

IQ Control Box

Installation and Owner's Manual

Model: 880-051-1

880-052-1

880-058-1

880-059-1



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Introduction





RED JACKET'S IQ™ Control Box raises the standard for typical relay control boxes. Incorporating a microprocessor on board that continuously monitors the submersible pump provides insurance against conditions that can permanently damage the pump. In addition, the increasing number of dispensers at a station has demanded more than one pump per tank. Red Jacket's IQ Control Box can be connected to additional control boxes to allow up to four pumps per tank with demand driven sequencing. This function can be set to alternate between pumps that initiate next dispensing events to average the wear on all of the pumps in the system. The pump control circuit features non-volatile memory retention eliminating the need to recalibrate if power is lost.


IQ Control Box version 3 software adds support for Faradyne motors. The software will also support Franklin motors. Software version 3 requires the motor type to be programmed into the unit. The five-position unit configuration switches, reset/calibration button, and bypass/normal jumper are used to program the Motor Type. The microprocessor chip containing software version 3 is marked 805-001C or higher.




Retain this instruction manual with the equipment after installation for future use.

Safety Precautions

The following safety symbols are used throughout this manual to alert you to important safety hazards and precautions.

 <p>TURN POWER OFF Live power to a device creates a potential shock hazard. Turn Off power to the device and associated accessories when servicing the unit.</p>	 <p>ELECTRICITY High voltage exists in, and is supplied to, the device. A potential shock hazard exists..</p>
 <p>WARNING Heed the adjacent instructions to avoid equipment damage or personal injury.</p>	 <p>READ ALL RELATED MANUALS Knowledge of all related procedures before you begin work is important. Read and understand all manuals thoroughly. If you do not understand a procedure, ask someone who does.</p>

 **WARNING**

  	<p>FAILURE TO COMPLY WITH THE FOLLOWING WARNINGS AND SAFETY PRECAUTIONS COULD CAUSE DAMAGE TO PROPERTY, ENVIRONMENT, RESULTING IN SERIOUS INJURY OR DEATH.</p> <ol style="list-style-type: none"> 1. All installation work must comply with the latest issue of the National Electrical Code (NFPA 70), the Code for Motor Fuel Dispensing Facilities and Repair Garages (NFPA 30A), and any European, national, state, and local code requirements that apply. 2. To protect yourself and others from serious injury, death, or substantial property damage, carefully read and follow all warnings and instructions in this manual.
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Installation and Wiring Instructions



This equipment must be installed in a non-hazardous location.

1. Locate an area that allows all of the wiring to enter through the bottom knockouts of the control box. Consider the ability to view the indicator on the side of the base and access to the reset button when choosing a location.
2. Remove the cover of the enclosure and mount the base.
3. While viewing the wiring diagram (Figure 1) or inside the enclosure lid, connect the input power L1 and L2 wires to the terminal block labeled TB1. This control box is designed to operate from 200 to 250Vac. Since the submersible turbine pump is powered by the M1 and M2 terminals (and M3 terminals -058, -059 models) on the circuit board, refer to the installation and instruction manual that was supplied with the pump for correct supply voltage. Typical pump ratings are 208 to 240Vac.
4. Locate the grounding lug on the enclosure base and make an electrical ground connection to this point.
5. Motor leads M1 and M2 should be terminated to the M1 and M2 terminals on TB1. The M3 lead for models -058 and -059 should terminate to the splice provided lead from the capacitor in the lid (Figure 2).
6. The D1 and D2 terminals are reserved for the dispenser signal. These terminals are not polarity sensitive and can accept 120V or 240V signals. For pump manifolded installations it is important to wire the dispenser signal to all of the controllers.
7. Jumper J3 should be in the Normal position. Use the Bypass position only to program the Motor Type, or if temporarily controlling the pump directly from dispenser. Pump protection operation is not available in this position.
8. Installations that will operate pumps in a manifolded configuration require a two conductor, twisted pair with shield (min. 22 AWG) connected to the COM+, COM-, and SHIELD terminals of TB1. Daisy chain the communication cable to all of the controllers as shown in Figure 3. Belden 9462, or equivalent cable is acceptable. The RS-485 link between pump controllers is not intended to be connected to other Red Jacket electronic equipment such as Prolink, CPT, VSFC or other ATG devices. However, it may be necessary to break communications in PLLD or DPLLD applications as shown in Figure 4 and Figure 5. This cable must be installed in conduit.

Note: Approved component only. Total systems installed shall comply with all codes.

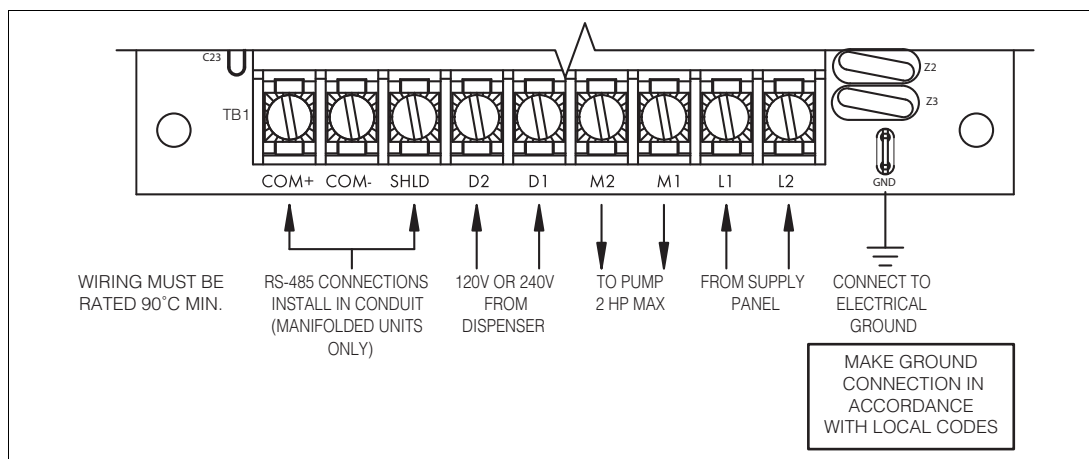


Figure 1. -051, 052

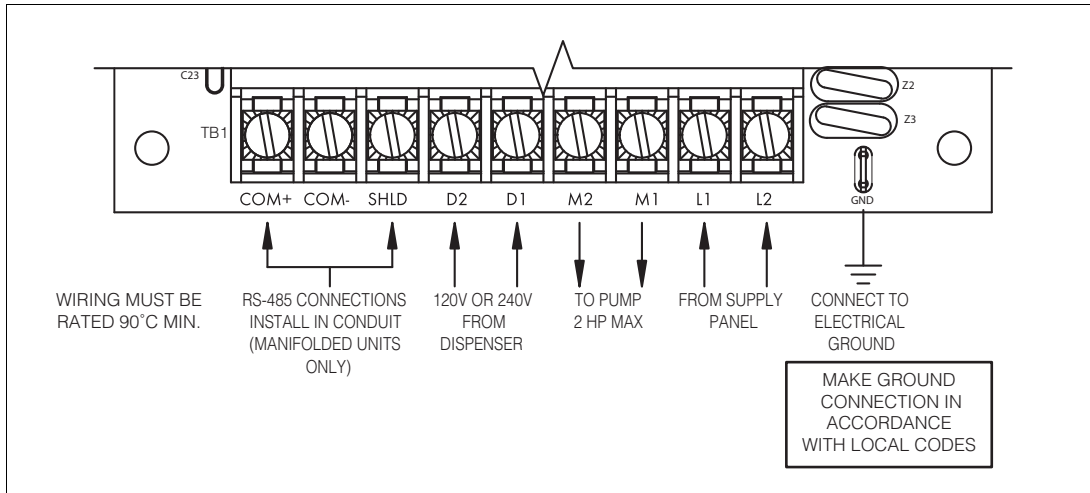


Figure 2. -058, 059

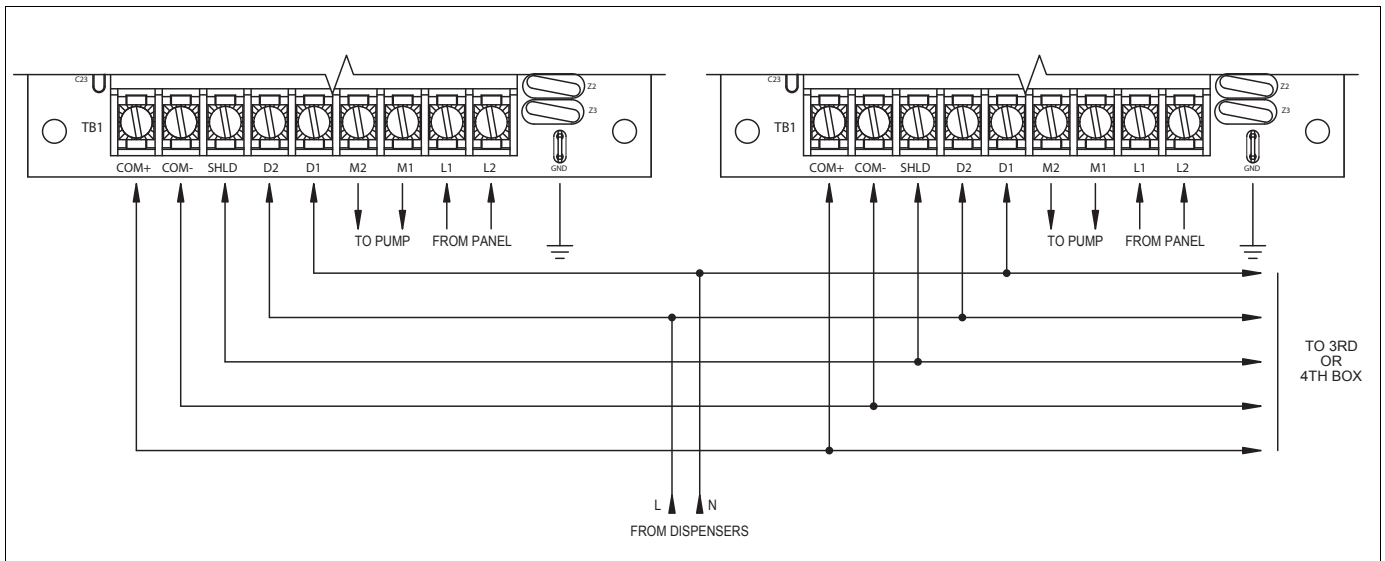


Figure 3. Wiring Diagram for Manifolded Systems

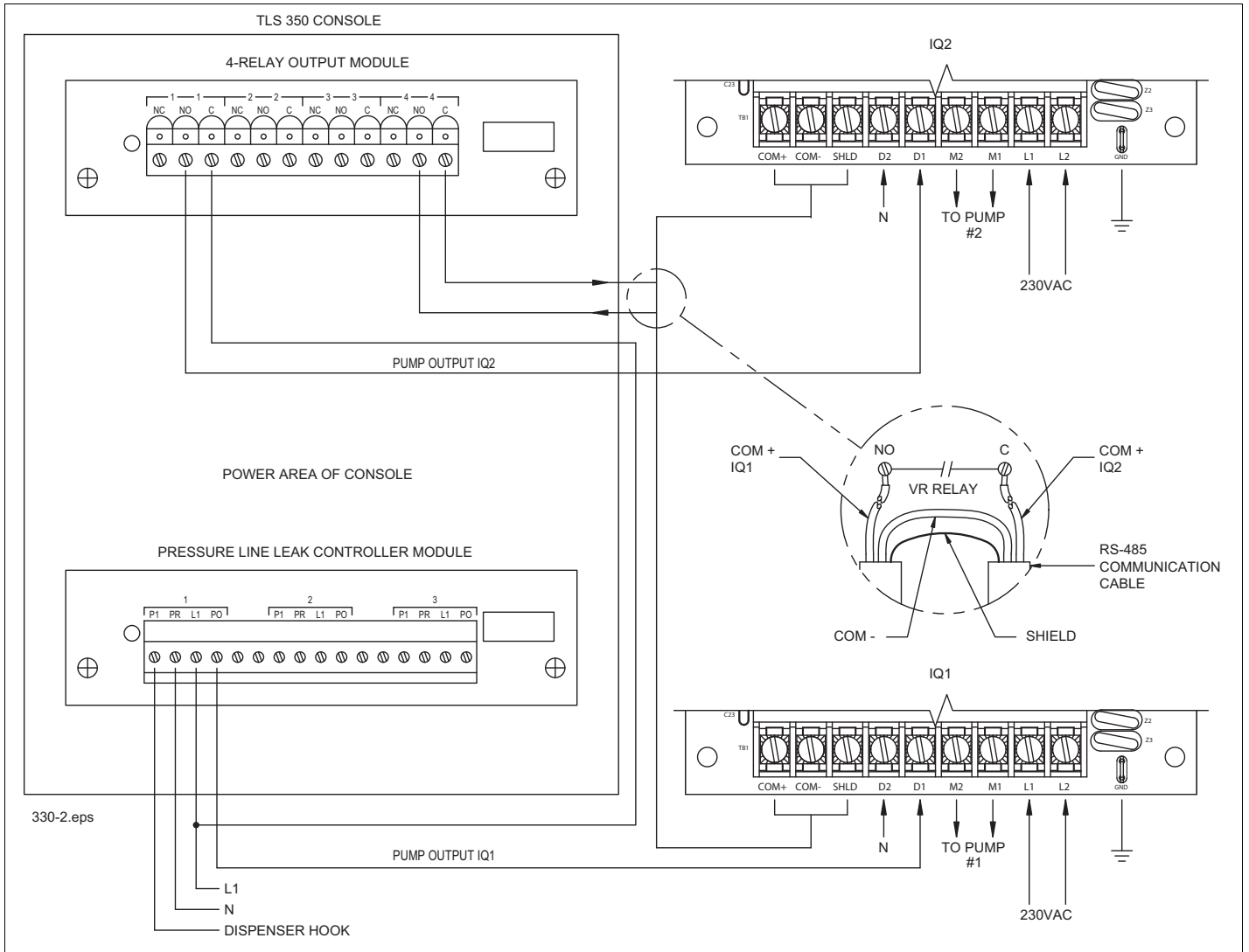


Figure 4. Wiring Diagram for IQ with TLS-350 Manifolded PLLD Systems

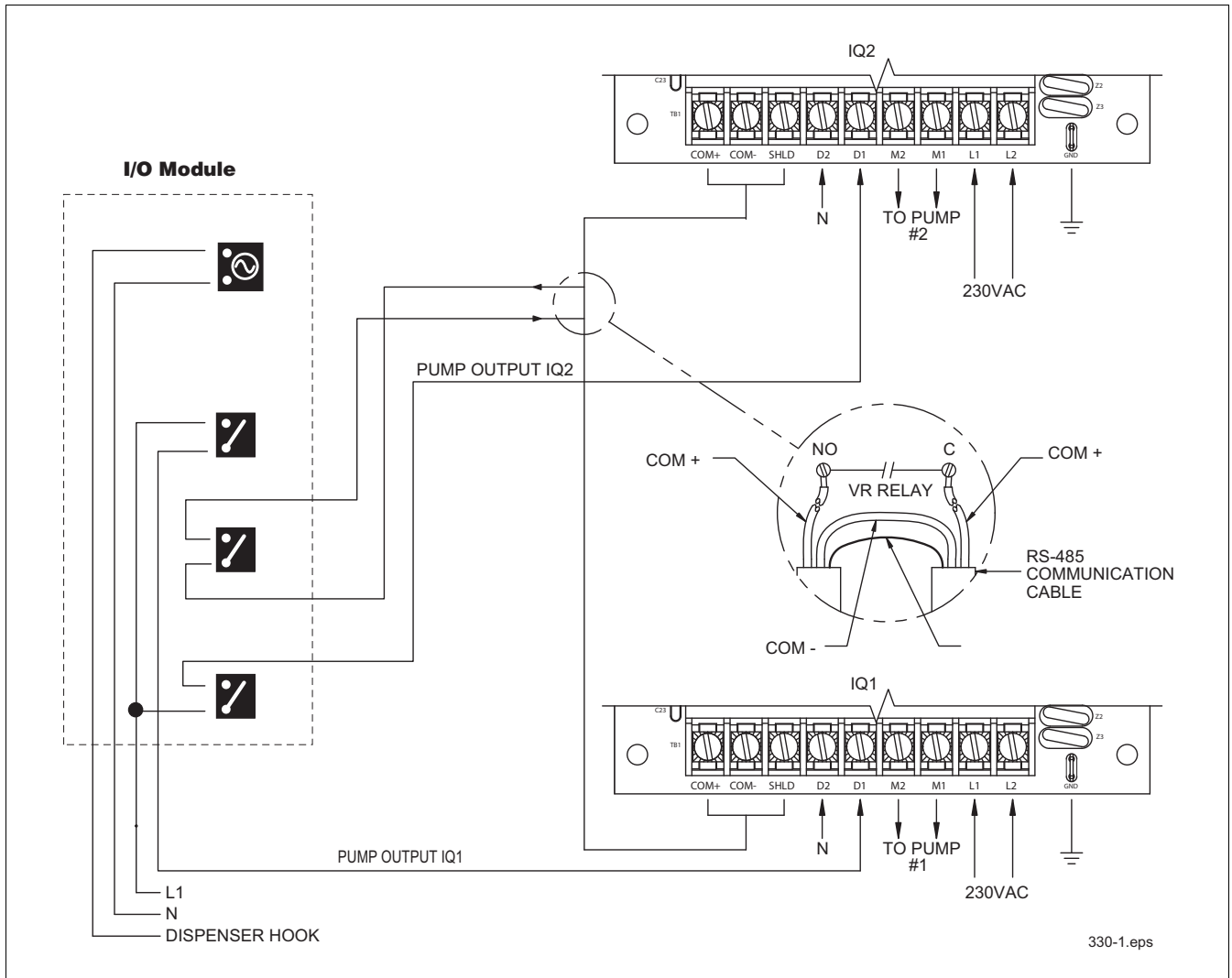


Figure 5. Wiring Diagram for IQ Box with TLS-450 manifolded DPLLD Systems

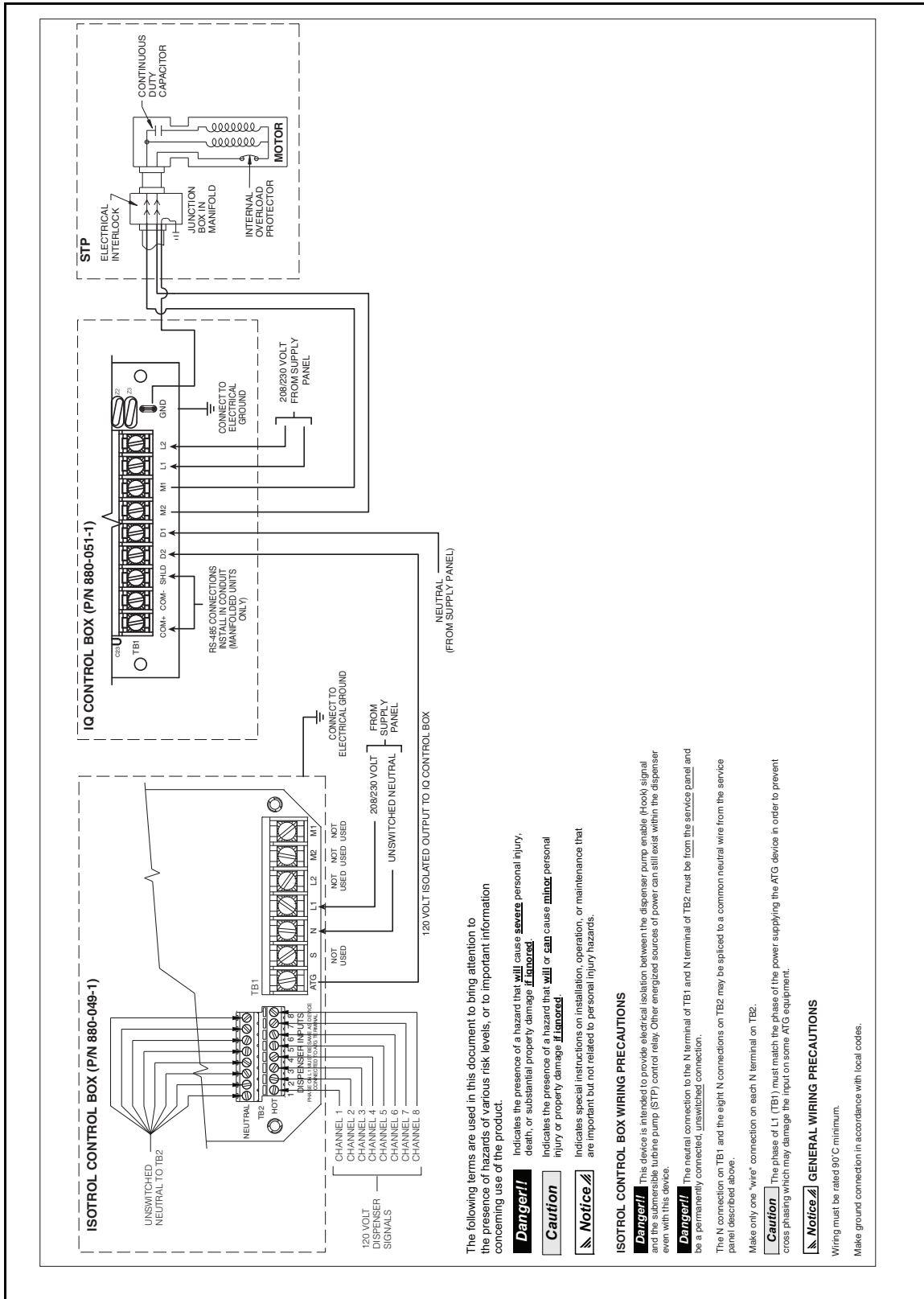
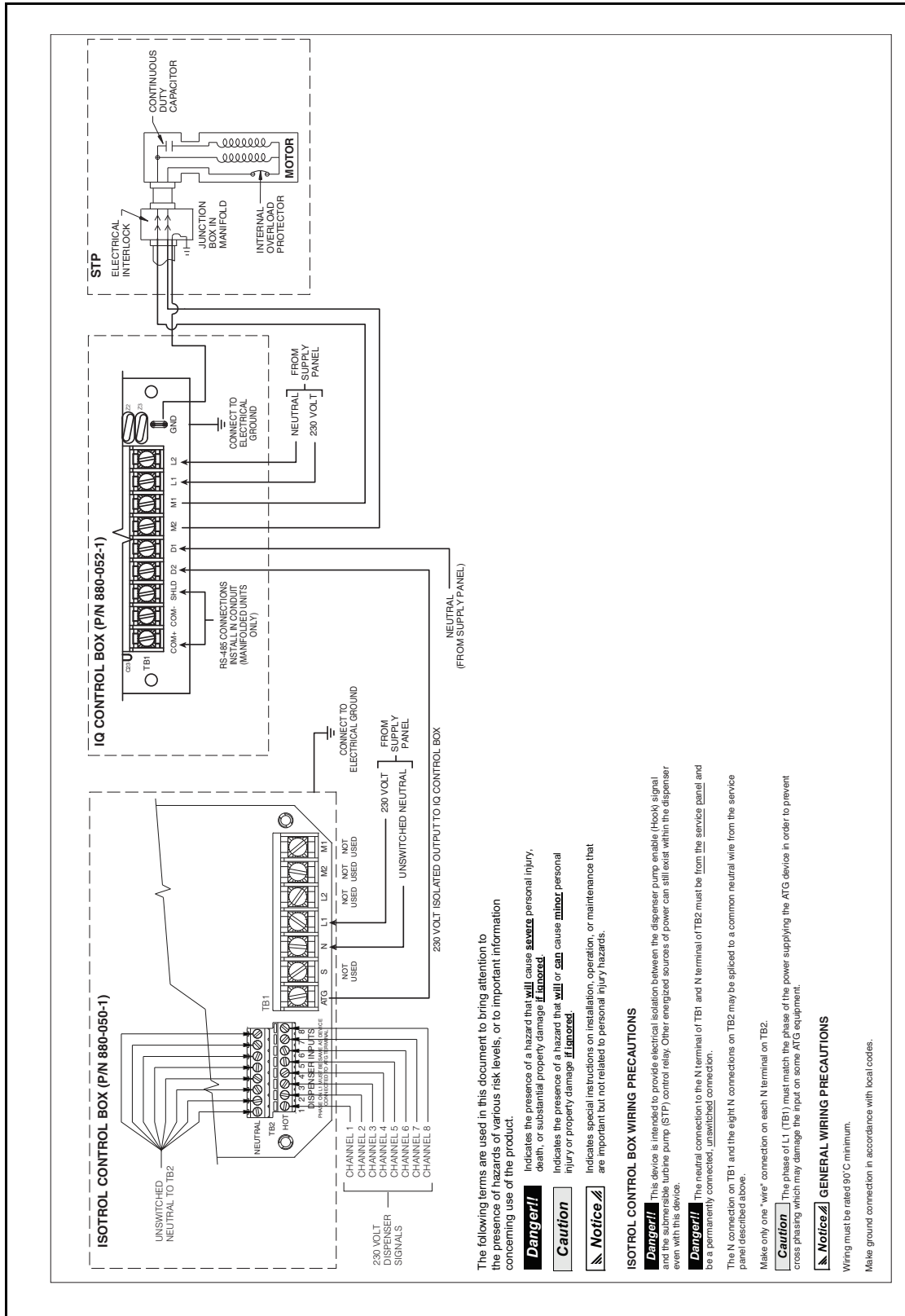


Figure 6. Isotrol to IQ Box Wiring - 120 Volt Dispenser Signals



The following terms are used in this document to bring attention to the presence of hazards of various risk levels, or to important information concerning use of the product.

- Danger!** Indicates the presence of a hazard that **will** cause **severe** personal injury, death, or substantial property damage **if ignored**.
- Caution** Indicates the presence of a hazard that **will** or **can** cause **minor** personal injury or property damage **if ignored**.
- Notice** Indicates special instructions on installation, operation, or maintenance that are important but not related to personal injury hazards.

ISOTROL CONTROL BOX WIRING PRECAUTIONS

Danger! This device is intended to provide electrical isolation between the dispenser pump enable (Hot) signal and the summable turbine pump (STP) control relay. Other energized sources of power can still exist within the dispenser even with this device.

Danger! The neutral connection to the N terminal of TB1 and N terminal of TB2 must be from the service panel and be a permanently connected, unswitched connection.

The N connection on TB1 and the eight N connections on TB2 may be spliced to a common neutral wire from the service panel described above.

Make only one "wire" connection on each N terminal on TB2.

Caution The phase of L1 (TB1) must match the phase of the power supplying the ATG device in order to prevent cross phasing which may damage the input on some ATG equipment.

GENERAL WIRING PRECAUTIONS

Wiring must be rated 90°C minimum.

Make ground connection in accordance with local codes.

Figure 7. Isotrol to IQ Box Wiring - 230 Volt Dispenser Signals

Determine the Motor Type



Warning! Disconnect, lock out, an tag power to the IQ Box at the panel before starting these steps.

Determination of the Motor Type can be accomplished by measuring the resistance readings at the junction box in the STP and comparing to Table 1 or Table 2 below. Motor Type can also be determined by observing the flow paths in the top of the UMP (Figure 8). UMPs containing a Faradyne motor will also have an 'FM' designation printed on the UMP shell.

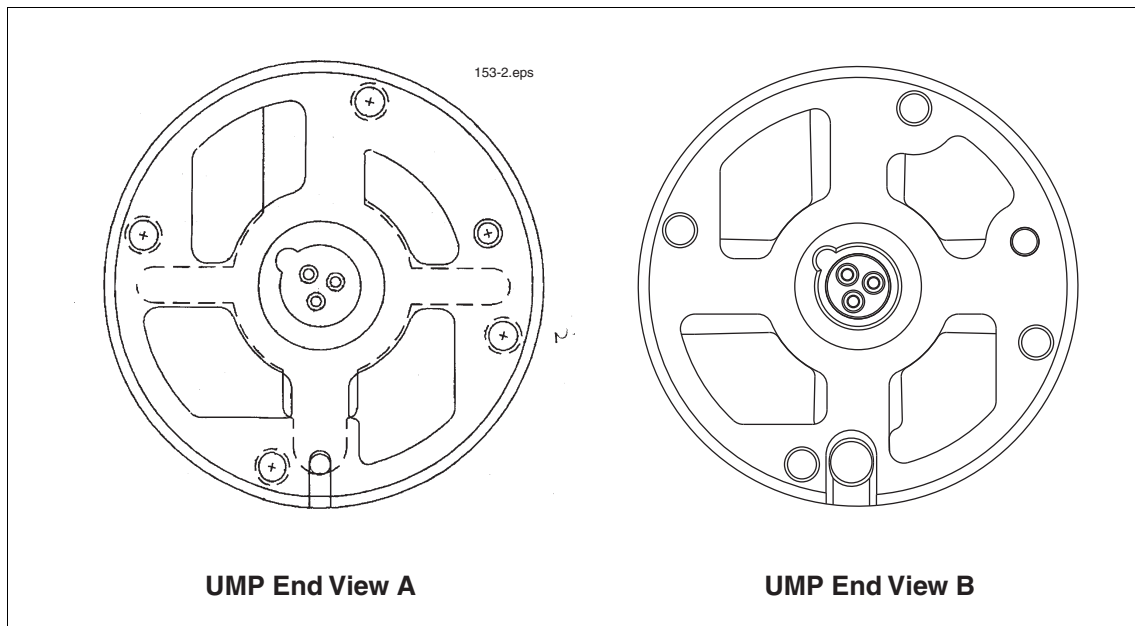


Figure 8. Identifying UMP Models by their End View

Table 1 and Table 2 show pump electrical service requirements for UMPs with end views A and B, respectively.

Table 1. Electrical Service Information (for UMPs Containing a Franklin Motor with End View A)

Required power supply rating for 60 Hz, 1 phase pumps is 208 - 230 Vac. For 50 Hz, 1 phase pumps, required rating is 220 - 240 Vac.

UMP Model No.	HP	Hz	PH	Voltage Fluctuation Range		Max. Load Amps	Locked Rotor Amps	Winding Resistance (Ohms)			Capacitor Kit (µF)
				Min.	Max.			Black-Orange	Red-Orange	Black-Red	
AGUMP33S1, UMP33U1	1/3	60	1	200	250	4.0	13	7.7 - 9.4	17.4 - 21.2	25 - 30.7	144-224-5 (17.5)
E85AGUMP75S1, UMP75U1	3/4	60	1	200	250	6.5	25	2.9 - 3.6	14.9 - 18.2	17.7 - 21.9	410164-001 (17.5)
E85AGUMP150S1, UMP150U1	1-1/2	60	1	200	250	10.5	37	2.0 - 2.5	11.6 - 14.2	13.5 - 16.8	410164-002 (25)
E85X3AGUMP150S1, X3UMP150U1	1/1/2	60	1	200	250	10.5	37	2.0 - 2.5	11.6 - 14.2	13.5 - 16.8	410164-002 (25)

Table 1. Electrical Service Information (for UMPs Containing a Franklin Motor with End View A)

Required power supply rating for 60 Hz, 1 phase pumps is 208 - 230 Vac. For 50 Hz, 1 phase pumps, required rating is 220 - 240 Vac.

UMP Model No.	HP	Hz	PH	Voltage Fluctuation Range		Max. Load Amps	Locked Rotor Amps	Winding Resistance (Ohms)			Capacitor Kit (µF)
				Min.	Max.			Black-Orange	Red-Orange	Black-Red	
E85AGUMP200S1-3, UMP200U1-3	2	60	1	200	250	11.4	46	1.4 - 1.7	2.5 - 3.2	3.8 - 5	410164-003 (40)
AGUMP75S3-3, UMP75U3-3	3/4	50	1	200	250	5.8	17	3.6 - 4.5	20.4 - 25	23.9 - 29.6	410164-001 (17.5)
AGUMP150S3-3, UMP150U3-3	1-1/2	50	1	200	250	10	28	2.5 - 3.1	11.5 - 14	13.9 - 17.2	410164-002 (25)
X4AGUMP150S3, X4UMP150U3	1-1/2	50	1	200	250	10	28	2.5 - 3.1	11.5 - 14	13.9 - 17.2	410164-002 (25)
AGUMP200S3-4, UMP200U3-4	2	50	1	200	250	11	37	1.9 - 2.4	3.1 - 3.9	5.0 - 6.3	410164-003 (40)

Table 2. Electrical Service Information (for UMPs Containing a Faradyne Motor with End View B)

Required power supply rating for 60 Hz, 1 phase pumps is 208 - 230 Vac. For 50 Hz, 1 phase pumps, required rating is 220 - 240 Vac.

UMP Model No.	HP	Hz	PH	Voltage Fluctuation Range		Max. Load Amps	Locked Rotor Amps	Winding Resistance (Ohms)			Capacitor Kit (µF)
				Min.	Max.			Black-Orange	Red-Orange	Black-Red	
AGUMP33S1, UMP33U1	1/3	60	1	200	250	4.0	10	8.9 - 10.8	11.7 - 14.2	17.4 - 21.1	144-224-5 (17.5)
E85AGUMP75S1, UMP75U1	3/4	60	1	200	250	6.5	19	4.6 - 5.6	7.0 - 8.5	11.6 - 14.0	410164-001 (17.5)
E85AGUMP150S1, UMP150U1	1-1/2	60	1	200	250	10.5	33	2.6 - 3.2	6.6 - 8.0	9.2 - 11.2	410164-002 (25)
E85X3AGUMP150S1, X3UMP150U1	1/1/2	60	1	200	250	10.5	33	2.6 - 3.2	6.6 - 8.0	9.2 - 11.2	410164-002 (25)
E85AGUMP200S1-3, UMP200U1-3	2	60	1	200	250	11.4	44	1.7 - 2.1	3.2 - 4.0	5.0 - 6.1	410164-003 (40)
AGUMP75S3-3, UMP75U3-3	3/4	50	1	200	250	5.8	18	4.9 - 5.9	11.0 - 12.2	15.0 - 18.2	410164-001 (17.5)
AGUMP150S3-3, UMP150U3-3	1-1/2	50	1	200	250	10	31	2.7 - 3.3	13.2 - 16.1	16.0 - 19.4	410164-002 (25)
X4AGUMP150S3, X4UMP150U3	1-1/2	50	1	200	250	10	31	2.7 - 3.3	13.2 - 16.1	16.0 - 19.4	410164-002 (25)
AGUMP200S3-4, UMP200U3-4	2	50	1	200	250	11	38	2.0 - 2.4	5.8 - 7.0	7.8 - 9.5	410164-003 (40)

Table 3 lists UMP weights and lengths and Table 4 lists pump shut off pressures.

NOTE: The weights and lengths listed below are approximate values and will vary due to manufacturing tolerances.

The optional trapper intake screen is available as a field installed accessory. Trapper options will increase the length of the UMP by 3.3 inches (83 mm). For installation instructions, see Red Jacket installation instructions #051-256-1. For models with floating suction adapter, add 2-3/8 inches (59 mm) and 4 pounds (1.8 kg).

Table 3. UMP Model Dimensions

UMP Model		Franklin Motor (Use these lengths for UMPs with end view A shown in Figure 8)		Faradyne Motor (Use these lengths for UMPs with end view B shown in Figure 8)		Weight		
		HP	in.	mm	in.	mm	lb.	kg
UMP33U1, AGP33R1		1/3	15-1/2	390	15-3/8	391	24	11.0
UMP75U1, E85AGUMP75S1		3/4	17-3/4	447	17-5/8	448	28	12.7
UMP75U3-3, AGUMP75S3-3		3/4	20	507	19-7/8	505	30.5	13.9
UMP150U1, E85AGUMP150S1		1-1/2	20-1/2	519	20-5/8	524	34	15.5
X3P150U1, E85X3AGUMP150S1		1-1/2	21-1/4	540	21-1/2	546	35	15.8
UMP150U3-3, AGUMP150S3-3		1-1/2	22-1/4	565	22-1/4	565	34	15.5
X4P150U3, X4GUMP150S3		1-1/2	22-3/4	576	22-7/8	581	35	15.9
UMP200U1-3, E85AGUMP200S1-3		2	24-1/4	618	24-5/8	626	36	16.3
UMP200U3-4, AGUMP200S3-4		2	26	660	26-1/4	667	38	17.2

Table 4. Approximate Pump Shut Off Pressures

UMP Model	Approximate Shut Off Pressure
AGUMP33S1, UMP33R1	25 psi (172 kPa) .74 SG @ 60°F (15°C)
E85AGUMP75S1, UMP75U1	28 psi (193 kPa) .74 SG @ 60°F (15°C)
E85AGUMP150S1, UMP150U1	30 psi (207 kPa) .74 SG @ 60°F (15°C)
E85X3AGUMP150S1, X3UMP150U1	43 psi (297 kPa) .74 SG @ 60°F (15°C)
AGUMP75S3-3, UMP75U3-3	30 psi (207 kPa) .74 SG @ 60°F (15°C)
AGUMP150S3-3, UMP150U3-3	32 psi (220 kPa) .74 SG @ 60°F (15°C)
X4AGUMP150S3, X4UMP150U3	40 psi (275 kPa) .74 SG @ 60°F (15°C)
E85AGUMP200S1-3, UMP200U1-3	43 psi (297 kPa) .74 SG @ 60°F (15°C)
AGUMP200S3-4, UMP200U3-4	43 psi (297 kPa) .74 SG @ 60°F (15°C)

Programming the Motor Type



WARNING! Disconnect, lock out, and tag power to the IQ box at the panel before starting this procedure.

1. Open the IQ box cover.
2. Place the Bypass Jumper in the Bypass Position (Figure 9)
3. Set the five Motor Type Programming DIP switches (Figure 9) to the positions indicated in Table 5 for your Motor Type.
4. Close and secure IQ Box cover.
5. Reapply power to the IQ Box. (Hook signal must be Off).
6. Locate the Code LED Indicator and the Reset/Calibration button on the side of the IQ Box. Depress the Reset/Cal button 20 seconds as you observe the Code LED flashing sequence shown in Table 6. Note the number of Green flashes for your Motor Type.






Table 5. Motor Type Programming

Number of Code LED Flashes	Switch Position					Manufacturer	Motor
	1	2	3	4	5		
1	OFF	OFF	OFF	OFF	OFF	FARADYNE	1/3 60 Hz
2	OFF	OFF	OFF	OFF	ON		3/4 60 Hz
3	OFF	OFF	OFF	ON	OFF		1.5 60 Hz
4	OFF	OFF	OFF	ON	ON		2.0 60 Hz
5	OFF	OFF	ON	OFF	OFF		X3
6	OFF	OFF	ON	OFF	ON		3/4 50 Hz
7	OFF	OFF	ON	ON	OFF		1.5 50 Hz
8	OFF	OFF	ON	ON	ON		2.0 50 Hz
9	OFF	ON	OFF	OFF	OFF		X4

Table 5. Motor Type Programming

Number of Code LED Flashes	Switch Position					Manufacturer	Motor
	1	2	3	4	5		
10	ON	OFF	OFF	OFF	OFF	FRANKLIN	1/3 60 Hz
11	ON	OFF	OFF	OFF	ON		3/4 60 Hz
12	ON	OFF	OFF	ON	OFF		1.5 60 Hz
13	ON	OFF	OFF	ON	ON		2.0 60 Hz
14	ON	OFF	ON	OFF	OFF		X3
15	ON	OFF	ON	OFF	ON		3/4 50 Hz
16	ON	OFF	ON	ON	OFF		1.5 50 Hz
17	ON	OFF	ON	ON	ON		2.0 50 Hz
18	ON	ON	OFF	OFF	OFF		X4
SOLID	ANY OTHER SETTING					UNKNOWN	UNKNOWN

Table 6. Reset/Cal Button and LED Indicator Actions

LED	Reset/Cal Button - Time Depressed	Action
Off 	Start	Press And Hold The Reset Button
Green 	5 seconds	Clears Alarms
Red 	10 seconds	Queues Calibration
Off 	20 seconds	Cancel calibration. If in Bypass mode, reads and stores Motor Type.
Green 	20 seconds	Flashes saved Motor Type code (see Table 5)

- Release the Reset/Cal button after confirming the Green LED has flashed the correct number of times for your Motor Type as shown in Table 5.



WARNING! Disconnect, lock out, and tag power to the IQ box at the panel before starting these steps.

8. Disconnect power from the IQ Box.
9. Place the Bypass Jumper in the Normal Position.
10. The unit must be calibrated every time the Motor Type programming is performed even if the Motor Type does not change. Set the five DIP switches to the desired pump type and mode / role select configuration (see Figure 9). NOTE: The unit will not calibrate if a Motor Type has not been programmed.

Setup Switch Chart

Each controller must have its duty established through the dip switch bank labeled SW1 on the circuit board (Figure 9).

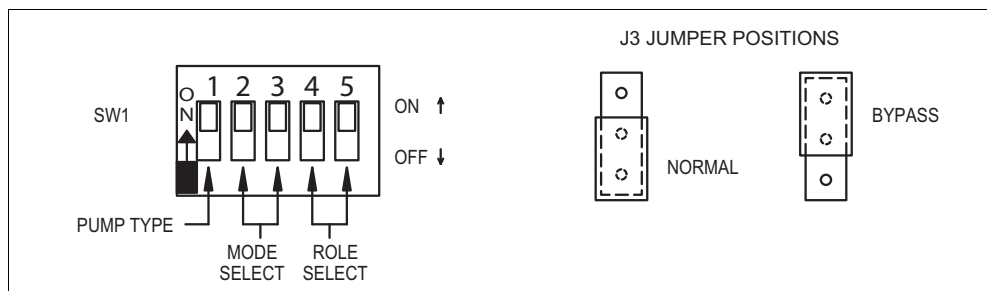


Figure 9. Dip Switch SW1 and Bypass Jumper J3

Follow Table 7 below to properly set the five switches for the controller.

Table 7. Motor Type Selections

Pump Type	Switch	Mode Select	Switch		Role Select	Switch	
	1		2	3		4	5
Standard	ON	Stand Alone	ON	ON	Unit 1	ON	ON
X-Series	OFF	Manifolded PLLD	ON	OFF	Unit 2	ON	OFF
		Manifolded Alternating	OFF	ON	Unit 3	OFF	ON
		Manifolded Direct	OFF	OFF	Unit 4	OFF	OFF

Manifolded PLLD mode allows interfacing with an ATG console. This mode has special communication wiring requirements. Refer to Figure 4 for IQ with manifolded PLLD systems or Figure 5 for IQ with manifolded DPLLD systems

Manifolded Direct mode allows for a primary pump to initiate all dispensing events and secondary pumps to help when required. The control box set as Unit 1 (switch 4 & 5 on) is the Primary.

Initial Calibration

Once all of the wiring is complete and the dip switch and jumpers are set the cover can be attached to the enclosure. Every controller in the system must be calibrated at this time.



WARNING! Power to the controller should only be applied when all wiring is connected and the cover is installed.

1. Energize the supply voltage to the control box. At this time the indicator on the side of the enclosure should illuminate green acknowledging circuits are energized. A single red flash from the indicator signals that the controller has not been calibrated.
2. Press and hold the Reset/Cal button on the side of the enclosure for 10 seconds until the indicator turns red.
3. Release the Reset/Cal button. The controller will automatically start the pump and perform a calibration procedure. Once the procedure is complete the pump will shut off and the indicator will display solid green. Should a dispenser handle be lifted during the calibration procedure the controller will suspend the calibration and dispense fuel as long as the handle remains lifted. A suspended calibration procedure is indicated by alternating red and green indication through the duration of the dispense event. Once the dispensing event is over the controller will perform the calibration procedure. Anytime that the pump or dispensing equipment has been replaced perform a new calibration to update the stored information in memory.
4. The saved Motor Type can be verified with the Bypass jumper in the Normal position.
5. Depress the Reset/Calibration button for 20-seconds – continue holding the button in until the Green LED has flashed the Motor Type code.
6. If the number of green flashes matches your Motor Type code noted in Step 6 on page 11 above, The IQ Box is now ready for operation.

Troubleshooting



WARNING! If at any time during a troubleshooting procedure the enclosure must be opened, disconnect controller power prior to removal of the cover. The input terminals D1 and D2 are powered from the dispenser which is on a different circuit and may be energized even with the control box power disconnected. Remember to remove power to dispenser circuits that energize the D1 and D2 terminals of TB1 whenever removing power to service the unit.

Basic Indicator Functions

- Solid green – controller circuit is energized
- Flashing green – pump is running

Description of Fault Conditions

The indicator on the side of the enclosure flashes the following alarms in red:

Table 8. Indicator Fault Conditions

# of Flashes	Condition
1	Uncalibrated Controller
2	Overcurrent Condition – Pump Shutoff
3	Dry Run Detected – Pump Shutoff
4	Low AC Current
5	Setup/Communication Error
6	Low Line Voltage < 200Vac
7	Bypass Mode
8	Extended Run Condition

Uncalibrated Controller

This fault indicates that the controller has not been run through an initial calibration to setup all critical points for pump protection. The device will operate the pump if a dispenser signal is detected but cannot correctly monitor pump until initialized. See Calibration Section. NOTE: The unit will not calibrate if the Motor Type has not been programmed.

Overcurrent Condition

This fault indicates that the device detected a high current in the pump's wiring which could be either a short in the wiring between the M1 and M2 terminals to ground or a locked rotor in the pump. The following procedure will determine if wiring must be replaced or the pump must be removed and replaced.



WARNING! Before starting this troubleshooting procedure disconnect all electrical power to the controller including the dispenser inputs. Failure to do so may **COULD CAUSE DAMAGE TO PROPERTY, ENVIRONMENT, RESULTING IN SERIOUS INJURY OR DEATH.**

Using an ohmmeter measure the resistance between the M1 and M2 terminals to ground. Ground can be found at the screw on the enclosure base. Both measurements should be greater than 1Meg ohm. Any measurement less may indicate a short in wiring between the control box and the submersible pump. The location of the short can be determined by breaking the wiring connections in the junction box at the pump's packer/manifold and taking ohmmeter readings on both sides of the circuit.

Refer to the manual for the extractable pump on instructions for its wiring, servicing, or replacement. Reset the controller by pressing the reset button momentarily and verify operation once condition is resolved, all wiring reconnected, and after power is reapplied.

Dry Run

This fault will shut off the pump since the level of the product has fallen below the suction end of the pump. The controller will automatically reset and start the pump when the next dispenser signal is received. Add fuel to the tank to restore operation.

Low AC Current

This fault indicates that the submersible pump will not operate. One of the following conditions are present: wire disconnected resulting in open circuit, thermal switch in motor has opened due to overheating, or the control relay has failed and the contacts will not close.

Setup/Communication Error

Five red flashes indicate that the controller has detected an improper dip switch setup or a missing connection on the RS-485 communication cable when set to manifolded operation. Verify that each controller has a unique unit number setting on the SW1 dip switch. Insure that all controllers have a communication cable connection unless in standalone mode.

Low Line Voltage

This fault will not shut off the pump but will indicate if at any time the line falls below 200V which is the minimum specified operating voltage.

Bypass Mode

If jumper J3 is set to bypass this mode will be displayed. Use this only to verify operation between dispenser and pump since controller cannot provide pump protection in this mode. Return the jumper to the normal condition to reset this alarm and have the controller monitor the pump.

Extended Run

Use this indicator to signal any pump that has run for more than 6 hours continuously. This may also indicate a nozzle that has not been properly stowed after dispensing.

Contact Red Jacket Technical Support for additional troubleshooting information at 1-800-323-1799.

