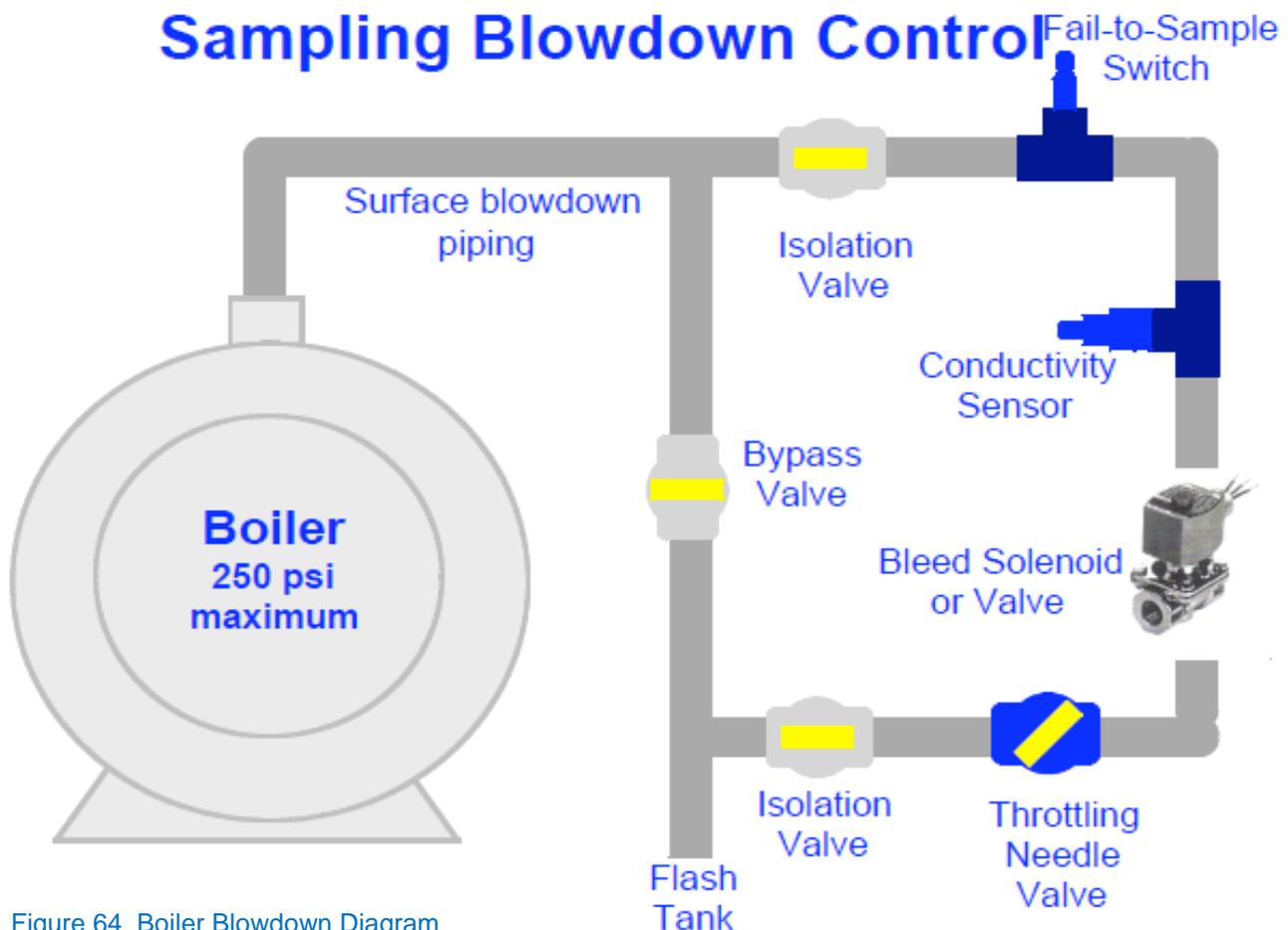


Figure 64 Boiler Blowdown Diagram

10.8 Interlocks

Interlocks are digital inputs that temporarily pause an output from operating (Relays 1 to 5 and 4-20mA outputs). Typically, a cooling tower control program will include a digital input signal from a flow switch. When the flow switch indicates that no sample water is flowing, any relay that has this digital input listed as an interlock will stop operating until the flow is restored.

Boilers can use 'online' relay dry contact signals to enable which boilers can be bled or have chemicals fed to them.

10.8.1 Setting/Removing Interlocks

- 1- From the MENU page, scroll down to I/O Setup and press OK
- 2- Scroll down to the relay you wish to edit and press OK
- 3- Scroll down to 'Interlock' and press OK
- 4- Scroll up and down to see all available interlocks (digital inputs configured as Contact Set) Press **F1** to select.
- 5- The block  symbol indicates that this input is currently selected.

From this screen, you can choose **multiple interlocks** or remove them. Once an interlock is chosen, the **F1** key will remove it.

Notice the F2 key says **'OR'**. This means if you have selected multiple interlocks for this relay, then press F2, the interlocks will be 'ORed'. 'ORed' means that if any one of the interlocks are ON, (shorted) the relay will be enabled. If you leave the 'OR' choice alone, you are in the 'AND' mode. The **"ANDed"** mode means **all** chosen interlocks must be ON to produce the enabled state.

Multiple Interlocks are not typical.



Choice, not Status

The F2 key gives a choice of AND or OR. What you see on the display is not the current status, it is the choice you can have after you press the F2 button. Therefore, if it shows OR, you are in the AND mode. If it shows AND, you are in the OR mode.

Any one interlock can be used on multiple relays and 4-20mA outputs. Typically, all outputs on a cooling tower are paused by the flow switch input.

10.9 Blocks

Blocks are used to ensure that two or more relays (Relays 1 to 5) are not on together should they be incompatible or cause problems. Often, chemical pumps will be blocked by the blowdown valve to prevent chemical feeding going down the drain.

Setting blocks

- 1- Press the MENU key
- 2- Use the ARROW keys to select I/O Setup, then press OK
- 3- Use the ARROW keys to select the relay to be blocked, then press OK
- 4- Use the up/down ARROW keys to select 'Blocked by' then press OK
- 5- Use the up/down arrow keys to locate the relay that will block the one above and press SELECT [F1]. A solid square  will appear to the left of any and all output(s) selected. Press **F1 REMOVE** to deselect an output. Once the blocking output selections are correct, press OK to save your selections. If you forget to press the OK key, the selections will not be saved.

10.10 Control Action (ON Decreases/ON Increases Sensor):

Control Action tells the controller what direction to expect the sensor value to take if the relay is turned on. Since Acid will drive a pH downward, this would be set for 'ON Decreases'. Most chemicals drive the sensor upwards. That would be an 'ON Increases' setting. The Control Action choice allows the output control to be inverted. This could be useful if the only blowdown valve available is a normally open solenoid, or if other controls require the inverted control signal. If you need to switch from acid to caustic on a pH control application or feed inhibitor based on conductivity, you can reverse control using these steps.

- 1- Press MENU
- 2- Scroll to the I/O Setup selection and press OK
- 3- Scroll to select the relay desired and press OK
- 4- Scroll to Control Action and press OK
Screen shows "ON decreases sensor" which is normal for blowdown function as the conductivity should decrease when the blowdown valve is open.
- 5- To invert the output to "ON increases sensor" press the SWITCH [F1] key, then press OK.

Since the basic control has changed, the display changes to the relay Adjust Set-points screen to allow

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you to edit the new set-points. You will notice that the On: and Off: values have been reversed.

- 6- Use the ARROW and OTHER keys to change the limit points if needed, then press OK to accept and use these values.

10.11 How to Setup a Relay as an Alarm Output:

An Alarm relay (Relays 3, 4 and 5) will change states whenever the controller posts an alarm condition on the alarm page.

Note: R1-R5 relays are Form C (SPDT) and if using NC contact for Alarm, NC contact is not held closed so losing power won't open the contact.

- 1- To Set a Relay to an Alarm press **MENU**
- 2- Use Up/Down Arrows to navigate to **I/O Setup**
- 3- Scroll to select the desired relay (for example 5:unused) and press **OK**, if there is no selection (Empty list) it means you haven't set any relays as an Event-Other
- 4- Use Up/Down Arrow keys to select **Special Control** then Press OK
- 5- Use Up/Down Arrow keys to Scroll to **Alarm Output** Press F1
- 6- Use **ESC** key to Exit

Note: See [9.2 Changing a Descriptor](#) to rename the relay.

10.12 Prime (Force On) a Relay

All relays can be forced on temporarily if not disabled, blocked or interlocked. If disabled, see [10.2 Enable and Configure a Relay](#). If blocked, see [10.9 Blocks](#). If Interlocked, see [10.8 Interlocks](#).

- 1- To force any relay on, press Menu.
- 2- Scroll down to Prime, Force ON and press OK.
- 3- Scroll down to the relay of your choice and press OK.
- 4- If the relays is blocked or interlocked, it will not prime until these impediments are removed. Blowdown relays are not included.
- 5- The timer defaults to 5 minutes. Use the arrows to adjust as needed. The underline is the cursor.
- 6- Press F3 Start
- 7- If you wish to stop the relay prior to the timer ending, press F3 Cancel.

10.13 4-20mA outputs:

4-20mA Outputs display both the loop current and it's corresponding 0-100% value. In Manual mode, you set the output percent.

Use **Manual mode** to verify that 100% equals 20mA and 0% is equal to 4mA. Confirm the operation of the proportional pump or valve that the 4-20mA output is controlling or verify that the receiving device, DCS or recorder, is displaying the correct value range.

Auto mode allows you to pass along an input analog value to an output device. The output can be scaled to all or any part of the input range.

A conductivity sensor with an operating range of 0 – 5,000uS could be set to output 4mA at 2,000uS and 20mA at 4,000uS for example. A temperature could be scaled from 32 to 120.

The scale can be set backwards to control an oxidant pump for example. An ORP value of 500mV could be set for 4mA causing the pump to stop, and set for 20mA when the ORP is 450mV causing the pump to run at maximum speed.

The mA outputs are powered from the SlimFlex 5 controller driver card with a 24VDC supply. The DC isolated 4-20mA output alarms on an open loop, or incorrect wiring.

Calculating Loop Current:

4-20mA Output current is based on this equation; $(CV-ZP)/(|FS-ZP|/16))+4$ where CV is the Current Value, FS is Full Scale value, ZP is the 4mA value, typically zero.

First, find the absolute value of the difference in the range and divide by 16. Divide this number into the current value (displayed on the controller), then add 4.

For example:

Using a conductivity range of 0 – 5,000uS, what is the current output when the reading is 3,000uS?

$$\begin{aligned} &((3,000-0)/(|5,000-0|/16))+4= \\ &(3,000/(5,000/16))+4= \\ &(3,000/312.5)+4= \\ &9.6+4= \mathbf{13.6mA} \end{aligned}$$

The output card can be configured to drop to 4mA when the stop button is pressed on the keypad (when using to control a pump or solenoid) or to continue if used to send sensor value to DCS.

10.13.1 How to assign 4-20mA output to measured value (application: feedback to PLC/DCS):

- 1- To Set 4-20mA output to measured value press **MENU**
- 2- Use Up/Down Arrows to navigate to **I/O Setup**
- 3- Scroll to select the desired output (for example E:4-20mA output) and press **OK** and then press F2 **Auto**.
- 4- Use Up/Down Arrow keys to select desired input (here we selected pH input) then press F1 **Select**.
- 5- If an interlock is desired, scroll up or down to the interlock and press F1 to select it, or just press F2 to skip this step.
- 6- Decide if you want an open loop to generate an alarm. Use Switch to toggle between yes and no and OK to save any change. Press F2 to move to the next step.
- 7- Controls a pump means if the red Stop button is pressed on the front of the controller, the output will drop to 4mA. Otherwise, the controller will assume the output is for information, not control, and continue to output the appropriate mA signal.
- 8- Set the high sensor value then press F1
- 9- Set the Low sensor value then press F1. Done.

10.13.2 How to set 4-20mA output to Manual Mode:

- 1- To Set 4-20mA output to Manual press **MENU**
- 2- Use Up/Down Arrows to navigate to **I/O Setup**
- 3- Scroll to select the desire 4-20mA output (for example E:4-20mA output) and press **OK** and then press F3 to set it to Manual
- 4- Use Up/Down and Right/Left Arrow keys to set the desire percentage (0-100% is 4-20mA), press F1 and then F2
- 5- Press F2 to go to next display since we are not controlling the output with any type of sensor in Manual Mode
- 6- If any interlocked needed use UP/Down arrow keys to select one of the digital or phantom inputs then press F1 and then F2 to go to next display
- 7- If any open loop alarm needed (if the 4-20mA output doesn't see a closed loop you will get open loop alarm) use F3 to switch back and forth between ON and OFF and F1 to save changes
- 8- Use **ESC** key to Exit

Programming the Outputs

10.13.3 Calibration of a 4-20mA Output

To calibrate 4-20mA output you will need a Multimeter set in mA mode placed in series with the output card and a load. See [Figure 65](#)

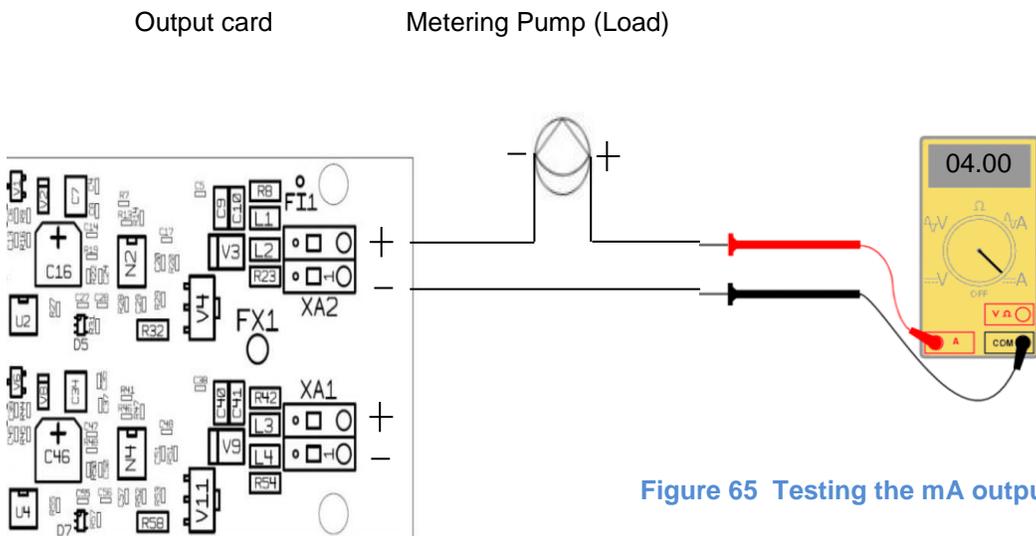


Figure 65 Testing the mA output

- 1- From the HOME display, press the CAL key
- 2- Using the UP and DOWN ARROW keys choose the 4-20mA Output you would like to calibrate, then press OK.
- 3- Observe the reading on your mA meter that is in series within your circuit. It should be close to 4.00 mA. Use the ARROW keys to match the controller display with your meter reading and press OK.
- 4- Press F1 to calibrate 20.0mA output. The display should read about 20.0mA.
- 5- Use the ARROW keys to match the controller display to your meter reading then press F1 to save.
- 6- Press F1 to go to Next screen.
- 7- Choose another output or press ESC to return to the main display

If the calibration was not successful (calibrate limits @ $\pm 0.5\text{mA}$ @ 4mA & $\pm 15\%$ on span (about $\pm 2.4\text{mA}$)). it will display "Sensor fault Overage", consider three choices after a fault; (**RECAL** to recalibrate, **IGNORE** to ignore the fault and accept calibration, **RESET** to reset calibration back to factory defaults)

11 System Menu

The System Menu is accessed by pressing the MENU key followed by the up arrow and the OK key. The following sections discuss the options available and how to edit the information. The options below appear in the order they are in the display if you use the down arrow to scroll.

The choices are:

- Communications
- System Setup
- Time and Date
- Set Sensor Type
- Enable I/O
- Passwords
- Activity Log
- Diagnostic
- Configurations

11.1 Communications

The Communications section has the IP addresses for the LAN and WiFi connections. Scroll down through; LAN IP Address, WiFi Netmask Address, WiFi IP Address, LAN Gateway, MAC Address and LAN Netmask.

Address Type	Default Setting
LAN IP Address	10.10.6.106
WiFi IP Address	192.168.1.1
LAN Gateway	192.168.100.1
Mac Address	nn.nn.nn.nn.nn.nn
LAN Netmask	255.255.255.0

Table 15 IP Addresses

The LAN address and Netmask can be changed if the controller will be on a network. The network administrator must provide a LAN address for this device. Edit them here.

The MAC address is assigned to the controller from the factory and cannot be changed. It is unique in the world. WiFi is how to connect wirelessly. Enable WiFi on your PC, Notebook or Smartphone.

This controller can be accessed by 4 simultaneous WiFi users. Consult the Browser manual for more information.

11.1.1 How to Change the IP Address:

The factory default IP Address of the controller is 10.10.6.106.

You can connect any PC device with an Ethernet port to the controller using a CAT5 Ethernet cable. Set up your device with a static IP address of 10.10.6.nnn, where, 'nnn' is a 3 digit number from 000 to 255 but not 106. 106 is the unique address of the controller.

Open a browser and enter 10.10.6.106 into the search box to make an HTTP connection to the controller. Refer to the Browser manual for more details.

If your controller is attached to a local area network (LAN) the IP address of the controller will need to be changed to match the plant scheme. This address is assigned by the site IT staff.

Enter that address as shown here.

- 1- To Edit IP Address press **MENU**
- 2- Use Up/Down Arrows to navigate to **System** then press **OK**
- 3- Scroll to **Communication** then press **OK**
- 4- Use F1 to go to Edit Mode
- 5- Use Up/Down and Left/Right Arrow keys to Edit the IP Address then Press F1 to save the change
- 6- Press NEXT to go to Netmask setting
- 7- Use F1 to go to Edit Mode if necessary
- 8- Use Up/Down and Left/Right Arrow keys to Edit the Netmask then Press F1 to save the change
- 9- Use ESC key to exit and return to the main display

11.1.2 Web Interface Wi-Fi

PC's, tablets and phones can connect to the Slimflex 5 via Wi-Fi.

The IP Address and Netmask for Wi-Fi is fixed (hard coded) so the only way to differentiate the connection between controllers is the Wi-Fi SSID #.

The SSID is the name you will see/connect to when using WiFi. From the factory, the last 3 digits of the name will be the same as the last 3 digits of the controller serial number. Should you be in an account that has multiple controllers, you need this to know which unit you are choosing a connection.

Once you are connected and logged in, you can change the SSID to anything you wish. The change will take place after you cycle power to the controller.

SSID: Service set identifier is a name for the wireless network.

The SSID cannot be edited from keypad. A Browser connection must be used.

11.2 System Setup

System Setup has 9 options;

- Site Name
- Controller Name
- Keypad Passwords
- Metric Units
- Sunday = Day 1
- Number of Systems
- Alarm on Stops
- System Restart
- Factory Reset
- Language

11.2.1 Site Name/Controller Name

You can label this device with two separate names. These names appear in any data file downloaded so as to help delineate these documents. The controller name also shows on the browser tab when connecting with a PC, tablet or Smartphone.

Edit these names using the keypad:

Notice the F2 key represents the word 'alpha'. You have three choices, ALPHA (upper case letters), alpha, (lower case letters), and NUMBERS, 0 through 9. Since the lower case 'alpha' is seen, please realize that this is a choice, not the current selection.

The default choice is upper case so use the up and down arrows to change the first digit. You will see the uppercase letters scroll by. Hold the key down for fast scroll, or press to move one letter at a time. Once you have rested on the letter you choose, press the right arrow to move to the next position.

Press the F2 key to choose **alpha**, lower case letters. Notice that the F2 choice now shows NUMBERS. That would be the next choice.

When finished, press **OK** to save.

11.2.2 Keypad Passwords On/Off

Use this page to turn keypad password protection ON/OFF. See section [11.5 Passwords – Login/Logout](#) to change your password, login or logout.

11.2.3 Metric Units

Switch Engineering units to Metric. Use the F2 key to make changes. Then press F1 to save.

11.2.4 Sunday=Day 1

Use this if you are setting up timers with a 28 day cycle. Since a 28 day cycle has 4 weeks of timers, setting this as week 1 lets you know that what you set up in week 1 will happen this coming week. (Every week is week 1 in a 7 day cycle.) See more in section [10.5.2.1 Choosing a Cycle](#)

11.2.5 Number of Systems

This is a function of the browser interface. Consult the browser section.

11.2.6 Alarm on Stops

Pressing the **STOP** button at any time will stop all outputs. It will also create an alarm condition unless you change it.

This **STOP** cannot be undone using the browser. It can only be engaged, or not, from the keypad.

11.2.7 System Restart and Factory Reset

System Restart will reset timers and clear alarms.

Factory Reset will perform a System restart plus all programming will be erased, the date and time will be reset and the controller will reboot. Neither will reset passwords nor change IP addresses.

11.3 Time and Date:

To Set Time and Date:

- 1- Press **MENU**
- 2- Use Up/Down Arrows to navigate to System then press **OK**
- 3- Scroll to Time & Date then press **OK**
- 4- Use Up/Down and Left/Right Arrow keys to set the Time
- 5- Use **F3**, Up/Down and Left/Right Arrow keys to set Date
- 6- Use **F2**, Up/Down and Left/Right Arrow keys to set Week day then press **OK**
- 7- Use **ESC** key to Exit and back to main display

11.4 Set Sensor Type

Use this to set the type of a new conductivity sensor. Used on boiler controllers only. Select from condensate or Boiler conductivity. Tower controllers only have 'Conductivity' as the choice.

Scroll up or down to find the sensor and press OK to select it. Then select the type.

11.5 Passwords – Login/Logout.

Use this section to change your password if the password option is enabled. If not enabled, See [11.2.2 Keypad Passwords On/Off](#) to turn protection on/off.

11.5.1 How to Change a Password:

There are 4 Operator level users, 3 Configure level users and one Admin user login. (8 Users)

The passwords allowed are the same on the keypad as those created/edited via a browser. You can edit your password from either place.

Operator level users can see the program parameters but not edit them.

Configure level users can change all programming but cannot edit system parameters.

The Admin user can edit all user parameters.

There is no manufacturers password. If you forget your password, ProMinent can reset the password list. All users would have to re-set their passwords.

If, while using the browser you fail 5 times, the controller will display “Alarmed” and lockout remote attempts until midnight. You can cycle power to the controller to reset this condition.

Keypad failures are not limited.

Keep in mind that the choice just before the button is pushed is the selected character type. Example: if the text above F2 says “alpha” pressing the F2 key once changes to lowercase.

Then use **F1** to save the change Use **ESC** key to Exit

11.6 Activity Log

Note: Most recent activities are shown first

- 1- To see the Activity Log, Press **MENU**
- 2- Use Up/Down Arrow keys to navigate to **SYSTEM** then press **OK**
- 3- Use Up/Down Arrow keys to navigate to **Activity Log** then press **OK**
- 4- Use F3 to set the Date (this will be a date that you want to see the activity for all I/O)
- 5- Set the date using Navigation keys and then press F1
- 6- The activities will be shown based on the Letters (for inputs) and digits (for outputs)
- 7- Use F1 key to go to Next activity and use Down arrow key to momentarily see the stamped time for that activity

User	Default PSW
Operator 1	1
Operator 2	2
Operator 3	3
Operator 4	4
Configure 5	5
Configure 6	6
Configure 7	7
Administrator	AAAA

Table 16 Default Users Passwords

- 1- To change a Keypad password Press **MENU**
- 2- Use Up/Down Arrow keys to navigate to **SYSTEM** then press **OK**
- 3- Use Up/Down Arrow keys to navigate to **Passwords** then press **OK**
- 4- Use Up/Down and Left/right Arrow keys to set your desire password (F2 on alpha for lower case letter, F2 on Number for Digits, F2 on ALPHA for Capital letter), use F1 to save password

11.7 Diagnostics

Serial #: The controller has a 10 digit number.

Fan Speed: displays fan speed, Monitoring fan if it fails will go to alarm

O-T wiring: 3 Wire meters only and if Digital input power supply fails because of miss-wiring.

Admin Password: Shows **Default** if it has not been modified from 'AAAA'. If modified, it will display 'Changed'.

Watchdog Reset: A **Watchdog Reset** should always display **0**. An increasing number of **Resets** indicates corrupted firmware or controller electrical fault or interference.

Relay Fuse: Displays the state of the Relay 1 and Relay 2 AC power fuse, Displays "Load Fuse open" if AC fuse is failed. The Board Fuse does not have an alarm. If it fails, the controller is without power.

Home Inputs: You can adjust which I/O points are displayed on the default menu.

See section 2.2 Modifying the Display's 'Home' Screen.

HMI Firmware: Hood **Firmware Version** indicates the date of issue of the firmware operating the keypad and display (16.04.06.00 means 2016-April-6th)

Firmware: Mother board **Firmware Version** indicates the date of issue of the firmware operating the controller (16.08.01.00 means 2016-August-1st)

11.8 Configurations

See section [13.2 USB – Save or Load the Program Configuration](#)

12 Controller Technical Data

12.1 Fuse Specification

The power relay fuse is 6.3 amps at 250 volts AC. This fuse is similar to the relay fuse used on the MultiFLEX and Aegis, except this is a slow blow fuse. Do not use this fuse in those controllers.

However, you can use the fast blow fuses provided with those controllers in the Slimflex 5. A fast blow fuse will not harm the device.

Component	Rating/type	vendor	Part#
Controller, Complete	100-230VAC, 50/60 Hz, 0.5-0.26A - No External Load	PFC	SF5
Controller, Complete	100-230VAC, 50/60 Hz, 7.8A - with External Load	PFC	SF5
Power relay R1,R2 and Power Out terminals	6.3 AT @250VAC 5x20mm, Slow-Blow, Glass Fuse	PFC	732379
Main Power Fuse	1.6AT 250VAC 5x20, 1.5 kA at 250 VAC ,Ceramic Fuse	PFC	732411
Enclosure	Rated for IP65	PFC	N/A

Table 17 Fuse Specifications

12.2 Controller Specifications

Description	Technical Data
Control characteristic:	ON/OFF, Proportional
Control:	5 Relays (see below)
Signal current output:	4-20 mA electrically isolated, max. load 450 Ω , range and assignment (measured, correction, control variable) can be set
Control output:	2 relays Line Power 3 Relays dry contact
	2 Maximum x 4 ... 20 mA
Alarm relay:	Relays 3 through 5 can be programmed as an alarm
Electrical connection:	100-240 V, 50/60 Hz, 30 Watt
Ambient temperature:	Ambient temperature 0 ... 50 °C (for inside deployment or with a protective enclosure)
Degree of protection:	Wall mounted: Rated for IP 65
	NEMA 4X (leak-tightness)
Tests and certification:	CE, MET (corresponding to UL as per IEC 61010)
Material:	Housing PC with flame proofing configuration
Dimensions:	356 x 235 x 105 mm (WxHxD)
Weight:	net 2.1 kg
Wire sizes	Power: 14 to 18 gauge. Outputs R3, R4 & R5 up to 12 gauge.

Table 18 Controller Specification



Fusing Relays R3, R4, and R5 for external power usage

Relays R3, 4 and 5 can be wired using on-board power as shown in section [6.3.4.4 Wiring Relays R3 – R5 Using On-board Power](#) or powered from an external source as shown in section [6.3.4.5 Wiring Relays R3 – R5 Using an External Power Source](#). When using external power, fusing must be provided by customer.

These relays are rated for a maximum of 5 amps each when using external power.

12.3 Sensor Specifications

Measuring Range/Measured value	
Measuring range connection type mV:	pH: 0.00 ... 14.00 ORP voltage: -1500 ... +1500 mV
Connection type mV (potentio- metric measured variables, measuring ranges according to the transmitters):	pH ORP millivoltage
Conductivity (variable ohm)	0 – 5,000µS
Conductivity (measuring ranges according to the transmitters):	0 – 5,000µS in a digital signal
Temperature:	via Pt 100/Pt 1000, measuring range 0 ... 150 °C
pH resolution:	0.01
ORP voltage:	1 mV
Temperature:	0.1 °C
Accuracy: based on the full-scale	0.3 %
pH/ORP measurement input:	Input resistance > 0.5 x 10 ¹² Ω
Correction variable:	Temperature via Pt 100/Pt 1000
Temperature compensation range:	0 ... 150 °C
Digital Inputs Auxiliary Supply	15VDC @ 50mA max

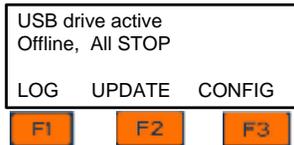
Table 19 Sensor Specifications

13 Using the USB Port

13.1 Capturing Data

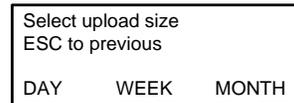
The Slimflex 5 logs all sensors, flow switches, meter values, relay ON times, fed volumes and status every 5 minutes. This data is easily captured from the USB port located behind the communication light cover.

- 1- Insert a USB flash drive into the USB port shown. The OLED screen will acknowledge the drive

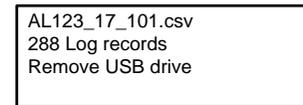
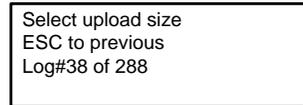


Phillips head screw

- 2- Choose F1, LOG to set up the download.



- 3- Choose the amount of history, DAY [F1], WEEK [F2], or MONTH [F3]. When you choose the period, the download starts.
- 4- *During the download, the keypad and browser connection are locked.*
- 5- The display will show the progress of the download
- 6- Once complete, the display will show the file name uploaded to the USB flash drive (ending in "csv"), the size of the file in number of records or time stamps, and instructs you to remove the drive to return the controller to normal operation.
- 7- Don't forget to close and re-secure the access door to assure the interior of the controller is not subjected to moisture or corrosive fumes from the environment.



No special conversion program or Excel add-in is needed to import the CSV formatted data into Microsoft Excel® or similar spreadsheet programs. Refer to your spreadsheet or graphing software product to learn how to import CSV data. (CSV = Comma Separated Value). The I/O data is stored in 5 minute intervals. (Not adjustable).

Values shown are as taken, not averaged over the 5 minute period. Relays show ON time in seconds if on/off.

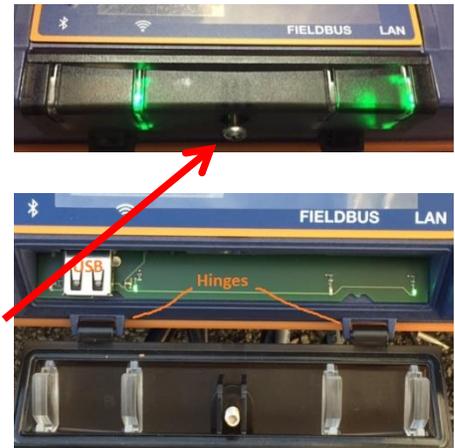


Figure 66 USB Access Door Closed [Top] and Open [Bottom]

Aegis II										
Serial number	Site name	Controller name		Firmware						
123	PFC	BW Test		1902352						
Log records										
I/O	Location	A	B	C	D	E	F	G	H	I
I/O	Units	uS		pH	mV	mA	mA	ppm	F	ppr
Date Da/Mo/Yr	Time	Conductivity	Unassigned	pH Sensor	ORP Sensor	pH mAOutput	ORP mAOU	Free Chlorin	Temperatur	CLE
3/8/2016	12:35:00	663.823	-100000	6.72	-5	3496.105	1200	-100000	-100000	
3/8/2016	12:30:00	661.725	-100000	6.71	-6	3505.023	1200	-100000	-100000	
3/8/2016	12:25:00	661.791	-100000	6.72	-7	3508.519	1200	-100000	-100000	
3/8/2016	12:20:00	661.871	-100000	6.73	-5	3503.924	1200	-100000	-100000	

Table 20 Partial example of captured data

13.2 Save or Load the Program Configuration

THIS IS NOT THE FIRMWARE INSTRUCTIONS. See 13.3 Firmware Upgrade

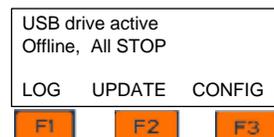
A program configuration is a list of instructions that the user can edit. Set-points, calibrations, names of I/O are all saved in the program configuration. You can save the configuration via a USB drive for backup purposes or to clone another controller. (Save from one controller and Load the configuration onto another.)

To see how to access the USB port, see section [13.1 Capturing Data](#).

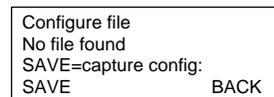
13.2.1 Saving to the USB

1- To **save** a copy of your current program onto a USB drive, insert a USB into the USB port located behind the Communication panel.

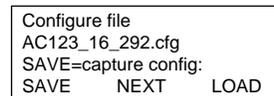
2- Press **F3 Config**



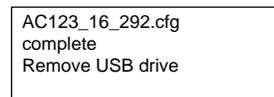
3- If you have **not** previously saved a program on this USB you can only **F1 SAVE** a copy to the USB.



4- If you have a previously saved program, you have the choice of saving **F1** or loading **F3**.



In either case, press **F1 SAVE** to copy the current configuration to the USB drive. When the save is complete, the display will notify you to remove the USB drive.

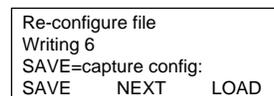


13.2.2 Loading from the USB

1- To load a previously saved program from the USB to your controller, insert a USB drive into the USB port as explained in step 1 above.

2- Press **F3 Config**

3- Press **F3 Load**.



4- The controller loads the program from your USB and notifies you to remove it.



Sometimes referred to as “Cloning”, a saved program file can be loaded onto a different Slimflex 5 controller. They will then have the same configuration.

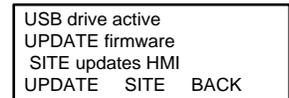
13.3 Firmware Upgrade using USB

If necessary, your controller can have the firmware upgraded. Firmware is a set of instructions which tell the controller CPU how to operate. Firmware is not your 'program configuration' which determines which relay operates when and how. The program configuration can be saved and if needed, re-loaded, or copied to another controller. See section, [13.2 Save or Load the Program Configuration](#)

1 File Please

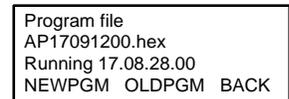
To avoid accidents and confusion with this important process, please remove all files from the USB drive prior to adding the .hex file. The controller will only allow you to view one file. Be sure you copy the correct file to the USB. If you have more than one, you may load the wrong file.

- 1- Obtain the hex file from ProMinent and insert thumb drive with the new file into the USB port located behind the Communication panel. See section [13.1 Capturing Data](#) above to find the port.
- 2- Press **F2**, UPDATE NOTE: If you do not have HMI files on your USB drive, when you press F2 you will skip ahead to step 4 below
- 3- The display explains the choice of pressing **F1 UPDATE** to continue this process, or to press **F2 SITE** to load HMI firmware. Choose **F1 UPDATE**.
- 4- The display now shows the one file from the USB drive; AP17091200.hex and the current hex file in use; Running : 17.08.28.00. Note: These numbers are date codes, year, month and day. '00' Indicates that this is a USB type file.

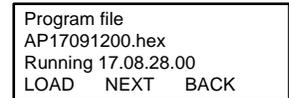


Your dates will differ from this example!

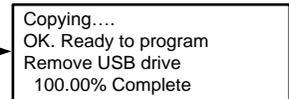
If the file on line 2 is the new firmware file, press **F1 NEWPGM** to select the new hex file.



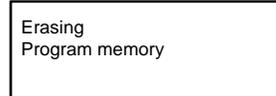
- 5- Press **F1 Load** to install the new hex file.



- 6- The firmware is copied to the controller. When complete Aegis will notify you to remove the USB drive.



- 7- After you remove the drive, the controller will erase the existing firmware and install the new one.



- 8- Once the new firmware is installed, the controller will restart.



13.4 E-mail Reports and Alarms

The E-mail function is explained in the Slimflex 5 Browser manual. You cannot access this feature through the keypad. The following explanation is for informational purposes only.

The E-mail tool can send three types of information; Alarms, Status and Daily data. Setup is via a PC or smart phone browser.

13.4.1 E-mail Types:

13.4.1.1 ALARM: Sent once when an alarm first occurs.

Lists all active alarms.
Includes enabled sensor, meter & contact values for alarm context
User Enabled/Disabled.

13.4.1.2 STATUS: Sent @ noon every day (12:00). Verifies that the controller is running & on the LAN.

Includes enabled sensor, meter & contact values.
Sent @ midday so that commercial systems will have some run time and some day is left to respond to operating issues.

13.4.1.3 DAILY: Sent @ midnight (23:59) every day. Verifies that the controller is running & on the LAN.

Includes enabled output run times or volumes and sensor, meter & contact values. User Enabled/Disabled.
All types send comma delimited values (CSV); one line per I/O or Alarm so that the both the subject & body can be easily parsed into a logging app, a typical use for the DAILY type.
Will make text-to-speech entertaining (bit encoded value-states are therefore intentionally excluded).

14 Spare Parts and Accessories

Slimflex 5 Controller - Base

Lower body section RAL5003 – Blue no electronics	1020595
Pc-board Slimflex 5, programmed complete. No WiFi	1094443
A2 WLAN (WiFi module)	734211
Battery BR2032	732829
Power supply 100-230V 5V 55W RPS-60-5	734526
Power supply cable 230V EPS-65-5AegisII	1050744
Power supply cable 5V EPS-65-5 AegisII	1050745
Fan 5VDC 50*50*10mm tachom. output	733328
Termination clip 3 port for power relays	733768
Termination clip – 2 port for pulse relay outputs	Ask
Termination clip – 3 port for digital inputs	Ask
A2 Fuse – Main Power 1.6A Ceramic 5x20mm	732411
A2 Fuse – Relays 6.3A slow blow 5x20glas	732379

Slimflex 5 Controller – Driver cards

A2 dual 4-20mA Output driver	734143
A2 dual pH & ORP with temp Input driver	1081805
A2 dual cond/temp Input driver	734223

Slimflex 5 Controller - Hood

Slimflex 5 Hood assembly complete (includes * items)	1094442
* Upper part Slimflex 5 RAL5003 blue hood	1059533
* Assy. Electronic Slimflex 5 HMI	734260
* Keypad Slimflex 5	1083482
* Ribbon cable 10P 2 socket 185mm	1050827
* USB 2.0 cable conn. A and Mini-B for hood	1058522
* LCD module 100x40 OLED 5V with cable	734486
Form Seal – Orange RAL2003 DXC	1020680

Cable

Cable, 2 conductor 22ga Quantity in feet	7760527
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Use this cable to lengthen 2-wire boiler probe wire or any 4-20mA signal.

Sensors and Accessories

Serial CTFS sensor (Conductivity-Temperature-Flow)

CTFS Sensor Assembly (includes 3 items)	7500979
3 Cond-Temp-Flow Serial Sensor	7761529
3 O-Ring seal for CTFS/CTF/TF Ass'y	7760577
3 Sensor entry fitting CTFS/CTF/TF	7760445
3 3/4" PVC Tee TxTxT Sch80	7741484

Potentiometric Sensors and Accessories

ORP sensor – Aquatics	7500442
Kll pH sensor – Aquatics	7500441
PHED 112 SE sensor	741036
RHEP Pt SE ORP sensor	150094
Coax cable, SN2 x Clamp, 32"	1024105
Coax cable, SN2 x Clamp, 6'	1024106
Coax cable, SN2 x Clamp, 30'	1024107
PHED/RHEP Long body probe holder	7746422
3/4" PVC Tee TxTxT Sch80	7741484
Metric PHED/RHEP long body probe holder w/T	1001493
Conductivity sensor, boiler 2/wire 250psi, 3/4" NPT,	7760189
Conductivity/Temp 4-wire, 250psi @ 450° F condensate	7760191
Conductivity boiler 3/4" cast iron Tee	7760384
Temp sensor Assembly* PT1000 & adapter for DGMA	1082254
* Resistance thermometer Pt-1000-SE	1080101
* Temp sensor adapter for SGT or PT1000 to DGMA	1051504
Temp Sensor, SGT, H2O Ground 316SS 1/4" MNPT 36"	1051505

Water meters

Size	For Cooling - Contact Head	For Cooling - Paddlewheel	For Hot Water - Paddlewheel
.75"	7760518	7760514	7760277
1"	7760515	7760508	7760279
1.5"	7760516	7760509	7760278
2"	7760517	7760510	7760280
3"	NA	7760511	7760281
4"	NA	7760512	7760282
6"	NA	7760513	NA

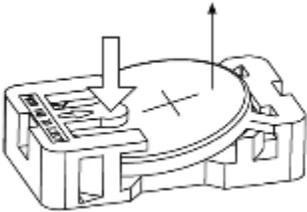
Table 21 Water meters

15 Maintenance

The Slimflex 5 Controller is maintenance free. Replace the battery after 10 years as a precautionary measure.

Battery type: BR2032, 3 V approx. 190 mAh

The battery is clamped in a holder on the Top center of the main board



NOTICE!

Hazardous waste

The battery is hazardous waste. It must be disposed of separately. Observe the conditions which apply on your site.

Figure 68 Aegis battery

Removing the battery

1. Unscrew the four retaining screws at the front on the housing upper section and take the housing upper section off from the housing lower section.
2. Press on the holder lug to release the battery from the holder, see Fig. 68
3. Insert a new battery in the holder, In so doing avoid pressing with the fingers on the battery poles. This will result in poor contacts.
4. Place the housing upper section on the housing lower section
5. Manually tighten the four retaining screws



CAUTION!

Solvent

Do not under any circumstances use solvent to clean the surfaces. Solvent can attack the surfaces.

Clean the housing with a damp cloth. Then rub dry.

16 Certifications

The Slimflex 5 Controller is built to conform to UL/CSA/IEC 61010-1 for safety. Additional information can be found on our website www.proMinent.us.

This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes: (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.



17 Necessary formalities

17.1 Disposal of used parts

Users' qualification: instructed persons, see [Section 4.5 Users' qualifications](#).

NOTICE!

Regulations governing disposal of used parts

– Note the current national regulations and legal standards which apply in your country

17.2 Agency Approvals

Safety: UL 61010-1, 3rd Edition
CSA C22.2 No. 61010-1-12, 3rd Edition
IEC 61010-1, 3rd Edition
EN 61010-1, 3rd Edition

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