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DULCOMETER®
DCM 510 series Aquatic Water Quality 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.

Contents

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Table of Contents

Table of Contents

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

There are two manuals associated with the DCM510 controller, the Assembly and Operating Instruction manual and a Browser manual. The Browser manual covers all Ethernet and WiFi communications and how to program the unit via a PC, tablet or Smartphone. Most programming operations are more easily performed in this manner.
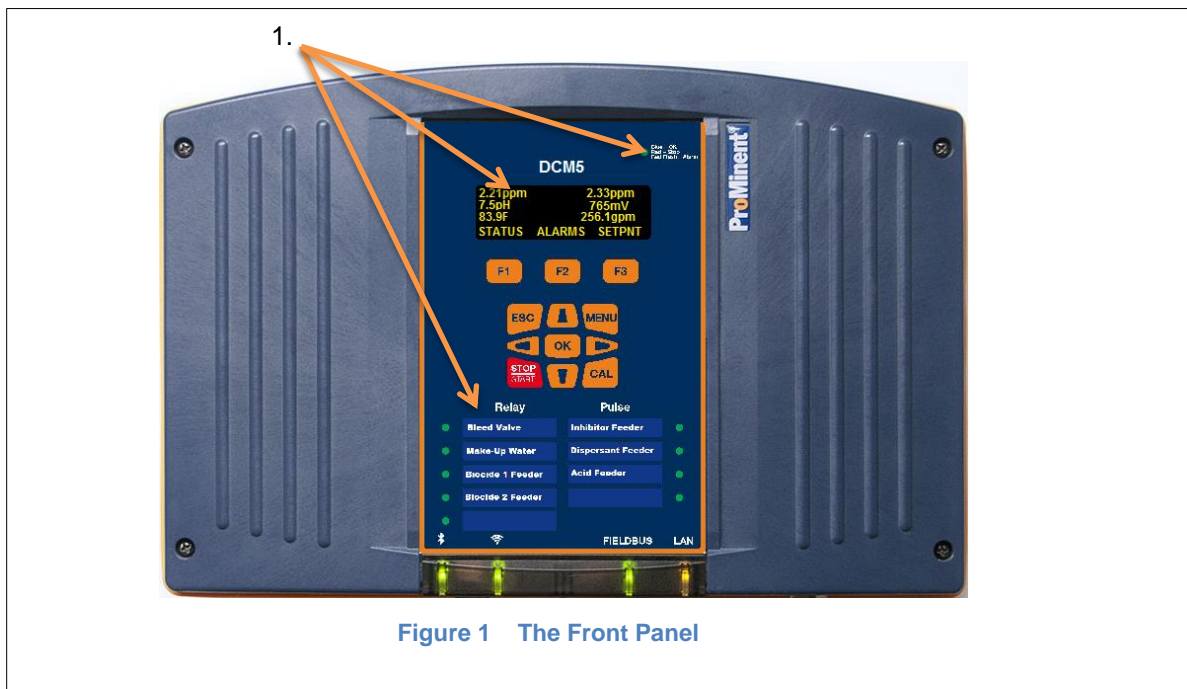
Figure 1   The Front Panel

1.1   The Front Panel

The DCM510 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 9 multicolored LEDs to indicate output 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 feeders is set to manual STOP, the status LED will be 'solid red'.

Figure 2 Status LED

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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.

1	2	3	4
Future	Wi-Fi (WLAN)	Fieldbus (LAN)	Ethernet (LAN)
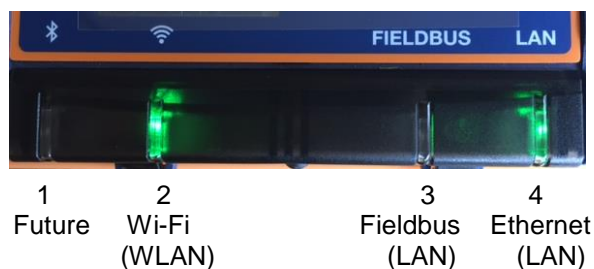
Figure 3 Communication Status LEDs

1.2   Functions of the keys

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

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**

2   Navigating the [Menu] display

Name of menu item	Jump to chapter
[Home]	↳ Return to the default display (See below)
[Adjust Set-points]	↳ Section 10.6.1 Feed Based on a Sensor
[Prime, Force ON]	↳ Section 10.23 Prime, Force On a Relay
[Adjust Alarms]	↳ Section 9.7.3 Analog Alarm Configuration
[Events]	↳ Section 10.9 Configuring an Event-Other relay
[Water Meter Setup]	↳ Section 9.9.1 Configure a Digital Input as a Water Meter or Status Input
[Set Feed Mode]	↳ Section 10.6 Configuring a Feed Relay
[Set Backwash Mode]	↳ Section 10.7 Configuring a Backwash Relay
[I/O Setup]	↳ Section 9.1 Analog and Digital Inputs
[I/O Status]	↳ Section 10 Programming the Control Outputs Use this menu choice to monitor the I/O
[System]	↳ Section 11 System Menu

Table 2 Main Menu lookup
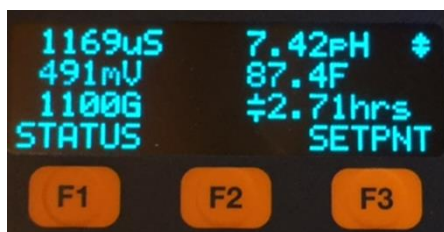
Figure 4 Typical default screen   Figure 4A Screen if any alarm present

The default display exhibits up to six current sensor values, and STATUS, ALARM and SETPNT buttons. The sensor choices can be changed or rearranged. See section **2.2 Modifying the '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 clear the latest alarms for all I/O points. See also section **9.7.3 Analog Alarm Configuration**, for more information on alarms.

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

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2.1 Input/Output Status [momentary display]

The Home screen, shown here with 6 input 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

   Note: The momentary information will remain on the display as long as you hold down the arrow key

Open Loop Warning

If you choose a 4-20mA output and press the right arrow, if the loop is not properly wired, you will see an Open Loop error
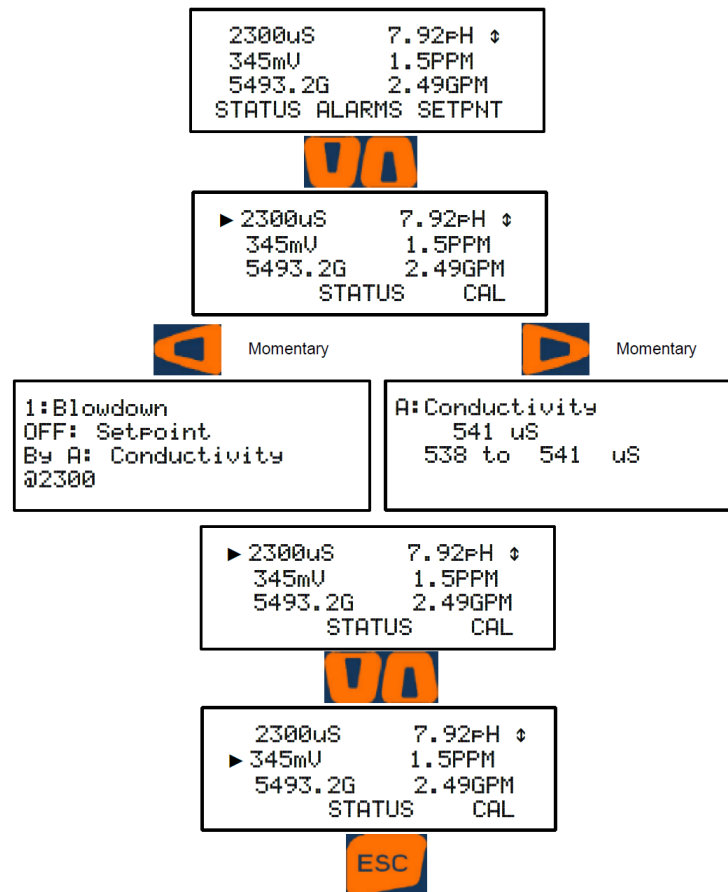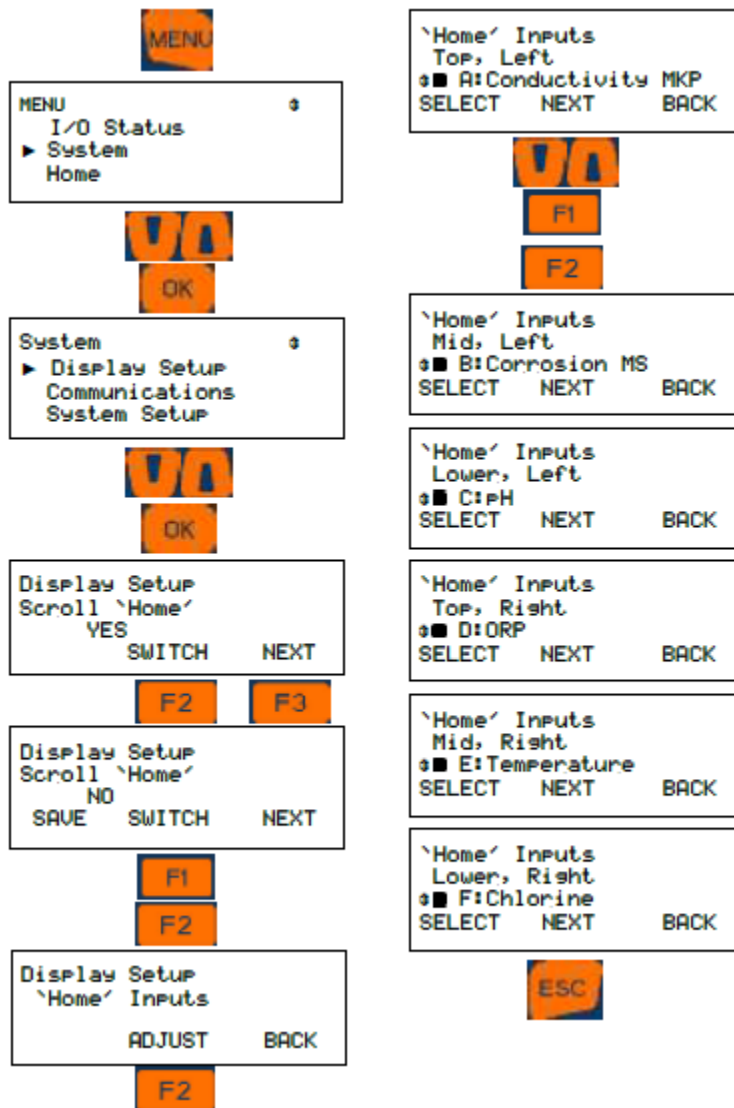
2.2 Modifying the 'Home' Screen

1- To set (modify) the Home Screen press MENU

2- Use the Up/Down Arrows to navigate to System then press OK

3- Scroll to Display Setup then press OK

You will now have the choice of 'Scrolling' the Home display. Once you choose the display points, if you choose 'scroll', you will see three points at a time.

4- Choose to scroll the I/O displayed or not by pressing F2 Switch. Press F1 Save if appropriate.

5- Press F3 Next to continue.

6- Press F2 Adjust to fill the display with I/O points or F3 Next to set the scrolling hold time.

7- Use the up/down arrows to find an I/O point for the top left corner of the display. Press F1 to select it then F2 to go to the next choice.

8- Continue choosing I/O points in this manner. At any time, press escape to exit.

3 Identcode

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

4   Safety and Responsibility

4.1   Explanation of the safety **information**

Introduction

> ⚠️ **CAUTION!**
>
> Read all installation and operating instructions completely before installing and operating this equipment.

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.

> ℹ️ 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!**
>
> 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.

> ⚠ **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!**
>
> 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.

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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.

CAUTION!

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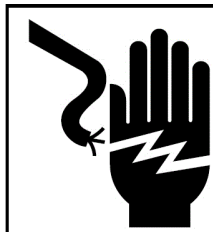
⚠ **DANGER**

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

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4.3 Intended Use

The device is intended for measuring and regulating liquid media in pool, spa, water features, splash pads and other aquatic 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!**

**Aquatic Water Treatment Controllers operate chemical feeders and other devices that may pump hazardous, corrosive and toxic chemicals.
Fully understand the implications of the control set-points, interlocks and alarms that you select.
Injury and damage to equipment may result from improper application.**

⚠ **CAUTION!**

READ AND FOLLOW ALL MSDS PRECAUTIONS REGARDING CHEMICALS USED

Water disinfection control involves irritating, corrosive, caustic, and potentially toxic chemicals. Please use extreme caution and comply with all national, state and local regulations and recommendations for the handling and storage of these chemicals.

It is the responsibility of the user of this equipment to obtain and follow the safety precautions of the manufacturer of the hazardous materials, including the proper use of all personal protective equipment.

⚠ **CAUTION!**

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

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⚠️ **WARNING!**

ProMinent controllers, like all modern electronic devices can be damaged by severe electrical spikes and surges, like lightning. Every effort has been made to harden your controller against such surges, but no precautions are 100% effective. Additional surge protection can be installed at time of installation, but even that is not a guarantee that surge damage will not occur. If surge damage occurs, chemicals could be fed to your pool or spa, continuously with no safety controls. If you inspect your ProMinent controller after a possibly damaging power surge (thunderstorm or power outage) and suspect the controller is not operating properly, disconnect the chemical feeders at once, and contact your ProMinent dealer for service.

⚠️ **WARNING!**

ALWAYS USE ANTI-SYPHON DEVICES

Uncontrolled feeding of chemicals can result in injury or death. Anti-Syphon devices must be installed on chemical feeders to prevent uncontrolled feed of concentrated chemicals. If a vacuum is created in the water circulation line and no anti-siphon device is installed on the chemical feeders, potentially hazardous concentrations of chemicals can be drawn into pool or spa. Always use injection check valves and anti-siphon valves in the chemical feed lines to prevent this situation.

⚠️ **WARNING!**

FLOW INTERLOCKS SHOULD NEVER BE BYPASSED, <u>EVEN TEMPORARILY</u>.

The DCM510 has the capability to assign a low flow interlock for a connected flow meter. The previous flowswitch precaution also pertains to those low flow lockouts. If the interlock is disabled or bypassed, the sensor would not be able to sense a hazardous situation and turn of the chemical feed pumps to prevent uncontrolled chemical feed.

⚠️ **WARNING!**

NEVER CONNECT FEEDER DIRECTLY TO POWER SOURCE

If the chemical feeders are connected solely to a wall outlet, the safety devices integral to your ProMinent controller, and necessary for the safe feeding of chemicals, may be bypassed. It is very important that the chemical feeders be connected to the controller and never solely to a wall outlet as the only way to control the feed of chemicals.

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⚠️ WARNING!

TEST FLOW SWITCH INTERLOCK REGULARLY

Testing of the flow switch regularly is essential to assure the flow switch stops chemical feed, remains stopped, and controller shows "Interlocked" within 20 seconds, whenever circulation flow stops. If the flow switch does not interlock chemical feed, plumbing corrections or the installation of additional flow switches or lockouts will be necessary to avoid uncontrolled chemical feed.

⚠️ WARNING!

NEVER OVERRIDE A FLOW SWITCH

Uncontrolled feeding of concentrated chemicals can result in personal injury or death. Sample and recirculation flow switches are critical safety devices which prevent uncontrolled chemical feed. Follow Instructions Carefully.

A Sample flow switch is provided with all ProMinent pool controllers and is an integral safety device to prevent the uncontrolled feed of chemicals, which could cause personal injury or death. This critical safety device must always be available to protect the swimmers and others near the pool.

An additional return line flow switch should always be installed to prevent chemical feed if return water to the pool is restricted.

⚠️ WARNING!

ELECTRICAL SURGES CAN DAMAGE YOUR CONTROLLER

Uncontrolled feeding of chemicals can result in injury or death.

A damaged controller could feed chemicals in an uncontrolled manner.

If you suspect your ProMinent controller is not operating properly, disconnect it from the chemical feeders until the problem has been corrected.

⚠️ WARNING!

Chemical feed during periods of no water flow, like filter backwash, can pose a serious health threat from potentially high chemical concentrations and hazardous chlorine gas formation.

This product must be installed with interlocks in place to avoid chemical overdose in case of loss of circulation flow in Pools and Spas.

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4.4 Warranty Guide

As of this date, the physical controller is warranted for 5 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.

Residual sensors are typically warranted for 12 months and the Industrial pH and ORP sensors are warranted for 24 months. All other sensors are 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.
> Unqualified personnel should be kept away from the hazard zone

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	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. 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.
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

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5   Functional Description

The DULCOMETER® DCM510 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® DCM510. The controller has been developed for continuous measurement and control of liquid analysis parameters in Aquatic applications. 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.

The controller's powered AC relays 1 and 2 may be used with solenoids, chemical metering pumps and related water treatment equipment, not to exceed 5 Amps total. Relays 3, 4, and 5 are dry contact mechanical relays that can be powered or unpowered "dry" contacts. If they are powered from the internal AC line power bus, they are fused by the same 5 Ampere fuse and limitation. If they are powered externally, external fusing may be required.

Typical applications:

- Swimming Pools
- Spas
- Water Features
- Zero Depth pools
- Splash Pads
- Therapy Pools
- Fountains
- Habitat environments for Mammals and Cetaceans

Standard Features:

- Two serial input channels for use with dual serial corrosion rate sensors or DP (differential Pressure) sensors.
- One dedicated digital Sample Flow switch input "O".
- Eight multi-purpose digital inputs for turbine and contact water meters and limit switches. ("U" and "V" are NAMUR - Intrinsically safe[1] contact inputs). See foot note on next page.
- One 4-20mA isolated analog input.
- One onboard analog temperature input.
- Temperature used for compensation of pH and conductivity sensor signals.
- Output Relays: On-Off, Time Modulated, (Pulse Width Modulation), Time Cycling, or PID control using any/all of the following: line voltage relays(2), unpowered 'dry' contacts(3), or Solid State DC contacts(4).

- Currently, 1 operating language (English)
- Saving the Controller Configuration to internal flash memory
- Cloning of controller configuration by saving and uploading via USB Flash Drive.
- Upgrading of the firmware using USB Flash Drive Data-logging all I/O at a 5-minute rate for 1 month.
- Ethernet LAN connection for remote monitor, operation or configuration.

Optional accessories:

- Up to 3 dual sensor input/output driver cards including:
- Dual pH/ORP,
- Single pH/ORP with temperature and 4-20mA input,
- Conductivity/Temperature,
- Dual 4-20mA Output,
- Dual 4-20mA input
- or a Dual Serial Input driver.

- A full line of ProMinent sensors as well as signals from most 4-20mA devices are compatible with the 4-20mA input. Sensors include: Free and Total Chlorine, Bromine for a number of specific applications including, stabilized, salt and seawater pools

- 1 Expansion card slot[2]

  - 1 Modbus-RTU Master port for Fluorimeter sensor input
  - 1 Modbus RTU Slave port
  - 1 Dual Analog input slot (4-20mA)
  - 2 Analog outputs (4-20mA)

- Wi-Fi WLAN local access

Foot note [1]   Namur Input Data
Passive amplifier passive to Namur:
(DIN19234-> EN60947-5-6)
Power supply: 8.2V / 1kOhm (proximity sensor)
High: 2.2mA..6.5mA
Low: 0.4mA..1.1mA
Operating range: 1.2mA..2.1mA (not continuous)
Switching current diff :: 0.2mA (input constant)
H / L threshold: 1.6mA
(Fraction: <0.2mA)

Footnote [2]: Complete Expansion Card information is available in the Addendum DCM510 Communication Driver Card manual. Download it from the ProMinent.com web site.

I/O Naming structure

The DCM510 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 C, Chlorine. In this example, the Chlorine sensor must be connected to input C on the driver card mounted in the C/D slot and the oxidant feeder must be connected to R3.
4-20mA outputs are the only signals that do not follow this plan. They are lettered as well.

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6 Mounting and Installation

User qualification, mechanical installation: trained qualified personnel, see ↳ Section **4.5 Users' qualifications.**
User qualification, electrical installation: Electrical technician, see↳ Section **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.

ℹ **Mounting position**

- Install the DCM510 OLED screen at eye level to make operation easiest.
- The controller is mounted as a system on an acrylic backpanel with the modular in-line probe housing as standard.
- Always install the controller vertically, so that the cable connections are on the bottom of the enclosure.
- If removing the controller from the supplied acrylic panel, leave sufficient free space (~18") for cables and access to any sensors or sample plumbing.

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, but in a room that prevents public access.

The installation must be secure, low-vibration

Avoid direct sunlight

Permissible ambient temperature of the controller's electrical enclosure 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. (6,500 feet)

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6.1 Scope of Supply

The following components are included as standard:

Description	Quantity
Controller DCM51x (AGIb) factory mounted on 18x30" polypro wall bracket Factory mounted DGMa sensor housing assembly Factory wired sensors and power cords All sensors included with the system ordered.	1
Various parts to connect sample and return lines and install supplied sensors	2
Operating Manuals on USB Flash Drive	1
General safety notes and quick start guide	1

NOTICE

pH and ORP sensors have pre-installed and labeled coaxial cables with SN6 connectors for easy connection to the sensors, but the sensors are not installed in the modular sensor housing.

NOTICE

Membrane oxidant residual sensors are pre-wired and pre-installed in the modular sensor housing, however they have not been charged with the required electrolyte. Please follow the instructions in the accompanying sensor manuals for electrolyte charging of the sensors.

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6.2 Mechanical installation

6.2.1 Wall mounting (of polypro backplane)

Mounting materials provided by others

(4) 3/8" Wall mounting holes are as shown in the drawing below

Remote mounting (optional)

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 (Fig. 7A)
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)

Drill the holes

1. Use the wall bracket as a drilling template to mark the positions of 4 drill holes. (Figure 7B)
2. Drill the holes: Ø 8mm (5/16"), depth = 50mm (1.96")
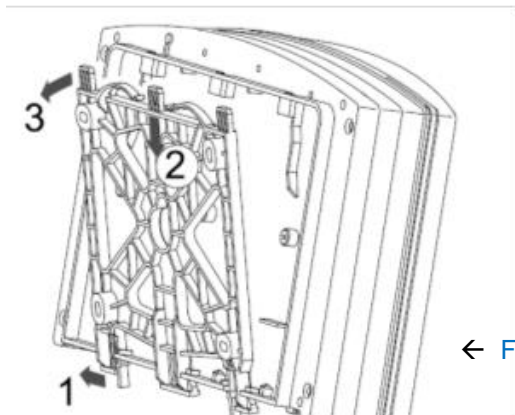
3. Screw the wall bracket into position using the washers provided. If needed, use the wall anchors provided.
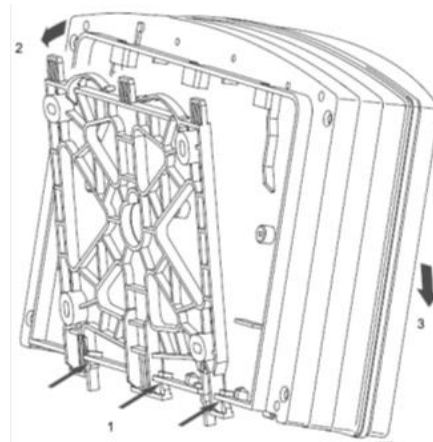
Figure 7C. Attaching the controller

Re-attach the controller

1. Hook the bottom of the housing (1) into the wall bracket (Figure 7C)
2. Lightly press the housing at the top (2) against the wall bracket
3. Then check that the housing is hooked in at the top and press down (3) until it clicks into place.
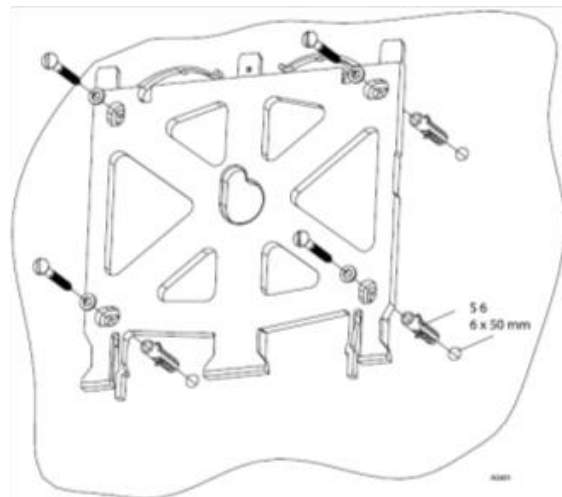
↑ Figure 7B Mounting the Wall Bracket

← Figure 7A Removing the wall Bracket

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6.2.2 Factory Panel Options

Custom panels are available from the ProMinent facility in Pittsburgh.

The panel mounted DCM includes outlet plugs and a configurable probe header.

Probe header options include a flow switch, Free Cl2, Total Cl2, pH and ORP sensors.
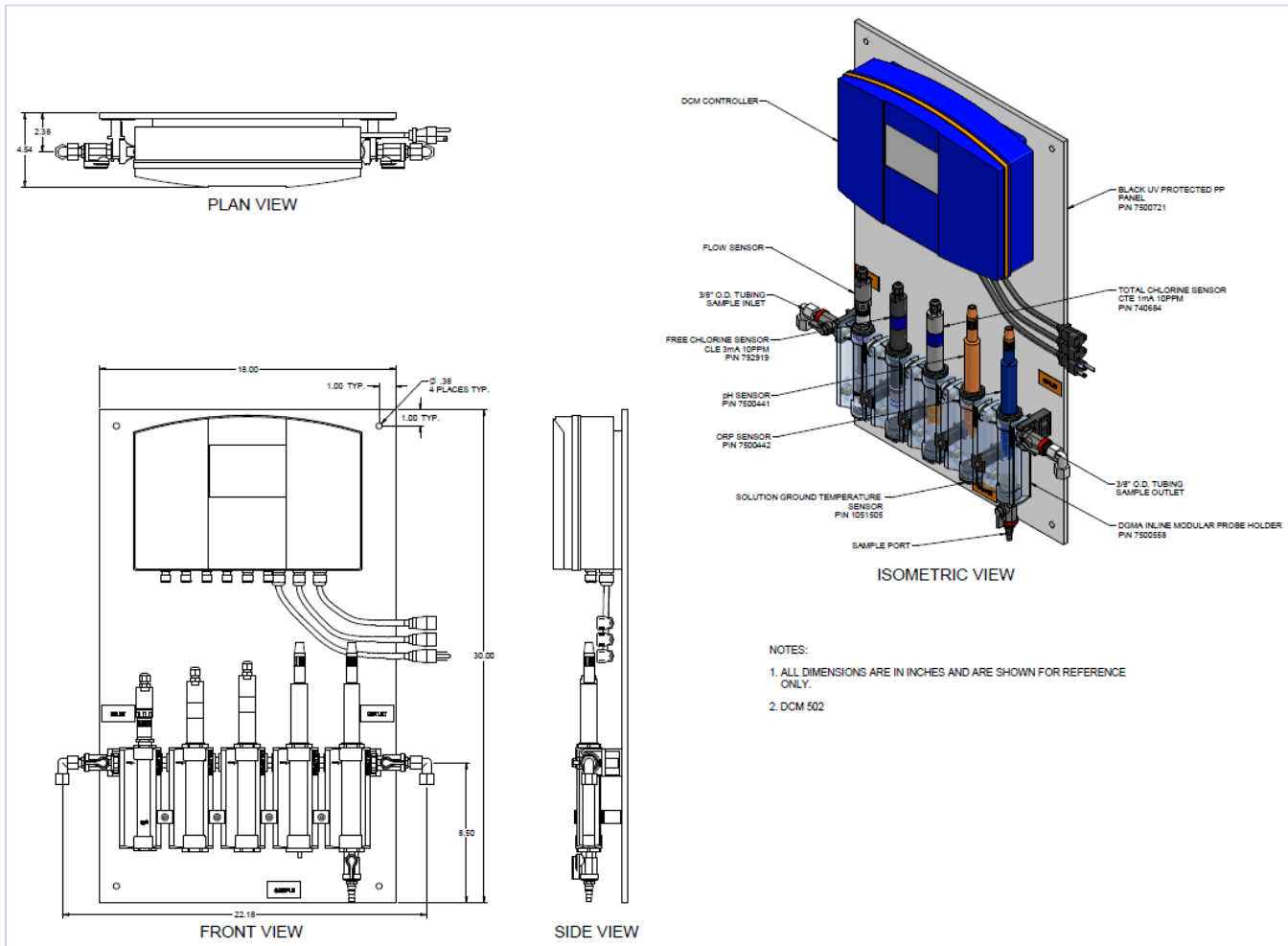
Figure 6 Typical panel drawing

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Mounting and Installation

6.2.3   Water Sampling

Best results for controlling the water chemistry in your pool or spa will always depend on the sample water for the sensors being representative of the water in the pool or spa. For consistent and stable sensor readings, it logically depends on the sample water being stable in flow and pressure at rates that are ideal for sensor performance. Vacuum or changing sample pressures will pump the reference electrolyte from the sensors and cause premature failure of the sensors. Entrained air in the sample stream will affect all residual readings and must be avoided or eliminated. pH, ORP and Temperature sensors are not usually affected by entrained air.

6.2.3.1   Sensor Requirements

Residual sensors, Free Chlorine, Total Chlorine, Bromine, etc. are the most sensitive to pressure and flow. The ideal pressure is never under vacuum, always slightly positive, and as low as possible to obtain 10-12 gallons per hour. Pressure should not exceed the 1 bar (15 psig) limit for the modular DGMA sensor holder. If the sample is under vacuum or the flow rate or pressure varies, so too will the residual sensor readings.

Less sensitive to flow are the pH, ORP sensors. Flow rates can be higher, as much as 2-3 GPM, as long as the pressure is under 15 psig and is constant and representative of the pool water. pH and ORP are still affected by pressure changes and vacuum sampling which will cause erratic readings and drastically shorten sensor life.

Temperature and Conductivity sensors are not sensitive to flow or pressure. They only require that the sample be representative of the treated water.

6.2.3.2   Sample Source and Return

Sample water for the sensors should always be filtered water from just downstream of the system filters. It is important to eliminate any small debris that might damage the glass or membrane sensors or clog the small ports in the sample housing or the flow meter / flow switch. The sample rate is ideally 10-15 gallons per hour or only 0.17 to 0.25 gallons per minute. Creating a differential pressure enough to cause this small amount of flow should not be difficult. Returning the sample to as far downstream as possible and after all other devices (i.e. Heater, UV system, etc.) should assure enough differential pressure.

Some unique installations have high backpressures that exceed the limits of the sensors (like high pressure water features such as high waterslides or high pressure spray pads). These types of applications will need special consideration for sampling the water. Contact your ProMinent distributor or the ProMinent Help Desk at the phone number located on the back cover of this manual.

Please look at the sample diagrams below for suggested sample locations for Pressure or Vacuum filters.

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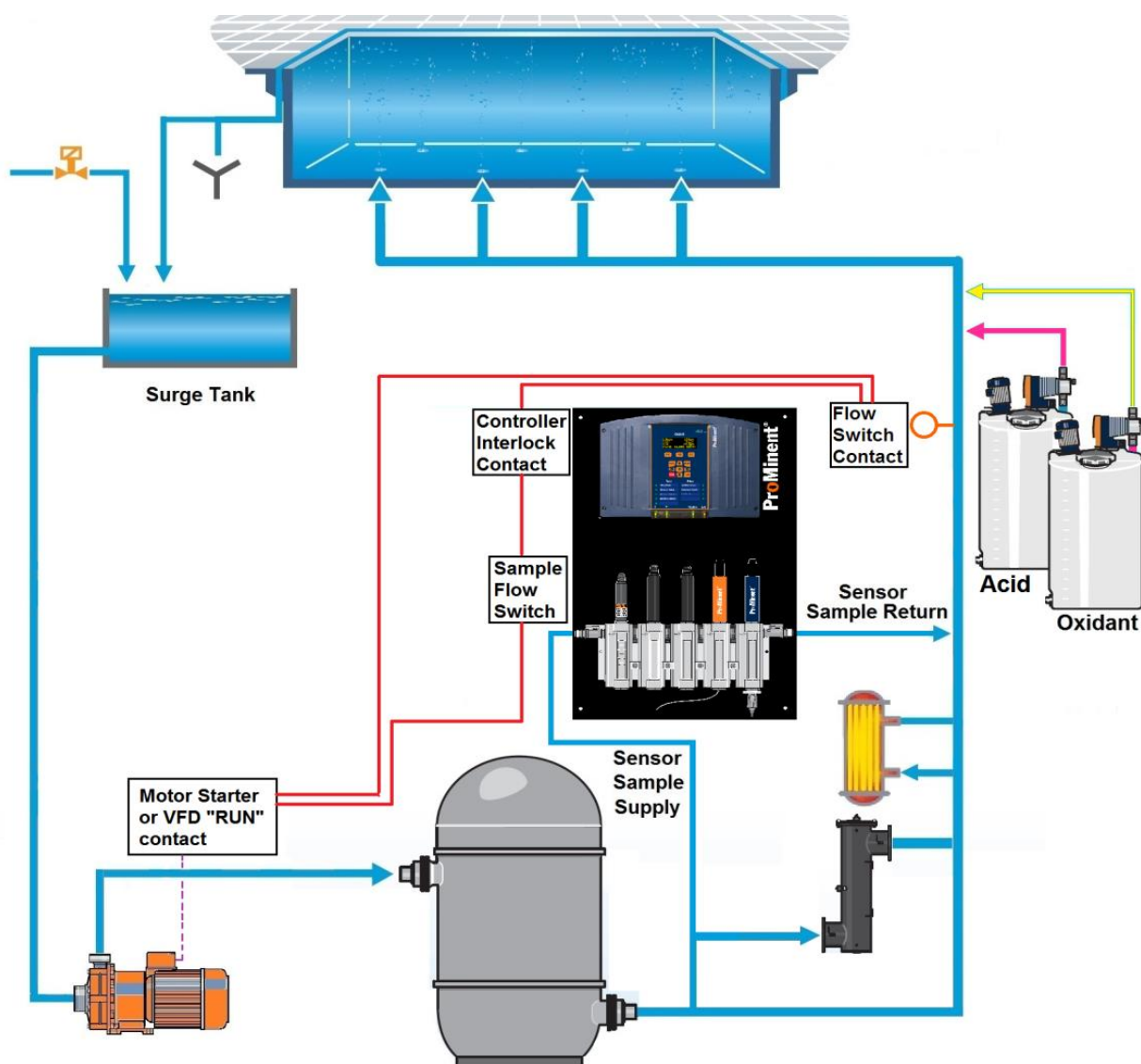
Figure 8A.   Recommended Pressure Filter Sample and Return locations with Interlocks.

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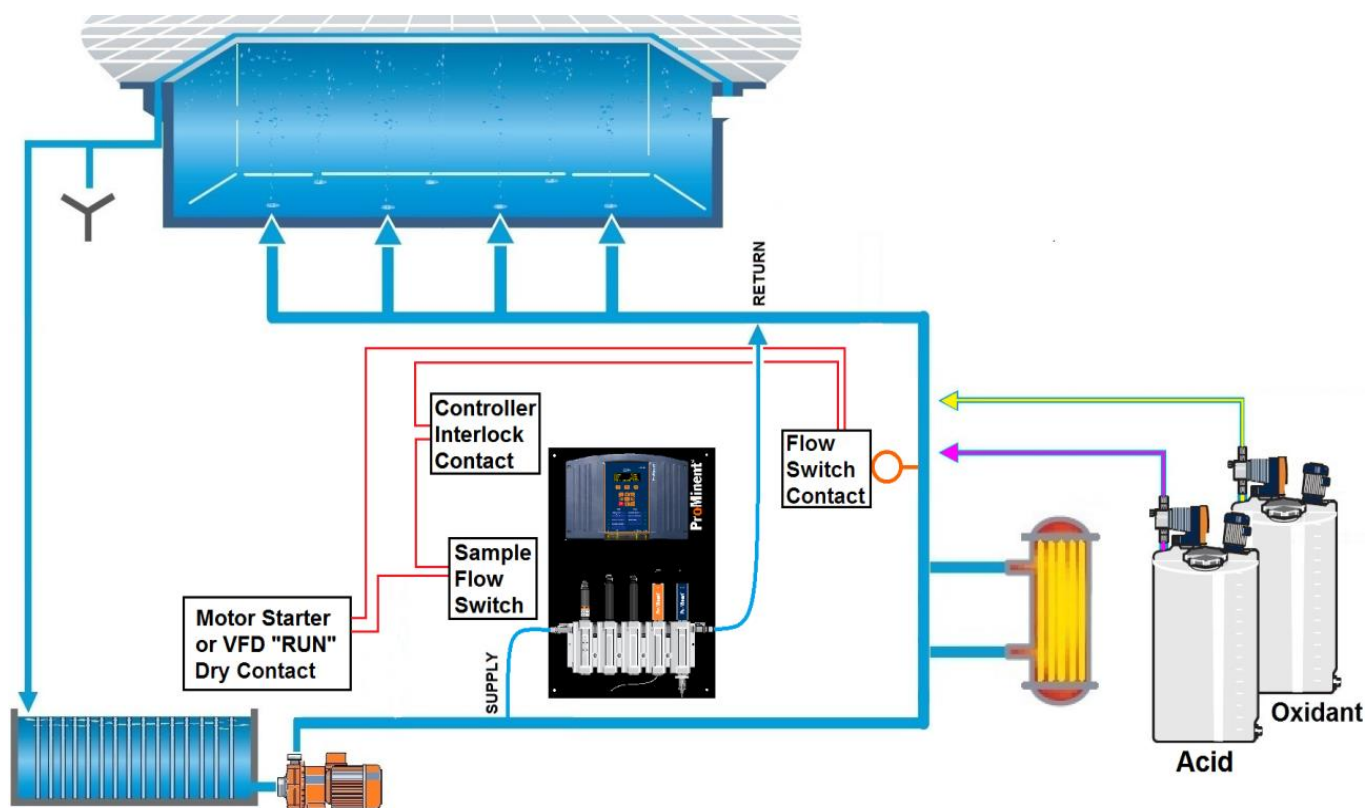
Figure 8B. Recommended Vacuum Filter Sample and Return locations with Interlocks.

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6.2.3.3 Optimizing for Accuracy and Repeatability

Accuracy of DPD tests and Amperometric Sensors

Your calibration can only be as accurate as the tool used to calibrate the instrument. The published accuracy of ProMinent residual amperometric sensors is typically the same as the published accuracy of the best available digital colorimeters being used to calibrate them (+/- 0.04 ppm for high quality DPD colorimeter). That means, under perfect conditions for both measurements, if they each have an error of 0.04 ppm, the next reading could still have as much as 0.08 ppm difference. If the DPD test method is not an electronic colorimeter, the errors can be +/- 0.2 or much higher, when using the human eye as the color comparator.

Accuracy Effects on Combined Chlorine Readings

You may see an impossible situation, especially during UV operation and chloramine control, where the Total Chlorine sensor measurement is less than the Free Chlorine measurement, with a perfectly calibrated and functional set of sensors. This situation cannot be seen on a DPD test kit, because the color change in DPD for Total Chlorine is additive to the Free Chlorine color change, so the minimum reading for Total Chlorine is the value of the Free Chlorine test.

Keep in mind that the DCM510 uses two separate sensors for Free and Total Chlorine. It also uses the same simple formula to calculate the combined chlorine residual (Total Cl_2 - Free Cl_2 = Combined Cl_2), and cannot be more accurate than the standards used to calibrate them. Using the accuracy example above, if all the errors of both the Free and Total Chlorine residual are added, the error for the combined chlorine reading may differ as much as 0.16 ppm under perfect conditions. Under practical day to day sampling and testing operations variations of +/- 0.5 ppm is very common. By definition, Free Chlorine cannot exceed Total Chlorine, but measuring accuracy limits as described, can cause this. Close examination of

the difference between the Free and Total Chlorine sensor readings may indicate a negative Combined Chlorine reading. To reduce confusion in situations like these, the DCM510 Combined chlorine calculation is not allowed to show an undefined negative combined residual.

Another phenomenon seen with real time residual readings is the chemical and sensor reaction times which occur faster with Free chlorine than Total residual. This can be seen immediately after chlorine feed events, when Free residual readings temporarily register higher than Total residual readings. This is especially noticeable with dry chlorine products due to the time needed for the chlorine to fully dissolve and combine. Once the Total residual species reactions are completed, then Total residual sensor readings return to normal. This is another good reason to not attempt hasty calibrations while chemistry is changing.

Conditions that cause DPD test inaccuracy

- Human eye sensitivity as color comparator
- Poor cleanliness of sample vial – clean regularly and replace when discolored
- Inadequate rinsing of sample vial between samples – 4-5 minimum
- Variable Total chlorine test timing – waiting the full 180 second reaction time?
- Varying sample volumes-top or bottom of meniscus?
- Varying reagent metering – dropper vertical?
- Aging reagents – fresh is always better
- Contaminated reagents – store as recommended, not out on the pool deck
- Aging or dirty comparator – Standards must be kept clean and an electronic comparator needs to have its lenses cleaned periodically-read the owner's manual
- Colorimeter calibration/alignment – read the manual for recommendations. If it has been dropped, it may no longer be accurate.

> **NOTE: Your DPD tester will have instructions for how to properly use and maintain your instrument to obtain optimum results. Read these instructions carefully and follow them _to the letter_, including the newest sequences of reagent first, then water sample introduction, vial cleaning, reagent shelf life and storage.**

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6.2.4 Sensor Installation

Note: If this is a new installation, be sure that circulating sample water is available during and after sensor installation as the sensors must be kept wet and they will take a number of hours to equilibrate and run-in. Additionally it is advised that the sample water be allowed to flow before being connected to the supplied DGMa hardware to eliminate any debris that might clog the small openings in the valves and sensor chambers. If this is not done, the debris from installation of plumbing, filter sand and other trash will be washed into and clog the DGMa. This will necessitate the complete disassembly and cleaning of the modular sensor housing. While this is not difficult, due to the modular design of the individual cells, it is time consuming.

6.2.4.1 Factory Installed Sensors

The factory installed sensors are connected and placed in the DGMa sensor holder but they are not yet ready to use. They must be "charged" with electrolyte before they will measure and react to changes in chlorine residual. The exceptions are the conductivity and temperature sensors which do not need to be charged, nor require constant moisture.

6.2.4.2 Field installed Sensors

The coaxial cables used to connect the pH and ORP sensors are normally pre-installed at the factory with the sensor type written on a label near the orange SN6 connector. pH and ORP sensors are shipped in individual boxes and their tips are protected by a moisture sealed cap that contains liquid electrolyte. When you are ready to install the pH and ORP sensors, follow the cleaning and rinsing procedure below. While just inserting the pH and ORP sensors into the DGMa modular sensor housing is acceptable, cleaning the sensors prior to first installation will dramatically speed up the sensor equilibration.

Pre-Cleaning pH and ORP sensors:

Remove the protective cap with the tip of the sensor down to avoid spilling the electrolyte. The electrolyte is a non-toxic, potassium chloride silver chloride salt solution. Use a soft bristled toothbrush and a few drops of 95% isopropyl alcohol (no additives) to remove the coating of plasticizing chemicals. Rinse the sensors with an acidic solution using the same soft bristled toothbrush. Any acidic solution will work, vinegar, acetic acid, Lime Away[©], or CLR[©], etc. pH and ORP sensors react faster when recovering from an acidic rinse solution.

Installing the pH and ORP sensors:

Be sure the petcock is open so that you are not forcing the sensors against pressure created from a closed housing. Place the O-rings (4) and compression rings (5) as shown in the drawing on both sensors before inserting into the cell. All 25mm sensors (residual, pH and ORP) use the same O-ring arrangement. Install the pH sensor above the Temperature (SGT or PT1000) sensor in the same cell. The ORP sensor is installed in the most downstream cell in the assembly, usually the one with the sample petcock. Turn on the sample water as soon as the sensors are installed, so the liquid junctions do not dry out. Adjust the sample flow rate to the guidelines below.

6.2.4.3 Vacuum and Pressure

Caution must be exercised when installing or removing the sensors in or from the DGMa sensor housing. Sensor membranes can be damaged by forcing the sensors into or out of the housing against pressure or vacuum caused by closed valves and no way of relieving the pressure or vacuum when sensors are inserted or removed. Open the sample Petcock before removing or installing sensors in the DGMa sensor housing to allow pressure to equalize as the sensor is changed.

6.2.4.4 Sensor Order

Figure 9 DGMa sensor housing

Residual sensors function by measuring the current used to reduce the sample presented to them. If the flow of the sample increases, the amount of chlorine presented increases, and so then does the reading shown. That is the reason the residual sensor accuracy is flow dependent, where pH, ORP and temperature sensors are not.

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When samples are taken using the sample petcock, flow will increase across the tips of the sensors and so too can the residual readings. Placing the residual sensors as far upstream from the sample petcock will minimize this effect, but it will not eliminate it. Since the Total Oxidant sensors (CGE, CTE, and BRE) are the most sensitive to these changes, they should be mounted the farthest upstream in the DGMa Sensor Housing. The Free Chlorine sensors (CLE and CLO) should be mounted next farthest from the sample petcock.
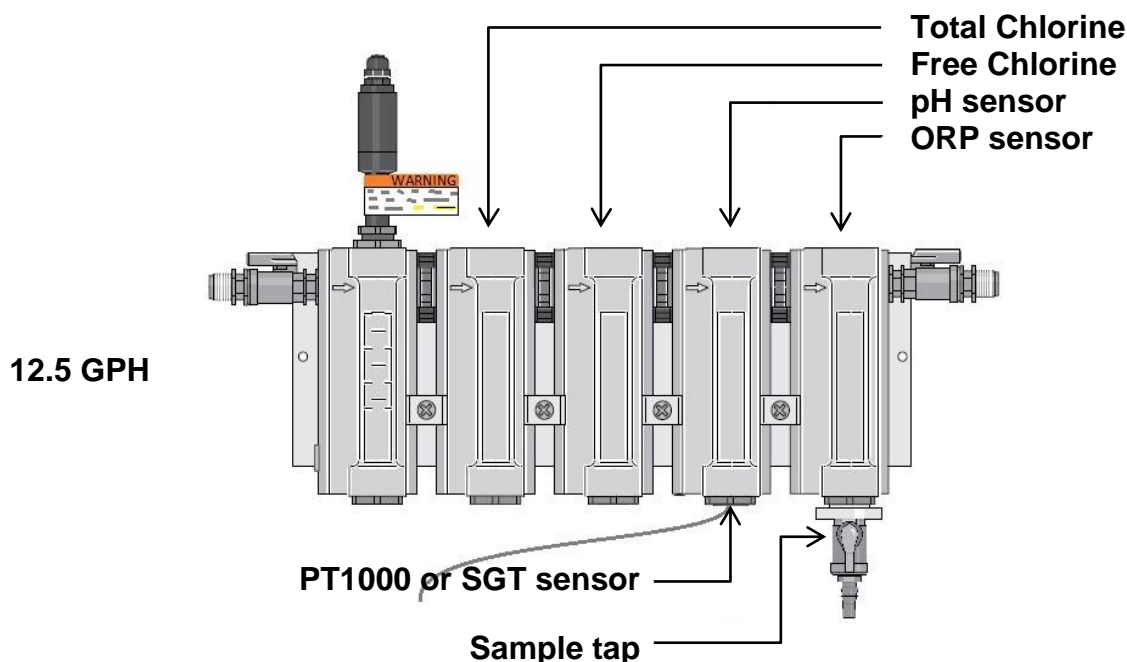
Figure 10 Aquatic Sensor Placement in DGMa Modular Sensor Housing

6.2.5 Maximizing sensor accuracy

As we saw in the sensor installation section, all sensors are adversely affected by excessive pressure, pressure changes and especially negative pressure (vacuum). Since the non-temperature sensors all have an internal electrolyte at atmospheric pressure, any negative pressure or frequent pressure changes on the sample stream will effectively suck or pump the electrolyte out of the sensors. Since this electrolyte is critical to sensor readings, any negative pressure will not only affect the readings, but it will deplete the electrolyte and require frequent sensor rebuilds (residual sensors) or sensor replacement (pH and ORP). Sensors are not warranted under these conditions.

6.2.5.1 pH Compensation

Free Chlorine residual sensors (CLE and CLO) use pH compensation. Any pH sensor calibration adjustments will therefore affect the Free Chlorine residual calibration. For this reason Calibrations of Free chlorine sensors require that the pH sensor be calibrated *before* the free residual sensor, otherwise pH calibrations performed after the Free Chlorine calibration will shift the Chlorine calibration.

6.2.5.2 Sample Flow Rate and Stability

Optimal sample flow rate for residual sensors is 10-15 gallons per hour. The residual sample accuracy is very dependent upon the sample flow rate, so any change in flow rate since the last calibration will be seen as a change in the residual reading.

**Figure 11
Flow switch**

A common misunderstanding by new users is the reading on the DGMa's flow meter and switch. The flow meter uses a plastic float to indicate the flow through the sensor housing, where the top of the float indicates the flow rate next to the markings on the body of the flowmeter cell. The switch portion of the meter is the plastic shaft

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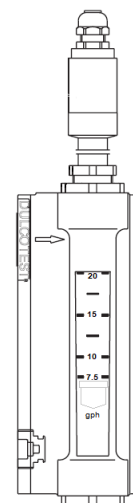
inserted from the top of the cell so that the magnet embedded in the float activates the flow switch.

A common example of a way the flow is improperly adjusted: The inlet and outlet valves are fully open and the flow through the sensor housing is at maximum, but the flow switch float is restricted by the switch shaft so it improperly shows ~12g/h (0.2 gpm), although the actual flow may be several times that because the float is prevented from rising higher and showing the actual flow.

If the flow is properly adjusted, the float is barely touching the bottom of the shaft, and any slight restriction of the flow valves will cause the float to fall away from the shaft. Secondly, it is important that the sample flow at the petcock should be a slow trickle, enough to take a sample but _not_ a vigorous stream, and _never_ a vacuum, where opening of the petcock draws air into the sample stream. A vigorous stream indicates excessive backpressure that must be eliminated. The DGMa modular probe housing is designed to withstand 1 bar [15 PSIG] pressure under normal operation.

This proper flow adjustment is important because any inadvertent increase in sample flow will cause the residual reading to increase with respect to the actual residual in the water. If this occurs, and the residual sensor is being used to control the chlorine, the actual residual will drop as the inflated sensor reading is used to achieve setpoint. Conversely, if the residual sensor is calibrated at the higher flow rate the actual residual would increase with respect to the sensor reading.

6.3   Electrical Installation

User qualification, electrical installation Electrical technician, see ✎ Section **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 DCM510 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.

Observe the technical data in these instructions.

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6.3.1 Specification and location of the cable grips and conduit entries
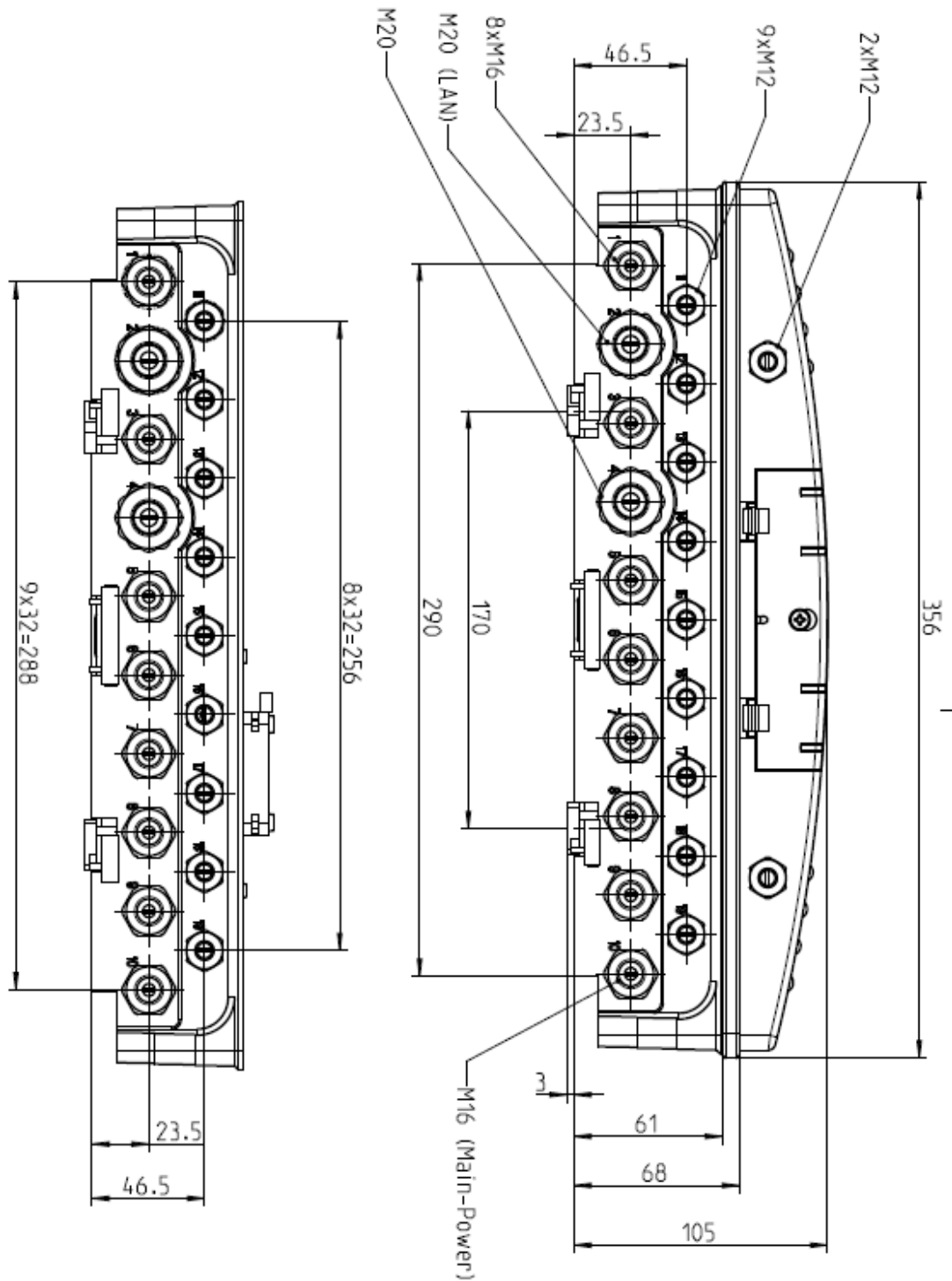
Figure 12 All Dimensions in millimeters (mm)

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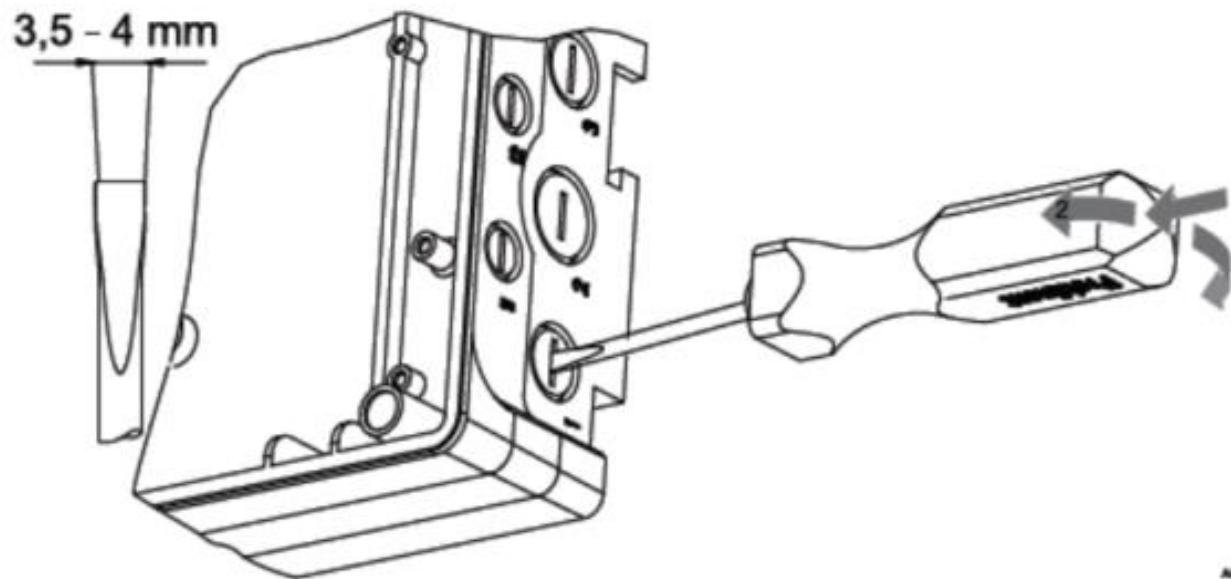
Figure 13A Use a screwdriver to break open a sealed enclosure entrance

6.3.2 Sensor Seals and Termination Procedure

Select the correct fitting cable glands (cord grips) for the controller's cable openings. Seal the open holes with blanking plugs (1) 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. Standard sizes for the cable glands are the metric sizes M12, M16 and M20.
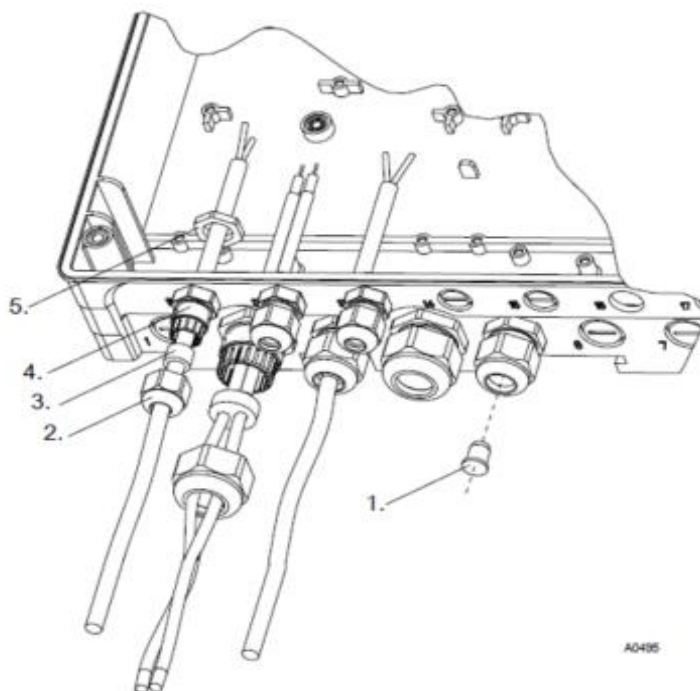
Figure 13B Examples of cable gland assembly.
1. Plug, 2 Cap, 3. Gland, 4. Connector Body, 5. Nut

6.3.3 Parking the Hood

The hood, also called the lid or cover, of the DCM510 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 hood 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 seated.
- The degree of protection IP 65 (NEMA4X) can only be assured if the hood perimeter seal is installed correctly.

Figure 14. 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.

6.3.4 General Layout and Terminal Diagrams

Figures 15 through 18 show general position of electronic components and wiring terminations.

Figure 15 shows the position of the internal relay indicators for each relay R1 through R9. These lights are repeated on the controller cover.

Figures 16A, B and C show general component layout.

Figures 17A, B and C are electrical schematics of the I/O.

Section 6.3.5 depicts wiring rules and examples.
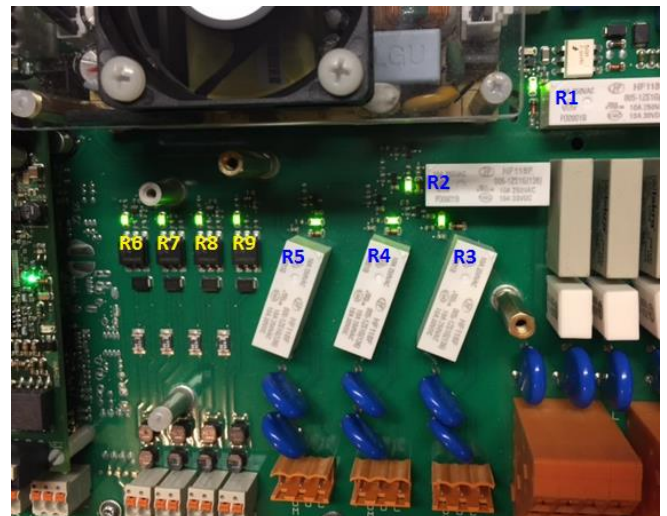
Figure 15 Internal Relay Indicator LEDs

ProMinent®
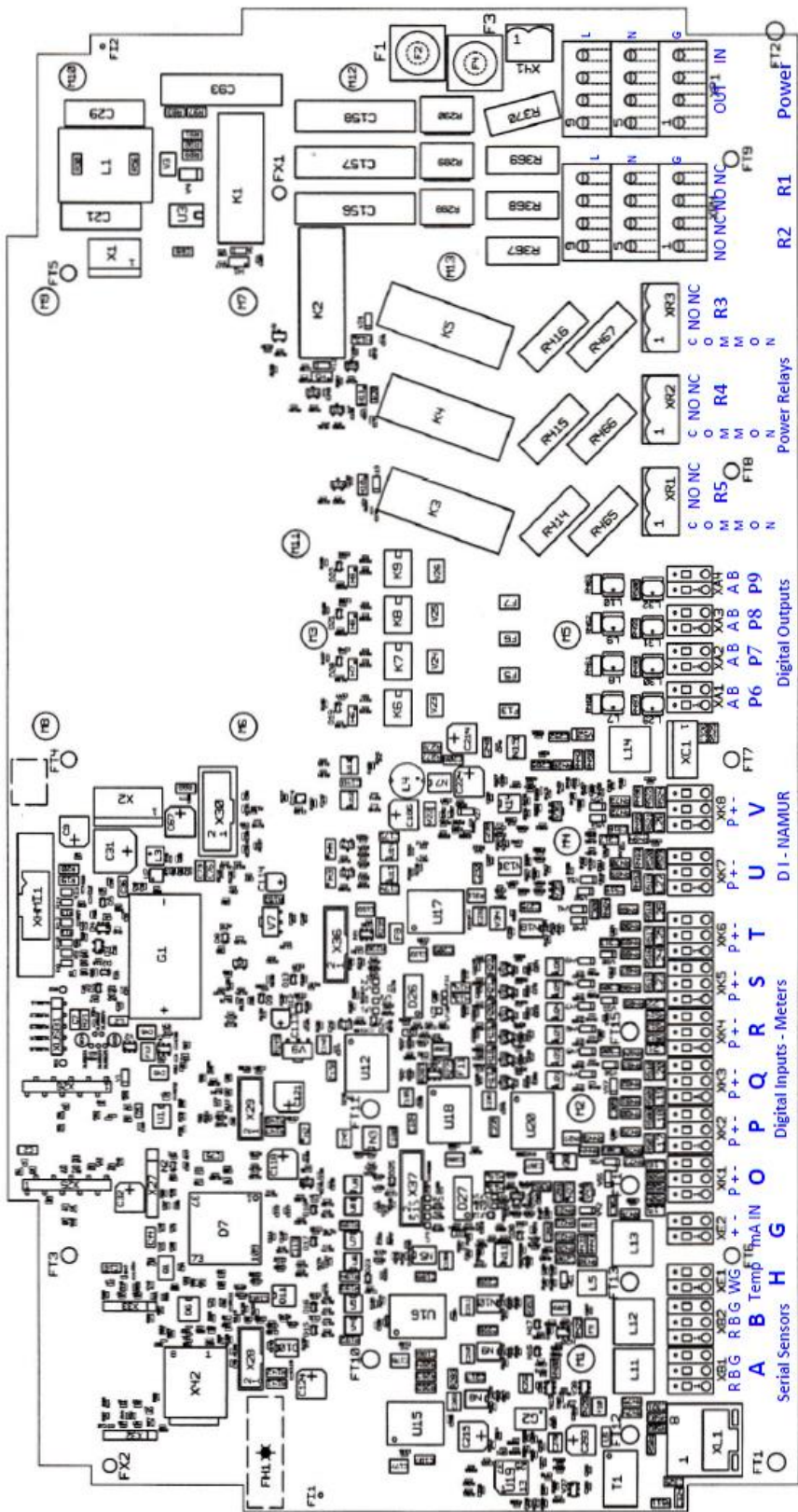
Building Power In

Line Power bus out x3(fused @ 5A total)

AC powered Control Relay R1

AC powered Control Relay R2

Unpowered AC/DC Relay R3

Unpowered AC/DC Relay R4

Unpowered AC/DC Relay R5

Unpowered DC Contact P9
Unpowered DC Contact P8
Unpowered DC Contact P7
Unpowered DC Contact P6

Digital Input V (NAMUR) – Intrinsically safe

Digital Input U (NAMUR) – Intrinsically safe

Digital Input T

Digital Input S   Default pulse flow meter input

Digital Input R

Digital Input Q

Digital Input P

Digital Input O   Default flow switch

4-20mA Input G

Temperature Input H

Serial Input B (CTFS / LogR / other)
Serial Input A (CTFS / LogR / other)

Figure 16A   I/O Terminal Arrangements and Callouts
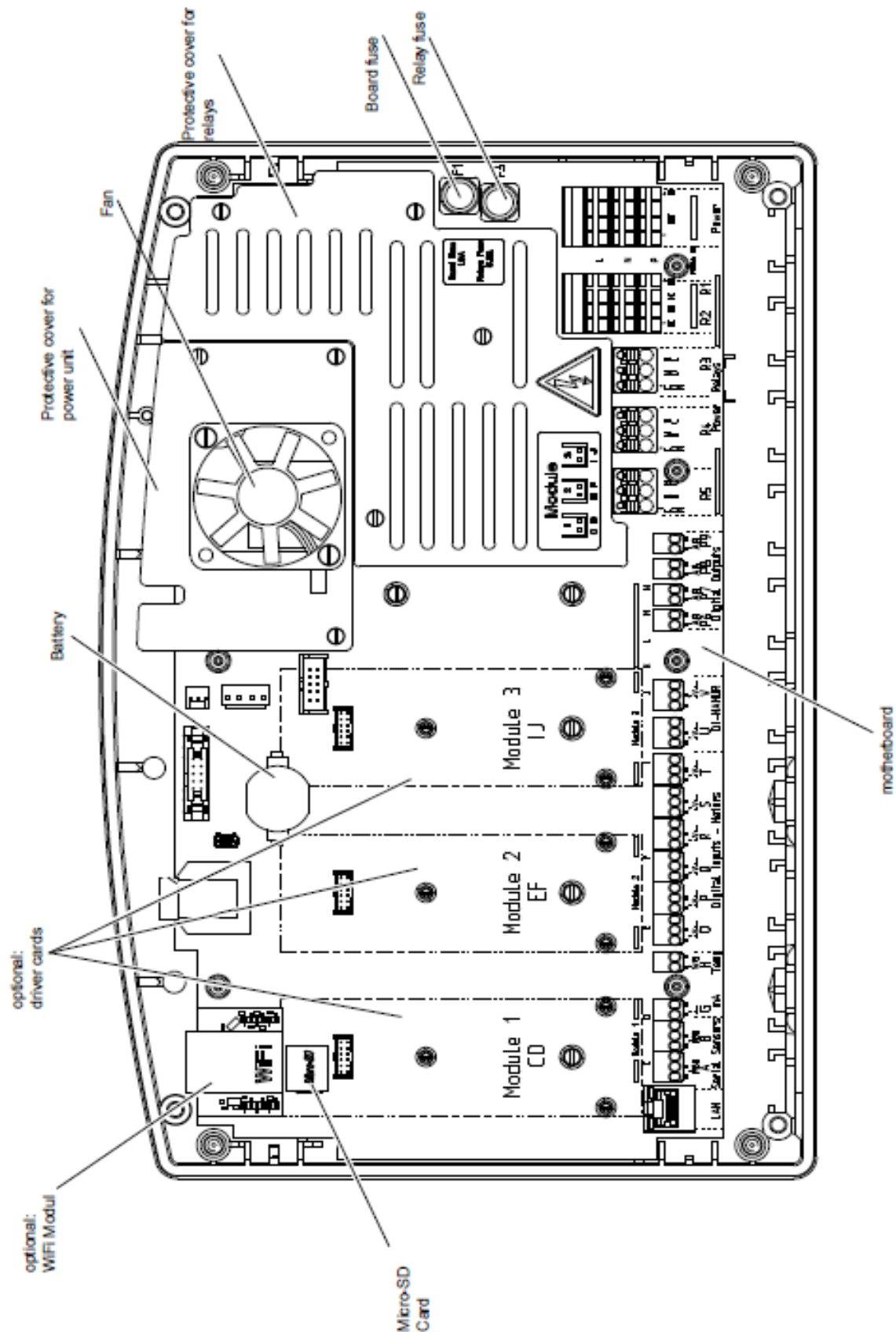
Figure 16B DCM510 overall location of major components

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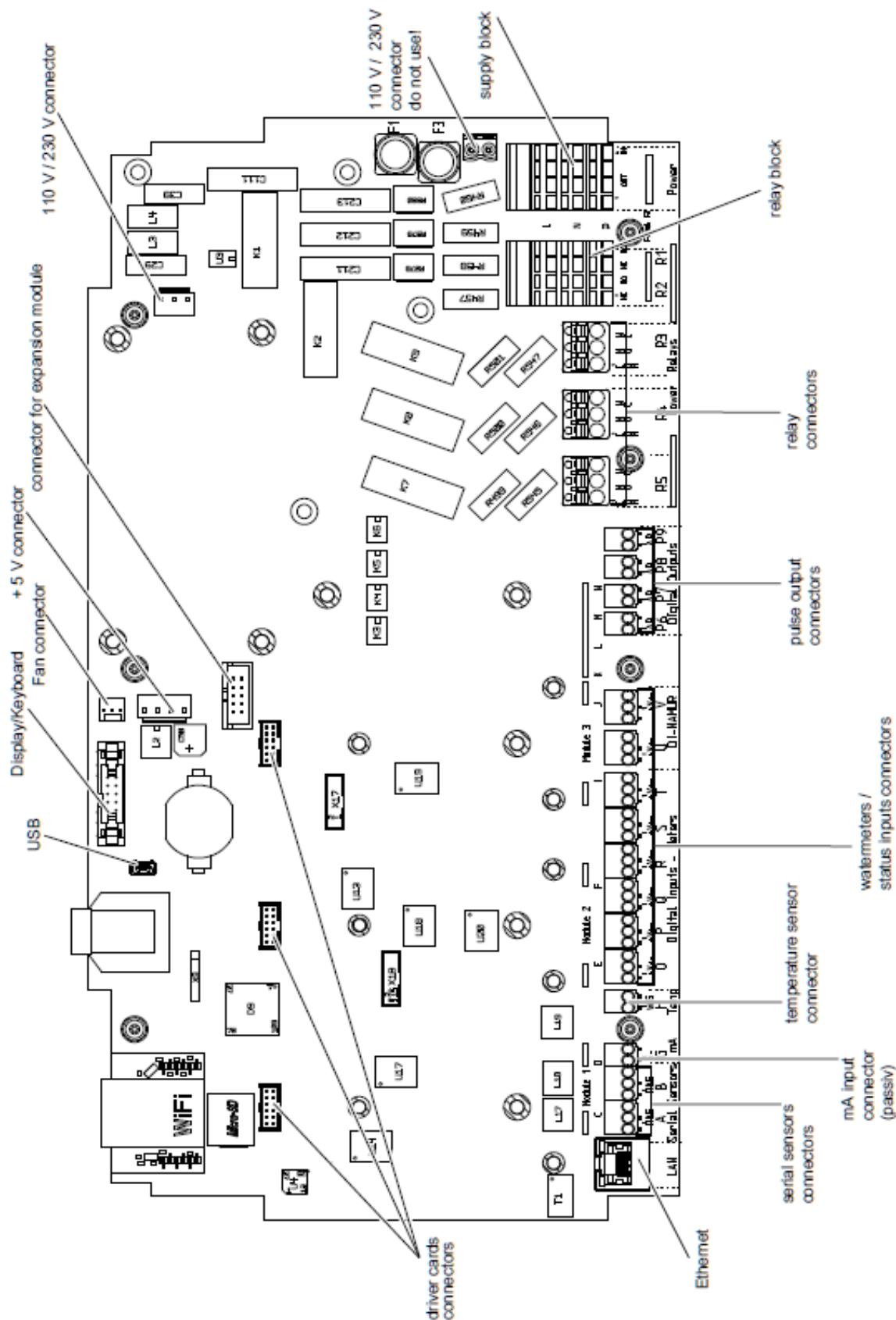
Figure 16C DCM510 motherboard general arrangement
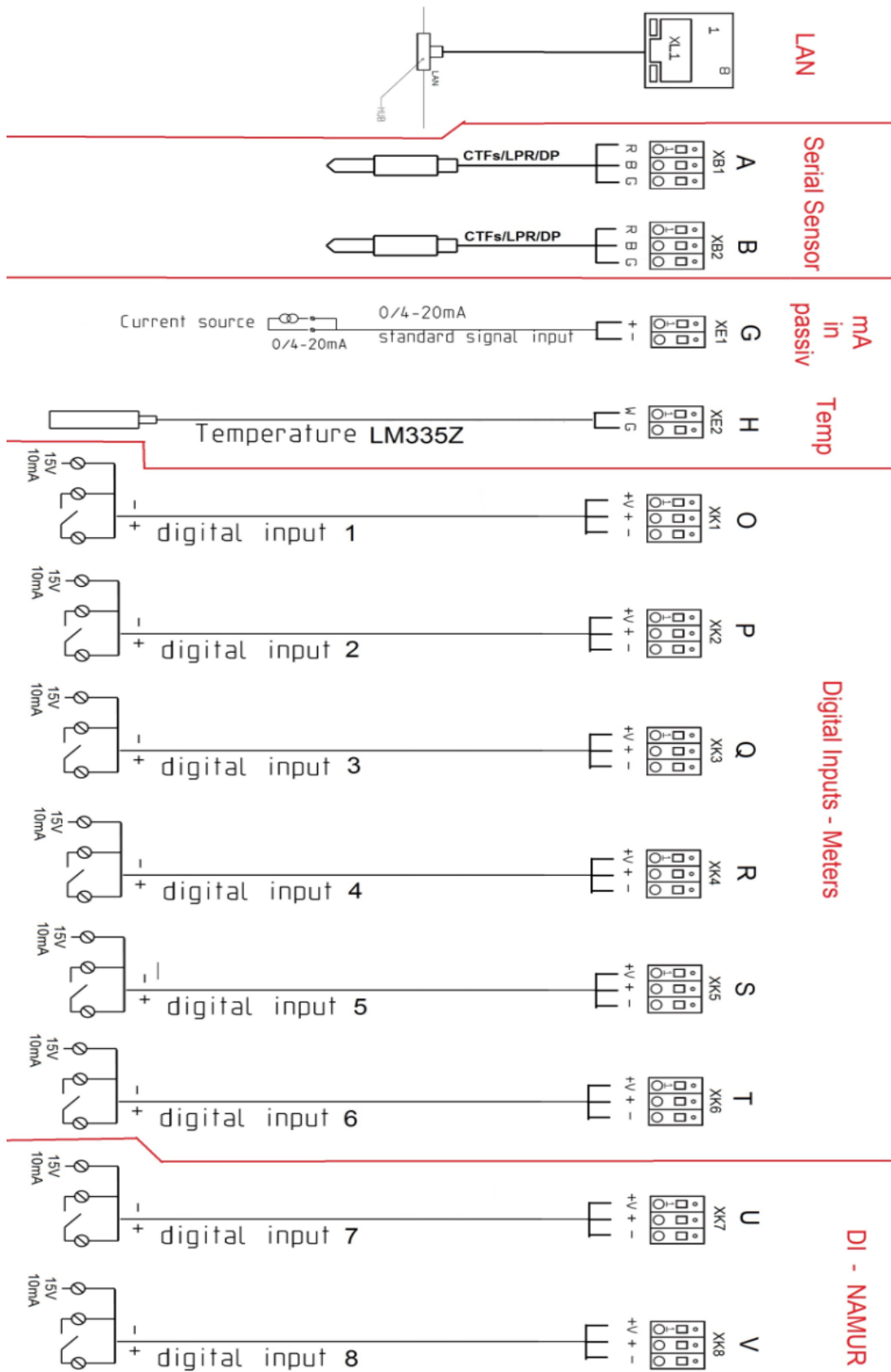
Figure 17A Main PC board Input Wiring diagram

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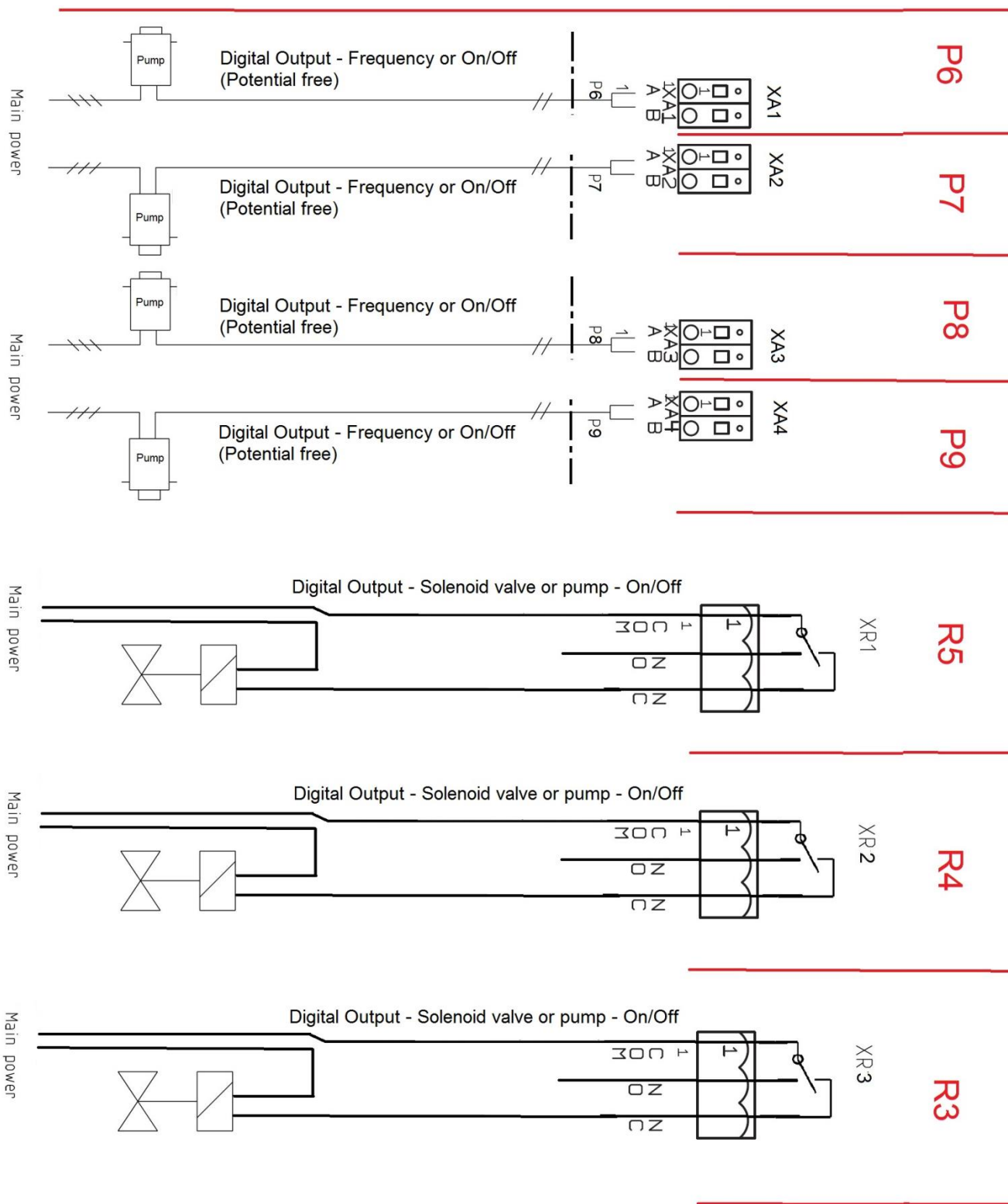
Figure 17B Main PC board Output Wiring diagram; Part 1: Relays R3 through P9
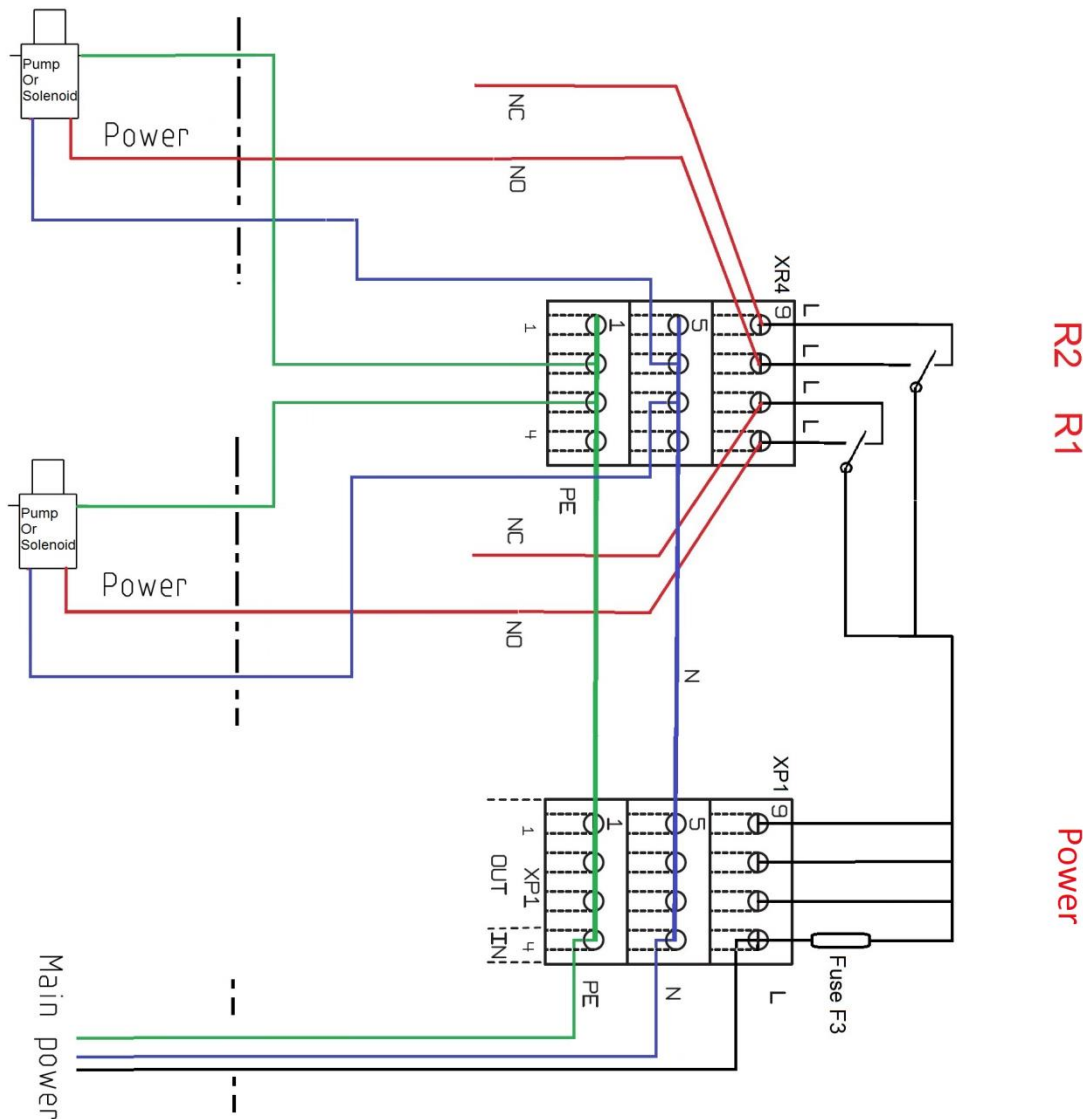
Figure 17C Main PC board Output Wiring diagram; Part 2: Relays R1, R2 and the Power block

The ground and neutral connections are all tied together through the printed circuit board as shown in the schematic 17C. 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 17D.

See section **6.3.5 Power In and Relay Output Termination**

Figure 17D Relays R1, R2 and the Power block

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6.3.5 Power In and Relay Output Termination

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.

6.3.5.1 Overview

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; **L**ine, **N**eutral and Ground (**PE**). Input power is connected to the right most row of the Power 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 120VAC at 50 to 60 Hz. No controller AC power configuration is required. Use wire/cables/plugs that are matched to the power you are using. See also **6.3.6.4 Connecting a Power Cord.**
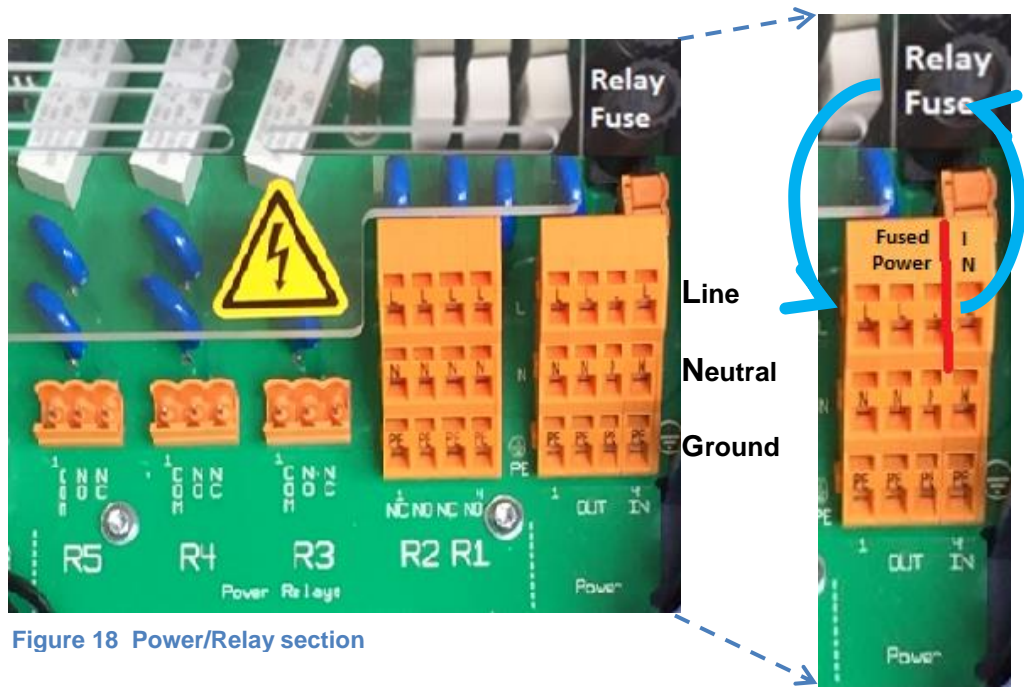
Figure 18 Power/Relay section

Note: The terminal connectors have been removed from relays R3, 4 and 5 for clarity. See them in Figure 25.

Figure 19 Power Block

Figure 20 Factory installed power

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 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 inputs of R1 and R2 (not shown). These relays are 'powered' relays. See Figure 17B

All 5 relays can be used for pumps and solenoids as well as motor operated valves (MOV). MOV terminations are explained in section **6.3.5.3 Wiring Relays R1 and R2 for a Motor Operated Valve**, and section **6.3.5.5 Wiring Relays for Externally Powered Motor Operated Valves (MOV).**

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 in the wire slot below.

> ℹ **These blocks accept a maximum of 14 gauge wire.**

To enter wires into the digital inputs and digital outputs, depress the spring loaded tab. See figure 21

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

Spring loaded tabs
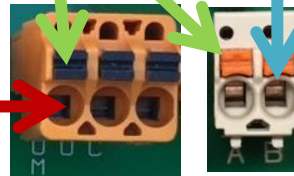
Figure 21 Spring loaded terminals

Figure 22 Open the terminals

6.3.5.2 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. See section **6.3.5.5 Wiring Relays R3 – R5 Using an External Power Supply**

Figure 23 Terminating R1 & R2

6.3.5.3 Wiring Relays R1 and R2 for a Motor Operated Valve

Motor Operated Valves are not common in Aquatic applications.

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

6.3.5.4 Wiring Relays R3 – R5 Using On-board Power

Figure 24 R1 MOV

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.

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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. The White and Green wires, Neutral and Ground respectively, are connected to the N and PE (Ground) connections on the Power output block as shown.

Figure 25 Wiring R3 using on-board fused power

6.3.5.5   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 for an externally powered device **_must not_** be terminated in the controller.

Figure 26 Remotely powered relay

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

Motor Operated Valves are not common in Aquatic applications.

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

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6.3.5.7 Connecting a Power Cord

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

The default configuration of the DCM510 controller has a power cord already attached as described below. These instructions should only be needed if for some reason the controller is a replacement for the original that does not have a power cord installed.

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 13A and 13B along with section **6.3.2 Sensor Seals and Termination Procedure.**

Terminate the line, neutral and ground wires as shown in figure 28. See also figure 22 in the overview section to open the terminations.

6.3.5.8 Converting from Power Cord to Conduit Connection

With the power cord unplugged, remove the power cord connections from the Line, Neutral and Ground terminals. Remove the cord grip as shown in Figure 28. See also Figures 9 and 10 and see Section 6.3.2.

Figure 28 Power cord

Terminate the line, neutral and ground wires as shown in Figure 28. See also Figure 22 in the overview section to open the spring loaded connector terminals.

6.3.5.9 DC Output Control Termination

Outputs 6 through 9 are unpowered (dry) solid-state digital outputs rated for 24VDC / 250mA which can be configured as a Pulse, ON/OFF or Enable/Disable output. See Figure 29A.

Figure 29A Digital DC outputs 6-9

In **pulse mode**, these outputs can control the speed of pulse driven pumps. The frequency outputs vary the pump speed in much the same manner as a 4-20mA signal.

In the **ON/OFF** mode, the outputs can start/stop a pump or other chemical feeder. The feed rate will then be determined manually at the feeder.

These outputs can also be used to **enable/disable** a remote device like a heater or UV System's pause or second setpoint feature.

6.3.6 Using a **'Pulse'** Output Relay

ProMinent pump types, Beta, Delta and Gamma using a Universal Control Cable will terminate with the brown, black and white wires as shown in Figure 29B. This connection is not polarity sensitive. The brown/black wires are shown in the A terminal. They could be in the B terminal.

The black is common. The white wire is used for the pulse signal. The brown wire is for pause/enable. The brown and black wires need to be connected to enable the pump. The enabled pump will stroke each time the white and black wires are shorted through the relay.

Figure 29C depicts a Concept termination for Pulse Mode pump control.
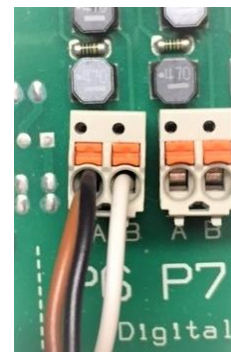
Figure 29B Universal Control Cable on Output Relay P6 (Pulse Mode)
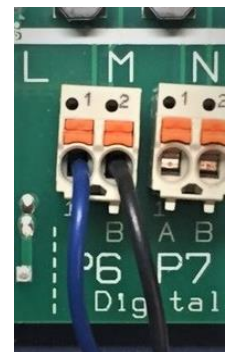
Figure 29C Concept pump cable on Output Relay P6 (Pulse Mode)

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6.3.7 Using an "ON/OFF" or "Enable/Disable" Output Relay

ProMinent pump types, Beta, Delta and Gamma using a Universal Control Cable will terminate using the brown and black wires as shown in Figure 29D. This connection is not polarity sensitive. The black is common. The brown wire is for pause/enable. When the brown wire is not connected to the black wire, the pump will be in pause mode. In the configuration shown, the controller will be enabled or "turned on" each time the P7 output closes, and will PAUSE whenever P7 turns off.

A Concept pump uses the same color code for pausing the pump. However, the action is opposite. When the wires are shorted through the relay, the pump will pause. When the relay is open, the pump will run. See Figure 29E.

Figure 29D Universal Control Cable on Output Relay P6 (Enable/Disable-ON/OFF Mode)

Figure 29E Concept pump cable on Output Relay P6 (Enable/Disable-ON/OFF Mode)

6.3.8 ProMinent Control Cables Available

Universal control cable for ProMinent Beta, Delta and Gamma pumps have this configuration.
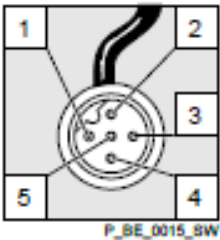
Pin	Function	5-wire cable
1	Pause	brown
2	External contact	white
3	mA input*	blue
4	Earth / GND	black
5	Auxiliary capacity / Auxiliary frequency	grey

Figure 30A Universal Control Cable

With Concept Plus pump speed knob in external position, black and blue are the pulse signal input. With pump in manual mode, black and brown will pause the pump when connected. See Figure 30B. *This is the opposite function of the pause function on other ProMinent pumps using the universal control cable.*

6.3.9 Wiring sensors to the controller

External control connectors

Colour	Function
GND	black
Contact (Pulse)	blue
Pause	brown

Figure 30B External Control cable connections for the Beta

NOTICE

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

Signal inputs to the controller attach to the main printed circuit board (PCB) or to expansion driver cards. See Figure 36. Each analog input (sensor) signal as well as all 4-20mA output signals are each assigned a letter, A through N, for program identification. Digital (contact) inputs are assigned a letter from O through Z. Digital outputs are assigned numbers 1 through 9.

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 section **10.25 4-20mA Outputs** for programming detail.

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6.3.9.1 Inputs on the Main Board

The main PCB inputs are shown in Figure 31.
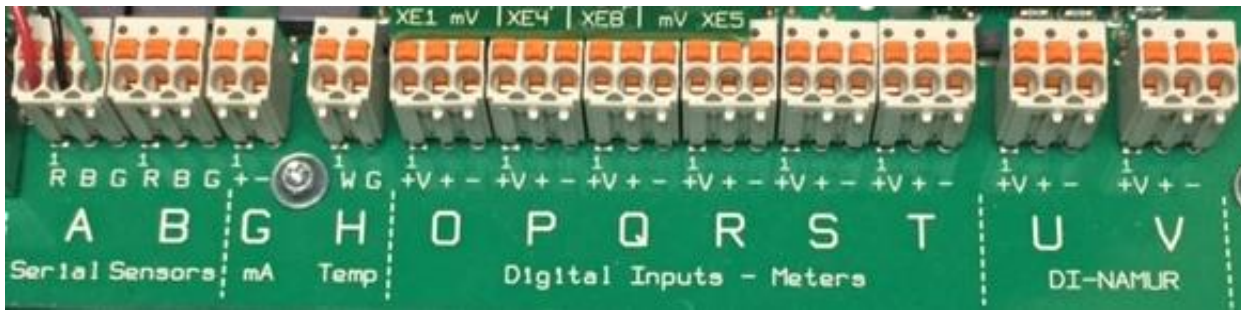
Figure 31 Main board inputs

Inputs A and B are ProMinent serial sensor inputs. Serial sensor choices currently include CTFS (Conductivity, Temperature, Flowswitch – Serial) and LogR serial corrosion sensors. These sensor have 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. The A input (figure 31) has a serial sensor attached to show the wire color matching the stencil; red, black and green.

Additional serial sensors may be added to the controller via serial expansion driver cards. See section **6.3.12 Dual Serial Input card (CTFs-LPR-DP)**

> **NOTICE**
>
> The CTFS sensor is not the same as a CT sensor. The DCM510 customers rarely use the 3 wire CTFS sensor. The more commonly used conductivity temperature (CT) sensor has 4 wires and is not compatible with inputs A or B. See section **6.3.13 Dual CT (Conductivity/Temperature)**
>
> See section **14 Spare Parts and Accessories** for a list of DCM510 compatible sensors.

6.3.9.2 The G input (4-20mA)

The G input is a passive input for 4-20mA devices. This means there is no power supply provided to power the 4-20mA transmitter generating the signal. Active, or powered loop devices, may include UV intensity % or W/m2 signals, turbidity, flow rate, temperature, analog tank level, or other analyzer signals, etc.

If the sensor is also passive, an external supply can be used and should be rated for 50mA minimum.

The G input is not configured for ProMinent amperometric sensors including pH and ORP sensors that have been converted to an active 4-20mA. All of these sensors require the optional 4-20mA expansion input card covered in section **6.3.11 Sensor Driver Cards**

Figure 32 shows an example of a 4-20mA input wired to the G input where the red wire is the sensor + (plus) and the black wire is the sensor – (negative) conductor.

Temperature compensation cannot be applied to this input, because the influence of the temperature measurement on the measured value is not known.

Remotely powered
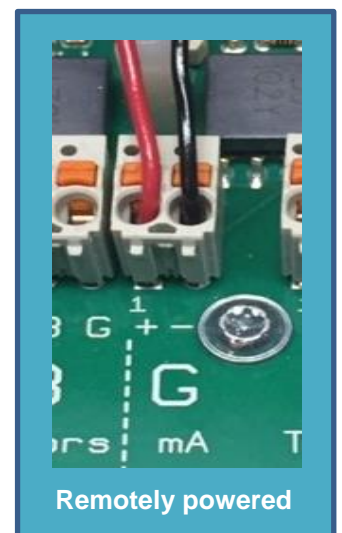
Figure 32 'G'; 4-20mA input

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6.3.10 Temperature - Input H

The DCM510 has four ways to input temperature readings. Serial conductivity sensors, 4-20mA input cards, any temperature terminal (on the Conductivity Temperature card, the ORP/pH card or the single OP/temp/mA card) or the H input. These inputs are not universally compatible with all ProMinent temperature sensors.

The H input is compatible with the following sensors;

Part # 1051505 SGT Solution Ground/Temperature (LM335 type) 10mV/°K sensor

Part # 7761452 Conductivity Temperature sensor - Aquatics

Part # 7760191 Conductivity Temperature condensate sensor with maximum of 250psi @ 450^0 F

Any temperature input can be used for temperature display, control or compensation.

A 1KΩ test resistor placed across the H input will display about 32^0 F depending on the resistor tolerance. An open circuit will show 277^0 F. 1500Ω will net about 88^0 F. See Figure 33.

Figure 33 Input H with test resistor

6.3.10.1 Digital Inputs O through V

Inputs O through V are digital inputs. They expect to monitor dry (unpowered) contact signals from flowmeters or any dry contact switch or relay contact. See figure 31. Wire the input between the + and – terminals. See figure 34. Black is on + and white is on –, but polarity is not important on these inputs.

Each input has a 16 volt (+V) terminal available as a power source for the sensor or input device. These power sources can also be used to power a 4-20mA loop for the G input. See section **6.3.7.2 The G input (4-20mA).**

Digital flowmeters 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. Signet 2536 "blue cap" or 2551-XX-11 water meters with a square wave pulse output are compatible and commonly used in aquatic applications. Signet 515 and similar sine wave output meters are not compatible with these digital inputs. Many other brands and models are also compatible.

Figure 34 Digital Input wiring

NOTICE

Various types of flowmeters 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 flowmeter manual.

6.3.10.2   Namur Inputs U and V

Inputs U and V are digital inputs that operate as mentioned above and can be used in some explosion proof applications. See section **5 Functional Description** for specifications.

Black (+)
Red Signal
Silver Shield (-)

⚠ CAUTION!

Explosion proof wiring and systems should be designed, installed and inspected by trained personnel.
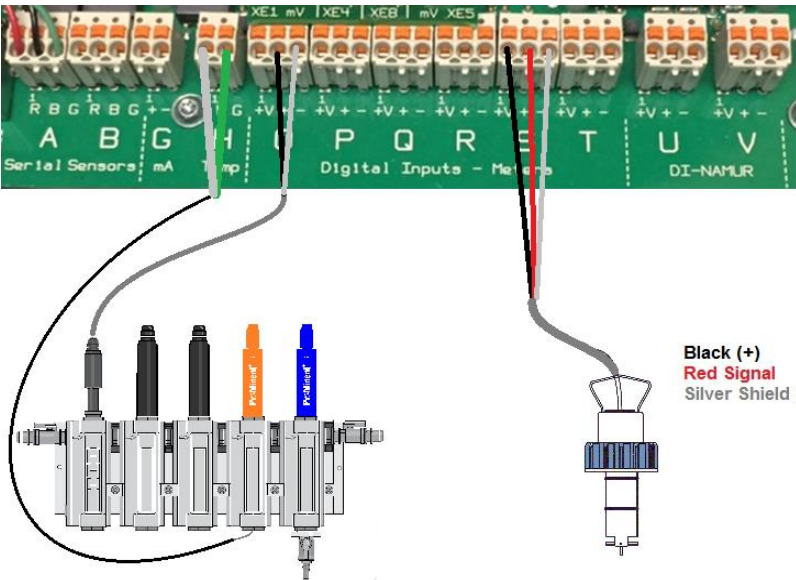
Figure 35 Temperature, Sample Flow Switch and commonly used Signet 2536 water meter wiring connections.

6.3.11 Sensor Driver Cards

The following sections identify wiring diagrams of the sensor driver cards. There are three available expansion slots as shown in section **6.3.4 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.

There are currently six expansion cards to choose from. Each is described in detail below.

Dual Serial Input card (CTFs-LPR-DP)

Dual CT (Conductivity/Temperature)

Dual pH-ORP-Temp Driver

ORP/pH Temp mA Input card

Dual 4-20mA Input Driver

Dual 4-20mA Output Driver

The three expansion slots are shown in figure 36 and figure 15B.

Note the letter designations in yellow. Inputs on these cards will be identified in the program by these letters for clarity.
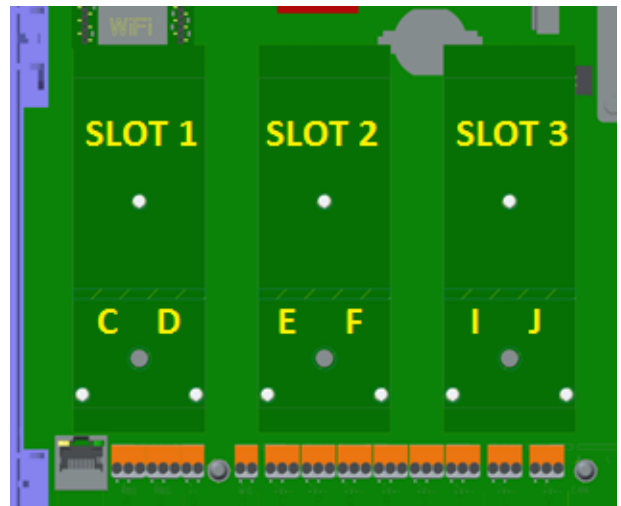
Figure 36 Expansion Card Slots and Letter Designations

6.3.12 Dual Serial Input card (CTFs-LPR-DP)

Only certified ProMinent serial sensors; CTFS (Conductivity Temperature Flowswitch Serial), Log R (corrosion rate sensors) and DP (differential pressure sensors) may be used with these inputs.
The sensor analog value is reported via a proprietary serial signal.
Maximum distance from sensor to driver card is 30 meters/100'.
Terminals are color coded for ease of connection; R – red, B – black and G – green.

Connector	Pins	Description	Color Code
2 x serial sensor HW Version: 734265 Rev. 2			
XB1 channel 1	1	5V	RED
	2	Signal UART half-duplex 1	BLACK
	3	GND	GREEN
	4	NC	
XB2 channel 2	1	5V	RED
	2	Signal UART half-duplex 2	BLACK
	3	GND	GREEN
	4	NC	

Table 5 Dual Serial Sensor Connections
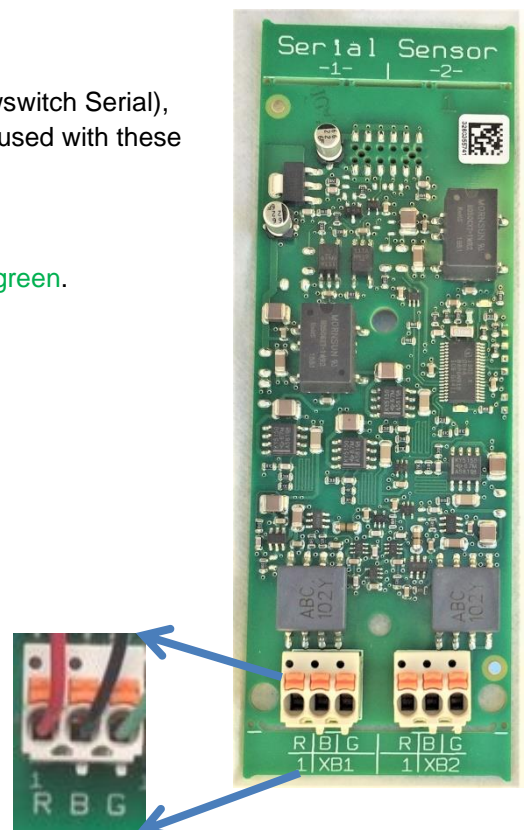
Figure 37 Dual Serial Driver

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Figure 38A Corrosion rate LPR serial sensor **(Linear Polarization Resistance) Shown with test resistor and adapter**
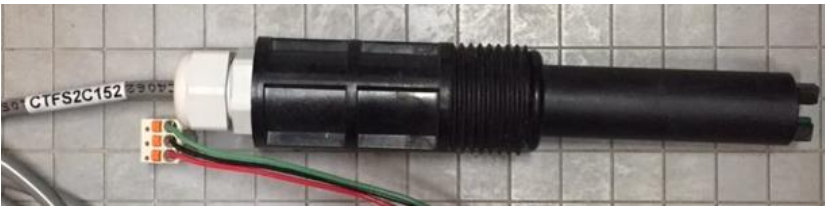
Figure 38B **CTFS sensor shown without adapter**
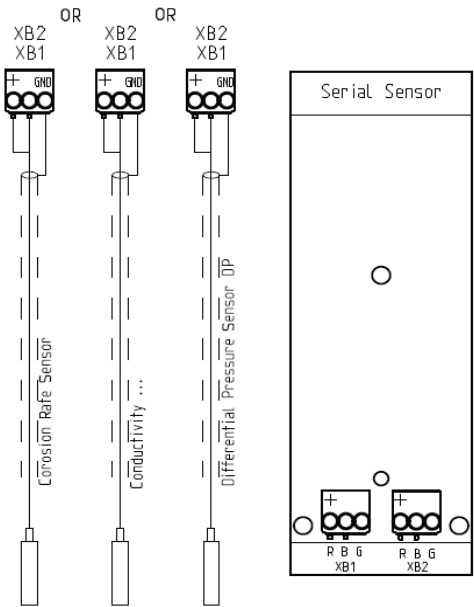
Figure 39 **Dual Serial Input Driver connections**

6.3.13 **Dual CT (Conductivity/Temperature)**

The inputs can be any combination of the following ProMinent sensors;
4-wire conductivity, 4-wire condensate conductivity, LM335[1] (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 1: LM335 is our SGT sensor, pn 1051507

NOTE: The ProMinent Toroidal conductivity sensor emits a 4-20mA signal and therefore requires a 4-20mA input driver.

NOTE: To lengthen a temperature sensor signal, use the temperature transducer and input this signal on a 4-20mA input card.

Figure 41 Dual Conductivity Driver
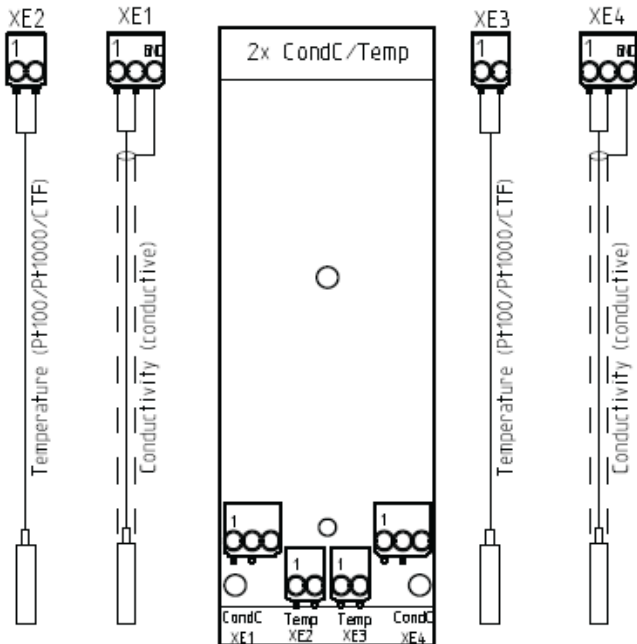
Figure 40 **Dual Cond/Temp input Driver Connections**

Typical conductivity card connections
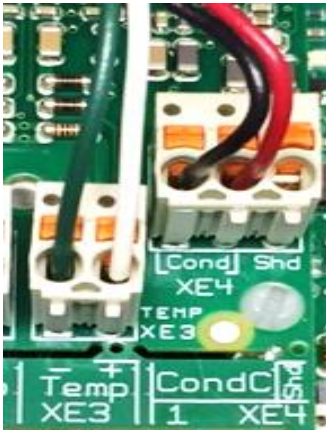
Figure 43 Four Wire Conductivity - Temperature Probe On channel 2

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 42 4 Wire Conductivity/Temperature sensor

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

Table 6 Dual Conductivity Temperature Connections   +.

6.3.14 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.

Temperature can be used for display, control or compensation.

This card is **not compatible** with our 'SGT' Solution Ground/Temperature sensor.

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 44 Dual pH/ ORP Driver
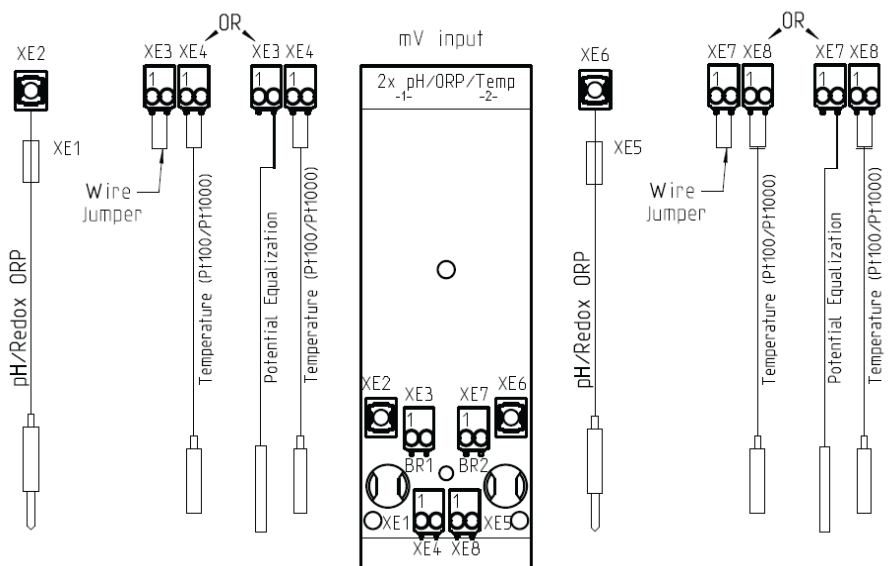
Figure 45 Dual pH/ORP input Driver Connections

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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.

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

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

If a "liquid potential" jumper and a potential equalization electrode are both or neither connected, it will cause incorrect sensor readings.

Always leave the jumper connected if not using potential equalization, or remove the jumper when connecting potential equalization.

6.3.14.1 Attaching the pH/ORP coax cable.

Once the cable has been prepared, (Figure 50) attach it to the pH/ORP driver card. Remove the shield grounding nut, XE5, and loosen the center conductor screw, XE6, as shown in Figure 47.
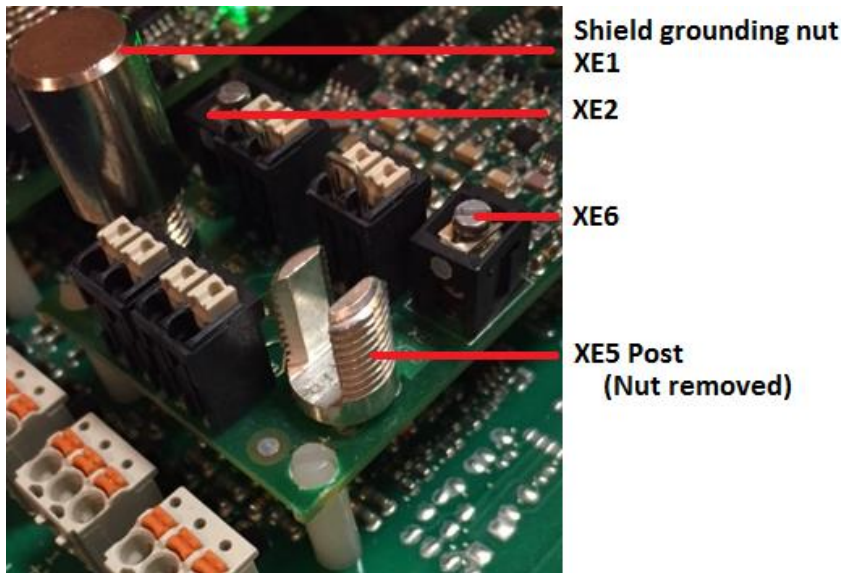
Figure 47 pH/ORP driver card coax connection
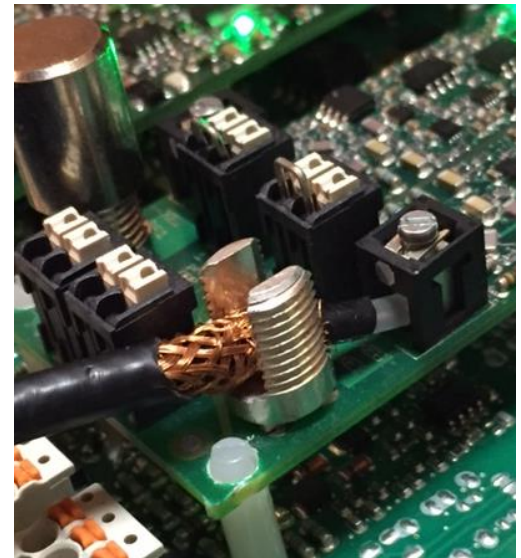
Figure 48 Coax placement

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!
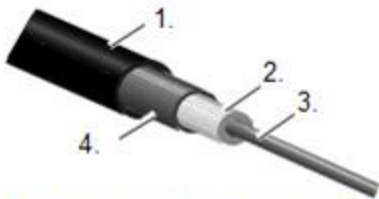
Figure 49 Coaxial Cable Construction

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

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

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

Figure 50B Coax cable preparation with 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. 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.

6.3.15 ORP/pH Temp mA Input card

The purpose of the card is to have pH and Free chlorine on one driver card.
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 +/- 1,500mV
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. We stock the PT1000.
Temperature can be used for display, control or compensation.
This card is **not compatible** with our 'SGT' Solution Ground/Temperature sensor.
The 4-20mA input can be connected to an active or passive loop. This input is isolated from the motherboard.

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Any linear 4-20mA input is acceptable; however, there is no square root operation as found in some older flow meters. Enter any engineering units for the range. 4mA does not have to be 0.

Maximum load per loop is 50mA. Short circuit protection at 70mA. Reactivation after 10 seconds. We recommend a maximum length of 1,000 feet using 22 AWG wire or larger. Twisted, shielded, stranded cable is best for long distances.
If a potential equalization electrode is used, the default wire jumper on XE3 must be removed before connecting the potential equalization electrode to input XE3:2. If not using a potential equalization electrode, leave the default jumper in place.
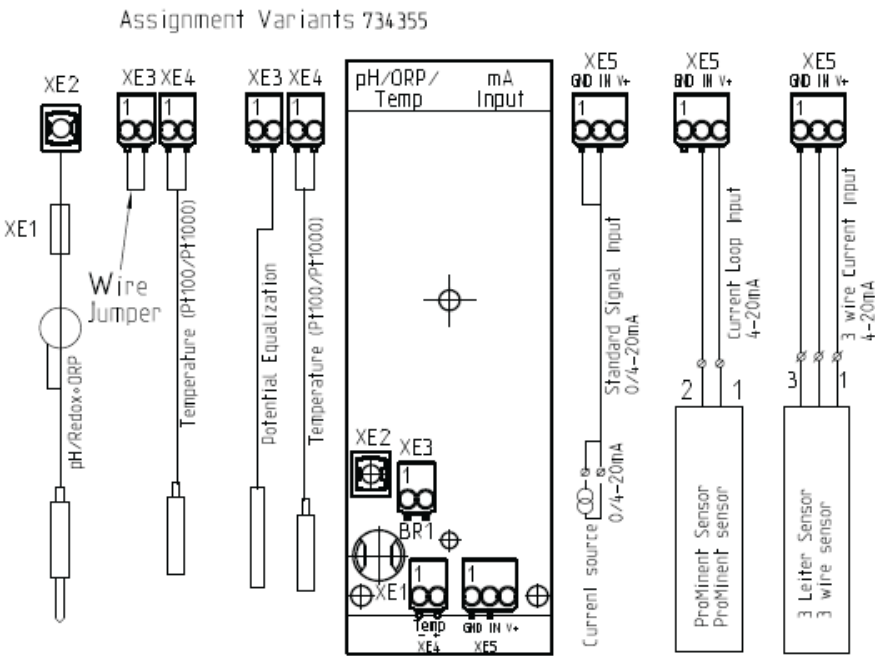
Figure 51 pH/ORP=Temp- 4-20mA Input Driver connections

Figure 52 ProMinent Industrial ORP and pH sensors

pH/ORP-Temp-4-20mA Input			
HW Version: 734355 RevA			
	Connector	Pins	Description
Channel 1	XE1	-	Reference electrode (Shield)
	XE2	-	Measurement signal (glass electrode)
	XE3	1	Short circuit using jumper
	Without liquid potential	2	
	XE3	1	NC
	With liquid potential	2	Liquid potential
	XE4	1	Temperature sensor (Pt100 or Pt1000)
		2	Temperature sensor (Pt100 or Pt1000)

Table 8 pH/ORP – Temperature Connections

Connector	Pins	Active 2 wire mA input	Active 3 wire mA input	Passive mA input
XE5	1	(-) NC	(-) GND	(-) GND
channel 2	2	(+) mA input	(+) mA input	(+) mA input
	3	(V+) 23V	(V+) 23V	(V+) NC

Table 9 mA Input Connections

6.3.16 Dual 4-20mA Input Driver

The dual 4-20mA input card can handle active and passive loops. Both inputs are isolated from each other and the motherboard.

Any 4-20mA input is acceptable; however, there is no square root operation as found in some older flow meters.

Enter any engineering units for the range. 4mA does not have to be 0.

Maximum load per loop is 50mA. Short circuit proof at 70mA. Reactivation after 10 seconds. ProMinent recommends a maximum length of 1,000 feet using 22 AWG wire or larger. Twisted, shielded, stranded cable is best for long distances.
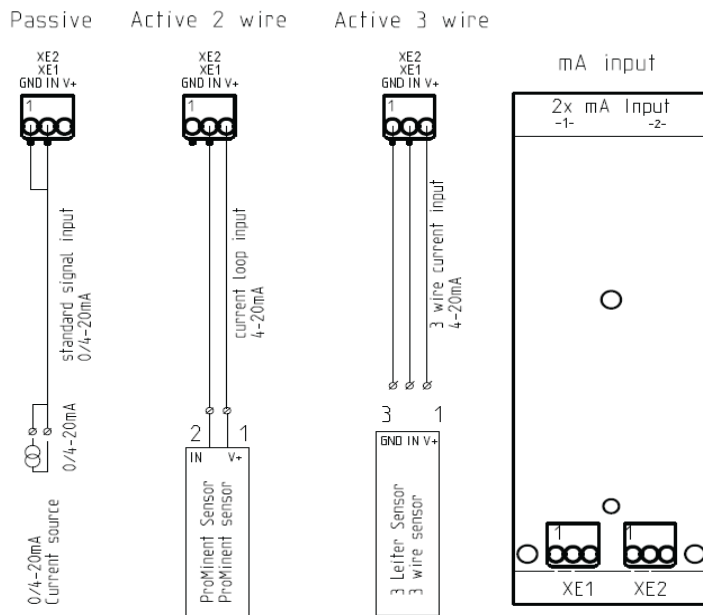
Figure 53 Dual mA Input Driver Connections

Figure 54 Dual 4-20ma Input driver

Connector	Pins	Active 2 wire mA input	Active 3 wire mA input	Passive mA input
XE1 channel 1	1	(-) NC	(-) GND	(-) GND
	2	(+) mA input	(+) mA input	(+) mA input
	3	(V+) 23V	(V+) 23V	(V+) NC
XE2 channel 2	1	(-) NC	(-) GND	(-) GND
	2	(+) mA input	(+) mA input	(+) mA input
	3	(V+) 23V	(V+) 23V	(V+) NC

2 x mA inputs — HW Version: 734126 Rev. 4

Table 10 Dual mA Input Connections

6.3.17 Connection of Amperometric Sensors

ProMinent amperometric sensors can be terminated to a 4-20mA input driver card.
Connect the sensor, as described in section **6.3.14 Dual 4-20mA Input Driver**

Note: if connecting a non-powered sensor to G input you will need to use 15VDC power supply from either one of the digital inputs or an external power supply. If power is pulled from a digital input, the digital inputs will no longer be isolated from 4-20mA input G, since they are sharing the same power supply. For this reason, we will not use the G input for ProMinent amperometric sensors. A toroidal conductivity probe or EcoPod level sensor will work.

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Pin 1 on the ProMinent amperometric sensor is connected to the V+ terminal

Pin 2 on the sensor is connected to the 'IN' terminal

Shown connected to XE1
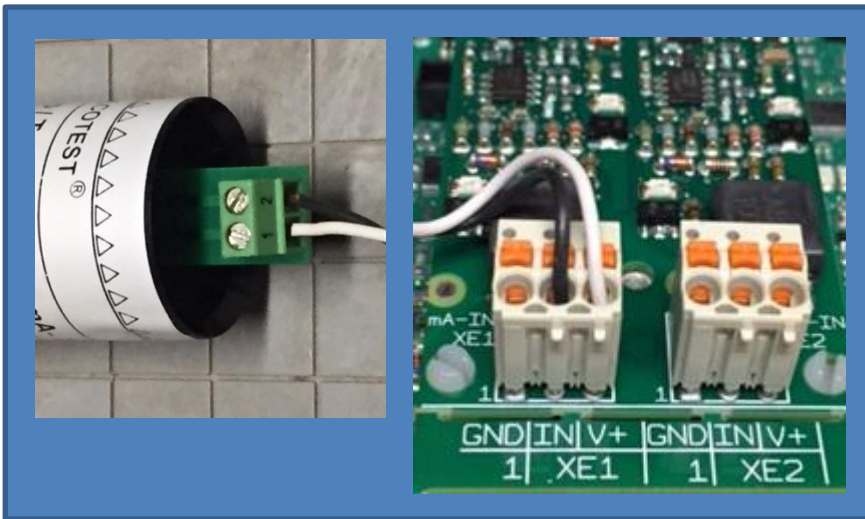
Figure 55 Amperometric probe to 4-20mA Input Driver

Figure 56 Three wire 4-20mA inputs that utilize V+

NOTICE

The wiring examples in this section show inputs on XE1 and XE2. Any of these examples could have used the other input. Both inputs are electrically identical.

MilliAmp inputs from powered devices do not need on-board V+. The + wire from the Input device, (analyzer, PLC, etc), connects to the 'IN' terminal and the – wire to the 'GND'.

Figure 57 Two wire remotely powered analog input

NOTICE

Analyzers and computer systems, DCS, PLC etc, typically have 120VAC. Therefore signals from these devices can be powered from them. However, the signals often have the option to allow the current loop to be powered from the receiving end. In this case, the receiving end is this controller.

The purpose of this page is to show how to wire inputs from devices that need to be powered from the controller, figures 55 and 56, and inputs that are powered remotely, figure 57.

6.3.18 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 = 32^0 F and 20mA = 212^0 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.

Figure 58 Dual 4-20mA Output driver

Assignment Variants 734143

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 +
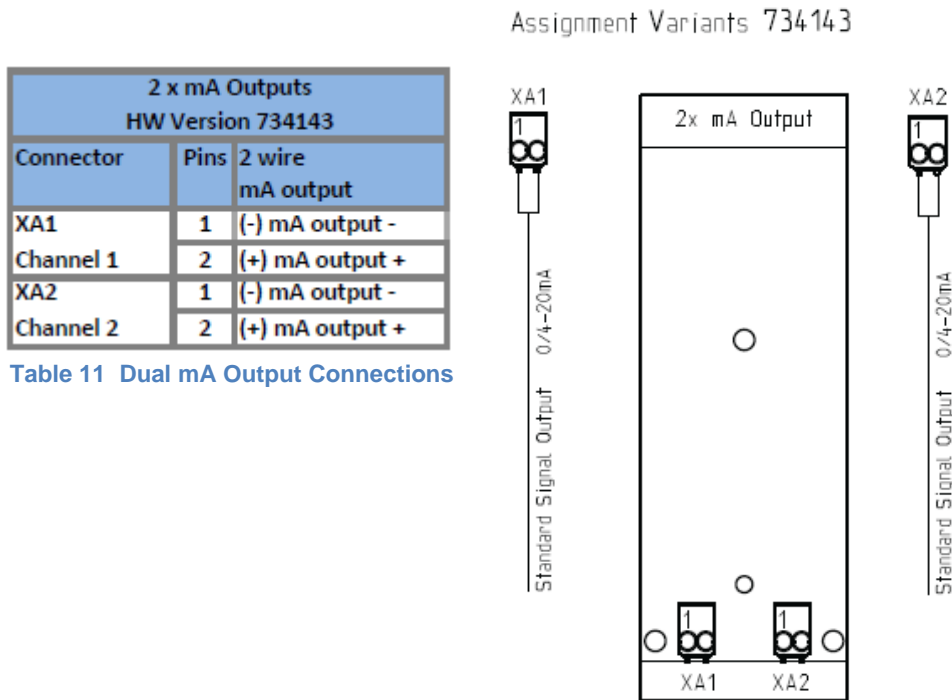
Table 11 Dual mA Output Connections

Figure 59 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 mA Output with ProMinent Universal Control Cable on output 1.

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6.4 Dual Pool Considerations

One of the significant improvements to the new DCM510 platform is the ability to control two bodies of water in a single controller. This can typically be two pools, two spas or a pool and a spa.

While the DCM510 now has the capability to measure and control two bodies of water, it does not have unlimited inputs and outputs. Considerations must therefore be made when deciding to control two bodies of water with a single controller. There are up to 3 dual analog input slots available for a total of 6 analog sensors, plus the temperature inputs that accompany pH and conductivity inputs.

A good use of all the sensors available might be: Control two indoor pools, each with pH/Temperature, ORP, and Free Chlorine sensor. That is shown as Configuration #1 below.

Another option utilizing all 6 analog sensors available might be each pool having pH/Temperature, Free and Total Chlorine, eliminating ORP. This combination allows the automatic calculation, and display of Combined chlorine. If using an Ultraviolet treatment system, Chloramines can then be controlled. This configuration is shown as Configuration #2 in the chart below.

Additional possible combinations are also shown in Configurations 3 and 4 below.

6.4.1 Dual Pool Sensors

All of the sensors available for a single pool are available for the dual pool configurations. The only limitation is the total number of sensor inputs and the associated control outputs needed. There is a lot of control flexibility with 9 control relays. The 9 includes 2 dedicated AC line relays, 3 dry contact mechanical relays that can be easily configured for AC or DC, and (4) 24 VDC solid-state contacts that can be used as an enable/pause output or a pulse output to control pump speed with PID.

6.4.1.1 Example Dual Pool Configurations

2 Pool Configuration #1					
Driver Slot C/D		Driver Slot E/F		Driver Slot I/J	
2xmA input Driver		pH/ORP Driver		pH/ORP Driver	
Input C	Input D	Input E	Input F	Input I	Input J
Free Cl	Free Cl	pH/Temp	ORP	pH/Temp	ORP
Pool 1	Pool 2	Pool 1	Pool 1	Pool 2	Pool 2

Figure 61A   2x pH/Temp, 2x ORP, 2x Free Cl

2 Pool Configuration #2							
Driver Slot C/D		Driver Slot E/F				Driver Slot I/J	
2x mA input Driver		pH/ORP Driver				2x mA input Driver	
Input C	Input D	Input E		Input F		Input I	Input J
Free Cl	Total Cl	pH	Temp	pH	Temp	Free Cl	Total Cl
Pool 1	Pool 1	Pool 1	Pool 1	Pool 2	Pool 2	Pool 2	Pool 2

Figure 61B 2x pH/Temp, 2x Free Cl, 2x Total Cl

2 Pool Configuration #3							
Driver Slot C/D		Driver Slot E/F				Driver Slot I/J	
2x mA input Driver		pH/ORP Driver				Spare	
Input C	Input D	Input E		Input F		Input I	Input J
Free Cl	Free Cl	pH	Temp	pH	Temp		
Pool 1	Pool 2	Pool 1	Pool 1	Pool 2	Pool 2	Unused	Unused

Figure 61C 2x pH/Temp, 2x Free Cl

2 Pool Configuration #4							
Driver Slot C/D		Driver Slot E/F				Driver Slot I/J	
Spare		pH/ORP Driver				Spare	
Input C	Input D	Input E		Input F		Input I	Input J
		pH	Temp	pH	Temp		
Unused	Unused	Pool 1	Pool 1	Pool 2	Pool 2	Unused	Unused

Figure 61D 2x pH/Temp, 2x ORP example
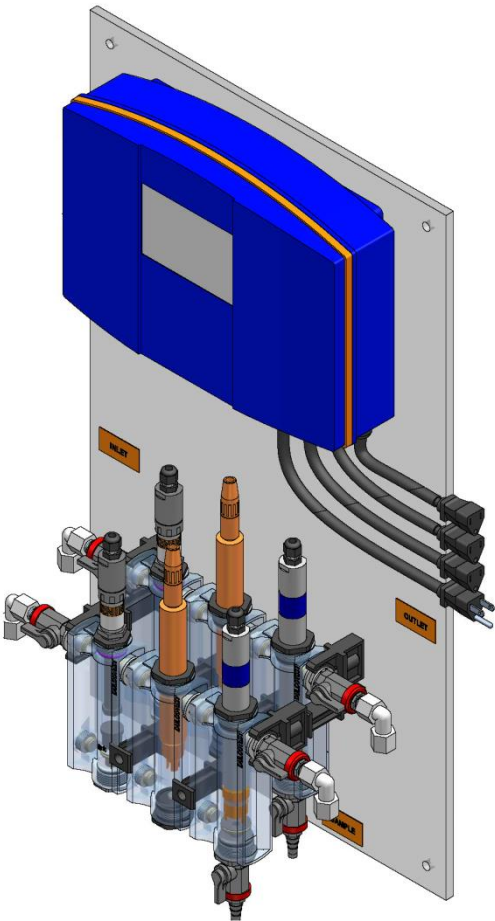
Figure 62A Dual pool panel layout

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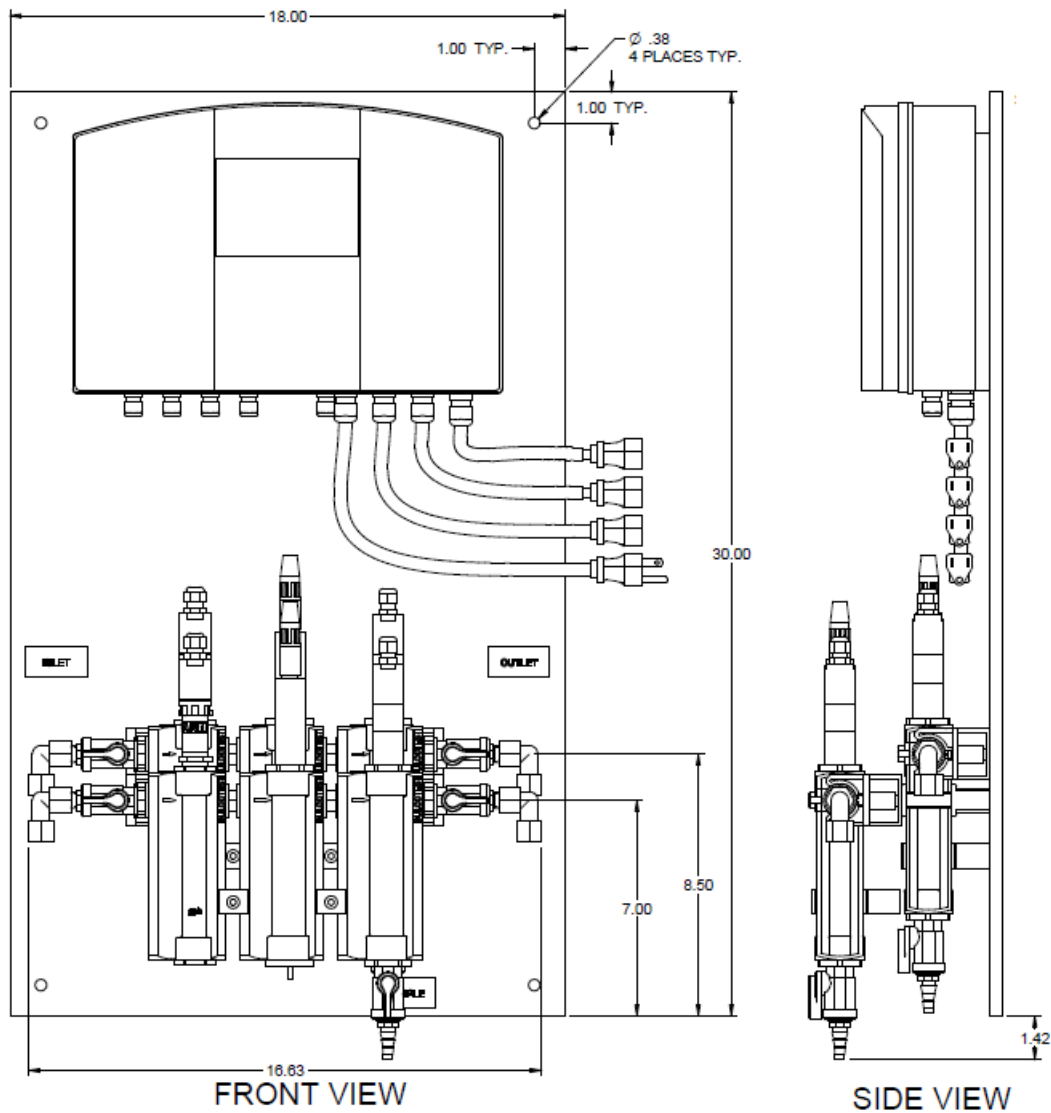
62B Dual panel layout

Additional possibilities for combinations of the above configurations are available to meet the demands of your facility.

6.4.1.2 Stacked DGMa

The DGMa modular sensor housing is typically mounted so the flow is left to right with the flow switch in the most left module. When a dual-pool version is ordered, the typical configuration has the DGMa "stacked" with one pool's sensors closest to the black polypropylene backpanel, and the sensor housing for the second body of water mounted just in front of the other DGMa, as shown in the SIDE VIEW drawing above. If this arrangement is inconvenient or unworkable, the DGMa sample assemblies can be mounted separately or reversed so the flow is right to left, to meet your needs. If considering separating the DGMa assemblies, keep cable lengths in mind and order longer coaxial SN6 cables, if needed, to accommodate the pH and ORP sensors (10.0 meters, 32.8 Feet Maximum). Residual and temperature sensors will also be limited to the same lengths as the coaxial SN6 cables because of proximity.

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6.4.1.3 Temperature inputs

There is only one dedicated temperature input on the motherboard of the DCM510 controller, the H input. With two bodies of water, if there is a need to display, datalog or control the water temperature of both bodies of water, it will be necessary to use an additional temperature sensor. A convenient way to accomplish this is to use the temperature inputs on the pH input driver card(s). The pH / ORP driver cards utilize a Pt1000 RTD sensor input which is different than the H input, which uses a mV/°K sensor. These sensors are not interchangeable. The H input SGT temperature sensor is part number 1051505m The RTD temperature sensor for the pH input is part number 1080101.

6.4.2 Salt Generator Pool Considerations

6.4.2.1 Salt Compatible sensors

Many of the standard sensors used in fresh water pools are not compatible with some on-site chlorine generators. Generators that utilize salt dissolved in the pool or spa water create special conditions that require special sensors. Standard ppm and ORP sensors used in salt water pools will seem to work at first, but will become less responsive over a short period of time. For that special condition we have specific sensors that must be used in salt water applications.

6.4.2.2 Temperature and pH Sensors

Conductivity, Temperature and pH sensors are fairly universal and are not adversely affected by salt water, so there are no special salt compatible sensors for Conductivity, Temperature or pH.

6.4.2.3 ORP Sensors

The platinum element used in standard ORP sensors does not work well in salt pools, so a gold element version of our ORP sensor must be used. The part number 1003875 RHEP-Au–SE ORP sensor is 13.5mm in diameter, and utilizes a more sensitive gold needle tip.

6.4.2.4 Chlorine Sensors

CLE3 Free Chlorine membrane sensors are not compatible with salt pool chemistry and will need to be substituted with a CLO free chlorine sensor. The CLO sensor is different in that it has a gold tip and no membrane.

6.4.2.5 Conductivity sensors

Conductivity sensors are more popular in salt pool applications as they allow the user to monitor the salinity level of the water, which is critical for optimal performance of most salt generators. Depending on the pool chemistry, it may be necessary to add a cell to the DGMa sensor housing to accommodate a conductivity sensor. Conductivity sensors do not require a specific orientation as do electrolyte sensors, so conductivity sensors use an adaptor to screw into the bottom of one of the 25mm cells as shown below.
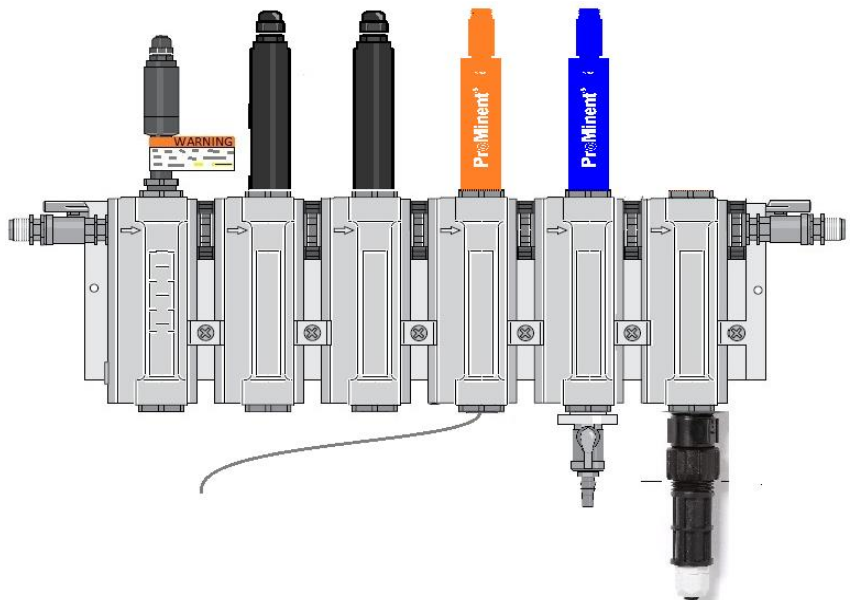
Figure 63 DGMA with Conductivity sensor

7 Communication Hardware

7.1 Diagram of the Communication Modules

See also section **11.1 Communications** in the System Menu

ProMinent®
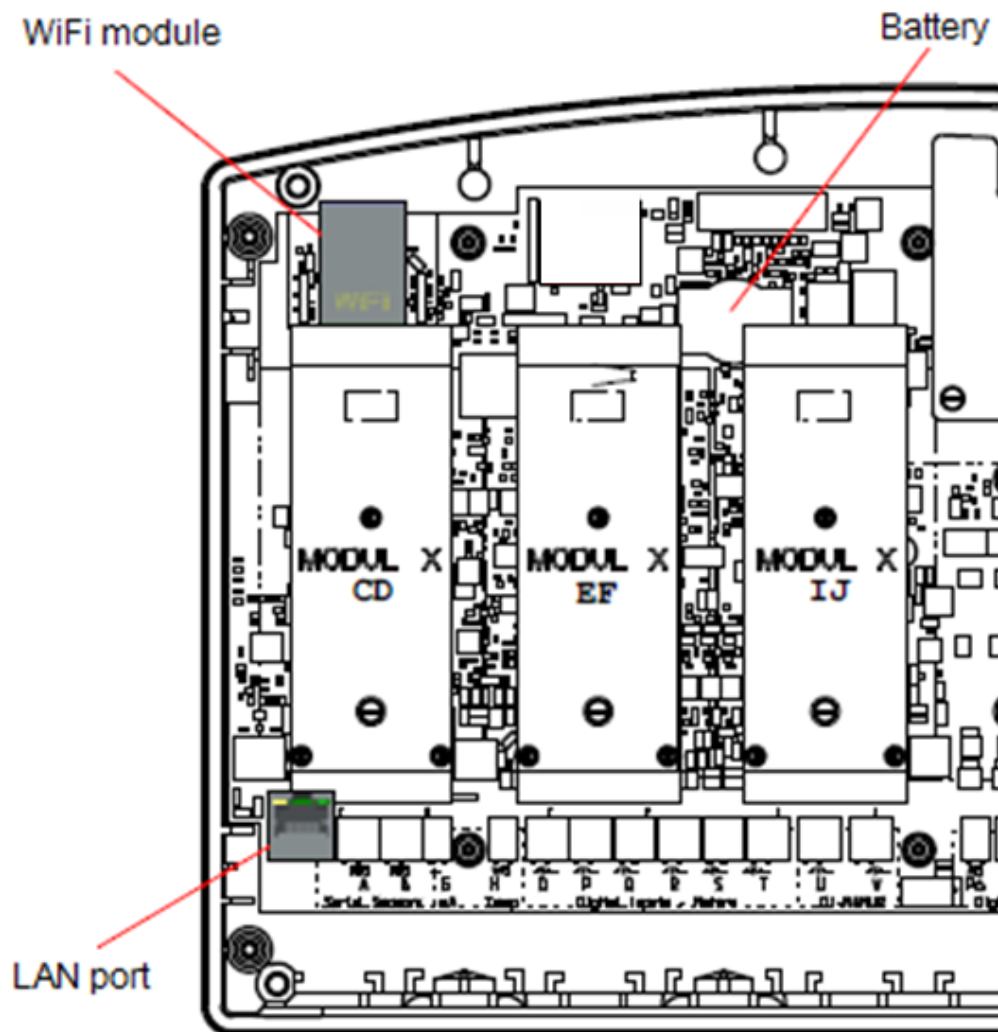
8 Commissioning

User qualification: trained user, see section **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:

These sensor choices can be changed or rearranged. See section **2.2 Modifying the 'Home' Screen.**

> ⚠️ **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

8.2 Defining Metering and Control Processes

Configuring the controller adapts it to your pool or spa.

8.2.1.1 Define the following parameters to set up a controller:

- What type of a process control is planned? Single or dual pool? Salt generator?
- Which measured variables are there? pH, ORP, Free Cl2, Total Cl2, Temperature…
- What other devices will interface the controller? (UV, Heater, flowmeter, flow switches or interlocks etc.)
- Should the controls operate as ON/OFF, frequency, proportional or PID?
- Which relays or control outputs are there?
- What control parameters are necessary? Setpoints, alarm points, feed timeouts.
- How should any mA inputs or outputs be configured?
- Are there chemicals to be fed using timer?

9 Programming the Inputs

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

> **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, a tablet computer or smart phone. Refer to the DCM510 Browser manual for more information.
>
> The keypad interface instructions in this manual are intended to show an operator how these individual tasks can be performed from the keypad. They are not all inclusive.

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. The factory does not setup analog flow or level inputs. However, this can easily be accomplished in the field if the range of the analog input is known. Refer to the calibration section **9.5 General Sensor Calibration**

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 serial sensors. See section **9.1.2 Enabling a Serial Sensor**

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. Sensor will probably need to be enabled after the driver card and sensor(s) are installed, and the controller is rebooted.

Never remove or install a driver card with the unit powered!

1- Press the MENU key.
2- Use the Up and Down ARROW keys to find and point to the **System** choice and press the **OK** button once.
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- The input has been enabled and the display returns to the System menu to enable additional sensors if desired.
7- Press ESC (Escape) to exit

WARNING!

Sensor run-in period

This can result in hazardous incorrect metering

Take into consideration the sensor's run-in period during commissioning:

There has to be adequate feed chemical in the sample water for your application (e.g. 0.5 ppm chlorine)

Accurate measuring and metering is only possible if the sensor is working correctly.

It is imperative that you adhere to the sensor's run-in periods before calibration and control.

Calculate the run in period when planning commissioning. It may take a whole day to run in some sensors.

Refer to the sensor's operating instructions.

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9.1.2 **Enabling a Serial Sensor**

Wire the sensor according to the color code on the controller terminations, Red, Black and Green.
For more wiring information:
If you are using input A or B, see section **6.3.7.1 Inputs on the Main Board.** If you are using a serial driver card, see section **6.3.12 Dual Serial Input card.**

1- Press Menu
2- Scroll up to System and press OK
3- Scroll down to Enable I/O and Press OK
4- Scroll down to the new sensor and press OK. Find your input A, B or a serial input card, (C, D, E, F, I or J).
5- Scroll up to Compensation and press OK
6- Scroll down to the correct metallurgy and press OK
7- Press Escape.

Use section **9.2 Changing a Descriptor** to give the input a name.

9.2 **Changing a Descriptor**

Once you have enabled an input or an output, naming is helpful in avoiding programming mistakes. Choose a unique name. Abbreviate as needed. There are a total of 16 spaces.

Example: pH Lap Pool 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 item you chose to name and press **OK**. If your relay/sensor is not listed, it is not enabled. See section **9.1 Analog and Digital Inputs** for sensors and for relays, **10.2 Determine if a Relay is Enabled**.
4- Press **OK** to edit the "descriptor" of the item.
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 'alpha' is seen, please realize that this is a choice, not the current selection.
6- The default choice is upper case so use the up and down arrows to change the R in Relay to B for Backwash or A for acid, etc.
7- 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.
8- Use the arrows to change the 'e' to 'a' and continue until your word is spelled.
9- When finished, press **OK** to save.

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9.3   Selecting an Analog Sensor Type

 ProMinent amperometric sensors are compatible with the DCM5 via the isolated 4-20mA Input driver. Once the sensor type is selected, the controller will scale the input, provide calibration limits for the type selected, and clamp the measured sensor values so that an open loop does not measure a negative value.
If your 4-20mA device is not on this list below, choose 'other' and enter the scale manually.

9.3.1   Selecting the sensor type:

The type cannot be changed once the sensor is linked with an output. If linked, use that output menu to uncouple the sensor from the relay/ output.

Refer to Table 12 4-20mA Sensors

1   Press **MENU**
2   Scroll up to **System**. Press **OK**
3   Scroll down to **Set Sensor Type**. Press **OK**
4   Scroll down to the 4-20mA input where the sensor is connected. Press **F3** SELECT
5   Scroll down until you see the type of sensor you have and press **OK**
6   Press **F1** to select the probe range.
7   Use the up/down arrows to change the range as needed. Press **F2** SELECT to save. Press **ESC**

Sensor Type	Span Options & units	mA Span	G=Gain, O=Offset Span not user modifiable
Unassigned	Other 0-100%	4-20	User modifiable span G=6.25, O=-25
CBR Bromine	CBR 0-2ppm	4-16	G=0.167, O=-0.667
	CBR 0-10ppm	4-16	G=0.833, O=-3.333
CGE Chlorine	CGE 0-2 ppm	4-16	G=0.167, O=-0.667
	CGE 0-10ppm	4-16	G=0.833, O=-3.333
CLE3 Chlorine	CLE 0-2ppm	4-16	G=0.167, O=-0.667
	CLE 0-10ppm	4-16	G=0.833, O=-3.333
	CLE 0-20ppm	4-16	G=1.67, O=-6.67
	CLE 0-50ppm	4-16	G=4.17, O=-16.6
	CLE 0-100ppm	4-16	G=8.33, O=-33.3
CLO Chlorine	CLO 0-2ppm	4-16	G=0.167, O=-0.667
	CLO 0-10ppm	4-16	G=0.833, O=-3.333
CTE Chlorine	CTE 0-2ppm	4-16	G=0.167, O=-0.667
	CTE 0-10ppm	4-16	G=0.833, O=-3.333
Diff.Pressure	DeltaP 0-100psi	4-16	G= 6.25, O=-25
pH-transducer	pH 0 to 14	4-20	4mA=-15.45pH 20mA=-1.45pH pH outside of 0-14 blocked G=-1.056, O=19.675 5.373mA=14pH, 18.6mA=0pH
ORP-transducer	ORP 0-1000mV	4-20	G= 62.5, O=-250
Temperature	Temp. 0-100C	4-20	G= 6.25, O=-25
Turbidity	0-5000NTU	4-20	G= 312.5, O=-1250
UV	0-100%	4-20	G= 6.25, O=-25
	0-1000wm2	4-20	G= 62.5, O=-250

Table 12 4-20mA Sensors

9.4 Analog Sensor Cleaning and Commissioning

9.4.1 General Remarks

Potentiometric sensors; pH, ORP, conductivity and corrosion rate.

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.

> ℹ **Amperometric Sensors:**
>
> **See Table 12.**
>
> **These sensors are shipped with a complete sensor specific manual. Refer to this manual for commissioning, cleaning and maintenance of the sensors. Refer to section 9.6 Calibrating an Amperometric Sensor**
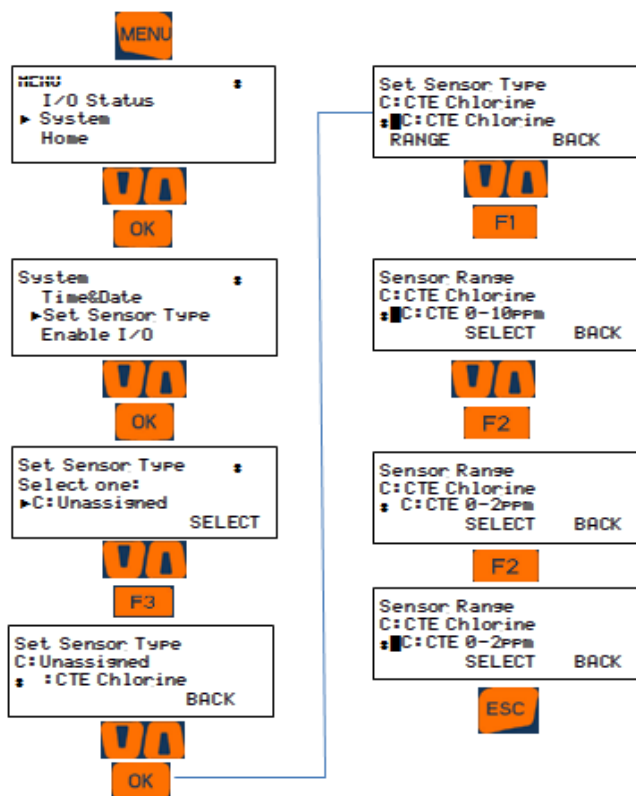
9.4.2 Sensor Commissioning

Before putting into operation, the protective cap or case must be removed from the glass

or metal electrode. The 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 **9.4.5. Cleaning and Servicing Probes**.

9.4.3 Checking pH Probes

Connect the probe to the controller 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 controller 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 the probe.

9.4.4 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.

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

9.4.5 Cleaning and Servicing Probes

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

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

<table>
<tr><td colspan="2"></td></tr>
</table>

⚠️ **CAUTION!**

Do not rub

This might cause damaging static electricity and false readings.

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.

> ℹ️ **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.

9.4.5.1 Storage

From the factory, pH and The pH and redox-ORP combination probes are shipped with a cap filled with a 3-molar KCl solution.

In the field, the cap can be used to cover the probe tips for protection when not in use. If a KCl solution is not readily available, pool water or city drinking water are excellent replacements as they typically have a neutral pH and a slight amount of sodium

hypochlorite (bleach). Preferably, a pH of 4 to 7 and a slight amount of chlorine will keep the sensor from biological fouling during the layup.

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).

Probes with KCl filling solution or gel should only be installed in open-ended in-line probe housings (max. 0.5 bar), type DLG III, or immersion-type probe housings, type ETS. Pressurized systems require special probes with a plastic electrolyte.

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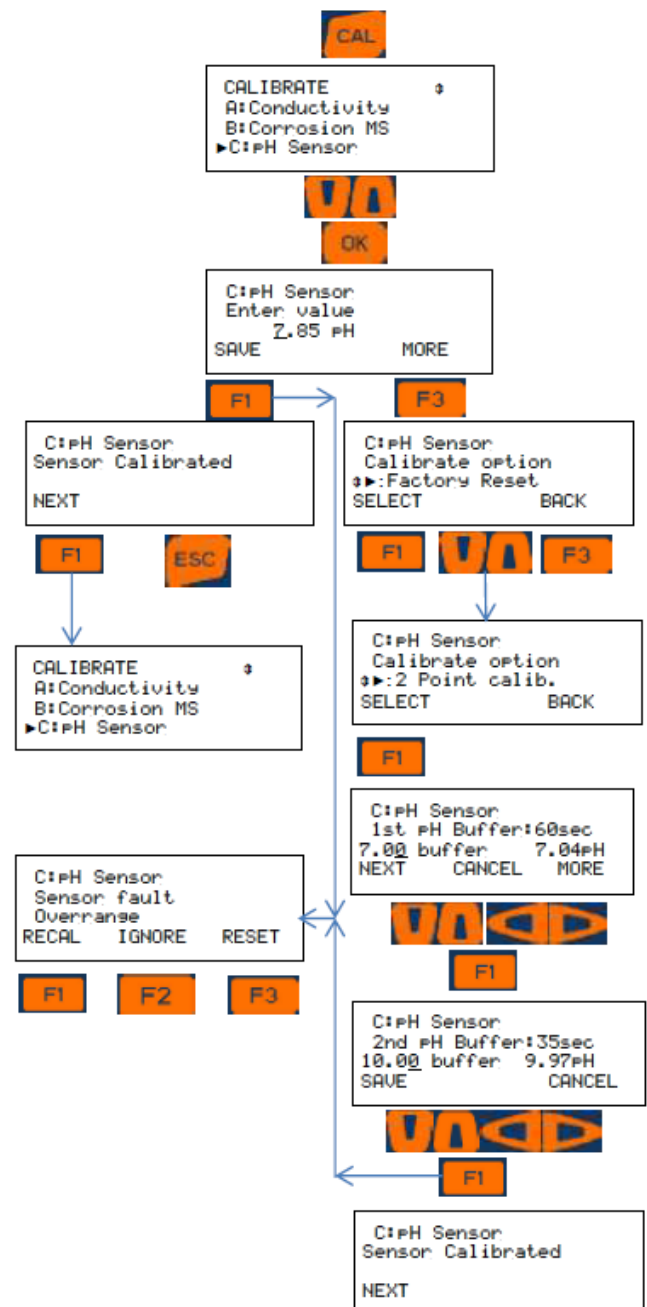
9.4.5.2 Service Life

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.

> ⚠️ **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

9.5.1 Calibration Notes

Conductivity Temperature Compensation: Conductivity sensors should always be temperature compensated. In the DCM510 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".

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.

1- Press the **CAL** button.
2- Use the Up and Down arrows to locate the sensor you wish to calibrate and press **OK**.

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 to match your wet test. Pressing **F1** SAVE completes the single point calibration adjustment, -or- Pressing **F3** MORE

gives you more calibration options.

The calibration program allows you to select a single or 2-point calibration method. Once chosen, the screen that follows step 2 above will be that choice. From this screen, you can select **F3**, MORE, to switch back to the other mode or use the up arrow to select reset to factory calibration or two point calibration.

3a- (Single Point Calibration) Edit the value and press **F1** to SAVE. Choose **F1** again to calibrate another sensor or press **ESC** to exit.

OR

3b- (2-Point Calibration). 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.

4- 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 the previously saved calibration.

> ℹ️ **Calibrations with pH Compensation**
>
> It is important that you always calibrate the pH sensor before any pH compensated sensor, like free chlorine. Otherwise the chlorine calibration and measurement will be incorrect.

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9.6 Calibrating an Amperometric Sensor

> ⚠️ **CAUTION!**
>
> Correct sensor operation / Run-in period
>
> Accurate measuring and metering is only possible if the sensor is working correctly.
>
> Please read the specific operating manual for each sensor for more information.
>
> The run in periods should be allowed for when planning commissioning.
>
> It may take an entire 24 Hour day to run in a new CTE or CGE sensor.

> ⚠️ **CAUTION!**
>
> Proper sensor plumbing rules.
>
> Prior to calibrating amperometric sensors, flow and pressure must be within certain parameters.
>
> Take the time to familiarize yourself with section 6.2 Mechanical Installation, especially sections 6.2.4 Sensor Installation

1- Press the **CAL** key
2- Scroll down to the sensor you wish to calibrate. Press **OK**
3- Get a sample and run a DPD test. Use the timer on the screen. Press **F1** DPD to start the clock.

> ℹ️ **Calibration Clock**
>
> Use this clock if your test method calls for a specific waiting period before reading the test value.

4- When the timer reaches the limit for your test, read the test value and enter it here using the arrows. Press **F1** to SAVE the change.
5- Or use the **MORE** button to reset the input to factory default.
6- The controller should accept the value and show the Sensor Calibrated screen.

7- If the value you enter is too far from what the controller has calculated as valid based on the input signal, a sensor fault message will be displayed.

If there is a Sensor fault:

Press either **F1**, RE-CAL to repeat the sensor calibration.

Or 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 chemistry changes may be marginal or not possible if the sensor is faulty.

Or press **F3**, RESET to cancel this calibration and return to the previous calibration.

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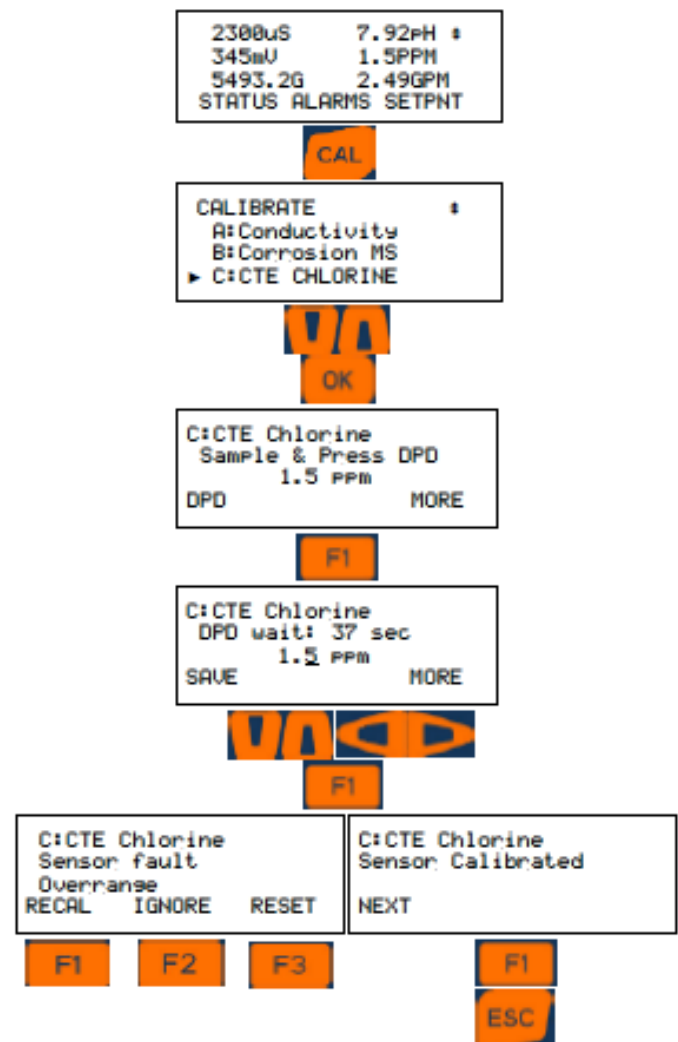
9.7 Analog Sensor Alarms

(See flowchart on next page)

Analog inputs have high and low alarms to alert the operator if a measured value is out of the normal operating range.

9.7.1 Latching Alarms

Alarms in the DCM510 can be latching or non-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. If this is undesirable, select non-latching=Yes in the alarms section of the menu for each alarm.

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.

Latching can only be edited via the browser connection. Refer to the DCM510 browser manual.

9.7.2 Delay on Alarm

The DCM510 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 a similar way. There are 3 types of settings for the alarms on any input.

- Adjust Alarms changes the High and Low alarm limits.
- Delay on Alarm adjusts the time the DCM510 will wait before activating an alarm.
- Clear Alarms, as implied will clear all alarms and reset the Delay on Alarm timer. Follow the steps below to alter the Alarm limit settings for any alarm.

9.7.3 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 Low and High alarm adjustment setting) **F2** MORE takes you to the latching and alarm on/off page, or **F3** DELAY (adjust the delay time).

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

To adjust the High and Low values:

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

6- To turn the alarm off or adjust the latching function: Press **F2** MORE

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.

MENU

```
MENU                    ⇕
  Prime, Force ON
  Water Meter Setup
▶Adjust Alarms
```

OK

```
Adjust Alarms           ⇕
  8:Chlorine Pump
  9:Acid Pump
▶ C:pH
```

OK

```
C:pH
HiAlarm:          7.80pH
LowAlarm:         7.40pH
OTHER      MORE    DELAY
```

F1   F2   F3

```
C:pH
HiAlarm:          7.80pH
LowAlarm:         7.40pH
OTHER      MORE
```

```
C:pH
Alarms
Latching
SWITCH    ALMOFF    BACK
```

F1

```
Delay on Alarm
   5:00 Minutes

SAVE                   BACK
```

OK

```
Adjust Alarms           ⇕
▶ C:pH
  D:ORP
  E:Free Cl2
```

```
C:pH
Alarms
NonLatching
SWITCH    ALMOFF    BACK
```

F2

F1

```
C:pH
HiAlarm:          7.80pH
LowAlarm:         7.40pH
OTHER    ALMOFF    DELAY
```

ESC

```
C:pH
Alarms Disabled

         ALRMON    DELAY
```

F3

ESC

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9.8 Analog Sensor Diagnostics

Each sensor type has a diagnostic page to assist in determining sensor and driver card health.

1- Press **MENU**
2- Press the Status button (F1) or scroll up to I/O Status and press **OK**.
3- Use the arrows to find the I/O point you wish to evaluate and press **OK**.

```
MENU            ↕
► I/O Status
  System
  Home
```

[↓][↑]

[OK]

```
E:pH            ↕
       7.63pH
  Alarmed Low
CAL   ALARMS   MORE
```

[F3]

```
E:pH            ↕
Diagnostic:1
Sensor Type
pH Sensor
```

[↓]

```
A:pH            ↕
Diagnostic:2
Raw Sensor
     727.00
```

[↓]

```
E: pH           ↕
Diagnostic:3
Gain Multiply
  0.0100
```

[↓]

[↓]

[↓]
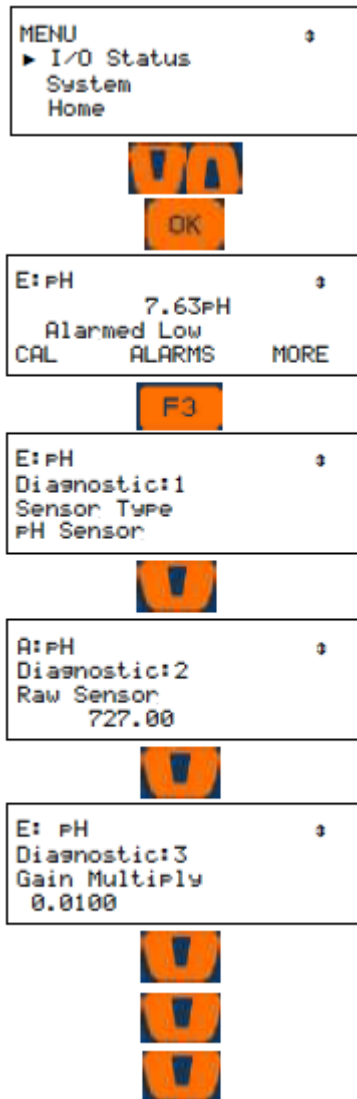
4- Press **F3 MORE**, to see the first Diagnostic for this sensor.
5- Press the down arrow to scroll through the remaining Diagnostic screens.

List of typical sensor Diagnostics:

Sensor Type, Raw Sensor input value, Gain Multiplier, Offset Adjustment, Last alarm, Current Status, Serial number and more.

A corrosion rate sensor has a pitting note and lists the metallurgy of the tips.

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

9.8.1 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"

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9.8.2 CT Conductivity 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 x 0.16+0=1599 µS
- 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, for example 75F

9.8.3 The 4-20mA Input Driver Card Diagnostics

To see diagnostic press **F1**
Use Up/Down Arrow keys to navigate to desired 4-20mA Input I/O then press **F3**

- Status
- Diagnostic 1: sensor Type (CLE3 Chlorine, CBR Bromine, CGE Oxidant, CLO Chlorine, CTE Chlorine, Fluorescent, pH Sensor, ORP Sensor, Temperature, Toroidal Conductivity)
- Diagnostic 2: sensor Raw value, 11.99mA=66.6%, Amperometric sensors use 4-16mA for min and max range
- Diagnostic 3: Gain, changes based on calibration Sensor Value = Raw x GAIN + OFFSET, for example 11.99mA x 0.833+(-3.333)= 6.655ppm
- Diagnostic 4: Offse changes based on calibration, see step 5
- Diagnostic 5: reports any Alarm
- Diagnostic 6: Driver Type, for example Dual 4-20mA input
- Diagnostic 7: Factory Use
- Diagnostic 8: Factory Use
- Diagnostic 9: Driver card Serial Number
- Diagnostic 10: Factory Use
- Diagnostic 11: Driver card Firmware version for example "00.00.00.17"
- Diagnostic 14: Sensor Range for example 0-10ppm

9.8.4 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"

9.8.5 Serial Sensors (CTFs, LPR, DP) Driver Card 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, Corrosion, Differential Pressure)
- 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=235x8.5+0=1998uS about 2000uS

9.8.6 ORP/pH Temp mA Input card

The diagnostic information for this card is the same as 9.8.1 pH/ORP diagnostic and 9.8.3 The 4-20mA Input information.

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9.9 Configuring Digital Inputs

9.9.1 Configure a Digital Input as a Water Meter or Status Input:

NOTE: All digital inputs O-V can be configured for a pulsing water meter or status (On/Off) input.

1- To Enable and Set 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 V) and press **F3**
5- Press **F3** again to switch from METER to CONTACT if necessary, then press **OK**

A contact input is used to inform the controller of the status of a process. The probe header flow switch uses a status input. Any device that has two states can be used as a status input. The input provides +15VDC to 'read' a status input from a dry contact, Hall Effect or Reed switch. Avoid 'Sine Wave' or powered outputs.
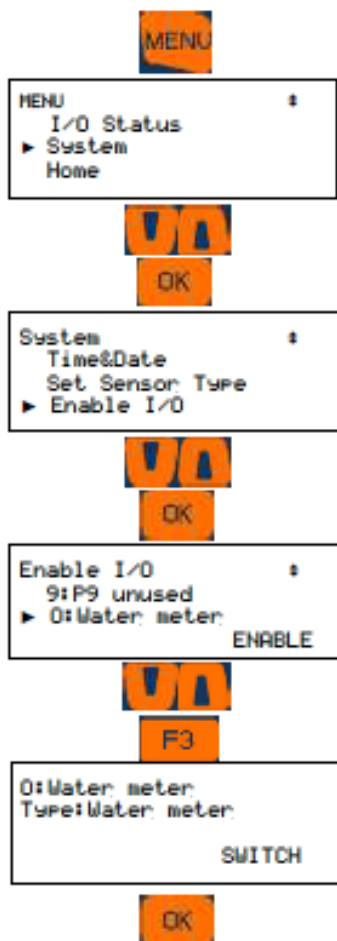
Continue the flowmeter setup:

1- Press **MENU**
2- Scroll to Water Meter Setup then press **OK**
3- Scroll down to your meter, then press **OK**

Use **F3** to switch to Vol/Contact if necessary, then use Up/Down and

4- Left/Right arrow keys to set gallon per contact or to adjust the K factor, then press **F1** to SAVE.

Note: See **9.2 Naming an Input or Output** to rename the relay for example to "Makeup Flow"

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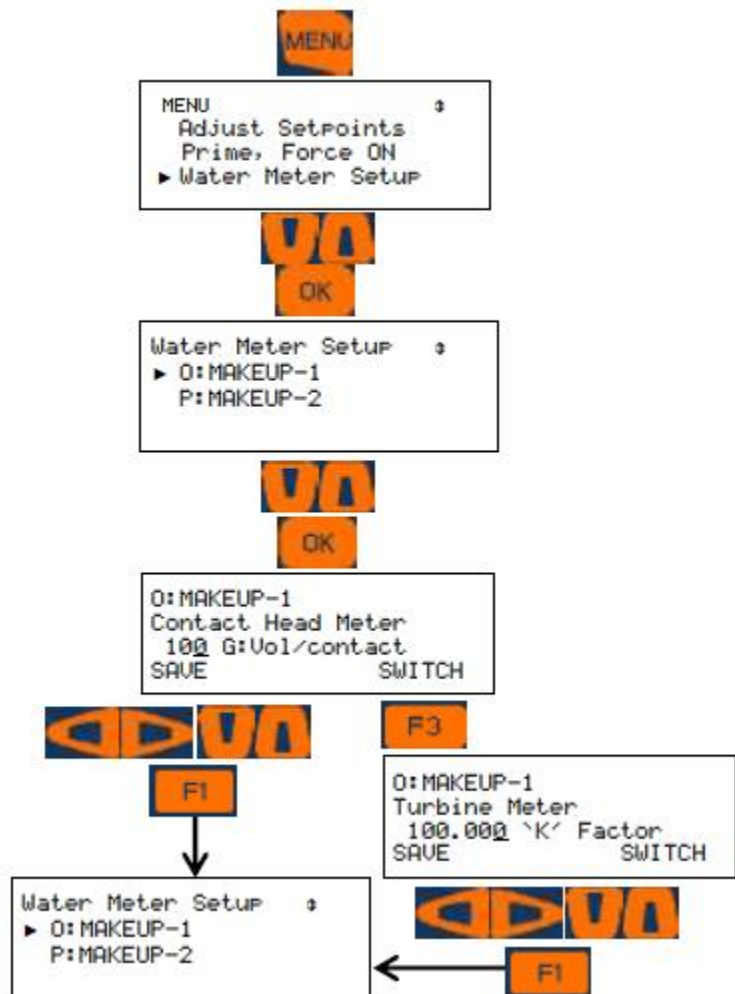
9.10 Disable an Analog or Digital Input

Inputs linked to outputs cannot be directly disabled. **Disable the output to sever the link, or choose a different analog sensor**. Use sections **9.10.1** and **9.10.2** to unlink the output, then return to this menu to disable the 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).
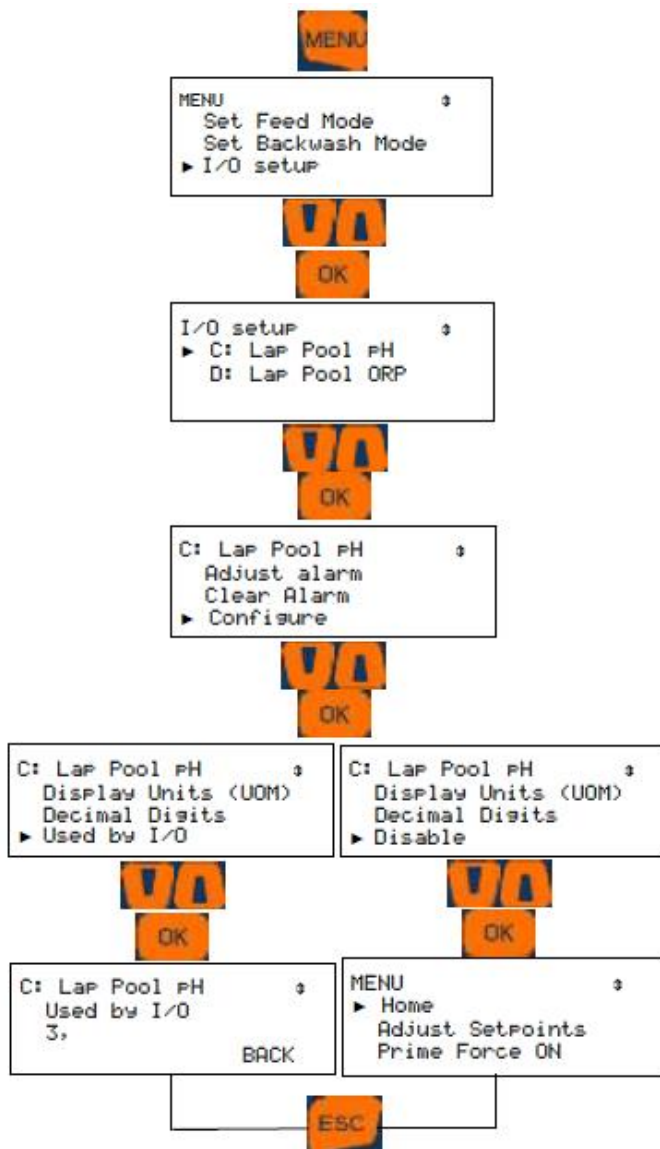
9.10.1 Changing or Unlinking an Analog Input Tied to an Output Relay

Inputs linked to outputs must be un-linked prior to being disabled. Analog inputs tied to Feed type relays, use pictogram **A,** or Backwash type use **B**.

A

1- Press **MENU**
2- Scroll down to Set Feed Mode. Press **OK**
3- Scroll down to the relay indicated in the 'In Use' menu (Step 6 in 9.11) and press **OK.**

Now you can choose a different sensor, or change the feed type. Either will release the sensor for deletion. See 4 and 5 below.

4- Use the up and down arrows to change the relay to a different type of control program, press **OK**.
5- Press OK, then 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 9.10 Disable an Analog or Digital Input menu, to finish.

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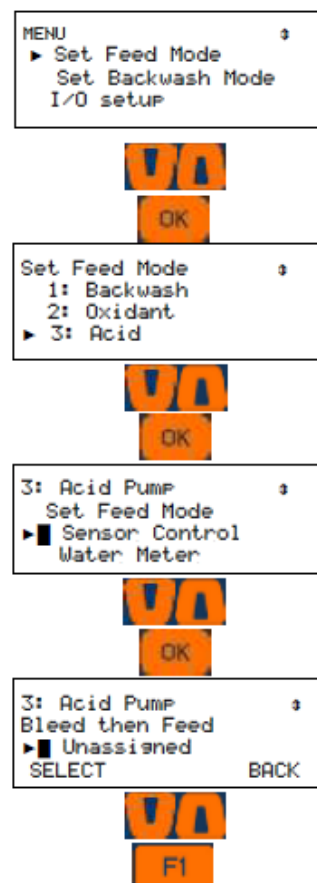
System Menu

B

1- Press **MENU**
2- Scroll down to Set Backwash Mode. Press **OK**
3- Scroll down to the relay indicated in the 'In Use' menu (Step 6 in 9.11) and press **OK.**

Now you can choose a different sensor, or change the feed type. Either will release the sensor for deletion. See 4 and 5 below.

4- Use the up and down arrows to change the relay to a different type of control program, press **OK**.
5- Press OK, then 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 **9.10 Disable an Analog or Digital Input** menu, to finish.

B
```
MENU                    ↕
   Set Feed Mode
 ▶ Set Backwash Mode
   I/O setup
```

[up/down arrows] OK

```
Set Blowdown Mode       ↕
 ▶ 1: Backwash
   2: Inhibitor
   3: Acid
```

[up/down arrows] OK

```
1: Backwash             ↕
   Set Backwash Mode
 ▶▮ Pressure Sensor
   Events
```

[up/down arrows] OK

```
1: Backwash             ↕
   Set Backwash Mode
 ▶▮ New Sensor
   SELECT        BACK
```

F1
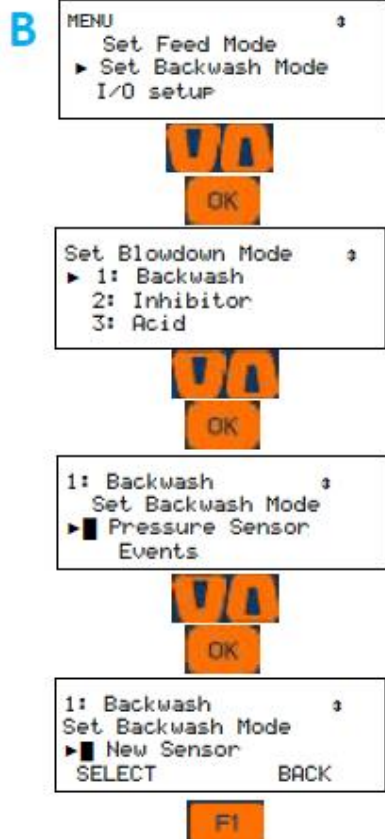
9.10.2 Changing or Unlinking an Analog Input Tied to a 4-20mA Output:

Inputs linked to outputs must be un-linked prior to the inputs being disabled. You can always unlink an output by deleting the output. Re-enable it if needed.

See section **9.1 Analog and Digital Inputs.**

Relay outputs are designated by their number, 1 through 9. 4-20mA outputs can be letters C, D, E, F, I or J. This procedure can be used to change the input that the mA output represents, or you can choose 'None'.

1- Press MENU
2- Scroll down to I/O Setup and press OK
3- Scroll down to the 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 **9.11 Disable an Analog Input,** to finish.

MENU

```
MENU                    ↕
   Set Feed Mode
   Set Backwash Mode
 ▶ I/O Setup
```

[up/down arrows] OK

```
I/O Setup               ↕
   E: pH sensor
   F: ORP sensor
 ▶ I:4-20mA Output
```

[up/down arrows] OK

```
I:4-20mA Output
   Control by: F
   4.00mA    0.0%
             Next    Manual
```

F2

```
I:4-20mA Output         ↕
Control by: F
↕▮:ORP sensor
SELECT   NEXT     MANUAL
```

[up/down arrows] F1

```
I:4-20mA Output         ↕
Control by: F
↕▮:pH sensor
SELECT   NEXT     MANUAL
```

ESC

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

Inputs linked to outputs must be un-linked prior to the inputs being disabled. You can always unlink an output by deleting the output. Re-enable it if needed. See section 9.1 Analog and Digital Inputs.

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 or 4-20mA Output 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.
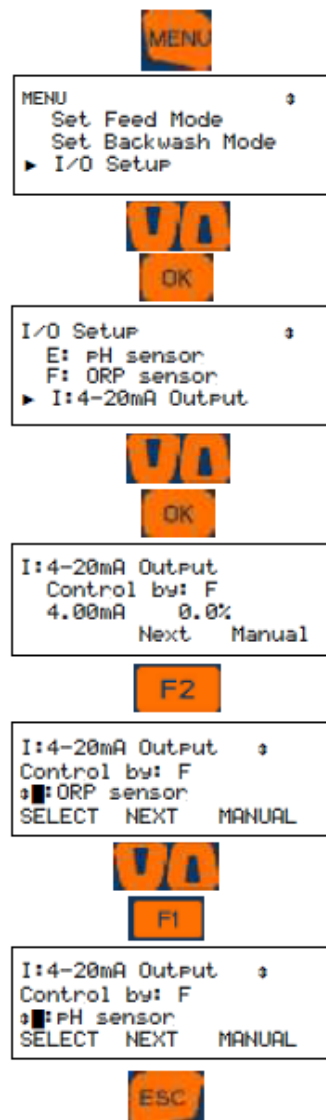6- Choose a new interlock or press OK to save the change. If more than one interlock, use the arrows to see them and remove as needed. Escape will void all changes.

See also **10.10 Interlocks**

Return to **9.10 Disable an Analog or Digital Input** to finish.
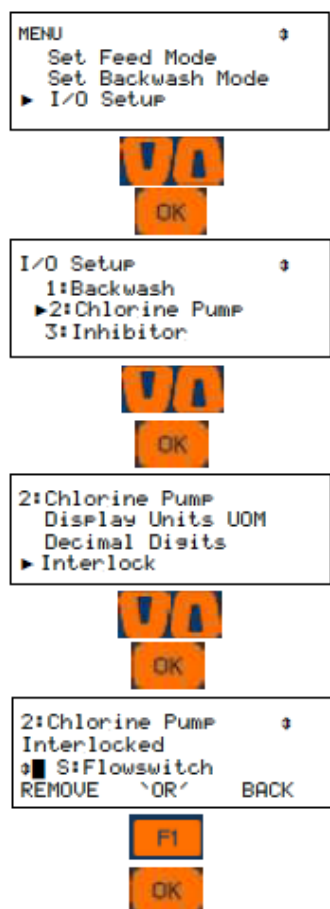
9.10.4 Changing or Unlinking a Digital Input Tied to a 4-20mA Output

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 **10.10 Interlocks**

Return to **9.10 to Disable an Analog or Digital Input**.

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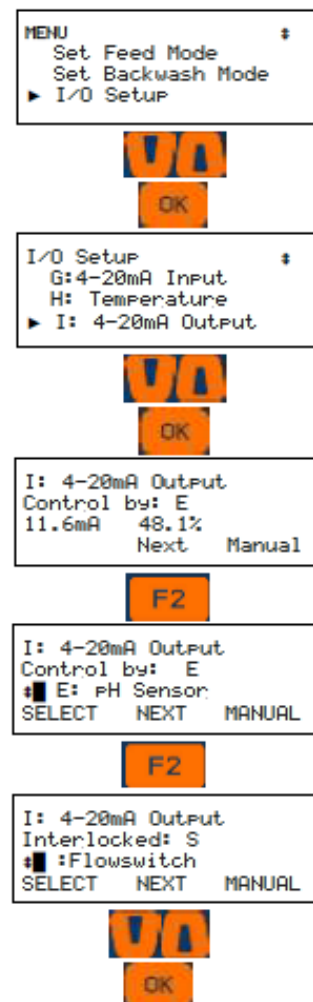
9.11 Phantom Inputs

The DCM510 has a maximum of 10 analog inputs, A through J. Analog inputs are linked to the first 14 letter of the alphabet, A through N, which means 4 letters, K through N cannot be assigned to any wired input. They have no terminals. These are phantom or virtual analog inputs.

Digital Inputs are lettered from O to Z. Wired inputs are labeled from O to V. Input designators 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. We use the common CTFs sensor as an example to highlight how this is done. See **9.1.2 Enable a Serial 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.

To create a phantom, enable an unused analog or digital input. Use the Configuration choice in the I/O Setup menu to edit the name, engineering units and decimal spaces. Use the Compensation menu to pick a phantom type; LSI, Inventory, Manual Entry, Calculate PPM or Combined Chlorine.

9.11.1 Create a Combined Chlorine Phantom

Since combined chlorine is the product of total Cl2 – Free Cl2, the controller must have one of each in order to calculate chloramines. If you do not see the choice for Combined Chlorine below, you may not have the correct probes. The Total Cl2 probe input must have either CTE or CGE as the type and the Free Cl2 probe input must be set for either CLE3 or CLO.

Enable an unused analog input. (Typically K). See section **9.1 Analog and Digital Inputs**.

1- Press Menu
2- Scroll down to I/O Setup. Press OK
3- Scroll down to the input you chose to be the combined Cl2 phantom. Press OK
4- Scroll down to Compensation. Press OK
5- Scroll up to Comb. Chlorine. Press OK.
6- Scroll down to the total Cl2 sensor. Press OK.
7- Scroll down to the free Cl2 sensor. Press OK.
8- Press Escape.

The phantom input can now be used to trigger the UV Secondary setpoint. See section **10.21 UV Secondary**

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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 sensor. Outputs can be energized based on a sensor with ON/OFF set-points, a timed event, a combination of an event and a sensor, base feed, percent timer, a backwash routine and more options. These can include interlocking with digital inputs, blocks from other relays and a few special controls. Special Controls include timed cycling, time modulation and PID.

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, ppm residual sensors). 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.

Note1: Relays can be enabled as one of three types; Feed, Backwash or Events-Other. Once a relay is enabled, the only way to change the assignment from one of these types is to disable the relay and enable it as a different usage.

Note2: 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 **10.6 Configuring a Feed Relay**

10.1 Frequency/Pulse Outputs:

Frequency controlled Pumps feed chemicals at varying rates (Frequency controlled pumps are outputs 6 to 9) Any analog sensor: temperature, flow, corrosion rate, ORP… may be used to frequency control a pulse controlled pump. The output is proportional to the input sensor using part or all of the sensor range.

Example: Using a pH sensor with an input of 0 to 14pH, you could set 0 pulses at 0pH and maximum pulses at 14pH. The higher the pH, the faster the output pulses. Or you could set the output as a

range of 0 pulses at 7.2pH and maximum pulses at 7.8pH. This shortened range would cause the pump to speed up and down more rapidly with changes in pH. In this manner, pump speed control is achieved without using a 4-20mA pump.

Alarm settings for Volume @Max SPM (Strokes per Minute) and Volume/Day are limited to 500 Gallons. These alarms are adjustable in the output alarm menu.
The alarm for volume @ maximum strokes per minute was created for the situation where a pump is at full speed for too long a period of time. For example, an acid pump that cannot lower the pH enough to slow the pump from the maximum speed after say 10 minutes, might be considered an alarm condition. Waiting until the pump feeds more than the volume per day would be much too long.
If you calculate the pump is feeding, for example, 24 GPD at 100% speed, you know that setting the Volume @ max stroke will alarm in one hour if set for 1 gallon. (24GPD / 24 hours = 1 GPH).
So if you want the pump to alarm after 10 minutes, enter $1/6^{th}$ of a gallon, or 0.1667G and if the pump runs at 100% for 10 minutes, it will have pumped 01.667 gallons and trip the alarm.
The Four OptoMOS DOs(Digital/Frequency Outputs) P6,P7,P8, & P9 can each be set to either:

1- Pulse output/Frequency
2- ON/OFF

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

In the ON/OFF mode, the output behaves the same as the powered relays, 1 through 5. Programming is the same in most cases.
Output relays, once configured, must be disabled and re-enabled if you need to change their type. See section **10.3** Enable and Configure a Relay**.**

10.2 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

```
2300uS      7.92pH ↕
345mV         78F
5493.2G    2.49GPM
STATUS ALARMS SETPNT
```

F1

```
2:Relay 2         ↕
OFF:Setpoint
By F:4-20mA Input
SETPNT   PRIME   MORE
```

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10.3 Enable a Relay Type

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.
   To complete the **enable** process, you must choose a relay type.
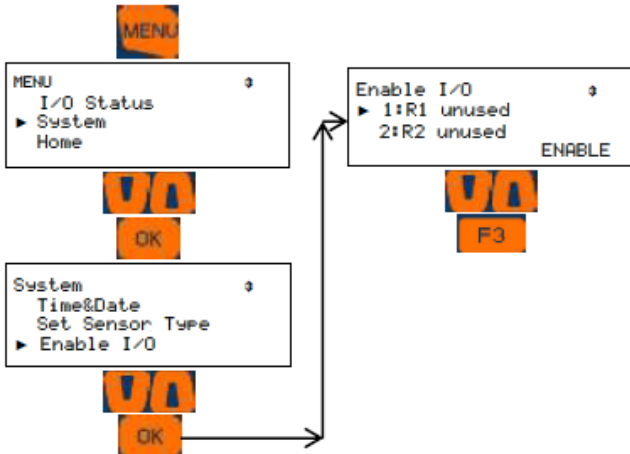
This menu shows the default type of output as "ON/OFF" and the control as "Events-Other". ON/OFF is the only choice for the first 5 relays. Relays 6 – 9 can be either ON/OFF or frequency type.

Step 6 is divided into two methods; the first for relays 1 – 5 and the second for pulse relays 6 – 9.

6a- For AC-Powered Relays 1 – 5 programming:
Choose which type of relay program you wish to use, F1 for Feed, F2 for Backwash or press OK to keep the Event-Other choice. Follow F1 or F2 with an OK to select the control

6b- For DC (Pulse) Relays 6 - 9 programming:
Use a pulse frequency output to control the speed of the pump. If you desire an ON/OFF output, press F3. To choose a control type different from an Event, use F1 or F2.

At this time, we recommend naming the relay to avoid confusion during programming. Once named, we will set up the remaining relay attributes.
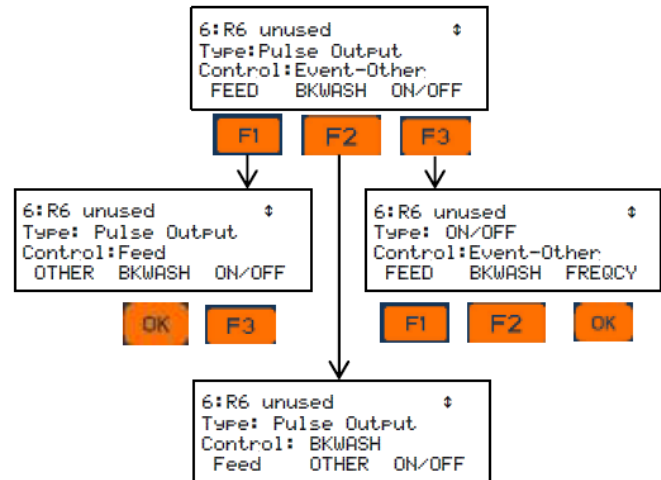
10.4 Naming the Output

In section 10.3, 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; Hypochlorite, Acid, CO2, 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.
4- See **10.2, Determine if a Relay is Enabled.**
5- Press **OK** to edit the description of the relay.
6- 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.
7- Use the arrows to change the next letter/space and continue until your word is spelled.
8- When finished, press OK to save.

> Please notice that 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.

NOTICE

This naming/Descriptor procedure is the same for all I/O points; Inputs and Outputs, digital and analog and that also includes 4-20mA ports.

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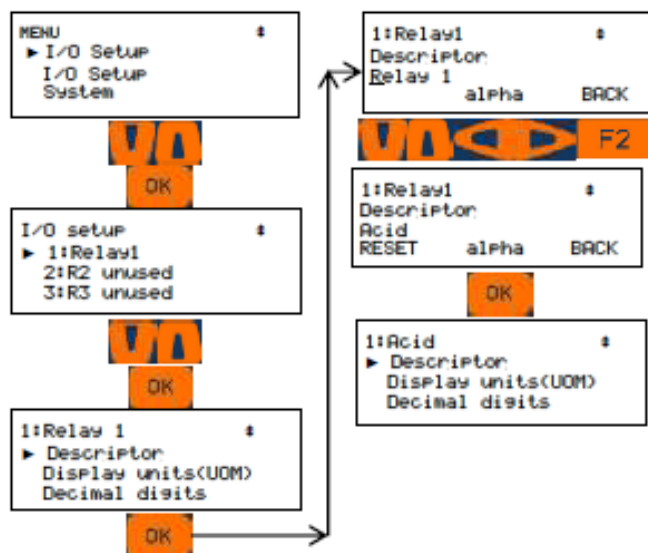
10.5 Relay Configuration

Bkwash will set up the output for a backwash based on the following options; Manual, based on a dry contact input, Timed Event, Pressure Switch, or a Pressure Sensor. See **10.7 Configuring a Backwash Relay.**

The *Feed* option prepares the output for a chemical pump based on sensor setpoints or water meter volume. See **10.6 Configuring a Feed Relay**

Additionally, a feed output has three special control types; Timed Cycling, Time Modulation, and PID.

Event-Other is used to configure a timed event relay. Timed events are used to deliver chemicals periodically. When selected, an **Events** choice is added to the main relay menu.
Other refers to Heater Stop, Alarm, Sensor Wash, Recirc Pump, UV Stop, UV Secondary and SCADA Notify. See **10.9 Configuring an Event-Other Relay**

Each of these relay types have special control functions available.

10.6 Configuring a Feed Relay

If you have not enabled the relay, see section **10.2 Determine if the Relay is Enabled** and/or **10.3 Enable and configure a Relay**. If you have not named the relay, See section **10.4 Naming the Output.**

There are four types of **Feed Relay** choices;

- Feed based on any analog sensor including any 4-20mA input,
- Using a percent timer
- Heater Stop
- Feed based on a water meter

Sections 10.6.1 through 10.6.3 show how to set up these types of feed. Meter control is not shown.

10.6.1 Feed Based on a Sensor

A sensor based relay will energize a pump or valve depending on the ON and OFF set-points.

Prior to these program steps, you need to enable an analog sensor input. See **9.1.1 Enabling an Analog Input** and **10.3 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 Deadband values.
7- Press **OK** to save.

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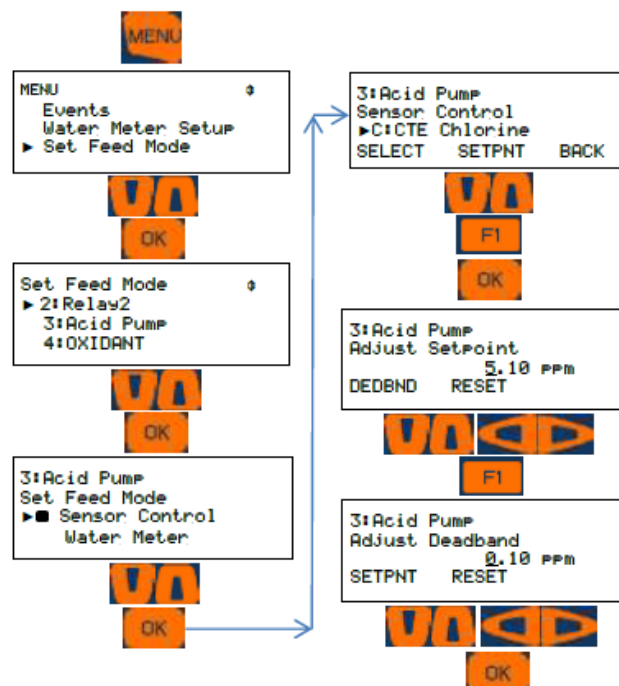
10.6.2 Percent Time & Base Feed

This method applies to the first 5 relays and the pulse relays R6 through R9 when programmed for ON/OFF mode.

> ⓘ Pulse outputs, R6 – R9, use a proportional range to control the speed of the pulses to the pump.

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.
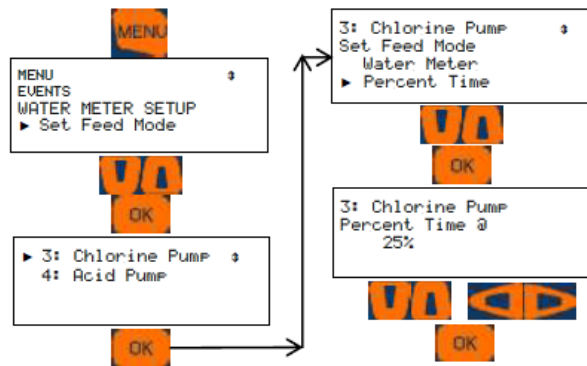
A *pulse* relay (R6 – R9) in frequency mode also has a base feed option Choose Base Feed and enter the milliliters per minute rate. This pump will then feed constantly at that rate.
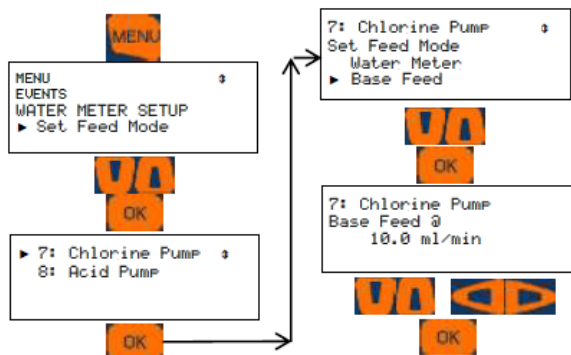
10.6.3 Heater Stop (Future option)

This method applies to all relays including R6 through R9 when they are selected as On/Off outputs.

10.7 Configuring a Backwash Relay (Future Option)

A backwash relay will send a powered or dry contact signal to your backwash controller based on a differential pressure switch, a pressure sensor (analog), by manually selecting 'Start' or a timed event. If you are using a switch or sensor, you will need to enable and configure them.

For inputs from pressure sensors or switches, enable and configure them. See section **9.1 Analog and Digital Inputs**

For the relay, See section 10.4 **Naming the Output**. If you have not enabled the relay, see section **10.2 Determine if a Relay is Enabled.**

Set up the Backwash relay by first choosing how it will be initialized. Manually, by a timed event, based on a differential pressure switch or based on a differential pressure sensor (analog) with a setpoint.

1- Press Menu
2- Scroll down to Set Backwash Mode and press OK
3- Scroll down as needed to select the start type.
The next section will discuss the four options.
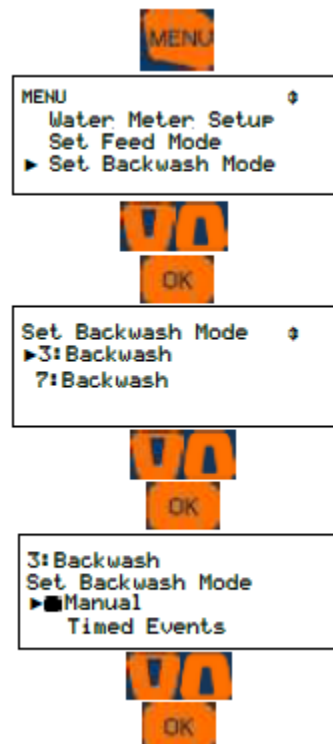
10.8 Manual Backwash (Future Option)

Press F1 to start a backwash cycle

```
3:Backwash
Press to Start

START          BACK
```

F1

10.9 Configuring an Event-Other Relay

10.9.1 Schedules

Events are used to energize a relay for a set amount of time repeating at a particular time and date. Any relay can be set up for event feeding. Choose from three cycle types; 24 hour, 7 day or 28 day. Events will repeat every day, week or every 4 weeks. See **10.9.2.1 Adding Events**

If you have not enabled the Feed relay, see section **10.6 Configuring a Feed Relay**

Events can be applied to any relay 1 through 9. Pulse relays R6 through R9 will program and react the same as the powered relays R1 through R5 unless you set the pulse relays for frequency. The difference is the On/Off relays will turn on for a set amount of time, and the pulse relays in frequency mode will turn on for a set amount of milliliters of feed. Typical Aquatic applications do not use frequency pumps so only On/Off mode is discussed here.

To set up an event schedule on a relay, you will need to choose a cycle. The cycle choice will depend on the frequency of the events. If you want the output energized more than once per hour, choose the daily cycle. If your events happen multiple times a week, choose Weekly. If less frequently, choose the 28 day cycle.
You can only choose one cycle per relay with a maximum of 28 events in the cycle.

Choosing a cycle;
1- Press Menu
2- Scroll down to Events and press OK
3- Scroll down your relay. Press OK
4- You should have 0 Events and Weekly is the default cycle. If you wish to change the cycle, press F3 Config. Use the right and left arrows to select another cycle. Press F1

MENU

```
MENU            ↕
  Prime, Force On
  Adjust Alarms
▶ Events
```

OK

```
Events          ↕
  2:Chlorine
▶ 3:Relay 3
  4:Acid
```

OK

```
3:Relay 3
  0 Events weekly
No Event
ADD          CONFIG
```

F3

```
3:Relay 3
Event Cycle
Daily  Weekly  28Days
SELECT          BACK
```

F1
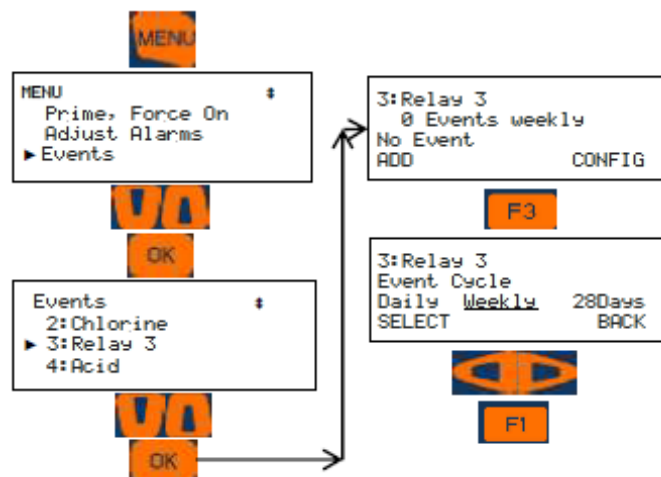
Now that you have picked a cycle, we will show three examples of On/Off relays. Daily, Weekly and 28 Day cycles.

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System Menu

10.9.2 Add, Remove, Edit Events

10.9.2.1 Adding Events

Once a relay is enabled as an Event output, and the cycle has been chosen, you can add events. Press the Menu key and scroll down to Events and press OK. Scroll down to your relay and press OK again. Press F1 Add. Depending on the cycle chosen, you will see slightly different screens.

The three cycle types are shown below. This chart works for all relays 1 through 9.

The Add screen presents a default day, start time and pump ON time. Use the arrows to edit these values and press F1 to save the changes

1- Use the left/right arrows to choose a frequency. ONCE will enter only the event you just created. It will repeat each cycle. The other choices differ for each cycle type. They can save time adding similar events.
 Press F1 Select to save the choice.

3. The event has been created. Press F1, *Add* to create another event, F2, *Adjust* to make changes to the current events or F3, *Config* to make changes to the cycle type.

Finish the programming. Use **10.4 Naming the Output, 10.10 Interlocks and, 10.11 Blocks, or 10.7.2 Remove or Edit an Event**
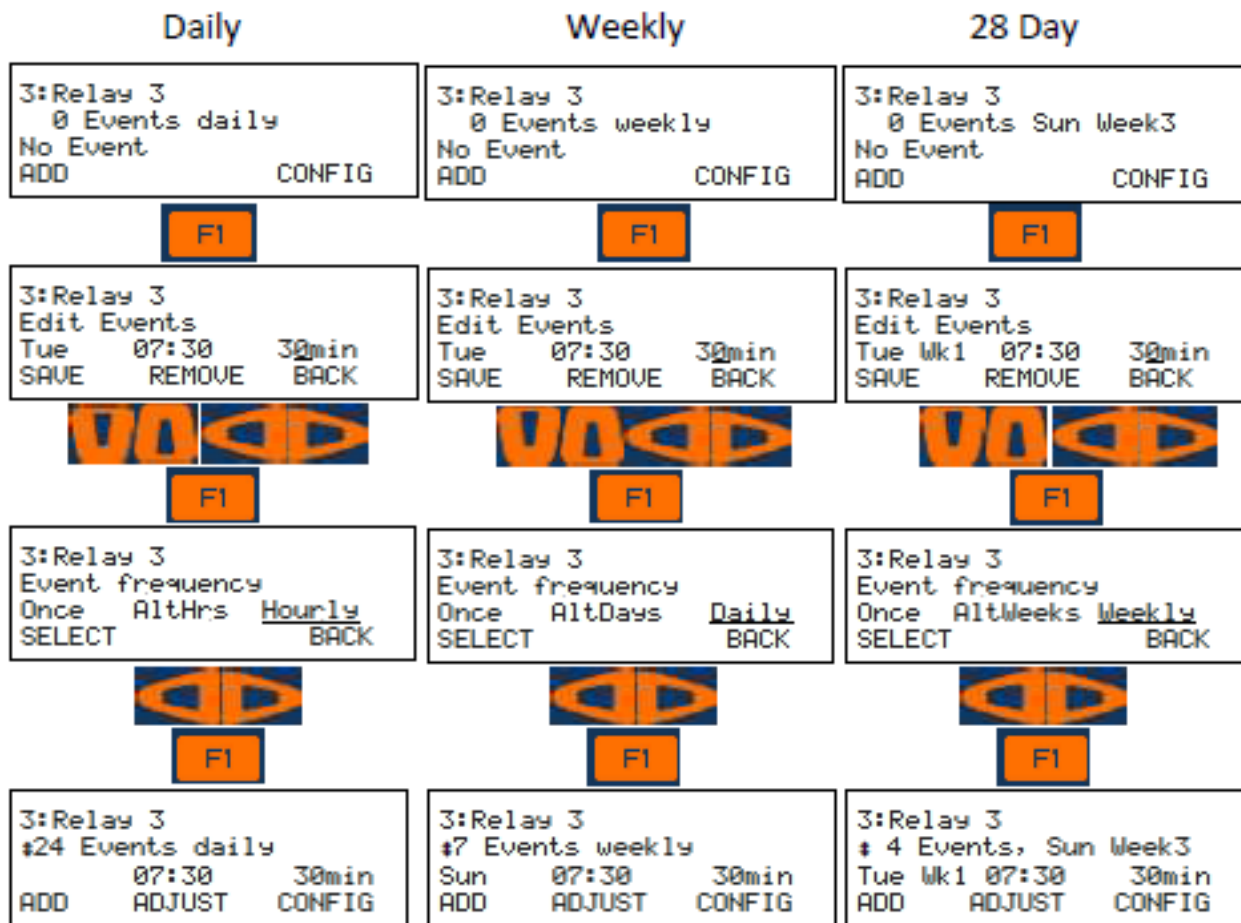
10.9.2.2 Remove or Edit Events

If you have event(s) you wish to remove or edit, follow these steps;

1- Press Menu and scroll down to Events. Press OK.
2- Scroll down to your relay and press OK
3- Use the up and down arrows to find an event you wish to edit or delete.
4- Press F2, *Adjust* to edit or delete an event or F3, *Config* to re-configure the relay. See **10.9 Configuring an Event-Other Relay**
5- If you pressed Adjust, use the arrows to make changes to the start time and length. Press F1 to save and exit or F2 to delete.

This process works for all relays.
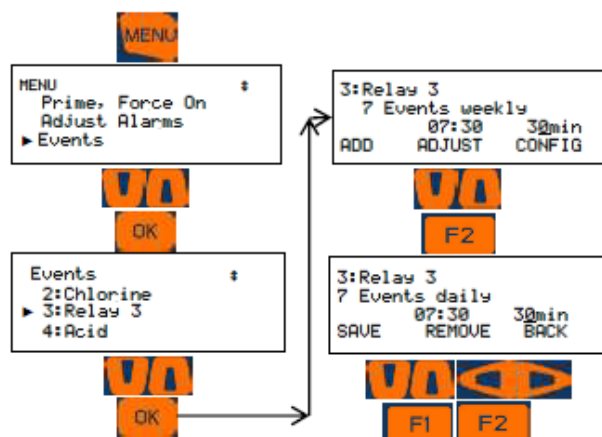
10.10 Interlocks

Interlocks are digital inputs that temporarily pause an output from operating (Relays 1 to 9 and 4-20mA outputs).

For example, a digital (dry contact) signal from a backwash system can be brought into the controller and used as an interlock to pause a UV and/or a heater.

10.10.1 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. The **F1** key will toggle between selection and removal.

> **Display choices**
>
> The Boolean OR and AND choices described below are selectable with the F2 key. Please remember that the text associated with the F2 key is a choice if you press the key, not the current use. Thus, if you see OR, you are in the AND mode. At this point, if you choose OR by pressing the F2 key, you will then be in the OR mode. Now the F2 key shows a new choice, AND. The F2 key will toggle between these two choices

Notice the F2 key says 'OR'. This means if you press F2, you will choose a Boolean OR for the interlocks. Thus, if any one of the interlocks are 'ON', (shorted) the relay will be enabled. If you do not press F2, the Boolean AND will rule the interlocks.

AND means all interlocks chosen must be ON to enable the relay. Multiple Interlocks are not typical.

Any one interlock can be used on multiple relays and 4-20mA outputs.

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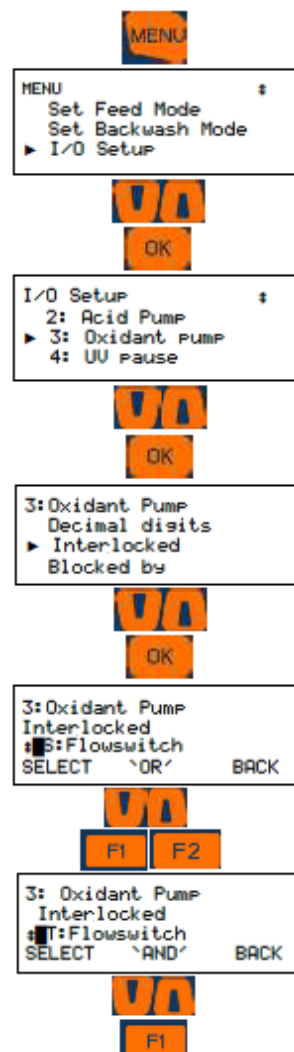
10.11 Blocks

Blocks are used to ensure that two or more relays (Relays 1 to 9) are not on together should their chemistry be incompatible. 4-20mA outputs cannot be blocked but have interlock capability.

 Setting blocks – all relays 1 to 9.

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 a relay that will be turned off by another relay, then press OK
4-   Use the ARROW keys to select 'Blocked by' then press OK
5-   Choose an output with ARROW keys 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.
You could have up to 8 relays blocking any 1.
Do not block in both directions! (R1 blocked by R2 and R2 blocked by R1).

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. If you need to switch from acid to caustic on a pH control application 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 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.

Be sure to change the relay description to fit the new chemical treatment.

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

Note: Used for R1-R5, and P6-P9 in the ON/OFF mode.

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

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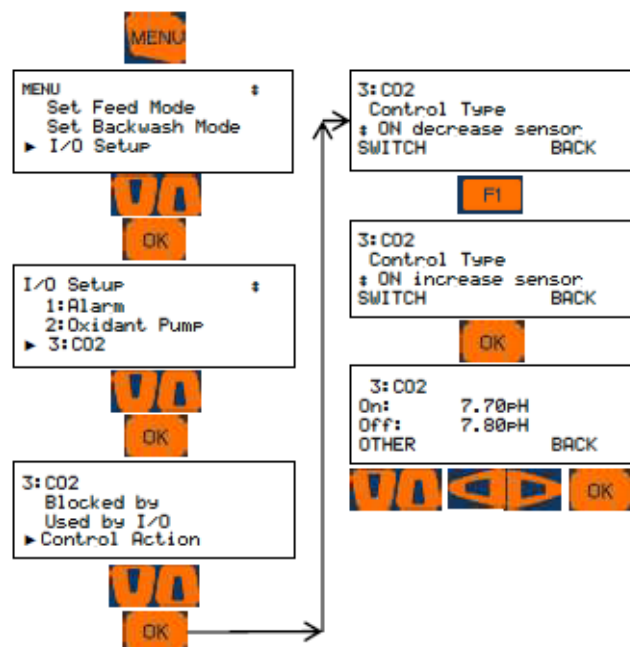
10.13 Special Control Functions:

Special controls are additional types of control that improve on simple ON/OFF control. The three general control types have the following special controls;

Feed: Time Cycling, Time Modulate, and Proportional, Integral and Derivative (PID) control and Heater Stop. (Heater Stop is a future option)

Backwash: None

Events-Other: Alarm output, Sensor wash, Recirculation Pump, UV Stop, UV Secondary and SCADA Notify

---

ⓘ **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.

10.13.1 Timed Cycling:

Note: Special Control for Feed type relay. These instructions work with relays 1 – 5. These instructions work with relays 6 – 9 when they are in ON/OFF mode.

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.

Timed Cycling feeds for a user defined **ON Time** then waits for a user defined OFF time (OFF time = Period – ON time) before feeding again, allowing the system to respond to the fed chemical. During the **ON Time,** ON-OFF pumps and frequency controlled pumps feed on set-point control. Setpoints are edited from the Adjust Setpoint menu.

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 relay 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.
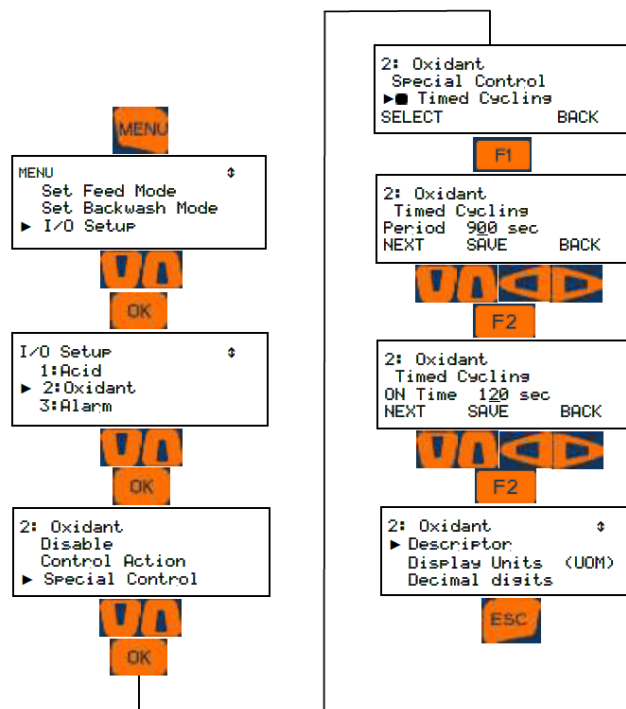
10.13.2 Time Modulate

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

Note2: Relays P6-P9 must be set to ON/OFF Mode

Time modulate has adjustable turn on and turn off set-points, a period and a direction, Increasing or

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Decreasing the variable. Example of Increasing: A chlorine pump will increase the ORP reading. Example of Decreasing: Acid will decrease the 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. Setpoints are edited from the Adjust Setpoint menu.

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 setpoints of 400 and 500 so the pump will be on for 50% of the period time or in this example 100sec x 50% = 50 seconds on 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.

Time Modulate works for both increasing and decreasing control loops.

1. To Setup and/or adjust the Time Modulate feature, press MENU
2. Scroll to the I/O Setup selection and press OK
3. Scroll to select the desired relay 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

This method works on relays 1 – 5 and with 6 – 9 when they are in the ON/OFF mode.

> ### SPECIAL CONTROL TIP:
>
> When using Timed Cycling, Time Modulate or

Table of Contents

control, best results for tuning the loop are achieved if you only change one
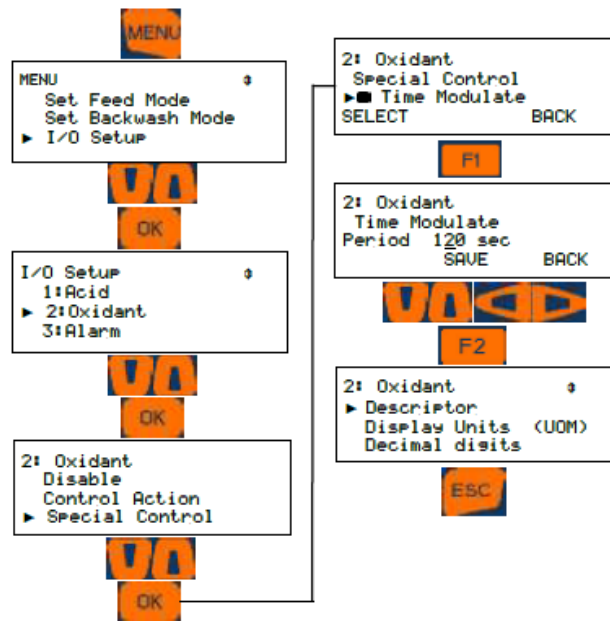
10.13.3   PID Control

Note: **Relays P6-P9 must be set to Pulse Mode**
See section **10.3 Enable and Configure a Relay**

Each of the P6 to P9 Outputs can be configured for PID (Proportional-Integral-Difference) control. PID control can also be used on 4-20mA outputs.
We highly recommend Timed Cycling or Time Modulate for control over PID because these methods are highly functional and simple to set up/understand. In most water treating applications, a full PID setup does not noticeably increase the control regulation of the process but is difficult to set up/tune. However, using only the proportional setting of the PID setup and leaving the others settings at default is easy and effective.
Relays configured for PID control are continuously modifying the pump relay ON & OFF times.

1. To set and adjust the PID settings, press MENU
2. Scroll to the I/O Setup selection and press OK
3. Scroll to select the desired output (6:Chlorine Pump) and press OK
4. Scroll to Special Control and press OK
5. Scroll to PID Control and press F1
6. Use Up/Down and Left/Right Arrow keys to Edit xP Proportional value then press F2
7. Use Up/Down and Left/Right Arrow keys to Edit Integral Rate value then press F2
8. Use Up/Down and Left/Right Arrow keys to Edit Difference Rate value then press F2
9. Use Up/Down and Left/Right Arrow keys to Edit Relay Period value (if P6-P9 is set to pulse output skip this step) then press F2
10. Use ESC key to Exit

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10.14 Math Functions

Mathematical expressions can be used for control when programming relays and 4-20mA outputs. Phantom inputs can be used in the expression as adjustable variables.

The expressions are entered into any relay Feed Mode equation.

10.14.1.1 Digital Inputs

Digital inputs that are used as either contacting head or turbine watermeters can be added together. No other math function is allowed. No other digital input type can be included in the mathematical equation.

The total value of all meters in the expression will be compared to the relay's setpoint to determine when the relay will actuate.

Select Set Feed Mode from the menu. Select the relay you wish to use. Choose feed mode as Watermeter. Scroll up or down to "Edit control eq'n". Enter the letters of the meters adding + signs (**Operators**) between each letter (**Operand**). These expressions may have up to 4 **operands** and 3 **operators**.

Examples: O+T,   O+P+Q+R

10.14.1.2 Analog Inputs

Relays and 4-20mA outputs controlled by analog sensors can be further controlled using some mathematical functions; Addition, Subtraction, Multiplication and Division.

These expressions may have up to 4 **operands** and 3 **operators**.

Example: A+B*C+D.

The expression is calculated from left to right as no parenthesis () are allowed.

Example:

If the values of the **operands** are as follows…

A = 2   B = 3   C = 4   D = 5

…the following expressions will be calculated as shown:

A+B/C = 1.25

B/C+A = 2.75

A/B+C = 4.666

Parameter	Minimum	Maximum	Default	Notes
Kp Proportional	0.001	10	0.5	
Integral Rate	0	9999	30	0 = no Integral update
Difference Rate	0	999	15	0 = no Differential update
Relay Period	30	600	120	In seconds

Table 14 PID parameters

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System Menu

10.15 Relay Outputs 1 through 9

To set up a relay, use the steps in section **10.6.1 Feed Based on a Sensor** . When you reach the step for selecting the controlling sensor, scroll down to "Edit control eq'n".

Press Ok. Use the up and down arrows to find the letter of the first sensor (**Operand**) then move to the right one space using the right arrow. Now use the up and down arrows to select the mathematical function you wish to use. (**Operator**) Addition (+), multiplication (*), subtraction (-) or division (/). Move to the right again and select the second **operand** letter and so forth. See section **10.11.4.2 Analog Inputs** for mathematical expression rules.

For relays 1 to 5 and the frequency relays 6 to 9 in the on/off mode, the output will be on based on the relay setpoints and the mathematical expression.

Frequency output relays 6 through 9 in the pulse mode will speed up or down proportionally between the on/off setpoints.

For example, if the selected analog inputs have values of 5 and 7, and you are using the multiplication function, the relay will operate based on the product, 35.

If you are using a frequency output in the pulse mode, and the ON setpoint is 40 and the OFF setpoint is 30, the speed of the pulses will be at 50% since 35 is half way between the ON and OFF setpoints. If the ON setpoint is 100 and the OFF setpoint 0, the output will be at 35% speed.

Notice that the analog choices include phantoms. Phantoms allow a user, either local or remote, to change its value.

10.16 Analog Outputs (4-20mA)

Analog outputs can use math functions as well as relay outputs, however the setup is not as simple as for relays. A frequency output relay must be utilized as a go-between.

Select an unused frequency relay and program it for pulse type output. Select the ON/OFF setpoints as above in section **10.11.4.1 Relay Outputs.** As before for relays, up to four analog **operands** can be selected including phantoms. Once the frequency relay is programmed, program the 4-20mA output for control by that frequency relay.

The mA output will be proportional to the ON and OFF setpoints in the frequency relay.

Example: If the on and off setpoints are 0 and 100, and the product of your math function is 75, the output will be 75% or 16mA.

10.17 How to Setup a Relay as an Alarm Output:

An Alarm relay will change states whenever the controller post an alarm condition on the alarm page.

This method applies to all 9 outputs, however, when enabling a pulse output, relays 6 – 9, choose the ON/OFF setting. See section **9.2 Enable and Configure a Relay.**

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.

R6-R9 relays are optoMOS. They can be used with 24VDC/250mA power. They must be in the ON/OFF mode.

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 Naming an Input or Output** to rename the relay for example to General Alarm

10.18 Sensor Wash:

Future Item
A special control function that allows pH and ORP sensors in the probe header to be washed in-line with acid based solution on a timer. **R6-R9 must be in ON/OFF mode.**
The relay will halt acid and oxidant outputs for a predetermined time to allow the sensors to recover from the acid wash.

10.19 Recirculating Pump:

Possible Future Item

10.20 UV Stop:

Future Item
Applies to relays 6 through 9 in ON/OFF mode. Use this to pause a UV during a backwash cycle.

10.21 UV Secondary:

Use combined chlorine to raise the power setpoint of a UV, increasing the destruction of chloramines.

Requires a free and a total chlorine probe. Use these probes to create a phantom sensor, combined chlorine. See section **9.1.1 Phantom Inputs.**

Requires a frequency output relay, R6 through R9 set for ON/OFF mode. See section **9.2 Enable and Configure a Relay.**

1- Press Menu
2- Scroll down to Setup I/O. Press OK
3- Scroll down to an unused frequency relay, 6 through 9. Press OK.
4- Scroll down to Special Control. Press OK.
5- Scroll down to UV Secondary. Press F1 Select.
6- Scroll down to the phantom input you created above. Press F1 Select.
7- Press Menu.
8- Scroll down to Adjust Setpoints. Enter the PPM level of chloramines that you wish to use as a setpoint. Typically, 0.4PPM with a Deadband of 0.0.

10.22 SCADA Notify:

Future Item.

10.23 Prime (Force On/OFF) a Relay

All relays can be forced on temporarily if not disabled, blocked or interlocked. If disabled, see **10.3 Enable and Configure a Relay**. If blocked, see **10.11 Blocks**. If Interlocked, see **10.10 Interlocks**.

To force any relay on, press Menu.
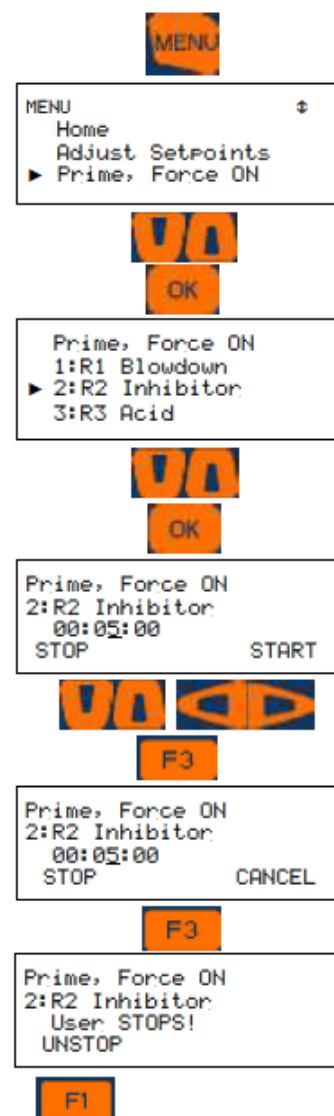Scroll down to Prime, Force ON and press OK.
Scroll down to the relay of your choice and press OK.
The timer defaults to 5 minutes. Use the arrows to adjust as needed. The underline is the cursor.
Press F3 Start
If you wish to stop the relay prior to the timer ending, press F3 Cancel.
Conversely, if the relay is on by any means, you can stop it temporarily using F1.

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10.24 Auto Fill

Set a relay to fill a pool based on a digital input from a float switch.

Enable a digital input (O through V) as a 'contact set'.

Use the menu to change the description to 'Float Switch' or similar.

Enable a relay and set for Feed mode.

Use the menu to Set Feed Mode for 'Sensor Control'.

Select the digital input letter you enabled above.

The Deadtime is how long the relay stays on after the input has turned off. Adjust and press OK.

Adjust setpoint menu will allow you to adjust the Deadtime value anytime.

10.25 4-20mA outputs:

4-20mA Outputs display the description, the loop current with it's corresponding percentage and the Control By sensor when in Auto.

Manual = User sets current. **Auto** = Sensor controls current.

Manual Mode:

Use **Manual mode** to verify the 100% ON=20mA, OFF=4mA or modulate operation of the proportional pump or valve that the 4-20mA output is controlling. Use **Auto mode** to verify that an input is proportionally represented at the output.

Load Powered 4-20mA Loop:

4-20mA current outputs are isolated and loop powered (24VDC). No need to add power to the loop.

Open Loop Alarm:

The DC isolated 4-20mA output alarms on an open loop, this function can be turned ON/OFF.

Calculating Loop Current:

4-20mA Output current $= 4 + (16 \times$ (Actual Sensor Value – 4mA sensor value))/ (Sensor 20mA value – Sensor 4mA value)

For example:

A pH sensor is reading 7.0pH. To calculate the 4-20mA output when the scale is 0 to 14;

$4 + (16 \times (7.0 – 0))/(14 – 0) = N$

$4 + (112/14) = N$

$4 + 8 = N = 16mA$

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.

1- To Set 4-20mA output to control decrease 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

4- Use Up/Down Arrow keys to select desired input (here we selected pH input) then press **F1**

5- The next menu will ask for interlock if any needed. If no need, scroll to none then Press **F1** (you could interlock it with any digital input for example flow switch or a phantom DI)

6- Set the high pH value then press **F1**(in this example if pH sensor is reading 7.7pH the 4-20mA will be 20mA and the acid pump will be feeding at max speed)

7- Set the low pH value, then press **F1**(in this example if pH sensor is reading 7.20 pH, the 4-20mA will be 4.0mA and the acid pump should stop feeding).

8- In this example between pH 7.20=4.0mA and 7.70=20mA the 4-20mA output will be proportional

9- Press **ESC** Escape to finish or press **F1** to continue with output setup. You can choose to turn the open loop alarm on or off, then choose to set the output to drop to 0% (4mA) or remain as is when the keypad **STOP** button is pressed. This allows you to shut down the output to a pump, or continue to send a value to a DCS.

10.25.2   How to assign 4-20mA output to control increase (e.g Caustic Feed):

1- To Set 4-20mA output to control increase 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

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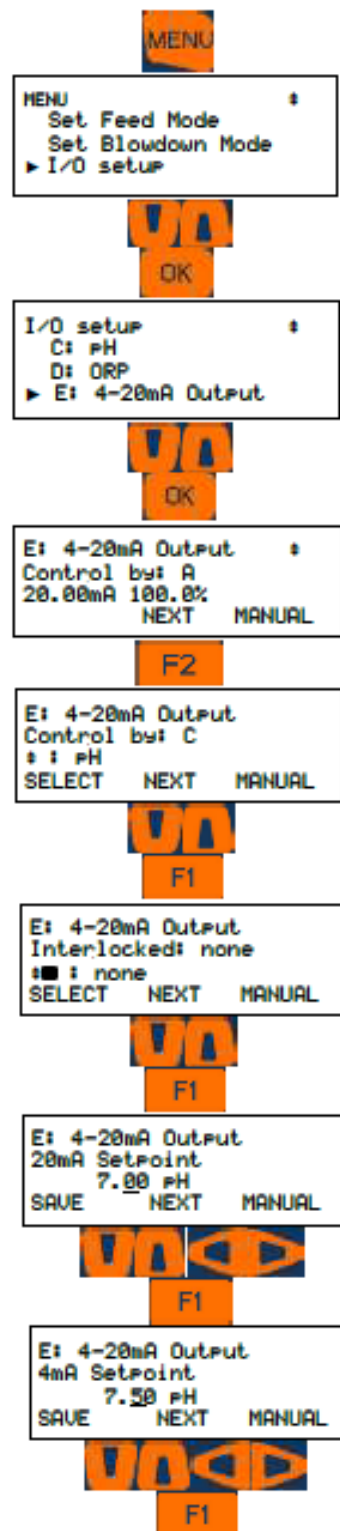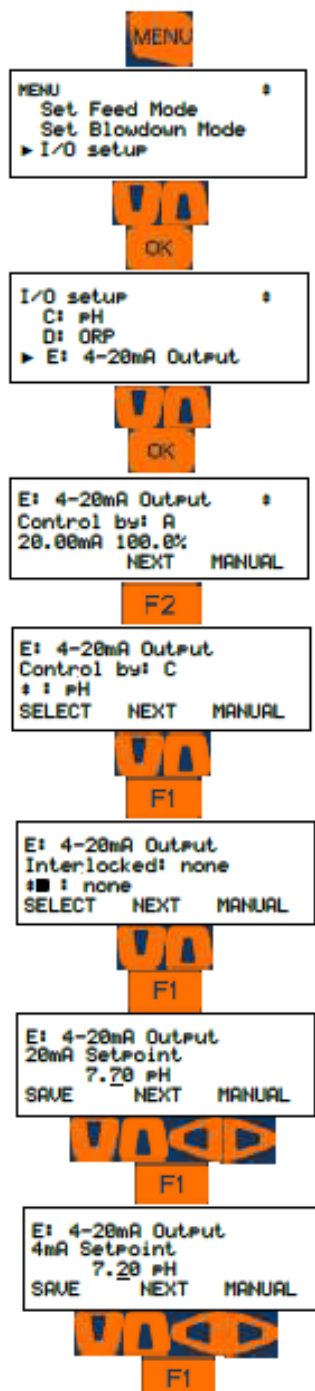
4- Use Up/Down Arrow keys to select desired input (here we selected pH input) then press F1

5- The next menu will ask for interlock if any needed if no need scroll to none then Press F1 (you could interlock it with any digital input for example flow switch or phantom DI)

6- Set the low pH value then press F1(in this example if pH sensor is reading 7.00 pH the 4-20mA will be 20mA and the Caustic pump will be feeding at max speed)

7- Set the high pH value then press F1(in this example if the pH sensor is reading 7.50pH, the output will be 4.0mA and the pump should stop)

8- In this example between pH 7.00=20mA and 7.50=4.0mA the 4-20mA output will be proportional

9- Press Escape to finish or press F1 to continue with output setup. You can choose to turn the open loop alarm on or off, then choose to set the output to drop to 0% (4mA) or remain as is when the keypad Stop button is pressed. This allows you to shut down the output to a pump, or continue to send a value to a DCS.

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10.25.3 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
4- Use Up/Down Arrow keys to select desired input (here we selected pH input) then press F1
5- The next menu will ask for interlock if any needed if no need scroll to none then Press F1 (you could interlock it with any digital input for example flow switch or phantom DI)
6- Set the High pH value then press F1(in this example if pH sensor is reading 14.00 pH the 4-20mA will be 20mA)
7- Set the Low pH value then press F1(in this example if pH sensor is reading 0.00 pH the 4-20mA will be 4.0mA)
8- In this example between pH 14.00=20mA and 0.00=4.0mA the 4-20mA output will be proportional.

9- Note: The customer must use the same scale. If their scale is different, one side must change to equal the other.
10- Press Escape to finish or press F1 to continue with output setup. You can choose to turn the open loop alarm on or off, then choose to set the output to drop to 0% (4mA) or remain as is when the keypad Stop button is pressed. This allows you to shut down the output to a pump, or continue to send a value to a DCS.

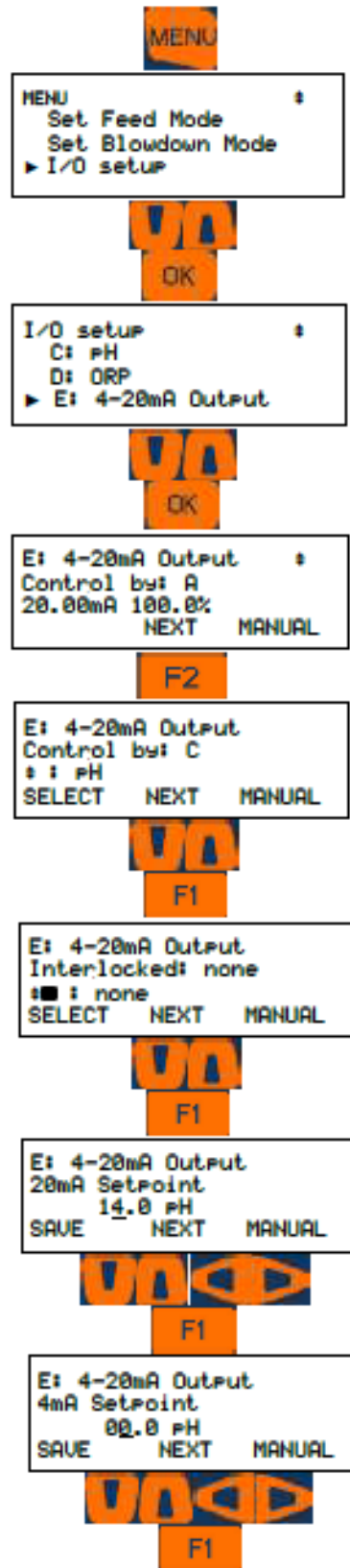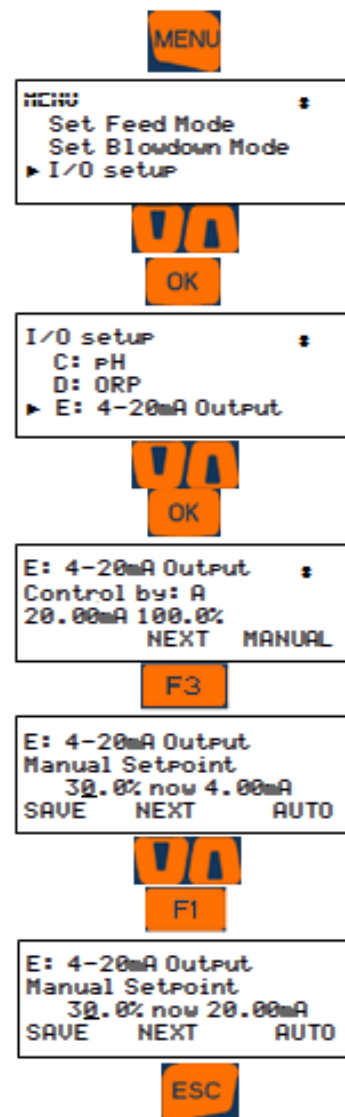### 10.25.4 How to set 4-20mA output to Manual Mode:

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

MENU

```
MENU                    ☼
  Set Feed Mode
  Set Blowdown Mode
▶ I/O setup
```

OK

```
I/O setup               ☼
  C: pH
  D: ORP
▶ E: 4-20mA Output
```

OK

```
E: 4-20mA Output        ☼
Control by: A
20.00mA 100.0%
           NEXT   MANUAL
```

F3

```
E: 4-20mA Output
Manual Setpoint
   30.0% now 4.00mA
SAVE   NEXT      AUTO
```

F1

```
E: 4-20mA Output
Manual Setpoint
   30.0% now 20.00mA
SAVE   NEXT      AUTO
```

ESC

10.25.5 Linking a 4-20mA Input with a 4-20mA Output

Any analog input from A to N, including phantom inputs in this range, can be used to control a 4-20mA output. Use the same steps as above and choose that input letter. See sections **10.14.1, 2, 3 and 4.** See also section **9.11 Phantom Inputs.**

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10.25.6 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**

Output card   Metering Pump (Load)
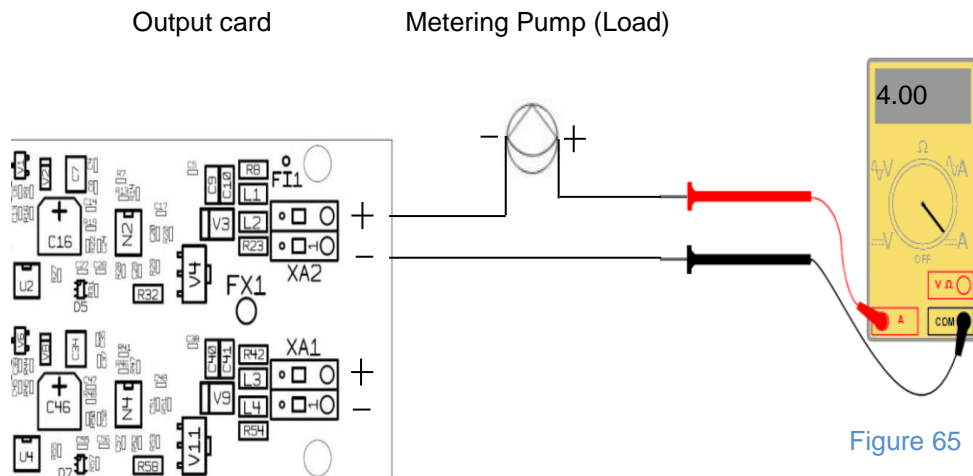
Figure 65

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
@ +/-0.5mA @ 4mA & +/-15% on span (about +/-
2.4mA).) it will display "Sensor fault Overrange",
consider three choice after fault (**RECAL** to
recalibrate, **IGNORE** to ignore the fault and accept
calibration, **RESET** to reset calibration back to
factory defaults)

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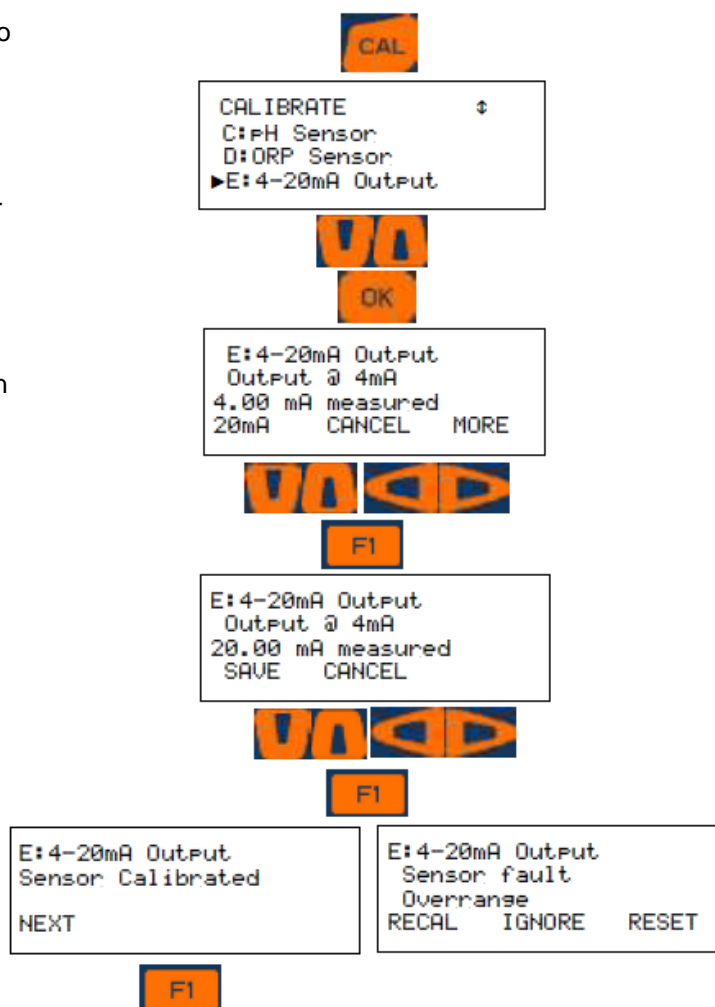
11 System Menu

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

- User setup
- Activity Log
- Diagnostic
- Configurations
- Display Setup

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 Netmask Address	255.255.255.0
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.

WiFi is how to connect wirelessly. Enable WiFi on your PC, Notebook or Smartphone.

The MAC address is assigned to the controller from the factory and cannot be changed. It is unique in the world.

11.1.1 How to Change the IP Address:

The factory default IP Address of the controller is10.10.6.106.

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 to the main display

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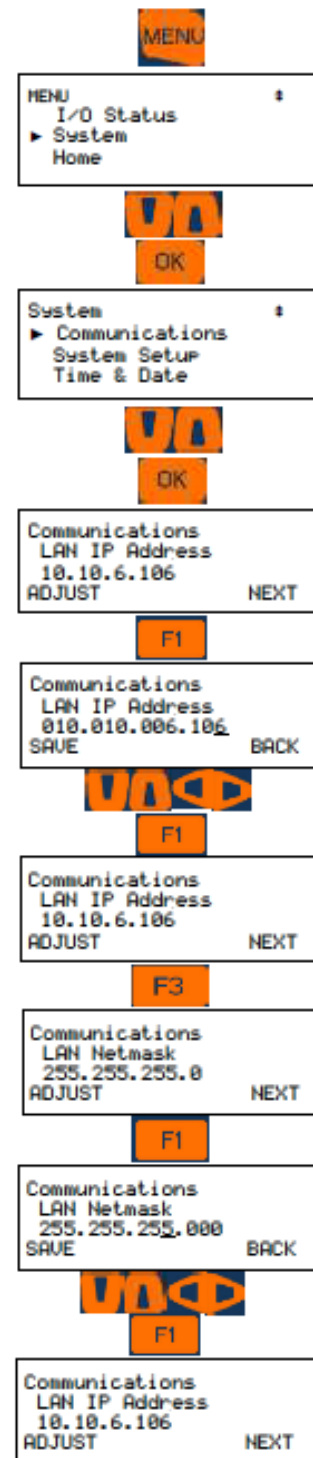
11.1.2 Web Interface Wi-Fi

PC's, tablets and phones can connect to the DCM510 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 to connect.

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.

See flow chart below to find the fixed IP Address and Netmask for Wi-Fi

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

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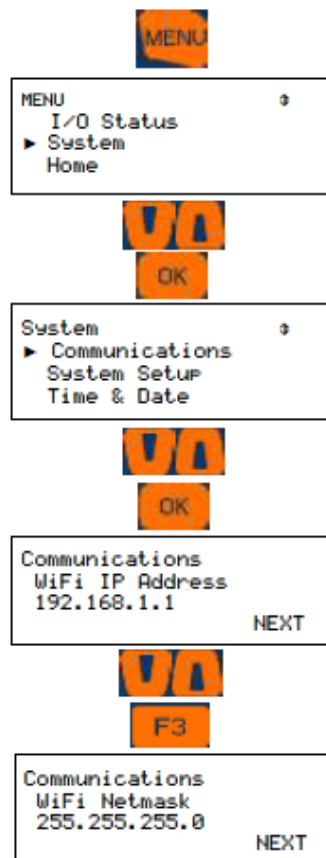
11.2 System Setup

System Setup has 9 options;

- Site Name
- Controller Name
- Keypad Passwords
- Metric Units
- Sunday = Day 1
- System Type
- Flow Switches
- Flow on Delay
- Alarm on Stops
- System Restart
- Factory Reset

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

Use this page to turn password protection ON/OFF. See section 11.6 **Passwords** to change your password, login or logout.

There are 4 Operator level, 3 Configure level and one Admin login.

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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 including user name, password and access level. This cannot be performed from the keypad. A browser connection is required.
There is not mfg password. If you forget your password, ProMinent can reset the password list. All users would have to re-set their passwords.

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
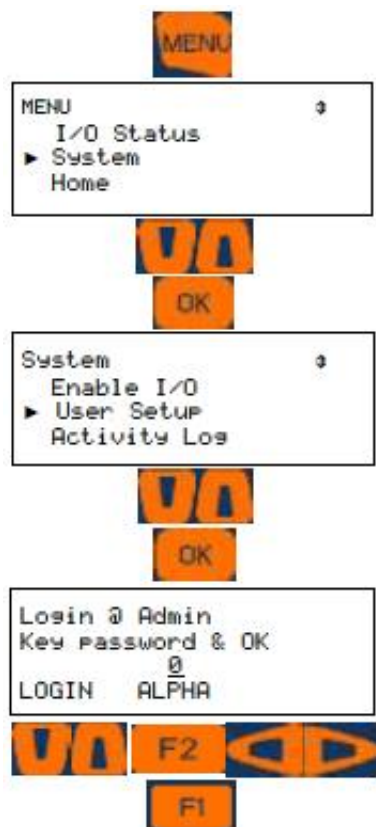
11.2.3 Metric Units

Toggle Engineering units between standard and Metric.

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 10.6.7 Choosing a Cycle

11.2.5 System Type

System Type can be a single or dual pool control scheme. A two pool scheme allow the user to tag all I/O as pool 1 or pool 2 so as to help identify sensors and controls with the correct body of water.

This also changes how the I/O is presented in the browser view. See the browser manual for more information.

11.2.6 Flowswitches

Select Flowswitches for the outputs. Once selected, you cannot de-select without a reset from a factory technician!

11.2.7 Flow on Delay

This delay holds output relays off for the set time in seconds. This allows sensors to more closely reflect the correct value.

Default is 45 seconds.

11.2.8 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.

11.2.9 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.

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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

11.6 User Setup

Use this section to change your password if the password option is enabled. If not enabled, See 11.2.2 **Keypad Passwords** to turn protection on/off.

With keypad passwords turned on, login using your current password. Now edit the password and save the change.

1- To Set 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 **User Setup** then press **OK**
4- Use Up/Down and Left/right Arrow keys to enter your current password.

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.

5- Enter a new password and press F1 to save.

Forgotten passwords can only be reset by a factory representative. The reset will set all passwords back to factory default.

11.4 Set Sensor Type

See **9.1.1 Enable an Analog or Digital Input**

11.5 Enable I/O

See **9.1 Analog and Digital Inputs**

11.7 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
8- Use ESC key to Exit

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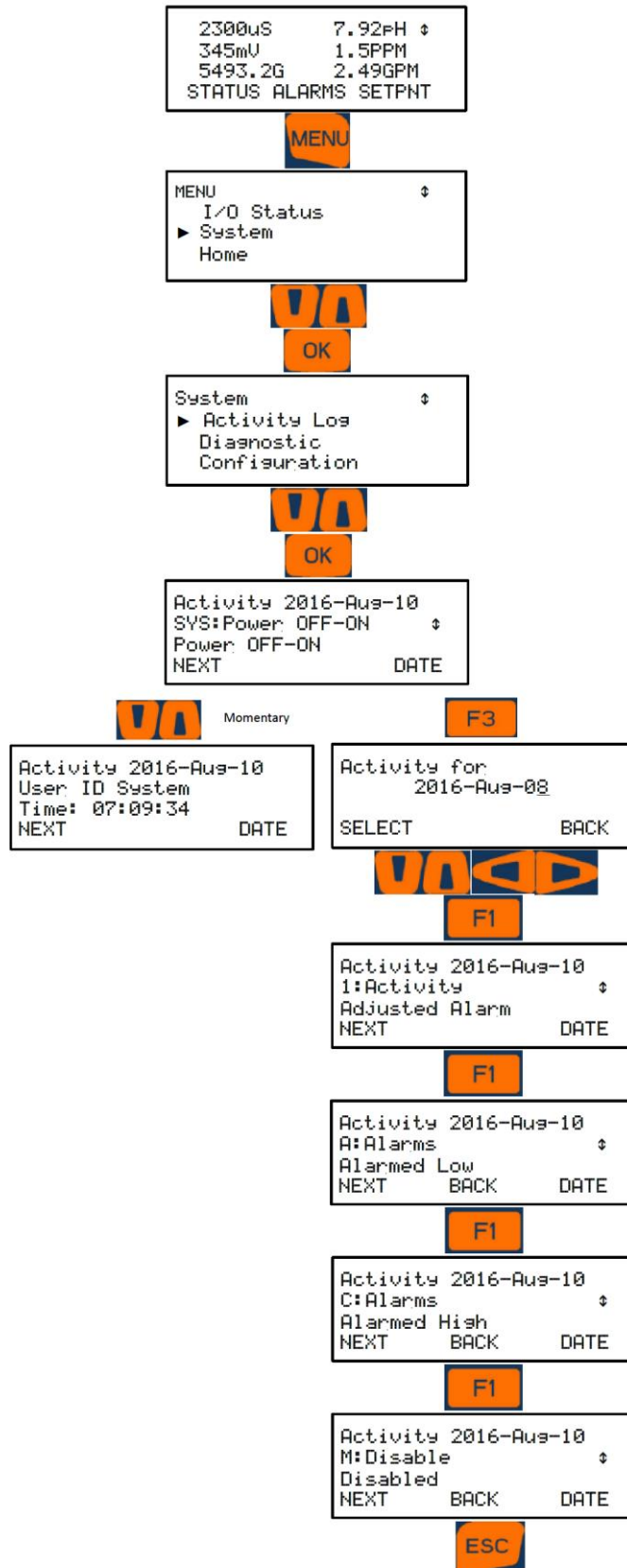
11.8 System Diagnostics

Serial #: serial # of the controller

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

O-T wiring: Status of power supplying digital inputs O through T.

U-V wiring: Status of power supplying digital inputs U and V.

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.

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)
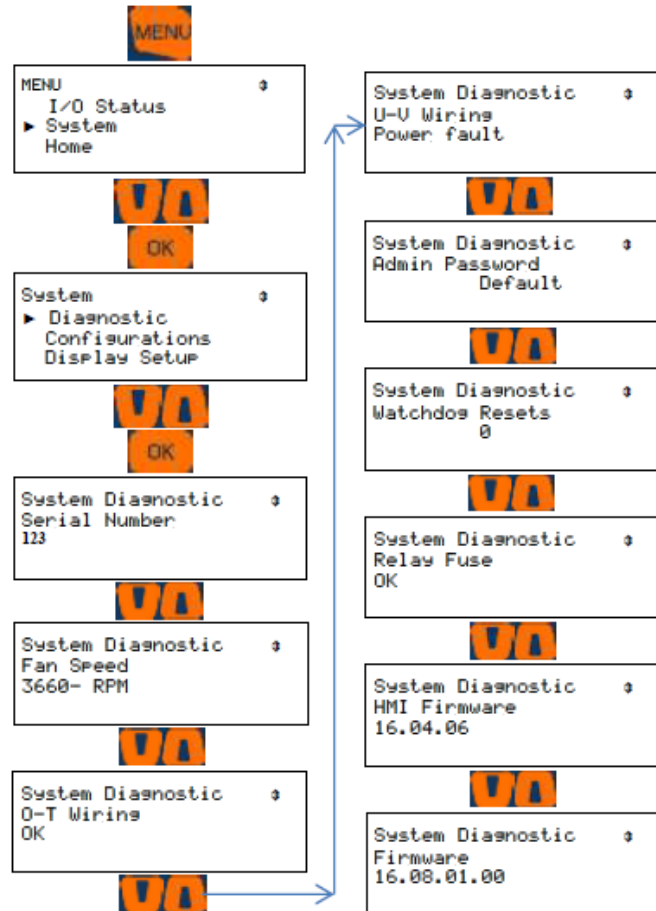
11.9 Configurations

See section **13.2 USB – Save or Load the Program**

11.10 Display Setup

Choose how and what is shown on the display.
See section **2.2 Modifying the 'Home' Screen**

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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 DCM510. A fast blow fuse will not harm the device.

Component	Rating/type	vendor	Part#
Controller, Complete	120VAC, 50/60 Hz, 0.5A - No External Load	PFC	DCM5
Controller, Complete	120VAC, 50/60 Hz, 7.8A - with External Load	PFC	DCM5
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
Inrush Current	Maximum inrush current 8.0Amps	PFC	DCM5
Enclosure	Rated for IP65	PFC	N/A

Table 17 Fuse Specifications

> **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 **6.3.5.4 Wiring Relays R3 – R5 Using On-board Power** or powered from an external source as shown in section **6.3.5.5 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.

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System Menu

12.2 Controller Specifications

Description	Technical Data
Control characteristic:	ON/OFF, P, PID, Pulse Frequency control
Control:	9 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:	4 relays optional pulse frequency outputs or ON/OFF, for control of metering pumps
	2 relays Line Power 3 Relays dry contact
	6 Maximum x 4 ... 20 mA
Alarm relay:	Any relay 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. Frequency outputs and digital inputs: 14 to 24 gauge.

Table 18 Controller Specification

12.3 Sensor Specifications

Measuring Range/Measured value	
Measuring range connection type mV:	pH: 2.00 ... 12.00
	ORP voltage: -1000 ... +1000 mV
Connection type mA (ampero-metric measured variables, measuring ranges according to the sensors):	Chlorine
	Bromine
	Peracetic acid
	Toroidal Conductivity
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
Amperometric analysis	(Chlorine 0.001/0.01 ppm, 0.01 Vol. %, 0.1 Vol. % etc.):
Accuracy: based on the full-scale reading	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
pH compensation range for chlorine:	6.5 … 8.5

Table 19 Sensor Specifications

13 Using the USB Port

13.1 Capturing Data

The DCM510 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

```
USB drive active
Offline, All STOP

LOG      UPDATE     CONFIG
 F1         F2          F3
```


Figure 65 USB Access Door Closed [Top] and Open [Bottom]

Phillips head screw

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

```
Select upload size
ESC to previous

DAY       WEEK      MONTH
```

3- Choose the amount of history, DAY [F1], WEEK [F2], or MONTH [F3]. When you choose the period, the download starts.

   During the download, the keypad and browser connection are locked.

4- The display will show the progress of the download

5- 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.

6- 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.

```
Select upload size
ESC to previous
Log#38 of 288
```

```
AL123_17_101.csv
2288 Log records
Remove USB drive
```

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 Seperated 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. Frequency outputs in volume (mL).

	A	B	C	D	E	F	G	H	I	J	K
1	DCM5										
2	Serial nun	Site name	Controller name		Firmware						
3											
4	123	W P Stein	Hot Tub		17.06.05.00						
5	Log records										
6	I/O	Location	A	B	C	D	E	F	G	H	I
7	I/O	Units	uS	mpy	ppm	ppm	pH	mV	mA	F	mA
8	Date	Time	Conductiv	Corrosion	CLE3 Chlo	CTE Chlori	pH Sensor	ORP Sens	4-20mA in	Temperat	4-20mAOu
9	20/06/17	10:45:00	0.85	0.002	0	0	6.73	-4	0.017	68.242	20
10	20/06/17	10:40:00	0.85	0.002	0	0	6.73	-4	0.015	68.109	20
11	20/06/17	10:35:00	0.85	0.002	0	0	6.75	-4	0.017	67.693	20
12	20/06/17	10:30:00	0.85	0.002	0	0	6.74	-4	0.017	68.319	20
13	20/06/17	10:25:00	0.85	0.002	0	0	6.74	-4	0.017	67.822	20
14	20/06/17	10:20:00	0.85	0.002	0	0	6.75	-4	0.017	68.071	20
15	20/06/17	10:15:00	0.85	0.002	0	0	6.78	-4	0.015	68.093	20

Table 20 Partial example of captured data
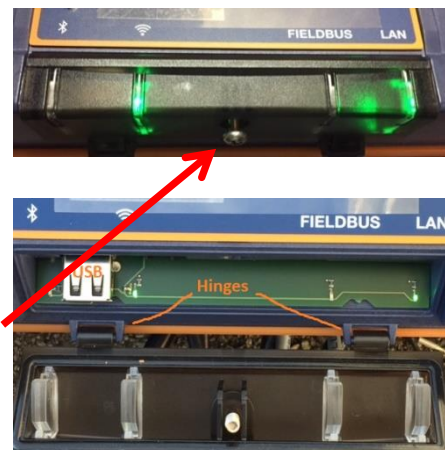
13.2 Save or Load the Program Configuration

THESE ARE 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

```
USB drive active
Offline,  All STOP

LOG     UPDATE    CONFIG
 F1        F2        F3
```

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

```
Configure file
No file found
SAVE=capture config:
SAVE               BACK
```

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

```
Configure file
AC123_16_292.cfg
SAVE=capture config:
SAVE      NEXT      LOAD
```

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.

```
AC123_16_292.cfg
complete
Remove 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 into the USB port located behind the Communication panel.

```
USB drive active
Offline,  All STOP

LOG     UPDATE    CONFIG
 F1        F2        F3
```

2- Press F3 Config.

3- Press F3 Load.

```
Re-configure file
Writing 6
SAVE=capture config:
SAVE      NEXT      LOAD
```

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

```
AC123_16_292.cfg
Complete restarts
Remove USB drive
```

Sometimes referred to as "Cloning", a saved program file can be loaded onto a different DCM510 controller. They will then have the same configuration. Afterwards, you can edit either program via the keypad or with a PC, etc.

13.2.3 Saving to/from flash

A copy of the configuration can be saved to the controller flash memory for immediate recall at a later time.

Press Menu, scroll up to System and press OK. Scroll up to Configuration and press OK. Save or load a configuration.

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13.3 Firmware Upgrade

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**.

2- Press F2, UPDATE

```
USB drive active
Offline,  All STOP

LOG     UPDATE     CONFIG
  F1        F2         F3
```

3- The display shows the one file from the USB drive; APQ17060500.hex and the current hex file in use; Running:16.10.13.00. NOTE: These numbers are date codes, year, month and day. '00' indicates they come from the USB drive.

   F2 "OLDPGM" is a list of hex programs on the controller. If OLDPGM is not a choice, there are no other backup hex files in the controller memory. You can load a previous program from this list.
   .

```
Program file
APQ17051300.hex
Running:16.10.13.00
NEWPGM  OLDPGM   BACK
```

4- **If the file on line 2 is the new firmware file**, press F1 NEWPGM to select the new hex file. Press F1, Load to install the new hex file.

```
Program file
AP17051300.hex
Running:16.10.13.00
LOAD      NEXT       BACK
```

5- Remove the USB drive when prompted.

```
Program file
OK. Ready to program
Remove USB drive
```

NOTE: OLDER FIRMWARE VERSIONS USE STEP 6.

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

```
Copying….
Program file
AP17051300.hex
  0.02% Complete
```
→
```
Copying….
OK. Ready to program
Remove USB drive
 100.00% Complete
```

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

```
Erasing
Program memory
```
→
```
Loading
AP17051300.hex
Record#  0
```

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

```
Hardware startup
Now…………..
```

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13.4 E-mail Reports and Alarms

The E-mail function is explained in the DCM510 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 on information; Alarms, Status and Daily data. Setup is via a PC or smart phone browser.
During controller power up or reset, E-mail initializes as disabled.

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

14.1 DCM510 Controller – base and cards

Lower body section RAL5003 No electronics	1020595
Pc-board DCM5, no batt, no fan, no P Supply	734190
A2 WLAN (WiFi module)	734211
Battery BR2032	732829
Power supply 100-230V 5V 55W RPS-60-5	734526
Power supply cable 230V EPS-65-5	1050744
Power supply cable 5V EPS-65-5	1050745
Fan 5VDC 50*50*10mm tachom.outp.	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

14.2 DCM510 Controller – Driver cards

A2 dual mA Input driver	734126
A2 dual mA Output driver	734143
A2 dual pH & ORP with temp Input driver	734131
A2 dual cond/temp Input driver	734223
A2 dual serial sensor Input driver	734265
A2 pH/w temp and mA Input driver	734355

14.3 DCM510 Controller – hood

Complete hood assembly (includes * items)	1081473
* Upper part RAL5003 blue hood	1059533
* Assy.Electrical HMI	734260
* Keypad DCM510	1074803
* 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

14.4 Sensors and Accessories

Conductivity/Temp/Flow Sensor **Serial Assembly** (includes * items)	1095087
* Conductivity/Temperature/flowswitch **serial** Sensor	1094802
* Various DGMA parts	

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14.4.1 Serial Corrosion Sensor (LPR)

Figure 66 LPR serial sensor assembly includes Tee, O-ring, entry fitting and shown with tips

LPR Sensor **Assembly. No Tips** (Includes * items)	7761473
* LPR Sensor Only. No tips 125 psi 50^0 C	7760792
* O-Ring seal for CTFS/CTF/TF Ass'y	7760577
* Sensor entry fitting CTFS/CTF/TF	7760445
* ¾" PVC Tee TxTxT Sch80	7741484
Admiralty Brass corr replc tips set w/Oring CRS-AM	7760238
Cupro/Nickle corr replc tip set w/Oring CRS-CN	7760239
Carbon Steel corr replc tip set w/Oring CRS-CS	7760240
Copper corr replc tip set w/Oring CRS-CU	7760241
304SS corr replc tip set w/Oring CRS-SS	7760243
Zinc corr replc tip set w/Oring CRS-ZN	7760244

14.4.2 Potentiometric Sensors and Accessories

Coax cable, SN2 x Clamp, 32"	1024105
Coax cable, SN2 x Clamp, 6'	1024106
Coax cable, SN2 x Clamp, 30'	1024107
PHED to 4-20mA converter	809126
RHEP to 4-20mA converter	809127
RHEP-Au-Se Gold pin ORP electrode Salt pools	1003875
ORP sensor – Aquatics	7500442
pH sensor – Aquatics	7500441
Conductivity Temperature Flowswitch -Serial	1094802
Temp sensor **Assembly*** PT1000 & adapter for DGMA	1082254
*Resistance thermometer Pt-1000-SE	1080101
*Temp sensor adapter for SGT or PT1000 to DGMA	1051504

14.4.3 Cable

Ethernet Adaptor - DCM2/DCM5	7500607
Cable, 2 conductor 22ga w/shield Quantity in feet	7760527

  Use this cable to lengthen low voltage sensors or any 4-20mA signal.

14.4.4 Amperometric Sensors and Accessories

CLE 3-mA-2 ppm sensor 0.02 to 2.0 mg/l	792920
CLE 3-mA-10 ppm sensor 0.10 to 10.0 mg/l	792919
CLO 1-mA-2 ppm sensor 0.02 to 2.0 mg/l	1033871
CLO 1-mA-10 ppm sensor 0.10 to 10.0 mg/l	1033870
CGE 3-mA-2 ppm sensor 0.02 to 2.0 mg/l	1047959
CGE 3-mA-10 ppm sensor 0.10 to 10.0 mg/l	1047975
CTE 1-mA-2 ppm sensor 0.02 to 2.0 mg/l	740685
CTE 1-mA-10 ppm sensor 0.10 to 10.0 mg/l	740684
CBR 1-mA-2 ppm sensor 0.02 to 2.0 mg/l	1038015
CBR 1-mA-10 ppm sensor 0.10 to 10.0 mg/l	1038014
Membrane cap for CLE3	790488
Sensor cap for CLO 1	1035197
Membrane cap for CGE/CTE 1	792862
Membrane cap for CBR 1	741274
Accessory set CGE 2/CTE 1 (2/5/10ppm) 2 caps/elect	740048

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Accessory set CLE (2 mem caps + 100mL electrolyte)   1024611

Accessory set CLO 1 (100mL electro, grinding disc. Plug)   1035482

Accessory set CBR 1 (2 mem caps + 100mL electrolyte)   1038984

Electrolyte for all CLE chlorine sensors 100mL   506270

Electrolyte CGE/CTE/BRE sensors 50mL   792892

Electrolyte CLO 1 100mL   1035191

Electrolyte CBR 1 100mL   1038017
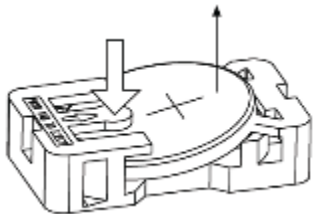
14.4.5 DGMA Sensor Header

Please consult the DGMA manual, available on the ProMinent.us website for parts and maintenance instruction.

15 Maintenance

The DCM510 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 67 AGlb 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. 66
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 Aegis II/DCM510 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

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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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