



Jockey Controller & Integrated Remote Monitoring Installation and Operation Manual

Another Digital Innovation from the Peerless Pump Company

2005 Dr. Martin Luther King Jr
Indianapolis, 46202 - U.S.A.
Phone: (+1) (317) 925-9661
www.peerlesspump.com

Blank

Table of Contents

Table of Contents	3
Chapter 1 - Symbols Used in This Document	6
Chapter 2 - General Information	7
2.1 Product Description	7
2.2 Warranty	7
2.3 Personnel Qualification	7
2.4 Warnings	8
Chapter 3 - Transportation, Handling, & Storage	9
3.1 Receipt and Inspection	9
3.2 Storage	9
3.2.1 Controlled Storage	9
3.2.2 Uncontrolled Storage	10
3.2.3 Standard Short-Term Storage	10
3.2.4 Long-Term Storage	10
3.3 Disposal of Packaging Materials	10
Chapter 4 - Identification	11
4.1 Identification Tag	11
4.1.1 Certifications	11
4.2 Model Number & Product Matrix of Configuration	11
4.3 Standard Product Specifications	12
4.3.1 Approvals	12
4.3.2 Voltage Rating	12
4.3.3 Pressure Display Accuracy	12
4.3.4 Short Circuit Current Rating	12
4.3.5 Horsepower Rating	12
4.3.6 Service Factor	12
4.3.7 Locked Rotor Code	12
4.3.8 Remote Contacts	13
4.3.9 Pressure Rating	13
4.3.10 Plumbing	13
4.3.11 Enclosure	13
4.3.12 Ambient Temperature	13
4.3.13 Standard Automatic Functions	13
Chapter 5 - Equipment & Installation	14
5.1 Factory Support	14
5.2 Inspection	14
5.3 Required Tools and Fixtures	14
5.4 Location	15
5.5 FireConnect® Jockey Controller (FCJC) Installation	15
5.5.1 Location	15
5.5.2 Ratings	15
5.5.3 Mounting	15
5.5.4 Conduit Entrance	15
5.6 Connections	15
5.6.1 General Piping Connections	15

5.6.2 Power Connections	15
5.6.3 Motor Circuit Conductors	16
5.6.4 Remote Alarm Connections	16
5.6.4.1 Pump Running Signal (Mod Code A1).....	16
5.6.4.2 Pump Running Signal (Mod Code A2 - 2nd set)	16
5.6.4.3 A.C. Power Failure Signal (Mod Code A3).....	16
5.6.4.4 Pump Trouble Signal (Mod Code TR).....	16
5.6.4.5 Failure to Start Signal (Mod Code F1)	16
5.6.4.6 Excessive Start Signal (Mod Code ESR)	16
5.6.4.7 Overpressure Signal (Mod Code OVP).....	16
5.6.4.8 Low Zone Remote Start (Mod Code DMD).....	17
5.6.4.9 Jockey Pump Off Signal (Mod Code MP)	17
5.6.4.10 Switch Off Signal (Mod Code SOA)	17
5.6.4.11 Remote Start Inputs	17
5.6.5 Modbus Connections	17
5.6.5.1 FireConnect Jockey Controller – Master Main Pump Controller	18
5.6.5.2 FireConnect Jockey Controller – Firetrol Main Pump Controller.....	18
5.6.5.3 FireConnect Jockey Controller – Tornatech Main Pump Controller.....	18
5.6.5.4 FireConnect Jockey Controller – Eaton Main Pump Controller	18
5.6.5.5 FPC & JPC Modbus Option Codes.....	18
5.7 Suction & Discharge Pressure Sensing Lines.....	20
5.7.1 Dimensional Analysis (Tank Applications)	20
5.8 Transit Time Flow Meter (TTFM).....	21
5.8.1 Transit Time Flow Meter (TTFM) Wiring	21
5.9 Diesel Tank Level Monitoring & Visual Indicator	24
5.9.1 Installation of the FireConnect Diesel Fuel Tank Level Sensor.....	24
5.9.2 Diesel Fuel Tank Level Monitoring (Dimensional Analysis)	25
5.9.2.1 Diesel Fuel Tank Level Monitoring; <i>Alternate Installation Method</i>	26
5.10 Closed Cooling Loop; Tank Return Monitoring	27
5.10.1 Closed Cooling Loop; Tank Return Monitoring Installation.....	27
5.10.1.1 Closed Cooling Loop; Tank Return Monitoring Installation (Wiring)	28
5.11 Digital Temperature Sensor Programming.....	29
5.11.1 Digital Temperature Sensor Display & Menu Navigation	29
5.11.2 Digital Temperature Sensor Menu Structure	30
5.11.2 Digital Temperature Sensor Menu Setting	31
5.12 Battery Backup	32
5.12.1 Battery Recommendations.....	32
5.12.2 Battery Location.....	32
5.12.3 Battery Wiring	33
5.11.3 Battery Maintenance	33
6.1 Menu Functions	34
6.1.1 Moving through the menus:.....	34
6.1.2 Function changes with buttons:	34
6.1.2.1 Home Menu.....	34
6.1.2.2 Motor Run Hours.....	34
6.1.2.3 Trip Setting.....	34

6.1.2.4 Reset Setting	34
6.1.2.5 Minimum Run Setting	34
6.1.2.6 Restart Time Setting	35
6.1.2.7 Motor Starts In 24 Hours Setting	35
6.1.2.8 Overpressure	35
6.2 Menu & Recorded Memory (HMI Only).....	35
6.2.1 Recorded Controller Settings	35
6.2.2 Recorded Controller History	35
Chapter 7 - FireConnect® Jockey Controller Startup Procedure & Checklist	36
7.1 Procedure	36
7.2 Startup Checklist	36
7.2.1 Energizing Controller	36
7.2.2 Energizing Controller; Stand-By Operation	37
7.2.3 De-energizing Controller	37
7.2.4 Manual Starting	37
7.2.5 Manual Electric Stopping	37
Chapter 8 - Maintenance	38
8.1 Annual Maintenance Checklist	38
Peerless Pump Contact Information	39
Appendix I - Drawings & Diagrams	40
Appendix-II	48
Greyline TTFM 6.1 Quick Start.....	48
CONNECTIONS; POWER INPUT	48
KEYPAD SYSTEM	48
ICONS.....	48
MENU SYSTEM	49
MAIN DISPLAY	50
MESSAGE ICON	50
STATUS.....	50
MENU SELECTIONS	51
UNITS/MODE	51
SET UP	52
CALIBRATION	53
SPECIAL FUNCTIONS.....	54
TYPICAL SE16B SENSOR INSTALLATION	55
SENSOR MOUNTING LOCATION	55
2 OR 4 CROSS INSTALLATION OVERVIEW – SE16B TMK-B1 Kit	56
SENSOR MOUNTING/COUPLING RECOMMENDATIONS	57
ENCLOSURE INSTALLATION	58
FIELD TROUBLESHOOTING	58
PIPE CHARTS.....	59
Greyline TTFM 6.1 Instruction Manual.....	61
Appendix-III	62
ProSense Digital Temperature Sensor Manual	62

Chapter 1 - Symbols Used in This Document



- ***Warning! If these safety instructions are not observed, personal injury may result.***



- ***Warning! If these instructions are not observed, electric shock with consequent risk of serious personal injury or death may occur.***

Caution

- ***If these safety instructions are not observed, the result may be a malfunction or damage to the equipment.***

Note

- ***These are notes or instructions that make the job easier and ensure safe operation.***

Chapter 2 - General Information

These instructions should be retained for reference regarding future maintenance and operation. Additional copies can be found at www.PeerlessPump.com

These are general instructions and may not take into account possible local regulations. All installations are subject to local code and regulations, and/or the authority having jurisdiction. The user should ensure such regulations are observed by all parties involved.

Information in this manual is believed to be reliable. In spite of all efforts to provide sound and necessary information, the content of this manual may be insufficient. It is not guaranteed to be complete or accurate in all instances.

2.1 Product Description

The **FireConnect® Jockey Controller** system is a hardware and software package developed by Peerless Pump to provide real-time fire pump system monitoring through cloud networking. FireConnect® integration to the pressure maintenance controller collects data from peripherals on-site such as: the controllers for the fire pump and jockey pump, a bulkhead mounted discharge and suction pressure transducer, an externally mounted, transit time flowmeter and other sensors as supplied. It will then communicate that data to the cloud via 3G or 4G LTE cellular communication. The system can then be monitored using the Peerless Pump FireConnect® application. Through the application, the user can view real-time fire system information such as: alarm conditions, system pressure, water flow, event logs, and much more...

Pressure maintenance controllers are used in installations designed to NFPA-20, Standard for the Installation of Stationary Fire Pumps for Fire Protection. They are designed to maintain the system pressure, so the fire pump does not start due to small leaks in the system.

Model FCJC controllers provide across-the-line (direct-on-line) full voltage starting for single or three phase motor driven jockey pumps.

See Appendix for Piping & Installation Diagram (P&ID) and Wiring Diagram for a typical electrical wiring connection diagram.

2.2 Warranty

This unit is manufactured under a quality management standard as certified and audited by external quality assurance organizations. Genuine parts and accessories have been designed, tested, and incorporated into the products to help ensure their continued product quality and performance in use.

Damage or malfunction caused by misuse, abuse, or failure to follow these instructions are not covered by warranty.

Any modification of our products or removal of original components may impair the safety of these products and affect their operation.

Standard warranty conditions can be found at www.PeerlessPump.com.

2.3 Personnel Qualification

All operations must be carried out by qualified personnel. Please consult the procuring organization for the recommended procedure for connections to equipment not supplied by Peerless Pump Company.

2.4 Warnings



- **Warning!**
Do not remove or paint over any safety labels. If labels are lost or damaged, contact a Peerless Pump representative for replacement.

- **Warning!**
Never perform maintenance work when the unit is connected to power. Use only qualified electricians for electrical installation and maintenance.

- **Warning!**
Danger of lethal electrical shock and arc flash hazard - use appropriate personal protective equipment (PPE) in accordance with NFPA 70e.

- **Warning!**
To prevent the possibility of serious injury or death due to an electrical fault, be sure the door is closed and latched before closing the manual motor protector or disconnect switch or operating the controller.



- **Warning!**
This equipment must only be serviced by qualified electrical personnel.

- **Warning!**
Do not defeat any interlocks or safety features or equipment or circuitry.

Chapter 3 - Transportation, Handling, & Storage

The FireConnect® system has been prepared for shipment at the factory in such a way as to minimize potential damage due to handling and transport.

Caution

- ***The equipment should not be subjected to excessive g-forces during the handling or transport.***

3.1 Receipt and Inspection

Receiver should report any shortage or damage to the transport company handling the shipment and to Peerless Pump.

Note any extent of damage or shortage on the freight bill and bill of lading. Failure to note damage may result in a declined warranty.

Take inventory of the shipment to ensure that the parts received match the list of parts on the order. Failure to report missing parts may result in a declined warranty.

It is important that all the components for the FireConnect® system are identified and properly stored until time of installation. There may be many small parts that are best left in their original shipping container until installation.

Check within all packaging material in order to verify that no parts or instructions are accidentally discarded. **In some shipments, be aware that small boxes containing additional parts may be bound to pump skids.** At the time of installation, match components using their markings to the system they are to be installed on if there is more than one.

3.2 Storage

Standard factory packaging and protection is suitable during transit and within covered storage at a jobsite for a short period between delivery and installation/startup. This protection includes preservatives applied at the factory to the components.

The effective protection is two to three months from the date of shipment from the factory. This is dependent on storage conditions and the severity of the environment to which the equipment is exposed as described below. For an international destination, this will vary depending on the seaworthiness of export boxing.

At the time of specification and/or order placement

Peerless Pump should be advised about an extended storage duration that will be excess of two to three months and other than what is described below. This is to ensure special storage protection can be provided for the equipment prior to shipping from the factory.

3.2.1 Controlled Storage

Storage facilities should be maintained at an even temperature of at least 40°F (4.5 °C) above the dew point with relative humidity lower than 50 % with little or no dust. The equipment is to be inspected weekly to ensure that all preservatives are intact, and internals are protected.

- ***Protect the equipment from flooding or from harmful chemical vapors.***

Caution

- ***Storage should be free from ambient vibration. Excessive vibration can cause bearing damage.***
- ***Precautions should be taken to prevent rodents, snakes, birds, insects, etc. from nesting inside the equipment.***

3.2.2 Uncontrolled Storage

For uncontrolled storage periods of three months or less, the equipment is to be inspected weekly to ensure internals are protected.

Provide a roof or shed shelter to protect from direct exposure to the elements

3.2.3 Standard Short-Term Storage

The FireConnect® system, as shipped, has an effective protection for short-term (two to three months) storage in a covered, dry, and ventilated location as described above at the job site prior to installation.

3.2.4 Long-Term Storage

Long-term storage protection from the factory does not extend the warranty in any manner. Warranty policy is twelve months from startup or eighteen months from time of shipment, whichever occurs first. This warranty is valid only if equipment has been properly handled and stored as per the stated requirements.

Should the equipment be stored or handled improperly, then the warranty becomes invalid and may be reinstated only after a factory representative inspects the equipment prior to startup. Expenses for the representative will be billed in accordance with the latest schedule for the field service engineer.

Any repairs or replacement parts needed will be billed to the customer at prices in effect at time they are shipped.

In addition to having complied with the storage conditions the FireConnect® system, once installed, should be inspected at regular periods, with intervals not to exceed three months.

3.3 Disposal of Packaging Materials

This product or parts of it must be disposed of in an environmentally sound way. For assistance, please contact Peerless Pump when disposing of packaging materials or FireConnect® components.

All electronic waste should be disposed of in a way that aligns with the EPA standards and recommendations.

Chapter 4 - Identification

4.1 Identification Tag

The product or device identification number can be found on the outside of the FireConnect Jockey Controller (FCJC) door. This unique number corresponds to the original device configuration and features.

Please reference this number when inquiring with the factory. Be sure to include any other pertinent information as deemed necessary by the inquiring personnel. Model NO, Part NO, Serial NO, and FireConnect ID NO should be included in the subject matter as well for optimum inquiry experiences.

Reference **Figure-1** for illustration of product identification nameplate.

4.1.1 Certifications

The FireConnect® Jockey Controller will provide a UL Type-1 standard on all enclosures.

(Additional standards are currently in development.)

4.2 Model Number & Product Matrix of Configuration

Please refer to the tables below in **Figure - 2 & 3** for the Model Number description key.

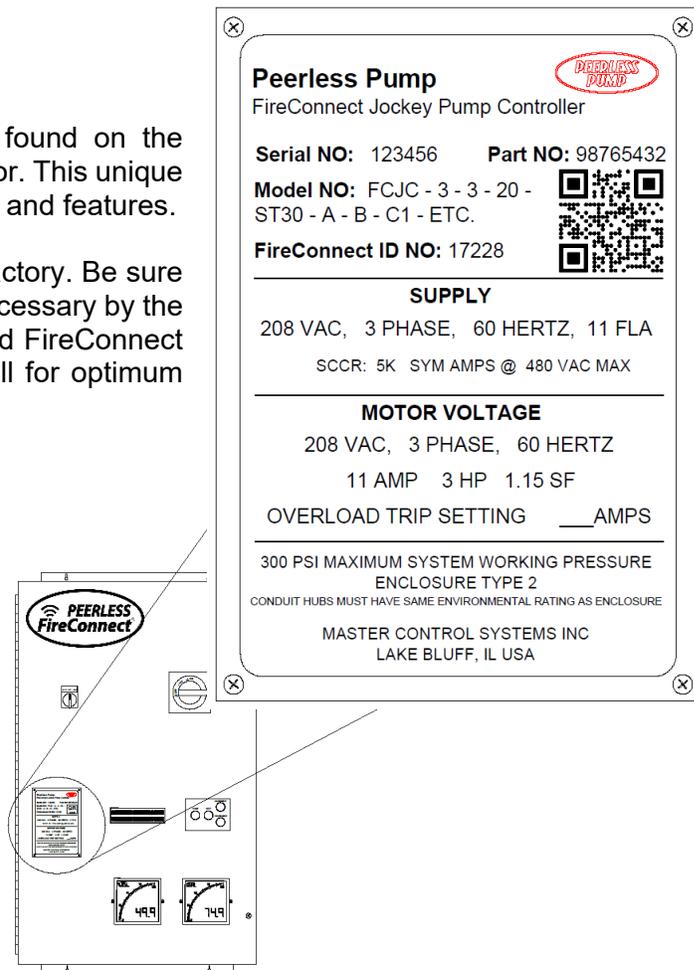


Figure 1 - FCJC FireConnect Jockey Controller & Nameplate

MODEL FCJC - FIRECONNECT JOCKEY CONTROLLER						
Maximum Motor Horsepower	Motor Rated Voltage					
	Single Phase		Three Phase			
	110-120V	220-240V	208V	220-240V	380-415V (50 Hz)	440-600V
1/3 to 3/4	X	X	X	X	X	X
1 - 2	X	X	X	X	X	X
3		X	X	X	X	X
5		X	X	X	X	X
7 1/2			X	X	X	X
10				X	X	X
15					X	X
20						X

Figure 2 - FireConnect Jockey Controller Voltage, Phase, & Horsepower Configuration Matrix

Symbol	Description
AUD	Audible alarm with silence switch
A1	Pump Pumping contacts (one N.O. and one N.C.)
A2	Pump Running contacts (Two N.O. and two N.C.)
A3	Power Failure contacts (one N.O. and one N.C.)
A4	Power Failure contacts (Two N.O. and two N.C.)
DMD	Demand Relay contacts (one N.O.)
ESR	Excessive Start contacts (one N.O and one N.C.)
F1	Failure to Start contacts
L1	Pump Running pilot light
L2	Power Available pilot light
L5	Failure to Start pilot light
MP	MMP closed contact (one N.C.)
OVP	Overpressure contacts (one N.O. and one N.C.)
RS	Remote Start Input
SOA	Switch OFF contact (one N.O)
ST30	Suction transducer - 30 psi range replaces standard 150 psi range
TR	Trouble contacts (one N.C. and on N.C.)
TRA	Trouble contacts (one N.O and one N.C.) with alarm light
W1	316 SS wetted parts
W7	High-pressure transducer (600 PSI)
H1	Space heater and CPT
H2	Space heater with thermostat and CPT
H3	Space heater with humidistat and CPT
PM	Phase Failure Monitor

Figure 3 - FireConnect Jockey Controller Option Codes

4.3 Standard Product Specifications

The following specifications are in regard to the controller itself and the physical components therein.

4.3.1 Approvals

UL listed to ANSI/UL 508A

4.3.2 Voltage Rating

Controllers are designed for or it's rated voltage, -15% and +10%.

4.3.3 Pressure Display Accuracy

The display accuracy is designed for +- 2% of rated voltage and current.

4.3.4 Short Circuit Current Rating

Standard controllers are rated for 5,000 symmetrical RMS amps at 200 VAC to 480 VAC.

Higher ratings may be available, refer to factory support for availability.

4.3.5 Horsepower Rating

Controller are designed to control the specific nameplated motor horsepower rating.

4.3.6 Service Factor

Controllers are designed for use with motors having a maximum Service Factor of 1.75 at 1/3 hp, 1.60 at 1/2 hp, 1.50 at 3/4 hp, 1.40 at 1 hp, 1.30 at 1 1/2 hp, 1.25 at 2 hp, and 1.15 at 3 hp and above.

4.3.7 Locked Rotor Code

Standard three phase and single-phase controllers are designed for use with motors having a locked rotor KVA/HP code based on the tables provided in **Figure-4**

Motor Voltage 200-600 VAC			Motor Voltage 380-415 VAC			Single Phase - Motor 230 VAC		
HP	Frequency	KVA/HP	HP	Frequency	KVA/HP	HP	Frequency	LRC
½	60	R	½	50	P	1/3	60	18
¾	60	P	¾	50	P	1/2	60	25
1	60	N	1	50	P	¾	60	35
1 ½	60	M	1 ½	50	N	1	60	45
2	60	L	2	50	M	2	60	65
3	60	K	3	50	L	3	60	90
5	60	J	5	50	K	5	60	135
7 ½	60	H	7 ½	50	J	7 ½	60	200
10	60	H	10 & up	50	H	10	60	260
15 & up	60	G						

Figure 4 - FireConnect Jockey Controller Approved Design Locked Rotor KVA/HP Codes

4.3.8 Remote Contacts

Optional voltage free contacts are rated for 6 amps (resistive) at 30 vdc, 6 amps (resistive) at 250 vac.

4.3.9 Pressure Rating

Standard controllers are rated for 300 PSI (20.7 BAR).

Higher ratings may be available, refer to factory support for availability.

4.3.10 Plumbing

Standard controllers are provided with brass fittings.

Other materials may be available, refer to factory support for availability.

4.3.11 Enclosure

Standard controllers are rated for NEMA Type 1.

Other enclosures may be available, refer to factory support for availability.

4.3.12 Ambient Temperature

Rated for operation in a 40C ambient.

No direct sunlight is allowed on the enclosure.

4.3.13 Standard Automatic Functions

- Pressure Start
- Remote Start (delayed by sequence start)
- 2 second fixed Sequence Start Delay
- Minimum Run Timer (factory set to 2 seconds)
- Restart delay (factory set to 3 seconds)
- Failure to Start alarm
- Excessive Start alarm
- Overpressure alarm and shutdown (999 disables alarm)
- Conversion between PSI and BAR

Chapter 5 - Equipment & Installation

5.1 Factory Support

For these customized products, we recommend that a Peerless Pump service engineer supervise installation, commissioning, and startup. This is to ensure that the equipment is properly installed. In addition, this allows end user personnel the opportunity to review and see implemented, factory recommended instructions.

5.2 Inspection

All system parts were carefully inspected before leaving the factory but may have become soiled or damaged in shipping and handling or storage at the site. The installer must therefore confirm that all parts are clean and undamaged prior to installation.

If there is reason to believe the factory wired connections have been damaged in transit, please refer to the factory support team for assistance in tracing the line diagram connections found in **Appendix-I**

For any and all other damages or discrepancies, please contact the Peerless Pump Company warranty services.

5.3 Required Tools and Fixtures

Tools and fixtures for FireConnect® system installation, disassembly and reassembly may include (but not limited to) these items:

- Lifting devices (hoist or straps)
- Screwdriver (slotted and/or Phillips)
- Wire strippers
- Standard pipefitting equipment (for the flowmeter & transducer installation)
- Drill motor and bits
- Calibrated measuring tape
- Calipers (for proper spacing of the Greyline TTFM Flowmeter and the ultrasonic sensors)
- Personal Computing Device for Field Programming (If not done prior to shipment; lack of site details)

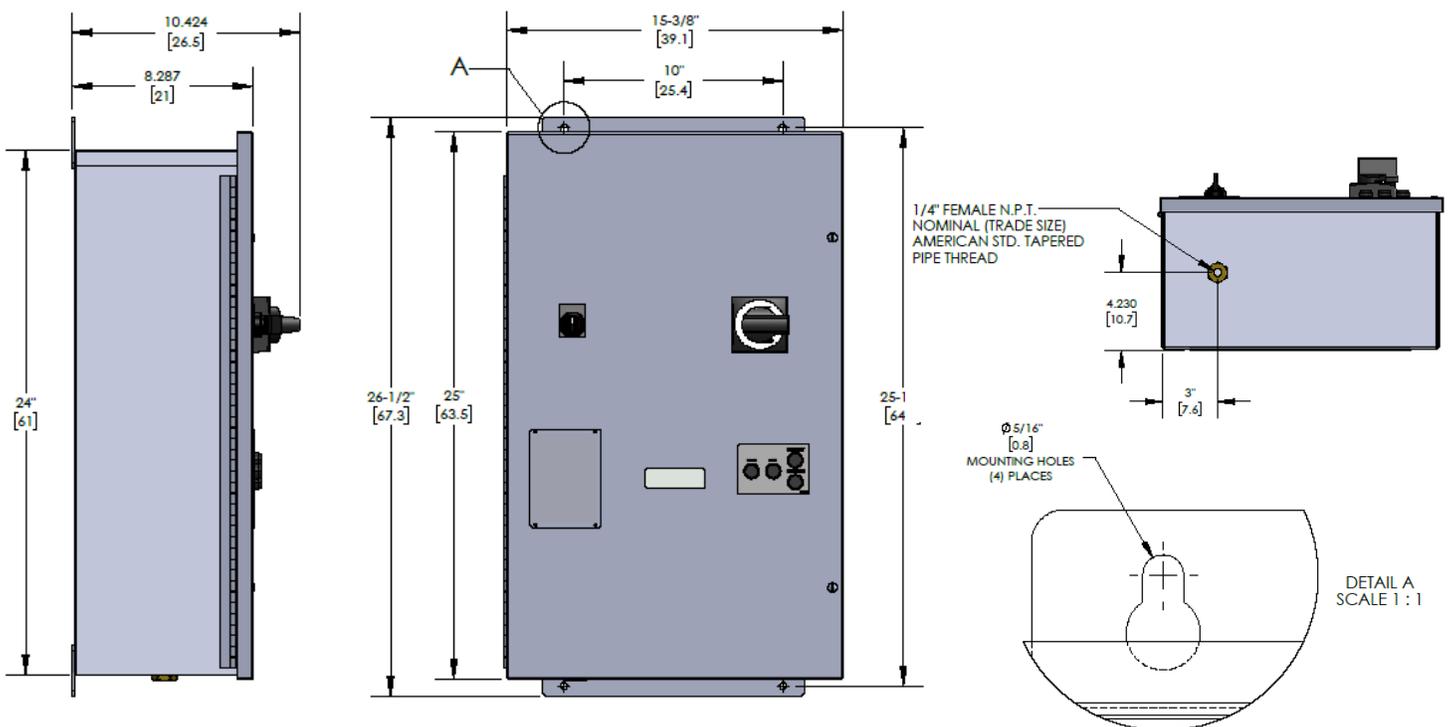


Figure 5 - Panel Specifications; Including Dimensions for Mounting and Plumbing

5.4 Location

The FireConnect® system must be installed on a panel stand or wall rigid enough to support the entire weight of the device. The system must be located indoors and protected from environmental exposures such as excessive heat, cold, dust, and water entry. Peerless Pump recommends installing the FCJC on the wall near the main fire pump controller.

5.5 FireConnect® Jockey Controller (FCJC) Installation

See **Figure-5.** (FCJC Panel Dimensions) for mounting dimensions and installation space requirements.

The FireConnect® Jockey Controller (FCJC) is essentially a pressure maintenance controller and all of its wiring and plumbing should be installed in accordance with the requirements given below and the wiring diagram located in the drawing section of this manual. It is designed to be installed in accordance with the requirements of NFPA-70, article 430, the National Electric Code, as well as any local requirements.

5.5.1 Location

Controllers should be located as close as practical to the motors they control. It should also be located within sight of the motor and in an area free from dripping and spraying water.

5.5.2 Ratings

Check that the system voltage and the motor nameplate voltage and horsepower ratings agree with the controller nameplate voltages and horsepower ratings before beginning installation.

5.5.3 Mounting

Controllers should be securely mounted and bolted to noncombustible surface or structure.

5.5.4 Conduit Entrance

Conduit entrance can be made either through the top or bottom of the enclosure.

Use appropriate conduit hub that matches the "Enclosure Type" as shown on the controller nameplate. When controllers suitable for outside installation are used, be sure the appropriate weatherproof conduit hub is used and provide a sun roof to prevent direct sunlight on the controller.

NOTE: If entering from the top, waterproof hubs are required for all installations.

Caution

- ***Foreign metallic debris, such as drilling chips, can cause a dangerous and/or damaging electrical fault when the equipment is energized. Be sure to protect all electrical parts from metallic debris during installation.***

5.6 Connections

5.6.1 General Piping Connections

A 1/4 inch nominal pressure sense line, typically made of brass, rigid copper or 300 series stainless steel, shall be connected to the incoming bulkhead connector located on the controller. The pressure sense line shall have two 3/32" orifices installed between the fire protection system and the bulkhead fitting. Secure this sense line as needed to prevent vibration or damage. For further installation details, consult NFPA-20 or refer to the Piping Diagram drawing located in the drawing section of this manual.

5.6.2 Power Connections

The three phase input power conductors are connected to the MMP line terminals **L1, L2, & L3**. The output motor wiring is connected to the bottom of the Main Contactor M load side terminal lugs **T1, T2, & T3**. Refer to the Wiring diagram for details.

For Single Phase motors, see the wiring diagram at the back of this manual.

5.6.3 Motor Circuit Conductors

All motor circuit conductors must be sized according to the National Electric Code (NFPA-70) on a continuous duty basis. Insulation for these conductors should be chosen so it will not be affected by the surrounding environment and have an insulation temperature rating at least 90 degrees C.

The ampacity of the wire is based on 125% of the motor full load current (FLA) using the 60C column for 100 amps or less and the 75C column in field wiring table 310.15(B)(16) of the 2017 edition of the NFPA 70 for higher currents. Also, apply the appropriate correction factors in accordance with 310.15(B)(1) through 310.15(B)(7).

Caution

- ***Be sure to secure conductors in such a manner so they will not move or interfere or rub against any components or mechanisms in the controller. Protect against contact with sharp edges or corners.***

NOTE: If modification code S1 is provided, the controller will be Suitable for Use as Service Entrance Equipment. A dual grounding lug is provided for the grounding electrode conductor and the grounded service conductor. No neutral connection is provided or needed. The controller is suitable for use on either three wire or four wire systems without the use of a neutral.

5.6.4 Remote Alarm Connections

See the contact rating limitations on the wiring diagram.

5.6.4.1 Pump Running Signal (Mod Code A1)

Terminals numbered M1, M2, and M3 provide a form "C" set of contacts which transfer when the motor current is detected. Contacts on terminals M1 and M2 close in the alarm state, while contacts on terminals M2 and M3 open in the alarm state.

5.6.4.2 Pump Running Signal (Mod Code A2 - 2nd set)

Terminals numbered M1, M2, and M3 and M4, M5, and M6 provide two form "C" sets of contacts which transfer when the motor current is detected. Contacts on terminals M1 and M2, M4 and M5 close in the alarm state, while contacts on terminals M2 and M3, M5 and M6 open in the alarm state.

5.6.4.3 A.C. Power Failure Signal (Mod Code A3)

Terminals numbered P1, P2, and P3 provide a form "C" set of contacts which transfer when any phase of the incoming normal power fails. Contacts on terminals P1 and P2 close in the alarm state, while contacts on terminals P2 and P3 open in the alarm state.

5.6.4.4 Pump Trouble Signal (Mod Code TR)

Terminals numbered T1, T2, and T3 provide a form "C" set of contacts which transfer when internal controller trouble exists. These are Low Voltage (80%), Failure to Start, Over Pressure, and Excessive Starting. Contacts on terminals T1 and T2 close in the alarm state, while contacts on terminals T2 and T3 open in the alarm state.

5.6.4.5 Failure to Start Signal (Mod Code F1)

Terminals numbered F1, F2, and F3 provide a form "C" set of contacts which transfer when the controller fails to start. Contacts on terminals F1 and F2 close in the alarm state, while contacts on terminals F2 and F3 open in the alarm state.

5.6.4.6 Excessive Start Signal (Mod Code ESR)

Terminals numbered E1, E2, and E3 provide a form "C" set of contacts which transfer when the controller starts excessively. Contacts on terminals E1 and E2 close in the alarm state, while contacts on terminals E2 and E3 open in the alarm state.

5.6.4.7 Overpressure Signal (Mod Code OVP)

Terminals numbered O1, O2, and O3 provide a form "C" set of contacts which transfer when an overpressure in the system exists. Contacts on terminals O1 and O2 close in the alarm state, while contacts on terminals O2 and O3 open in the alarm state.

5.6.4.8 Low Zone Remote Start (Mod Code DMD)

Terminals numbered D1, D2, and D3 provide a form “C” set of contacts which transfer immediately when a start demand is received. Contacts on terminals D1 and D2 close in the alarm state, while contacts on terminals D2 and D3 open in the alarm state.

5.6.4.9 Jockey Pump Off Signal (Mod Code MP)

Terminals numbered J1 and J2 provide a form “A” set of contacts which transfer when the MMP operator is turned Off or the internal overload trips. Contacts on terminals J2 and J3 close in the alarm state.

5.6.4.10 Switch Off Signal (Mod Code SOA)

Terminals numbered S1 and S2 provide a form “A” set of contacts which transfer when the Auto-Off-Man switch is turned Off. Contacts on terminals S1 and S2 close in the alarm state.

5.6.4.11 Remote Start Inputs

Wire a normally open remote contact between terminals R1 and R2. Contacts close to start. See Circuit Wiring Table below for size and length of wire run.

Note

- **Resistance and number of splices and contacts in circuit must be taken into consideration. A single splice may exceed the total resistance of 1,000 Ft. or more of wire.**

Remote Start Circuit Wiring Table			
Wire Size	Wire Resistance Ohm/1,000 Ft.	12 vdc (50 Ohms)	24 vdc (250 Ohm)
#12 AWG	1.588	15,700 Ft.	78,500 Ft.
#14	2.525	9,900	49,000
#16	4.016	6,200	31,000
#18	6.385	3,900	19,500
#20	10.15	2,500	12,500
#22	16.14	1,500	7,500
#24	25.67	940	4,700
#26	40.18	620	3,100

5.6.5 Modbus Connections

The FireConnect® system is compatible with a number of Fire Pump Controllers (FPC) and Jockey Pump Controllers (JPC). The built-in functionality of the FireConnect® system utilizes the accessible information from these panels in such a way, as to provide Smart Pump Technology with real time monitoring and analytics for existing systems and new installations alike.

Prior to purchasing the FireConnect® system for retrofit applications, contact with our sales team is required determine compatibility with existing systems and retrofitting requirements. Prior to purchase, the customer is required to complete the RFQ Peerless FireConnect® retrofit forms to complete the quote and determine (if any) retrofitting requirements.

The FireConnect Jockey Controller utilizes Modbus RTU protocols for serial data transmission, both to the FireConnect Gateway for cloud communications, as well as the main fire pump controllers.

Reference subcategories below for further information regarding specific compatibility to various manufacturers.

Note

- Every Main Pump Controller will have specific terminals or ports for Modbus communication (TCP/IP or RS485) and will vary depending on manufacturer, make, and model. Each installation will require contact with the respective main pump controllers' manufacturer to obtain the specific directions for networking communication, connection points, and programming parameters within the panels user interface.

Reference **Figures–6 & 7** for network communication terminals and location with respect to the components on the inside of the FireConnect Jockey Controller enclosure.

5.6.5.1 FireConnect Jockey Controller – Master Main Pump Controller

An RJ45 connector is provided on the control board inside the pressure maintenance controller. It is designed to connect directly to the RJ45 connector on the MASTER fire pump controller control unit (Modbus RTU connector).

Communications with the FireConnect gateway utilize an integrated RJ45 to RS485 converter and connect directly to gateway as configured from the factory.

5.6.5.2 FireConnect Jockey Controller – Firetrol Main Pump Controller

The FireConnect® Jockey Controller system is currently compatible with Firetrol Legacy FPC’s known as the Mark II and the Mark IIxg, as well as their latest design, the Mark III.

These legacy controllers, the Mark II and Mark IIxg, may require some retrofitting for compatibility with the Modbus RTU RS485 communication protocol in order to communicate with the FCGC. This retrofitting may involve replacement of the microcontroller, and an update to the operating system firmware. The controller will also require the ZPM option for Modbus RTU. The latest design FPC’s are called the Mark III and utilizes the TCP/IP Modbus communication protocol. Therefore, legacy controllers Mark II and Mark IIxg will utilize Modbus RS485, and the Mark III will utilize Modbus TCP/IP.

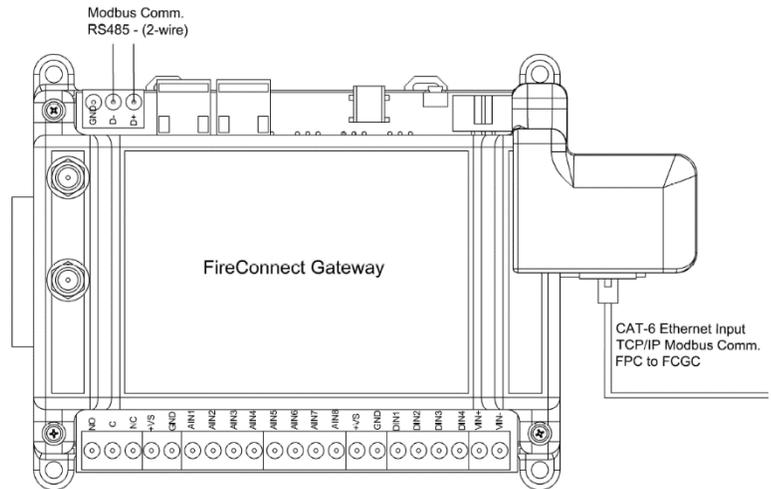


Figure 6 - FireConnect Gateway Board; Communication Terminals for Networking Main Fire Pump Controllers

Mark II & IIxg Modbus connections will be connected to the gateway board via RS485 2-wire configuration and should be installed with modern conventions for the typical “Daisy Chain” configuration as needed for system integration

Mark III will require CAT-6 cables for connection to the gateway board via the ethernet jack for TCP/IP communications via Modbus protocol.

5.6.5.3 FireConnect Jockey Controller – Tornatech Main Pump Controller

Current design of the main FPC is called the Tornatech Vizitouch V2 and utilizes the TCP/IP Modbus communication protocol.

Tornatech main controllers will require CAT-6 cables for connection to the gateway board via the ethernet jack for TCP/IP communications via Modbus protocol.

5.6.5.4 FireConnect Jockey Controller – Eaton Main Pump Controller

The FireConnect® Jockey Controller system utilizes Modbus RTU RS485 communication protocols on all Eaton FPC’s with the appropriate Modbus options (**Reference section 5.6.5.5 for Modbus Option Codes**)

5.6.5.5 FPC & JPC Modbus Option Codes

The below is list of option codes for FPC’s and JPC’s

Required FCGC Modbus Option Adder by Brand:	Firetrol	Tornatech	Eaton	Master
Electric Controller FC Option Code	Y99	ELE-OPTD26H	COM	82H
Diesel Controller FC Option Code	Y99	DIE-OPTD32H	COM	82H

This configuration would have been specified at the time of order by the Sales Representative upon submittal of the “RFQ Peerless FireConnect® Retrofit” form used to specify controller options required for communication to the FireConnect Jockey Controller and gateway.

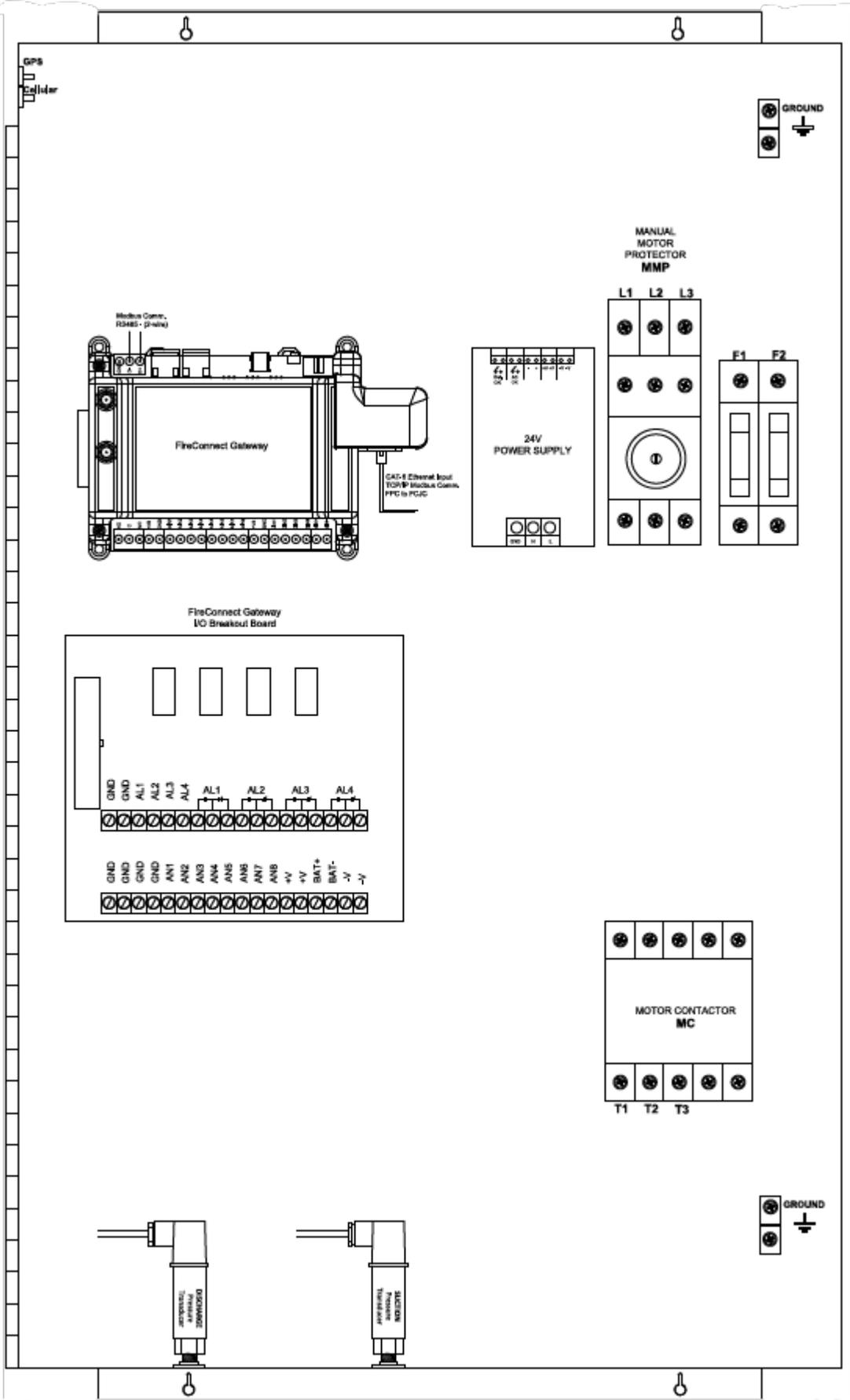


Figure 7 - FireConnect Jockey Controller Internal Component Layout and Orientation

5.7 Suction & Discharge Pressure Sensing Lines

The FireConnect Jockey Controller comes equipped with two pressure transducers installed in the bottom of the enclosure via bulkhead fittings. Both transducers will be wired as an integral part of the system, but after installation critical dimensions will need to be recorded for proper scaling of the display meter if a storage supply tank is being utilized.

Both sensing lines will need to be plumbed and connected with respect to their intended application, both suction and discharge, in relatively close in proximity to the flange of the pump. The factory recommended placement of connection for suction is directly on the side of the flange via the 1/4" NPT female connection provided on all Peerless Pumps. The discharge pressure line will need to be placed downstream from the check valve for proper system pressure readings.

5.7.1 Dimensional Analysis (Tank Applications)

Once the enclosure has been mounted and installed or the permanent location determined with the sensing lines marked to their respective locations, critical dimensions will need to be recorded and sent to factory support for optimal programming and scaling. This is required for the Tank Level Remote Monitoring via the FireConnect User Interface and to be sure the level is accurately reflected therein.

Note

- Any inaccuracies on critical dimensions will be directly reflected on the accuracy for the Tank Level Remote Monitoring via the FireConnect User Interface.
- All measurements must be recorded as vertical distance with critical respect to earth level

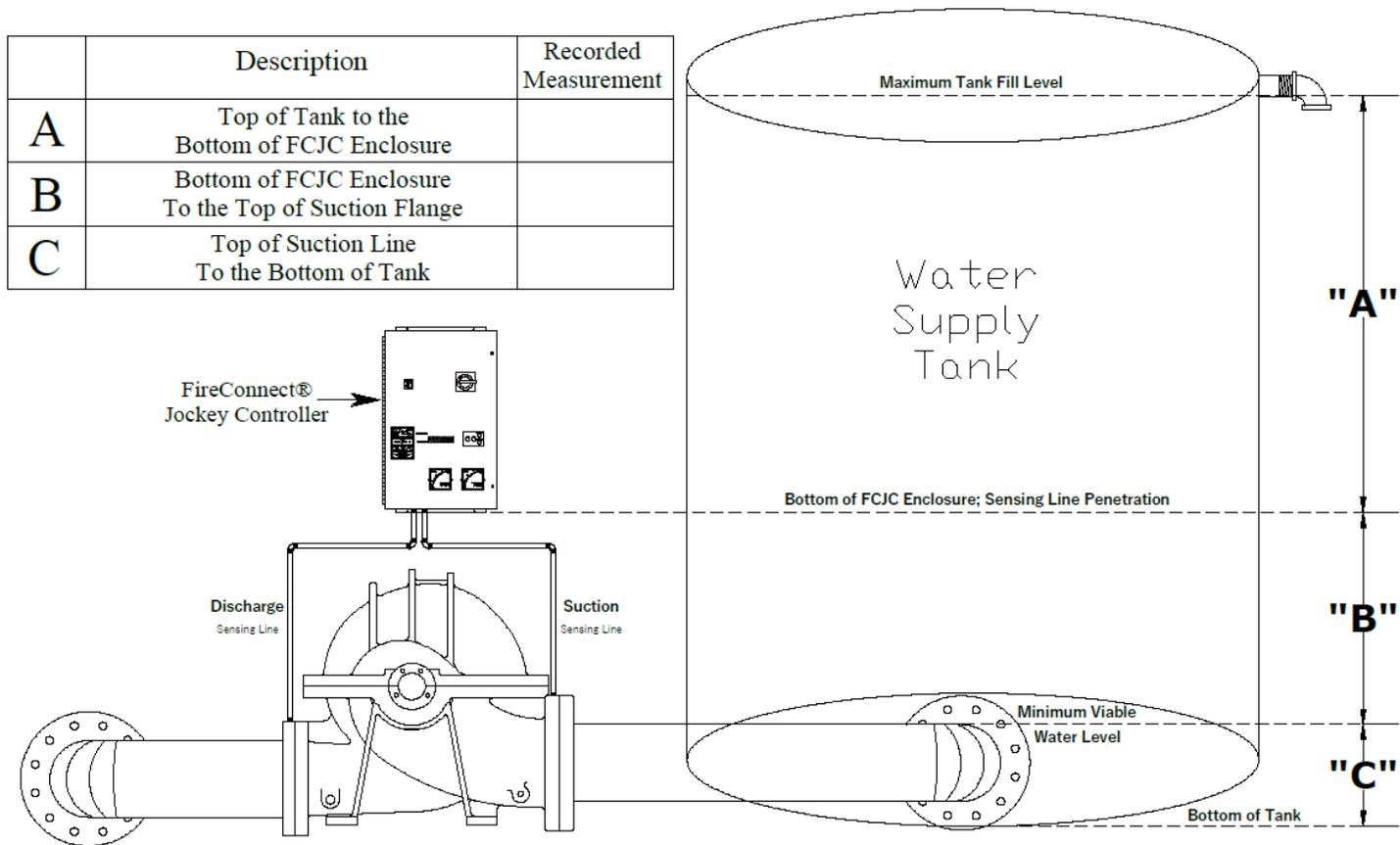


Figure 8 - Tank Level Monitoring; Illustration for Reference to Dimensions Required

Please use the following instruction subset with illustration to determine three dimensions as described. Record all information in the table provided to be communicated with factory support and stored within the enclosure for future reference. Reference **Figure-8** for illustration of required dimensions.

- Record the “**A**” dimension
 - This will be the vertical distance from the top of the tank to the bottom of the FCJC enclosure
- Record the “**B**” dimension
 - This will be the vertical distance from the FCJC enclosure bottom, to the top of the suction line
- Record the “**C**” dimension
 - This will be the vertical distance from the top of the suction line to the bottom of the tank

Note

- To ensure all dimensions have been recorded accurately, all three dimensions should add up to the total linear height of the tank.

This information should be collected at the time of order entry for programming prior to shipment, but in the event placement of enclosure cannot be guaranteed please consult the factory service department for detailed programming instructions.

5.8 Transit Time Flow Meter (TTFM)

Please reference **Appendix-II** for the complete Installation and Operations Manual of the Greyline Transit Time Flow Meter (TTFM) to be used in conjunction with the FireConnect Gateway Controller (FCGC), utilizing the +/- 24V power source contained within and the analog signal output from the TTFM wired to the analog input of the FCGC.

The location selected should be in close proximity to the FireConnect Jockey Controller and the TTFM local display (25 feet max).

The factory recommended placement on the desired line should have 5x the pipes diameter in liner straight length upstream and be free from bends, flanges, and fittings while also having 2x the pipes diameter in liner straight length downstream and be free from bends, flanges, and fittings as well.

Reference **Figure-9** for optimal TTFM installation location.

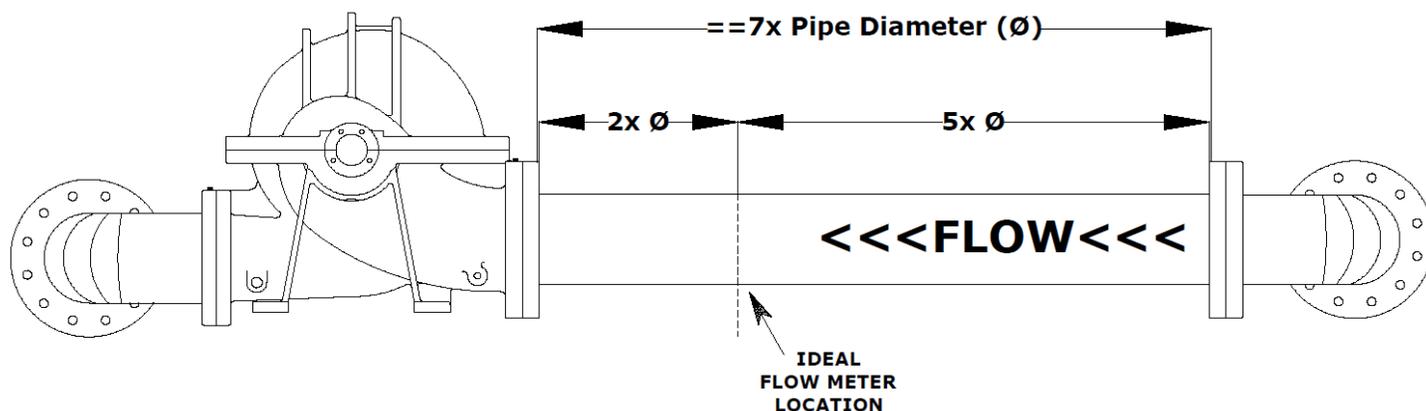


Figure 9 - TTFM Flowmeter; Illustration for Factory Preferred Location

5.8.1 Transit Time Flow Meter (TTFM) Wiring

In most installations, FireConnect® utilizes a Transit Time Flow Meter (TTFM) requiring two ultrasonic sensors to be mounted to the suction or discharge piping, which ever presents the best suited conditions to meet the installation requirements and straight run of piping dimensions. See Appendix-II for the complete installation and operation manual for the Greyline TTFM Flow Meter with available quick start instruction set.

Connection of the TTFM display unit to the FCJC will utilize the +24VDC and analog input terminals between the flow meter display unit and the FCJC.

After following the **Appendix-II** instructions for choosing your location to install the TTFM display unit and setting up the hardware, make the connections for the power supply and analog signal to and from the TTFM & FCJC as follows:

1. Make sure the power is off and all “Lock Out Tag Out” procedures are followed according to site practices.
2. Run all the necessary conduit and connections to and from the bottom of each enclosure, the TTFM and FCJC
3. Run two lengths of 18awg/2c shielded wire, or wire approved by the local authority, from the TTFM to the FCJC
4. Route both sets of shielded wire properly labeled and exposed in the bottom of each enclosure
5. TTFM Display Unit Enclosure
 - a. Terminate the Positive (+) and Negative (-) leads to their respective terminals in the TTFM enclosure for the power supply terminals labeled **9-32 VDC Power Input**
 - i. Reference **Figure-10**
 - b. Terminate the Analog OUTPUT signal to its respective terminal for the data to be sent to the FCJC controller.
 - i. Reference **Figure-10**
6. FCJC Enclosure
 - a. Terminate the leads for TTFM power supply to their respective polarity inside the FCJC
 - i. The **Positive +24v** lead is to be connected to either **Terminal 9 or 10** (both +24v)
 - ii. The **Negative 0v** ground reference lead is to be connected in any available in available grounding terminals (**GND**)
 - b. Terminate the leads for TTFM Analog Signal to their respective polarity inside the FCJC
 - i. Terminate the Analog signal positive line to the terminal labeled (**Analog**) **Input 2** and the negative lead to be grounded in available grounding terminals (**GND**)

Once these connections are made and checked for errors, power on FCJC to verify the TTFM has been properly connected.

Once power and communication has been established to the TTFM display unit, proceed with the installation and calibration steps found in the **Appendix-II Greyline TTFM Flow Meter Installation and Operation Manual**

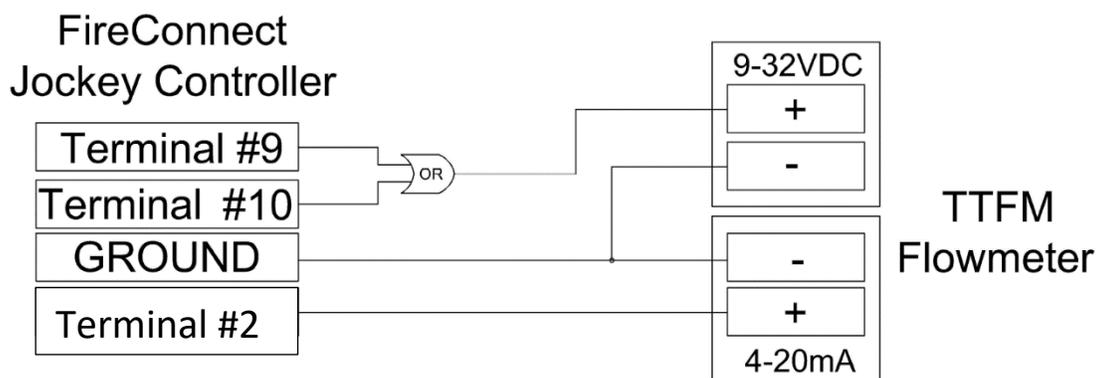


Figure 10 - Connections for the FireConnect Jockey Controller to the TTFM

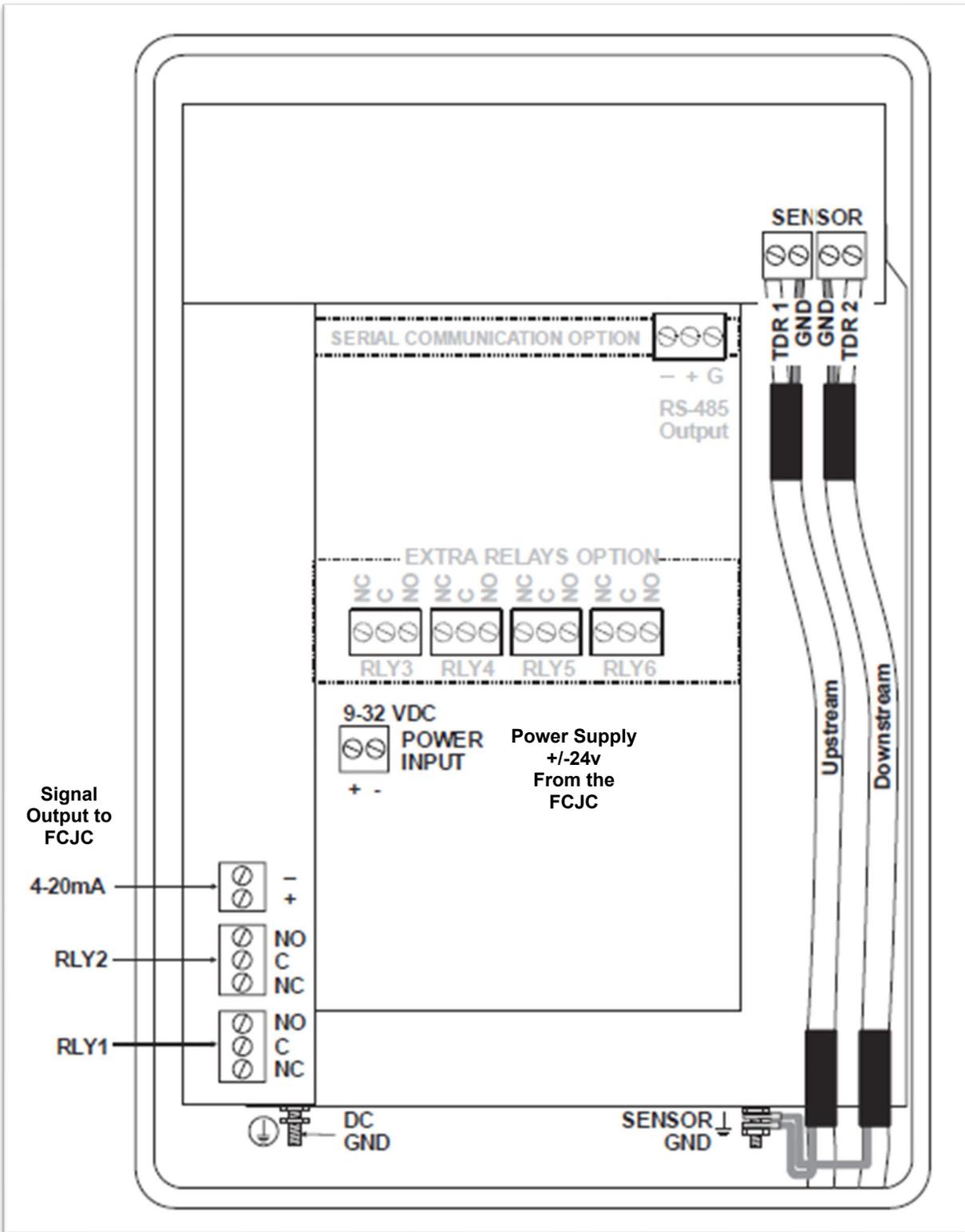


Figure 11 - TTFM Wiring Diagram; Terminal Illustration

5.9 Diesel Tank Level Monitoring & Visual Indicator



- Warning! If these safety instructions are not observed, personal injury may result. Read entire instruction set prior to beginning the installation process, including the standards provided within NFPA 20 in regard to the assembly and configuration requirements for fuel lines on Diesel Driven Fire Pumps.

Caution

- If these instructions are not observed, the result could lead to malfunction, damage to the equipment, or violations to the NFPA 20 standards. All of which are to ensure safe and reliable installations for peripheral monitoring.

The Diesel Tank Level Monitoring system is designed to be an integral part of the FireConnect® Gateway Controller. The system includes a Visual Tank Level Display mounted to the FCGC enclosure which will provide visual confirmation of the current tank level. The gauge will be preconfigured at the time of order fulfillment based on the tank size and dimensions provided at the time of order placement.

The Installation of the FireConnect Diesel Fuel Tank Level Monitoring Assembly is to be performed by qualified personnel according to the following procedure and in accordance with the authority having jurisdiction. The customer assumes all responsibility for installation and plumbing connections, acknowledging that deviations from the recommended installation procedure could potentially result in violations to the NFPA 20 standard.

All responsible parties should review NFPA 20, chapter 11 to ensure complete compliance.

Provided in **Figure – 12 & 13** are two options for installation, both for new construction and retrofitting an existing tank. These options are designed to prevent the need for an existing tank to be drained which is filled with fuel. However, if at all possible, the primary design in **Figure - 12** should be applied for the most accurate readings to be returned by the Diesel Tank Level Monitoring option. Should the method of installation found in **Figure – 12 & 13** be utilized, the “A” dimension should be reported at the time of order, or parameterization will need to be performed at the time of installation.

All sensing units supplied with the Diesel Tank Level Monitoring option are to be ATEX certified in order to ensure intrinsic isolation of the electrical components and meet the appropriate requirements for the specified application.

5.9.1 Installation of the FireConnect Diesel Fuel Tank Level Sensor

Prior to installation, review of NFPA 20 Chapter 11 is required

The Peerless FireConnect Diesel Fuel Tank Level Monitoring Assembly is installed on the outlet of the tank where the fuel line connections to the engine are attached. Please note, the path of fuel from the tank to the engine must not be obstructed in any way, contain only one isolation valve, and is to remain locked open at all times per NFPA requirements. The sensing assembly is designed as a peripheral unit, leaving the path of fuel flow unobstructed and unaltered from the tank to the engine. Please refer to **Figure-12 & 13** for the recommended configuration diagrams.

Contained within **Figure-12** is the preferred method of installation but may require the fuel to be drained from the tank if installation is to be performed on an existing system. This installation method is best suited for “New Construction” and should be performed prior to commissioning and filling the tank.

The Tee fitting to be installed for the sensing configuration should be of equal diameter to the outlet of the tank and be constructed of NON-galvanized steel or cast iron, along with all other required fittings. The sensing lines must all be horizontally aligned with earth level to the outlet of the tank for accurate measurement. All fittings should be installed with the appropriate PTFE thread sealant.

The orientation of the locked isolation valve can be modified to meet the needs of installation as required by the customer and conditions of the installation environment. The customer assumes all responsibility for the compliance of regulations according to NFPA standards. Reference **Figures-12 & 13** for examples of these options and dimensions required.

The wiring and connections for the sensing unit:

- Run one length of 18awg/2c shielded wire, or wire approved by the local authority, from the Microsensor transducer provided in the kit to the FCJC using approved conduit connections for penetrations to the enclosure
- A positive +24v connection is made to the **+24v** rail found inside the FCJC and is to be connected to the sensing unit by conduit or means approved by the jurisdiction having authority.
 - Connection to the sensing unit will be terminated by connection to the **BLACK LEAD** of the transducer for the **+24v** supply.
- A second wire is connected to the Analog Input #6 and connected to the sensing unit by conduit or means approved by the jurisdiction having authority.
 - Connection to the sensing unit will be terminated by connection to the **RED LEAD** of the transducer for the **4-20mA analog signal**

5.9.2 Diesel Fuel Tank Level Monitoring (Dimensional Analysis)

The optional Diesel Fuel Tank Level Monitoring Assembly must be configured in a similar manor to the Tank Level Monitoring found in section 5.7 of this Installation and Operation Manual. Configuration will be programmed prior to shipment if all dimensions are provided at the time of order placement.

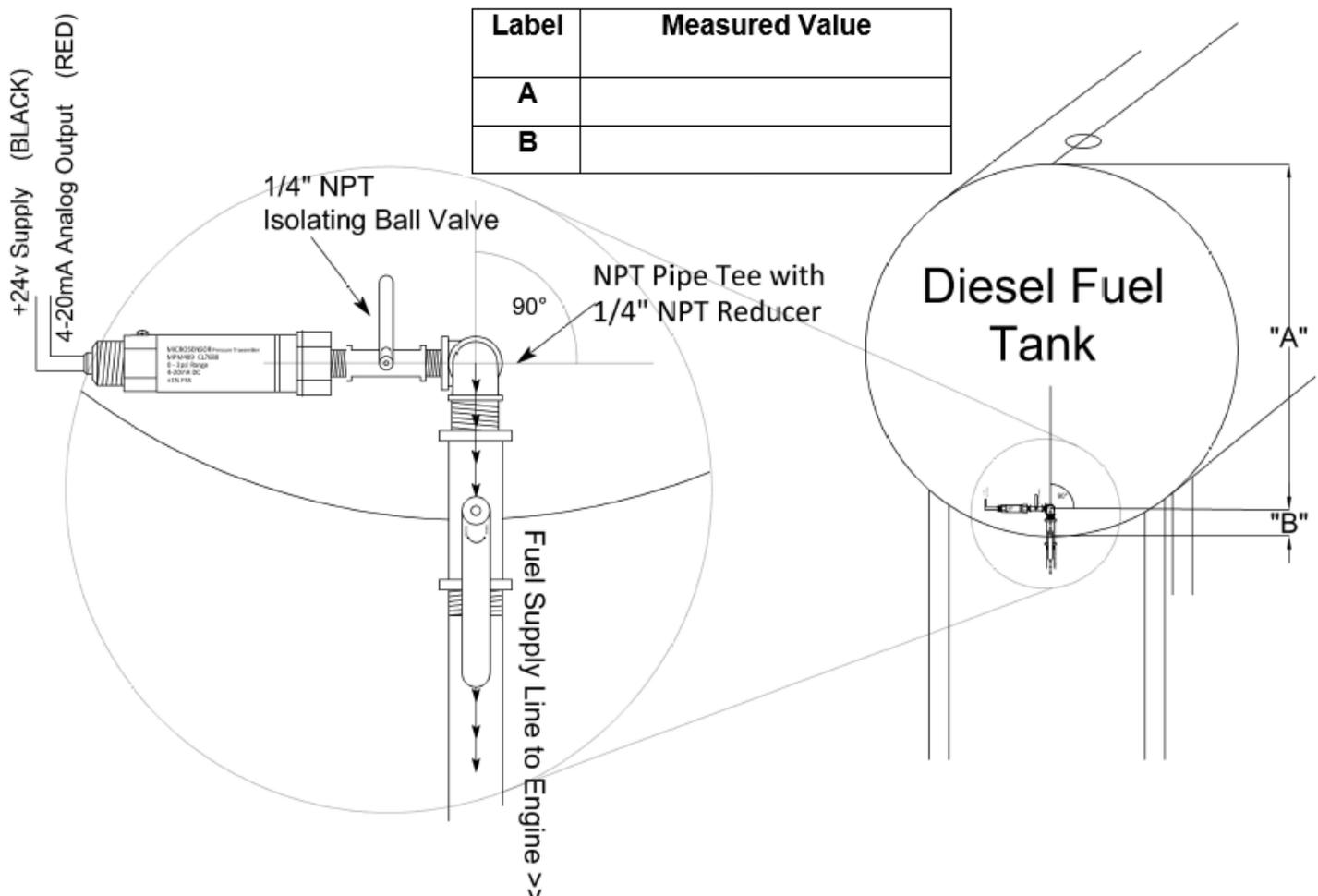


Figure 12 - Diesel Level Monitoring; Factory Preferred Installation Method

If dimensions are not provided at the time of order, field programming may be necessary and will require the dimensions to be provided as shown below in **Figure-12**

Please use the following instruction subset with illustration to determine the dimensions as described. Record all information in the table provided to be communicated with factory support and stored within the enclosure for future reference.

- Record the “**A**” dimension
 - This will be the vertical distance from the Center Line of tank outlet to the Top of the Tank
- Record the “**B**” dimension
 - This will be the vertical distance from the Center Line of tank outlet to the Bottom of the Tank

5.9.2.1 Diesel Fuel Tank Level Monitoring; *Alternate Installation Method*

In the event of installation on an existing tank and in order to prevent draining the tank for installation, please use the following instruction subset with illustration to determine the dimensions as described. This method allows the peripheral monitoring transducer to be installed below the isolation valve.

- Record the “**A**” dimension
 - This will be the vertical distance from the Centerline of tank outlet to the Top of the Tank
- Record the “**B**” dimension
 - This will be the vertical distance from the Centerline of tank outlet to the Centerline of the Transducer
 - Installations may vary with configurations of the isolation valve in relation to the tank and illustration provided in **Figure-13** and can be accounted for with careful measurement of the dimensions for vertical distance (height)

Label	Measured Value
A	
B	
C	

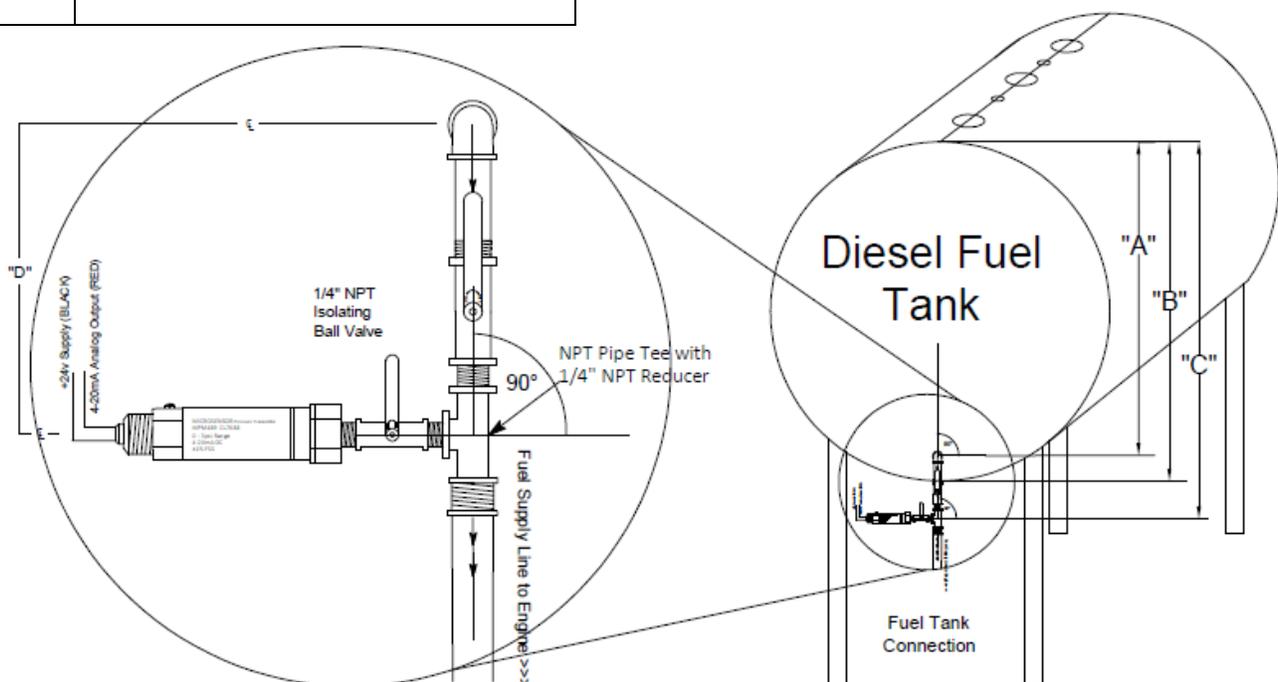


Figure 13 - Diesel Level Monitoring; Alternate Installation Method for Existing Fire Systems
(Allows Installation Without Draining Tank)

5.10 Closed Cooling Loop; Tank Return Monitoring

The closed cooling loop with tank return monitoring is an option available for the FireConnect Jockey Controller and allows the FireConnect Gateway User Interface to monitor and capture the amount of water conserved and track the annual savings for positive representation of the environmental impact.



Caution

- This option is available for installations with a FireConnect Jockey Controller, but it is the customer's responsibility to ensure compatibility with their system's diesel engine manufacturer's specification for minimum required flow through the heat exchanger for proper functionality and required thermal transfer of engine coolant.
- Each installation and purchase of this remote monitoring package will require the customer to consult their respective engine manufacturer for approval of the installation.
 - This is required due to the positive head pressure created by gravity when returning the cooling water to the reservoir.

The customer assumes all liability and risk ensued by the installation of this modification and is responsible for ensuring the engine manufacturer specifications are compliant.

The customer assumes all responsibility for NFPA compliance, or compliance with authority having jurisdiction.

5.10.1 Closed Cooling Loop; Tank Return Monitoring Installation

The closed cooling loop return is to be connected to the discharge from the heat exchanger of the diesel engine. The piping must be increased by at least two nominal pipe sizes and will be connected to the assembly provided as part of the monitoring kit. The nominal sizes for components provided will be 2.0" NPT pipe threads and connected as shown in **Figure – 14**.

The Kit assembly will include the following:

- 2x Digital Temperature Sensor
- Discrete Flow Switch
- Sight Glass Indicator

When installing the kit assembly, orientation must be observed with respect to the direction of flow indicated by the markings on the flow switch.

The return line should be routed to the top of tank for factory approved installation, or by best means as deemed necessary and approved by the authority having jurisdiction.

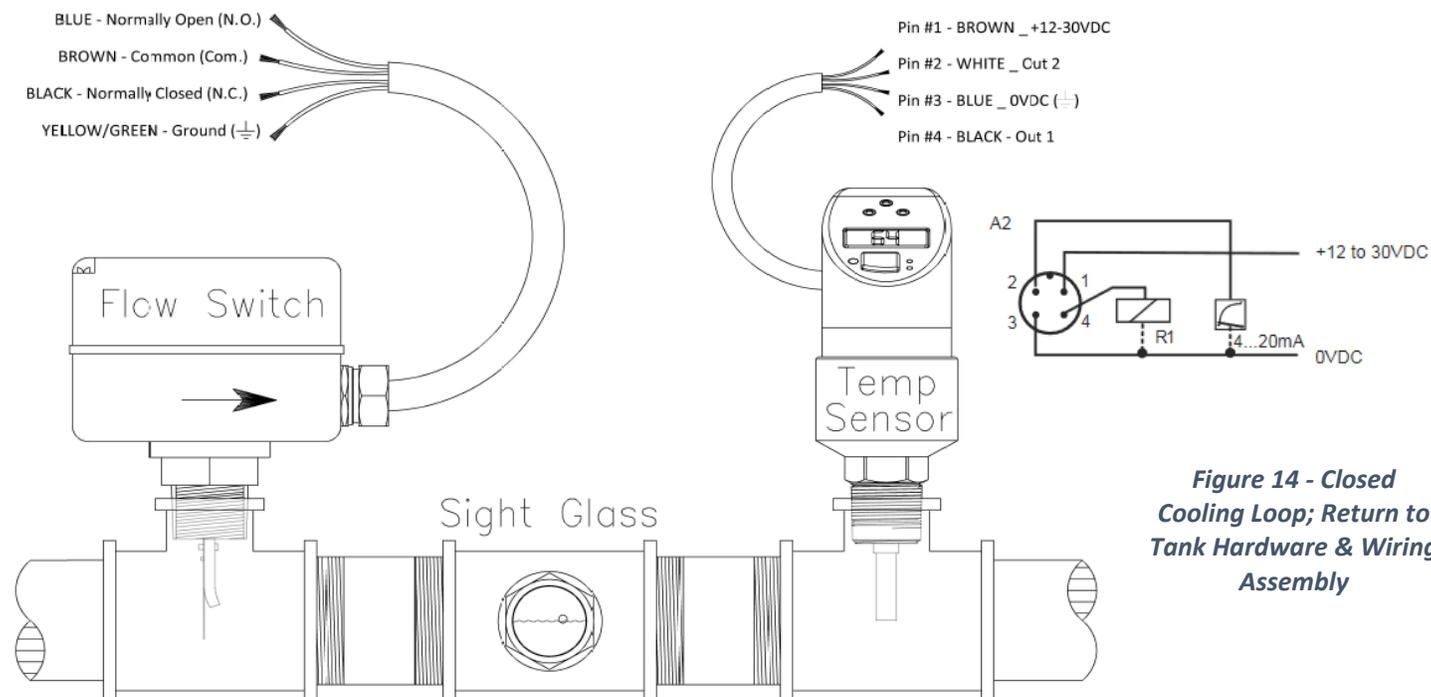


Figure 14 - Closed Cooling Loop; Return to Tank Hardware & Wiring Assembly

5.10.1.1 Closed Cooling Loop; Tank Return Monitoring Installation (Wiring)

The closed cooling loop return will require termination of the Flow Switch and Temperature Sensor inside the FireConnect Jockey Controller.

The wiring and connections for the Flow Switch unit:

- Run one length of 18awg/2c shielded wire, or wire approved by the local authority, from the discrete Flow Switch transducer provided in the kit to the FCJC using approved conduit connections for penetrations to the enclosure.
- A negative (0v) connection is made to the **GROUND** rail found inside the FCJC
 - Connection to the sensing unit will be terminated by connection to the **Brown – Common (Com)** lead of the flow switch
- The second wire is connected to the **Digital Input #1** Found inside the FCJC
 - Connection to the sensing unit will be terminated by connection to the **BLUE – Normally Open (NO)** lead of the switch now configured as a Normally Open switch.

The wiring and connections for the Temperature Sensing unit:

- Run one length of 18awg/4c shielded wire, or wire approved by the local authority, from the Digital Temperature Sensor M12 connection lead provided in the kit to the FCJC using approved conduit connection & penetration to the enclosure.
- A negative (0v) connection is made to the **GROUND** rail found inside the FCJC
 - Connection to the temperature sensing unit will be terminated by connection to
 - **Pin #3 – Blue Lead**
- A positive (+24v) connection is made to **Pin #9 or #10** for the +24v DC supply found inside the FCJC
 - Connection to the temperature sensing unit will be terminated by connection to
 - **Pin #1 – Brown Lead**
- The third wire is connected to the **Analog Input #7** found inside the FCJC
 - Connection to the sensing unit will be terminated by connection to
 - **Pin #2 – White Lead**
 - Note; The sensing device can also be configured for the same 4-20mA signal on Pin #4 as well, using the same Analog Input inside the FCJC

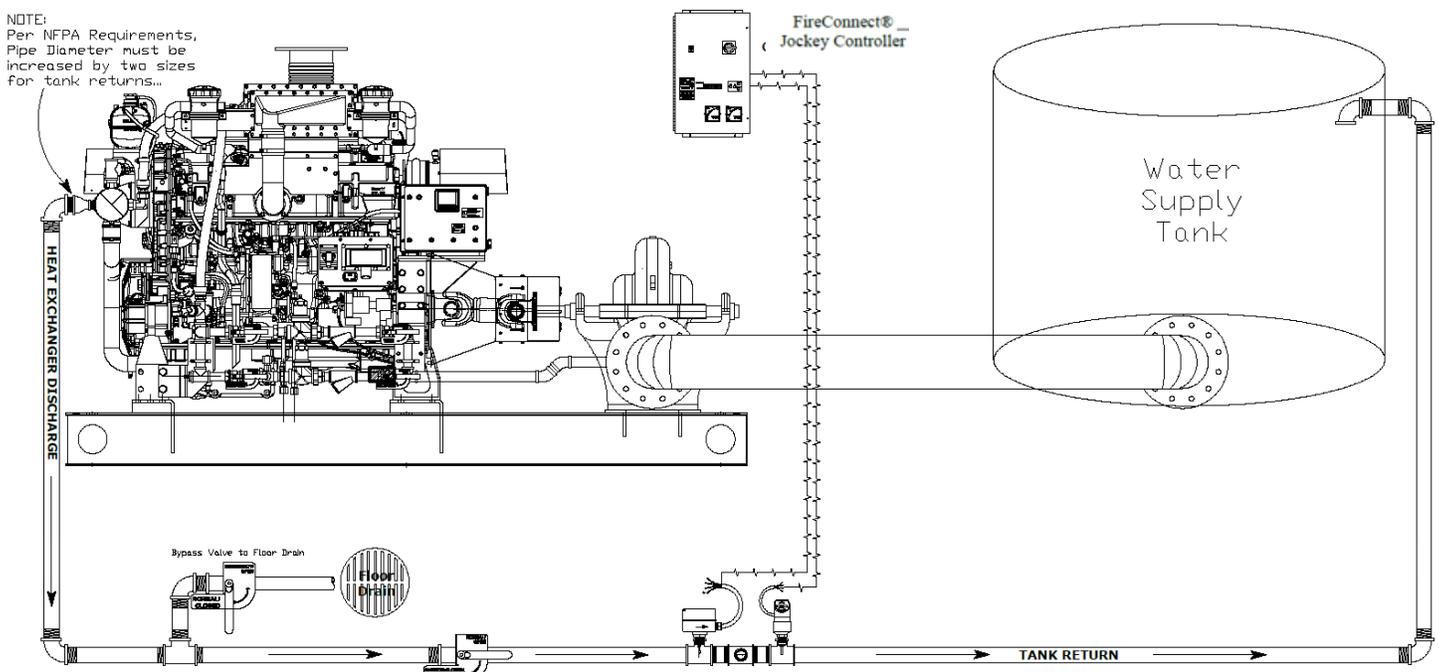


Figure 15 - Closed Cooling Loop; Tank Return Monitoring Hardware Assembly and Overview

5.11 Digital Temperature Sensor Programming

The ProSense ETS Series digital temperature sensor is available as an integral part of the closed cooling loop return monitoring feature and is also available as a standalone instrument for measuring the temperature of liquid being pumped. This device has the ability to be custom programmed for various settings and applications, although the unit should arrive preconfigured for the specific application.

In the event of your preconfigured devices memory becoming compromised during transit or from prolonged periods of storage prior to commissioning, the unit will require configuration.

The wiring diagrams and instructions will utilize **Output-#2** for both the closed cooling return monitoring and the pumped liquid temperature applications. This output will need to be configured as a 4-20mA analog output and a quick start set of instructions are as follows for the basic elements. This basic setup procedure is required for commissioning and compatibility with the FireConnect Jockey Controller and Remote Monitoring user interface. A complete set of the programming instructions are included in the **Appendix-III**

5.11.1 Digital Temperature Sensor Display & Menu Navigation

The ProSense ETS Series is programmed and operated by means of three keys (+, -, E) or by using XT-SOFT programming software (see the Programming with XT-SOFT Software section in **Appendix-III**). The digital display and the light emitting diodes (LEDs) support navigation in the operating menu.

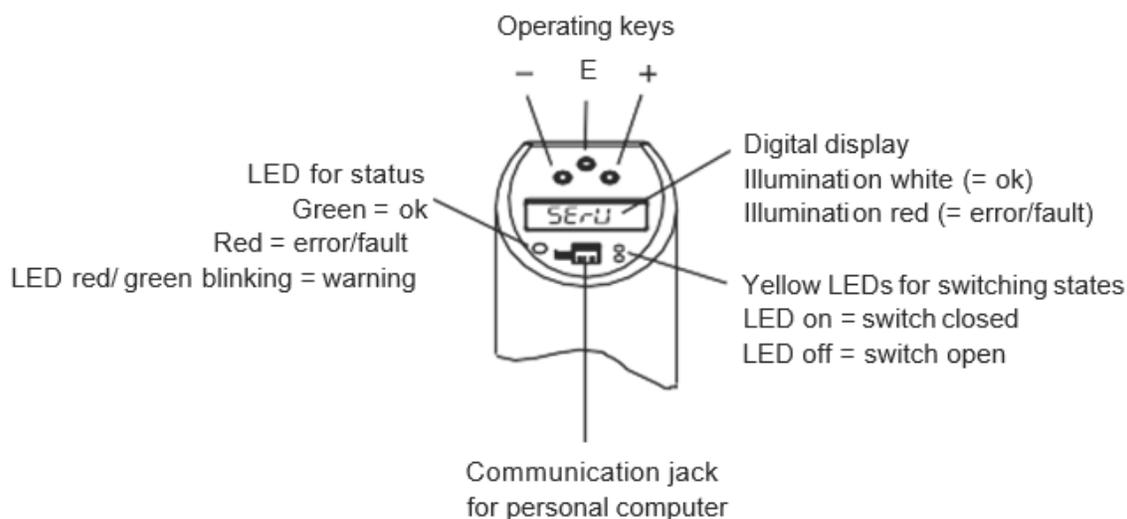


Figure 16 – ProSense Digital Temperature Sensor Display and Function Controls

The ProSense ETS Series is programmed and operated by means of three keys (+, -, E) and is the most suitable option for field programming and configuration. The following steps outline the

1. Enter the operating menu.
 - Press the **E** key for longer than 3 seconds.
2. Select the “Function group” with the + or - key.
3. Select the “Function” with the **E** key.
4. Enter or change parameters with the + or - key. Then return to “Function” with the **E** key.
 - Note: If software locking is enabled, it must be disabled before making entries or changes.
5. Press the **E** key several times to return to the “Function group” - until the appropriate function group is reached again.
6. To exit, press the **E** key for longer **than 3** seconds. If changes were made, see step 7.
7. Query to save data (select “**YES**” or “**NO**” with the + or - key) - confirm with the **E** key.
 - Changes to the parameter settings only become effective if you choose ‘**YES**’ when asked to save data.

5.11.2 Digital Temperature Sensor Menu Structure

The following outline is specific to the FireConnect Jockey Controller in regard to the desired output configuration. Further information is available in Appendix-III for the full functionality.

In **Figure-17** we can see the menu structure and the breakout for selections. All values are acceptable for use as configured by default with exception to **Output-#2** which will need to be configured for a 4-20mA analog signal.

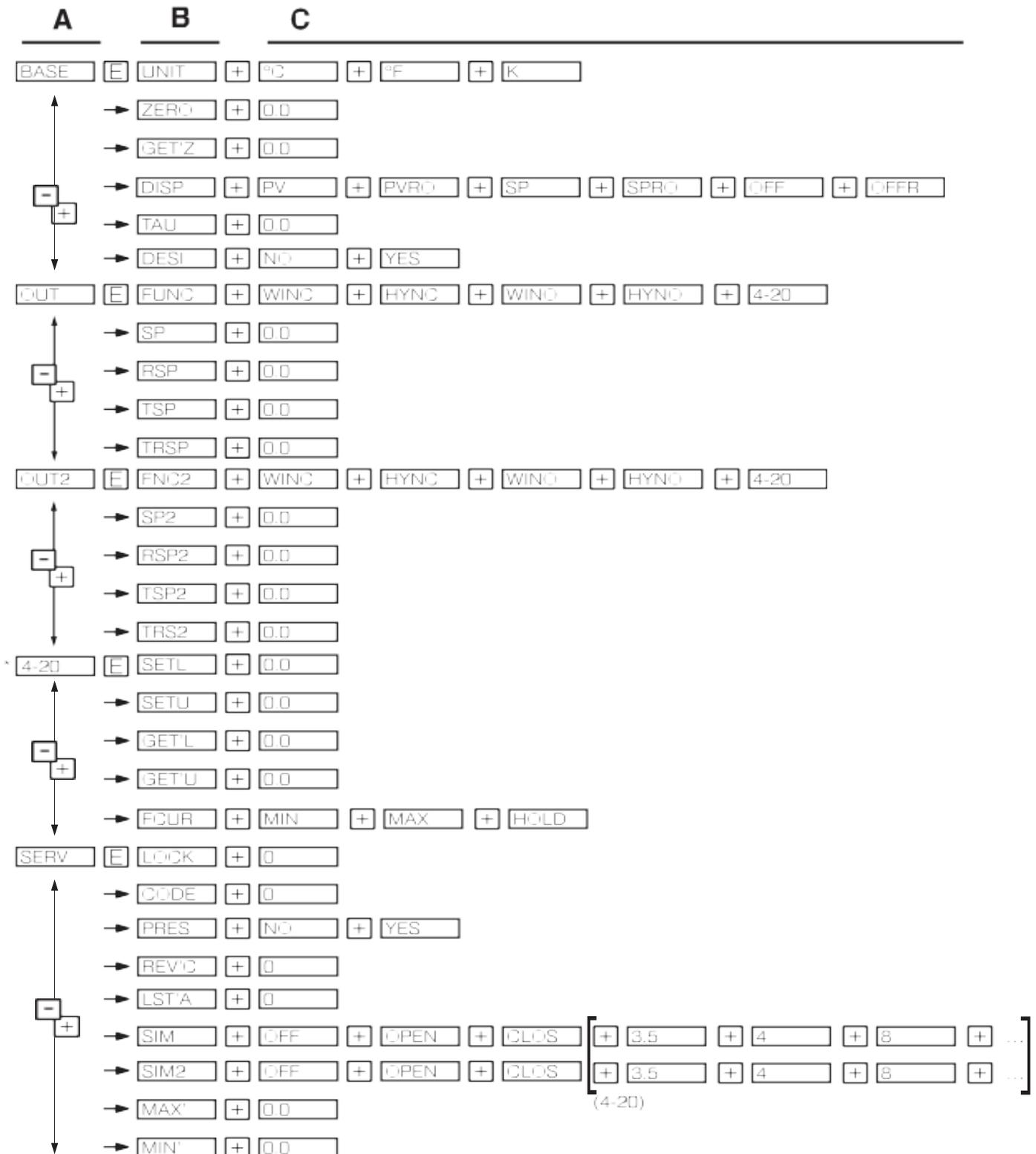


Figure 17 - ProSense Digital Temperature Sensor; Menu Function Tree
 Operating menu: A=function groups, B=functions, C=settings

5.11.2 Digital Temperature Sensor Menu Setting

The **Output-#2** will need to be configured as an analog output with a 4-20mA span. Follow the menu structure tree found in **Figure-17** to establish this selection and be sure to commit the changes by selecting the “YES” query.

All other settings do not need to be changed from the default values unless desired by the user. Some of the available options desired by the user may be units of measure for the temperature value (F, C, K) or various display options.

Note

- If any other settings or values are changed on the Temperature Sensor, this information will need to be communicated with the FireConnect Support Team in order to properly configure the remote monitoring system and user interface.

Function Group	Function		Settings	Description
BASE	UNIT	Technical unit	°C °F K	Select technical unit: °C, °F, K Factory setting: °F
	ZERO	Configure zero point	0 . 0	Position adjustment: within ±18°F/K (±10°C) of the upper range limit
	GETZ	Accept zero point	0 . 0	No settings possible (not available in XT-SOFT)
	DISP	Display	PV PVRO SP SPRO OFF OFFR	PV: measured value display PVRO: measured value display rotated 180° SP: set switch point display SPRO: set switch point display rotated 180° OFF: display off OFFR: display off rotated 180° Factory setting: measured value PV
	TRU	Damping: display value, output signal	0 . 0	Measured value damping with regard to display value and output: 0 (no damping) or 9 to 40s (in increments of 1 second) Factory setting: 0s
BASE	DES1	DESINA	NO YES	PIN assignment of the M12 connector is in accordance with the guidelines of DESINA Factory setting: No
OUT 2 Output 2	FUNC FUNC2	Switching characteristic	WINC HYNC WINO HYNO 4-20	WINC: window/NC contact HYNC: hysteresis/NC contact WINO: window/NO contact HYNO: hysteresis/NO contact 4-20: analog output Factory setting: HYNO

Figure 18 - Digital Temperature Sensor; Menu Functions Specific to the FireConnect System Integration

5.12 Battery Backup

Each FireConnect Jockey Controller comes equipped with an internal battery charger for the intended application of a battery backup to the remote monitoring portion of the system. This is intended to prevent a loss of monitoring services in the event of a power failure to the installed site. The system does NOT include batteries, these will need to be furnished by the customer. Reference section **5.12.1** for the types of batteries recommended by the manufacturer.

5.12.1 Battery Recommendations

The factory recommended equipment is a sealed lead acid battery designed for backup power supply, preferably with an F1 terminal type for ease of installation. The battery should be approximately 3-5 Amp hours in capacity for extended duration of the remote monitoring in the event of a power failure.

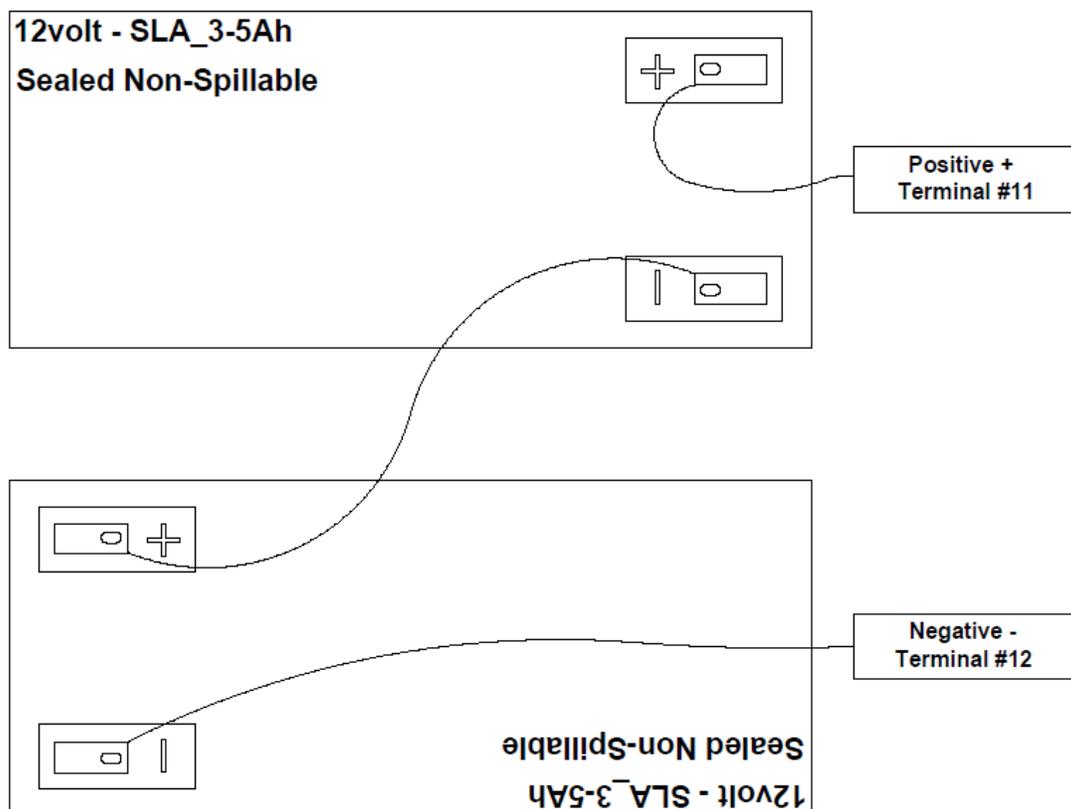
Recommended products:

- SLA12-5F Duracell Ultra 12V 5AH AGM SLA Battery with F1 Terminals
- Interstate Batteries FAS1055 12V 5AH SLA .187 FASTON

5.12.2 Battery Location

It is recommended that the batteries be placed in an external enclosure, separate from the internal control components, but in close proximity to the controller.

This is recommended due to inherent risk created by the combination from the arc flash created by the motor contactor and poorly maintained batteries having the potential to excrete volatile gasses.



*Figure 19 - Remote Monitoring Battery Backup.
Series Wiring Configuration*

5.12.3 Battery Wiring

The recommended batteries are a 12v design in nature, therefore two batteries will need to be connected in series for a 24v configuration. Reference **Figure-18** for an illustration of a series connection.

- Run two lengths of 18awg insulated wire, or wire approved by the local authority, from the batteries configured in series to the FCJC using approved conduit connection & penetration to the enclosure.
 - The **Positive +** lead will be connected to **Terminal #11**
 - The **Negative –** lead will be connected to **Terminal #12**

Reference the wiring diagram found in **Appendix-I** for further illustration on the battery backup feature.

5.12.4 Battery Maintenance

All battery backup systems require regular maintenance. An annual inspection of the system is recommended, and batteries must be replaced on, or before their expiration date.

Chapter 6 - FireConnect® Jockey Controller HMI Menu

6.1 Menu Functions

6.1.1 Moving through the menus:

- On power up, the Home screen is displayed.
- Press the Home button to always return to the Home screen.
- Press the Next button to move to the next screen
- Hold Next, then press DEC to move to the previous screen.
- In all menus, except the Home screen, use the INC or DEC buttons to change values. Hold the INC or DEC buttons down for 3 seconds to change values by 10.

6.1.2 Function changes with buttons:

- To change **PSI to BAR**
 - In the Home screen, press the **HOME** button for 3 seconds to change the pressure reading from **PSI to BAR** or vice versa.
- To enable **Sequence Start**
 - In the Home screen, press the **INC** button for 3 seconds to enable the “**D**” setting for a fixed 2 second sequence starting time delay.
- To calibrate the **Pressure**
 - In the Home screen, press the **INC** and **DEC** buttons simultaneously for 3 seconds to access the pressure calibration screen.
 - Reduce the incoming pressure to zero, then Hold **HOME** for 3 seconds to set zero.
 - Press **NEXT**.
 - Increase the incoming pressure to the highest pressure possible, then Press INC or DEC to adjust the screen pressure to the calibrated gauge pressure reading.
 - Hold HOME for 3 seconds to set calibration.
 - Press INC and DEC to return to Home screen.
- To reset **Motor Run Hours**
 - In the Motor Run Hours screen, press **INC** and **DEC** simultaneously for 3seconds.
- To reset **Starts**
 - In the Starts/24Hr screen, press **INC** and **DEC** simultaneously for 3 seconds.
- To reset all settings to **Factory Defaults**, power-up while pressing the **HOME** button.
- To view **SOFTWARE VERSION**
 - In the HOME screen, press the **HOME** button 3 times to view version number.
- To **Secure Settings**, move jumper **J1** on the control board to position 2-3 (upper).

6.1.2.1 Home Menu

Powers up to this screen. Displays actual pressure, Start and Stop pressures, and the Auto-OFF-Man mode. Press **HOME** three times to view the software version.

6.1.2.2 Motor Run Hours

Displays the total motor run hours to tenths of an hour. Press the **INC** and **DEC** buttons simultaneously for 3 seconds to clear the Run Hour history.

6.1.2.3 Trip Setting

Displays the Trip/Start setting. Press the **INC** or **DEC** buttons to change.

6.1.2.4 Reset Setting

Displays the Reset/Stop setting. Press **INC** or **DEC** buttons to change.

6.1.2.5 Minimum Run Setting

Displays the minimum run time. The factory default is 2. Press **INC** or **DEC** buttons to change.

6.1.2.6 Restart Time Setting

Displays the restart delay time. The factory default is 3. Press **INC** or **DEC** buttons to change.

6.1.2.7 Motor Starts In 24 Hours Setting

Displays the number of Auto starts in a 24 hour period that will trip the Excessive Start Alarm. The factory default is 96. Press **INC** or **DEC** buttons to change. Press the **INC** and **DEC** buttons simultaneously for 3 seconds to clear the start history. Note: The EEPROM is written to every 15 minutes so depending on when the power is turned off, the last 15 minutes of start data may be lost.

6.1.2.8 Overpressure

Displays the overpressure that will stop the pump and trip the alarm. Automatically resets 10 psi below trip point. The factory default is 999, which is disabled. Press **INC** or **DEC** buttons to change.

6.2 Menu & Recorded Memory (HMI Only)

These functions are relevant only to the actual controller interface and are not relative to the capabilities found within the FireConnect dashboard on the remote monitoring interface.

Once connected and enabled in the SERVICE menu, the pressure maintenance controller settings will be shown on the fire pump controller FCJC screen. They can now be adjusted at the fire pump controller. Also, the fire pump controller will record the settings and history.

6.2.1 Recorded Controller Settings

The jockey pump controller settings recorded on the fire pump controller are as follows:

- Jockey Start
- Jockey Reset
- Jockey Restart
- Jockey Minimum Run Delay
- Jockey 24HR Over Cycle
- Jockey Starts/24HR
- Jockey Runtime-Hours
- Jockey Total Starts
- Jockey Delay Start
- Jockey VFD Mode

6.2.2 Recorded Controller History

The jockey pump controller history recorded on the fire pump controller are as follows:

- Jockey Sequence Timer On/Off
- Jockey Auto mode On/Off
- Jockey Manual mode On/Off
- Jockey Security On/Off
- Jockey Running On/Off
- Jockey Remote Start On/Off
- Jockey Motor Run Timer On/Off
- Jockey Failure to Start On/Off
- Jockey Excessive Starting On/Off
- Jockey Trouble On/Off
- Jockey Comm Lost On/Off
- Jockey VFD mode On/Off

Chapter 7 - FireConnect® Jockey Controller Startup Procedure & Checklist



- *Perform these preliminary checks before energizing any input connection to the controller*

Caution

- *be sure the discharge valve is closed, and the fire pump and fire sprinkler system are ready for operation.*



- *To prevent the possibility of serious injury or death due to an electrical fault, be sure the door is closed and latched before closing the manual motor protector or disconnect switch on the controller.*

7.1 Procedure

Make absolutely sure that the system (power supply) voltage, motor nameplate voltage and horsepower ratings correspond to the controller nameplate voltages and horsepower ratings.

Inspect for and remove any metal chips which may have fallen in the controller during installation.

Remove all shipping ties and packing material that may not yet have been removed. Check all control wires for tightness.

Check that all connectors are seated and latched.

Check all connections in the power path of the motor and any Ground or Grounded conductors for tightness. Retorque any loose connections to the component manufacturer's specifications. Contact Master Control Systems for additional information.

7.2 Startup Checklist

The following checklist is designed to verify basic operation and all field input and output connections. It is recommended for each new installation and the annual fire pump test.

Caution

- *Be sure the discharge valve is closed and the fire pump and fire sprinkler system are ready operation.*

7.2.1 Energizing Controller

When energizing the controller for the first time after installation or after any service to the controller, motor, or motor wiring, follow the "Start-up Procedure" found earlier in this manual. For other cases, follow the Operating Instructions.

1. Close and Latch the controller door(s).
2. Place the Auto-Off-Man switch in the OFF position
3. With the controller door closed, close the MMP Operator.
4. Check that the display begins powering up.
5. Check the Pump Rotation by jogging (bumping) the motor. Do this by momentarily changing the Auto-Off-Man switch to Man position. For 3 phase motors, if the pump runs backwards, open the MMP Operator or Disconnect Switch and have a qualified electrician change rotation by swapping two of the three motor leads on the (M) contactor output terminals.
6. Change the Auto-Off-Man switch to Man position to run the motor.
7. Change the Auto-Off-Man switch to Off position to stop the motor.

7.2.2 Energizing Controller; Stand-By Operation

The normal stand-by configuration for the controller is for the MMP Operator to be closed, the display to be On and the Auto-Off-Man to be in the Auto position.



- *To prevent the possibility of serious injury or death due to an electrical fault, be sure the door is closed and latched before closing the manual motor protector or disconnect switch or operating the controller.*



- *Emergency Stopping – rotate the MMP operator counter clock- wise 90 degrees to power off the controller and stop the motor.*

1. Go to the Trip Setting menu and adjust the trip setting to the desired value.
2. Go to the Reset Setting menu and adjust the reset setting to the desired value.
3. Go to the Minimum Run Setting menu and set to the desired value.
4. Go to the Overpressure Setting menu and set to the desired value.
5. Change the Auto-Off-Man switch to Auto position.
6. Drop the pressure and check for a pressure start at the desired setting.
7. Verify it stops at the desired setting.

7.2.3 De-energizing Controller

To de-energize the controller, rotate the MMP operator counterclockwise 90 degrees.

7.2.4 Manual Starting

Change the Auto-Off-Man switch to Man position.

7.2.5 Manual Electric Stopping

Change the Auto-Off-Man switch to Off position.

Chapter 8 - Maintenance



- *Danger of lethal electrical shock and arc flash hazard - use appropriate personal protective equipment (PPE) in accordance with NFPA 70E.*



- *This equipment must only be serviced by qualified electrical personnel.*

8.1 Annual Maintenance Checklist

On an annual basis, qualified electrical personnel should inspect the inside of the controller and check:

- 1. Verify all control wires for appropriate tightness.
- 2. Verify that all connectors are seated and latched.
- 3. Verify all connections in the power path for tightness, re-torque any loose connections.
- 4. Verify there are no indications of water marks or signs of moisture on any of the components.
- 5. Verify there are no indications that the wire insulation is cracking.
- 6. Verify Battery Backup (optional) components have not expired and still maintaining sufficient charge.
- 7. Verify the TTFM Flow Meter is operational with sufficient signal strength, found in the display settings.

If any operation of the controller does not function correctly, or the inspection reveals any of the above problems, contact Master Control Systems Inc. for factory authorized service agent recommendations and/or torque specifications.

Peerless Pump Contact Information



Peerless Pump Company

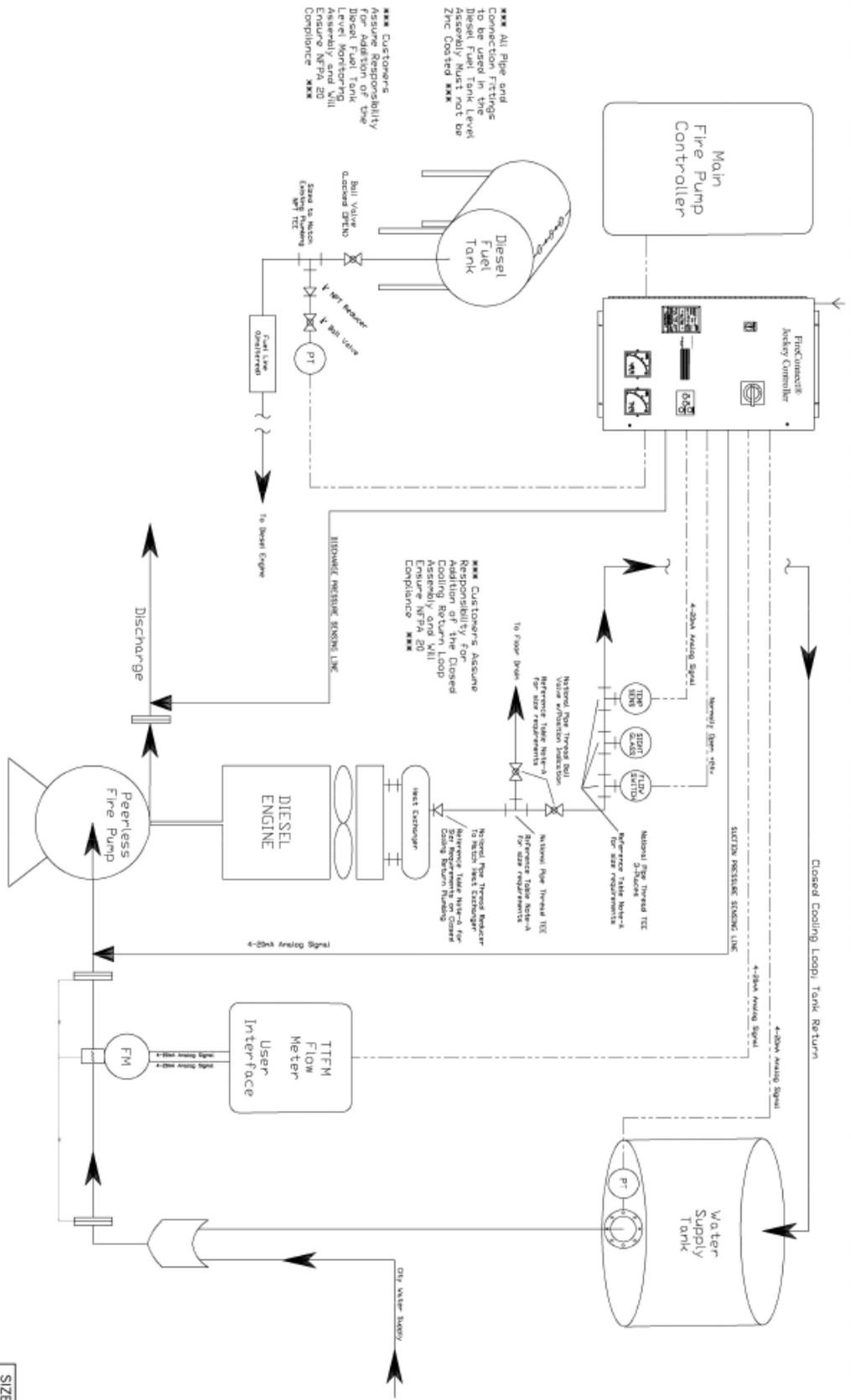
2005 Dr. Martin Luther King Jr

Indianapolis, 46202 - U.S.A.

Phone: (+1) (317) 925-9661

www.peerlesspump.com

Appendix I - Drawings & Diagrams



UNLESS OTHERWISE SPECIFIED,
 ALL BOLT HOLES \varnothing 0.30 A | B
 REMOVE SHARP EDGES
 FINISH :
 XX ± 0.1 MAY
 XXX ± 0.03
 XXXX ± 0.005

***NOTE-A - Closed Cooling Feature & Plumbing**
 All plumbing and fittings to maintain a minimum increase, two sizes larger than the discharge fittings from the heat exchanger.
 Minimum of 2'-11 1/2 NPT & 2" pipe diameter is recommended unless design requires larger sizes.
 Further detail can be found in the FireConnect Installation & Operation Manual

Drawing Type: P&ID
 Related Drawings:
 THIRD ANGLE PRODUCTION

Chg Number	Date Int.
XXXXX	XXXX-XX-XX



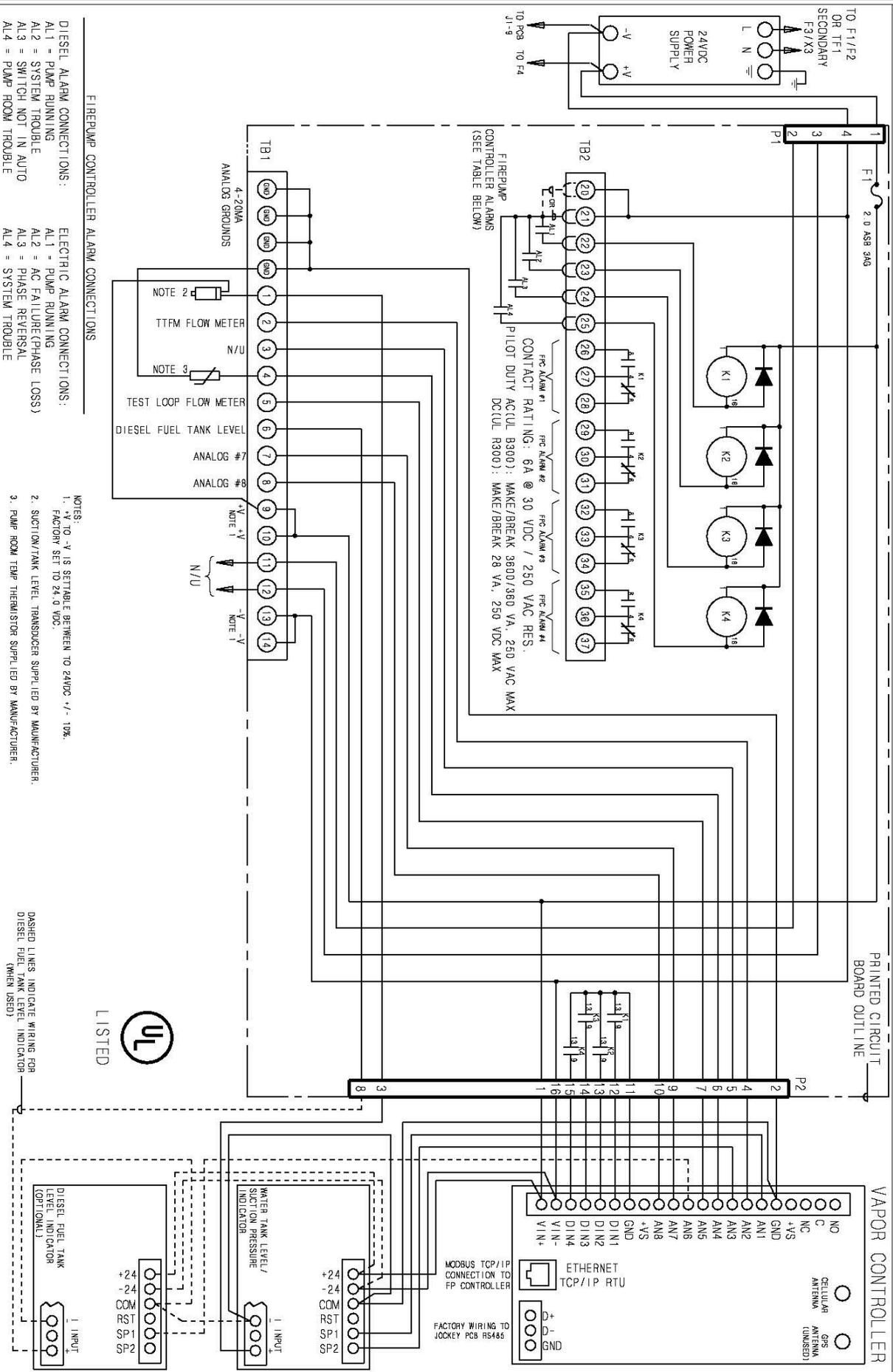
This drawing is the property of Peerless Pump Company and is not to be reproduced or employed for any manufacturing or other purpose without the express written permission of Peerless Pump Company. All rights reserved. Peerless Pump Company, Selma, Oregon.

Scale:	None	Drawer:	JNF	Date:	01/22/2022
DO NOT SCALE DRAWING		Approver:	JNF	Date:	01/22/2022
Description:	P&ID FireConnect Peerless Pump Company				
FireConnect Jockey Controller					
Page:	1	of	1		

SIZE A

Model FCJC Fire Connect Wiring Diagram

MASTER



FIREPUMP CONTROLLER ALARM CONNECTIONS:

DIESEL ALARM CONNECTIONS:

AL1 = PUMP RUNNING
AL2 = SYSTEM TROUBLE
AL3 = SWITCH NOT IN AUTO
AL4 = PUMP ROOM TROUBLE

ELECTRIC ALARM CONNECTIONS:

AL1 = PUMP RUNNING
AL2 = AC FAILURE(PHASE LOSS)
AL3 = PHASE REVERSAL
AL4 = SYSTEM TROUBLE

NOTES:

1. +V TO -V IS SETTABLE BETWEEN TO 24VDC +/- 10% FACTOR SET TO 24.0 VDC.
2. SUCTION/TANK LEVEL TRANSDUCER SUPPLIED BY MANUFACTURER.
3. PUMP ROOM TEMP THERMISTOR SUPPLIED BY MANUFACTURER.

DASHED LINES INDICATE WIRING FOR DIESEL FUEL TANK LEVEL INDICATOR (WHEN ISSD)



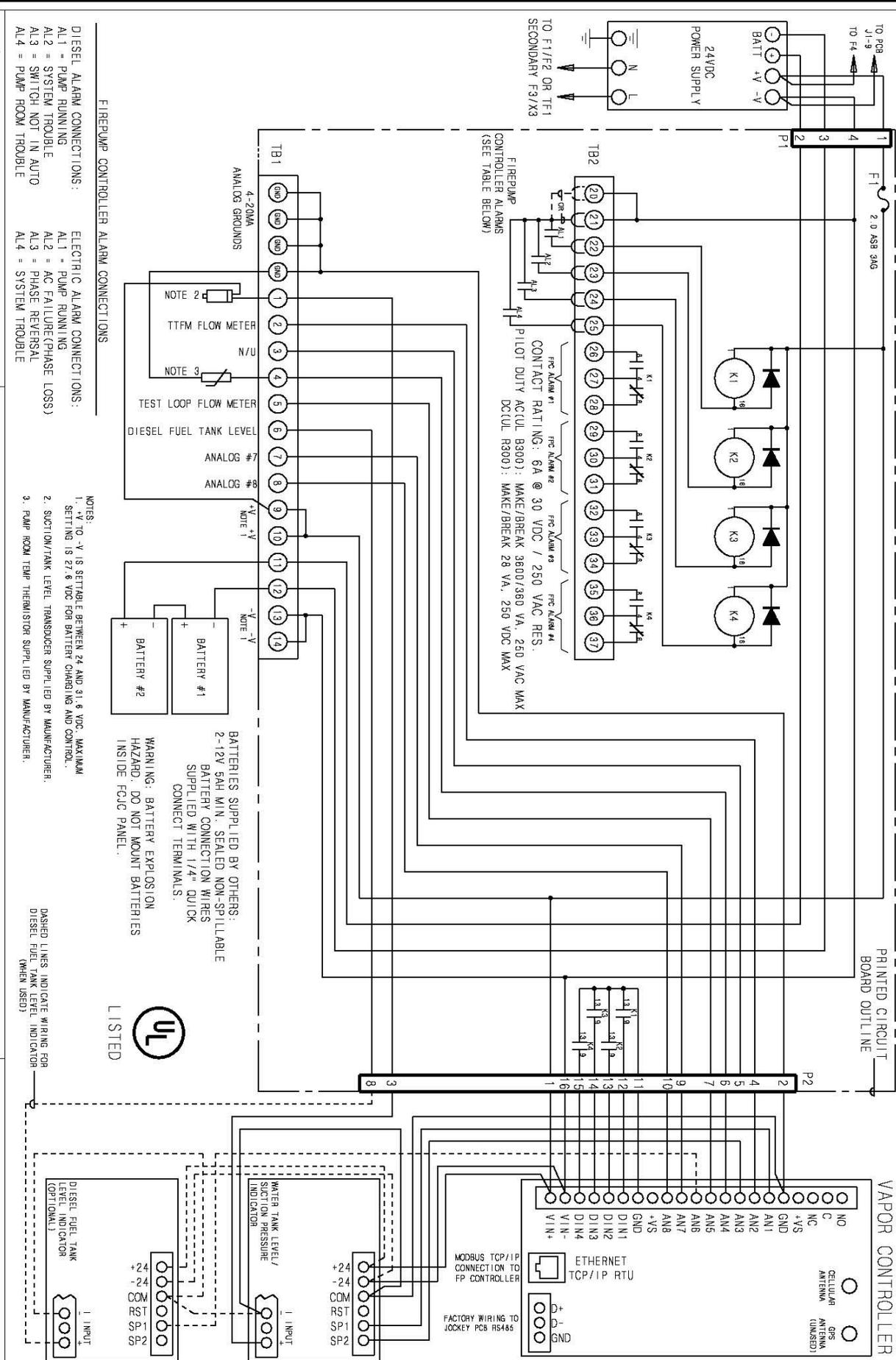
Master Control Systems Inc.
LAKE BLUFF, ILLINOIS U.S.A.

Model FCJC Fire Connect Wiring Diagram

Date: 27 March 2023
Drawing: 24197 Issue 1

Model FCJC Fire Connect Wiring Diagram

MASTER



FIREPUMP CONTROLLER ALARM CONNECTIONS:

DIESEL ALARM CONNECTIONS:
 AL1 = PUMP RUNNING
 AL2 = SYSTEM TROUBLE
 AL3 = SWITCH NOT IN AUTO
 AL4 = PUMP ROOM TROUBLE

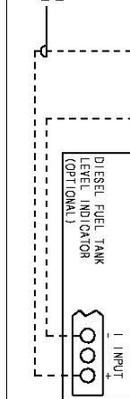
ELECTRIC ALARM CONNECTIONS:
 AL1 = PUMP RUNNING
 AL2 = AC FAILURE(PHASE LOSS)
 AL3 = PHASE REVERSAL
 AL4 = SYSTEM TROUBLE

NOTES:

1. SETTING 19 IS SETTABLE BETWEEN 24 AND 31.6 VDC MAXIMUM
 2. SUCTON/TANK LEVEL TRANSDUCER SUPPLIED BY MANUFACTURER.
 3. PUMP ROOM TEMP THERMISTOR SUPPLIED BY MANUFACTURER.

WARNING: BATTERY EXPLOSION HAZARD. DO NOT MOUNT BATTERIES INSIDE FCJC PANEL.

BATTERIES SUPPLIED BY OTHERS:
 2-12V 5AH MIN. SEALED NON-SPILLABLE BATTERY CONNECTION WIRES SUPPLIED WITH 1/4" QUICK CONNECT TERMINALS.



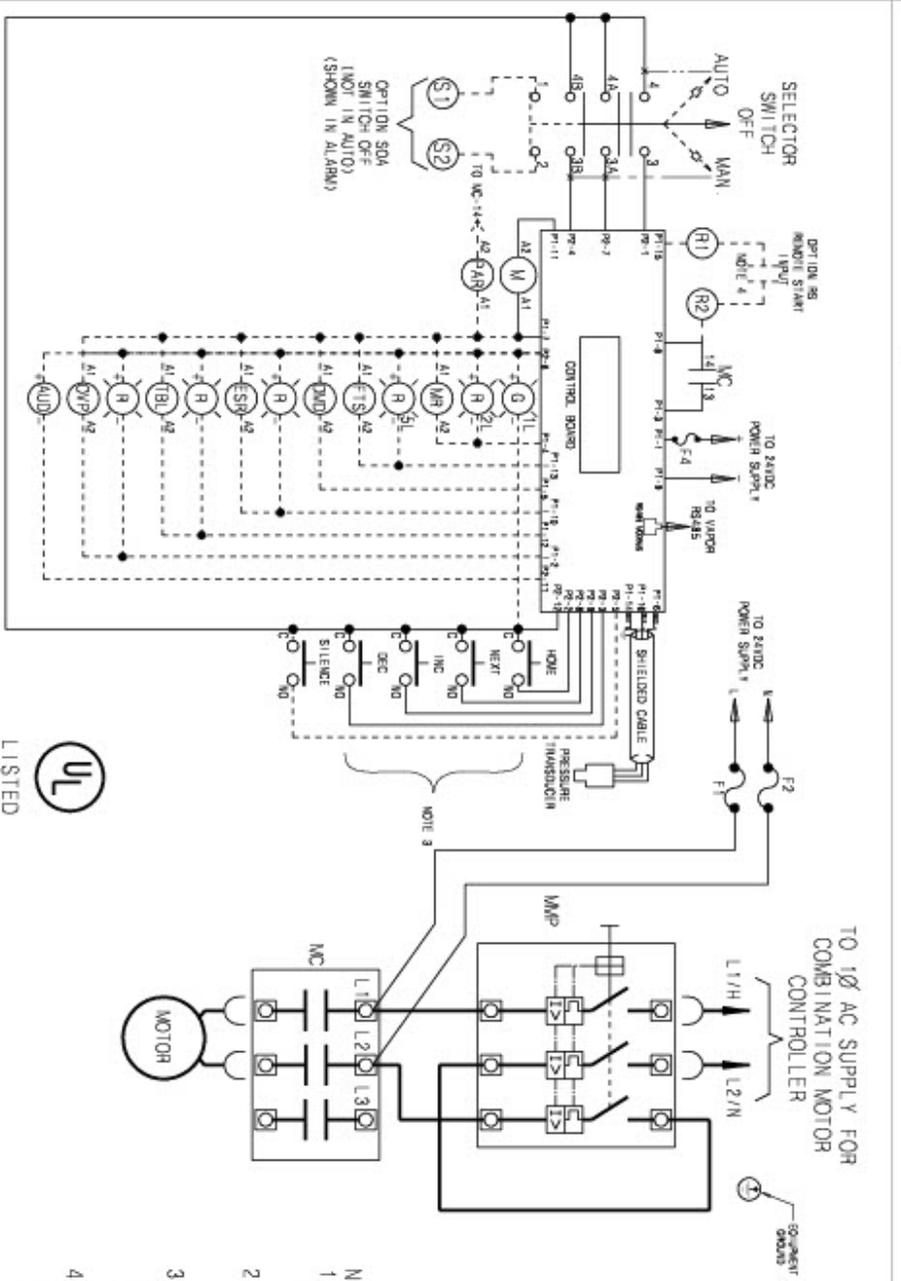
Master Control Systems Inc.
 LAKE BLUFF, ILLINOIS U.S.A.

Model FCJC Fire Connect Wiring Diagram W/Mod BC

Date: 25 May 2023
 Drawing: 24196 Issue 2

Model FCJJC Pump Motor Controller

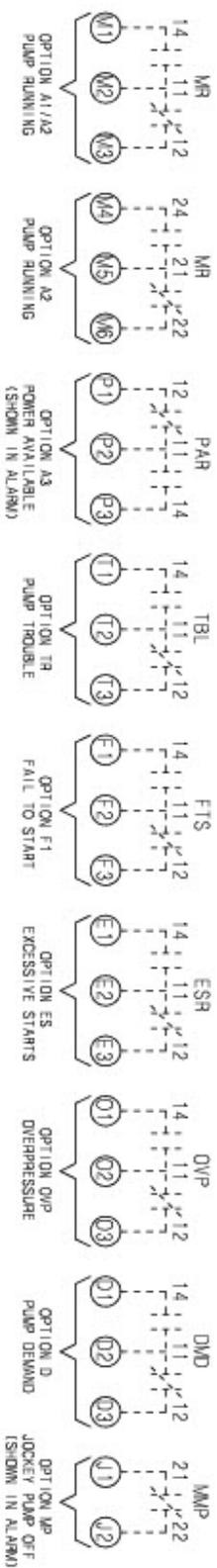
MASTER



- | SYMBOL | DESCRIPTION |
|--------|--------------------------------|
| MMP | MANUAL MOTOR PROTECTOR |
| MC | MOTOR CONTACTOR CONTACTS |
| M | MOTOR CONTACTOR COIL |
| MR | MOTOR RUN RELAY(OPTION A1/A2) |
| FTS | FAIL TO START RELAY(OPTION F1) |
| F1, F2 | PRIMARY CONTROL CKT FUSE |
| 1L | POWER ON LAMP (OPTION L2) |
| 2L | PUMP RUNNING LAMP (OPTION L1) |
| 5L | FAIL TO START LAMP(OPTION L5) |
| DMD | DEMAND RELAY |
| AUD | AUDIBLE ALARM |
| ESR | EXCESSIVE STARTS RELAY |
| TBL | TRouble RELAY |
| OVP | OVERPRESSURE RELAY |
- OPTIONAL EQUIPMENT
FIELD WIRING
- NOTES:
1. MINIMUM RUN TIMER FACTORY SET TO 3 SECONDS, MAX SETTING 999 SECONDS.
 2. RESTART DELAY TIMER FACTORY SET TO 3 SECONDS, MAX SETTING 99 SECONDS.
 3. PRESS 'NEXT' TO MOVE THROUGH SETUP SCREENS. PRESS 'INC/DEC' TO CHANGE SETTINGS. SEE MANUAL FOR MORE DETAILS.
 4. MOMENTARY CONTACT. RUNS FOR MIN RUN TIME IF RESET PRESSURE IS SATISFIED. USE MAINTAINED CONTACT FOR CONTINUOUS RUNNING.

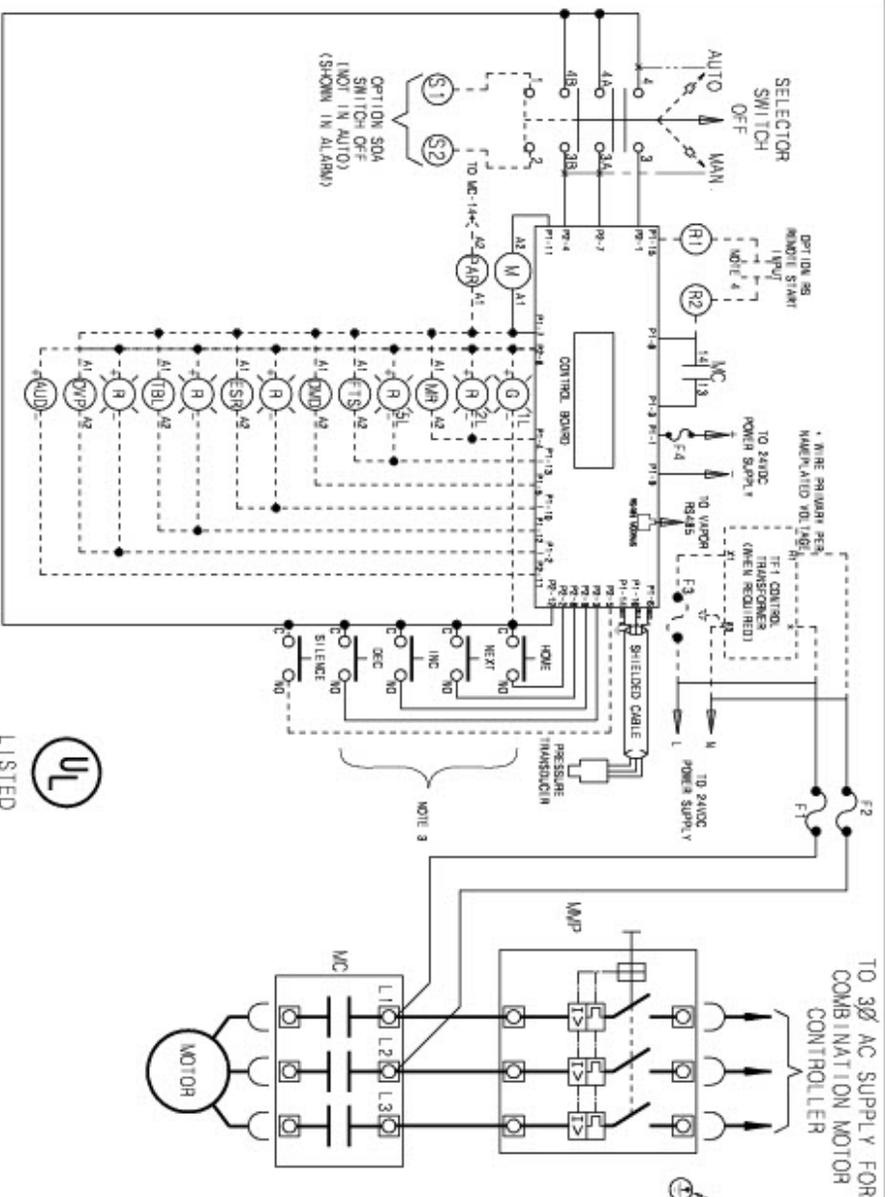


ALARM CONTACTS CONTACT RATING: 5A MAX. AT 240VAC OR 28VDC

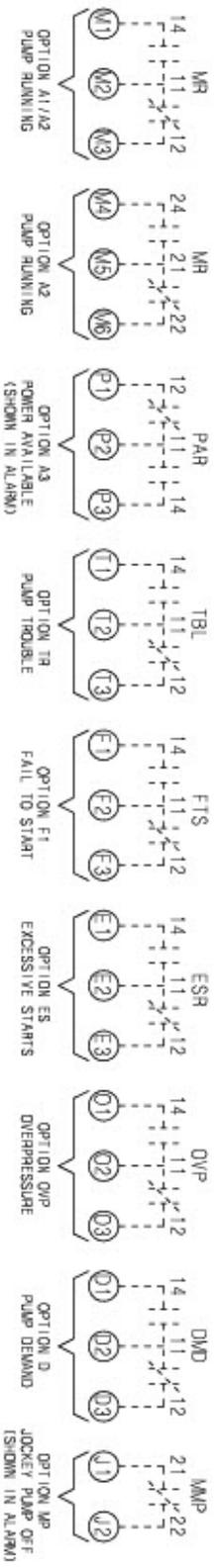


Model FCJC Pump Motor Controller

MASTER



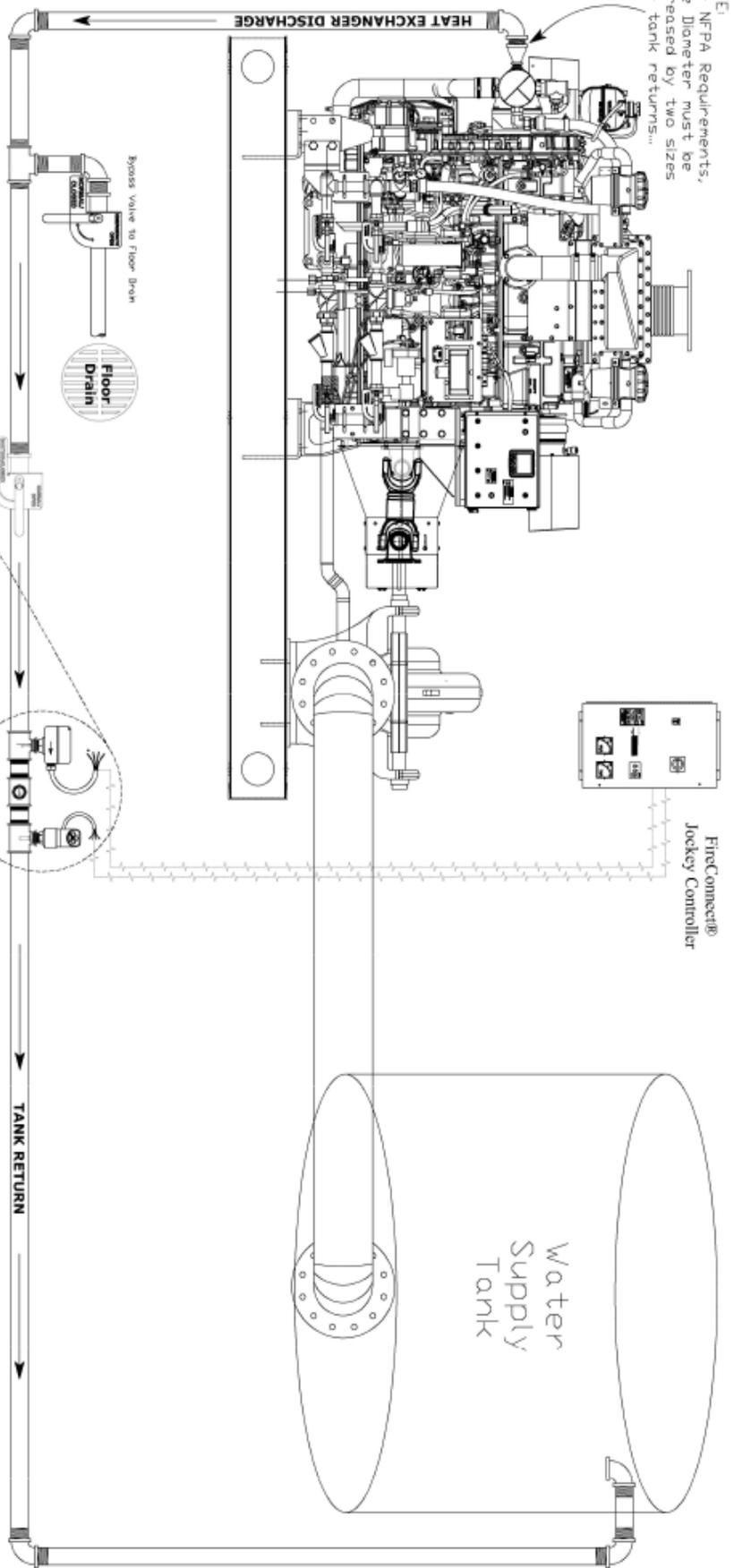
ALARM CONTACTS CONTACT RATING: 5A MAX. AT 240VAC OR 28VDC



SYMBOL	DESCRIPTION
MMP	MANUAL MOTOR PROTECTOR
MC	MOTOR CONTACTOR CONTACTS
M	MOTOR CONTACTOR COIL
MR	MOTOR RUN RELAY(OPTION A1/A2)
FTS	FAIL TO START RELAY(OPTION F1)
F1, F2	PRIMARY CONTROL CKT. FUSE
1L	POWER ON LAMP (OPTION L2)
2L	PUMP RUNNING LAMP (OPTION L1)
5L	FAIL TO START LAMP(OPTION L5)
DMD	DEMAND RELAY
AUD	AUDIBLE ALARM
ESR	EXCESSIVE STARTS RELAY
TBL	TROUBLE RELAY
OVP	OVERPRESSURE RELAY
- - -	OPTIONAL EQUIPMENT
—	FIELD WIRING

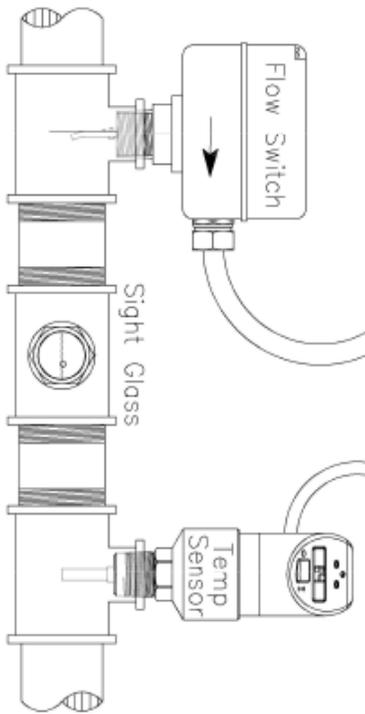
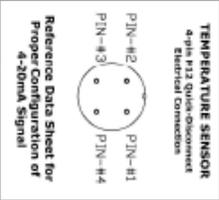
- NOTES:
1. MINIMUM RUN TIMER FACTORY SET TO 3 SECONDS. MAX SETTING 999 SECONDS.
 2. RESTART DELAY TIMER FACTORY SET TO 3 SECONDS. MAX SETTING 99 SECONDS.
 3. PRESS 'NEXT' TO MOVE THROUGH SETUP SCREENS. PRESS 'INC/DEC' TO CHANGE SETTINGS. SEE MANUAL FOR MORE DETAILS.
 4. MOMENTARY CONTACT. RUNS FOR MIN RUN TIME IF RESET PRESSURE IS SATISFIED. USE MAINTAINED CONTACT FOR CONTINUOUS RUNNING.

NOTE:
Per NFPA Requirements,
Pipe Diameter must be
increased by two sizes
for tank returns...



BLUE - Normally Open (N.O.)
BROWN - Common (Com.)
BLACK - Normally Closed (N.C.)
YELLOW/GREEN - Ground (GND)

Pin #1 - BROWN - +12.0VDC
Pin #2 - WHITE - Out 2
Pin #3 - BLUE - 0VDC (GND)
Pin #4 - BLACK - Out 1



The drawing is the property of Panther Pump Company and is not to be reproduced or transmitted in any form or by any means, electronic, mechanical, photocopying, recording, or by any information storage and retrieval system, without the prior written permission of Panther Pump Company. At the request of Panther Pump Company or upon completion of the job, it is to be returned to Panther Pump Company, Ash Grove, Illinois.

Scale:	None	Drawer:	JNF	Date:	01/29/2022
DO NOT SCALE DRAWING		Approver:	JNF	Date:	01/29/2022
Description: Closed Cooling Loop FireConnect Illustration					
FireConnect Jockey Controller					
Page:	1	of			1

Customer assumes responsibility for assembly and maintaining NFPA compliance

11.4.4.2

"Fuel piping shall not be galvanized steel or copper"

11.4.4.2.1

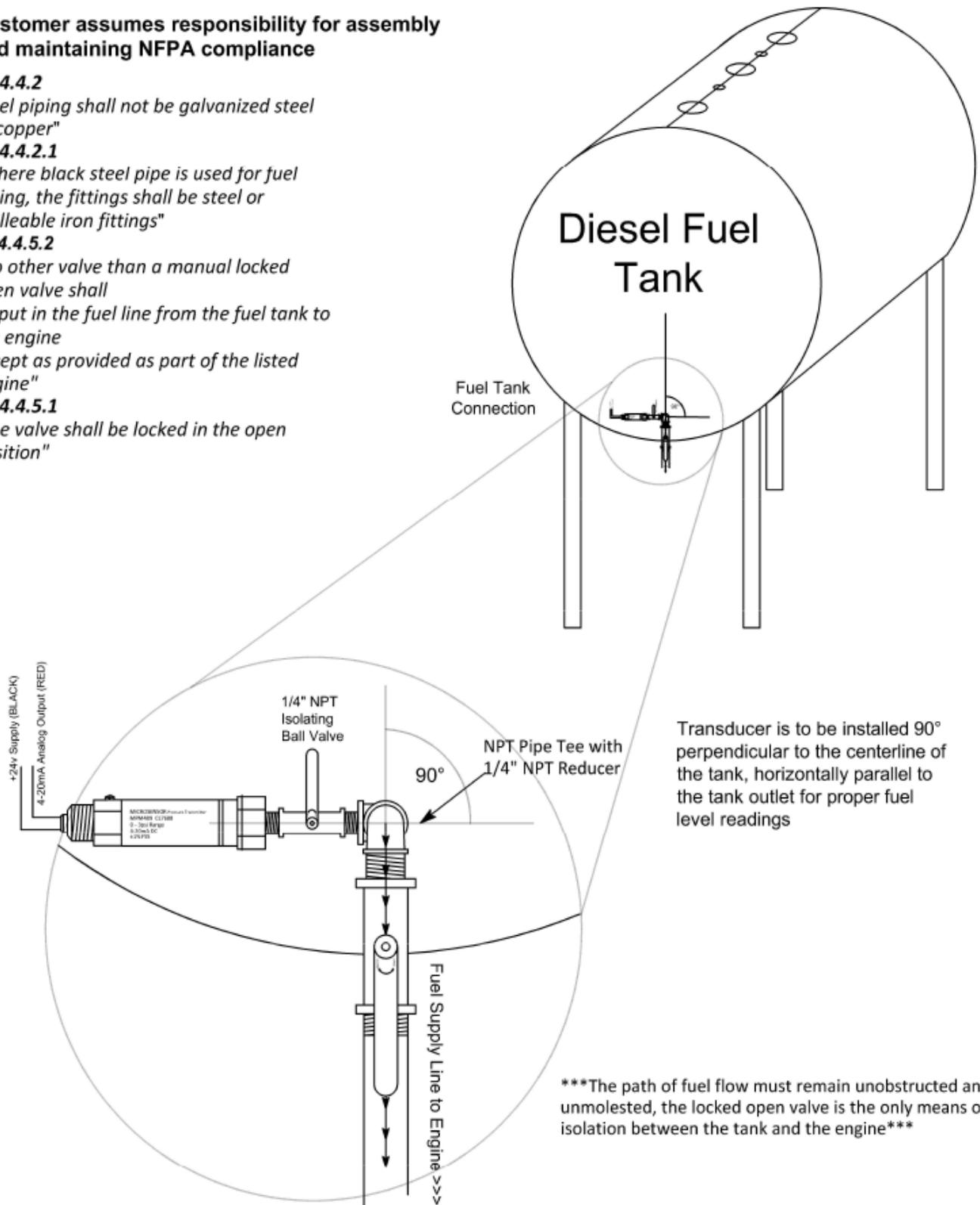
"Where black steel pipe is used for fuel piping, the fittings shall be steel or malleable iron fittings"

11.4.4.5.2

"No other valve than a manual locked open valve shall be put in the fuel line from the fuel tank to the engine except as provided as part of the listed engine"

11.4.4.5.1

"The valve shall be locked in the open position"



Basic Material No.: 4		 2005 Dr. Martin Luther King Jr. Street Indianapolis, IN 46202 This drawing is the property of Fireless Pump Company and is not to be reproduced or employed for any manufacturing purpose except upon the explicit instructions of Fireless Pump Company. At the request of Fireless Pump Company or upon completion of the job, it is to be returned to Fireless Pump Company, Indianapolis, Indiana.	Scale: None	Drawn: JNF	Date: 07/01/2021
Dimension of basic material: ..			DO NOT SCALE DRAWING	Approver: JNF	Date: 07/01/2021
Type of basic material:			Description: FireConnect Fuel Tank Level Monitoring Assembly		
Drawing Type: SHOP			Drawing No.: Front View Orientation (MicroSensor)		
Related Drawing: "		Page: 1 of 1			
Chg note	Date Int.	THIRD ANGLE PROJECTION			

Customer assumes responsibility for assembly and maintaining NFPA compliance

11.4.4.2

"Fuel piping shall not be galvanized steel or copper"

11.4.4.2.1

"Where black steel pipe is used for fuel piping, the fittings shall be steel or malleable iron fittings"

11.4.4.5.2

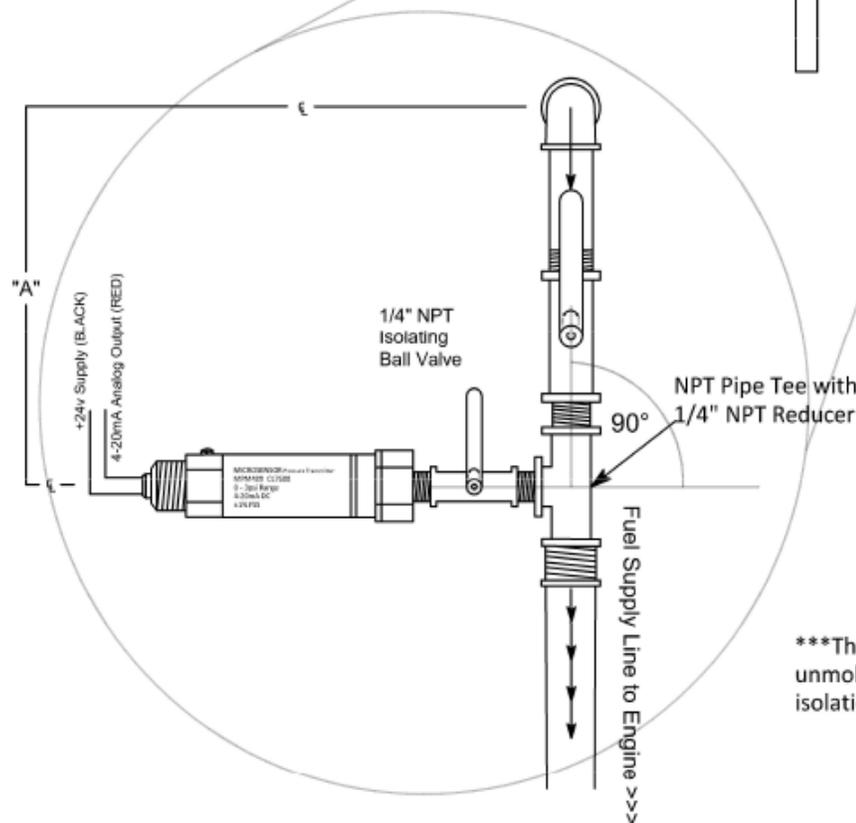
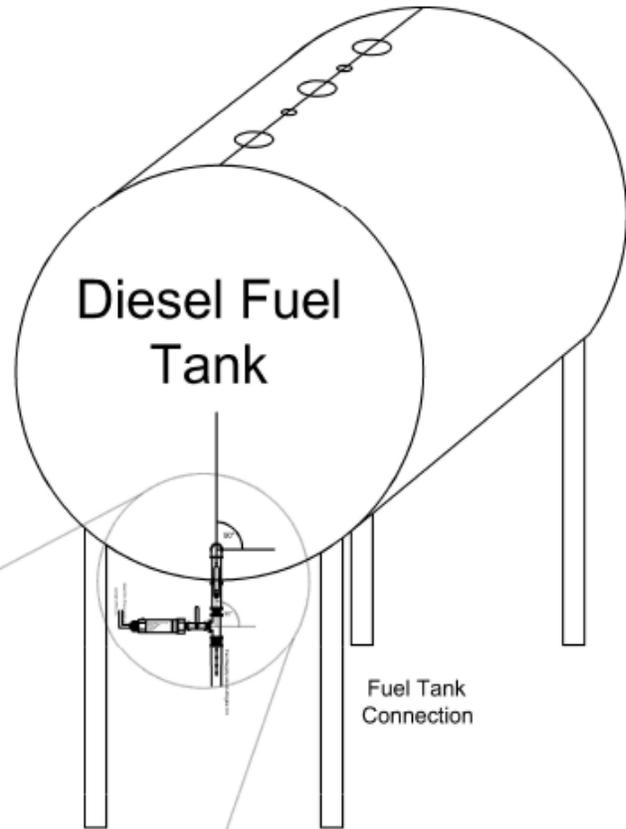
"No other valve than a manual locked open valve shall be put in the fuel line from the fuel tank to the engine except as provided as part of the listed engine"

11.4.4.5.1

"The valve shall be locked in the open position"

Transducer is to be installed 90° perpendicular to the centerline of the tank, horizontally parallel to the tank axis.

The "A" dimension will be required for proper scaling, accurate to 0.5 Inches or 1.0 Centimeters



The path of fuel flow must remain unobstructed and unmolessted, the locked open valve is the only means of isolation between the tank and the engine

Basic Material No.: INSTALLATION OPTION #2	
Dimension of basic material: ..	
Type of basic material:	
Drawing Type: SHOP	
Related Drawing: "	
Chg note	Date Int.
THIRD ANGLE PROJECTION	



2008 Dr. Martin Luther King Jr Street
INDIANAPOLIS, IN 46202
This drawing is the property of Peerless Pump Company and is not to be reproduced or employed for any manufacturing purpose except upon the explicit instructions of Peerless Pump Company. At the request of Peerless Pump Company or upon completion of the job, it is to be returned to Peerless Pump Company, Indianapolis, Indiana.

Scale: None	Drawer: JNF	Date: 07/01/2021
DO NOT SCALE DRAWING	Approver: JNF	Date: 07/01/2021
Description: FireConnect Fuel Tank Level Monitoring Assembly		
Drawing No.: Front View Orientation (MicroSensor)		
Page:	1	of 1

Appendix-II

Greyline TTFM 6.1 Quick Start

The following “Quick Start” installation and operation manual is an adaptation from the original and can be referenced in Appendix III should further details be required during the installation and commissioning of the FireConnect® Gateway Controller system . All “Quick Start” instructions are specific for the application of the Greyline TTFM 6.1 flow meter as an integral component to the FireConnect® Gateway Controller system.

CONNECTIONS; POWER INPUT

The FireConnect® system utilizes the optional DC input model and requires 9-32 VDC/10 Watts as our standard configuration. Connect to + and – terminals as **referenced in section 5.5.1.3**.

An option is available for standard supply at 100-240V 50/60Hz upon request when ordering the FireConnect® system.



- Warning! If these instructions are not observed, electric shock with consequent risk of serious personal injury or death may occur.

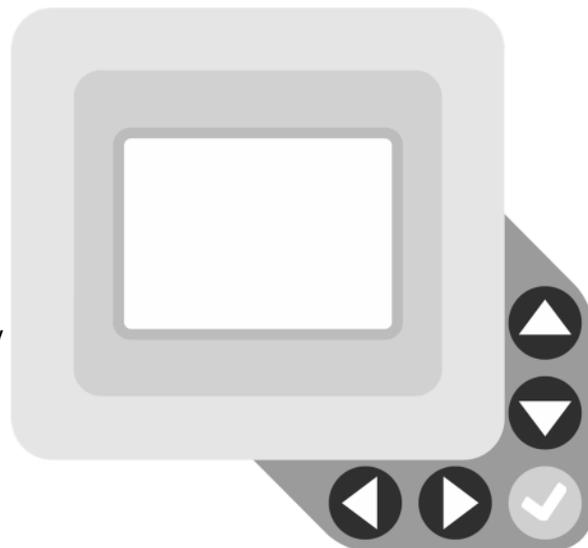


Figure 2 - Greyline TTFM 6.1 Display and Panel

KEYPAD SYSTEM

The diagram in Figure-7 shows the TTFM 6.1 menu system. Arrows show the four directions to leave a menu box. Pressing a corresponding keypad arrow will move to the next item in the direction shown. Move the cursor (highlighted) under numerals and increase or decrease numerals with the ▲ and ▼ keys.

To store calibration values permanently (even through power interruptions), press the ✓ button.

ICONS



- Message waiting. Press ▲ from main page to view.



- Data logging off.



- Data logging on.



- USB file downloading.



- File download completed.



- Download Error.



- TTFM Echo OK.

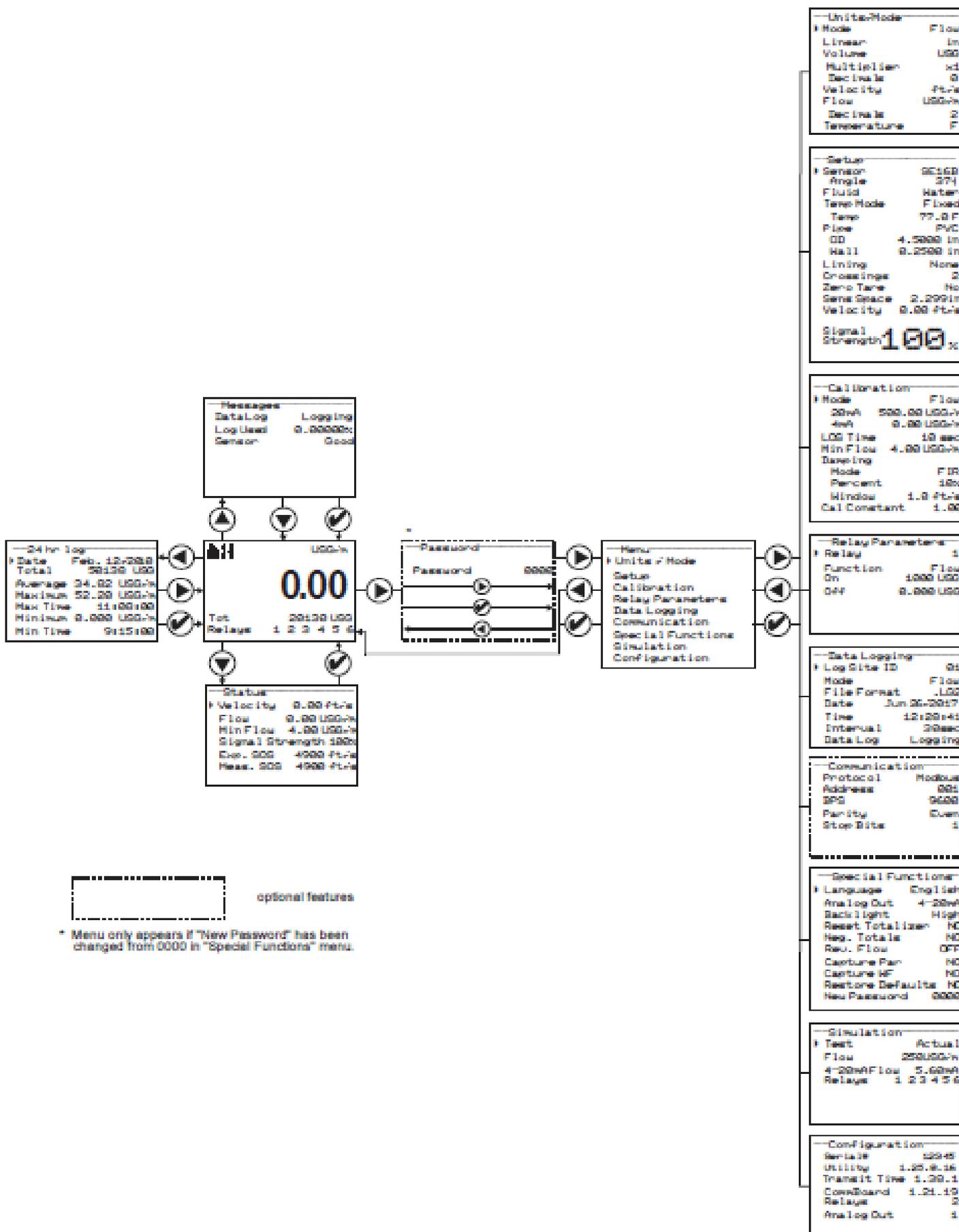


- TTFM - Low Signal / No Echo, Empty Pipe or high Aeration.



- TTFM - No Sensors Attached / Wrong Settings

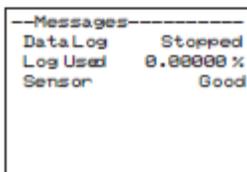
MENU SYSTEM





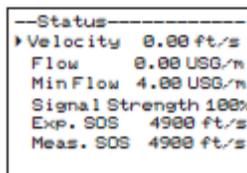
MAIN DISPLAY

The Main Display shows the units selected from the Units/Mode menu, flow rate or velocity rate being measured, totalizer, totalizer multiplier, and relay states. The TTFM 6.1 will go to this display after start-up.



MESSAGE ICON

Press ▲ from the Main Display to view status of the data logger and error/warning messages provided by the instrument. The Message Icon will appear on the Main Display if error messages are being generated by the instrument. Press ✓ to return to the Main Display.



STATUS

Press ▼ from the Main Display to view Status of the measurement. Press ✓ to return to the Main Display.

- **Velocity**

Displays flow velocity in ft/s or m/s, selected in the Units/Mode menu.

- **Flow**

Displays flow rate in units selected in the Units/Mode menu. A list of flow rate units is provided in the Units/Mode section of the manual.

- **Min Flow**

Displays a read-only value for the minimum flow cutoff, in units which match the Flow selection. Measured flow rates below the Min Flow will result in the displayed flow rate on the LCD display to be 0.0. This parameter is used to suppress electrical noise at zero flow conditions, and it is typically set to the flow rate equivalent of 0.1 ft/sec in the programmed pipe size. The Min Flow can be adjusted in the Calibration menu.

- **Signal Strength**

Displays magnitude of signal being received by the ultrasonic sensors. 100% is the ideal signal strength. Signal strengths less than 100% could indicate poor pipe conditions (corrosion), highly aerated water, or programmed setup parameters which don't closely match field conditions. Consideration should be made to use 1-cross installation method in such cases, if not already using it.

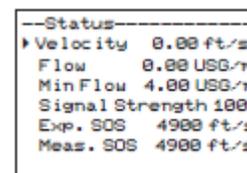
- **Exp. SOS**

Displays the expected fluid speed of sound measurement, in units that match the Velocity. The expected speed of sound is based on the pipe, fluid, and temperature selection in the Setup menu.

- **Meas. SOS**

Displays the measured fluid speed of sound, in units that match Exp. SOS. The meter calculates this value based on the time it takes for the signal to arrive from one transducer to another. Large differences between expected and measured speed of sound (> 10%) typically indicate an error in the setup of the instrument. Verify the following are correct in the Setup menu and with the physical installation of the transducers:

- Pipe Material
- Pipe OD
- Pipe Wall Thickness
- Liner Type
- Liner Thickness
- Fluid Type
- Fluid Temperature
- Crossings
- Separation Distance



MENU SELECTIONS

The Menu selections page is used to navigate to specific menus which are described in more detail on the following pages.

Press ▲ or ▼ to navigate to different menus, and ▶ to enter the selected menu.

```

--Menu-----
▶ Units / Mode
  Setup
  Calibration
  Relay Parameters
  Data Logging
  Communication
  Special Functions
  Simulation
  Configuration
  
```

UNITS/MODE

Mode

Press the ▶ and then the ▲ or ▼ to select Flow or Velocity. Flow mode displays the flow rate in engineering units (e.g. gpm, litres/sec, etc.) Press the ✓ to store your selection then the ▼ to the next menu item.

Linear

Press the ▶ key and then the ▲ or ▼ to select your units of measurement. The Linear units define what units the pipe dimensions and sensor spacing will be displayed in. Typically inches or mm is selected. Press the ✓ to store your selection then the ▼ to the next menu item.

```

--Units/Mode-----
▶ Mode           Flow
  Linear         in
  Volume         USG
  Multiplier     x1
  Decimals       0
  Velocity       ft/s
  Flow           USG/m
  Decimals       2
  Temperature    F
  
```

Volume

Press the ▶ and then the ▲ or ▼ to select units for volume. Note: "bbl" denotes US oil barrels. Press the ✓ to store your selection then the ▼ to the next menu item.

Multiplier

Press the ▶ and then the ▲ or ▼ to select the totalizer multiplier. Multipliers are used when resolution down to single digit is not required, or when you don't want to convert from gallons to thousands of gallons, as an example. Press ✓ to store your selection then ▼ to the next menu item.

Decimals (Volume)

Press the ▶ and then the ▲ or ▼ to select the number of decimal points to be present on the totalizer display on the LCD screen. Default = 0. Options = 0, 1, 2. Press the ✓ to store your selection then the ▼ to the next menu item.

Velocity

Press the ▶ and then the ▲ or ▼ to select the engineering units for flow velocity and sonic velocity of the fluid. Press ✓ to store your selection then ▼ to the next menu item.

Flow

Press the ▶ and then the ▲ or ▼ to select the engineering units for flow rate. Press ✓ to store your selection then ▼ to the next menu item.

Decimals (Flow)

Press the ▶ and then the ▲ or ▼ to select the number of decimal points to be present on the flow rate display on the LCD screen. Default = 2. Options = 0, 1, 2. Press the ✓ to store your selection then the ▼ to the next menu item.

Temperature

Press the ▶ and then the ▲ or ▼ to select units for temperature. Press the ✓ to store your selection then the ▲ to go back to another menu item, or ◀ to exit back to the Menu Selection screen.

SET UP

Press ▼ or ▲ to position cursor at Setup, and ▶ to enter. Use ▼ or ▲ to position cursor before each menu item and ▶ to enter. When settings are completed press ✓ to store and ✓ again to return to the Main Menu.

Sensor Select

Choose SE16A, SE16B, or SE16C, depending on transducers connected to TTFM 6.1.

Angle

For SE16B only, select angle which matches the transducer pair connected to the TTFM. Options: 35, 37, 39, and 41. Angle is determined by the part number on the SE16-B transducer label. For SE16A and SE16C, Angle should be 37.

Part Number on SE16-B Label

- SE16-B-35
 - Corresponding Transducer Angle 35
- SE16-B-37
 - Corresponding Transducer Angle 37
- SE16-B-39
 - Corresponding Transducer Angle 39
- SE16-B-41
 - Corresponding Transducer Angle 41

Fluid

Select fluid type.

Vel@25C

When Fluid = Other, enter the fluid velocity at 25C from table or other reference. Engineering units may be m/s or ft/s depending on Units menu programming.

dV/C

When Fluid = Other, Enter fluid velocity adjustment factor over change in temperature in units of m/s or ft/s per °C.

Temp Mode

Choose Fixed.

Temp

Enter fluid operating temperature in displayed engineering units.

Pipe

Select pipe material.

Pipe Vel

When Pipe = Other, enter pipe material speed of sound (consult factory).

OD

Highlight the digits and then ▲ or ▼ to change the numbers and decimal point. Pipe OD should be entered as the exact outside diameter of the pipe where the sensor is mounted. Refer to the Pipe Charts Appendix in this manual for outside diameter of common pipe types and sizes.

Wall

Enter pipe wall thickness. Pipe wall thickness should be entered as the exact wall thickness of the pipe where the sensor is mounted. Refer to the Pipe Charts Appendix in this manual for wall thicknesses of common pipe types and sizes.

Lining

Select liner material

Vel

When Lining = Other, enter speed of sound of liner (consult factory).

---Setup---	
▶ Sensor	SE16B
Angle	37
Fluid	Water
Temp Mode	Fixed
Temp	77.8 F
Pipe	PVC
OD	4.5888 in
Wall	0.2588 in
Lining	None
Crossings	2
Zero Tare	No
Sens Space	2.299 in
Velocity	0.88 ft/s
Signal Strength	100%

Thick

When Lining \neq None, enter liner thickness.

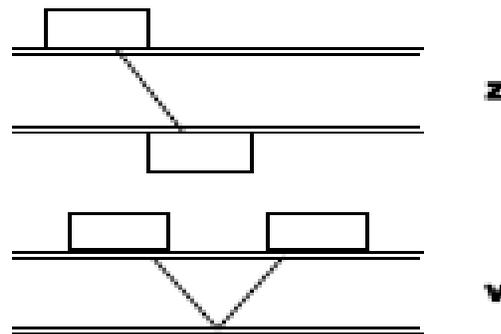
Crossings

Crossings 1 = Z mounting

Crossings 2 = V mounting

*These are the only two approved methods for the FireConnect® System

Older pipes are often degraded or scaled on the inside. These conditions can hinder the ability to receive a strong signal when Crossings = 4 or 2. We suggest starting with Crossings = 2 or 1, respectively, in these cases.

**Zero Tare**

Used to calibrate zero-flow measured by the TTFM 6.1 in process. Flow in the pipe should be confirmed as 0 before enabling, or significant errors in flow accuracy could occur.

Set Calibration/Damping to 0%, and under no flow conditions and with a full pipe, select Yes to force readings to zero.

Sens pace

After sensor, angle, fluid, and pipe material are defined, this displays the calculated sensor spacing. Also called the separation distance. The sensors will be set to this dimension when installed on the pipe, as described later in this manual.

Velocity

Displays the measured velocity after the sensors have been connected at the specified separation distance.

Signal Strength

Displays magnitude of signal being received by the ultrasonic sensor. Should be 100% under ideal operating conditions. Signal strengths less than 100% do not indicate that the meter is not reliable, however, the meter may be more susceptible to complete signal loss should process conditions like entrapped air worsen. When signal strength is less than 100%, consideration should be made to using 1- cross mounting method if this is not the current mounting mode.

CALIBRATION

Press \blacktriangledown or \blacktriangle to position cursor at Calibration menu, and \blacktriangleright to enter. Use \blacktriangledown or

\blacktriangle to position cursor before each menu item and \blacktriangleright to enter. When settings are completed press \checkmark to store and \checkmark again to return to the Main Menu.

Mode

Displays the Mode which was selected in the Units/Mode menu. This is read-only.

20mA

Press \blacktriangleright then \blacktriangledown or \blacktriangle to change the numbers and decimal point position. Use this menu to set the corresponding flow rate that will be represented by 20mA analog output. If maximum flow is unknown, enter an estimated flow rate and observe actual flow to determine the correct maximum value. Any velocity or flow rate up to +40 ft/sec (12.0 m/sec) may be selected.

4mA

Press \blacktriangleright then \blacktriangledown or \blacktriangle to set the flow rate corresponding to 4mA analog output. This setting may be left at zero or can be raised to any value less than the 20mA setting, or lowered to any velocity or corresponding flow rate down to -40 ft/sec (-12 m/sec).

LOS Time

Use LOS Time to suppress intermittent loss of signal.

Example: systems with high concentrations of undissolved gasses will cause fluctuations in signal strength when the gasses move past the ultrasonic signal. If a complete loss of signal is experienced, the TTFM 6.1 will hold the last valid reading for the duration of the LOS Time. If the signal strength returns before the LOS Time is expired, because the ultrasonic signal is no longer being impeded, the meter will return to normal operation automatically. If signal strength does not return after the LOS Time has expired, then the meter will report zero flow on the LCD display and outputs and produce a Low Signal alarm. Default LOS Time is 30 seconds, and the value can be set between 0 and 99 seconds.

Min Flow

Flow rates below this setting will be displayed as zero flow.

Default flow rate is ~ 0.1 ft/sec for the pipe size programmed in the Setup menu.

Damping

Mode Choose between OFF, FIR (Default), or LOW PASS.

When measured flows are outside the Window of the running average, the FIR filter will reduce the damping average so that a fast response can be made to the sudden change in flow rate.

The LOW PASS filter will ignore measured flow rates outside the Window, while holding the running average, until there are enough data points outside the Window to cause a step- response to the new measured value.

While measured flows are within the Window of the running average, both the FIR and LOW PASS filter behave the same.

Percent

Higher percentages increase the number of measurements which are averaged together to produce a stable flow reading. Higher percentages also increase the time it takes for the meter to make a step-response to the measured flow rate outside the Window in the LOW PASS Mode.

Window

Defines the Window around the running average, in units of Velocity set in the Units/Mode menu. Measurements made inside the Window are added to the running average, and measurements outside the Window effect the response of the meter as described in the Mode section.

Cal Constant

Calibration constant defined when the TTFM was calibrated at the factory.

Press ✓ to return to Menu Selections and Save Adjusted Settings.

SPECIAL FUNCTIONS

Press ▼ or ▲ to position cursor at Special Functions, and ▶ to enter. Use ▼ or

▲ to position cursor before each menu item and ▶ to enter. When settings are completed press ✓ to store and ✓ again to return to the Main Menu.

Language

Select English, French or Spanish

Analog Out

Select 4-20mA mode for the analog output.

Backlight

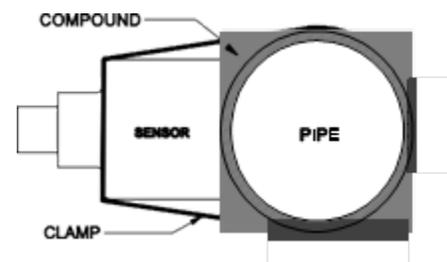
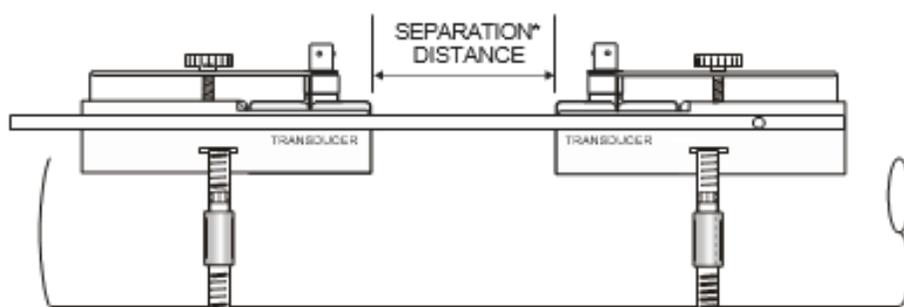
Select High, Medium or Low for continuous backlight brightness.

Select Key Hi/Lo for high backlight lasting 1 minute after a keypress, and then Lo backlight until a key is pressed again.

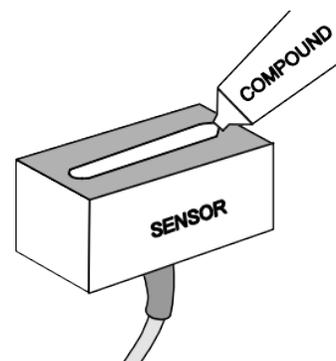
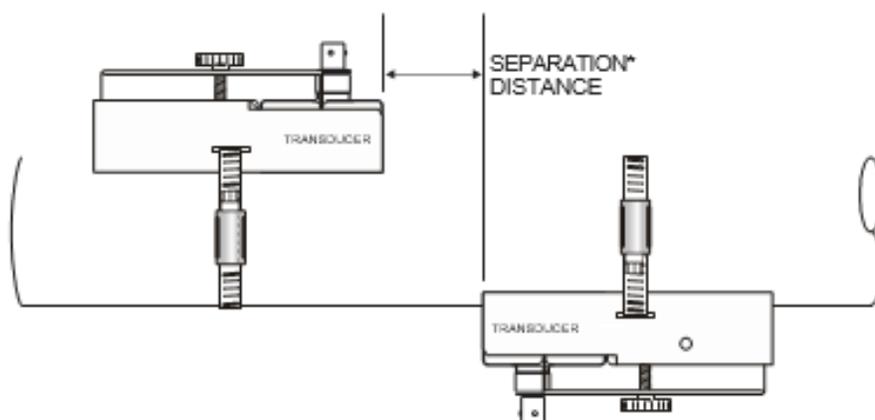
Select Key High, Med or Low for backlight lasting 1 minute after a keypress and then backlight off until a key is pressed again.

TYPICAL SE16B SENSOR INSTALLATION

2 Cross Separation Distance



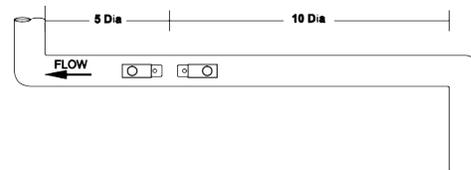
1 Cross Separation Distance



* Shown in 'Setup' menu after sensor, fluid and pipe parameters are entered.

TMK-B1 transducer mounting kit shown. Sensor spacing method is consistent with TMK-B21 and TMK-B22 kits, but the brackets will be different.

Arrows on top of transducers should be pointed towards each other.



SENSOR MOUNTING LOCATION

The position of the sensor is one of the most important considerations for accurate flow measurement. The same location guidelines apply to Transit Time as most other flow meter technologies.

VERTICAL OR HORIZONTAL PIPE - Vertical pipe runs are acceptable, and the transducers can be mounted in any orientation around the pipe. Downward flow should be avoided in case the pipe becomes partially filled or aerated. On Horizontal pipes and liquids with high concentrations of gas or solids, the sensors should be mounted on the side (1 to 5 o'clock positions) to avoid concentrations of gas at the top of the pipe, or solids at the bottom.

STRAIGHT RUN REQUIREMENTS – For best results, the transducers must be installed on a straight run of pipe, free of bends, tees, valves, transitions, insertion probes and obstructions of any kind. For most installations, ten straight unobstructed pipe diameters upstream and five diameters downstream of the transducers is the minimum recommended distance for proper operation. Additional considerations are outlined below.

- Do not, if possible, install the transducers downstream from a throttling valve, a mixing tank, the discharge of a positive displacement pump or any other equipment that could possibly aerate the liquid. The best location will be as free as possible from flow disturbances, vibration, sources of heat, noise, or radiated energy.
- Avoid mounting the transducers on a section of pipe with any external scale. Remove all scale, rust, loose paint, etc., from the location prior to mounting the transducers. A sanding block is included with every meter to facilitate proper pipe preparation.
- Do not mount the transducers on a surface aberration (pipe seam, etc.).
- Do not mount transducers from different ultrasonic flow meters on the same pipe.

- Do not run the transducer triaxial cables in common bundles with cables from other instrumentation. You can run these cables through a common conduit ONLY if they originate at the same flow meter.
- Never mount transducers under water.

IMPORTANT NOTE: In some cases, longer straight runs may be necessary where the transducers are placed downstream from devices which cause unusual flow profile disruptions or swirl. For example: modulating valves, or two elbows in close proximity and out of plane.

SEPARATION DISTANCE (Sensor Spacing Distance)

Separation distance is automatically calculated by the TTFM 6.1 based on parameters entered in the Setup menu. Sens Space is a parameter where this distance is given and is located in the Setup menu. Document this value for the following transducer installation procedure.

2 OR 4 CROSS INSTALLATION OVERVIEW – SE16B TMK-B1 Kit

1. Prep the pipe, removing paint and coating in the area the sensor is to be placed, and mind the installation location requirements. Clean the location where the sensor is to be mounted on the opposite side of the pipe after we've marked where it will be installed. Picture below shows a very clean ductile iron pipe which did not require much cleaning. The outside paint is very well bonded and did not need to be removed:
2. Install the stainless-steel mounting brackets on the pipe. Position them at approximately the correct separation distance. Exact measurement is not required at this time. Tip: Use a 5/16" nut driver to tighten the hose clamps.
3. Use alignment bar to ensure the brackets are parallel. Completion of steps 2 & 3 is shown below.



4. Mark the position of the permanent bracket on the pipe. This is the bracket that will not be adjusted and will be used as the reference for the separation distance and alignment. It is your choice which bracket is permanent. With a marker, mark the bracket position by placing the mark directly in front of the stainless side-rail.
5. Measure the separation distance from the mark you created in step 4 and create a new mark on the pipe at the separation distance. It may be useful to mark your tape measure (included with every meter) at the separation distance point before marking the pipe. The marked pipe is shown below.



6. Move the non-permanent bracket to position at the mark you created at step 5 and tighten it completely. Apply coupling compound to the transducers and install them in the brackets.

Tips for installing transducers:

- a. Be sure the red knob on the brackets are loosened completely
- b. Put the transducer into the bracket by ensuring the bottom of the transducer and the couplant does not touch the pipe as you slide it in. (Hover)
- c. With the transducer hovering, tighten the red knob on the bracket until tight. The transducer will be level with the surface of the pipe, and no coupling will have moved.
- d. (pictures of proper coupling application and finished installation on the next page)

- Coupling compound only: If you need to make fine adjustments ($\pm 0.25''$) to the spacing at this point, you may do so by loosening the hose clamps slightly and sliding the brackets while the transducers are installed inside them. Tighten hose clamps when done.



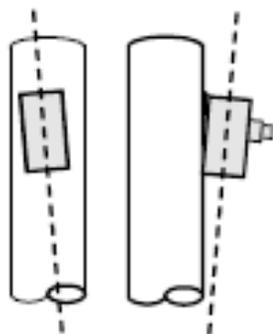
SENSOR MOUNTING/COUPLING RECOMMENDATIONS

BAD

Avoid air travelling at the top of a horizontal pipe.

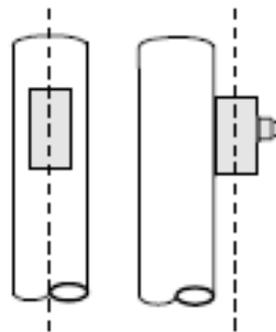
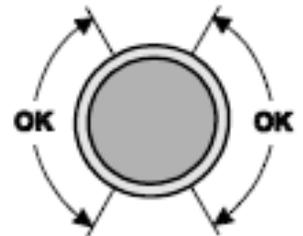


Avoid debris travelling at the bottom of a horizontal pipe.



GOOD

Installing between 1 and 5 o'clock, and 7 and 11 o'clock on horizontal pipes is acceptable.



ENCLOSURE INSTALLATION

Locate the enclosure within 25 ft (7.6 m) of the sensors (up to 100 ft - 30 m optional). The enclosure can be wall mounted with the four mounting screws (included) or panel mounted with Option PM Panel Mount kit from Pulsar Measurement. Avoid mounting the enclosure in direct sunlight to protect the electronics from damage due to overheating and condensate. In high humidity atmospheres, or where temperatures fall below freezing, Option TH Enclosure Heater and Thermostat is recommended. **IMPORTANT:** Seal conduit entries to prevent moisture from entering enclosure.

NEMA4X (IP66) WITH CLEAR COVER

1. Open hinged enclosure cover.
2. Insert #12 screws (supplied) through the four enclosure mounting holes to secure the enclosure to the wall or mounting stand.

Additional conduit holes can be cut in the bottom of the enclosure when required. Use a hole saw or Greenlee-type hole cutter to cut the required holes.

IMPORTANT: DO NOT make conduit/wiring entries into the top or sides of the enclosure.

Note: This non-metallic enclosure does not automatically provide grounding between conduit connections. Grounding must be provided as part of the installation. Ground in accordance with the requirements of the National Electrical Code. System grounding is provided by connecting grounding wires from all conduit entries to the steel mounting plate or another point which provides continuity.

CLEANING

Cleaning is not required as a part of normal maintenance.

FIELD TROUBLESHOOTING

POSSIBLE CAUSES:

CORRECTIVE ACTION:

METER READING WHEN THERE IS NO FLOW?

Erratic measurement (set damping to 0% to check) due to electrical noise or poor signal quality.

- Set Calibration / Damping to 0% with zero flow use Setup / Tare function.
- Ensure all Flowmeter wiring is in METAL conduit and sensor shield is properly connected to Ground.
- Ensure correct power input Ground connection (<1 ohm resistance).
- Ensure 4-20mA Shield connected to Instrument Ground stud.
- Adjust Calibration / Min Flow setting.
- Contact Pulsar Measurement for further assistance.
- Follow Drive manufacturers wiring and Grounding instructions
- Relocate Flowmeter electronics, Sensor and wiring away from VSD

Variable Speed Drive interference

METER READING LOWER THAN EXPECTED?

Calibration Error

- Review calibration menu. Pipe dimensions and fluid selection/fluid velocity.

Lower flow rate than expected

- Investigate pump/valves. Compare velocity with alternate instrument.

Erratic measurement (set damping to 0% to check) due to electrical noise or poor signal quality.

- Ensure all Flowmeter wiring is in METAL conduit and sensor shield is properly grounded.
- Ensure correct power input Ground connection (<1 ohm resistance).
- Ensure 4-20mA Shield connected to Instrument Ground stud.
- Contact Pulsar Measurement for further assistance.

NO ECHO INDICATION Icon: No Echo

Improper Installation

- Check Setup menu to ensure pipe material, size, thickness, liner type, thickness, fluid type, and fluid temperature and configured properly. Check transducer mounting method and spacing matches Setup menu values.

Sensors not mounted to Pipe or mounted improperly

- Apply coupling compound and mount sensors to pipe with proper sensor spacing.

Empty pipe or partially filled

- Pipe must be fluid filled and acoustically transparent in order to obtain echoes.

Coupling compound washed out, or sensor loose on pipe.

- Remount sensor
- Use Super Lube® Silicone Compound

OPEN/SHORT SENSOR ICON	<ul style="list-style-type: none"> No sensors attached Short in transducer, or in triax transducer cable. Follow Sensor Connections steps
Sensor Connections	<ul style="list-style-type: none"> Check sensor connections at TTFM and at sensor junction box. Note: Refer to Sensor Cable Resistance Test to test final connections.

METER READING HIGHER THAN EXPECTED?

Calibration Error	<ul style="list-style-type: none"> Review calibration menu. Pipe dimensions and fluid selection/fluid velocity.
Higher flow rate than expected	<ul style="list-style-type: none"> Investigate pump/valves. Compare velocity with alternate instrument.
Erratic measurement (set damping to 0% to check) due to electrical noise or poor signal quality.	<ul style="list-style-type: none"> Ensure all Flowmeter wiring is in METAL conduit and sensor shield is properly grounded. Ensure correct power input Ground connection (<1 ohm resistance). Ensure 4-20mA Shield connected to Instrument Ground stud. Contact Pulsar Measurement for further assistance.
High viscosity fluid	<ul style="list-style-type: none"> Laminar flow profile due to high viscosity fluid requires an adjustment to Cal Const.

PIPE CHARTS

Note: Not all pipe types allowed in programming have charts below. Pipe dimensions will need to be acquired from pipe markings or the pipe manufacturer in such cases.

Carbon Steel & PVC Pipe

Pipe Size	Pipe O.D.	Schedule Standard		Extra Heavy		Dbl. Extra Heavy		Schedule 10		Schedule 20		Schedule 30		Schedule 40		Schedule 80	
		I.D.	WALL	I.D.	WALL	I.D.	WALL	I.D.	WALL	I.D.	WALL	I.D.	WALL	I.D.	WALL	I.D.	WALL
½	0.840	0.622	0.109											0.622	0.109	0.546	0.147
¾	1.050	0.824	0.113											0.824	0.113	0.742	0.154
1	1.315	1.049	0.133											1.049	0.133	0.957	0.175
1 ¼	1.660	1.380	0.140											1.380	0.140	1.278	0.191
1 ½	1.900	1.900	0.145											1.900	0.145	1.500	0.200
2	2.375	2.067	.154	1.939	.218	1.503	.436							2.067	.154	1.939	0.218
2 ½	2.875	2.469	.203	2.323	.276	1.771	.552							2.469	.203	2.323	0.276
3	3.500	3.068	.216	2.900	.300	2.300	.600							3.068	.216	2.900	0.300
3 ½	4.000	3.548	.226	3.364	.318	2.728	.636							3.548	.226	3.364	0.318
4	4.500	4.026	.237	3.826	.337	3.152	.674							4.026	.237	3.826	0.337
5	5.563	5.047	.258	4.813	.375	4.063	.750							5.047	.258	4.813	0.375
6	6.625	6.065	.280	5.761	.432	4.897	.864							6.065	.280	5.761	0.432
8	8.625	7.981	.322	7.625	.500	6.875	.875			8.125	.250	8.071	.277	7.981	.322	7.625	0.500
10	10.750	10.020	.365	9.750	.500	8.750	1.000			10.250	.250	10.136	.307	10.020	.365	9.564	0.593
12	12.750	12.000	.375	11.750	.500	10.750	1.000			12.250	.250	12.090	.330	11.938	.406	11.376	0.687
14	14.000	13.250	.375	13.000	.500			13.500	.250	13.376	.312	13.250	.375	13.124	.438	12.500	0.750
16	16.000	15.250	.375	15.000	.500			15.500	.250	15.376	.312	15.250	.375	15.000	.500	14.314	0.843
18	18.000	17.250	.375	17.000	.500			17.500	.250	17.376	.312	17.124	.438	16.876	.562	16.126	0.937
20	20.000	19.250	.375	19.000	.500			19.500	.250	19.250	.375	19.000	.500	18.814	.593	17.938	1.031
22	22.000	21.250	.375	21.000	.500			21.500	.250	21.250	.375	21.000	.500				
24	24.000	23.250	.375	23.000	.500			23.500	.250	23.250	.375	22.876	.562	22.626	.687	21.564	1.218
26	26.000	25.250	.375	25.000	.500			25.376	.312	25.000	.500						
28	28.000	27.250	.375	27.000	.500			27.376	.312	27.000	.500	26.750	.625				
30	30.000	29.250	.375	29.000	.500			29.376	.312	29.000	.500	28.750	.625				
32	32.000	31.250	.375	31.000	.500			31.376	.312	31.000	.500	30.750	.625				
34	34.000	33.250	.375	33.000	.500			33.376	.312	33.000	.500	32.750	.625				
36	36.000	35.250	.375	35.000	.500			35.376	.312	35.000	.500	34.750	.625				
42	42.000	41.250	.375	41.000	.500					41.000	.500	40.750	.625				

Ductile Iron Pipe – Standard Classes

Size INCH	OUTSIDE DIA. INCH	Class S0		Class S1		Class S2		Class S3		Class S4		Class S5		Class S6		CEMENT LINING	
		WALL	I.D.	**STD	**DOUBLE												
																THICKNESS	THICKNESS
3	3.96			0.25	3.46	0.28	3.40	0.31	3.34	0.34	3.28	0.37	3.22	0.41	3.14	.125	.250
4	4.80			0.26	4.28	0.29	4.22	0.32	4.16	0.35	4.10	0.38	4.04	0.44	3.93		
6	6.90	0.25	6.40	0.28	6.34	0.31	6.28	0.34	6.22	0.37	6.16	0.40	6.10	0.43	6.04		
8	9.05	0.27	8.51	0.30	8.45	0.33	8.39	0.36	8.33	0.39	8.27	0.42	8.21	0.45	8.15		
10	11.10	0.39	10.32	0.32	10.46	0.35	10.40	0.38	10.34	0.41	10.28	0.44	10.22	0.47	10.16		
12	13.20	0.31	12.58	0.34	12.52	0.37	12.46	0.40	12.40	0.43	12.34	0.46	12.28	0.49	12.22		
14	15.30	0.33	14.64	0.36	14.58	0.39	14.52	0.42	14.46	0.45	14.40	0.48	14.34	0.51	14.28	.1875	.375
16	17.40	0.34	16.72	0.37	16.66	0.40	16.60	0.43	16.54	0.46	16.48	0.49	16.42	0.52	16.36		
18	19.50	0.35	18.80	0.38	18.74	0.41	18.68	0.44	18.62	0.47	18.56	0.50	18.50	0.53	18.44		
20	21.60	0.36	20.88	0.39	20.82	0.42	20.76	0.45	20.70	0.48	20.64	0.51	20.58	0.54	20.52		
24	25.80	0.38	25.04	0.41	24.98	0.44	24.92	0.47	24.86	0.50	24.80	0.53	24.74	0.56	24.68		
30	32.00	0.39	31.22	0.43	31.14	0.47	31.06	0.51	30.98	0.55	30.90	0.59	30.82	0.63	30.74		
36	38.30	0.43	37.44	0.48	37.34	0.62	37.06	0.58	37.14	0.63	37.04	0.68	36.94	0.73	36.84		
42	44.50	0.47	43.56	0.53	43.44	0.59	43.32	0.65	43.20	0.71	43.08	0.77	42.96	0.83	42.84		
48	50.80	0.51	49.78	0.58	49.64	0.65	49.50	0.72	49.36	0.79	49.22	0.86	49.08	0.93	48.94		
54	57.10	0.57	55.96	0.65	55.80	0.73	55.64	0.81	55.48	0.89	55.32	0.97	55.16	1.05	55.00		

**REDUCE I.D. BY DIMENSION SHOWN

Cast Iron Pipe - ASA Standard

Pipe Size	Pipe O.D.	Class 60		Class 100		Class 150		Class 200		Class 260		Class 300		Class 360	
		WALL	I.D.	WALL	I.D.	WALL	I.D.	WALL	I.D.	WALL	I.D.	WALL	I.D.	WALL	I.D.
3	3.96	0.32	3.32	0.32	3.32	0.32	3.32	0.32	3.32	0.32	3.32	0.32	3.32	0.32	3.32
4	4.80	0.35	4.10	0.35	4.10	0.35	4.10	0.35	4.10	0.35	4.10	0.35	4.10	0.35	4.10
6	6.90	0.38	6.14	0.38	6.14	0.38	6.14	0.38	6.14	0.38	6.14	0.38	6.14	0.38	6.14
8	9.05	0.41	8.23	0.41	8.23	0.41	8.23	0.41	8.23	0.41	8.23	0.41	8.23	0.41	8.23
10	11.10	0.44	10.22	0.44	10.22	0.44	10.22	0.44	10.22	0.44	10.22	0.48	10.14	0.52	10.06
12	13.20	0.48	12.24	0.48	12.24	0.48	12.24	0.48	12.24	0.48	12.24	0.52	12.16	0.56	12.08
14	15.30	0.48	14.34	0.51	14.28	0.51	14.28	0.55	14.20	0.59	14.12	0.59	14.12	0.64	14.02
16	17.40	0.54	16.32	0.54	16.32	0.54	16.32	0.58	16.24	0.63	16.14	0.68	16.04	0.68	16.04
18	19.50	0.54	18.42	0.58	18.34	0.58	18.34	0.63	18.24	0.68	18.14	0.73	18.04	0.79	17.92
20	21.60	0.57	20.46	0.62	20.36	0.62	20.36	0.67	20.26	0.72	20.16	0.78	20.04	0.84	19.92
24	25.80	0.63	24.54	0.68	24.44	0.73	24.34	0.79	24.22	0.79	24.22	0.85	24.10	0.92	23.96

Cast Iron Pipe - AWWA Standard

Pipe Size	Class A 100 Ft. 43 P8IG			Class B 200 Ft. 88 P8IG			Class C 300 Ft. 130 P8IG			Class D 400 Ft. 173 P8IG		
	O.D.	WALL	I.D.	O.D.	WALL	I.D.	O.D.	WALL	I.D.	O.D.	WALL	I.D.
3	3.80	0.39	3.02	3.96	0.42	3.12	3.96	0.45	3.06	3.96	0.48	3.00
4	4.80	0.42	3.96	5.00	0.45	4.10	5.00	0.48	4.04	5.00	0.52	3.96
6	6.90	0.44	6.02	7.10	0.48	6.14	7.10	0.51	6.08	7.10	0.55	6.00
8	9.05	0.46	8.13	9.05	0.51	8.03	9.30	0.56	8.18	9.30	0.60	8.10
10	11.10	0.50	10.10	11.10	0.57	9.96	11.40	0.62	10.16	11.40	0.68	10.04
12	13.20	0.54	12.12	13.20	0.62	11.96	13.50	0.68	12.14	13.50	0.75	12.00
14	15.30	0.57	14.16	15.30	0.66	13.98	15.65	0.74	14.17	15.65	0.82	14.01
16	17.40	0.60	16.20	17.40	0.70	16.00	17.80	0.80	16.20	17.80	0.89	16.02
18	19.50	0.64	18.22	19.50	0.75	18.00	19.92	0.87	18.18	19.92	0.96	18.00
20	21.60	0.67	20.26	21.60	0.80	20.00	22.06	0.92	20.22	22.06	1.03	20.00
24	25.80	0.76	24.28	25.80	0.89	24.02	26.32	1.04	24.22	26.32	1.16	24.00
30	31.74	0.88	29.98	32.00	1.03	29.94	32.40	1.20	30.00	32.74	1.37	30.00
36	37.96	0.99	35.98	38.30	1.15	36.00	38.70	1.36	39.98	39.16	1.58	36.00
42	44.20	1.10	42.00	44.50	1.28	41.94	45.10	1.54	42.02	45.58	1.78	42.02
48	50.50	1.26	47.98	50.80	1.42	47.96	51.40	1.71	47.98	51.98	1.96	48.06
54	56.66	1.35	53.96	57.10	1.55	54.00	57.80	1.90	54.00	58.40	2.23	53.94
60	62.80	1.39	60.02	63.40	1.67	60.06	64.20	2.00	60.20	64.82	2.38	60.06
72	75.34	1.62	72.10	76.00	1.95	72.10	76.88	2.39	72.10			
84	87.54	1.72	84.10	88.54	2.22	84.10						

Greyline TTFM 6.1 Instruction Manual

The following contents is property of the Pulsar Measurement Company, and to be used only in accordance with the installation of the Greyline TTFM 6.1 Flowmeter and intended for application as an integral component to the FireConnect line of products.

Utilize the QR Code for access to the complete installation manual provided by the Pulsar Measurement Company if further information is required.



<https://drive.google.com/file/d/1hYuSSvoXdL3TBe9o9MUFqyvMI823W1a/view?usp=sharing>

Appendix-III

ProSense Digital Temperature Sensor Manual

The following contents is property of the Automation Direct, and to be used only in accordance with the installation of the ProSense ETS Series Digital Temperature Sensors and intended for application as an integral component to the FireConnect line of products.

Utilize the QR Code for access to the complete installation manual provided by Automation Direct if further information is required.



<https://drive.google.com/file/d/14Q2UB9nc5awxXJs8RvBd7oF9XqXs9gVL/view?usp=sharing>