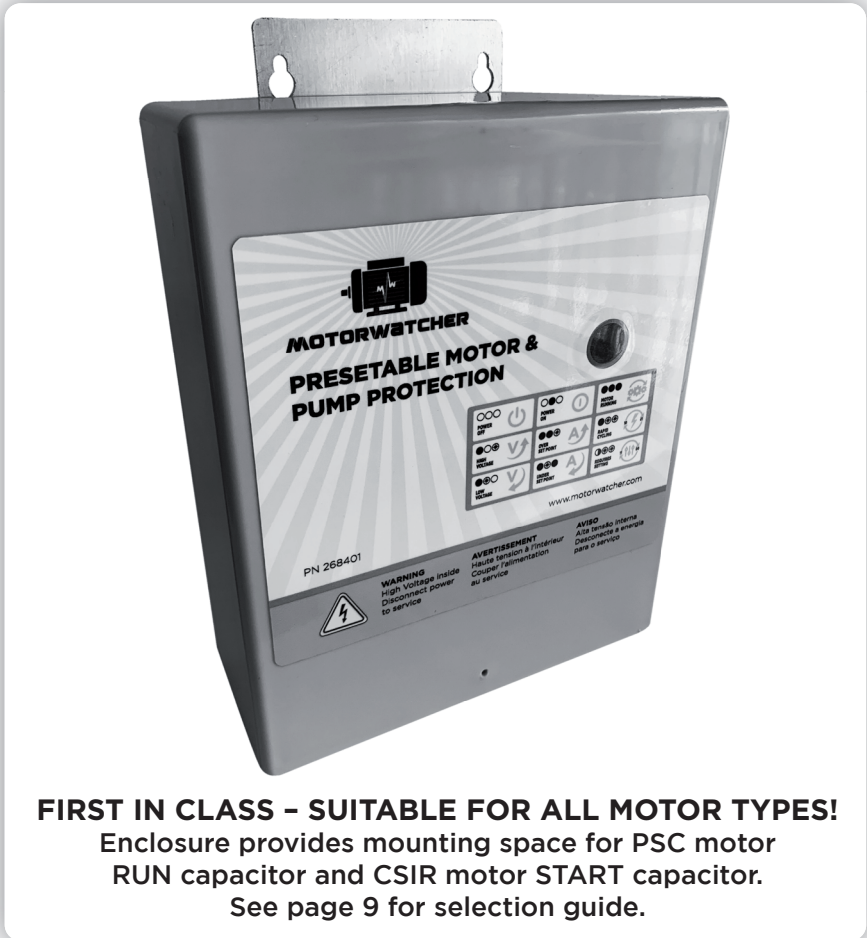




MOTORWATCHER

THE COMPLETE MOTOR & PUMP PROTECTOR
WITHOUT SACRIFICING OPERATING TIME...



FIRST IN CLASS - SUITABLE FOR ALL MOTOR TYPES!

Enclosure provides mounting space for PSC motor
RUN capacitor and CSIR motor START capacitor.

See page 9 for selection guide.

PN268440 (Version 1/2023)

INSTALLATION, OPERATION AND MAINTENANCE MANUAL

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ASK YOURSELF THESE SIMPLE QUESTIONS

What is the **MOTORWATCHER**®?

MOTORWATCHER® is a one model for all motor sizes' motor and pump protection device with easy calibration. The simple 2-button process places the controller safely in set mode in preparation for on-site tuning to the correct operating parameters. Parameters are stored in the controller to provide the least amount of nuisance tripping with the widest possible supply voltage operating range.

When do I use **MOTORWATCHER**®?

MOTORWATCHER® provides hassle-free pump/motor dual-end protection against electrical supply variations and varying pumping requirements. Installation requires a minimum amount of equipment to ensure that the preset parameters are within the motor and pump specifications. A panel switch is provided to control the motor as and when required.

Where do I use **MOTORWATCHER**®?

MOTORWATCHER® is suitable for all single and three phase borehole, surface and general water pumping applications, compatible with all borehole and other water pump controls.

Why should I use the **MOTORWATCHER**®?

It is easy to install. Nuisance tripping is minimized while the dynamic operating range is set as wide as possible. Operating conditions and diagnostics are visible on a simplified display, giving you peace of mind. The comprehensive indicator system displays the operating status of the controller at all times, including warning and fault conditions. The **MOTORWATCHER**® is designed with simplicity, quality and least cost for maximum protection of motors and pumps. It is suitable for permanent split phase (PSC), capacitor start run (CSIR) single phase and three phase electrical motors, as well as single phase motors with built-in capacitor.

Why not another product?

- Many advanced watchdog parameters have been incorporated into the compact **MOTORWATCHER**® electronic controller, designed to withstand local power supply characteristics and water conditions.
- It is designed and manufactured in South Africa, with local support and service, backed by many years' experience.
- Parameters monitored and protected include supply voltage quality dynamic motor current. Other products may attempt to do the same but may cause nuisance tripping.
- The Expert System operating in the background requires no user inputs and operates continuously in the background, adapting to changing supply and load conditions and monitors load conditions.

INTRODUCTION

MOTORWATCHER® manages your pumping system by:

- avoiding nuisance tripping
- making maximum use of a weak borehole
- allowing the widest possible voltage fluctuation
- anticipating transient overload conditions
- using a unique dry-run management programme
- limiting the destructive effects of over currents and
- reducing rapid cycling automatically when required.

MOTORWATCHER® protects your pumping system by:

- monitoring supply voltage
- monitoring current
- monitoring shaft load
- eliminating rapid cycling which can cause motor overheating
- detecting excessive continuous over currents
- detecting dry-running
- logging data during operation for fast and versatile technical support
- detecting bad connections
- allowing for voltage and current stabilization during start-up

MOTORWATCHER® diagnoses the cause of fault conditions:

- Status prior to *switch-on*—prevents switch-on under conditions regarded as detrimental to the motor/pump
- Status during *normal operation*—voltages or currents not within specification are continuously monitored without interrupting operation unnecessarily
- Load, current or voltage *fault* condition— a timing mode is activated following a fault condition

THE LATEST INTELLIGENT TECHNOLOGY

Severe faults

Severe faults are recognized and classified as conditions that make safe operation impossible, locking out operation.

Temporary holding or delay conditions

Temporary holding or delay conditions due to transients to prevent nuisance tripping caused by transients are activated and causes soft delay, not visible to the user or operation.

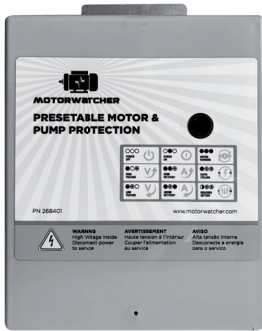
Overload delay condition

Overload delay condition severity determines the reaction of the **MOTORWATCHER®** in order not to compromise motor life.

Underload delay condition

Underload delay condition invokes an intelligent waiting time determined for best operation to achieve maximum water delivery from a weak water source.

UNspoken Advantages



Apart from all the features and benefits offered there are some distinct advantages to using the **MOTORWATCHER®** in your pumping installations. Your decision to use **MOTORWATCHER®** will result in considerable cost saving. Consider the advantages below before proceeding with your installation to avoid unnecessary additional expenses:

- **MOTORWATCHER® does not require additional switchgear** such as an ON/OFF switch, phase failure relay, rapid cycle supply detection relay, connectors, enclosures etc. to provide reliable operation.
- **The convenient sliding lid design** makes easy mounting and convenient access possible, yet provides a safe and secure installation.
- **Clear and directly visible status indication** with simple pictorial explanation eliminates the need for having to refer to the manual, while making easy communication with a service technician or installer possible where necessary.

TECHNICAL SPECIFICATIONS

The table below summarizes the absolute maximum and minimum operating specifications of the **MOTORWATCHER®**. Correct pre-setting is important. All % are of preset value.

Overload Control	<p>Trip time varies with severity of overload and is approximate:</p> <table border="0"> <tr> <td>< 120%</td> <td>Continuous run</td> </tr> <tr> <td>120 - 125%</td> <td>16 seconds</td> </tr> <tr> <td>125 - 133%</td> <td>12 seconds</td> </tr> <tr> <td>133 - 150%</td> <td>8 seconds</td> </tr> <tr> <td>> 150%</td> <td>4 seconds</td> </tr> </table>	< 120%	Continuous run	120 - 125%	16 seconds	125 - 133%	12 seconds	133 - 150%	8 seconds	> 150%	4 seconds
< 120%	Continuous run										
120 - 125%	16 seconds										
125 - 133%	12 seconds										
133 - 150%	8 seconds										
> 150%	4 seconds										
Underload Control	App. 70% of nominal shaft power.										
Reset On Dry-run	Runtime is automatically matched to water available for pumping. The longest time before reset is approximately 60 minutes.										
Reset On Overload	Auto reset after 15 minute delay, OR reset by power-up with 90 second delay.										
Switch Control	<p>External Distribution Board circuit breaker or isolator: Required for protecting MOTORWATCHER®, cables and motor against extreme overload and short circuit conditions only - not recommended for repeated on/off switching activity.</p>										
	<p>ON/OFF, PRESSURE, FLOAT or other type of switch: Intermittent starting and stopping of the pump/motor unit utilizing Switch input.</p>										

TECHNICAL SPECIFICATIONS

The table below summarizes the technical specification of the MOTORWATCHER® . Models may differ with respect to timer characteristics, detailed voltage transition points and current levels.	
Single Phase - 230V Split Phase Motor (PSC) or Motor With Internal Capacitor	
Absolute Voltage Range	196V - 265V AC
Absolute Continuous Current	1A - 12A AC
Capacitor	Select for motor size - contact motor manufacturer
Enclosure	ABS 160x220x70mm
Weight	1 Kg
IP Rating	IP43
Single Phase - 230V CSIR Motor (Capacitor Start Induction Run)	
Absolute Voltage Range	196V - 265V AC
Absolute Continuous Current	1A - 8A AC
Capacitor	Select for motor size - contact motor manufacturer
Capacitor Relay Active	below 165V AC
Enclosure	ABS 160x220x70mm
Weight	1Kg
IP Rating	IP43
Three Phase - 400V	
Absolute Voltage Range	340V - 460V AC
Absolute Continuous Current	1A - 8A AC
Enclosure	ABS 160x220x70mm
Weight	1Kg
IP Rating	IP43

WARNING:

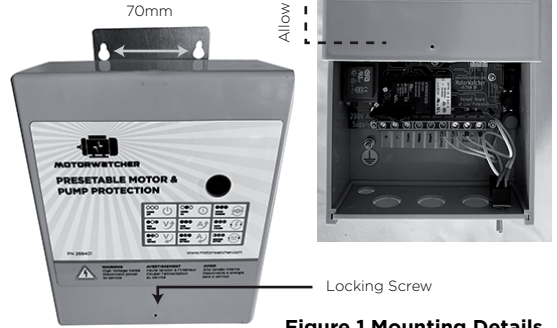
To avoid possible fatal shock, disconnect power at the main power distribution board before installing, wiring or servicing your MOTORWATCHER®

Installation and maintenance work should only be carried out by technically qualified personnel. Serious or fatal injury could result from tampering by unqualified personnel.

INSTALLATION

MOTORWATCHER® Mounting instructions

- The **MOTORWATCHER®** features an integrated easy-to-mount structure, requiring two mounting points with convenient keyhole feature. The spacing between holes is 70mm.
- Ensure sufficient clearance for sliding lid on flat mounting surface.
- Remove locking screw to allow lid removal by sliding upward.
- Mark the holes for the mounting plate, drill and use M4 screws with wall plugs (or wood) to fasten. Keyholes provide easy mounting.



Electrical installation - Opening the MOTORWATCHER®

- TURN OFF AC POWER AT THE SOURCE (DB BOARD)
- Remove locking screw.
- Slide the enclosure lid upwards to expose the connectors.

Electrical installation - Connecting the Motor

- Before connecting the motor to the **MOTORWATCHER®**, use a 500V DC insulation tester (Megger) to test the insulation resistance of both the motor and supply cable to earth. Use multimeter on lowest ohm range if a megger is not available.
- Verify the insulation resistance between each cable and earth.
- Check motor windings' resistance with multimeter and confirm with supplier.
- To identify a single phase motor's windings, follow the guide below.
- Connect the motor to the **MOTORWATCHER®**, and ensure that the wiring of the motor matches the terminals of the **MOTORWATCHER®**.
- Verify that the **MOTORWATCHER®** is wired according to the specific schematic diagram.
- Note that single phase and three phase motors differ.

Electrical installation - Identifying Single Phase

Motor Windings

It is important to make sure that the windings of a single phase motor, requiring an external START/RUN capacitor are identified correctly. Incorrect wiring will cause permanent damage to the motor.

Follow the 3 steps in the tables below to avoid motor damage.

Complete the following table and select the correct combination.		
1. Tag the leads with the numbers and fill in the lead colours below.		
Number	Lead/wire Colour	
1		
2		
3		
2. Measure the individual resistances. Fill in the values in the table below.		
Measure from number... to number...	Resistance (Ohm)	Note High, Middle, Low reading (First complete all readings to the left)
1-2		
1-3		
2-3		

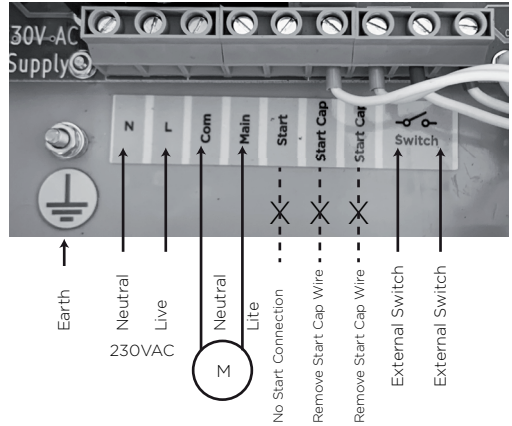
3. Select correct option below and add lead description to number on lead tag:	
Option 1 - 1-2 High, 1-3 Middle, 2-3 Low	
Number	Lead
1	Start
2	Main
3	Common
Option 2 - 1-2 Middle, 1-3 Low, 2-3 High	
Number	Lead
1	Common
2	Start
3	Main
Option 1 - 1-2 Low, 1-3 High, 2-3 Middle	
Number	Lead
1	Main
2	Common
3	Start

Electrical Installation – Record Installation Details Below For Future Reference

Single Phase Motor Connection - Built-in Capacitor

- Do not remove the built-in capacitor from motor junction box.
- Connect Live and Neutral to the Distribution Board. Ensure that the correct wire diameter is used.
- Connect the **MOTORWATCHER®** leads (MAIN > LIVE and COMMON > NEUTRAL) to the motor terminal box.
- No motor START/RUN connection is required. Remove the START/RUN capacitor wires from the control box.
- Connect the external/remote switch in parallel to the control box on/off switch provided, if required. Use screened cable for external switch.
- Connect screen to control box earth. Do not earth any switch terminal.

Figure 2 Single Phase Motor - Built-in Capacitor



Single Phase Motor Connection - With Start Or Run Capacitor

- Select the correct capacitor, based on the motor type and size.
- Use the table as a guide.
- Contact the motor supplier for more information if required.
- Place the capacitor in the space provided for and connect the spade terminals. See picture.
- Ensure that the spade terminals are inserted correctly.
- Use the cable ties provided to secure the capacitor. See picture.
- Connect **MOTORWATCHER®** Live and Neutral to the Distribution Board. Ensure that the correct wire diameter is used.

Suggested capacitors for single phase motors		
The table below offers some guidance with single phase motor capacitor selection. Confirm selection with motor supplier. Capacitor voltage must be rated for operation (330VAC-450VAC)		
PSC motor RUN capacitor selection		
230VAC Motor Rating	Motor Nominal Amps	Capacitor Size (uF)
0.37kW	3.4	16-20
0.55kW	4.3	20-30
0.75kW	5.8	30-45
1.1kW	8.4	40
1.5kW	10.7	50
CSIR motor START capacitor selection		
230VAC Motor Rating	Motor Nominal Amps	Capacitor Size (uF)
0.37kW	3.4	48
0.55kW	4.3	65
0.75kW	5.8	95

- Connect the **MOTORWATCHER**[®] to the motor, ensuring that MAIN, COMMON and START/RUN correspond.
- Connect the external/remote switch in parallel to the control box on/off switch provided, if required.
- Use screened cable for external switch.
- Connect screen to control box earth. Do not earth any switch terminal.

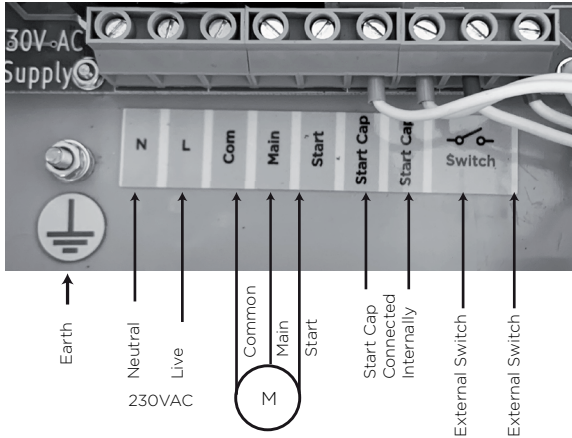


Figure 4 PSC or CSIR Single Phase Motor Requiring Capacitor Connections

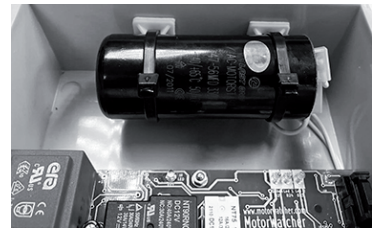
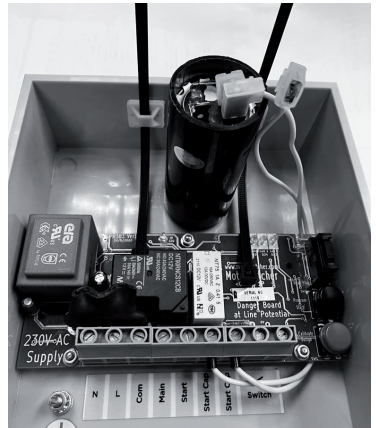


Figure 3 Installing START/RUN Capacitor

Three Phase Motor Connections

- Connect the incoming **MOTORWATCHER**[®] as shown in the photograph.
- Connect the motor to the **MOTORWATCHER**[®], and ensure that the wiring of the motor matches the terminals of the **MOTORWATCHER**[®].
- Connect the incoming earth wire to the Earth point.
- In the case of three phase operation, ensure that left Switch terminal is connected to Earth.
- Use shielded or screened two core cable if an external switch is used.
- Earth the screen to the control box earth terminal provided.
- Ensure that remote switch complies with specifications and is double insulated.

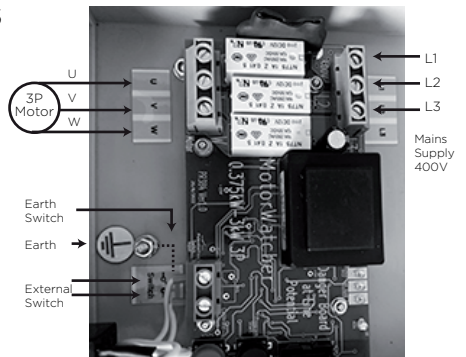


Figure 5 Three Phase Motor Connections

Presetting Motor/Pump Assembly On Site

- Verify that the **MOTORWATCHER®** is wired according to the specific schematic diagram or picture. Note that single phase and three phase motors differ.
- Switch the Isolator/Circuit Breaker on.
- Ensure that the mains supply matches the **MOTORWATCHER®** specification label using a multimeter set on Volts AC.
- Connect an AC current clamp meter on the Common motor lead if single phase, or on the “U” motor connection if a three phase unit.
- Push and **hold** in position the **Program Start Button**.
- Push and **hold** in position the **Calibrate Button**.
- While **holding** the **Calibrate button** in position, release the **Program Start Button**.
- During the Program sequence (see pictures) the following process takes place:
 - a. **LED 1** will immediately flash twice,
 - b. **LED 2** will flash twice,
 - c. **LED 1** will flash twice,
 - d. **LED 2** will flash a further 2 times.
- **MOTORWATCHER®** is now in the field preset mode.
- After the first double flash, the **Calibrate Button** can be released.

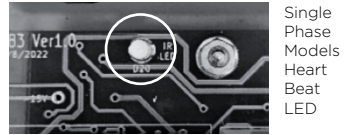
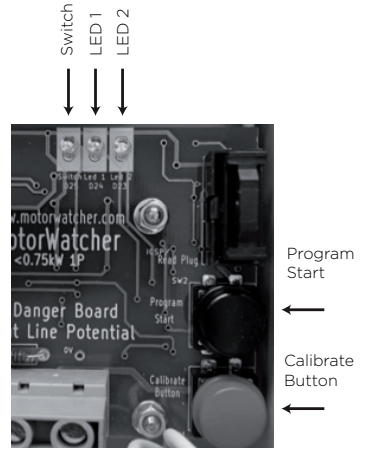


Figure 6 Pre-setting and commissioning the MOTORWATCHER®

- The relay will pull in immediately, starting the motor, and the **Heart Beat** will start flashing. See pictures.
- Using an AC current clamp meter, verify that the current to the motor matches the rating on the motor name plate.
- In the case that the readings are not as expected, switch off the Isolator/Circuit Breaker immediately to prevent motor failure.
- Recheck the wiring, motor direction in the case of a three phase motor or check that the pump is not stuck. Correct before continuing with the preset process.
- Check that motor rotation is correct if surface motors. In the case of submersible motors, check that the water flow is as expected. In the case of the three phase motor, switch off the Isolator/Circuit Breaker, swap any two of the motor wires to reverse rotation. Go back to point 2 again.

- Once the readings are acceptable, press the **Calibrate Button**. **LED 1** will immediately flash twice, then **LED 2** will flash twice, **LED 1** will flash again and **LED 2** a further 2 times to indicate that **MOTORWATCHER®** has recorded all required settings as the running parameters. Upon the first double flash, the **Calibrate Button** can be released.
- If the switch input is active then the **Switch LED** will be on and the controller will continue running. In the case that the switch input is not active, the controller will stop the motor running, and will wait for the switch input to be activated.
- Once the running parameters are programmed, the **Heart Beat LED** will flash to indicate the controller is operational.

OPERATION

External Switch

A float, pressure or any other external switch can be used. Connect to the Switch terminals as indicated in the electrical wiring diagrammes. Use the terminals provided.

NOTE: Connect Switch terminals according to single phase and three phase instructions to earth. See Electrical Installation section. Remember to leave the ON/OFF switch in the **MOTORWATCHER®** in the OFF position when using an external switch.

Managing on/off switching activity- Rapid Cycle Protection

Your electric motor accumulates a certain amount of heat each time it is switched on. It must run for a period of time during which it has the opportunity to dissipate the heat. **MOTORWATCHER®** will do all the necessary calculations and management of the switching process. If too many starting cycles are called for, a waiting period will be applied. The water distribution system must be designed to allow the pump to run for as long as possible before switching off. When a faulty pressure switch is connected as an external switch, the rapid cycle protection function of the **MOTORWATCHER®** is activated. Rapid cycling will now be prevented. Try to set your system parameters so that the motor will run for about 2 minutes without stopping.

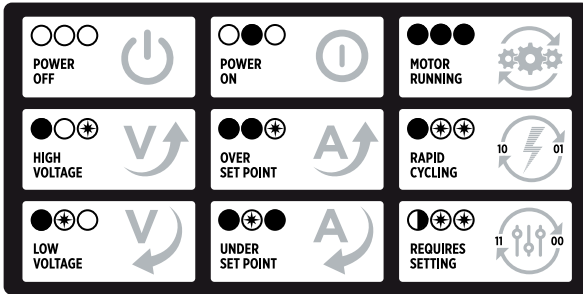
Switching ON/OFF

Under normal conditions switching on will result in a “click” (relay activating only in the case of CSIR motors) being heard and water being discharged. No special attention is required under normal operating conditions. The **MOTORWATCHER®** acts as a controlling switch that will interrupt power to your motor if all is not well in the borehole or pressure pumping system. **MOTORWATCHER®** checks for voltage variation and continuously measures various parameters of the motor.

Operation with Mains Switch

In some cases it may be necessary or desirable to use a Mains Switch in the distribution board supplying the **MOTORWATCHER®** which will interrupt power to the **MOTORWATCHER®** completely. In such a case the **MOTORWATCHER®** protects the motor although it cannot store some of the operating data. Operation in this manner may result in occasional trouble indication. This is not a recommended operating mode. (See trouble shooting section).




CONDITION INDICATOR








Operating conditions are displayed continuously, using simple mnemonics (pictures). Normal operation is indicated, as well as fault or dangerous operation. The accompanying legend provides the necessary information to allow for optimal use of any pumping system.


The development of the **MOTORWATCHER®** mnemonic system is a result of experience gained from studying user interaction with motor/pump control systems. While useful voltage, current and power readings can be displayed, the interpretation of such information requires expert knowledge and hence is often more of a complication than an aid. The interpretation of voltages and currents are dealt with by the **MOTORWATCHER®** expert system and incorporated in the mnemonic communication - no user interpretation is required - **MOTORWATCHER®** does the reading of values and interprets the prevailing conditions.

Normal Operation

Status Indication	Condition	Remedy
	No mains supply to MOTORWATCHER®	Switch mains on (Main DB)
	Manual mode: Switch is in the OFF position. Automatic mode (pressure switch): System is pressurized. Pressure switch is in OFF position.	Switch ON to pump. Pump will start when pressure falls below set -point of pressure switch.
	Manual mode: Switch is in the ON position, pump is running. Automatic mode (float/pressure switch): Float/Pressure switch is in ON position, pump is running	Switch OFF to stop. Pump will stop when shut-off pressure is reached.




Trouble Shooting

Status Indication	Condition	Remedy
	<p>Motor/Pump does not switch on</p>	<p>Loss of power - check supply voltage (Are other appliances working?)</p> <p>Unit faulty - return to supplier. No serviceable internal parts.</p>
	<p>Motor/Pump does not switch on</p>	<p>Damaged switch - contact supplier</p> <p>Float/Pressure switch in series - float/pressure switch off</p>
	<p>Motor/Pump does not switch off</p>	<p>Damaged switch - contact supplier</p> <p>Incorrect wiring - check wiring</p> <p>Unit faulty - return to supplier. No serviceable internal parts.</p>
	<p>Motor/Pump does not switch on</p> <p>Supply problem - high voltage condition occurred.</p>	<p>MOTORWATCHER® will reset within 10 seconds after supply is rectified. If the condition persists, contact power company, supplier or installer.</p>
	<p>Motor/Pump does not switch on</p> <p>Supply problem - low voltage condition occurred.</p>	<p>MOTORWATCHER® will reset within 10 seconds after supply is rectified. If the condition persists, contact power company, supplier or installer.</p>

Status Indication	Condition	Remedy
	<p>Motor/Pump runs for less than 5 minutes and stands for more than 60 minutes</p> <p>Motor/Pump does not switch on within 60 minutes</p> <p>Motor/Pump runs for less than 5 minutes after installation and the water level in borehole/tank is sufficient</p> <p>Pump is on for more than 5 minutes and off for less than 60 minutes</p>	<p>Too much water is being pumped - reduce pump flow rate partially closing discharge valve.</p> <p>Contact supplier. MOTORWATCHER® does not function correctly.</p> <p>Pump is operating against a shut valve or heavy flow restriction (almost no flow) remove flow restriction or reduce flow when pumping.</p> <p>Pump rotation wrong - check wiring.</p> <p>Frequent occurrence of this condition - the borehole cannot deliver the required for flow rate. Reset time varies between 5 to 60 minutes to ensure maximum water delivery from a weak well. MOTORWATCHER® expert system calculates optimal on/off times. To maintain optimal on/off time, do not switch mains on/off. Record on/off times and contact installer.</p> <p>Unit run time was longer before - operating conditions may have changed or water level in borehole has changed. Use current clamp to confirm new working conditions and reprogramme field pre-set point. Refer to setting instruction above. See installation section.</p>

WARNING:

Installation and maintenance work should only be carried out by technically qualified personnel. Serious or fatal injury could result from tampering by unqualified personnel.

Status Indication	Condition	Remedy
	<p>Motor/Pump does not switch on</p> <p>MOTORWATCHER® will reset in approximately 15 min.</p>	<p>Pump locked up – debris may have entered the pump. Remove motor/pump from the borehole and clean.</p> <p>Cable damaged – drop cable may have been damaged. Remove pump and check cable for damage.</p> <p>If pumping does not restart in 20 min, or if the problem persists, contact installer or supplier.</p> <p>Unit operated correctly before – operating conditions may have changed. Use current clamp to confirm new working conditions and reprogrammed pre-set point. Refer to setting instruction above.</p>
	<p>Motor/Pump does not switch on</p> <p>No user intervention will restart the pump/motor. Do not switch mains power supply on/off.</p> <p>MOTORWATCHER® will reset within 3 minutes.</p> <p>MOTORWATCHER® does not reset within 3 minutes</p>	<p>Motor/Pump is switching on too often or is running for very short periods - continuous rapid cycling and excessive motor thermal cycling can be caused by a waterlogged tank, faulty contacts, faulty pressure switch, supply problem or a system fault. Check pressure tank charge level or bladder for damage. Check for faulty wiring. Check for intermittent mains supply.</p> <p>Switch power off and on after 5 minutes. Contact installer or supplier if condition remains. No serviceable internal parts.</p>
	<p>Motor/Pump does not switch on or switches off unexpectedly.</p>	<p>MOTORWATCHER® requires pre-setting. Unit has not been pre-set. Refer to setting instructions above.</p>

READ THIS MANUAL CAREFULLY BEFORE ATTEMPTING INSTALLATION

- Have you purchased the correct model, suitable for the pump/motor you purchased?
- Have you selected the correct capacitor for a single phase motor, if required?
- Do you have a multimeter and an AC current clamp meter to be used during installation?

Contact www.motorwatcher.co.za for assistance or advise.