VEEDER-ROOT

Manual No: **D051-330** • Revision: **M**

IQ Control Box

Installation and Owner's Manual

Model: 880-051-1
880-052-1
880-058-1
880-059-1

REDJACKET®

Notice

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1. Fax Bill of Lading to V/R Customer Service at 800-234-5350.
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1. Customer files claim with carrier.
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3. If "lost" equipment is delivered at a later date and is not needed, VR will allow a Return to Stock without a restocking fee.
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RETURN SHIPPING

For the parts return procedure, please follow the instructions in the "General Returned Goods Policy" pages of the "Policies and Literature" section of the Veeder-Root North American Red Jacket Mechanical Products Price Book. Veeder-Root will not accept any return product without a Return Goods Authorization (RGA) number clearly printed on the outside of the package.

RESPONSIBILITIES OF THE INSTALLER AND STATION OWNER

This installation, operation and service instruction manual shall be left with the owner of the service station at which this equipment is installed. Retain these instructions for future use and provide them to persons servicing or removing this equipment.

Introduction

Installation and Wiring Instructions

Troubleshooting

Appendix A - TLS-450PLUS Diagnostic Monitoring of Red Jacket IQ Control Boxes

Figures

Tables

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.

Appendix A provides application, technical and installation guidelines for Veeder-Root certified technicians who will be installing and setting up the Red Jacket IQ Control Standard Diagnostic Feature with a TLS-450PLUS system.

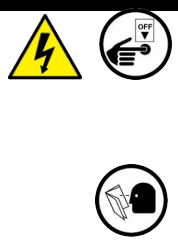
Retain this instruction manual with the equipment after installation for future use.

Safety Precautions

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

	**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.		**ELECTRICITY** High voltage exists in, and is supplied to, the device. A potential shock hazard exists.
NOTICE	**NOTICE** Is used to address practices not related to physical injury.	⚠DANGER	**DANGER** Indicates a hazardous situation which, if not avoided, will result in death or serious injury.
⚠CAUTION	**CAUTION** Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury or property damage.	⚠WARNING	**WARNING** Indicates a hazardous situation which, if not avoided, could result in death or serious injury or substantial property damage.
	**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.		**STATIC SENSITIVE COMPONENTS** Wear grounded anti-static wrist strap before handling the printed circuit boards and mounted components.

⚠ WARNING



FAILURE TO COMPLY WITH THE FOLLOWING WARNINGS AND SAFETY PRECAUTIONS COULD CAUSE DAMAGE TO PROPERTY, ENVIRONMENT, RESULTING IN SERIOUS INJURY OR DEATH.

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.**

Specifications

Parameter	Value	Unit
Electrical		
Input Voltage Range	200 to 250	V
Input Voltage Frequency	47.5 to 61.8	Hz
Maximum Motor Rating	2	HP
Dispenser Interface (-051, -058)	101 to 132	VAC
Dispenser Interface (-051, -058)	3	mA
Dispenser Interface (-052, -059)	192 to 264	V
Dispenser Interface (-052, -059)	5	mA
Voltage Reading Accuracy	0.1	%
Current Reading Accuracy	0.8	%
Communications	RS-485	
Environmental		
Ambient Temperature Range	0 to 40	°C
Storage Temperature Range	-20 to 65	°C
Mechanical		
External Dimensions (-051, -052)	6.75 x 7.63 x 4.00	Inches (Height x Width x Depth)
External Dimensions (-058, -059)	6.75 x 7.63 x 6.05	Inches (Height x Width x Depth)
Terminal Block Screw Size	8-32	

NOTES:

1. All specifications at an ambient temperature of 25 °C.

2. Wiring must be rated 90°C minimum.

IQ Manifold Control Information

The main difference between Manifold PLLD, Manifold Direct and Manifold Alternation modes shown in Figure 1 is which IQ Box unit turns on first when there is an active hook signal.

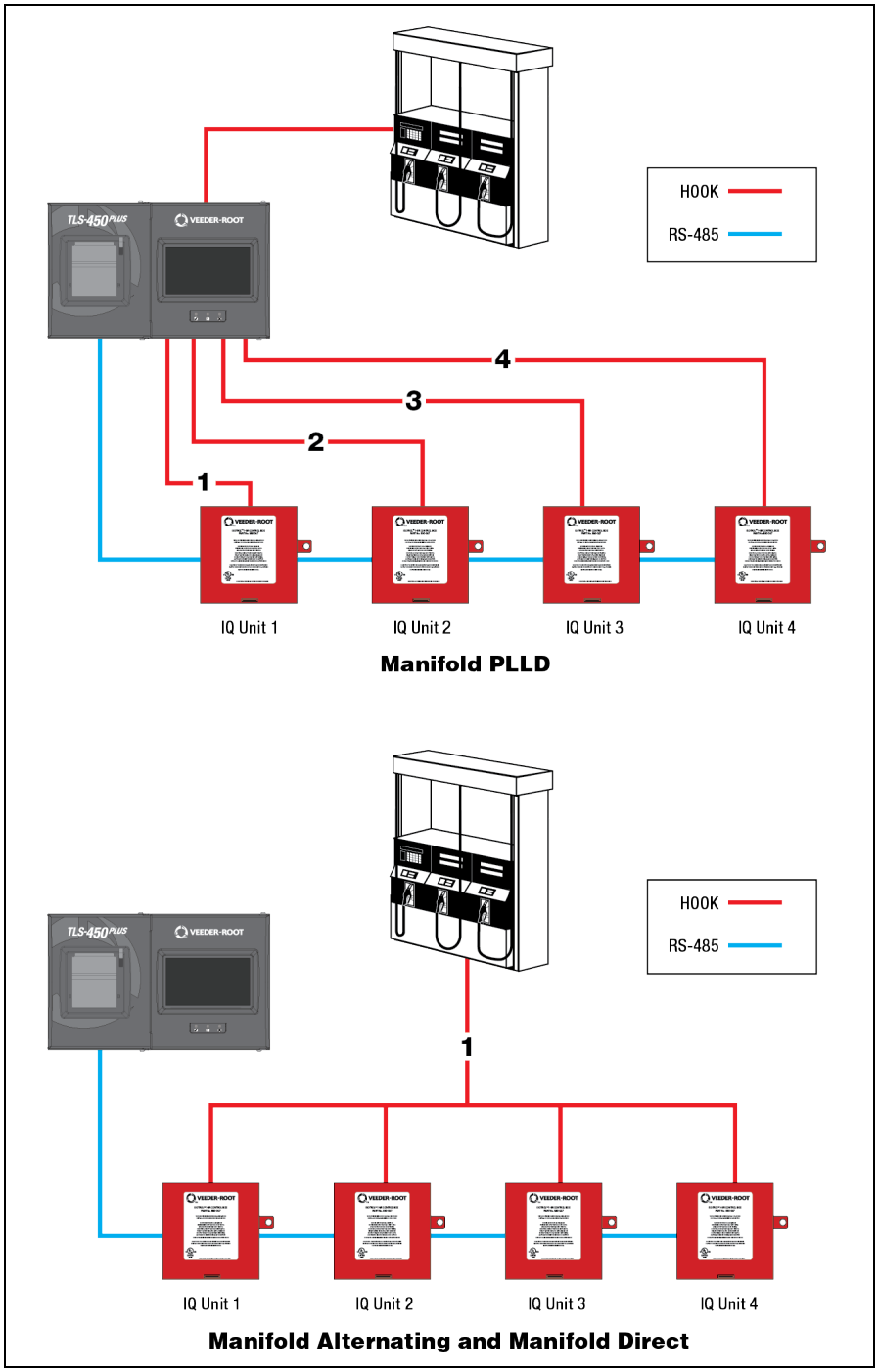


Figure-1. Simple Wiring Configuration Diagrams

Manifolded PLLD – TLS Decides (multiple hook signals)

Overview

In this mode the devices operate while being networked together over RS485 and with a PLLD installation. In this scenario, each IQ box receives a separate hook signal from the TLS. The TLS is then able to turn on the devices with a hook signal to activate a PLLD test. Essentially any device can be turned on first via hook switch. The helping units will then initialize the turn on sequentially over their own RS485 communication.

Operating Example

When a pump request is made by a dispenser the TLS receives the signal. The TLS then decides which pump to turn on first. This can be based on which tank has the highest fuel height. After the TLS sends the hook signal to the designated device it begins pumping. As more nozzles are opened there becomes a point where the power drawn by the motor reaches its threshold. At this point the IQ box sends a request for the next device in line to turn on in conjunction with itself. For example, the TLS turns on IQ Box Unit 2 first because that was in the tank with the most volume. When the power threshold is reached Unit 2 will send a request over RS485 for the next unit in line to turn on. Unit 3 will then turn on and acknowledge the request was complete. If more nozzles are opened yet, unit 3 will send a request for the next unit in line to turn on over RS485. All pumps once turned on continue to stay on until the active hook signal is disabled. Once disabled they will all turn off. This process repeats at the next active hook signal.

Manifolded Direct – Unit 1 always turns on first (One shared hook signal)

Overview

In this setup the Unit 1 always turns on first with a hook signal. The helping units will then turn on sequentially. All units share a hook signal in this mode, so all units have the hook signal engaged and the hook is controlled by the Master Hook switch.

Operating Example

When a pump request is made by a dispenser every IQ Box receives this information. Unit 1 will always accept or try to accept pending any faults. Once it acknowledges it sends out an acknowledged signal over RS485 and all other IQ boxes will wait in standby for an RS485 message to request to turn on. As more nozzles are opened there becomes a point where the power drawn by the motor reaches its threshold. At this point the IQ box sends a request for the next device in line to turn on in conjunction with itself. So, in this case Unit 2 will always turn on next. Then when Unit 2 is running and more flow is needed it, Unit 3 will be the next to turn on. Lastly Unit 4 will turn on. All pumps once turned on continue to stay on until the active hook signal is disabled. Once disabled they will all turn off. This process repeats at the next active hook signal.

Manifolded Alternating – The devices alternate turning on first every time the hook signal is disabled. (One shared hook signal)

Overview

In this setup the devices take turn passing a token that designates which one will turn on first from a hook signal. The helping units will then turn on sequentially. All units share one common hook signal in this mode, so all units have the hook signal engaged and the hook is controlled by the Master Hook switch.

Operating Example

When a pump request is made by a dispenser every IQ Box receives this information. Unit 1 will accept, or try to accept pending any faults, this initial hook signal and then pass a token for Unit 2 to turn on first at the next pump cycle. Once Unit 1 acknowledges the hook signal, it sends out an acknowledgment over RS485 and all other IQ boxes will wait in standby for an RS485 message to request to turn on. As more nozzles are opened there

becomes a point where the power drawn by the motor reaches its threshold. At this point the IQ box sends a request for the next device in line to turn on in conjunction with itself. So, in this case Unit 2 will always turn on next. Then when Unit 2 is running and more flow is needed it, Unit 3 will be the next to turn on. Lastly Unit 4 will turn on. All pumps once turned on continue to stay on until the active hook signal is disabled. Once the hook signal is disabled, they will all turn off. On the next hook signal the next unit in line will turn on. So, if 1 turned on first, 2 will be the first to accept the hook request on the next cycle. On the next cycle Unit 3 will be the first to turn on and so forth. If it is the last Unit in the setup, it will pass the token back to Unit 1.

Installation and Wiring Instructions

⚠WARNING **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 IQ 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 or inside the enclosure cover, connect the input power L1 and L2 wires to the terminal block labeled TB1 (see Figure 2). 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 200 to 250 Vac.
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 cover (see Figure 3).
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 or TLS450PLUS monitoring 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 and/or the TLS-450PLUS as shown in Figure 4. Belden 3106A, or equivalent cable is acceptable. If adding a TLS-450PLUS monitoring configuration to an existing controller installation, reuse the existing cable between the controllers. 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 5 and Figure 6. This cable must be installed in conduit.

NOTICE **Approved component only. Total systems installed shall comply with all codes.**

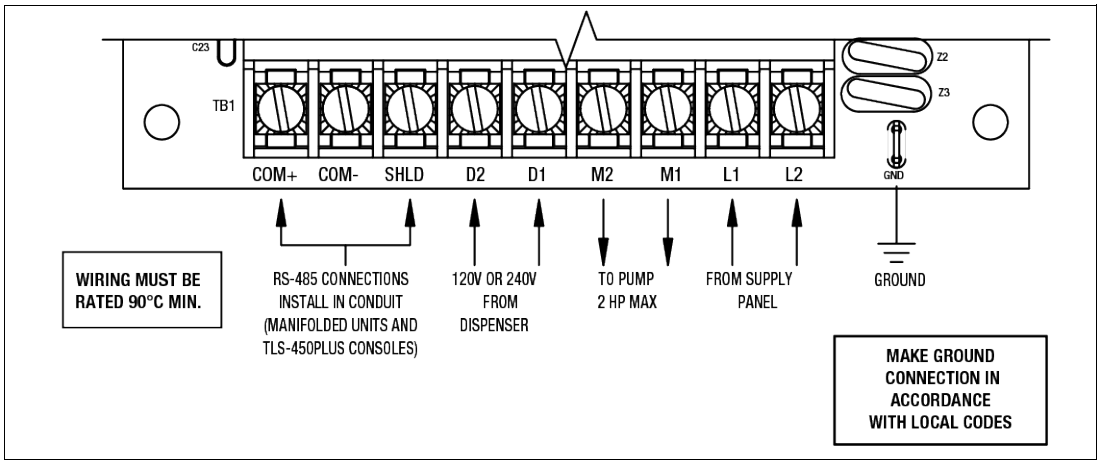


Figure-2. Terminal Block TB1, Models -051, -052

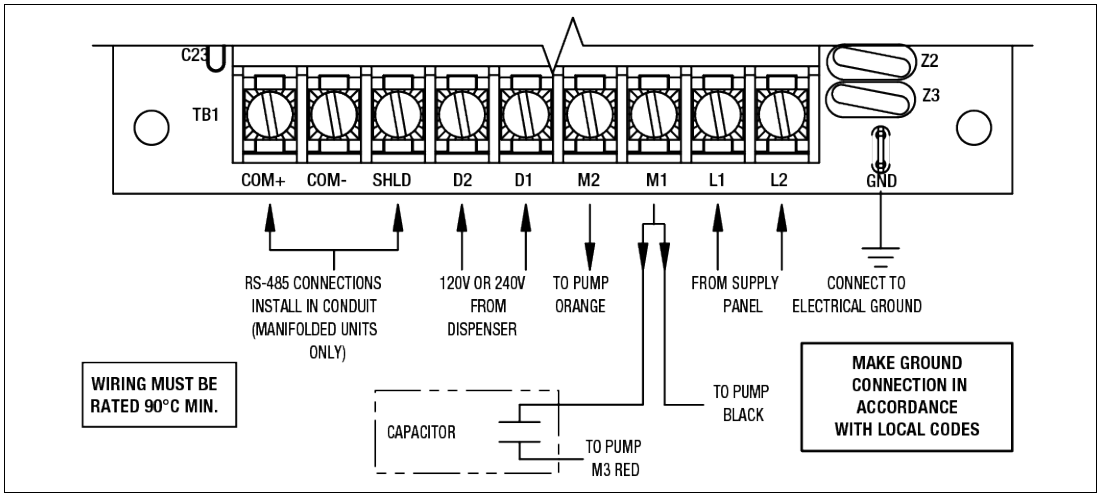


Figure-3. Terminal Block TB1, Models -058, -059

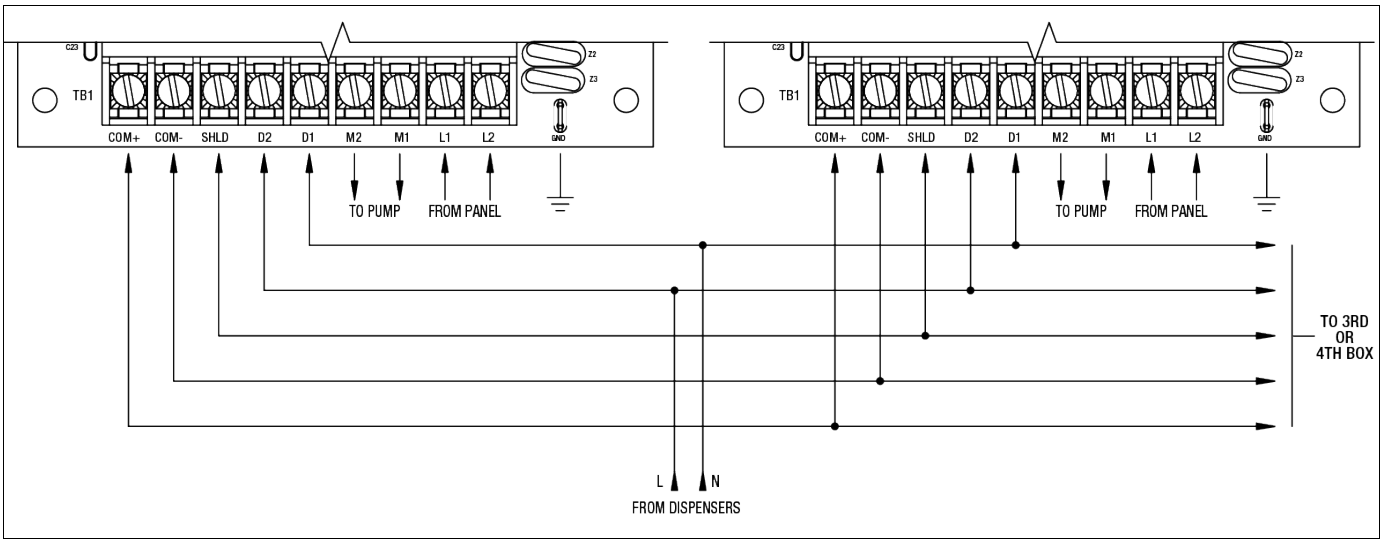


Figure-4. Wiring Diagram for Manifolded Systems

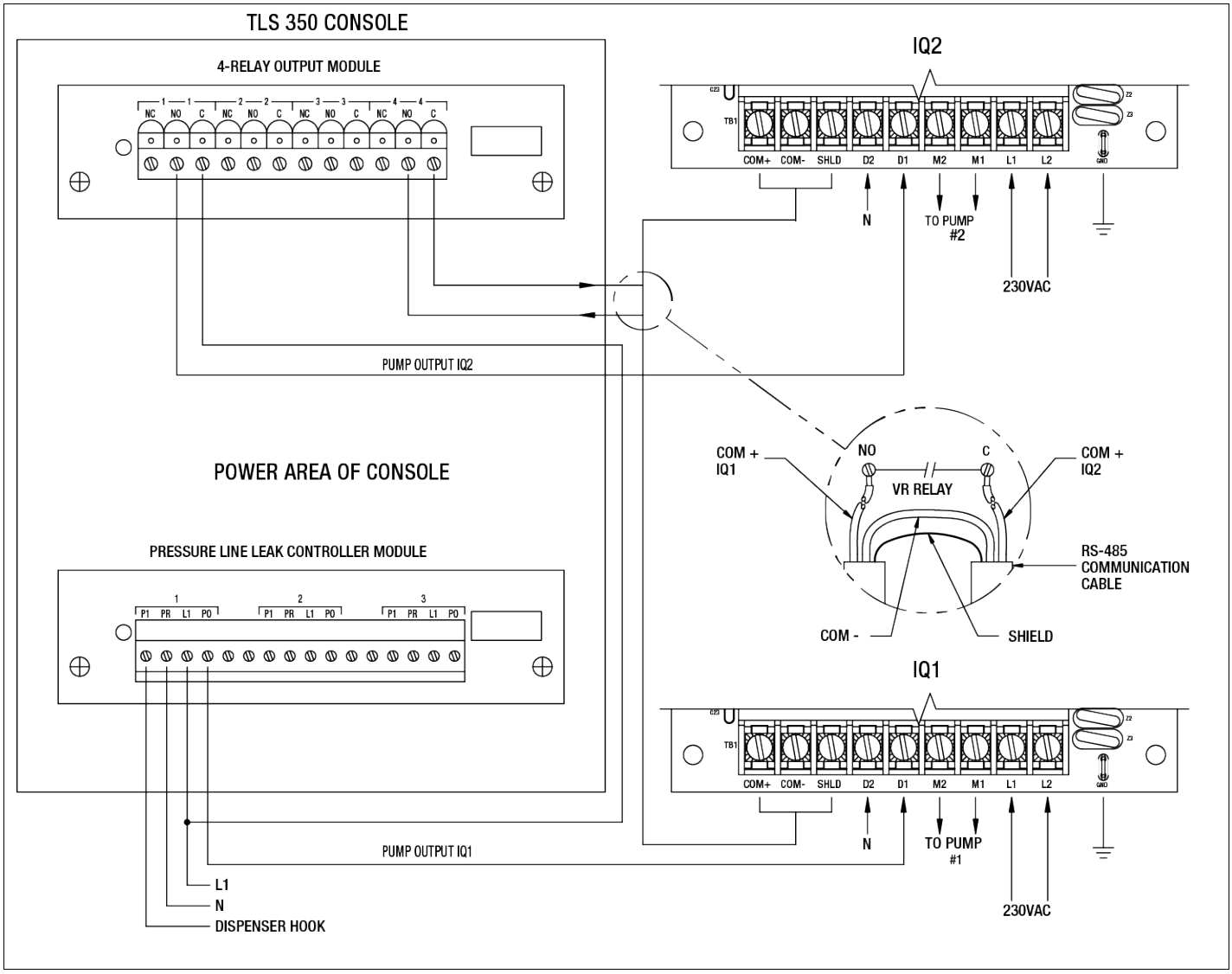


Figure-5. Wiring Diagram for IQ Control Box with TLS-350 Manifolded PLLD Systems

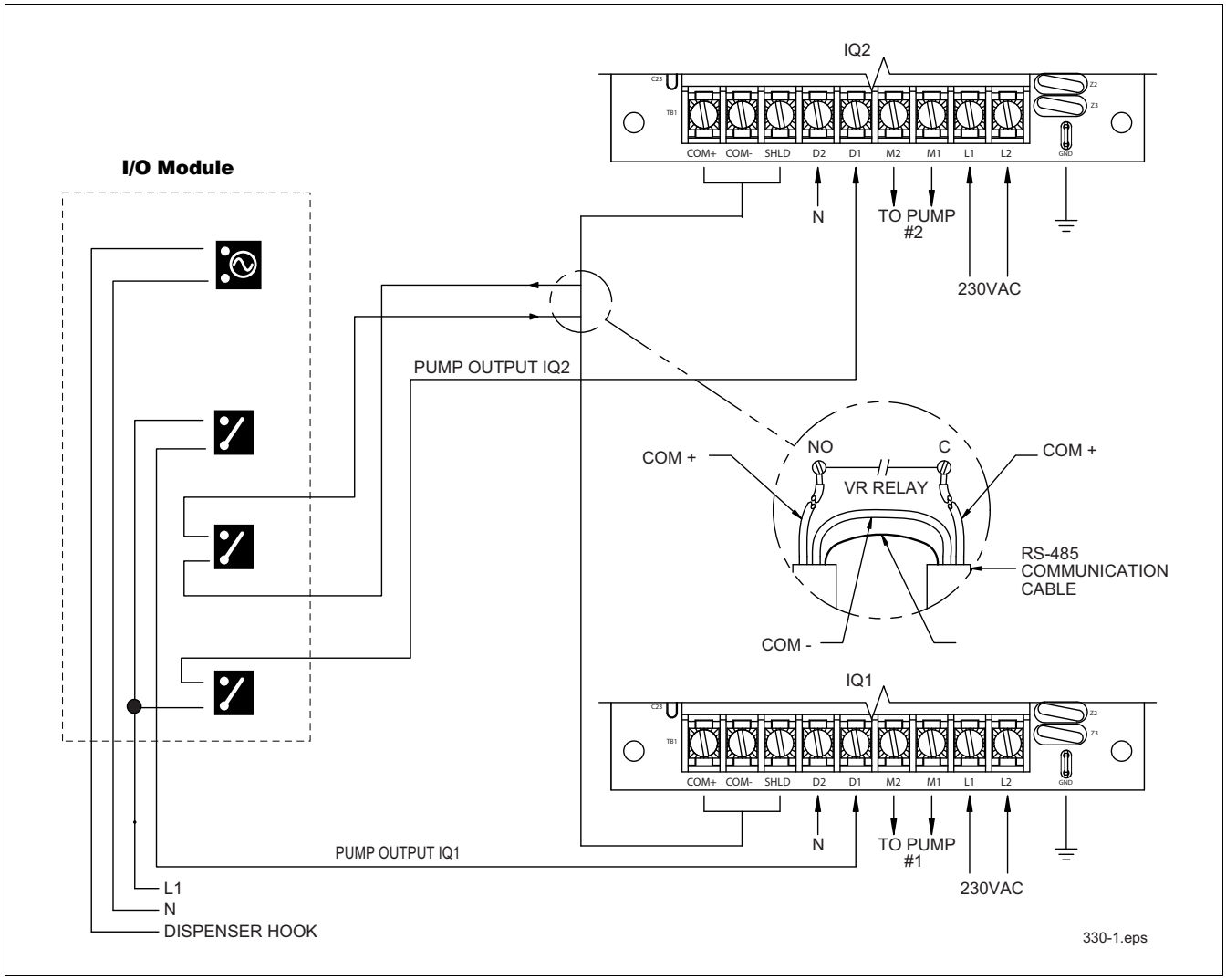


Figure-6. Wiring Diagram for IQ Control Box with TLS-450PLUS Manifolded DPLLD Systems

Determine the Motor Type

⚠WARNING **Warning! Disconnect, lock out, an tag power to the IQ Control 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 10). UMPs containing a Faradyne motor will also have an 'FM' designation printed on the UMP shell.

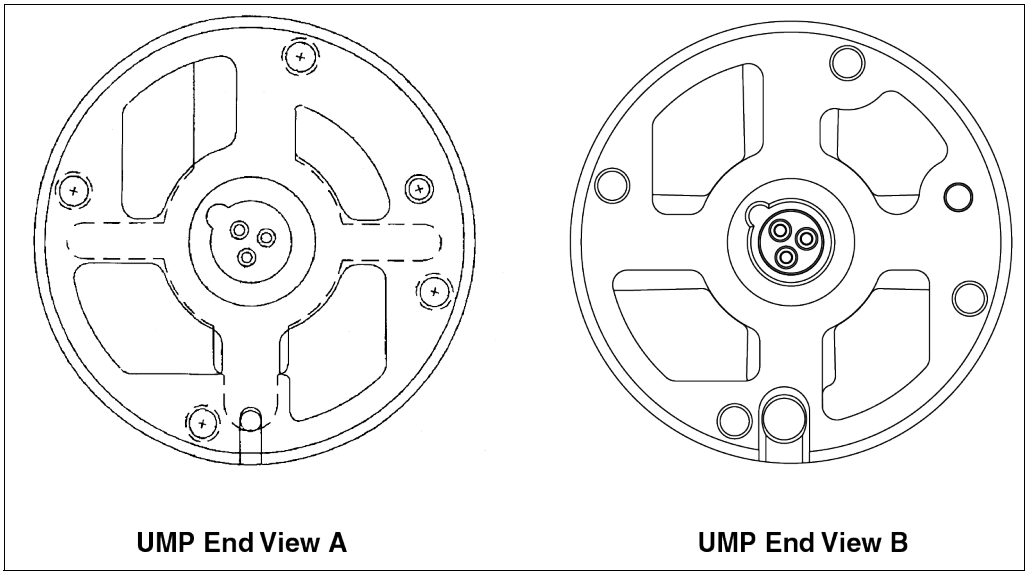


Figure 10. Identifying UMP Models By Their End View

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.

NOTICE **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

		Franklin Motor (Use these lengths for UMPs with end view A shown in Figure 10)		Faradyne Motor (Use these lengths for UMPs with end view B shown in Figure 10)		Weight	
UMP Model	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 Connected To The IQ Control Box

WARNING **Warning! Disconnect, lock out, an tag power to the IQ Control Box at the panel before starting this procedure.**

1.Open the IQ Control Box cover and locate the Bypass/Normal jumper and S1 DIP switches (see Figure 11).

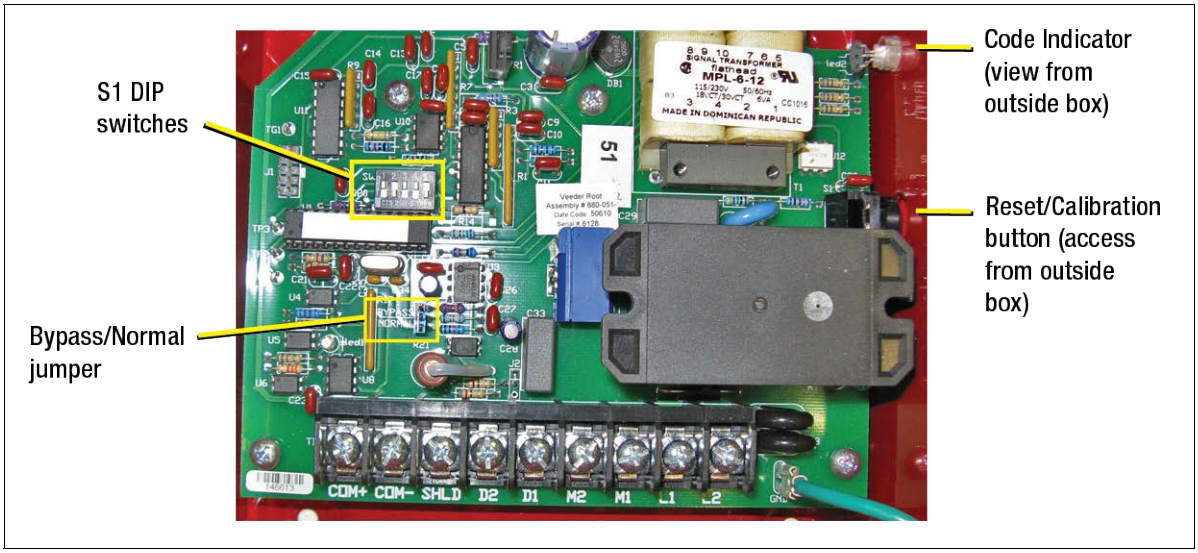


Figure-11. IQ Control Box Programming/Calibration Components

2. Place the Bypass/Normal Jumper in the Bypass position (see Figure 12).

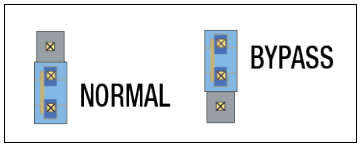


Figure-12. Bypass/Normal Jumper Positions

3. Set the five SW1 DIP switches to the positions indicated in Table 5 for the connected STP Motor Type.

Table-5. Motor Type Programming - Bypass/Normal Jumper In Bypass Position

Number of Green LED Flashes	SW1 DIP Switch Position					Manufacturer	Motor Type
	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
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
ON but not flashing	ANY OTHER SETTING					UNKNOWN	UNKNOWN

4. Close and secure the IQ Control Box cover.
5. Reapply power to the IQ Control Box. (Hook signal must be Off).
6. To verify the motor type, locate the Code LED and the Reset/Calibration button (see Figure 11). Depress and hold the Reset/Calibration button, after approximately 20 seconds the Green LED begins flashing the motor type code. The number of Green flashes (1 to 18) indicates the programmed motor type.

NOTICE **If the green light is on but not flashing, the motor type was incorrectly entered and the motor type must be reprogrammed.**

7. Release the Reset/Cal button after verifying the programmed Motor Type is correct.

8. Disconnect power from the IQ Control Box and open the cover.
9. Place the Bypass/Normal Jumper in the Normal Position (see Figure 12).
10. Reset the SW1 DIP switches to the appropriate positions for the STP connected to the IQ Control Box as shown in Figure 13.
    .

Pump Type	Switch 1	Mode Select	Switch 2	Switch 3	Role Select	Switch 4	Switch 5
Standard	On	Standalone	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

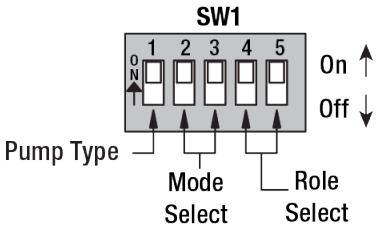


Figure-13. SW1 DIP Settings - Bypass/Normal Jumper In Normal Position

NOTICE **Manifolded PLLD mode allows interfacing with an ATG console. This mode has special communication wiring requirements. Refer to Figure 5 for IQ Control Box with manifolded PLLD systems or Figure 6 for IQ Control Box 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.

11. Close the cover to the IQ Control Box.
12. The IQ Control Box is now ready for calibration.

Calibrating the IQ Control Box

The unit must be calibrated every time the Motor Type programming is performed even if the motor type does not change. NOTE: The unit will not calibrate if a motor type has not been programmed.

1. Apply power to the IQ Control Box. (Hook signal must be Off and no product flowing from the pump). 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. Depress the Reset/Cal button for 10 seconds until the red light flashes, let go of the button and the IQ box will start up the pump for 3 or 4 seconds.
3. This completes the IQ Control Box calibration.

Repeat the Motor Type Programming and Calibration steps for each IQ Control Box.

Troubleshooting

⚠WARNING 

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-6. Indicator Fault Conditions

# of Flashes	Condition
1	Uncalibrated Controller
2	Over-current 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

To turn off the flashing alarm light on the side of the box, press the Reset/Cal button (see Figure 11) until you see a single green light flash of the Code Indicator.

⚠WARNING **Acknowledging the alarms and turning off the flashing red light will not correct the problem that is causing the alarm(s).**

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.

Over-Current 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.

First check the capacitor - replace if required.

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.

Check the capacitor - replace if required.

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 Bypass/Normal jumper is set to Bypass, this mode will be displayed. Use this only to verify operation between dispenser and pump since the controller cannot provide pump protection in this mode. Return the Bypass/Normal jumper to the Normal position 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.

Appendix A

TLS-450PLUS Diagnostic Monitoring of Red Jacket IQ Control Boxes

Equipment Requirements, Installation and Setup

Introduction

This Appendix provides application, technical and installation guidelines for Veeder-Root certified technicians who will be installing and setting up the Red Jacket IQ Control Standard Diagnostic Feature with a TLS-450PLUS system.

Pre-Installation Consideration

Verify site layout and feasibility to install RS-485 communications cables from IQ Control Boxes to TLS-450PLUS Communications bay.

Equipment Requirements

- TLS-450PLUS System Software Upgrade (9W or Higher)- P/N 330020-744. Software upgrades can be downloaded from the Veeder Root Web Site Support page https://www.veeder.com/us/software-downloads.
- TLS-450PLUS I button Intelligent Pump Control Feature P/N 332972-028
- P/N 332869-001; Dual Port RS-485 Communications Module
- Red Jacket IQ Control for each STP installed.
- Red Jacket IQ Control Software Prom Version 3.5 or Higher, P/N 349805-001.
- RS-485 Cabling, shielded cable (Belden 3106A or equivalent SF/UTP cable) - Length as needed between each RJ IQ Control Box and/or the TLS-450PLUS console - customer supplied.
- RJ-45 Connectors as needed to connect comm cables to TLS-450PLUS RS-485 ports - customer supplied.
- Verify site profile to ensure proper equipment is ordered for the application.

Installation Precautions

NOTICE **It is recommended that the site is shut down during these procedures to ensure no interruptions during the IQ Control Box programming and calibration procedures.**

Prior to performing System Software update, I-button upgrade, installation of Dual RS-485 communications Module in the TLS-450PLUS and the Firmware upgrades in the IQ Control Box(s), it is recommended that the RS-485 cabling between the TLS-450PLUS and the IQ Control Boxes has been installed to minimize shutdown time during the system update. (Do not terminate at this time).

Determining Number of RS-485 Ports Needed

Table A-1 contains the allowable TLS-450PLUS Comm Modules and their permissible slots in the console's comm bay.

NOTICE **If both RS-232 ports of the dual RS-232 port module (shipped with the console) are being used you will be limited in the number of RS-485 ports available (Max 3, 2 in Slot 2 and 1 in Slot 3). If only one RS-232 port is being used, you can switch the Dual RS-232 module for a single RS-232 module, move it to slot 3, leaving slots 1 and 2 open for two dual RS-485 port modules.**

Table A-1. TLS-450PLUS Comm Module Compatibility

COMM Modules	TLS-450PLUS Console										Modules Per System	Type
	Slot 1[3]		Slot 2		Slot 3		Slot 4		Slot 5			
	Port 1	Port 2	Port 1	Port 2	Port 1	Port 2	Port 1	Port 2	Port1	Port 2		
RS-232		I		I		I	Ethernet Module (3 Ports) (Fixed)		USB Module (2 Ports) (Fixed)		3	Hardware
Dual RS-232	I	I	I	I							3	
RS-485		I		I		I					3	
Dual RS-485	I	I	I	I							3	
RS-232/RS-485	I	I	I	I							3	
Internal Modem		I		I		I					3	
CDIM	I		I								2	
EDIM[1]	I	I	I	I		I					3	Software
IFSF LON[2]		I		I		I					1	Hardware

[1] *EDIM can be programmed in any position with an RS-232 port - up to 3 per system*

[2] *Can be combined with EDIM*

[3] *Console ships standard with dual RS-232 or dual RS-232/RS-485 in Slot 1*

Turn off, tag and lockout the breaker that supplies power to the IQ Control Box.

1. Go to each IQ Control Box and determine/record its mode/role setting (Figure A-6) or refer to site documentation to identify IQ Control Boxes that are set to standalone and/or manifolded mode and their assigned STP/tank.
2. If in Standalone mode, up to four independent IQ Control Boxes may be daisy chained to a single RS-485 port.
3. If in one of the manifolded modes, IQ Control Boxes must only be connected to IQ Control Boxes on the same manifold (one RS-485 port per manifold).
4. Manifolded and direct mode IQ Control Boxes may be combined on the same TLS-450PLUS and may share a single RS-485 Comm Module as long as they are connected to different RS-485 ports.
5. After determining the number of RS-485 ports needed for the site, it is recommended to install the site RS-485 cables.

Installing RS-485 Wiring Between IQ Control Boxes & TLS-450PLUS

6. Prepare a satisfactory length of CAT5 or better 3-wire cable having a RJ-45 connector on one end (connects to TLS-450PLUS and no connector on the end that connects to the IQ Control Box (see Figure A-1).

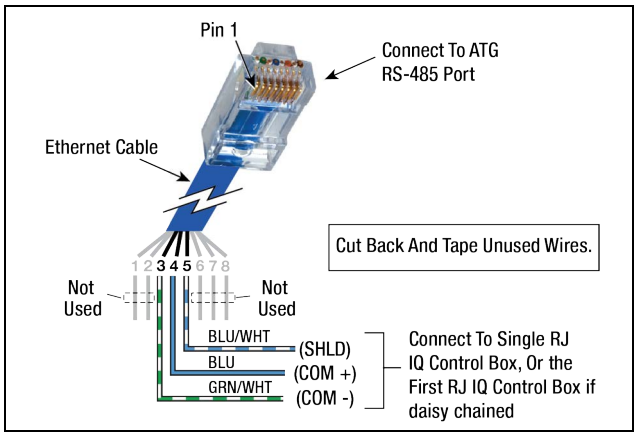


Figure A-1. RS-485 Serial Cable Pin-Outs

7. Run completed RS-485 cables from the TLS-450PLUS to the first IQ Control Box in a daisy chain (see Figure A-2) and between IQ Control Boxes, but do not connect the comm cables to the IQ Control Boxes or to the TLS-450PLUS at this time.

NOTICE **Label each Comm wire with its polarity and the source IQ Control Box.**

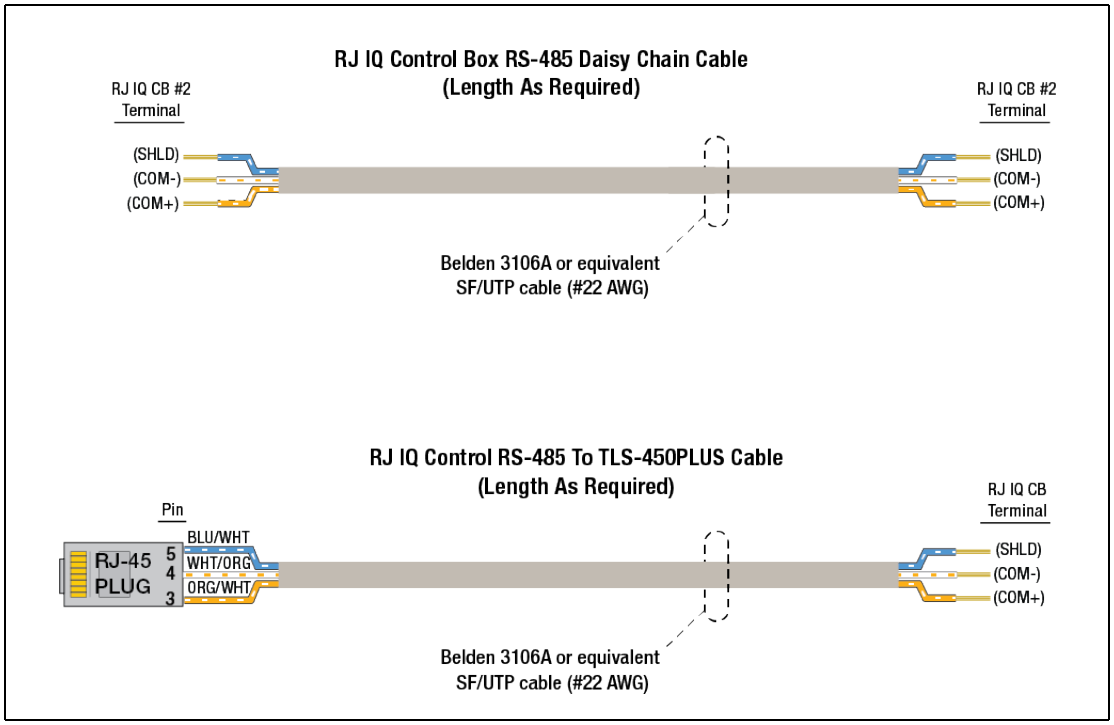


Figure A-2. Example IQ Control Box Comm Wiring Example (Belden 3106A Cable Shown)

Upgrading IQ Control Box Software - Repeat For Each IQ Control Box

Replacing the Software PROM

Before removing electronic components from their anti-static bags read the following static electricity precautions.

- Before handling any components, discharge your body's static electric charge by touching the ground lug on the enclosure.
- Do not remove parts from their anti-static bags until you are ready to install them.
- Do not lay parts on the anti-static bags! Only the insides are anti-static.
- When handling parts, hold them by their edges and their metal mounting brackets.
- Avoid touching components or edge connectors that plug into slots.
- Never slide parts over any surface.

⚠WARNING **Turn off, tag and lockout the breaker that supplies power to the IQ Control Box.**

1. Open the IQ Control Box cover.
2. Attach an anti-static wrist strap onto your wrist and the other end around the ground lug on the enclosure.
3. Locate the Software PROM U1 (see Figure A-3).

Figure A-3. Locating Software Upgrade Components Inside Typical IQ Control Box

4. Position the small hooks in the ends of the chip removal tool under the ends of U1 as shown in Figure A-4. Rock the tool lengthwise as you pull on the chip to lift it out of socket.
5. Orient the new upgrade chip with the end having a semicircle indent pointing toward TP3 as shown in Figure A-4. Carefully align the chip pins over the holes in socket and gently push the chip into the socket. Firmly seat the chip in the socket. Remove and discard the anti-static wrist strap.

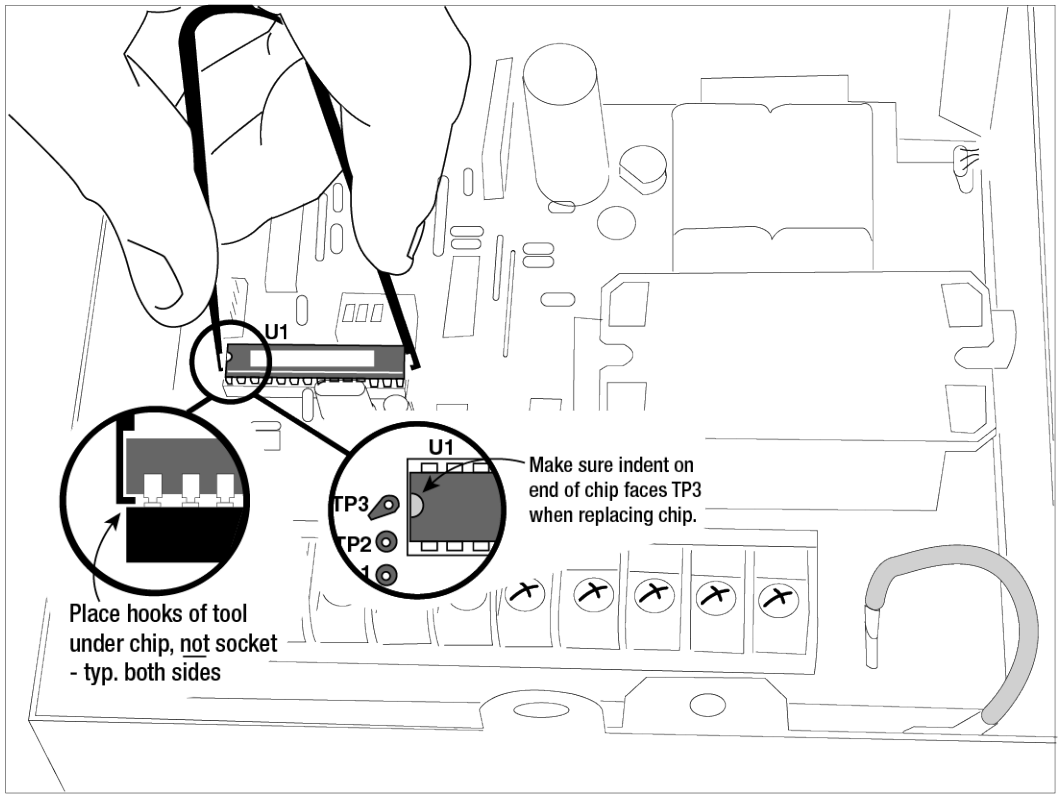


Figure A-4. Removing Software PROM U1 From IQ Control Box

Programming the Motor Type

Turn off, tag and lockout the breaker that supplies power to the IQ Control Box.

1. Place the Bypass/Normal Jumper in the Bypass position (see Figure A-5).

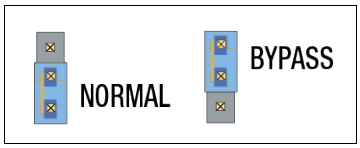


Figure A-5. Bypass/Normal Jumper Positions

2. Set the five SW1 DIP switches to the positions indicated in Table A-2 for the connected STP Motor Type.

Table A-2. Motor Type Programming - Bypass/Normal Jumper In Bypass Position

Number of Green LED Flashes	SW1 DIP Switch Position					Manufacturer	Motor Type
	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 A-2. Motor Type Programming - Bypass/Normal Jumper In Bypass Position

Number of Green LED Flashes	SW1 DIP Switch Position					Manufacturer	Motor Type
	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
ON but not flashing	ANY OTHER SETTING					UNKNOWN	UNKNOWN

3. Close and secure the IQ Control Box cover.
4. Reapply power to the IQ Control Box. (Hook signal must be Off).
5. To verify the motor type, locate the Code LED and the Reset/Calibration button (see Figure A-3). Depress and hold the Reset/Calibration button, after approximately 20 seconds the Green LED begins flashing the motor type code. The number of Green flashes (from 1 to 18) indicates the programmed motor type.

NOTICE **If the green light is on but not flashing, the motor type was incorrectly entered and the motor type must be reprogrammed.**

6. Release the Reset/Cal button after verifying the programmed Motor Type is correct.
7. Disconnect power from the IQ Control Box and open the cover.
8. Place the Bypass/Normal Jumper in the Normal Position (see Figure A-5).

9. Reset the SW1 DIP switches to the appropriate positions for the STP connected to the IQ Control Box as shown in Figure A-6.

.

Pump Type	Switch 1	Mode Select	Switch 2	Switch 3	Role Select	Switch 4	Switch 5
Standard	On	Standalone	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

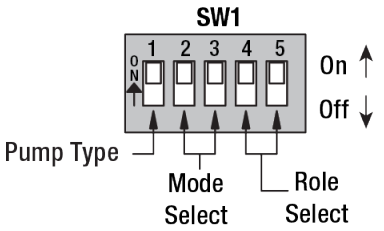


Figure A-6. SW1 DIP Settings - Bypass/Normal Jumper In Normal Position

10. Close the cover to the IQ Control Box.
11. The IQ Control Box is now ready for calibration.

Calibrating the IQ Control Box

The unit must be calibrated every time the Motor Type programming is performed even if the motor type does not change. NOTE: The unit will not calibrate if a motor type has not been programmed.

1. Apply power to the IQ Control Box. (Hook signal must be Off and no product flowing from the pump). 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. Depress the Reset/Cal button for 10 seconds until the red light flashes, let go of the button and the IQ box will start up the pump for 3 or 4 seconds.
3. This completes the IQ Control Box calibration.

TLS-450PLUS Software Upgrade Procedure

1. Insert the Software Maintenance thumb drive into one of the two USB ports (console Comm bay, slot 5).
2. Navigate to the **Menu>Software Maintenance>Download** screen.
3. Touch the Download Source down arrow and select the thumb drive. Notice the Version field displays new software version.
4. Touch the **Download** button to begin the software download.

5. After successful completion of the download (approximately 30 minutes), the 'Download Completed' message appears.
6. Navigate to the **Menu>Software Maintenance>Activate/Revert** screen. Notice the Current version and Available (downloaded) version are displayed.

IMPORTANT! During feature activation, which only takes a few minutes, there must be no dispensing.

7. Touch the box beside the message 'Click to acknowledge the system will be stopped.'
8. Touch the **Activate** button to overwrite the Current of software with the Available (just downloaded) version of software.
9. The Confirmation Needed dialog box displays. Touch the ✓ button to confirm and activate the new software, or touch the X button to cancel the activation.

TLS-450PLUS RJ IQ Monitoring Feature Installation Procedure

IMPORTANT! During feature activation, which only takes a few minutes, there must be no dispensing.

1. Insert the USB Adapter and upgrade I-button from the upgrade kit. Remove the plastic end cap from the USB Adapter.
2. Plug the USB Adapter into one of the two USB ports in the console Comm bay (slot 5).
3. Navigate to the **Menu>Software Maintenance>Upgrade Features** screen.
4. The screen displays the feature which are available to be activated, e.g., **Intelligent Pump Control**. Select the box beside the desired feature.
5. Touch the **Install Feature** button to start the installation process.
6. The current status of the feature install displays:

   - Activation in Progress
7. When you have completed the upgrade features procedure remove the upgrade thumb drive.
8. From the Home Screen, touch the following **Menu > Overview > About** and verify that the features in the upgrade were installed.
9. With the new software version and feature installed perform a system backup onto the site's V-R Backup thumb drive.

Verifying RS-485 Single or Dual Comm Module Jumper Positions

Prior to installing single or dual RS-485 modules, verify their jumper positions as shown in Figure A-7 and Figure A-8 respectively.

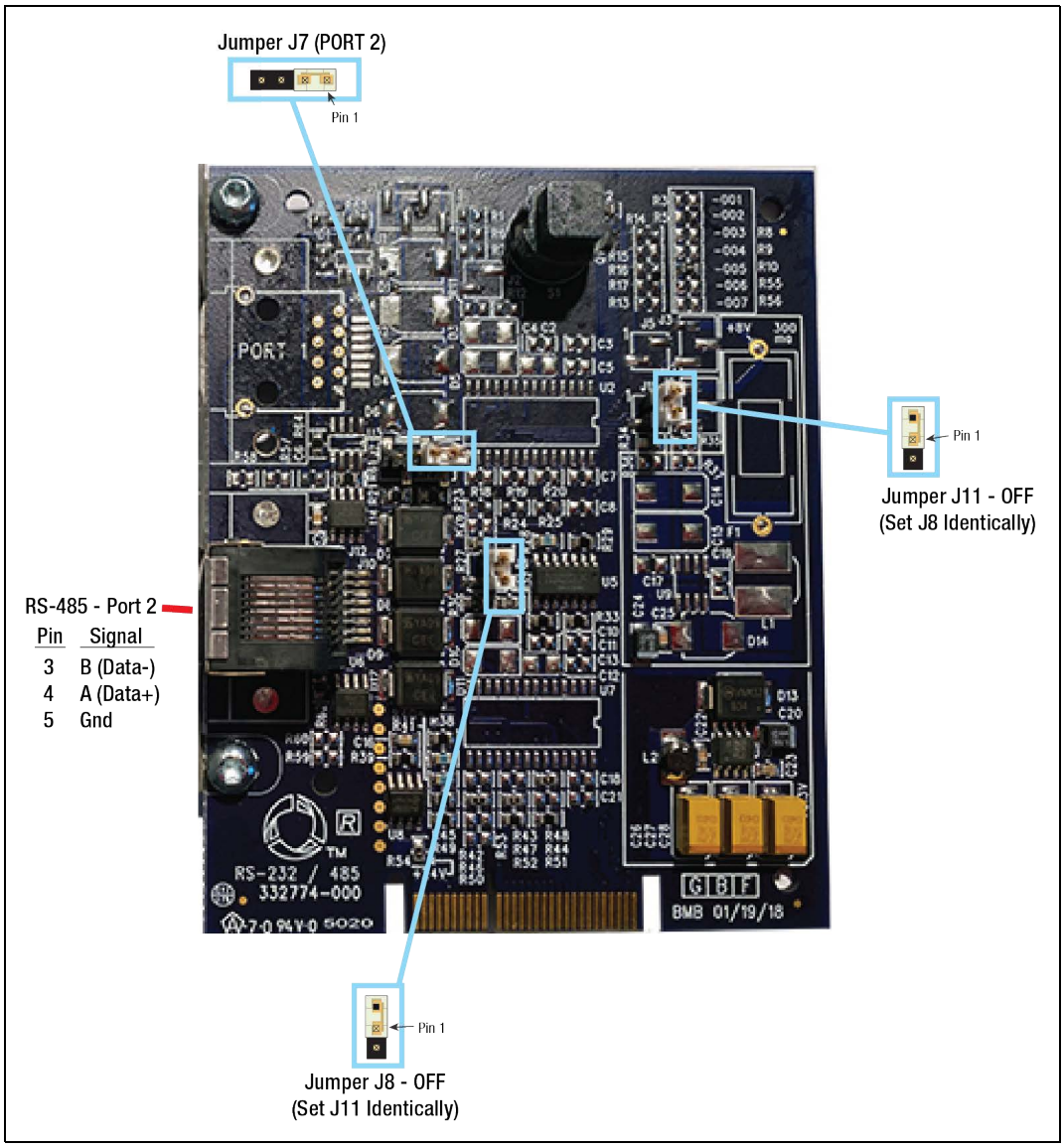


Figure A-7. Single RS-485 Port Module Jumper Positions

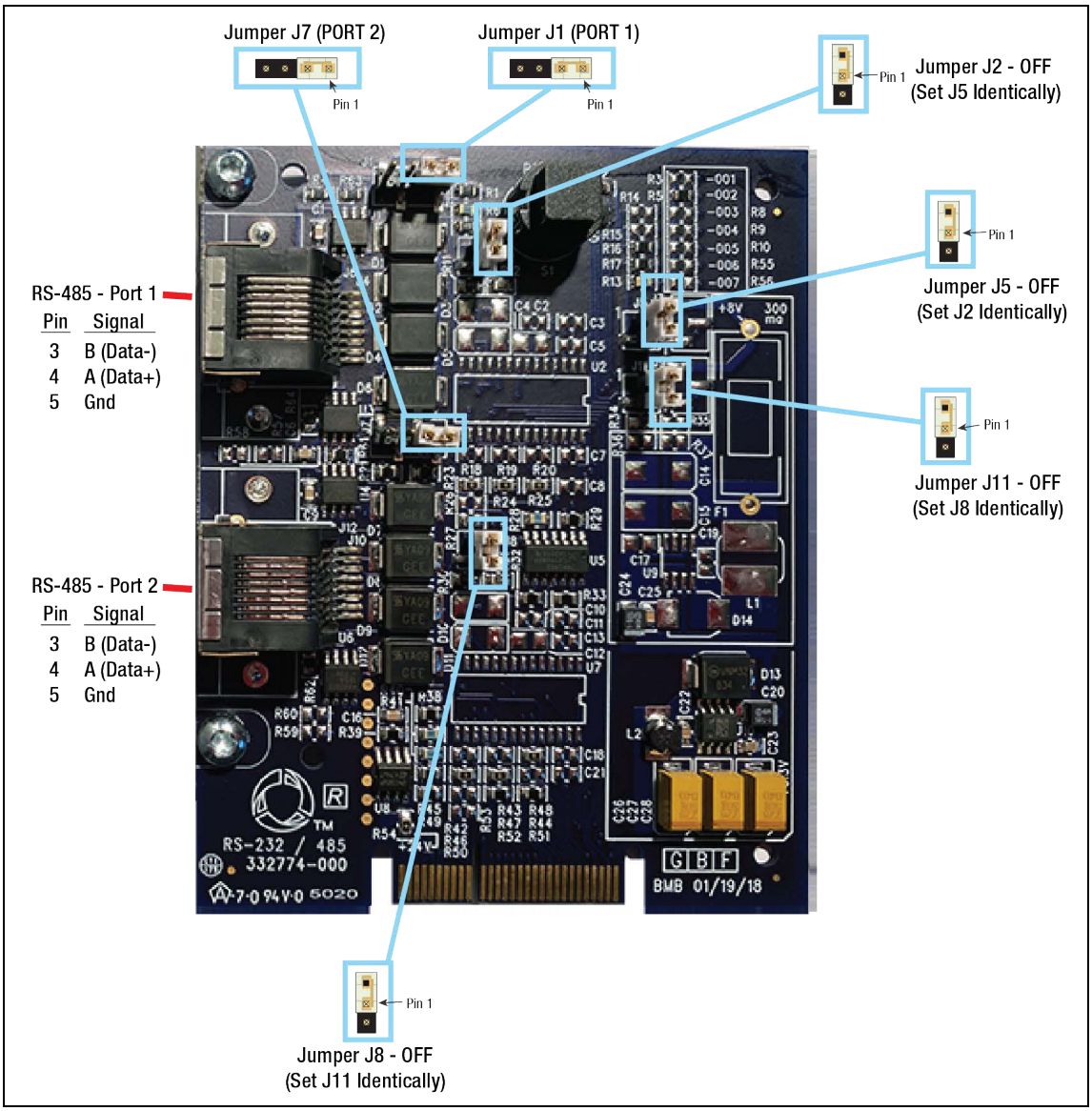


Figure A-8. Dual RS-485 Ports Module Jumper Positions

Installing RS-485 Comm Module

WARNING **Disconnect, tag and lockout power to the TLS-450PLUS console before starting this procedure.**

1. Remove both left and right door screws (with a T-15 Torx driver) and swing open both doors to the left.
2. On the communications bay, use a T-15 Torx driver to loosen the module clamp securing screw and remove the clamp (see Figure A-9).

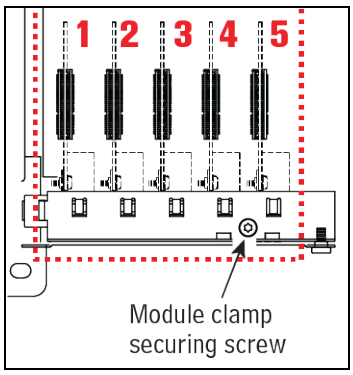


Figure A-9. Comm Module Clamp Securing Screw

3. The Comm Bay is divided into 5 communication slots numbered from 1 to 5 going left to right. Only slots 1-3 are available for user-selectable Comm modules (ref. Table A-1). The Comm modules in Slots 4 and 5 are fixed and cannot be moved.
4. Using a T-15 Torx driver, remove the module clamp securing screw (and clamp and set them aside.
5. Remove the blank cover from underneath the desired empty comm slot(s) by punching it into the console or by using pliers to remove it from the inside of the console. Be careful not to damage any internal components in the process of removing the blank cover.
6. Place the new RS-485 Comm module(s) in the slot(s). Align the edge connector on the back of the board with the center of the vertical connector on the Comm Backplane board, then push the module board firmly in as far as it can go. The sheet metal bracket of the module slides into the comm bay slot and the front edge of the bracket goes into the keyed slot in the front of the Comm Bay (see Figure A-10).

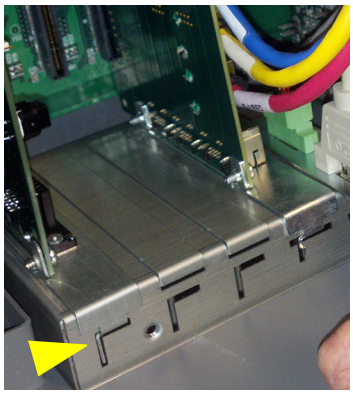


Figure A-10. Comm Module Bracket Keyed Slot

7. After the comm module(s) is installed, replace the comm module clamp and the screw that secures it.
8. Connect the IQ Control Box comm cable RJ-45 connectors to the ports of the modules installed. Record the slot/configurable port for each cable which will be needed in the communication setup procedure.
9. Close the console's front doors, reversing the procedure in Step 1.
10. Do not apply power to the TLS-450PLUS at this time.

Connecting RS-485 Wiring To The IQ Control Boxes

WARNING **Turn off, tag and lockout the breaker that supplies power to each of the IQ Control Boxes.**

1. Open each IQ Control Box cover and attach the RS-485 comm cable wires as shown in Figure A-11.

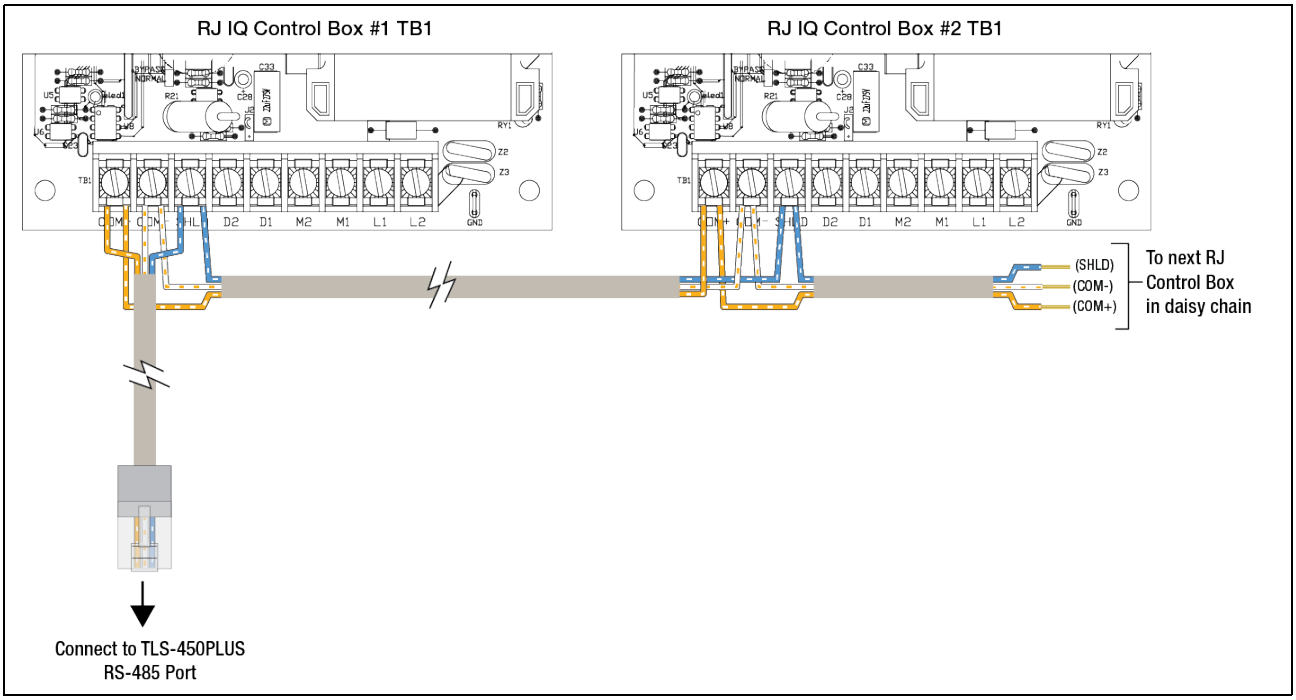


Figure A-11. Attaching Comm Cables To RJ IQ Control Boxes (Belden 3106A Cable Shown)

TLS-450PLUS Setup For IQ Control Box Monitoring

Restore all power to the IQ Control Boxes and the TLS-450PLUS.

Serial Port Setup

1. At the TLS-450PLUS display touch **Menu>Setup>Communication>Serial Port** (see Figure A-12).

Figure A-12. RJ IQ Comms Setup Screen

2. Select the serial port setup sequence for each standalone/loop of sites RJ Control Boxes.
3. In the 'Usage' field, choose 'RJ IQ Comms'.
4. Enter a label for this port, e.g., Unleaded tanks 1 - 4.
5. Grayed out fields are not changeable.
6. Select the Enabled radio button.
7. Continue to the next RS-485 port if necessary.

Pump Controller Setup

1. At the TLS-450PLUS display touch **Menu>Setup>Pumps and Lines>Pump Controller** and select Pump Cntlr #1 (see Figure A-13).

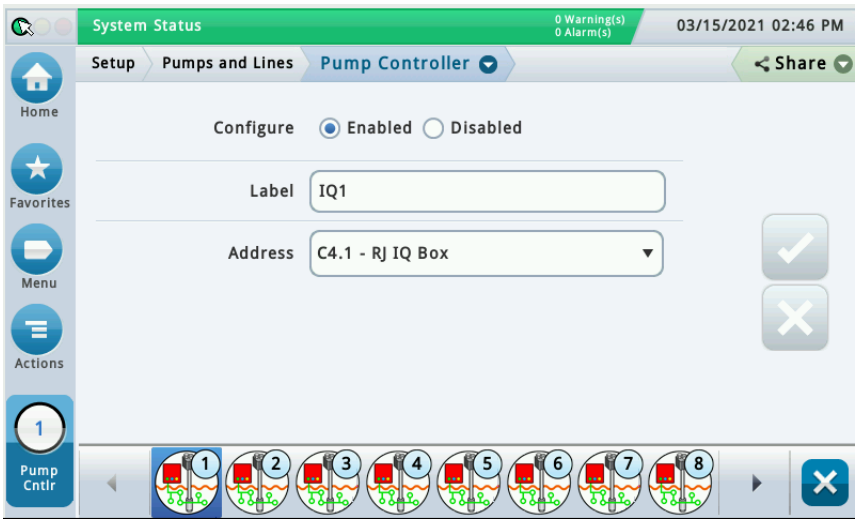


Figure A-13. RJ Control Box Setup Screen - Unit 1 Example

2. Touch the Enable button and enter a label for this RJ box to identify which STP it controls (e.g., RJ 1 - reg unld tnk 1-4).
3. Select address from drop down menu.
4. Select the remaining Pump Controllers to label and enter addresses for each.

DB Backup

1. After setting up the RJ Control Feature insert the V-R Backup thumb drive into one of the two USB ports on the USB ports in the console Comm bay (slot 5).
2. From the Home Screen touch **Menu > Software Upgrade > DB Backup** to view the Database Backup Screen. Touch the down arrow in the **Backup Destination** field to select the thumb drive.
3. Follow the on-screen instructions to backup the TLS-450PLUS console data A perform a DB backup.

Diagnostics

STP Status

You can view the status of each STP by navigating to **Diagnostics > Pump Controller > Communications** (see Figure A-14).

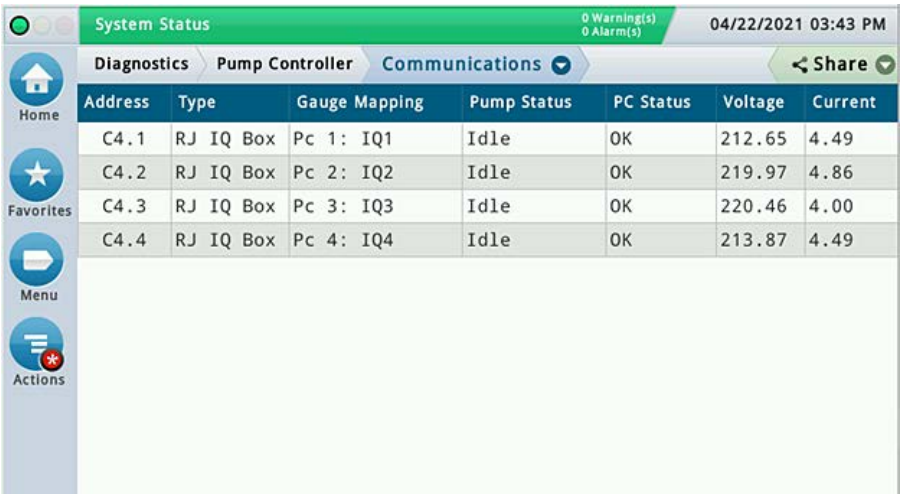


Figure A-14. IQ Control Box Communications Status Screen

The normal operating voltage range for Red Jacket pumps is 200 to 250 Vac.

Alarms

Table A-3 lists the IQ Control Box Diagnostic alarms. Reference “Description of Fault Conditions” on page 16.

To turn off the flashing alarm light on the side of the box, press the Reset/Cal button (see Figure A-3) until you see a single green light flash of the Code Indicator.

⚠WARNING **Acknowledging the alarms and turning off the flashing red light will not correct the problem that is causing the alarm(s).**

Table A-3. IQ Control Box Diagnostic Alarms

TLS Alarm	Pump Controller Comm Screen PC Status	IQ Control Box Red LED Indicator	Cause[1]
UNCALIBRATED	Uncalibrated	DEVICE IS UNCALIBRATED (1 Flash)	Uncalibrated IQ Control Box
OVERLOAD	Overload	OVERCURRENT FAULT (2 Flashes)	Over-Current Condition, e.g., Locked Rotor – Pump Shutoff
DRY RUN	Dry Run	DRY RUN FAULT (3 Flashes)	Dry Run Detected – Pump Shutoff
UNDERLOAD	Underload	LOW AC CURRENT (4 Flashes)	Low AC Current
NETWORK ERROR	Network Error	SETUP/COMMUNICATION ERROR (5 Flashes)	Setup/Communication Error
UNDER VOLTAGE	Under Voltage	LOW LINE VOLTAGE (6 Flashes)	Low Line Voltage < 200Vac
BYPASSED	Bypassed	BYPASS MODE (7 Flashes)	IQ Control Box Bypass/Normal jumper left in Bypass position
EXTENDED RUN	Extended Run	EXTENDED RUN (8 Flashes)	Extended Run Condition

[1] *See “Description of Fault Conditions” on page 16.*

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