

SM99 PUMP CONTROLLER

INSTALLATION & MAINTENANCE GUIDE

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PUMP CONTROLLER – GENERAL DESCRIPTION

TYPICAL APPLICATIONS

The main function of the SM99 pump controller is to provide power to a pump when liquid levels have risen to a defined threshold in a large tank or container, and to halt the pump when liquid levels have fallen to another, lower threshold. It must perform this function so that it will call for human intervention should the pump or input sensors behave in a way that do not meet normal operating parameters. The controller must do this in a way that is safe for both the client and the maintenance staff.

The advanced microprocessor design within the pump controller allows statistical information to be collected by management or maintenance staff. Management staff can use the information accumulated in each controller to ascertain usage patterns and flow rate trends over an extended period. Maintenance staff can use the logged information to diagnose customer difficulties and faults by reading an extensive profile of the last 24 hours of pump activity.

Because of the clear front of the enclosure forms a safety barrier, non–electrically qualified staff can gain access to the pump to jog the pump motor or download data log information with a non-contact infrared link. (only qualified electrical staff are permitted to access the interior of this unit.)

CONTROL SYSTEM ENCLOSURE

The SM99 control system is mounted within an ABS enclosure. It has a tough 3mm wall thickness and a neoprene lid sealing gasket. It is rated to IP65 for dust and water ingress immunity.

The enclosure has a high water proofing integrity. It will support cable entry from the top, bottom side or rear. Clearance has been provided at the base of the circuit board to allow cable glands to be mounted from the rear.

(Installing staff must use cable glands and seals of suitable integrity to maintain the water proofing integrity of the enclosure.)

This enclosure is not rated for continuous direct exposure to sunlight. Prolonged direct sunlight through the clear front panel could elevate the interior of the enclosure to high temperatures and damaging UV radiation.

SAFETY INFORMATION

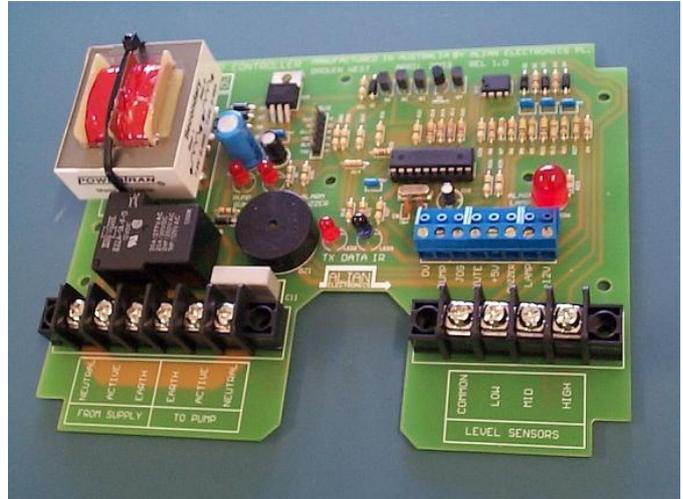
- Do not install this equipment if the enclosure or any internal components appear damaged.
- Power cabling and circuit breaker rating at the power distribution panel must be selected to support the pump operating power. (240VAC at 10Amps.
- Power should not be extended to the SM99 control unit until all cabling is in place and correctly terminated.
- The IP (Ingress Protection) rating of the control unit enclosure will be diminished if conduit seals to the enclosure are not of a high standard. Suitable cable glands and seals must be used on all conduits.
- Before drilling holes behind the control unit for mounting purposes or cable access, ensure that no active 240VAC cables in the wall cavity will be damaged by drill bits or mounting screws.
- Access within the SM99 enclosure is limited to qualified electrical personnel.
- Do not open the access door to the control unit enclosure during inclement weather or where water spray is present.
- Do not operate this equipment until all outgoing cables to pumps and sensors are correctly terminated and sealed against the ingress of moisture.

SM99 PUMP CONTROL UNIT- FEATURES

The SM99 unit features an advanced microprocessor controller bonded to the backplane within the enclosure. A two horsepower relay supports single phase 240VAC pumps with an average load current of up to 10 Amps.

Electrical connections are extremely simple. A three conductor 'Active, Neutral & Earth' cable from the 240V supply and a similar cable to the pump. The level sensors are simple stainless steel probes set to different levels within the tank. Probe signals are fixed at an extra safe 4Volts DC.

The enclosure is an robust ABS unit rated to IP65 with a transparent lid and a rubber sealing gasket. The transparent top is present to accommodate the viewing of the various LED indicators and allows the infrared data transmitter to link with a PC for information downloads.



The cabinet is intended to be wall mounted. Cable access may be achieved from top, bottom, side or rear of the enclosure using conventional cable and conduit glands .

OTHER FEATURES

Should tank levels become too high or too low, audible and visual alarms will be triggered for the duration of the fault. A single or double flash will indicate the fault type. The audible alarm may be suppressed for 6 hours by briefly pressing an 'Alarm 'Mute button on the underside of the cabinet. Motor operation is inhibited with 'Tank Low' alarms.

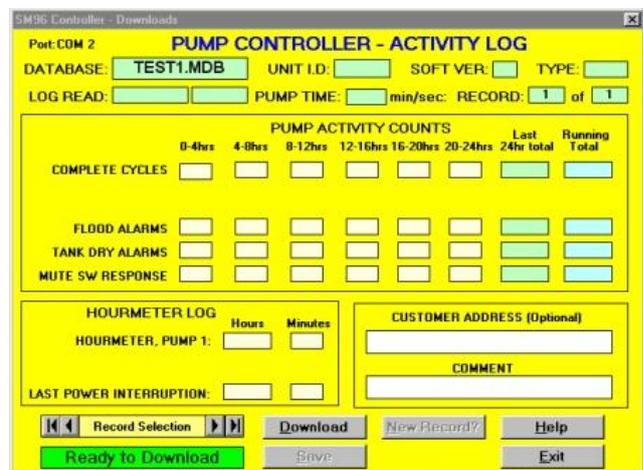
A third alarm condition will indicate the accidental reversal of the 'High' and 'Low' probes by installation staff.

A 'Motor Jog' button inside the cabinet will force the pump to operate for a brief period. (This feature is inhibited if tank levels are low)

The enclosure size is 75mm high, 186mm wide and 146mm deep. Unit weight is 0.8 Kg

A full electronic 'Data Logging' system is standard with each controller. It records pump cycles, hours of operation, alarm conditions both as running totals and within 4 hour blocks over the last 24 hours. A counter also indicates the number of hours since the last power interruption.

Data is extracted from the unit by bringing a standard PC with a special terminal program near the controller. When the 'Send Data' button is pressed, the entire data log contents are sent to the PC by an infrared signal broadcast through the protective enclosure. The log data is stored indefinitely in a special memory which requires no battery.



The retrieved information may be saved within the PC in a simple 'Microsoft Access' format for later analysis. (The infrared receiver probe and software package are available as separate product, 'SM96 TERM'.

ELECTRICAL CONNECTIONS

There are three electrical connections that must be made to the SM99 Pump Control unit. There is the 240VAC supply cable, the Pump Motor cable and a sensor cable to the tank level switches.

The 240VAC Supply cable must be suitably rated for fixed power installations. For most installations 2.5sq mm conductors are sufficient. An isolation circuit breaker rated at 10Amps should be fitted to the power distribution board to protect the wiring to the Pump controller.

The 240VAC supply cable terminates within the Pump Controller enclosure at the screw terminal strip labelled **240V Supply**. The Active Neutral and Earth conductors must be securely fastened to the corresponding terminals at this point. The integrity of the earth connection should be tested before applying power to the Pump Control unit.

The cable feeding the pump unit should support three conductors. The three conductors are Active, Neutral and Earth. The pump power cable terminates within the Pump Controller enclosure at the screw terminal strip labelled **To Pump**. The Active, Neutral and Earth conductors must be securely fastened to the corresponding terminals at this point. The integrity of the earth connection should be tested before applying power to the Pump unit.

The cable that connects the water level probes to the Pump Control unit requires four conductors. Level Low probe, Level Mid probe, Level High probe and a 'common' conductor. The electrical potential in this cable is classified as 'Extra Low Voltage' and is typically less than 5V D.C. Here the conductor size is not critical, but the cable sheath must be suitably robust for harsh outdoor environments. The sensors function by measuring electrical conductivity through the effluent between the three sensor probes and a common probe.

Where Float switches are available in lieu of conductivity probes, as may be the case where an existing installation is being upgraded to use the SM99 Controller, they may be connected to the three sensor inputs with respect to the common. The Float Switch contacts would need to be **Open Circuit** when dry and **Closed Circuit** when submersed.

The Water Level Probe cable terminates within the Pump Controller enclosure at the screw terminal strip labelled **Level Sensors**. The Low, Mid High and Common conductors must be securely fastened to the corresponding terminals at this point.

NOTE: Should the **Level Low** and **Level High** probes or wires be transposed in error, this will be detected as a fault condition by the controller when the tank first fills with water & effluent. The Alarm Lamp and buzzer will produce a triple flash/beep every four seconds whenever the Level High probe is submersed while the Level Low probe remains dry.

GENERAL OPERATION

When power is first applied to the panel the Alarm buzzer will sound for one second. This is a part of a normal start up sequence. Note that immediately following this start up sequence the controller will attempt to monitor the level probes and respond accordingly. If no probes are connected a **Level Low** alarm will be triggered.

Also note that an internal counter/timer is reset whenever the mains power is interrupted so that the internal Data Log facility will be aware of how many hours/days have transpired since the unit was last powered up.

ALARMS

There are three alarms that can be generated by the Alarm Lamp and Alarm Buzzer. A five second delay is built into the response time of all probes to prevent false triggering by splashes of water and electrical transients.

1. A slow flash (one burst every four seconds) indicates that the water levels in the tank are low. Specifically this means that the **Level Low** probe has no conductivity path to the **Common** probe. This is also the case where no probes are connected to the controller. During a **Level Low** alarm condition the motor is halted and inhibited from any operation.
2. A Double Flash (two bursts every four seconds) indicates that the water levels in the tank are too high. Specifically this means that both the **Level Low and Level High** probes both have a conductivity path to the Common probe.
In this state the controller forces the pump **on** until the level high condition ceases. It would indicate that (A.) The pump has failed to operate and the tank is at risk of an overflow.
(B.) The Mid Level probe is defective. (C.) The tank has is filling at a rate greater than the normal pumping rate and the tank levels have slowly risen.
3. A Triple flash (three bursts every four seconds) indicates that the **Level High** and **Level Low** probes are probably transposed during wiring. This means that the controller has sensed that the Level Low probe is dry while the Level High probe is submerged. This is an unusual state and would not normally occur after installation unless the Low probe is defective and the water levels in the tank are high.

Pressing the **Alarm Mute** button on the underside of the enclosure will force the **Alarm Buzzer OFF** for the next six hours. The **Alarm Lamp** is unaffected by this button.

MOTOR JOG

The button protruding from the protective safety barrier labelled **Jog Motor** is a test function for motor integrity. To avoid accidental operation of the Jog feature, this button will need to be pressed for a full second before the controller will respond.

When pressed, the **START** contactor will engage for two seconds, and the **RUN** contactor will engage for 20 seconds. Note that this function is disabled if the Level Low probe has not detected the presence of water within the tank. This is to ensure that the pump motor will not be damaged by operating while not submerged.

NORMAL PUMP CYCLE OPERATION

Under normal conditions, **Level Low** probe is always submerged, and the **Level High** probe is always dry. Whenever the **Mid Level** probe is submerged, the pump will be activated. It will remain activated until the **Mid Level** probe becomes dry again and has remained dry for 'XX' seconds. (where 'XX' is a time delay in seconds consistent with the capacity of the tank) Typically, this means that when the **Mid Level** probe is pumped dry, the pump will continue to operate until the level is just a little above the **Level Low** probe. This would take 2-4 minutes for most installations. Note that the 'XX' time delay is adjustable by implementing a tank 'Learn' mode. (detailed next page) Where a portable PC is available with a working copy of the SM96 TERM software, the actual pump time can be read from the display, along with the number of complete pump cycles and other alarm information.

STORING A USER-SELECTABLE PUMP DELAY TIME

The SM99 has a pump delay time preset in the factory. This is the time that the pump will operate after the MID level probe has first gone dry. The time delay should be such that the pump will take the tank level down to a short distance before the normally immersed LOW probe is exposed.

If during a normal pump cycle, the LOW probe *is* exposed, this could be because the MID probe was set too low in the tank, or the LOW probe was not set deep enough in the tank, or even that the tank capacity is too small for the standard time delay.

Another problem may occur where a bigger than normal tank is used, the standard pumping time may not be *long enough* to fully utilise the tank capacity.

Either way, the standard pumping time should be overridden with a customised pumping time. This is a learning process where the controller performs an extended pump cycle and learns the optimum time value for the current pump, tank and probe positions.

Follow these steps to set a new pump delay period.

1. Setup the LOW, MID, and HIGH probes to the desired positions within the tank.
2. Slowly fill the tank with water until the MID probe JUST GETS WET, then turn off the water. A standard pump cycle should automatically commence and the level should begin to fall.
3. Within **ten seconds** of the pump cycle commencing, **press and hold** the MOTOR JOG button (on the controller panel) for **six consecutive seconds**. When the Alarm Lamp comes on with a continuous glow, remove your finger from the button, the LEARN mode has just been activated.
4. There is nothing more for the operator to do. The pump will continue until the LOW probe is eventually exposed. The pump will halt and the slow flash LEVEL LOW alarm will be activated. The alarm may now be stopped by letting a little water back into the tank until the LOW probe is covered again.

What just happened is that the controller measured the pumping time from when the MID probe went dry until the LOW probe went dry (rounded to the nearest ten second period). The unit then subtracted 20 seconds of pumping time from this period and stored this new value into the permanent memory of the controller. It will use this new pumping time thereafter.

The new pump time can be tested by letting more water into the tank and commencing a normal cycle. If all is well, the pump should stop with the level a short distance from activating the LEVEL LOW probe. If a portable PC is available, a standard download sequence with the SM96TERM software package will show on the screen exactly what the revised pumping time has become.

Should the result be unsatisfactory, the LEARN mode may be engaged several times until the desired pump delay is achieved.

TEST PROCEDURE

To check for correct operation of the pump controller, power is applied and the unit must successfully manage a normal pump cycle. In addition, the Level Low and Level High alarm conditions must be simulated to confirm the integrity of all probes.

Note that with all level measurements, the SM99 control unit will wait for five seconds of stable conditions before responding to changes. The starting position for these tests assumes that the pump motor is installed and the three probes are in position in the tank. The **Level Low** probe is to be submerged with some fresh water. The **Level Mid** and **Level High** probes are to be exposed (dry).

STEP	ACTION	RESULT
1	Apply power to the panel.	<ul style="list-style-type: none"> Alarm buzzer beeps for one second. The +5V led lamp should be ON All other lamps should be OFF
2	Restore the Earth Leakage breaker to the ON position.	<ul style="list-style-type: none"> Alarm buzzer beeps for one second. The +5V led lamp should be ON All other lamps should be OFF
3	Wait 5 seconds for probe settling time	Pump should remain OFF . If not, it means that the Level Low probe is not submerged or the wiring to the probes is open.
4	Test the Jog Motor feature: Press the Jog Motor button for one second.	The pump relay should operate for 20 seconds then halt.
5	Expose the Level Low probe to the air. (This may be done by removing some water from the tank or simulated by lifting the probe assembly out of the water briefly.)	A Level Low alarm condition should be generated. (slow flash every 4 seconds)
6	Restore the Level Low probe to below the water line in the tank.	The Level Low alarm should cease.
7	Add water to the tank until the Level Mid probe is submerged,	<ul style="list-style-type: none"> The Pump relay should operate and the pump should now be reducing the water level. When the Level Mid probe is exposed, the motor should continue for the predetermined pump operating period then halt. (time may vary with pump capacity and tank size) <p>When the pump stops, the tank level should be approx 50mm <i>above</i> the Level Low probe. (if the Level Low probe becomes exposed, tripping an alarm, then probe spacing is incorrect, or tank/pump size does not match pump times in present software version.</p>
8	Assuming Step 7 was successful, briefly disconnect the wire that comes from the Level Mid probe and add water until the Level High probe is submerged. (this will simulate a Level Mid probe failure)	<ul style="list-style-type: none"> A Level High alarm should commence. The pump should operate until the Level High probe is exposed once more The Level High alarm should then cease.
9	Test the Send Data button: Press the Send Data button for one second	<ul style="list-style-type: none"> The buzzer should sound and the Send Data LED lamp should go on for One Second. (a copy of the internal data log has just been sent via the infrared LED next to the Send Data LED lamp.)
11	Test the Alarm Mute feature: Activate a Level Low alarm by briefly disconnecting the Level Low probe, or by lifting the probe out of the water	When the alarm lamp flashes and the alarm buzzer sounds, press the Alarm Mute switch. The buzzer should stop sounding while the lamp continues to flash. The alarm will remain muted until 6 hours have passed or until 240V mains have been interrupted.
	TESTS COMPLETE	

SM99 SPECIFICATIONS

Cabinet Height/Width/Depth	75 x 186 x 146mm
Cabinet weight	0.8 Kg
Supply Voltage	240VAC, 50Hz
Supply Current	10A max

EMC (C-tick) compliance	N12656
Electrical Safety compliance	CS03057V (AS3100)

WARRANTY INFORMATION

A warranty period of 12 months applies to the pump control system from the date of installation. This warranty becomes void where: (A) The unit has been damaged by excessive and unreasonable impacts, or (B) Water damage has resulted from an ingress of water caused a poor cable seal (fitted by an installer), or (C) Water damage has resulted by exposure to weather where a door has not been fully closed, or (D) The controller has been used for an application other than that specified in the installation document.

The warranty implies that a repair or replacement will be given when the defective unit is returned to the supplier. The warranty does not cover delivery and handling charges, compensation for time lost, damage caused by incorrect wiring during installation, or damage to other plant and equipment at the installation site.