Giant Fountain
Subtrol-Plus Motor Protection System
Owner's Manual

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How Subtrol-Plus Motor Protection System Works

The Subtrol-Plus Motor Protection System represents the ultimate in protection for the three phase submersible motors used in the Giant Fountain. The submersible motor and the Subtrol-Plus system are both manufactured by Franklin Electric.

Digital electronics has made it possible to develop a unique programmed system capable of detecting overloads, underloads, overheating, and rapid cycling only when used with a Subtrol submersible motor. Subtrol-Plus turns off the submersible motor when any of these faults occur and provides a visual display of the fault condition. It also offers automatic restart capabilities when problems are temporary. Subtrol-Plus is calibrated to a particular horsepower motor by a rating insert.

A microcomputer in the receiver is the main element of the Subtrol-Plus system. It monitors the operating conditions of the submersible motor and decides whether or not the motor should be allowed to operate. The receiver's control circuit terminals are wired in series with the motor control's contactor coil so that if the Subtrol-Plus system detects a fault, it can immediately turn off the motor. To make sure fault conditions are not temporary, the Subtrol-Plus system will attempt to restart the motor. Depending on the fault condition, after a given number of trips, Subtrol-Plus will go into manual restart mode.

Subtrol-Plus protects a submersible motor by monitoring the motor's amperes and turns it off if they are too high or too low (both the overload and underload trip points are adjustable in the field). It also monitors the temperature of the motor's windings and turns it off if they exceed a safe range. It forces the motor to wait at least one minute between run cycles. Subtrol-Plus also detects chattering, or "machine gunning" starter contacts by stopping the motor if ten starts are detected within 10 seconds.

The receiver inputs are gathered by the sensor coils, which are placed over any two of the three phases. Each sensor coil actually contains two elements. One is current transformer which reads the motor's amperage. The other is a special coil which detects overheat pulses generated by a transmitter/thermostat assembly located in the Subtrol submersible motor. The two sensor coils are identical and can be plugged into either of the receptacles on the Subtrol-Plus receiver. If the sensor coils have not been properly connected, the green off time light will flash to indicate the improper installation and the motor cannot be started.

WARNING: This equipment should be installed by a qualified electrician in compliance with national and local electrical codes.

WARNING: Subtrol-Plus is NOT compatible with phase converters, reduced voltage starters or variable-speed inverter drives.

Before Installing the Subtrol-Plus System

1. Read this manual thoroughly.
2. Be sure the incoming power supply is turned off before working on motor or controls.
3. Voltage rating of Subtrol-Plus receiver must match incoming power supply.
4. Make sure horsepower and voltage rating of the Subtrol-Plus rating insert matches horsepower and voltage rating of motor to be protected.

Subtrol-Plus Receiver (Figure 1)

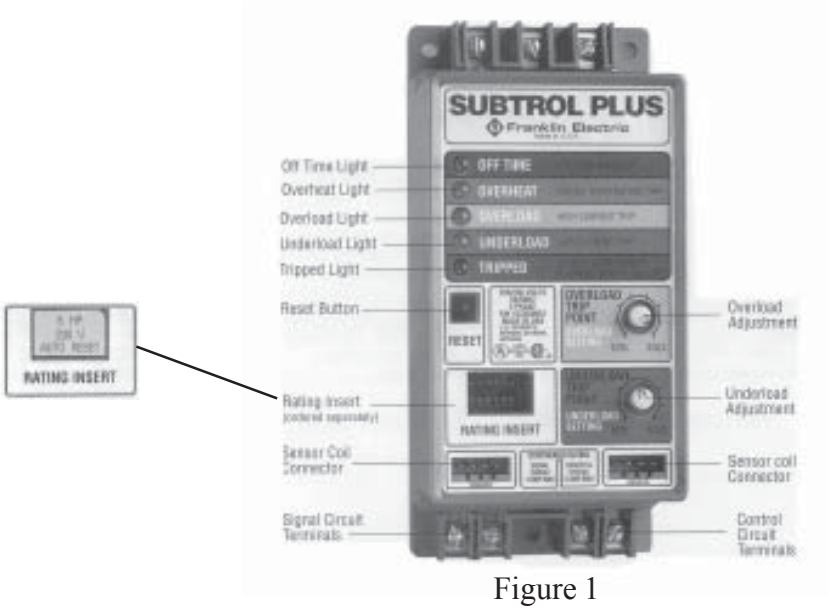


Figure 1

The Subtrol-Plus receiver voltage and frequency rating must match the voltage and frequency rating of the power supply and motor. The programmed receiver interprets information from the sensor coils and turns the motor off if a fault occurs. It also provides a record of faults for dianosing problems and an automatic restarting sequence.

A 9-volt rechargeable nickel-cadmium battery is included in the Subtrol-Plus receiver to provide approximately 15 minutes of power to the display lights after system power is turned off. A charging circuit keeps it at full strength when system power is applied to the receiver. The battery is in a removable drawer on the top panel of the receiver and can be replaced, if necessary. Replacement batteries must be nickel-cadmium rechargeable type, not carbon zinc or alkaline type. When power will be turned off for an extended period of time (more than 24 hours), it is best to remove the battery from the receiver to avoid damage due to excessive discharge.

The rating insert (See Figure 1) programs the Subtrol-Plus receiver for the proper underload and overload amperage. Its horsepower and voltage should correspond to the motor being protected. Using a rating insert of higher horsepower than the motor results in no overload protection.

HP	Voltage	Part Number	65% Service Factor Amps	125% Service Factor Amps
7.5	230	31-0125-001	16.0	30.8
7.5	460/380	31-0125-002	8.0	15.4
10	230	31-0125-003	20.9	40.3
10	460/380	31-0125-004	10.5	20.1
15	230	31-0125-005	30.8	59.3
15	460/380	31-0125-006	15.4	29.6
25	230	31-0125-007	48.8	93.8
25	460/380	31-0125-008	24.4	46.9

Subtrol-Plus Receiver Control Circuit

The control circuit terminals (See Figure 1) are wired in series with the contactor coil. Anytime the receiver control circuit is closed, the motor is capable of running as long as other devices in the control circuit are closed.

Anytime the control circuit is open, it interrupts voltage to the contactor coil, preventing the motor from running. The control circuit opens any time the off time or tripped lights are on or flashing.

Subtrol-Plus Receiver Reset Function

The function of the reset button (See Figure 1) is to self-test the Subtrol-Plus receiver cicuitry and to clear the fault memory.

The receiver will not allow itself to be reset for at least 1 minute after a fault trip. This allows time for the motor to cool before it is restarted after a problem has occurred. Resetting within 1 minute of a fault trip will initiate an additional 1 minute delay.

When the reset button is depressed, the control circuit terminals open, self testing the circuit. Releasing the reset button causes all lights to flash once, any fault memory is cleared and the control circuit is closed.

Resetting with all lights off or flashing will not activate the off time function. Subtrol-Plus will reset automatically when power is turned on if the battery is low.

Overload Adjustment

Figure 2

The overload trip point is adjustable from 80 to 125% of the motor service factor amps, and is factory preset at 125%. Each increment on the dial equals approximately 10% of the motor load amps. Adjusting for optimum motor overload protection may be accomplished when the motor is running normally and the overload trip point is set at 10% above the pump load. Overload protection is lost when adjusted more than 105% above motor service factor amps.

Overload Adjustment Procedure:

A. Slowly decrease (turn CCW) the overload adjustment knob (See Figure 2)until the over load light glows. This indicates the motor pumping load.

B. Within two seconds, increase (turn CW) the knob by one increment.

C. Should the Subtrol-Plus trip on overload during adjustment, wait for the off time one minute delay, reset and repeat procedure.

Underload Adjustment

The underload trip point is adjustable from 30 to 100% of the motor service factor amps, and is factory preset at 65%. Each increment on the dial equals approximately 10% of the motor load amps. Adjusting for optimum motor underload protection may be accomplished when the motor is running normally and the underload trip point is set at 10% below the pump load.

Figure 3

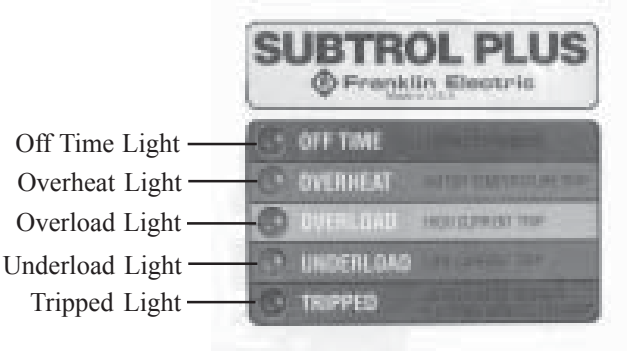
Underload Adjustment Procedure:

A. Slowly increase (turn CW) the underload adjustment knob (See Figure 3)until the under load light glows. This indicates the motor pumping load.

B. Within two seconds, decrease (turn CCW) the knob by one increment.

C. Should the Subtrol-Plus trip on underload during adjustment, wait for the off time one minute delay, reset and repeat procedure.

All Lights Function

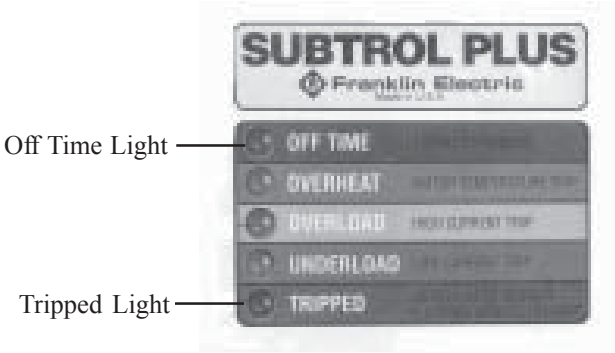


1. **All lights off**: System ready for operation, motor not running.

2. **All lights flashing**: The motor and system are running normally when all lights flash every two seconds.

3. **All lights flash once**: When power is applied to the Subtrol-Plus receiver and battery is not charged, all lights flash one time. When the battery is charged, the lights do not flash on power up.

Off Time Function



1. **Off time light off and tripped light off**: System ready to start.

2. **Off time light on and tripped light off**: One minute delay in progress, will auto reset when complete.

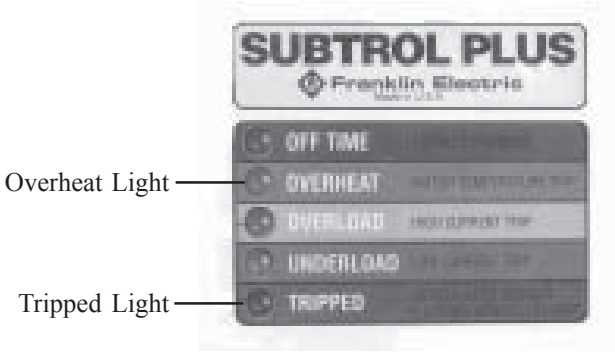
3. **Off time light on and tripped light on**: False start trip*, one minute delay in progress, will auto reset when complete.

4. **Off time light on and tripped light flashing**: False start trip* has occurred three consecutive times, manual reset required.

5. **Off time light flashing**: One or both sensor coils not connected.

* False start trip is ten starts within ten seconds typical of chattering or "machine gunning" starter contacts. If contactor is not chattering look for arcing starter contacts or loose connections in power circuit.

Overheat Function



1. **Overheat light on and tripped light off**: An overheat trip has occurred in the past. Motor is presently not running, but is ready to start. Light can be canceled by depressing and releasing reset button.

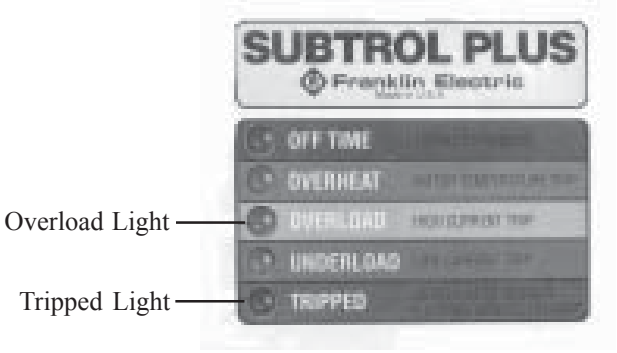
2. **Overheat light on and tripped light on**: System presently tripped by overheat fault; 10, 20, or 20 minute delay in progress, will auto reset when complete. Fault may be canceled by depressing and releasing reset button and waiting through one minute off time delay. If one minute has expired since fault trip, the one minute off time is canceled.

3. **Overheat light on and tripped light flashing**: Overheat trip sequence completed. Manual reset required. Fault may be canceled by depressing and releasing reset button and waiting through one minute delay. If one minute has expired since fault trip, the one minute off time is canceled.

Overheat Fault Diagnosis

Fault Light Indication	Problem	Possible Cause
Overheat light on, Tripped light on or flashing	Motor temperature has exceeded safe limits	1. High or low line voltage 2. Motor is overloaded 3. Excessive current unbalance 4. Poor motor cooling 5. High water temperature 6. Pump not matched to motor 7. Single phasing

Overload Function



1. **Overload light on and tripped light off**: An overload trip has occurred in the past. Motor is presently not running, but system is ready to start. Light can be canceled by depressing and releasing reset button.

2. **Overload light on and tripped light on**: System presently tripped by overload fault; 10, 20, or 20 minute delay in progress, will auto reset when complete. Fault may be canceled by depressing and releasing reset button and waiting through one minute off time delay. If one minute has expired since fault trip, the one minute off time is canceled.

3. **Overload light on and tripped light flashing**: Overload trip sequence completed. Manual reset required. Fault may be canceled by depressing and releasing reset button and waiting through one minute delay. If one minute has expired since fault trip, the one minute off time is canceled.

Overload Fault Diagnosis

Fault Light Indication	Problem	Possible Cause
Overload light on, Tripped light on or flashing	Normal line current	1. Overload adjustment set too low 2. Wrong rating insert
	High line current	1. High or low line voltage 2. Ground fault 3. Phase loss 4. Phase reversal 5. Pump or motor dragging 6. Motor stalled or bound pump

Underload Function

1. **Underload light on and tripped light off**: An underload trip has occurred in the past. Motor is presently not running, but system is ready to start. Light can be canceled by depressing and releasing reset button.

2. **Underload light on and tripped light on**: System presently tripped by underload fault; 30 minute time delay in progress, will auto reset when complete. Fault may be canceled by depressing and releasing reset button and waiting through one minute off time delay. If one minute has expired since fault trip, the one minute off time is canceled.

Underload Fault Diagnosis

Fault Light Indication	Problem	Possible Cause
Underload light on, Tripped light on	Normal line current	1. Underload adjustment set too high 2. Wrong rating insert
	Low line current	1. Clogged intake 2. Loose pump impeller 3. Phase loss 4. Broken shaft or coupling

Subtrol-Plus Component Troubleshooting

CAUTION: All testing must be performed with **POWER OFF**, sensor coils unplugged and the rechargeable battery replaced with a 9-volt alkaline battery unless otherwise specified.

RECEIVER TEST

A. Power Transformer (resistance)

Terminal Connections: L1 and L3

Reading: 230 volt receivers, 700-900 ohms

460/380 volt receivers, 2200-3200 ohms

B. Line Capacitor (resistance)

Terminal Connections: L1 and L2, L2 and L3

Reading:Needle or digital readout should go towards zero then float back to infinity. Reverse ohmmeter polarity than repeat. Again, needle or digital readout should go towards zero then float back to infinity. Repeat test for L2 and L3.

C. Batery Circuit & Control Board Assembly

Upon insertion of battery, all lights should momentarily flash on, then green off time light should blink.

D. Reset Circuit and Microprocessor

Depress reset button. All lights should be off. When the reset button is released, all lights should momentarily flash on, then the green off time light should blink.

E. Sensor Safeties and Microprocessor

Install the rating insert and connect jumper wires between the two center pins of the sensor coil connectors. The blinking green off time light should go off.

F. Control Circuit (triac resistance)

Terminal Connections: Place jumper wires across the two center pins of each sensor coil connector, and install rating insert. Ohmmeter leads to be connected across the control terminals.

Reading: 100 to 400 ohms. Depress reset button. Ohmmeter reading should be infinity.

G. Power Supply Rechargeable Battery

Install rechargeable battery and connect rated line voltage to L1 and L3. Allow battery to recharge for 1/2 hour. While battery is recharging, repeat steps D, E, and F. Remove rated line voltage once battery is charged and repeat steps D, E, and F on battery power.

SENSOR COIL TEST

A. Pulse Coil Check (resistance)

Terminal Connections: Ohmmeter leads to red and either white leads.
Reading: 1.8 to 2.0 ohms

B. Current Coil Check (resistance)

Terminal Connections: Ohmmeter leads to black and either white leads.
Reading: 90 to 145 ohms

C. Sensor Safeties Check (resistance)

Terminal Connections: Ohmmeter leads across the two white leads.
Reading: 1 ohm or less

TRANSIENT SUPPRESSOR MODULE TEST

A. Resistance Check

Terminal Connections: Isolate module leads. Connect ohmmeter across the two black leads.
Reading: Needle or digital readout should go towards zero then float back to infinity.

LIGHTNING ARRESTOR TEST

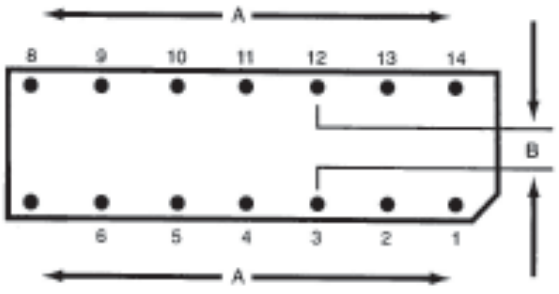
A. Resistance Check

Terminal Connections: Isolate module leads. Connect ohmmeter from white to each black and from each black to the other black leads.
Reading: All combinations should read infinity.

RATING INSERT TEST

A. Resistance Check

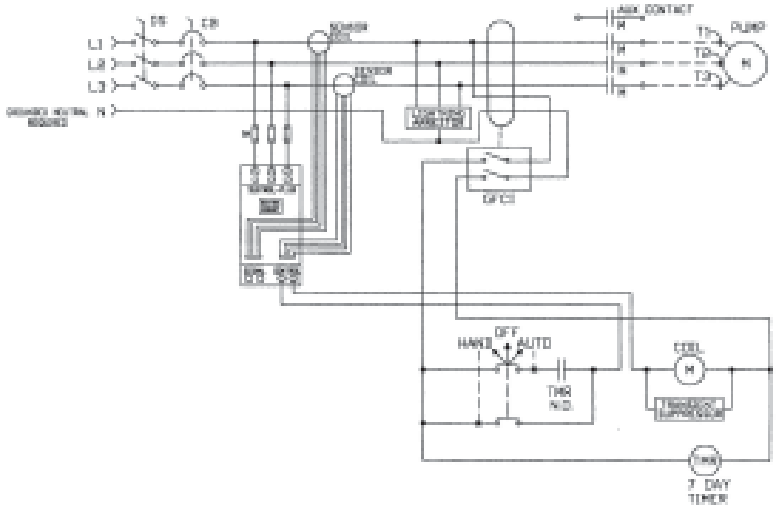
To determine if the calibration and horsepower rating are correct, three resistance readings must be taken. Listed on the next page are the ohm values by rating. “A” readings are taken between pins 1 & 7 and pins 8 & 14. “B” reading is between pins 3 & 12.



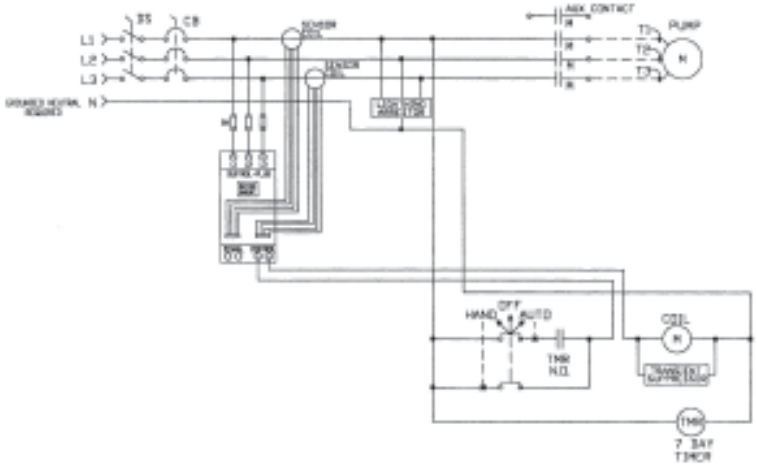
Rating Insert Ohms Readings

HP	Voltage	Part Number	"A" Ohms	"B" Ohms
7.5	230	31-0125-001	56	33K
7.5	460/380	31-0125-002	110	39K
10	230	31-0125-003	56	20K
10	460/380	31-0125-004	110	22K
15	230	31-0125-005	33	27K
15	460/380	31-0125-006	56	33K
25	230	31-0125-007	24	20K
25	460/380	31-0125-008	56	15K

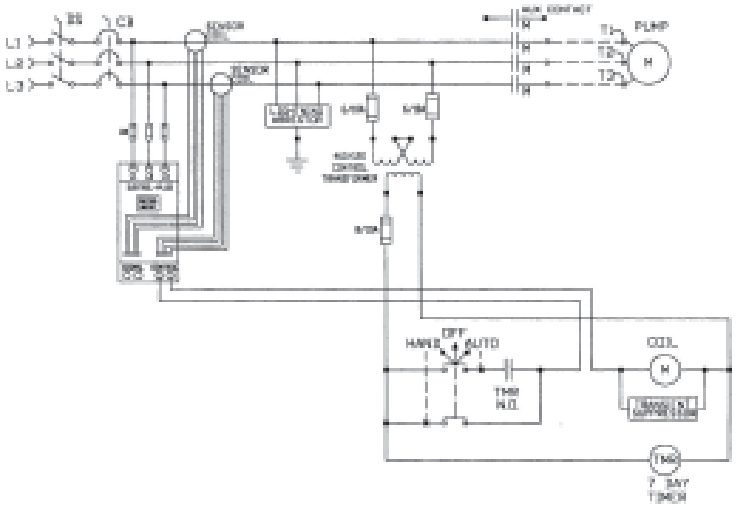
Giant Fountain 7.5, 10, 15HP 230V 3Ph 60Hz Schematic with Subtrol-Plus System



Giant Fountain 25HP 230V 3Ph 60Hz Schematic with Subtrol-Plus System



Giant Fountain 7.5, 10, 15, 25HP 460V 3Ph 60Hz Schematic with Subtrol-Plus System



Limited 3 Year Warranty
Otterbine® Product
Giant Fountain with Subtrol-Plus System

WARRANTY: Barebo, Inc 3840 Main Road East, Emmaus Pennsylvania 18049,U.S.A. hereby warrants, subject to the conditions hereinbelow set forth, that should the **OTTERBINE** product prove defective by reason of improper workmanship or materials at any time during the warranty period the Purchaser at retail will be guarantee that **BAREBO** will repair or replace the said **OTTERBINE** product as may be necessary to restore it to satisfactory operating condition, without any charge for materials or labor necessarily incident to such repair or replacement, provided that:

a) The enclosed Warranty Registration Card should be mailed to **BAREBO** within fifteen (15) days of the original receipt by the Purchaser at retail in order to avoid delays:

b) The **OTTERBINE** product must be delivered or shipped, prepaid, in its original container or a container offering an equal degree of protection, to **BAREBO** or a facility authorized by **BAREBO** to render the said repair or replacement services or, if purchased from an authorized **OTTERBINE** dealer, to such dealer;

c) The **OTTERBINE** product must not have been altered, repaired or serviced by anyone other than **BAREBO,** a service facility authorized by **BAREBO** to render such service, or by an authorized **BAREBO** dealer, and the serial number of the **OTTERBINE** product must not have been removed or altered: and

d) The **OTTERBINE** product must not have been subjected to lightning strikes and other Acts of God, vandalism, freezing-in, accident, misuse or abuse, and must have been installed in conformance with applicable electrical codes (including proper electrical protection), and also installed, operated and maintained in accordance with guidelines in the Owner's Manual shipped with the Otterbine product.

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