LED Display and KEYPAD User's Manual

ProMinent® DCM 2 series

Aquatic Water Quality Controller

p/n 7500614

CONTENTS

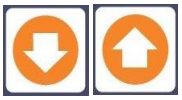
DCM2 Keypad User
1.0 Day-to-Day Operation
Basic Keypad Navigation

KEYPAD

If you get lost in a sub-menu, press 
BACK or **EXIT**
& you'll stop what you're doing & move back to the main menu

An **ENTER** ↵ symbol on the display signals that there are sub-menus available.

Press & Hold **RIGHT**  when viewing a pump status to switch between Auto-OFF-Manual. See section **1.4**

UP & **DOWN** to view options or to EDIT numbers 

Move **RIGHT** to select next field when editing 

ENTER to select an option & to execute editing 

BACK or **EXIT** to escape option, info display or editing 

MAIN MENU

The sensors and controls in the main menu vary with your controller part number and sensors and pumps/feeders that you enable or disable.

The main menu auto-groups sensors with the pumps/feeders that they control, so you will find the menu order changing when you modify a pH sensor from controlling an ON/OFF pump connected to Relay #1 to a frequency controlled pump connected to Output #5.

Where are Sensors, Solenoids, Valves & Pumps Connected?

You may modify the names of sensors, meters, flowswitches and pumps. Since you can change the names, the controller keeps track of each input with a letter **A** to **F** and each output with a number **1** to **5** representing where each is wired so you can locate each I/O within the controller enclosure.

Inputs **A** thru **C, E** and **F** have wiring terminals on the lower left side of the controller board.
A is the pH sensor, with terminals labeled **+pH-** (where '+' is the center conductor & '-' is the shield)
B is either the ORP sensor, with terminals labeled **+ORP-** or the CLB3 Free ppm sensor connected to its own special driver card.
C is a solution ground with temperature sensor with terminals labeled **RED & BLK** & used for the SGT sensor.
D is a Langelier-Ryznar calculated virtual input & does not have wiring terminals.
E is sensor sample flowswitch, labeled **FS** & ground ⏚.
F is an assignable contact set, defaulted to monitoring the Recirculation Pump & labeled **RP** & ground. The adjacent **+12** terminal is used if input **F** is used for a paddlewheel or turbine water meter.

Terminals for relay outputs **1** to **3** are located on the right hand side of the circuit board. They are ON/OFF power relays that switch line voltage to pumps & solenoids.

DCM2 Keypad User

The AC load connections are labeled, **P1**, **P2** & **R3** for outputs **1** to **3** with state indicated by **green** LEDs.

Terminals for outputs **4** & **5** are located to the right of the Ethernet jack & are labeled **A4B** and **A5B**. Outputs **4** & **5** are solid state DC relays configurable for frequency controlled pumps or dry contacts, DO outputs and thermally fused to 24VDC & 250mA with state indicated by **red** LEDs.

FREQUENCY CONTROLLED PUMPS

DCM2 controllers combine the 3 AC Relays for ON/OFF control with 2 DC relay outputs with options for on/off or frequency controls.

Depending on your feed application, frequency controlled pumps may deliver more accurate feed, easier to understand setpoints and longer pump life, since you are not turning the pump on and off.

Frequency controls may be new to you:

Typical Applications	**ON/OFF** Controller switches AC power ON/OFF to pump or solenoid.	**Frequency** Pulses on control cable varies stroke rate.
PID controls	Modulates pump ON & OFF time within a user set period	Continuously modifies the pump feed rate.
Acid or Oxidant Feed on Setpoints	Turn ON pump when pH greater than setpoint & OFF when pH less than setpoint	Increase the acid feed rate as the pH increases. Decrease the acid feed rate as the pH decreases.
Proportional Feed (Very popular in Aquatics)	Modulates the pump ON & OFF times proportionally to deviation from setpoint	Proportionally changes the pump strokes/minute as sensor deviates from setpoint (Between Sets)
Metered Feeds (filter aid)	Turn-on pump for 45 minutes @ 7:00 every Tuesday	Turn-on pump for 0.535 Gallons @ 7:00 every Tuesday
Typical Base Feed (Not typical in Pools and Spas)	Turn pump ON for 45 seconds every 5 minutes	Feed @ 4.5mL/minute
User Support	Relies on user to correctly set pump stroke & frequency	Won't let you set feed rate greater than the pump can deliver. Auto-switches from proportional to MAX rate depending on feed mode.

You can select one of 6 of the most popular ProMinent pumps for each frequency control which automatically sets the maximum stroke rate and volume per stroke OR you can define a mL/stroke and maximum frequency for any manufacturer's frequency controlled pump.

Sidebars: Are used to explain typical uses for feed and control functions.
Sidebars are at the bottom of the page detailing the function.
New aquatics users & users new to the DCM2 and DCM2-Cl may find these explanations helpful.

DCM2 Keypad User
1.1.0 Main Menu: DCM200 (ORP)

Displays the current values of controlling sensors.

Press **ENTER** to view or modify system settings

Displays the status of the oxidant feed.

Alternates with **Alarms**.
Active alarms are displayed by the name of the input or output in alarm (see example at right). If there is more than one alarm, the letters **A…F**, of the input or the number **1…5**, of the output will appear.
Press **ENTER** to reset alarms, to view alarm details, or to view the Activity Log.

Press **DOWN** to advance down to the first sensor.

Present value of the **pH Sensor** connected to sensor input '**A**' is shown. Updates every second.
Press **ENTER** to Calibrate, view-set Alarms & Diagnostics.

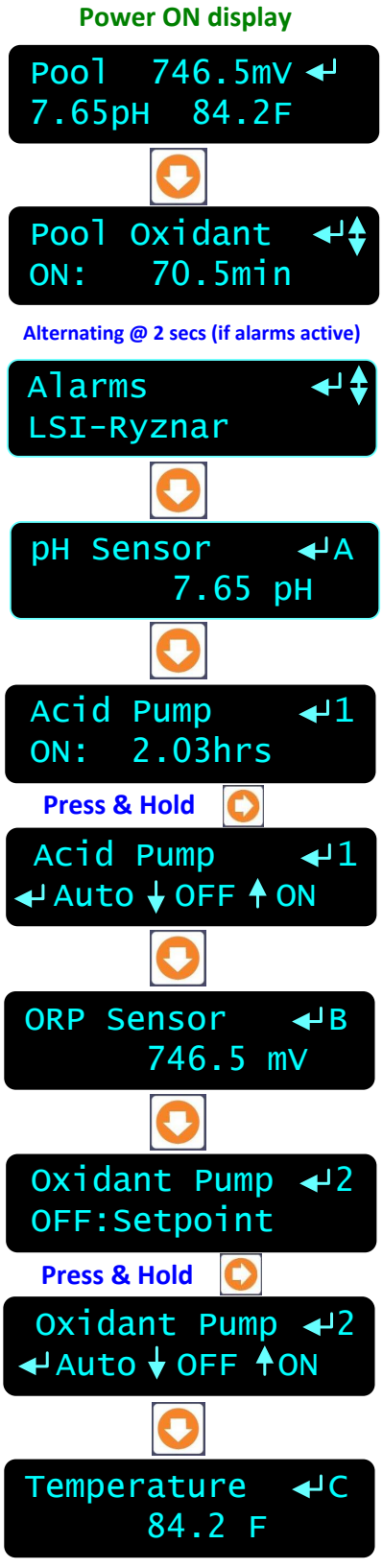
pH Sensor '**A**' controls the **Acid Pump** connected to relay output '**1**' by default, so they display together.
The pump is **ON** because the pH is greater than the Turn OFF **Setpoint.**
Press **ENTER** to view-modify Setpoint, Alarms, Diagnostic…

Press & hold **RIGHT** to select Auto-OFF-Manual ON selections for the pH control feeder. **DOWN** advances to the next Sensor.
Present value of the **ORP Sensor** connected to sensor input '**B**'. Updates every second.
Press **ENTER** to access calibration reset, view and set Alarms & Diagnostics.

ORP Sensor '**B**' controls the **Oxidant Pump** connected to Relay output '**2**', by default, so they display together.
The display shows `OFF:Setpoint`; if the ORP has reached the OFF setpoint.
Press **ENTER** to view and modify Setpoint, Alarms, Diagnostics.

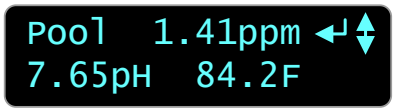
Press & hold **RIGHT** to select Auto-OFF-Manual selections.

Press **UP** or **DOWN** to scroll through all of the enabled I/O, flowswitches, solenoids, manual LSI-Ryznar entries, etc.
Press **ENTER** to select each I/O's sub-menus.



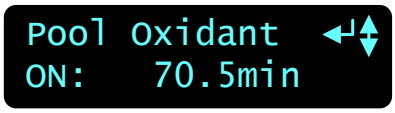
1.1.1 Main Menu: DCM2Cl (Free Chlorine)

Power ON display



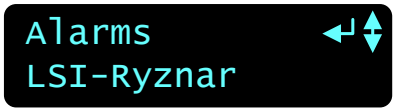
Displays the current values of controlling sensors.

Press **ENTER** to view or modify system settings



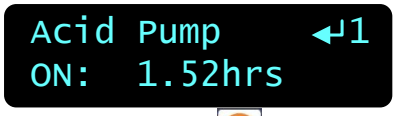
Displays the status of the oxidant-chlorine feed.

Alternating @ 2 secs (If alarms are active)



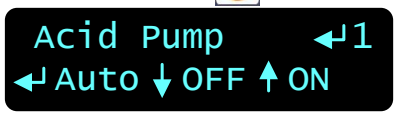
Alternates with **Alarms**.
Active alarms are displayed by the letter, **A...F**, of the input or the number **1...5**, of the output or '**None**'.
Press **ENTER** to reset alarms, to view alarm detail, or to scroll the key-press log,

Present value of the **pH Sensor** connected to sensor input '**A**'. Updates every second.
Press **ENTER** to Calibrate, view and set Alarms & Diagnostics.



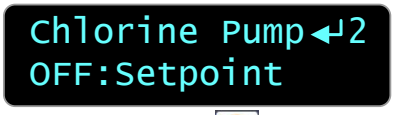
pH Sensor '**A** controls the **Acid Pump** connected to relay output '**1**' by default, so they display together.
The pump is **ON** because the pH has not yet reached the Turn OFF **Setpoint .**
Press **ENTER** to view and modify Setpoint, Alarms, and view Diagnostics.

Press & hold



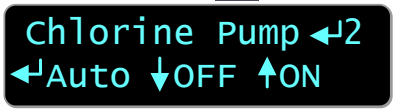
Press & <u>hold</u> **RIGHT** to select Auto-OFF-Manual selections.

Present value of the **Free Chlorine Sensor** connected to sensor input '**B**'. Updates every second.
Press **ENTER** to Calibrate, view-set Alarms & Diagnostics.



Chlorine sensor '**B**' controls the **Chlorine Pump** connected to relay output '**2**' by default, so they display together.
The pump is **OFF**; the chlorine ppm is above the Turn OFF setpoint.
Press **ENTER** to view and modify Setpoints, and Alarms, or view Diagnostics.

Press & Hold

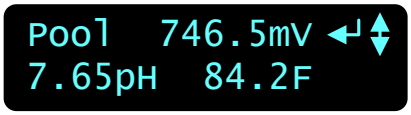


Press & <u>hold</u> **RIGHT** to select Auto-OFF-Manual selections.

Press **UP** or **DOWN** to scroll through all of the enabled I/O, flowswitches, solenoids, manual LSI-Ryznar entries…
Press **ENTER** to select each I/O's sub-menus.

DCM2 Keypad User
1.2 Checking & Clearing Alarms

Key **DOWN** from the power ON display to view alarms.



In this example, the temperature sensor @ input '**C**', the LSI-Ryznar calculation @ input '**D**' and the acid pump controlled by Relay '**1**' have alarmed.

Press **ENTER** to view or clear **Alarms**

Press **ENTER** to clear **Alarms.**
Press **ENTER** again to reset all alarmed feeds and controls; zeroing owed time & volume, and resets the delay on alarm for all sensors.

Press **BACK** to exit the acknowledge display.
The adjacent flashing **ORANGE** LED will switch to **BLUE**.

Returns to the main menu **Alarms** display.
See **Sidebar** @ bottom of page.

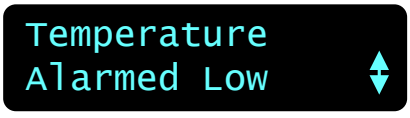
View Alarms

Press **ENTER** then **DOWN** to view active alarms.
All alarms latch and display until cleared, so you'll know there was a problem although it may have occurred and corrected itself when you were not at the controller.

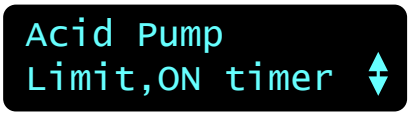
and

Press **ENTER** at **Alarms**
and **UP** or **DOWN** to view active alarms.

'**C**' is a temperature sensor which is or has been below its low alarm limit.



'**1**' is a pump, which has exceeded its Mins/Actuation alarm.
Acid pumps are usually set to stay OFF after alarming until the issue that caused the alarm has been corrected.



Sidebar: Feed limit and water meter alarms will immediately re-trip unless you adjust the alarm limits. Sensor alarms will re-trip after the user set 'Delay' unless the fault is corrected.

DCM2 Keypad User
1.3 View & Adjust Setpoints

Key **UP** or **DOWN** to the desired Pump or Solenoid then press **ENTER**.

Press **ENTER** when Setpoints is on the top line. Setpoint types differ with control type and ON/OFF or frequency.

When the controlling ORP falls below The TurnON setpoint, **735mV**, the **Oxidant Pump** will **TurnON**.
Key **ENTER** to adjust.
The Free Chlorine sensor and setpoints work similarly with ppm units.

Key **RIGHT** to move the underline and then **UP** or **DOWN** to change the number.

Press **ENTER** to change the setpoint or **BACK** to leave unchanged

The deadband between TurnON and TurnOFF sepoints is adjusted in the browser interface only. See Browser manual for more details.

Sidebar:
'Alarms-Limit' displays if the new setpoint exceeds the sensor alarm limits.
Setpoint is auto-set to the alarm limit.
'ON=OFF fault' displays if the ON setpoint = OFF setpoint.
Setpoints auto corrected for a 1% deadband.
'Out of Range' displays if ON > OFF on Oxidant feed or ON<OFF on Acid feed
'Out of Range' displays if PID control setpoint = 0.0. Setpoint changes are rejected in both cases.

Frequency outputs 4 and 5 can be configured as dry contact special controls (Digital Outputs)
Default display shows **No sensor**, **No Setpoint**.

ON-OFF Acid pumps without PID control selected typically use a deadband of 0.05 pH so that the delay between feeding acid and measuring its pH does not cause wide pH swings.

DCM2 Keypad User
1.3 View & Adjust Setpoints

Key **UP** or **DOWN** to the desired Pump, or Feeder then press **ENTER**.

The **Acid Pump**, frequency controlled by output **5** is **ON** and feeding at **65.84%** of maximum SPM (strokes/minute).

This chemical is fed based on the value of a pH sensor.

Key **ENTER** once to **Setpoints** and again to view the **100%ON Setpoint**. At pH's greater than 7.50 the '**5**' **Acid Pump** is @ maximum, rated SPM (Strokes per Minute).

Press **ENTER** to adjust.

The **OFF Setpoint** is determined by the deadband setting that is only accessible by the browser interface. *See Browser manual for more details.*

Press **ENTER** to adjust.
Key **RIGHT** to move the underline and then **UP** or **DOWN** to change the number.

Press **ENTER** to change the setpoint or **BACK** to leave unchanged

In this example, we've changed the 100% ON setpoint from 7.50 to 7.37 pH.

Adjust Setpoints
Variable Frequency

Sidebar:
The controller keeps track of the pump type connected to output '**5**' and its rated maximum SPM. Pumps of varying SPM and ml/stroke rating may be controlled at the same time.

In this example, the red '**A5B**' indicating LED on the lower controller board flashes at the pump stroke rate. As the feed rate slows and approaches zero, the time between flashes increases.

Any sensor may be used to frequency control any pump connected to outputs '**4**' or '**5**', delivering proportional control without using 4-20mA controlled pumps.

Controls inherit the setpoint units and decimal resolution from the controlling sensor.

DCM2 Keypad User
1.4 Auto-Manual-Off Selection

Key **UP** or **DOWN** to the desired Pump, or Feeder Output displays alternate with Auto-Manual-OFF selection

If you are operating in Auto, a sensor is controlling the pump. Press & ***HOLD*** **RIGHT** to change state.

.

UP turns the output relay controlling the pump or solenoid ON for the time limited by the Min/Manual time.

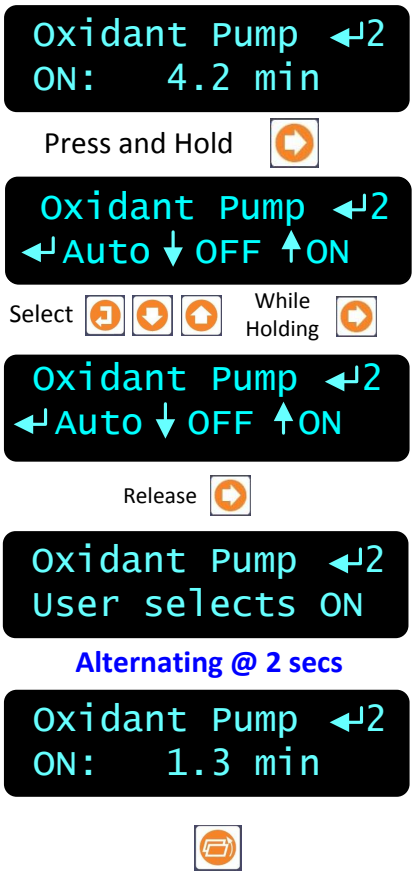
Open flowswitch and RUN-STOP contacts will still turn the output OFF.

Selecting **DOWN**, turns **OFF** the pump or solenoid & it remains OFF until **Manual** or **Auto** is selected

An alarm will be set when **OFF** is selected if **Alarm on STOPs** is set to **Yes** in the **SYS Configure** browser page.

After the ON / OFF / AUTO selection is made press **BACK** to return to the home or Power ON menu.

HOA: Hand/OFF/Auto



Sidebar:
Manual ON is an easy way to prime pumps or to slug feed a chemical on system start-up. **Manual ON** overrides sensor control set points to turn ON a control relay but it does not bypass safety interlocks and blocking. Default Minutes/Manual time is 2 Minutes.

Stop finds most use as a way to disable a faulted feed control until corrective maintenance can be performed

Two Key Select:
The need to press **RIGHT ARROW** and another key eliminates accidental state change selection.

ON/OFF Indicators
If the green or red LED on the controller circuit board is ON, the pump or valve connected to that output **1** to **5** should also be ON. In addition, the AC output plug cords supplied and installed have a neon indicator to show when the feeder is powered by the control relay.

2.0 Chemical Feed Controls

2.1 Limiting Feed & Alarms

To view or modify the **Alarms-Limits** used on a pump or solenoid, key **UP** or **DOWN** to the target Pump, & press **ENTER**.

Key **UP** or **DOWN** to **Alarms-Limits** & key **ENTER**.

The **Minutes per Actuation** limit is the elapsed ON time for each ON-OFF cycle. Key **ENTER** to adjust. The default is 240 Minutes and a non-zero value is required by NSF Standard 50.

The **Minutes per Manual** limit is the total ON time Allowed when output forced to Manual ON. Key **ENTER** to adjust. The total time resets at midnight.

If this timer alarms, as shown, it will turn the feeder OFF. All Pumps are set by default to **OFF on alarm** This setting is required by NSF Standard 50. Key **ENTER** to adjust.

Set to **Yes** to control any output with the Alarm Relay special control set, then press **ENTER**.

ENTER ends all owed time or volume & feed events.

If this pump or solenoid has ever previously alarmed, displays type of alarm and time & date it occurred. Used to flag alarms that have been **Reset**

Alarms-Limits

Sidebar:
Alarms and Feed Limits can prevent over feeds and/or alert users to operating faults.
Set limits to more than 1440 to disable alarms.
Example:
An acid feed that exceeds 240 minutes indicates that we're out of CO_2, the feeder's unplugged, leaking, frozen or incorrectly adjusted, the pH sensor isn't responding (Alkalinity is too high),etc.

DCM2 Keypad User
2.1 Limiting Feed & Alarms

To view or modify the **Alarms-Limits** used on a feeder, key **UP** or **DOWN** to the target feeder, & press **ENTER**.

In this example, the **Oxidant** feeder is DC relay controlled by output **4** and has been **ON** for 2.4 Minutes.

Key **ENTER** & **DOWN** to **Alarms** & key **ENTER**.

The **Minutes/Actuation** limit is currently set at 240 Minutes (4 hours), and must be a non-zero value under 1440 minutes to comply with NSF Standard 50. Key **ENTER** to adjust.

Key **RIGHT** to move the underline and then **UP** or **DOWN** to change the number.

Press **ENTER** to change the **Mins/Actuation** limit or **BACK/EXIT** to leave unchanged.

In this example, we've decreased the **Mins/Actuation** limit from **240.0** to **180.0** Minutes
Sanity Check: A 180 minute actuation would only occur of the feeder was on continuously for a full 3 hours without reaching the desired setpoint.

Alarms-Adjust

Sidebar:
Feed Limits are times for pumps & solenoids controlled by AC relays **1** to **3** and times or volumes for DC controlled outputs **4** and **5**. If **4** or **5** are in PID mode, the alarms would be maximum output volume, not time. When **4** and **5** are selected as Simple ON/OFF the alarms would be times like the AC relays.

Set the limits so that worst-case operation on the hottest day or highest bio-load load will not trip the limit, avoiding nuisance alarms.

The **Minute/Actuation** limit should be set so that, under normal operation the feeder will achieve setpoint in half the time of the Mins/Actuation. Any alarm would then be an alert that there is a fault with the feeder output (no chemical) or output rate (clogging injector).
Example:
A pH feeder in Time Modulate mode with a period of 60 Seconds would not reach the Min/Actuation limit until it has been feeding with modulation for quite some time and has reached the far end of its proportional band (and has been feeding at a progressively higher rate). Under this scenario the Mins/Actuation time can be comparatively short like 2 or 3 minutes.

DCM2 Keypad User
2.1 Limiting Feed & Alarms

Alarms-OFF On Alarm

To view or modify the **Alarms-OFF on Alarm** used on a pump or solenoid, key **UP** or **DOWN** to the target Pump, & press **ENTER**.

Key **ENTER** & **UP** to **Alarms** & key **ENTER**.

Key **ENTER** & **DOWN** or **UP** to **OFF on Alarm**
NOTE: NSF Std. 50 requires Off on Alarm to be ON to retain the NSF Standard 50 certification.

Key **ENTER, DOWN, ENTER**.
to change the **OFF on Alarm** from **No** to **Yes**
or **BACK** to leave unchanged.

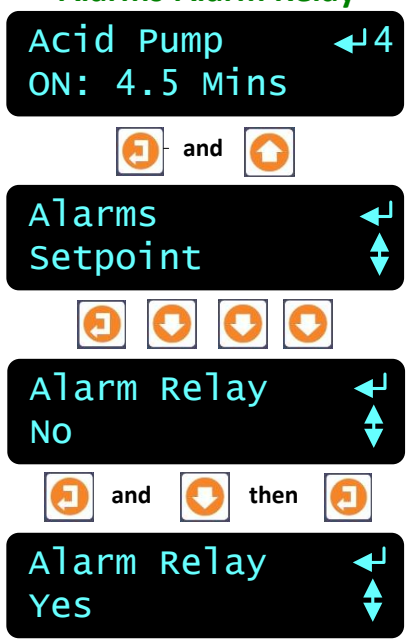
Alarms-Alarm Relay

To view or modify the **Alarms-Alarm Relay** used on a pump or solenoid, key **UP** or **DOWN** to the target Pump, & press **ENTER**.

Key **ENTER** then **UP** to **Alarms** & key **ENTER**.

Key **DOWN** x3 or **UP** x3 to **Alarm Relay**

Key **ENTER, DOWN, ENTER**.
to change the **Alarm Relay** from **No** to **Yes**
or **BACK** to leave unchanged.



Sidebar:
Chemical feeds are set to **OFF on alarm** by default since a time limit alarm indicates an operating problem which requires correction, and it is a requirement of NSF Standard 50.

Setting **Alarm Relay** = **YES** turns ON the output with an Alarm when an Alarm Output Relay special control is set.
Multiple sensors and pumps may be set to trip the alarm power relay or contact set.

DCM2 Keypad User
2.2 Feed Diagnostics

To view the **Diagnostic** for a feeder, key **UP** or **DOWN** to the target Chemical Feeder
The main menu display provides the current state.
Press **ENTER**.

Key **DOWN** to **Diagnostic** & key **ENTER**.
then **UP** or **DOWN** .

Displays **Alarmed** if feed stopped on **Min/Actuation** limit.

Displays the controlling sensor, meter or contact set & current value.
This example shows a pump controlled by the ORP sensor connected to input '**B**'.

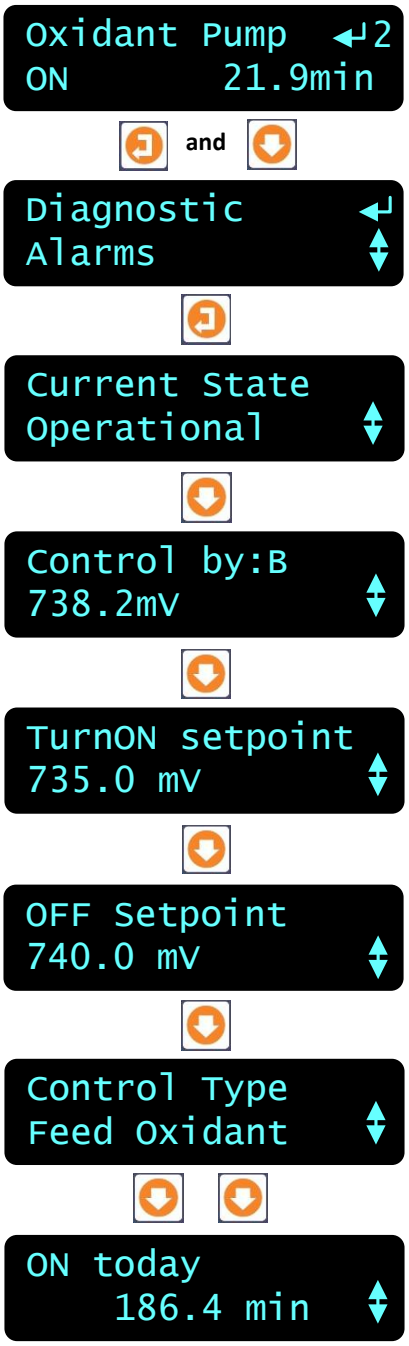
Displays the first setpoint type & value.
This example is ORP sensor controlled so the first setpoint is the mV value @ pump turn ON

Displays the 2nd setpoint type & value (TurnON+Deadband) only accessed by browser interface, not available via keypad.
This example is ORP controlled so the OFF setpoint is higher than TurnON. Adding oxidant increases the ORP.

Typical ORP controls **Feed Oxidant**, but it's also possible to use the same ORP sensor to De-Chlor (rare in Pools and Spas).
Similarly, a pH sensor can be used to control both Acid & Caustic chemical pumps.

A pump that never runs may indicate a setpoint, sensor or sample cell problem. Always ON may indicate a setpoint, pump sizing, feed or sensor problem.

Pump Diagnostics (View Only)



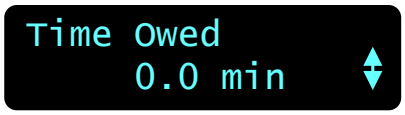
Sidebar:
Diagnostics vary with the output type and control. Relays '**1**' to '**3**' use ON time instead of the feed rates displayed on outputs '**4**' and '**5**' when using frequency controls.

The main menu displays **Interlocked: E** if the flow switch is keeping the relay from activating a feeder**. Alarm-Feed Limit** will show if Mins/Actuation has been reached.

DCM2 Keypad User
2.2 Feed Diagnostics

Diagnostics cont.

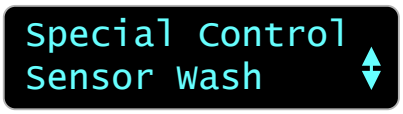
Pumps or solenoids with ON time or volume events will display the time or volume owed



Available **Special Controls** vary with the type of output: Relay, Frequency or Digital Out and the controlling sensor type.

OR

Displays active **Special Control**; **PID, Percentage Time-Base Feed, Time Modulate, Alarm Output, Filter Events...**
Flow Meter paced feeds don't use **Special Controls**.



and we're now back at the top of the **Diagnostic** scroll.

Sidebar:
DCM2 controllers are **Diagnostic** intensive.
Each sensor, water meter, contact set, relay-frequency-digital output and the controller itself has a **Diagnostic** display sequence.

Diagnostic tells you a lot about the operation of the control system and is invaluable if you have a configuration problem or feed fault.

Even if you have **Passwords** turned ON, any user can still view the **Diagnostics**.
An on-site person reading the **Diagnostic** screen sequence over the phone may save a site trip.

Browser access available directly, local network or remotely via internet connection displays all controller Diagnostics.

DCM2 Keypad User
2.3 Selecting a Pump Type

Controller outputs '**4**' and '**5**' may be used for frequency-controlled pumps or as dry contact, digital outputs**.**

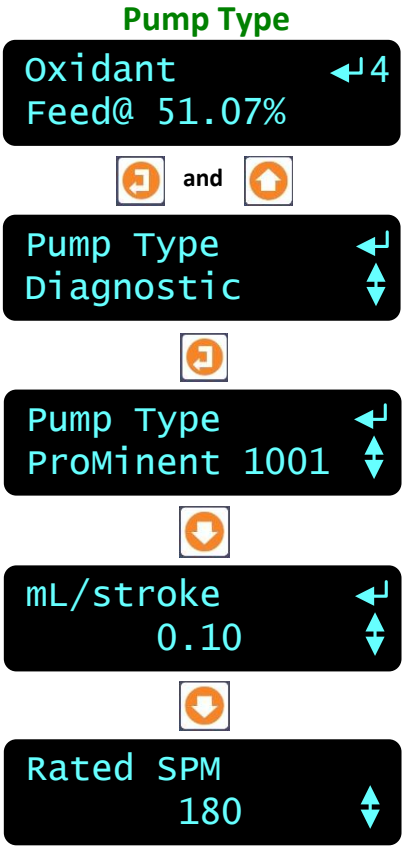
To view or modify a **Pump Type** key **UP** or **DOWN** to the target pump and press **ENTER** then **UP**.

Key **ENTER** @ **Pump Type**.

Displays one of six default pump types or **Other**. In this example **Oxidant** '**4**' controls a **ProMinent 1001** type pump. Key **ENTER** to modify.

Displays the current **mL/stroke** volume in mL. In this example, it's the default for a **ProMinent 1001** type pump. Key **ENTER** to modify.

Displays the current **Rated SPM** in strokes per minute. In this example, it's fixed by selecting a **ProMinent 1001** type pump.



Sidebar:
Pump Type:
If you select one of the 6 built-in ProMinent pumps, the feed volume mL/stroke and maximum frequency are correctly and automatically assuming a nominal 40psi feed line pressure.

If you select '**Other**' as a pump type, you'll need to provide both the nominal mL/stroke and maximum stroke rate. Pumps with maximum stroke rates from 50 SPM to 400 SPM are supported by the controller.

Relay Controls:
Frequency controlled pumps may be switched ON/OFF by one of the controller's relays '**1**' to '**3**'. Disconnect and remove the frequency control cable and plug the pump power cord into the controller.
This is not the best use for a frequency controlled pump but if you need more than the controller's four frequency controls, it's an option.

DCM2 Keypad User
3.0 Sensors

3.1 Calibration

NOTE: Calibrations should only be performed when the water chemistry/temperature is stable and the chemicals are not being fed, to assure the most accurate chemistry readings and calibrations.

The example used below will be the pH sensor, but other sensors are calibrated in a similar way.

To calibrate a sensor, key **UP** or **DOWN** to the target sensor and press **ENTER**.

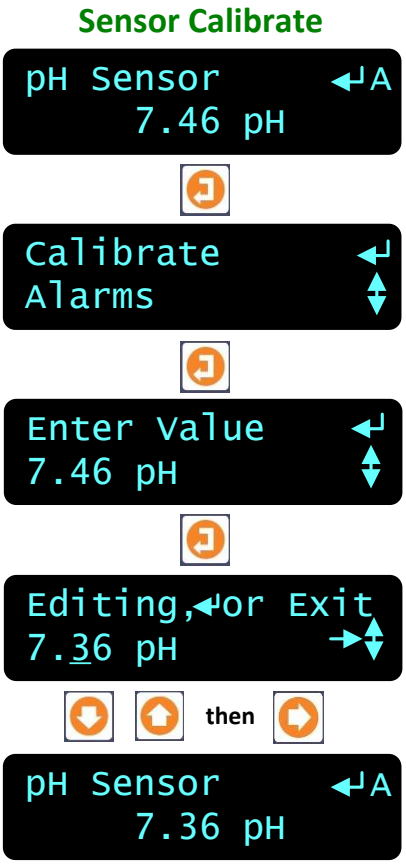
Key **ENTER** @ **Calibrate**.

If Display asks for "1st pH Buffer", press the UP button once, press **ENTER** to change to **1 point Calibration**=**Yes** then press **ENTER.**
Key **UP** or **DOWN** until **Enter Value** is displayed. press **ENTER**
Lower line displays current sensor value. Key **ENTER** to modify.

Key **UP** or **DOWN** to change the underlined digit.
Key **RIGHT** to move the digit underline.

Press **ENTER** to calibrate.
or **BACK** to leave unchanged.

In this example we decreased the value measured by a pH sensor from **7.46** to **7.36**.



Sidebar:
Single Point Calibration: All sensors can be single point calibrated. Measure a grab sample from the sensor housing sample petcock and calibrate the sensor based on the grab sample. It's the simplest, most repeatable method.

Aquatics systems normally control so that the pH, ppm or ORP is controlled within a narrow range, allowing simple, single point calibration.

2-point calibration is available for all but the ORP sensor if required.

Calibration Faults: Refer to the next page for options on fault.

DCM2 Keypad User
3.1 Sensor Calibration

If the controller cannot calibrate you'll view this warning after you modify the sensor value & key **ENTER**.

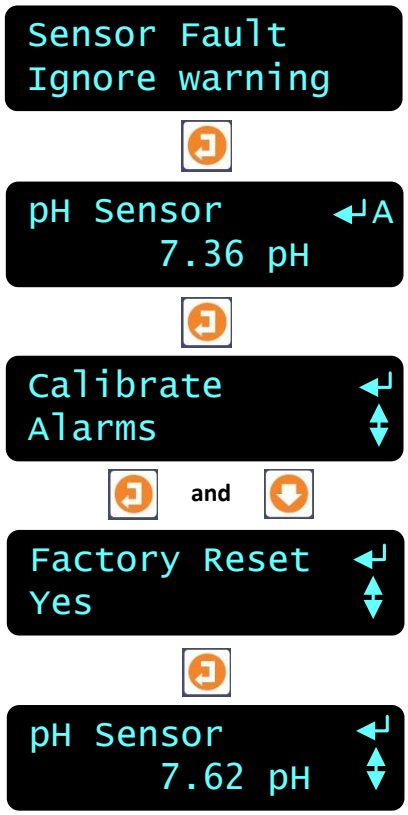
Key **ENTER** to ignore the warning or **BACK** to return the sensor to its pre-calibration value. CAUTION: The calibration error is a sanity check in the software usually triggered by a sensor reading that exceeds normal sensor drifting caused by fouling or sensor age and may indicate sensor cleaning or replacement is needed. Pressing **ENTER** in this situation will force the controller to read what may be a false reading.

To reset the sensor to its factory default setting key **ENTER** and **DOWN** to **Factory Reset**.

Press **ENTER**.
Factory Reset doesn't correct the problem which caused the warning, it just changes the calibration back to the factory default for a "perfect" sensor.

In this example, we started at **7.46**, got a warning when we calibrated at **7.36** and returned to **7.62** after **Factory Reset**.
Is the fault due to a failing or fouled pH sensor or our pH tester?
Verify the tester against a calibration buffer.

Calibrate Faults



Sidebar:
Sensor Fault: The controller verifies that sensor OFFSET or GAIN required to make the sensor read its new value are within the range of typical sensor operation. **Sensor Fault** when sensor is out of range.

Fault Cause varies with sensor type**.**

ORP: Verify sensor cable not shorted & firmly connected. Verify not visibly fouled (clean it). If stream contains organics, clean with alcohol or detergent. Follow with an acid flush.

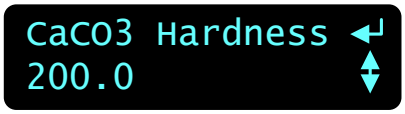
pH: Verify solution ground in sensor header connected & excess pH sensor cable coiled at sensor, not in enclosure. Verify sensor cable not shorted & firmly connected. Then replace if no recovery after **Factory Reset**. pH sensor life decreases with handling and temperature extremes.
ppm: Stable flow is required for accurate readings. Fouling from calcium scale can be a cause for low sensor readings in some pool chemistries. See cleaning instructions provided with your CLB3 sensor.
Temperature: Verify cabling color-coding correct and sensor wires firmly connected. Inspect sensor for damage or leaking. Verify sensor and sample cell not in direct sunlight.

DCM2 Keypad User
3.2 LSI-Ryznar Manual Entry

To calibrate the Langelier – Ryznar indexes, key **UP** or **DOWN** to the **LSI RSI** display and press **ENTER**.

Key **ENTER** @ **Calibrate**.

Displays current calcium hardness ppm value.
Key **ENTER** to modify.



Key **UP** or **DOWN** to change the underlined digit.
Key **RIGHT** to move the digit underline.

Press **ENTER** to calibrate or **ENTER** to view-modify **Alkalinity**.

Displays current alkalinity ppm value.
Key **ENTER** to modify.

Key **UP** or **DOWN** to change the underlined digit.
Key **RIGHT** to move the digit underline.

Press **ENTER** & then calibrate **Conductivity** to match the grab sample value.

Press **ENTER** to calibrate or **ENTER** to View the updated **LSI** & **RSI** indexes.

Sidebar:
The LSI-Ryznar scaling & corrosion indexes calculations require current pH, temperature & conductivity in addition to hardness & alkalinity.

You'll be prompted for a conductivity calibration value after you view-modify **Alkalinity.**

Calcium limits = 50 to 400ppm
Alkalinity limits = 30 to 140 ppm
Conductivity limits = 100 to 10000
If you enter a value outside of the limits, it will be set to the limit

DCM2 Keypad User
3.3 Sensor Alarms

To view or adjust sensor alarm, key **UP** or **DOWN** to the target sensor and press **ENTER**.

In this example we're viewing the alarms on the **Temperature** sensor connected to input '**C**'

Key **UP** and **ENTER** @ **Alarms**.

In this example, the controller will alarm if the **Temperature** exceeds **90.0 F**. Key **ENTER** to modify.

In this example, the controller will alarm if the **Temperature** falls below **60.0 F**. Key **ENTER** to modify.

Delay on Alarm prevents nuisance alarms by requiring, in this example, **5** minutes of fault occur before alarming.

Set the Delay to zero minutes if you require an immediate alarm.
Key **ENTER** and use the **UP**, **DOWN** and **RIGHT** buttons to modify.

Sidebar:
Sensor Alarms: Nuisance alarms tend to be ignored.
Select alarm limits that represent user safety & comfort and detect control fault & sensor failure.

Sensors can be configured using the browser interface to trip a relay or digital output designated as an Alarm Output.

Reset Alarms: Section 1.2 **Clear Alarms** resets the **Delay on Alarm** time
If the **Delay on Alarm** is set to zero minutes and the sensor is above the **High Alarm** or below the **Low Alarm**, the sensor alarm will immediately re-trip.

DCM2 Keypad User
3.4 Sensor Diagnostics

Diagnostic

To view sensor **Diagnostics**, key **UP** or **DOWN** to the target sensor and press **ENTER**.

Key **UP** and **ENTER** @ **Diagnostic**.

Sensor Type; **'pH Sensor'** in this example. Also displays ORP, Temperature, or 'Calculated' for LSI-Ryznar.

Current State may also display **Alarmed**, **Fail Calibrate**, or **Overrange** (Hardware fault).

Current value of the sensor. With user set digits after the decimal and user set units. Sensors may be displayed with from 0 to 3 digits after the decimal

Thermal Compensation can used with pH sensors, but is usually <u>not</u> used in Pool/Spa applications.
.

Gain Multiply is the value required to convert the sensor millivolts to the displayed pH. See following page for an example.

Default Gain is the **Gain** after a **Factory Reset**. pH Sensor **Gain** is usually only modified by a 2 point sensor calibration.

continued

Sidebar:
Diagnostic displays how the sensor is configured, compensated and calibrated.
This is where you go if you have a non-obvious sensor problem.

DCM2 Keypad User
3.4 Sensor Diagnostics

Offset Adjust is the value required to make the displayed pH, ORP or temperature match your last calibration.

Default Offset is the **Offset** after a **Factory Reset**. pH & ORP sensors with offsets remote from the default offset will not usually track & have failed, contaminated or fouled.

Measured Level is the sensor voltage measured by the controller. Varies with sensor type. Useful when diagnosing non-tracking sensors.

Example: 44.3 mV x **0.0170 Gain** + **6.896 Offset** = **7.65 pH**
The **pH Sensor** value displayed on the previous page.

Diagnostic cont.

Sidebar:
Offset & Default Offset
When you calibrate a pH, ORP or temperature sensor, the controller adjusts the OFFSET to make your measured value match the displayed value.
Note above that the actual pH sensor OFFSET is not the Default.

Gain & Default Gain
When you two point calibrate a pH sensor, the controller adjusts both OFFSET and GAIN.

Measured Level:
pH sensors have a well defined mV to pH relationship.
Example pH7 = 0mV, pH10=176 mV and pH4 = -176 mV.
Displayed sensor value = (**GAIN** x **Measured Level**) + **OFFSET**.

Using this simple equation, you can directly modify the OFFSET & GAIN to get a desired display.
This is seldom done, but it's convenient for some unusual sensor types.

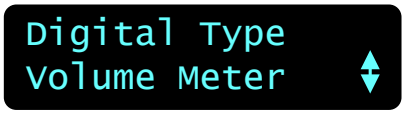
DCM2 Keypad User
3.4 Sensor Diagnostics

Meter Diagnostic

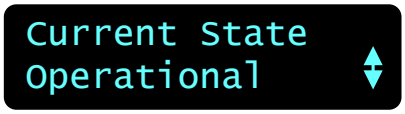
To view Diagnostic for a flow meter, press **UP** or **DOWN** to the target meter **F** and press **ENTER**.

Key **UP** and **ENTER** at **Diagnostic**.

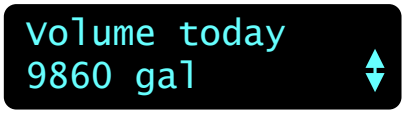
Both Turbine & Contact Head meter display as **Digital Type Volume Meter**.



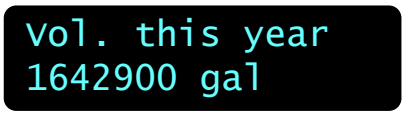
Displays **Alarmed** if **Volume Today** greater than **High Alarm** or less than **Low Alarm**.



Volume Today is the measured volume from midnight of the current day.



Vol. this year is the measured volume in the current calendar year.



continued

Sidebar:
If we are viewing the **Volume Today** at noon and this site runs 24 hours a day, is this the expected volume for the current load?

If it's high, are we losing water? If it's low is the meter volume/contact correct? & if it is, is the level control functioning?

Diagnostics are only useful if you draw operating conclusions from the data.

Note: A DCM2 can only set input '**F**' to be a water meter. Input '**E**' is fixed as a flowswitch.

3.4 Sensor Diagnostics

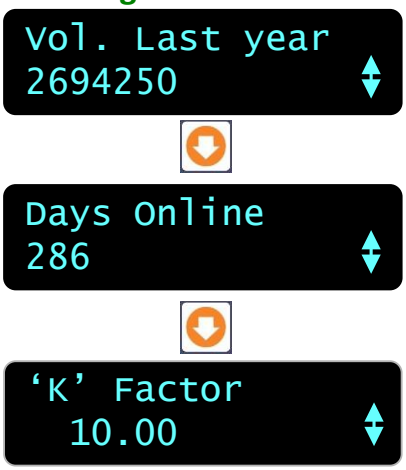
Compensation Volume to Rate
(not shown at right)

Vol. Last year is the measured volume in the previous calendar year.

Days Online is the number of days that this meter has been enabled and operating in this controller.

Volume/Contact or **'K' Factor** is the current scaling factor for the installed meter

Diagnostic cont.



Sidebar: (Water totals feature not normally used in Pools and Spas)
If **Days Online** = 286 and **Vol. this year** = 1642900 & the site operates 24/7 then we're averaging 5750 Gallons/day.
Is this the expected make-up volume for the load?
If we've been averaging 5750 and today at noon we've measured **Volume today** = 9860 Gallons, why the increase?

Meter Alarms: Low Alarm
The **Low Alarm** for water meters only trips at midnight if the meter has not exceeded the **Low Alarm** volume. Set **Low Alarms** = 0 to prevent alarms @ midnight.

Use **Low Alarm** to flag sites that have not made-up water as expected.

Meter Alarms: High Alarm
The **High Alarm** for water meters trips when the meter exceeds the **High Alarm** volume.

Set **High Alarms** higher than the volume expected @ highest load to prevent nuisance alarms OR close to actual usage to flag you on increased load.

Set **High Alarms** on feed verify meters to flag you on increased usage.

Note; clearing a water meter **High Alarm** without adjusting the **High Alarm** level will immediately trip another alarm on the meter.

DCM2 Keypad User
3.5 Contact Set Alarms

To view or modify contact set **Alarms** key **UP** or **DOWN** to the target contact set input and press **ENTER**.

Key **UP** and **ENTER** @ **Alarms**.

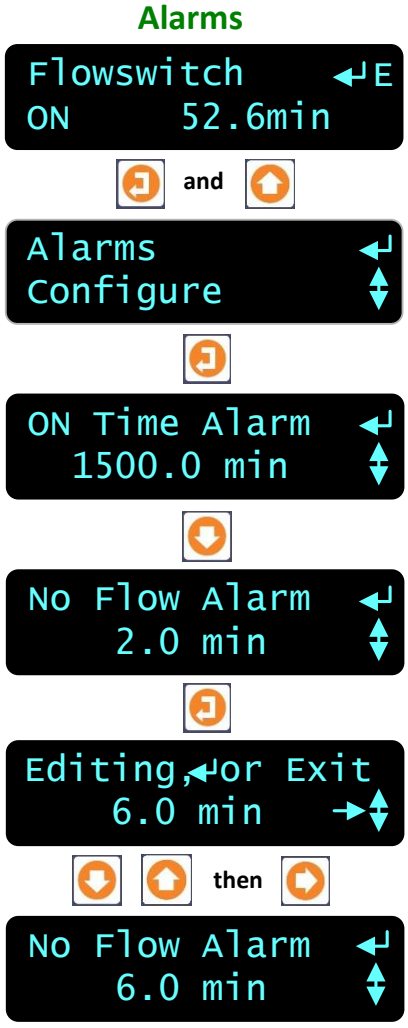
Alarms if the contact set is **ON** today for longer than the **ON Time Alarm**. Timing resets every time contact set turns **OFF** and at midnight. **1500 min** is a normal default for the Flowswitch E

Alarms if the contact set is **OFF** today for longer than the **No Flow Alarm**. Timing resets every time contact set turns **ON** and at midnight. **2.0 Min** is normal for a no flow alarm. Chemical feeder will be interlocked immediately, only the alarm will wait for 2 minutes to latch ON.

Keying **ENTER** to modify.
Key **UP** or **DOWN** to change the underlined digit.
Key **RIGHT** to move the underline.

Press **ENTER** to save the new **No Flow Alarm**.
or **EXIT** to leave unchanged.

In this example we've reduced the **No Flow Alarm** from its factory default of **2.0** minutes to **6.0** minutes.



Sidebar:
Default alarm times are set so that contact sets won't alarm unless user configured. It's unlikely that you would set both alarms on any one contact set but the ability to alarm both ON & OFF states gives you a lot of application flexibility.

ON Time Alarm:
A Flowswitch is normally on 24/7, so the ON time alarm should be set above 1440 minutes, 1500 is the default.

No Flow Alarm:
If you had a system that typically runs 24/7 you'd want to alarm on a flowswitch that has no flow since it indicates that the sensor or return line is blocked or inadvertently valved OFF.

DCM2 Keypad User
4.0 System Settings

4.1 Passwords

Controllers are defaulted to **Keypad Password** OFF.

To turn ON the **Keypad Password** press **ENTER** and **DOWN** to **Configure** at the power up or top of menu display.

Key **ENTER** @ **Configure**.

Key **DOWN** to **Keypad Password**.

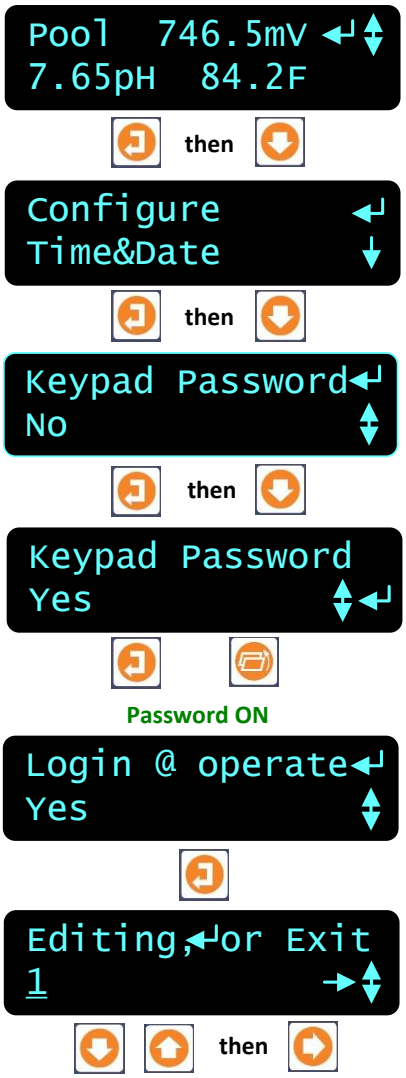
Key **ENTER DOWN ENTER** to turn ON **Keypad Password**.

You'll view the **Login** display when you select a password protected part of the controller. See **Login Displays**:.
Key **ENTER**

Key **UP** or **DOWN** to change the underlined letter or digit.
Key **RIGHT** to move the underline.

Press **ENTER** to **Login**.
If you have not keyed any of the current, valid passwords, you'll view an error message.

Turn ON Passwords



Password ON

Sidebar:
Default Passwords:
The first time you turn ON **Keypad Password** the 8 default passwords are**:**
Operator1 = **1** Operator2 = **2** Operator3 = **3** Operator4 = **4**.
Configure5 = **5** Configure6 = **6** Configure7 = **7** Administrator = **AAAA**
There are 3 password levels, Operator, Configure and Administrator.
The 8 default User IDs are used in the controller's keypress log.

Modify Password: Once you Login you can modify your password.
Refer to the following page.
Login Displays: Prompts you for the required password level. **Login** @ **Admin**, **Config** or **Operate** depending on what key press activity required a password.

DCM2 Keypad User
4.1 Passwords

After you've turned ON passwords and logged in as one of the eight users:

To modify your **Keypad Password** press **ENTER** and **UP** to **Passwords** at the power up or day-time display.

Key **ENTER** at **Passwords**.

To **Logout** as the current user, key **ENTER** at **Logout**.
The controller automatically logs you out 30 minutes after your last key press.
Note that this display shows **Operator1,** your user ID.

Key **ENTER** at **Reset Pswrds**.
to key in the reset code which returns all passwords to default.

Key **ENTER** at **Edit Passwords** to view or modify your password.

Key **UP** or **DOWN** to change the underlined letter or digit.
Key **RIGHT** to move the underline.

Press **ENTER** to change your password or EXIT to leave unchanged.
In this example we changed **Operator1**'s default password from '**1**' to **OP1**.

Sidebar:
Modify Passwords:
Because all 8 default passwords are listed on the previous page.
You should modify all 8 passwords when you initially turn ON passwords.
Passwords are limited to 8 numbers mixed with capital letters.
Spaces in passwords are not allowed. Any space in a password ends the password on both editing and **Login** password entry.

Two users cannot share the same password because the password is used to identify the user.
The controller displays **Password Fail** on a duplicate password.

Reset Passwords: If you forget your password, a **Reset Password** is available from ProMinent, specific to your controller's serial number and sets all passwords to default.

Passwords: This menu item only displays on controllers that have turned ON **Keypad Password**.

DCM2 Keypad User
4.2 Time & Date

To view or adjust the **Time&Date**
press **ENTER** and **DOWN** to **Time&Date**
at the power up display.

See **Controller Response to a new Time&Date:**
on this page **Sidebar** prior to adjusting

Key **ENTER** @ **Time&Date**.

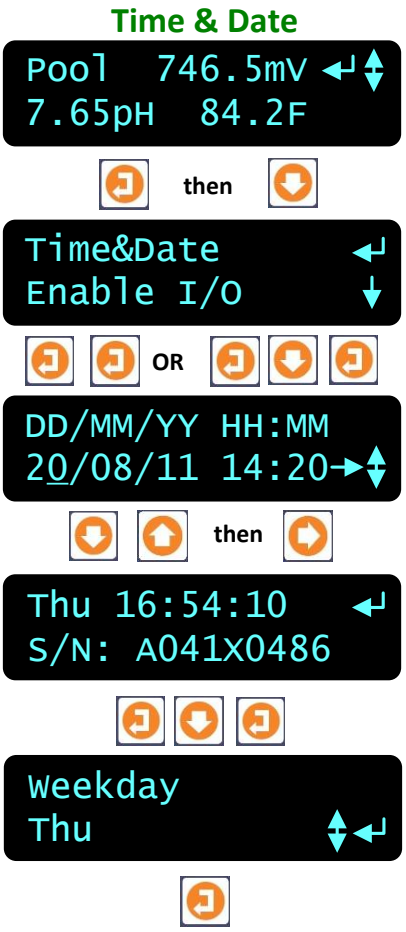
Key **ENTER** twice to modify **Time&Date**.
OR ENTER, **DOWN** & **ENTER** to modify **Weekday**.

Display current date and time.
Key **UP** or **DOWN** to change the underlined digits.
Key **RIGHT** to move the underline.

Press **ENTER** to save the new **Time&Date**.
or **EXIT** to leave unchanged.

Displays current day.
Key **UP** or **DOWN** to modify.

Press **ENTER** to save the new **Weekday**.
or **EXIT** to leave unchanged.



Sidebar:
Time & Date:
The controller uses a 24 hour clock where 14:30 is 2:30 PM.

Controller Response to a new Time&Date:
When you change the time & date, the controller:
1. Turns all outputs OFF, resets all control timing and restarts the logging period on each I/O
2. Ends time and volume owed which ends all events.
3. Does a midnight reset which will may set volume-meter Low Alarms.
4. Sets the event control Day 1 to the most recent Sunday.
   Example: If you are at Day 19, Thursday of week 3, on a 28 day event feed cycle.
   After a **Time&Date** change you are now at, Day 5,Thursday of week 1.

DCM2 Keypad User
4.3 Activity Log

To view the **Activity Log** press **DOWN** then at the **Alarms** display, press **ENTER** and **DOWN** to **Activity Log**.

Key **ENTER** @ **Activity Log**.

Each entry in the log initially displays it's activity as you key **DOWN** .

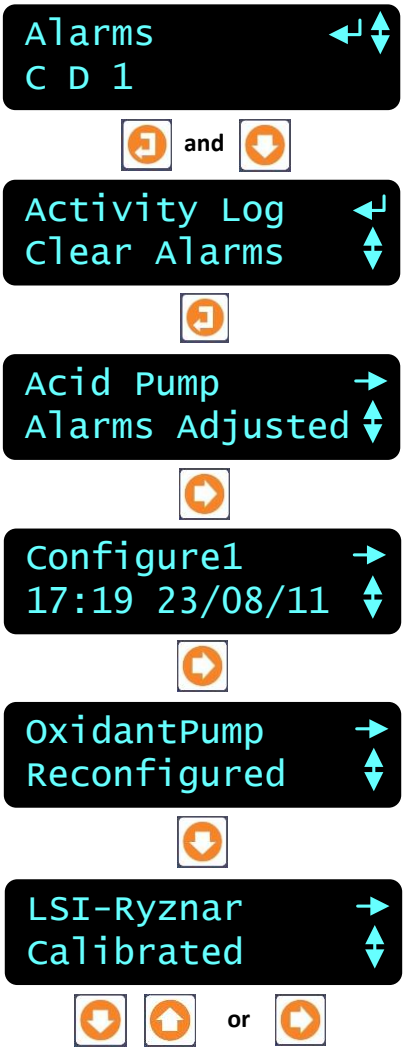
In this example the feed limit **Alarms** for the **Acid Pump** were **Adjusted**.

Key **RIGHT** to view the User ID and the Time & Date stamp for the Activity.

Key **RIGHT** again to get back to the **Activity** or key **DOWN** to scroll the User ID and Time-Date stamps.

Scroll UP or **DOWN** through the Activity Log. Keying **RIGHT** to view the User IDs & Time-Date stamps

View Activity Log



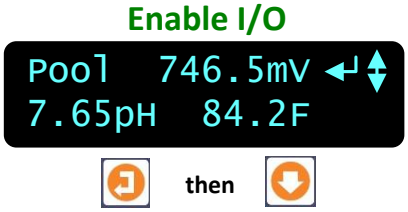
Sidebar:
Keypress-Alarm Log:
The log contains the last 25 activities that effect the operation of the controller.
Most recent activities are shown first. Both keypad and browser user activities are logged.

User IDs:
Keypad Password ON: Logs the User IDs listed in **Section 11.1**

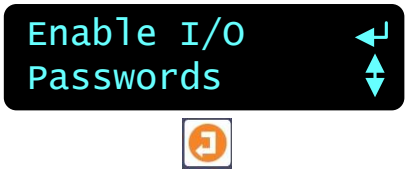
Default Passwords.
Keypad Password OFF: Logs all User IDs as **Keypad**.
Browser user IDs are always logged because login is required to browse.
Actions taken by the controller, like logging a power OFF/ON, use the **System** user ID.

DCM2 Keypad User
4.4 Enabling Inputs & Outputs

To **Enable I/O** press **ENTER** and **DOWN** to **Enable I/O** at the power up display..

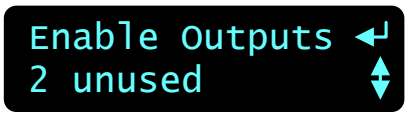


Key **ENTER** at **Enable I/O**.



Displays the number of sensor inputs and meter-contact inputs available for enabling. Key **ENTER** to select one.

Displays the number of relays and frequency controlled outputs available for enabling. Key **ENTER** to select one.



Disabling I/O:
Individual Inputs and Outputs are disabled using the browser interface.
I/O cannot be disabled via Keypad.

Disabled I/O does not display on the LCD or Browser, is not logged and does not appear in the selections used to compensate and configure other enabled I/O

Enabling Inputs:
Sensor inputs **A**:pH, **B**:ORP or ppm and **C**: Temperature Inputs are fixed and cannot be disabled.

Contact set input '**E**' is fixed as the sensor flowswitch

Digital input '**F**' may be configured as a Meter-Volume or Contact Set Input. This is typically an additional flowswitch, square wave flow meter or auto-fill switch.

Enabling Outputs:
Outputs **1** to **3** are AC power switching relays that are enabled to power pumps, or solenoid valves.

Outputs **4** and **5** are DC contact outputs that are able to control pulsed input pumps or can be used as 24VDC dry contact digital outputs to control the remote enable/disable of heaters or UV systems.

DCM2 Keypad User
4.5 Metric & U.S. Units

To view or adjust the Metric - U.S. Units setting press **ENTER** and **DOWN** to **Configure** at the power up display.

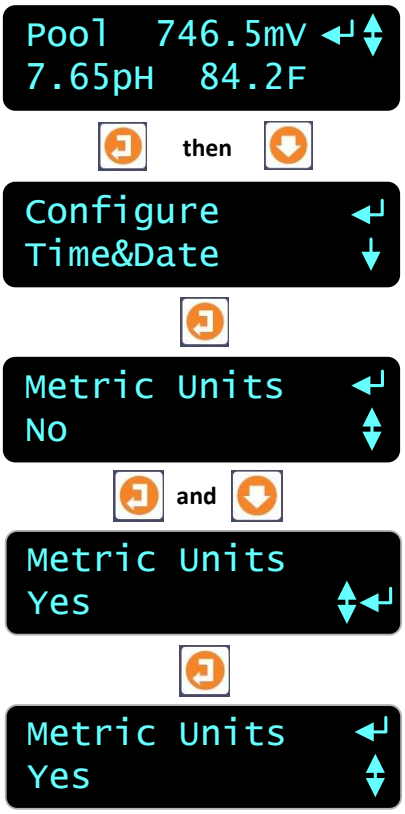
Key **ENTER** at **Configure**

This controller in currently set to U.S. units. Temperatures are in F and volumes greater than 100mL are in Gallons.

Key **ENTER** to **DOWN** to switch to **Metric Units**.

Key **ENTER** to set **Metric Units** or **EXIT** to leave as U.S. Units.

Switch to Metric



Sidebar:
Commissioning:
Select U.S. or Metric Units when you commission or install the controller.
Data logging uses the Units setting for the units on logged volumes and temperatures.
Changing units does not change data already logged.

Metric Inputs:
Temperature inputs are converted to Centigrade using the default offset and gain for each of the thermal input type.
If you switch back to U.S. units, temperatures are converted to Fahrenheit using the default offset & gain, removing the effect of any user calibration.
Water meter units default to 'L'iters not 'G'allons.

Metric Outputs:
Pumped volumes are reported in mL & Liters.
Timed event volumes are in Liters and not Gallons.
The controller uses the units of the controlling sensor for setpoints.
If a water meter was set to measure Gallons prior to switching the **Metric Units**, it will still display Gallons on the meter and wherever it's used for control.

DCM2 Keypad User
4.6 Configuration

To view or adjust the configuration of the whole controller press **ENTER** and **DOWN** to **Configure** at the power up display.

Key **ENTER** @ **Configure**

.
Currently set to U.S. units.
To switch to **Metric Units**, key **ENTER**, select **Yes** & **ENTER**.

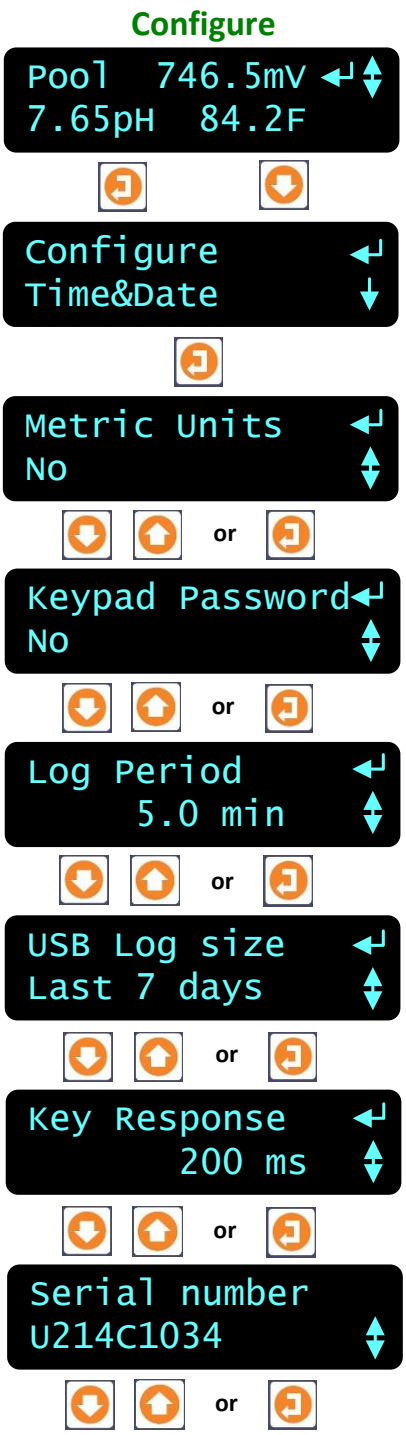
Password for LCD-Keypad users currently OFF.
To turn ON passwords key **ENTER**, select **Yes** & **ENTER**.

The DCM200 logs up to 24000 records at Log Periods from 1 to 60 minutes. Five minutes is an 83 day log of sensor values, state & pump ON times.
Key **ENTER** to modify the **Log Period**.

Insert a USB flash drive & auto-uploads the **Last 7 days** of Log records.
Key **ENTER** to select **Last 48 hours** or **All Logs**.

You can modify the keypress response to your preference from 150mS, default to 200mS.
Key **ENTER** to modify.

You can modify the Auto-Manual-OFF, **HOA** Press & HOLD response to prevent accidental Selection from 1 to 10 seconds; 2 second default.
Key **ENTER** to modify



Sidebar: Recommended:
Turn on Keypad password.
Log on as the 'admin' and modify the password if this controller is likely to be accessed by untrained users. Do this to prevent accidental or malicious controller reconfiguration.

DCM2 Keypad User
4.7 Communications

To view or adjust the controller Ethernet settings press **ENTER** and **DOWN** to **Communicate** at the power up or top of menu display.

Key **ENTER** @ **Communicate**

Displays the current LAN **IP address**. In this example, it's the factory default.

Key **ENTER** to modify.

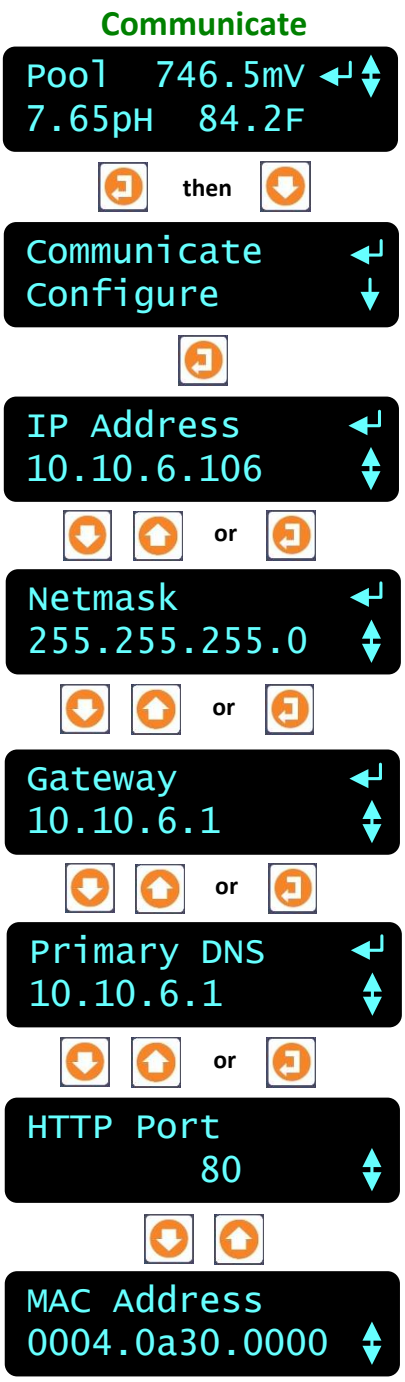
Netmask is usually this value for most sites. Key **ENTER** to modify.

Gateway is frequently the '1' address on the subnet Key **ENTER** to modify.

Primary DNS is frequently provided @ the same address as the **Gateway** Key **ENTER** to modify.

The DCM200 HTTP sever is fixed at Port 80.

The **MAC address** is six 2 digit hexadecimal numbers, separated by colons into 3 groups of 4 to fit the LCD screen. In this example, the **MAC address** is **00 90 C2 00 00 00**



Sidebar:
Not Connected to the Site LAN?
Leave the IP Address at 10.10.6.106. Connect a crossover cable from your notebook PC to the controller and browse 10.10.6.106.
Browser passwords are the same as the default keypad passwords listed in manual Section **5.1 Passwords**.
You'll need to configure your notebook or netbook to connect & browse.
Refer to DCM2 Browser manual.

DCM2 Keypad User
4.7 Communications

To view or adjust the Ethernet **IP Address** press **ENTER** and **DOWN** to **Communicate** at the power up or top of menu display.

Key **ENTER** at **Communicate**

Key **ENTER** to modify.

Key **UP** or **DOWN** to change the underlined number
Key **RIGHT** to move to the next 3 digit number.

Key **ENTER** to change or **EXIT** to leave the **IP Address** unchanged.

In this example we've changed the **IP Address** from **10.10.6.106** to **192.168.24.86**.

Modify IP Address

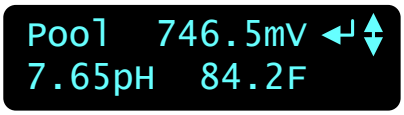
Sidebar:

Not LAN connected: Using An Ethernet CrossOver Cable:
You'll need to set your notebook PC's IP Address to the same network to browse the controller using a crossover cable. In this pages example, the controller **IP Address** is **192.168.24.86**.

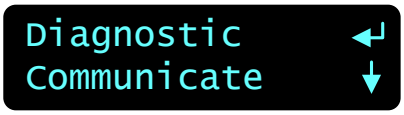
To be on the same network, your notebook needs an **IP Address 192.168.24.**xxx where xxx is any number from 2 to 255, excluding **86**.

DCM2 Keypad User
5.8 System Diagnostic

To view the controller's **Diagnostic** press **ENTER** at the power up or top of menu display.

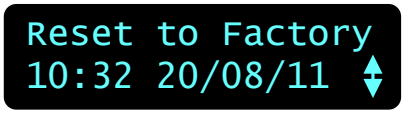


Key **ENTER** @ **Diagnostic**.

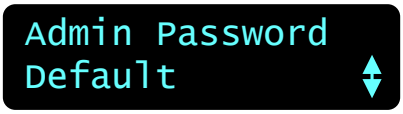


The **12VDC Power** level is the unregulated voltage @ the controller's **+12** terminal.
At less than 10VDC, an alarm will indicate an external wiring error is loading the 12V turbine meter supply.

Displays the time and date of the most recent **Factory Reset** I/O reset or the time and date of DCM200 manufacturing

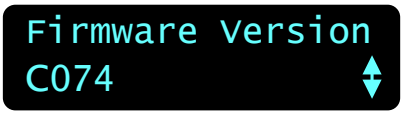


An **Admin Password** @ **Default** has not been modified from '**AAAA**'. If modified displays '**Changed**'.



An **Watchdog Resets** should always display something very low like **0 or 2**.
An increasing number of **Resets** indicates a firmware issue or controller electrical fault or interference.

The controller **Firmware Version** indicates the version of the software operating the controller.



Sidebar:
Reset to Factory: Sets volume-water meter total for this year and the previous year to zero.

5. Data Logging

5.1 Overview

The DCM2 logs all sensors, flowswitchs & meter values & status and all pump-valve-solenoid ON times or fed volumes & status at a user set interval every 1 to 60 minutes.
The 24,000 record log therefore has time span of 16.6 days @ a 1 minute logging rate, up to 1000 days (2.7 years) at a 60 minute logging rate.

There are several ways to connect to the DCM2:

1. **LAN Connected DCM2 Controllers**
   - **1A:** Use any internet browser (Internet Explorer, Firefox, Google Chrome, Apple Safari, etc.) to connect to the DCM2 via the building Network LAN.
   - **1B:** Use a VPN internet connection to connect to the building LAN and into the DCM2 Controller.
   - **1C:** Use a 3G cell modem to remotely access the data log via internet Browser without using a local network

2. **Stand-alone DCM2 Controllers**
   - **2A:** Use a crossover cable and a laptop computer to connect via a generic internet browser.
   - **2B:** Use a local WiFi router to create a local hotspot to connect to the controller wirelessly. (This method is extremely popular with tablet and smartphone users.)

Log files are CSV (comma separated variable) delimited text files, structured to be read by an application but also human readable. Log files are named '**DxxxLyyy**' where **xxx** = last 3 digits of controller serial number and **yyy** = day of year from 1 to 365.

5.2 USB Flash Drive Log Upload

HP v125w flash drives are both SCSI and USB 2.0 compatible and can be written by the DCM2. Other flash drives may or may not be compatible. The DCM2 will detect an incompatible flash drive on insertion into the DCM2 USB connector.

1. **Insert the Flash Drive**
   If the DCM2 cannot read or write the flash drive, you'll view an error message.
2. **Auto-Upload**
   Log upload starts automatically.
   Keypad is locked during upload control is suspended.
   Do not browse during log upload.
   LED display alternates between the current sensor values & the record# uploading with record number counting down to zero.
   If you have requested more records than the log holds, you get all of the log.
3. **Remove the Flash Drive**
   LED displays **Upload Complete Remove Drive** on completion.
   An Excel add-in is no longer needed to import the CSV data into Microsoft Excel® or similar spreadsheet programs. Refer to your Excel documentation for how to import CSV data.