

Instruction Manual



Waste-water Treatment -Duplex pH Neutralisation Controller

Dual pH Monitoring, Dosing and Process Control

Note: On-going product development may lead to changes in the specifications of this product without notice.

Warranty/Guarantee: This product is guaranteed for a period of 12 months from installation date. The warranty is limited to manufacturing or component defects, which may cause the unit to malfunction under specified conditions. The guarantee does not cover damage due to abuse, tampering or improper installation.

Disclaimer: AQUALUTIONS Pty Ltd will not be held liable for any consequential damage or loss arising from product malfunction.

Table of Contents

Introduction	3
Mounting the Controller	3
Controller Display	4
Process Status Display	4
Function Keys Summary	5
Setup Mode –Adjust pH Setpoint	5
Setup Mode –pH Probe1 ‘Process’ Calibration	6
Setup Mode –pH Probe2 ‘Discharge’ Calibration	7
Setup Mode –Process Mode	8
Setup Mode –Dosing Mode	9
Setup Mode –pH Ok Range	10
Setup Mode –Hysteresis Value	10
Setup Mode –Test Acid Dosing Pump	11
Setup Mode –Test Caustic Dosing Pump	11
Setup Mode –Test Mixer	11
Setup Mode –Test Discharge Relay.....	12
Setup Mode –Dosing Pump Duty	13
Specifications	14
Alarms	15
Process Interfacing Wiring Diagram	17
Factory Settings /Programmable Options	18

Introduction

The Waste-water Controller can measure and control the pH of a wide range of industrial waste-water process applications by automatically dosing either an Acid or Caustic.

The Controller allows automatic pH correction and process control.

Automatic process control is achieved by interfacing the Controller to waste-water sensors and pumps.

Sensors required include:

- ‘Control’ Industrial pH probe (option)
- ‘Discharge’ Industrial pH probe (option)
- Sump/tank -High level float-switch (option)
- Discharge/Batching level float-switch (option)

Pumps required:

- Chemical dosing pump (option)
- Circulation/Mixing pump c/w float-switch or solenoid (option)
- Discharge pump(s) (option)

The Duplex pH Neutralisation Controller is equipped with dual pH probes and transmitters. The ‘process’ pH probe monitors and controls the acid and caustic dosing pumps. The ‘Discharge’ pH probe ensures that if the discharge pH deviates from the acceptable discharge range then the discharge is stopped.

The ‘Discharge’ pH probe and transmitter are separate to the ‘Control’ pH probe and transmitter, thereby providing reliable and redundant discharge monitoring. If the ‘Control’ pH probe or transmitter fails the duplexed ‘discharge’ setup will protect against an inadvertent discharge.

The entire system is completely automated and does not require operator intervention. A Unitronics Programmable Logic Controller (PLC) is at the heart of the control system. All system functions, including pH control are controlled by the PLC. The entire electrical control system is AS3000 compliant. In order to ensure electrical safety 24Vdc is used wherever practical in the control system. A combined RCD/MCB (safety-switch) protects users from 240Vac voltage potentials.

Mounting the Controller

Mount the Controller away from extreme heat and if possible, away from direct sunlight at eye-level to allow good visibility of the LCD display.

A 3phase 415Volt 10Amp electrical supply is required.

Controller Display

The controller displays process status and alarms on a backlit 2-line 16 character display. Also allows system setup adjustment via operator prompts and keypad entry.

Process Status

Display during normal operation:

pH Probe1= 7.20
Process: pH ok

Process status

Process pH probe value

pH OK displayed if pH is within 'pH ok range'.

ACIDIC is displayed if process pH is below 'pH ok range'.

CAUSTIC is displayed if process pH is above 'pH ok range'.

STANDBY is displayed if 'batching' process is selected and the discharge/batching float is not activated.

pH Probe2= 7.20
Discharge: ON

Discharge Relay status

Discharge pH probe value

ON is displayed if 'discharge' pH is within 'pH ok range' –Discharge relay is switched on.

OFF is displayed if 'discharge' pH is not within 'pH ok range' –Discharge relay is switched off.

STANDBY:Batching
-Low Level

will oscillate approx. every 5seconds if 'Batching' process is selected and the waste-water level is 'low', below the discharge/batching float level.

In Standby mode, dosing will not occur.

Function Keys Summary



Move forward through the menu options.



Move backward through the menu options.

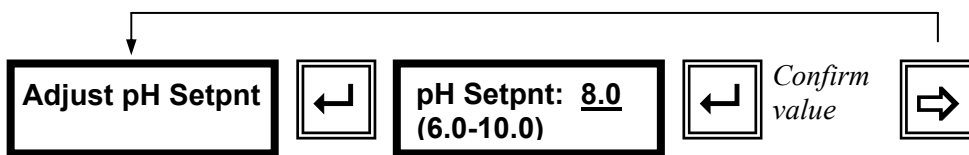


Select a menu option; enter system changes, toggle output on/off.

Set-up Mode



Press right arrow key to enter **Setup Mode**



*Adjust value using controller's numerical keyboard. **Range 6.0-10.0***

Operation:

Enter the desired pH setpoint value of the process.



Press right arrow key to enter **pH Probe1 Calibration Mode**



**Calibrate pH
Probe1-Process**



**pH Probe1 Offset
Set (4.00) 4.00**



Operation:

Remove 'Process' pH probe from the process and place in pH 4 buffer solution. Locate the 'OFFS' potentiometer on the APCS 'Process' pH transmitter module. Slowly turn the pot with a miniature screwdriver until the displayed pH reads 4.00. Note: when Calibration mode is selected, dosing pump(s) and discharging will be disabled.

**pH Probe1 Span
Set (7.00) 7.00**



Operation:

With pH probe1 still removed from the process, place probe in pH 7 buffer solution. Locate the 'SPAN' potentiometer on the APCS 'Process' pH transmitter module. Slowly turn the pot with a miniature screw- driver until the displayed pH reads 7.00. Note: when Calibration mode is selected, dosing pump(s) and discharging will be disabled.



Repeat calibration adjustments, if necessary, until consistent readings are obtained.

Press right arrow key to enter **pH Probe2 Calibration Mode**

**Calibrate pH
Probe2-Discharge**



**pH Probe2 Offset
Set (4.00) 4.00**

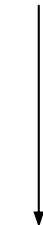


Operation:

Remove 'Discharge' pH probe from the process and place in pH 4 buffer solution.

Locate the 'OFFS' potentiometer on the APCS 'Discharge' pH transmitter module. Slowly turn the pot with a miniature screwdriver until the displayed pH reads 4.00.

Note: when Calibration mode is selected, dosing pump(s) and discharging will be disabled.



**pH Probe2 Span
Set (7.00) 7.00**



Operation:

With pH probe1 still removed from the process, place probe in pH 7 buffer solution. Locate the 'SPAN' potentiometer on the APCS 'Discharge' pH transmitter module. Slowly turn the pot with a miniature screw- driver until the displayed pH reads 7.00.

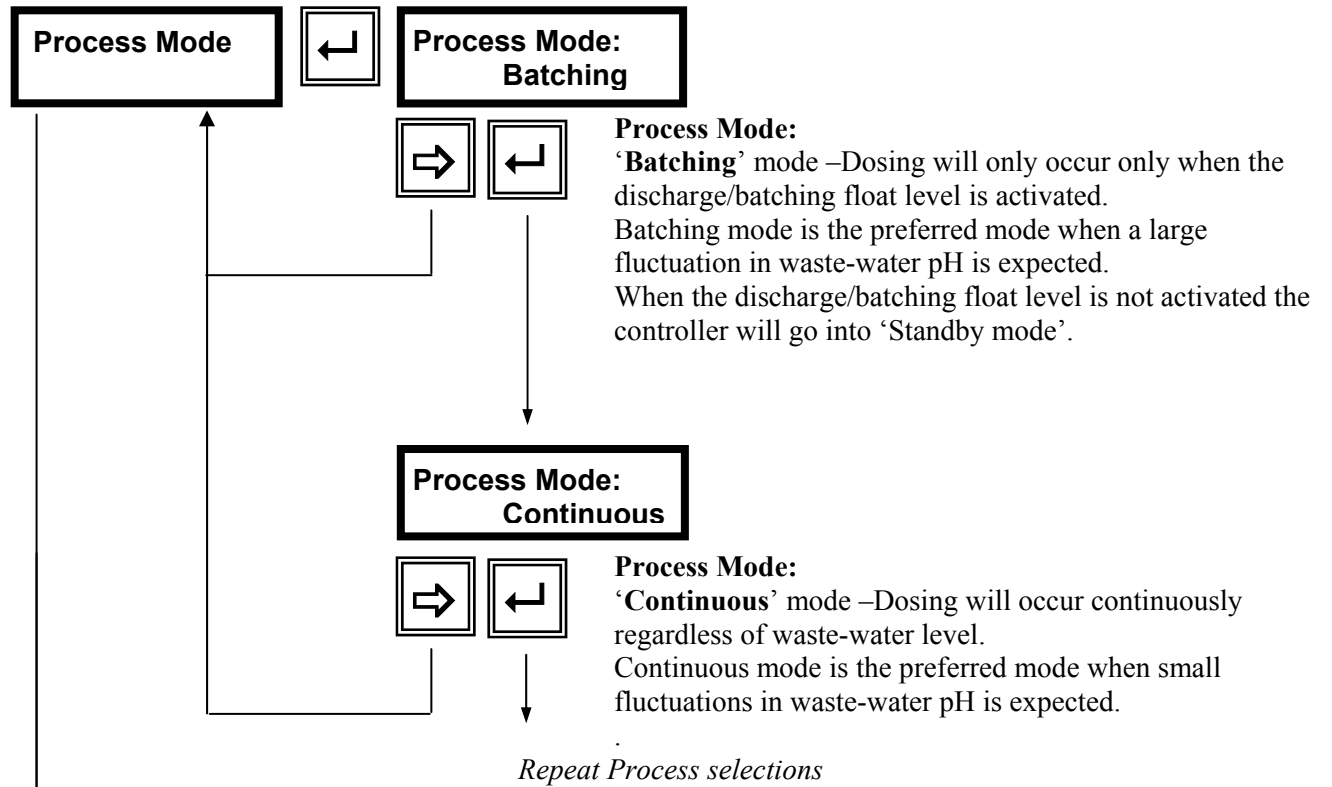
Note: when Calibration mode is selected, dosing pump(s) and discharging will be disabled.



Repeat calibration adjustments, if necessary, until consistent readings are obtained.

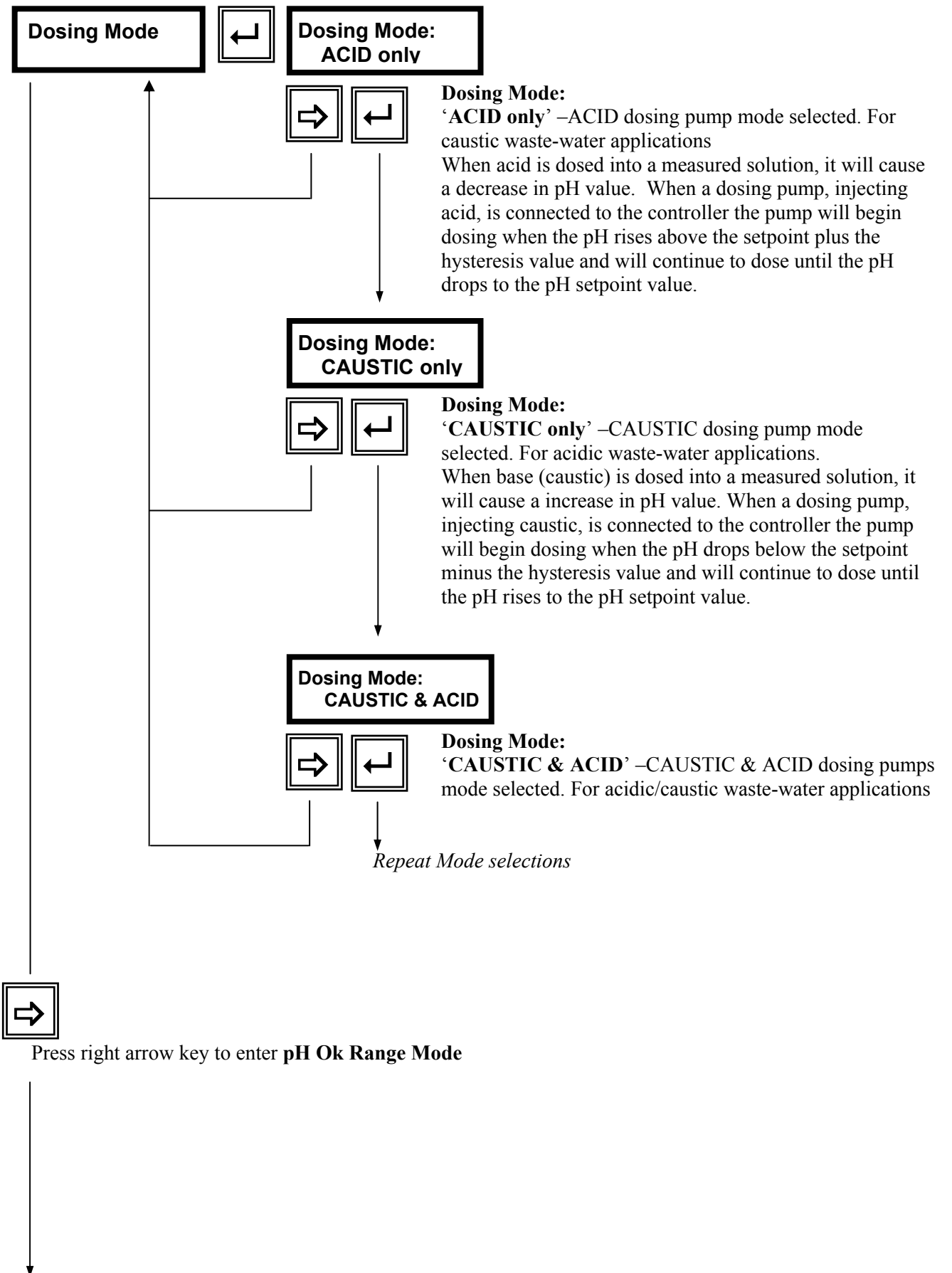
Press right arrow key to enter **Process Mode**

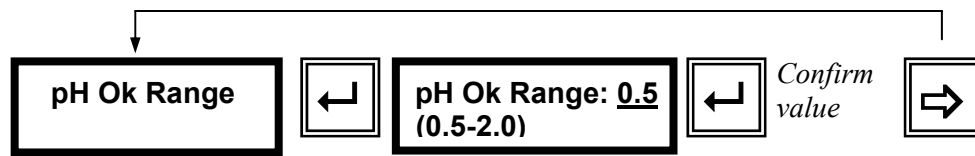




Press right arrow key to enter **Dosing Mode**







Adjust value using controller's numerical keyboard. **Range 0.5-2.0**

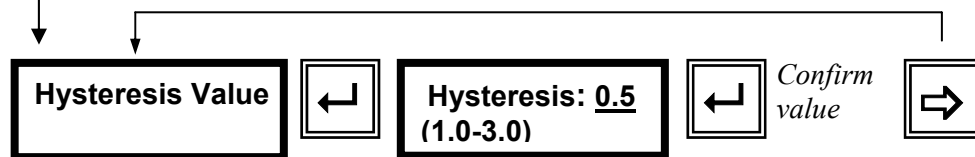
Operation:

pH ok range is the allowable discharge range. Discharge pump(s) are allowed to run in auto if the process pH is within the pH Ok range of values (pH setpoint value minus pH ok range value) and (setpoint value plus pH ok range value).

Example: setpoint value = 8.0 and pH ok range = 1.0
 Discharge pump(s) will be enabled if process pH is within the range pH 7.0 –9.0.



Press right arrow key to enter **Hysteresis Mode**



Adjust value using controller's numerical keyboard. **Range 1.0-3.0**

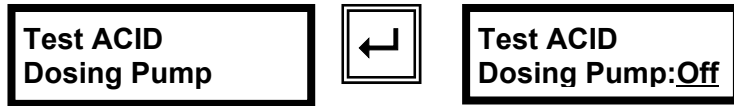
Operation:

Hysteresis prevents rapid switching of the dosing pump(s) on and off when the process pH hovers around the setpoint. 'Hysteresis' is the difference in pH value at which the dosing pump starts and stops.

Example: Setpoint value = 8.0 and Hysteresis = 1.0
 If dosing acid, the acid dosing pump will be started when the pH rises above pH=9.00 (pH setpoint value plus hysteresis value) and will stop when the pH value reaches pH=8.00 (pH setpoint value).
 If dosing base, the base dosing pump will be started when the pH drops below pH=7.00 (pH setpoint value minus hysteresis value) and will stop when the pH value reaches pH=8.00 (pH setpoint value).



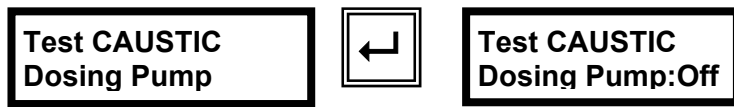
Press right arrow key to enter **Test ACID Pump Mode**



Operation:
 Press 'Enter' key to momentary toggle ACID Dosing Pump On.
 Useful for testing and priming ACID dosing pump.



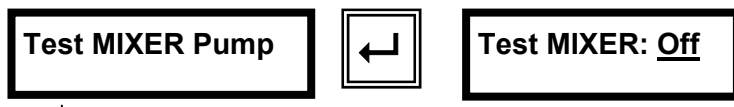
Press right arrow key to enter **Test Caustic Pump Mode**



Operation:
 Press 'Enter' key to momentary toggle CAUSTIC Dosing pump On.
 Useful for testing and priming CAUSTIC dosing pump.



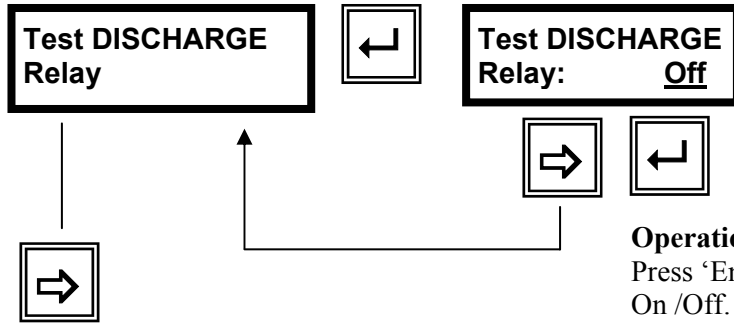
Press right arrow key to enter **Test MIXER Mode**



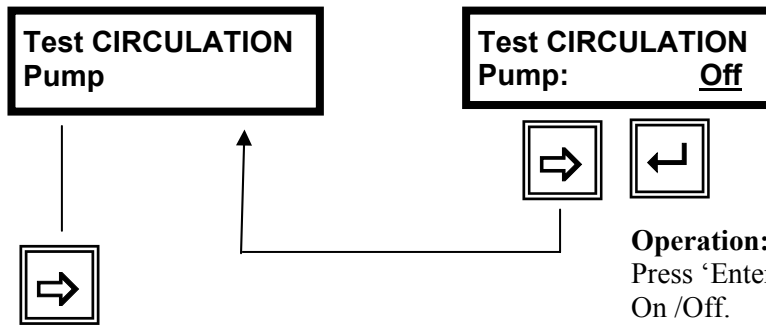
Operation:
 Press 'Enter' key to momentary toggle MIXER pump/solenoid On /Off.



Press right arrow key to enter **Test Discharge Relay Mode**

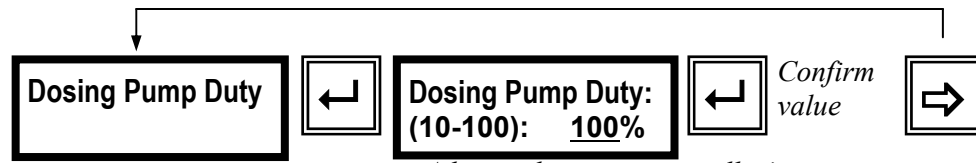


Press right arrow key to enter **Test Circulation Pump Mode**



Press right arrow key to enter **Dosing Pump Duty Mode**





*Adjust value using controller's numerical keyboard. **Range 10 -100***

Operation:

When Acid or/and Caustic is dosed into a measured solution, for pH correction, some time is required for acid or base to mix. Depending on the location of the dosing point and the volume of waste-water in the system, it may take some time before the change in pH of the solution is detected by the pH electrode. If the response is slow, overdosing can occur due to the delay between dosing and measurement.

To overcome this problem, 'Dosing Pump Duty' can regulate the duty of the dosing pump(s).

Example: if the 'Pump Duty' is set at 30%, the dosing pump will dose for 18 seconds (30% of 1minute), then allow 42 seconds (70% of 1minute) for reaction time. This on/off cycle will be repeated until the setpoint is reached.

If no reaction time is desired set 'Pump Duty' to 100%, the dosing pump(s) will run continuously until setpoint is reached.



Press right arrow key to return to **Process status Display Mode**

Specifications

OPLC M91 Controller:

Display:	2 line, 16 character, STN, LCD display
Illumination:	LED yellow-green backlight
Character size:	5x7 matrix, 3.07 x 5.73mm
Keyboard:	15 key sealed membrane
Environmental:	IP65 (weather-proof)
Operation Temp.:	0-50°C
Program storage:	non-volatile memory EEPROM
Battery back-up:	7 year typical battery back-up for set-up parameters.
Resolution:	0.01 pH
Process update time:	1 sec.
Display update time:	5 secs.
User Inputs:	I00 –Sump/Tank High Level float switch I01 –Discharge/Batching Level float switch I05 –Reserved –Temperature probe option
User Outputs:	O00 –Acid dosing pump run relay. (240Vac 6A max.) O01 –Caustic dosing pump run relay. (240Vac 6A max.) O02 –Mixer relay. (240Vac 6A max.) O03 –Discharge relay. (240Vac 6A max.) O04 –Circulation Pump relay. (240Vac 6A max.) O05 –Alarm/Fault relay. (240Vac 6A max.)
Electrical Safety:	240V outputs are protected with a 10Amp combined RCD/MCB safety switch.

pH transmitter:

Input: pH Probe1	0-14pH (standard electrode)
Input: pH Probe1	0-14pH (standard electrode)
Output: pH Probe2	4-20mA direct
Output: pH Probe2	4-20mA direct
Temp. Comp.:	Fixed @ 25°C (Pt100 optional)
Linearity & drift error:	<0.5% of span
Isolation:	>2kV rms (eliminates ground loop errors)
Offset & Span Adjust:	via potentiometers for final calibration adjustment
EMF Compliance:	complies with AS/NZ 4251.1 (EN 50081.1) C-tick approved
Retransmission:	isolated signal splitter pH 0-14 to 4-20mA (optional)

Enclosure:

Type:	Rittal KS -fully insulated plastic.
Material:	fibreglass-reinforced, unsaturated polyester, self-extinguishing.
Mains Isolator:	16A pad-lockable isolator.

Alarms

Display:

**pH Probe1 Fault
~ Transmitter**

**call AQUALUTIONS
Ph: (08) 8381 4886**

pH Probe1 Transmitter output failure. Dosing and discharging will be disabled. Fault lamp will flash and Alarm/Fault relay will be activated.

Controller has detected a pH value less than 0 pH. (less than 4mA output)
Remove 'Process' pH Probe1 from process and check displayed pH using pH Probe1 CALIBRATION mode and buffer solutions pH4 and pH7.

Check 240V supply to pH transmitter module. Check wiring terminations. Measure pH transmitter output with mA meter connected in series, output should be in the range of 4-20 milliamps.

Contact AQUALUTIONS for service

**pH Probe2 Fault
~ Transmitter**

**call AQUALUTIONS
Ph: (08) 8381 4886**

pH Probe2 Transmitter output failure. Dosing and discharging will be disabled. Fault lamp will flash and Alarm/Fault relay will be activated.

Controller has detected a pH value less than 0 pH. (less than 4mA output)
Remove 'Discharge' pH Probe2 from process and check displayed pH using pH Probe2 CALIBRATION mode and buffer solutions pH4 and pH7.

Check 240V supply to pH transmitter module. Check wiring terminations. Measure pH transmitter output with mA meter connected in series, output should be in the range of 4-20 milliamps.

Contact AQUALUTIONS for service

**pH Probe1 Fault
~ Sensor Probe**

**call AQUALUTIONS
Ph: (08) 8381 4886**

pH Probe1 Sensor failure. Dosing and discharging will be disabled. Fault lamp will flash. Alarm/Fault relay will be activated.

Controller has detected that the 'Process' pH probe is not connected or is faulty. Check wiring and connections from pH Probe1 to Controller. Replace pH probe and/or wiring.

Contact AQUALUTIONS for servicing.

**pH Probe2 Fault
~ Sensor Probe**

**call AQUALUTIONS
Ph: (08) 8381 4886**

pH Probe2 Sensor failure. Dosing and discharging will be disabled. Fault lamp will flash. Alarm/Fault relay will be activated.

Controller has detected that the 'Discharge' pH probe is not connected or is faulty. Check wiring and connections from pH Probe2 to Controller. Replace pH probe and/or wiring.

Contact AQUALUTIONS for servicing.

High Level Fault

Tank/sump High Level detected. Dosing and discharging will be disabled. Fault lamp will flash. Alarm/Fault relay will be activated.
Check dosing pump(s) operation using 'Test DOSING Pump' mode.
Check Acid/Base dosing chemical level.
Check 'Dosing Pump Duty %' value.
Check Discharge relay and pump/valve operation.
Check dosing rate is sufficient for maximum process waste-water demand rates.
Check float-switch adjustment.

**call AQUALUTIONS
Ph: (08) 8381 4886**

Contact AQUALUTIONS for servicing.

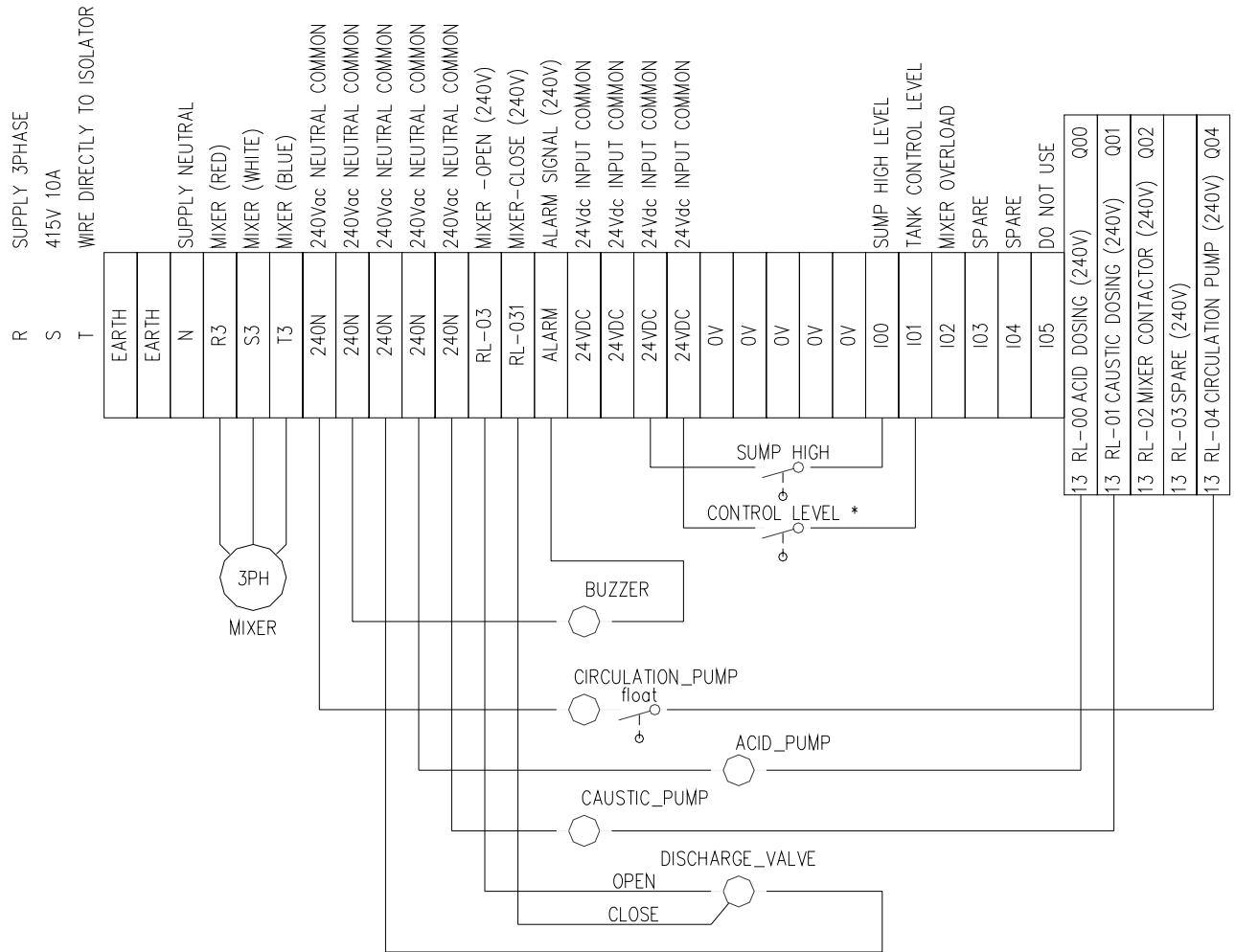
**Mixer Overload
Tripped**

MIXER Overload Tripped.
Fault lamp will flash. Alarm/Fault relay will be activated.

**call AQUALUTIONS
Ph: (08) 8381 4886**

Contact AQUALUTIONS for servicing.

Process Interfacing Wiring Diagram



* CONTROL LEVEL -BATCHING =BATCHING & DISCHARGE LEVEL
 -CONTINUOUS =DISCHARGE LEVEL
 -IF CONTROL FLOAT IS NOT REQD LINK 24VDC & I01

Factory Settings / Programmable Options

Mode	Description	Setting range	Factory Setting	Commissioned
Adjust pH Setpnt	Desired process pH value	6.0 - 10.0	8.0	
Process Mode	Batching or Continuous	Batching, Continuous	Continuous	
Dosing Mode	Acid only, Base only or Acid & Base dosing	ACID only, BASE only, ACID & BASE	ACID & BASE	
pH ok range	pH ok range -value below & above pH setpoint	0.5 - 2.0	2.0	
Hysteresis	Dosing pump(s) switching hysteresis value	1.0 - 3.0	1.0	
Dosing Pump Duty	Dosing Pump(s) dosing duty cycle.	10 – 100%	100	
				Date:
				Sign: