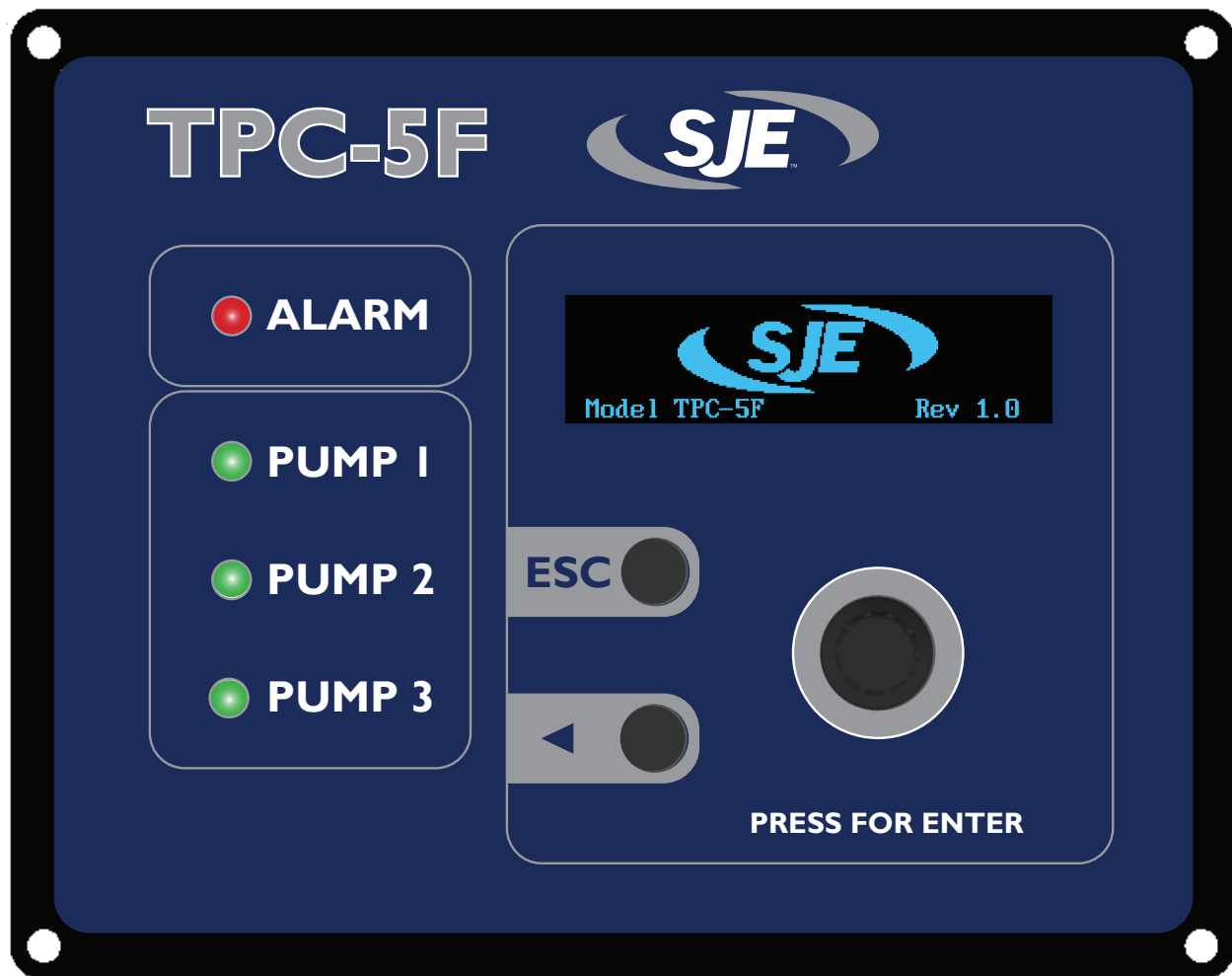

TPC-5F

PUMP CONTROLLER

INSTALLATION INSTRUCTIONS

User Manual



Manufactured by: SJE Inc.
Technical support: +1-800-746-6287
techsupport@sjeinc.com

www.csicontrols.com

www.primexcontrols.com

www.sjerhombus.com

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WARNINGS

Failure to read and understand the information provided in this manual may result in personal injury or death, damage to the product or product failure. Please read each section in its entirety and be sure you understand the information provided in the section and related sections before attempting any of the procedures or operations given.

Failure to follow these precautions could result in serious injury or death. Keep these instructions with warranty after installation. This product must be installed in accordance with National Electrical Code, ANSI/NFPA 70 to prevent moisture from entering or accumulating within the controller housing.	
	WARNING ELECTRICAL SHOCK HAZARD A qualified service person must install and service this product according to applicable codes and electrical schematics. Disconnect power prior to servicing any equipment with the TPC-5F controller.
	• Do not connect power to this equipment if it has been damaged or has any missing parts. • The TPC-5F contains no serviceable parts; do not attempt to repair this equipment. • Do not install in areas with excessive or conductive dust, corrosive or flammable gas, moisture or rain, excessive heat, regular impact shocks, or excessive vibration.
	WARNING EXPLOSION OR FIRE HAZARD Do not use this product with flammable liquids. Do not install in hazardous locations as defined by National Electrical Code, ANSI/NFPA 70.
	

Warning: Users must read this manual and understand controller operation before changing any settings. Entering incorrect settings may result in damage to equipment.

If the TPC-5F controller was shipped pre-installed in a control panel, some default values may have been changed at the factory in order to properly test the control panel operation. The user must adjust the settings to the requirements of their particular installation

The user should always keep a record of the settings before making changes, in case there is a need to revert to previous settings. The user should also record all settings changed for use in programming a new controller in case a replacement is ever needed.

Always thoroughly test controller operation in the installed configuration to verify user settings.

INTRODUCTION & SPECIFICATIONS

Congratulations, and thank you for your purchase of the TPC-5F controller. This manual explains the features and operations of the TPC-5F controller which is designed to operate up to 3 pumps in a pump down application. The controller sequences pumps on and off in response to the position of up to 5 float switches. A rotary selector knob, back and escape push buttons are utilized for intuitive menu navigation and quick setting adjustments.

GENERAL

One, two or three pumps
Pump down
Configurable units
Operates using 3, 4, or 5 float switches
4-20mA output for level indication or input retransmit
Demand or Timed Dose operation
Rotary selector for menu navigation
2.7" blue OLED 64 x 256-pixel display

DIMENSIONS

7.2 x 5.7 x 2.5 inches (18.3 x 14.5 x 6.4 cm)

PUMP CONTROL AND PROTECTION

Automatic pump alternation
Multiple alternation configurations
Pump fault inputs
Pump fail to start detection
Pump run indication

SYSTEM

Cycle counter/hour meters

- Alarm counts
- Number of starts for each pump
- Run time for each pump

ELECTRICAL SPECIFICATIONS

Power

- 24 VDC (19-28 VDC, 325 mA max)

Dedicated I/Os

- 11 digital inputs
- 6 relay outputs (120 VAC, 3A Max.)
- 1 analog input (4-20 mA, 14-bit resolution, non-isolated)
- 1 analog output (4-20 mA, 12-bit resolution, non-isolated, fully scalable)

Serial Communication Port

- RS-485 3-Wire (half duplex)
- Modbus RTU
- 9600 baud, 1 stop bit, no parity
- Designed for complete compatibility with the SJE Panel Link™ Gateway.

ENVIRONMENT

Operational temperature -4°F to 158°F (-20°C to 70°C)

Storage temperature -4°F to 158°F (-20°C to 70°C)

Relative Humidity (RH) 5% to 95%
(non-condensing)

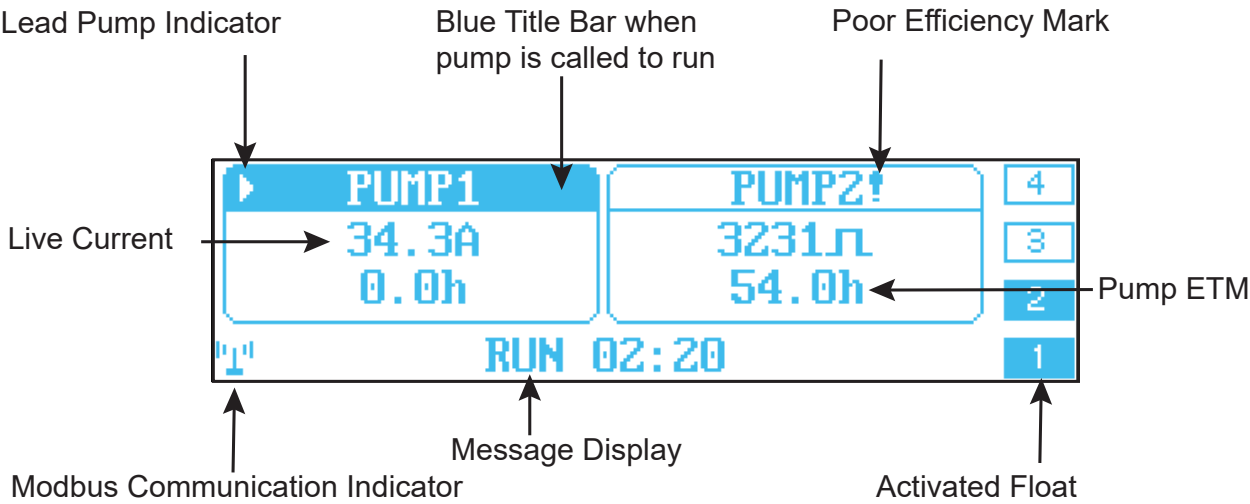
Not outdoor rated—use only indoors or inside an outdoor rated enclosure



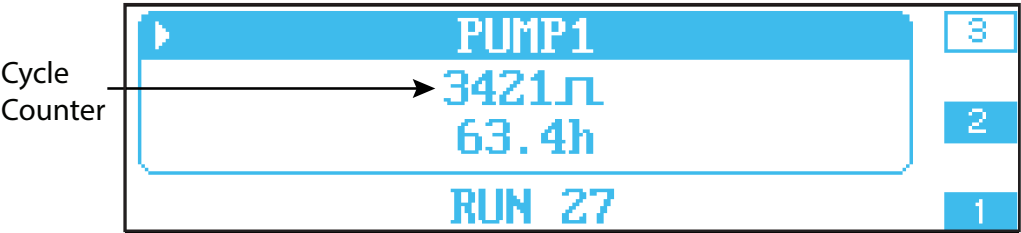
PROGRAMMING

MAIN SCREEN

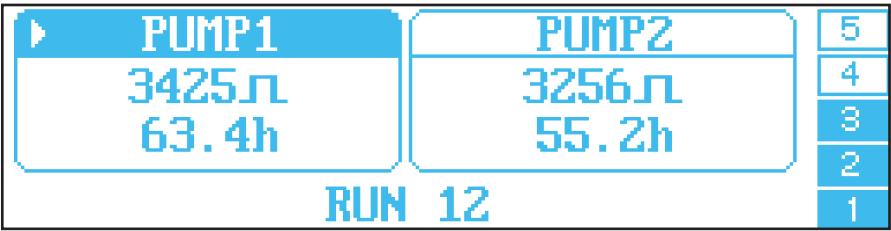
The main screen gives the operator an overview of the lift station status including any active alarms.



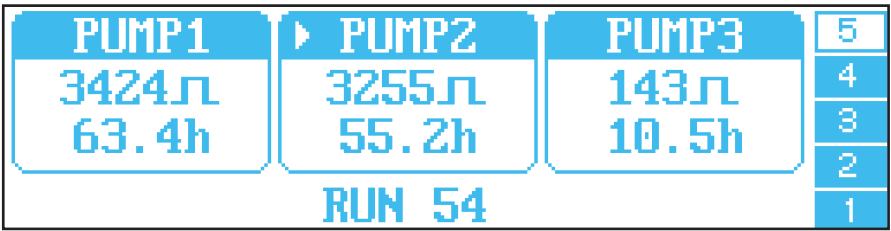
Simplex



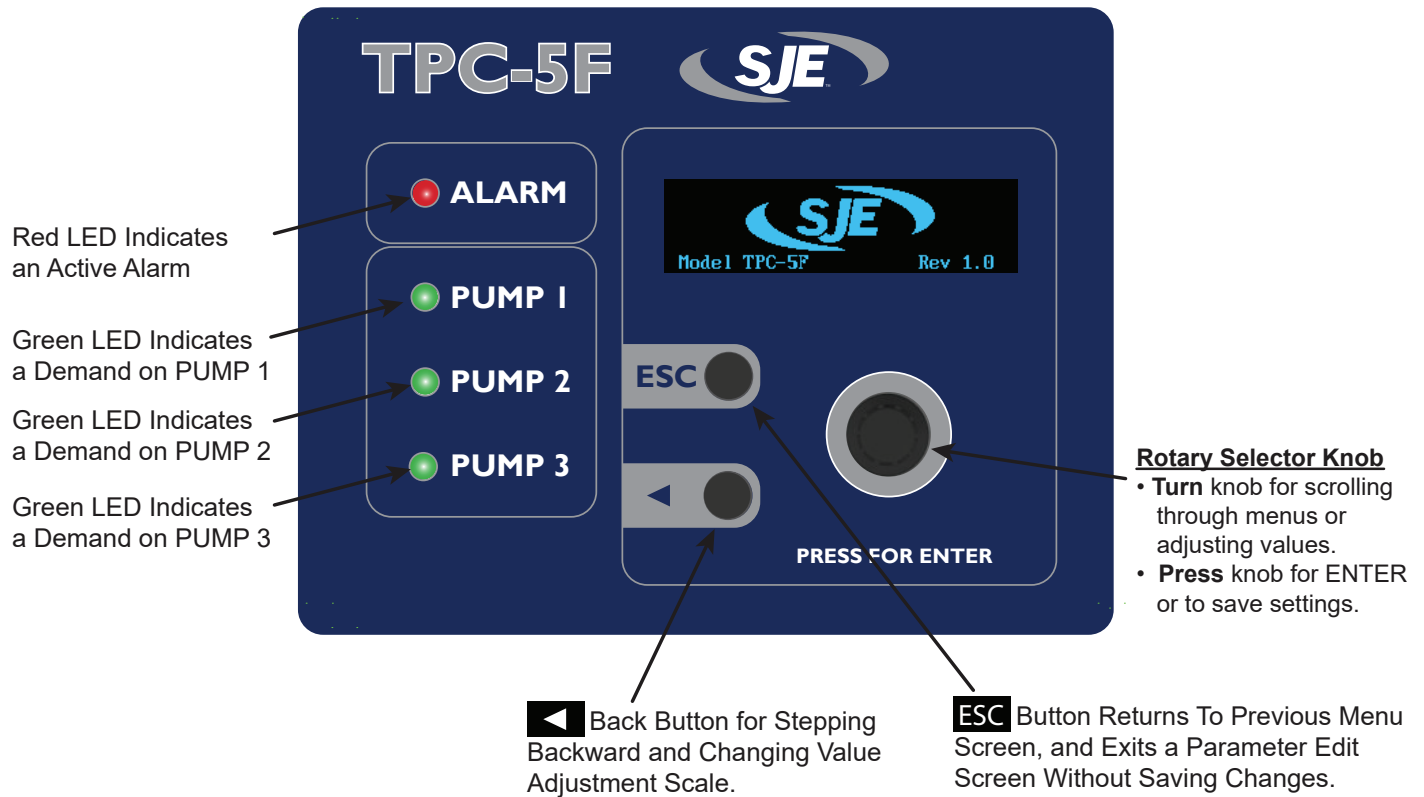
Duplex



Triplex



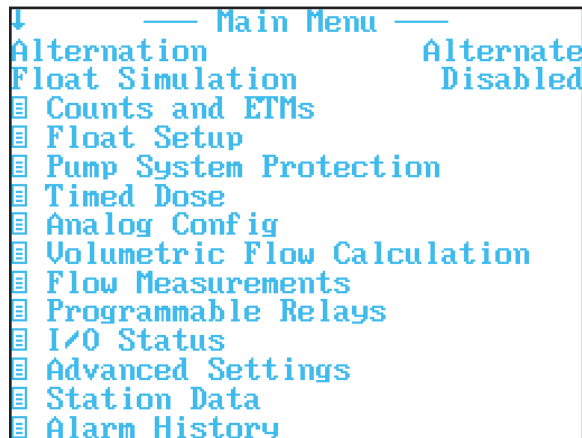
USER INTERFACE



Green LED indicates pump is running input or pump demand depending on settings.

MAIN MENU

While in the Main Display screen, press the ENTER button to view the Main Menu.



Note: Menus may be different based on current configuration. For example, timed dose settings will only be available if a timed dose configuration has been selected.

ALTERNATION

Select Alternate for the lead pump (the lead pump is the first pump to turn on in a pump cycle) to change every pump cycle. This will allow the pumps to wear evenly over time. Select Pump 1 Lead if Pump 1 should always turn on first.

— Edit Alternation —		
Alternate		
Pump 1	Lead	
Pump 2	Lead	
Pump 3	Lead	

This menu will change based on how many pumps are used in the selected float configuration (example: simplex vs. triplex).

Alternate:

Each time a pump is called and stopped, the lead pump will advance to the next available pump. 1-→2-→3-→1.

Pump 1 Lead:

The lead pump will be pump 1, lag pump will be pump 2, and Lag2 pump will be pump 3, unless certain alarms are present.

Alternation with a poor efficiency pump:

If a pump has been detected as “poor efficiency”, that pump will be called last. For example, in a duplex configuration with Pump1 as poor efficiency, the order will always be lead Pump 2, & lag Pump 1. As soon as the alarm that detected poor efficiency pump operation has been cleared, normal alternation will resume.

▶ PUMP1	PUMP2!	4
34.3A	3231л	3
0.0h	54.0h	2
"I" RUN 02:20		1

Example: Pump2 has been marked poor efficiency(!). This means Pump2 will always be used only as a lag pump until cleared.

PUMP1	▶ PUMP2!	4
FAULT	3231л	3
56.8h	54.0h	2
P1 Fail Start (ESC to Reset)		1

Example: Pump2 has been marked poor efficiency(!) & Pump1 is unavailable due to fault. Since Pump1 cannot run, Pump2 will be used as the lead pump in all Alternation choices.

Alternation with all pumps having poor efficiency:

If all pumps have been detected as poor efficiency, Alternation will function normally.

PSE Alternation:

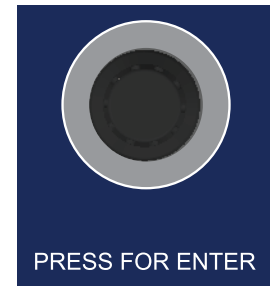
PSE alarm may cause pumps to alternate. This is normal and is used to detect a stuck stop float.

FLOAT SIMULATION

Float Simulation mode allows the user to test controller operation without requiring a change in the wet well liquid level or float switch positions. This can be helpful for troubleshooting, or for initial setup and testing. When Float Simulation is enabled, rotating the selector knob clockwise will simulate a liquid level increase (more floats activated), and rotating the selector knob counterclockwise will simulate a liquid level decrease (fewer floats activated). Float Simulation mode will turn off after 2 minutes without any user inputs, or it can be turned off by pressing the ESC button at any time.

Note: Always test control panel operation with the installed float switches before considering the installation to be complete.

PUMP1	PUMP2	4
3413л	3247л	3
63.3h	55.1h	2
Simulate Mode (ESC to exit)		1



Rotate the selector knob to activate or deactivate floats.

COUNTS AND ETMS (Elapsed Time Meters)

The following screen shows different Counts and ETMs that are tracked.

↓ — Counts and ETMs —			
Pump 1	ETM	63.37	HRS
Pump 2	ETM	55.14	HRS
Pump 3	ETM	10.54	HRS
Pump 1	Run Cycles	3,413	
Pump 2	Run Cycles	3,246	
Pump 3	Run Cycles	142	
Pump 1	Faults	33	
Pump 2	Faults	36	
Pump 3	Faults	2	
Pump 1	Low Amp Alarm	8	
Pump 1	High Amp Alarm	9	
Pump 2	Low Amp Alarm	6	
Pump 2	High Amp Alarm	8	
Pump 3	Low Amp Alarm	2	
Pump 3	High Amp Alarm	1	
High Level Alarms		41	
Low Level Alarms		47	

A CLEARING COUNT APPROVAL screen can be viewed by clicking the ENTER button when the desired count is highlighted. Pump ETMs cannot be cleared.

CLEARING COUNT APPROVAL
Are you SURE you want to clear
the counter below?
Pump 1 Run Cycles
Press ENTER for YES, ◀ for NO

Following the on screen directions, press ENTER for YES, ◀ for NO.

If ENTER is pressed the next screen will ask if you are sure you want to clear. If ENTER is pressed for YES here, the count is permanently cleared to zero, and this action cannot be reversed.

WARNING!
Clearing the count is permanent
and cannot be reversed.
Are you SURE you want to clear?
Press ENTER for YES, ◀ for NO

If ◀ for NO is pressed you will be returned to the main Counts and ETMs screen.

FLOAT SETUP

Float Configuration - This will decide how many pumps are available, dose mode, float type, and float options. Some float configurations have special features:

- **AUX Alarm:** generic alarm that will be activated by closing the float contacts. This can be paired with programmable relay 1 or 2.
- **Lag2 Timer Option:** once the lag float closes, a timer will be started. Once the timer expires, the 3rd pump will turn on. The time can be adjusted in advanced settings.

Float Config.	Number of Pumps	Control Mode	Number of Floats	Float 1 Function	Float 2 Function	Float 3 Function	Float 4 Function	Float 5 Function	Special
1	Duplex	Demand	4	Stop	Lead Start	Lag Start	High	-	
2	Duplex	Demand	4	Stop	Lead Start	High	Lag Start	-	
3	Duplex	Demand	5	Low	Stop	Lead Start	Lag Start	High	
4	Triplex	Demand	5	Low	Stop	Lead Start	Lag Start	High	Lag 2 Delay Timer
5	Triplex	Demand	5	Stop	Lead Start	Lag Start	Lag 2 Start	High	
6	Duplex	Timed Dose	4	Redundant Off	Timer Enable	Timer Override	High	Aux Alarm	Aux. Alarm Input
7	Triplex	Timed Dose	4	Redundant Off	Timer Enable	Timer Override	High	Aux Alarm	Aux. Alarm Input
8	Simplex	Demand	3	Stop	Pump Start	High	-	-	
9	Simplex	Demand	4	Low	Stop	Pump Start	High	-	
10	Simplex	Timed Dose	4	Redundant Off	Timer Enable	Timer Override	High	Aux Alarm	Aux. Alarm Input

Warning! Once you change the float configuration, MAX Pumps On At Once in advanced settings will reset to default. Disable Pump settings that don't exist in the configuration will be forgotten. Pump System Efficiency (PSE) setting may be disabled, and baseline forgotten.

High Float Contact - Options are N.O. (normally-open) & N.C. (normally-closed).

High Alarm Delay - Duration after High level float activated before High level float alarm is activated.

High Float Pump Run - Options are Disabled, On float failure, or Always. Once the high float has been activated and condition met, a pump will be called for regardless of the condition of the control floats. Once the High float is deactivated, the pumps will continue to run for High Float Pump Run Time.

High Float Pump Run Time - When High Float Pump Run is enabled, this determines how long the pump will continue to run after the high float deactivates.

Float Fault Detection - Enable this function to allow for float failure detection. The controller will ignore floats that appear to be faulty and assign their function to a working float. If a float becomes unstuck, it will auto-reset the float failure. If two or more floats are faulty the controller will ignore all control floats.

Note: Float failures will be shown flashing on the status screen. When the controller doesn't have enough information to determine which float has failed, pump operation will be suspended until the float inputs change and the failed float can be determined; once the float failure has been detected controller operation will continue as described above.

Timer Override float cannot fail down. Alarm floats (REDUN OFF, LOW and HIGH) will not be reassigned nor disabled. AUX ALARM is not treated as a float.

Float Failure Operation for Float Config 1

Float Status 1234	Float 1 Failed	Normal Float Assignment	New Float Assignment	Reassignment with High Level N.C. Float
DUUD DUUU DUDD*	1	STOP	IGNORED	IGNORED
	2	LEAD	STOP	STOP
	3	LAG	LEAD	LEAD
	4	HIGH	LAG & HIGH	HIGH
	Float 2 Failed			
UDUU DUDD* UDUD*	1	STOP	STOP	STOP
	2	LEAD	IGNORED	IGNORED
	3	LAG	LEAD	LEAD
	4	HIGH	LAG & HIGH	HIGH
	Float 3 Failed			
DDUD UDUD* UUDU*	1	STOP	STOP	STOP
	2	LEAD	LEAD	LEAD
	3	LAG	IGNORED	IGNORED
	4	HIGH	LAG & HIGH	HIGH
	Float 4 Failed			
DDDU UDDU UUDU*	1	STOP	STOP	STOP
	2	LEAD	LEAD	LEAD
	3	LAG	LAG	LAG
	4	HIGH	HIGH	HIGH
	UNKNOWN OR >1 Float Failed			
DUDD* UDUD* UUDU* DUDU DDUU	1	STOP	IGNORED	IGNORED
	2	LEAD	IGNORED	IGNORED
	3	LAG	IGNORED	IGNORED
	4	HIGH	HIGH	HIGH

U= Float up

D= Float down

*= Float failure depends on prior float status

PUMP SYSTEM PROTECTION

Starter Run Feedback

This will use the auxiliary contacts on the motor contactor to determine if the pump is running. If a pump is called to run and the running contact is not detected (Fail to Start Time), a Fail to Start Fault will occur. This fault will cause the pump to be unavailable. Each time a high level alarm is active, the pump will be called once more and if a successful start has been detected the fault will be reset.

Fault Input Monitor

This setting determines how the Pump Fault inputs on J3-7 through J3-9 are used. Options include disabled, manual reset, and auto reset. If not disabled, a pump fault input closing will trigger an alarm and disable the corresponding pump. For Auto Reset, the pump will be reenabled when the input opens. For Manual Reset, the pump will not be re-enabled until the input opens and the user acknowledges the fault by pressing ESC.

Clog/Fail Detection (Demand Dose Only)

This setting can only be enabled when a Demand Dose float configuration is selected, the Alternation mode is set to Alternate, and at least two pumps are currently available to run. By monitoring lead & lag pump activation the Clog/Fail Detection can determine if a pump is running poorly. Once a pump has been detected to be “poor efficiency”, it will be used as a lag pump, giving preference to all “working” pumps.

Pump System Efficiency (Demand Dose Only)

The Pump System Efficiency (PSE) is a proprietary formula developed by SJE based on pump on and off times, which determines if the pump is running at a much lower efficiency than expected. Once enabled, the system will monitor the next full pumping cycle to calculate a baseline PSE value. Each “pump cycle” for PSE calculation begins when the Stop Float transitions from Off to On. Once a baseline PSE value is established, whenever one pump is running, the PSE will be continuously calculated. If the PSE value is 10x greater than the baseline value, an alarm will be activated, the pump will be marked as having “poor” performance, and the next pump in the alternation sequence will be called. A new baseline PSE value can be reset by disabling this setting, then re-enabling it. PSE will only be calculated for pump cycles with fill time >10 seconds and pumping time >10 seconds. A typical PSE value is between 5 and 40.

If two pumps get a PSE fault in the same pump cycle with the lead float down a **PSE stop fault** will be triggered. This means it is likely the Stop float is stuck in the “up” position. If Float Fault Detection is enabled the stop float will be reassigned.

PSE Val/Base - The first value shown is the current PSE value while the pump is running or the PSE value at the time it exceeded 10x the baseline value. This value will update every 3 seconds. If no pump is running or the PSE cannot be calculated for some reason, “_” is displayed. The second number displayed is the baseline PSE value. If a baseline value has not yet be calculated, NOT SET is displayed.

```

‡—— Pump System Protection ——
Pump System Eff(PSE)      Enabled
PSE Val/Base              —/1.00
Max Cycle Time Alarm      Disabled
Max Fill Timer             0 hr

```

```

‡—— Pump System Protection ——
Pump System Eff(PSE)      Enabled
PSE Val/Base              5.68/1.00
Max Cycle Time Alarm      Disabled
Max Fill Timer             0 hr

```

Once Val is >10x than the baseline a “Clog/Dry Run” fault will occur. The value will be held until a new pump runs, or there is a new PSE cycle.

```

‡—— Pump System Protection ——
Pump System Eff(PSE)      Enabled
PSE Val/Base              10.40/1.00
Max Cycle Time Alarm      Disabled
Max Fill Timer             0 hr

```

PSE cannot be calculated when any of the following conditions are present:

- >1 pumps are running at the same time
- High float alarm present
- A Cleanout cycle is in progress
- A Pump Exercise cycle is in progress
- Float out of sequence
- A valid tank fill period beginning with a Stop Float activation event was not detected
- The tank fill time was 10 seconds or less
- A Timed Dose pump configuration is selected

Max Cycle Time Alarm (Demand Dose Only)

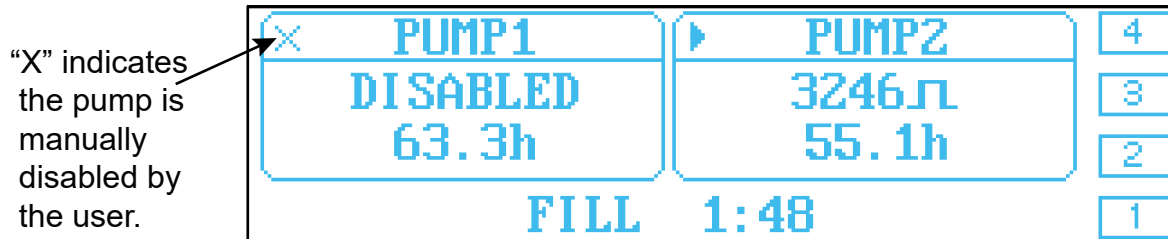
Choices are:

- Disabled: Pumps will not be monitored for Max Cycle Time.
- Alarm Only: If a pump runs for a duration greater than Max Cycle Time an Alarm will be displayed and pump will be marked as “poor efficiency”. Refer to Alternation for more details.
- Stop Pump & Alarm: If a pump runs for a duration greater than Max Cycle Time an Alarm will be displayed and pump will be unavailable to be called.

Septic Prevention Timer (Demand Dose Only)

If a pump hasn't run in the amount of time indicated in the Septic Prevention Timer setting, an alarm will be activated. If Stop float is active, the pump will be called to run until Stop float is open. Setting this to zero disables the Septic Prevention Timer.

Manually Disable Pump



Select which pumps you want to disable. Once disabled, the controller will not use it for operation. If you change your float configuration, all pumps will become available again. If the user disables all pumps, "No Pumps Available" alarm will be triggered.

Exercise After Idle

If a pump has not been called for "Exercise After Idle" days, the pump will run for the specified exercise duration. This is useful to prevent seizing or damage to a pump from extended periods of sitting idle. Exercise will reset if a fault is active on the pump being called. Other pumps will not be able to be called during an Exercise pump run. An Exercise may cause extra pump time in a timed dose mode. Setting Exercise After Idle to zero days disables pump exercise operation.

Exercise Duration

The number of seconds a pump will run during a pump exercise operation.

Cleanout Frequency (Demand Dose Only)

↑ — Pump System Protection —	
Cleanout Frequency	20 cyc
Cleanout Countdown	20 cyc
Cleanout Duration	120 sec
Cleanout Now!	

A cleanout cycle will continue running the pump for a user-defined period of time after the stop float tips down. This is used to periodically pump out floating solids or grease layer, and should only be used with pumps that can pass this debris. This Cleanout Frequency determines how many pump cycles occur between cleanout cycles.

Cleanout Countdown

This is how many pump cycles remain until a cleanout cycle is performed. Once Cleanout Countdown equals 0, a cleanout will happen the next time the Stop float tips down.

Cleanout Duration

A Cleanout cycle will continue pumping after the Stop float tips down for the number of seconds set in Cleanout Duration. This should be carefully set and tested to ensure the desired results are achieved without excessive dry pumping.

Cleanout Now!

A cleanout cycle may be started by pressing Cleanout Now!, and selecting Start. This will begin a pump cycle immediately and will continue running below the Stop float for the number of seconds defined in Cleanout Duration.

TIMED DOSE

↓ — Timed Dose —		
P1 OFF time	00:01	HH:MM
P1 ON time	00:10	MM:SS
P1 Peak OFF time	00:01	HH:MM
P1 Peak ON time	00:20	MM:SS

Timed Dose float operation consists of:

- Redundant Off - Back up float to prevent dry run. Install a jumper if not using a Redundant Off float.
- Timer Enable - Once this float is activated, the pump timer will start timing the Pump Off time.
- Timer Override - An optional float used to override the normal pump timer. When this float is up, the Peak on and off times are used instead. Note: Float failure detection will operate with or without timer override float.
- High Level - When activated for High Alarm Delay seconds this will trigger a high level alarm.
- Auxiliary Alarm - This is not part of the pump control scheme and does not necessarily have to be a float switch. This can be used as an extra alarm input for any normally-open contact.

For each pump enter:

- OFF time - Once the timer enable float is activated, the off timer will start. Measured in hours and minutes.
- ON time - Once the off timer has expired, the lead pump will turn on and the On timer will start. Measured in minutes and seconds.
- Peak OFF time - If the override float is activated, this time will replace OFF time. Measured in hours and minutes.
- Peak ON time - If the override float is activated, this time will replace On time. Measured in minutes and seconds.

PUMP1	PUMP2	4
3414л	3247л	3
63.3h	55.1h	2
⌚ 8		1

The amount of time remaining on the Pump Off timer or Pump On timer.

ANALOG CONFIGURATION

Analog Input Selection

The 4-20mA input can be used for two different functions, depending on what is selected here:

Disabled - 4-20mA input is not used

Amps - 4-20mA current transducer. One conductor from the same phase of each pump must pass through the single current sensor.

Flow - 4-20mA flow meter. The flow meter needs to be in the combined discharge pipe so that the flow of all pumps is measured.

Units (Flow selection only)

This setting defines what units label is applied to the input reading and all analog settings. The available settings are gallons per minute, meter³ per hour, liters per second.

Transmitter 4mA

The setting is used to scale the 4-20mA input signal. The Sensor Range should be set to the pump motor current or flow rate at which the 4-20mA transmitter is rated to output 4mA. In most cases this will be 0.0.

Transmitter 20mA

The setting is used to scale the 4-20mA input signal. The Sensor Range should be set to the pump motor current or flow rate at which the 4-20mA transmitter is rated to output 20mA.

High Amp Alarm (Amp selection only)

Low Amp Alarm (Amp selection only)

The setpoint in which the sensor reading must be greater or less than for High/Low Amp alarm Delay to activate an alarm. Once an alarm is activated and detected, the sensor reading will be shown and highlighted on the status screen until acknowledged. Note: If two or more pumps are on, the high and low amp alarms will not be triggered.

PUMP1	PUMP2	4
3416л	56.3A	3
63.3h	55.1h	2
P2 High Amp (ESC to Reset)		1

Highlighted current at which the High Amp Alarm value was exceeded.

High Amp Alarm Delay (Amp selection only)

Low Amp Alarm Delay (Amp selection only)

This will delay the alarm for the specified number of seconds after the alarm threshold is reached.

4-20mA Output

Select AI retransmit to retransmit the 4-20mA input signal received, or Level to output a 4-20mA signal that reflects float status, as shown below:

Floats on	3 Float system	4 Float System	5 Float system
0	4.00mA	4.00mA	4.00mA
1	9.33mA	8.00mA	7.20mA
2	14.67mA	12.00mA	10.40mA
3	20.00mA	16.00mA	13.60mA
4		20.00mA	16.80mA
5			20.00mA

VOLUMETRIC FLOW CALCULATION (Demand Dose Only)

Volumetric flow calculation uses the time between float activation together with the tank dimensions to calculate flow out of the tank. If a 4-20mA flow sensor is enabled or timed dose configuration has been selected, this feature will be disabled.

Mode

Select cylindrical or rectangular tank measurement to match the shape of your wet well.

Units

Select which units of flow you want to measure. Gallons per minute (GPM), cubic meters per hour (m^3/h), or liters per second (l/s). When GPM is selected, tank measurements will be in feet & inches; otherwise, tank measurements will be in centimeters.

Tank Diameter

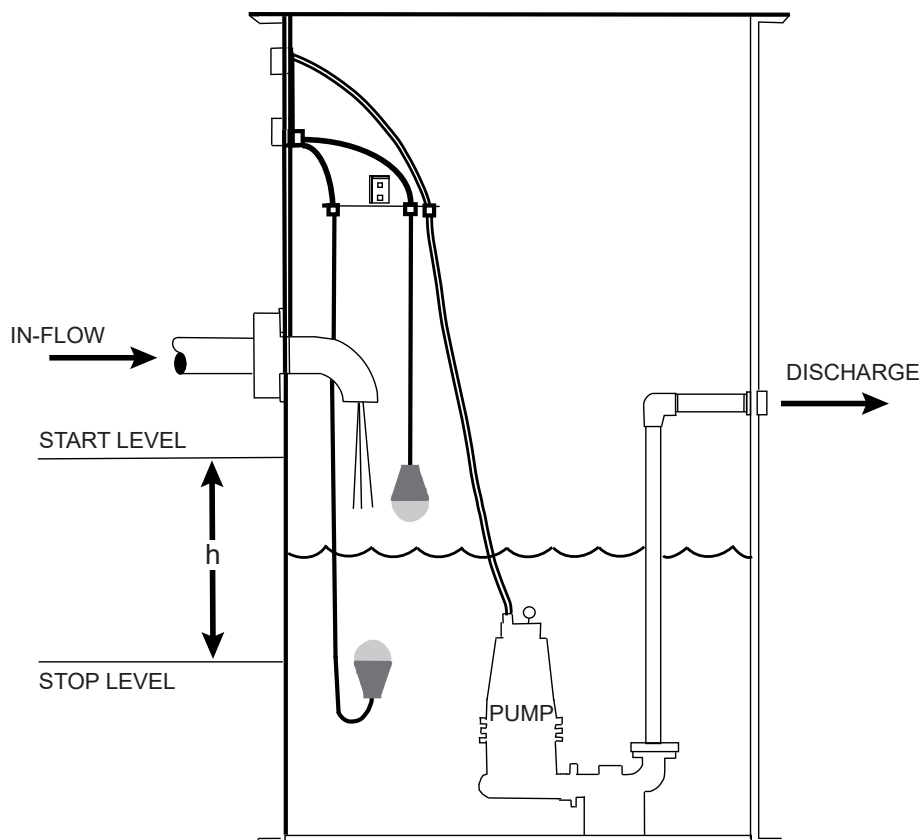
Tank Length

Tank Width

These settings define the geometry of the wet well, and are used to calculate the tank volume. The dimensions are in feet or centimeters, depending on the Units setting.

Start-Stop Height

This is the difference in activation points between the Lead float and Stop float. If float tether length is the same for both floats, this can be the height difference between the float tether mounting points. The dimensions are in inches or centimeters, depending on the Units setting.



FLOW MEASUREMENTS

These menu items will display the flow rates for last complete pumping cycle for each pump. Flow measurements can be measured by a 4-20mA flow sensor or by Volumetric flow calculation. If a sensor has not been selected and volumetric flow calculation has not been set up, this menu will be hidden. The values shown in these menu lines are always for the most recently completed fill or discharge cycle. Note: Flow sensor measurements take preference over volumetric flow calculations.

Pump 1 Avg Flow

Pump 2 Avg Flow

Pump 3 Avg Flow

This is the flow rate for this pump during its most recent pumping cycle.

Station Inflow (not available in Timed Dose)

The average inflow rate during the last tank fill cycle.

Pumped Yesterday

The totalized volume pumped in the previous 24-hour period. This period does not necessarily line up with calendar day, since there is no time-of-day clock on the TPC-5F controller. Depending on the units of flow selected, the volume is given in 1000 gallon units (kGal), cubic meters (m³) or kiloliters (kL).

PROGRAMMABLE RELAYS

Programmable Relay 1

Programmable Relay 2

Select a condition which will trigger the programmable relay. Options available are:

- General Alarm: Any alarm or fault.
- High Level: If high level alarm is active.
- Low Level: If a low level alarm is active.
- Pump Fault: If any fault including start fail, fault input, lag fault, PSE fault are active.
- Pump Running: If any pump is running now.
- Clog Dry Run: If any PSE clog/dry run or PSE stop faults are active.
- Float Failure: If any float failure alarm is active.
- Max Cycle Time: If any of the pump max cycle alarms are active
- Septic Prevention Time: If no pumps have run for longer than the Septic Prevention Time.
- Low Amp: If any of the Low amp alarms are active.
- High Amp: If any of the High amp alarms are active.
- Aux Alarm: If auxiliary alarm is active.

I/O STATUS SCREENS

DIGITAL INPUT STATUS

— Digital Input Status —						
		Run	Fault	Floats		
Pump 1	Open	Open	1	Open	4	Open
Pump 2	Open	Open	2	Open	5	Open
Pump 3	Open	Open	3	Open		

This screen shows the status of all eleven digital (discrete) inputs. Each input is shown as either open circuit (“Open”) or closed circuit, meaning shorted to COM (“Clsd”). This can be used for troubleshooting to ensure the controller is accepting changes in input states.

RELAY OUTPUT STATUS

— Relay Output Status —					
Pump 1	Off	High Alarm		Off	
Pump 2	Off	Prog 1		Off	
Pump 3	Off	Prog 2		Off	

This screen shows the status of all six relay outputs. Each relay output is shown as either open circuit (“Off”) or closed circuit (“On”). This can be used for troubleshooting to ensure the controller is turning on and off the output relays as expected.

ANALOG I/O STATUS

— Analog I/O Status —	
AI Level	A Out
09.50 mA	12.00 mA

This screen shows the current in mA of the analog input (AI Level) and analog output (A Out). This can be used for troubleshooting to ensure the 4-20 mA signals are operating as expected.

ADVANCED SETTINGS

↓ — Advanced Settings —		
Float Detect Time	2 sec	
Max Pumps On At Once	3	
Pump ON Delay	5 sec	
Pump OFF Delay	5 sec	
Lag2 On Delay Time	20 sec	
Factory Reset		

Float Detect Time

The time it takes for a float contact to be closed before detection. Allowable range: 1 to 30 seconds.

Max Pumps On At Once (Demand Dose Only)

Typically, the Max Pumps On At Once will be set the same as Number Of Pumps. However, if for reasons of limiting the maximum current or maximum flow, the number of pumps running at the same time needs to be limited, this setting can be lowered. Note: Each time you change float configuration this value will be reset. In timed dose this is fixed to one pump on at once.

Pump On Delay

This setting controls the minimum time allowed between one pump turn-on and the next pump turn-on. Note: the Pump ON Delay does not affect the first pump to turn on after power-up. Allowable range: 1 to 250 seconds.

Pump Off Delay

This setting controls the minimum time allowed between one pump turn-off and the next pump turnoff. Note: the Pump OFF Delay does not affect the first pump to turn off after power-up. Allowable range: 1 to 250 seconds.

Lag2 On Delay Time (Float config 4 Only)

Time for Lag float to be closed before the 2nd lag pump is to be called. Allowable range: 1 to 250 seconds.

Factory Reset

This will clear all settings except Counts & ETMS to factory default settings. Press enter and accept warning to execute the factory reset.

STATION DATA

This information is not used in any control or alarm functions, and is simply for the user's future reference. The pump's horsepower, voltage, and FLA can be entered here and referred to at a later date.

ALARM HISTORY

The controller stores the last 9 alarms/faults. Press enter & accept warning to clear Alarm History.

↓ — Alarm History —	
1	High Level Alarm
2	Auxiliary Alarm
3	High Level Alarm
4	Low Level Alarm
5	P2 High Amp
6	Low Level Alarm
7	High Level Alarm
8	Low Level Alarm
9	Low Level Alarm

ALARMS

ALARM TEXT	DEFINITION	FIX
AUXILIARY ALARM	The auxiliary alarm (5th float option) is closed.	Check if 5th float is closed or float configuration.
FLOAT FAILURE	Floats have been activated out of expected sequence.	Check that float switches are working, and that float switches are installed in correct order.
HIGH LEVEL ALARM	The level is at or above the High Level float switch.	Check pump operation, check for excessive inflow, check float switches.
LOW LEVEL ALARM	The level is at or below the Low Level float switch.	Check wet well for leak, check float switches.
SEPTIC PREVENTION TIMER	The system has been inactive for longer than the defined duration.	Check inflow and/or floats.
NO PUMPS AVAILABLE	No pumps are available to be called.	Check whether pumps are manually disabled or unavailable due to faults.
P1 CLOG/DRY RUN P2 CLOG/DRY RUN P3 CLOG/DRY RUN	PSE function has detected abnormalities in system.	Check pump operation. If multiple Clog/Dry Run faults exist, look for excessive inflow or inaccurate PSE baseline value.
P1 FAIL START P2 FAIL START P3 FAIL START	Pump has failed to start in the expected number of seconds after pump relay closed.	Check Fail to Start Time setting, motor contactor, or pump.
P1 FAULT INPUT P2 FAULT INPUT P3 FAULT INPUT	Pump fault is or has closed.	Check sensor that is used for fault input.
P1 HIGH AMP P2 HIGH AMP P3 HIGH AMP	Amp sensor has detected a high amp condition.	Check High Amp setting, pump locked rotor, excessive pump current.
P1 CLOG/FAIL P2 CLOG/FAIL P3 CLOG/FAIL	The lag float has activated multiple successive cycles while this pump was the lead pump.	Check pump operation.
P1 DRY RUN P2 DRY RUN P3 DRY RUN	Pump Amp sensor has detected a low amp condition.	Low Amp Alarm setting too high, pump running dry, broken impeller.
P1 MAX CYCLE P2 MAX CYCLE P3 MAX CYCLE	Pump has run longer than max cycle duration.	Check max cycle settings, running input contacts, or pump condition.
TRANSMITTER SHORT CIRCUIT	The 4-20 mA input signal is greater than 20.25 mA.	Check transmitter operation and wiring.
TRANSMITTER OPEN CIRCUIT	The 4-20 mA input signal is less than 3.75 mA.	Check transmitter operation and wiring.
PSE STOP FLOAT FAIL	Multiple PSE faults in a row indicate the Stop float is likely stuck in the up position.	Check that float switches are working, look for excessive inflow, look for inaccurate PSE baseline value.

I/O TERMINAL CONFIGURATION

TPC-5F



ELECTRICAL RATINGS

Inputs:

Power Supply: 24 VDC, 350mA max.

Digital Inputs: 12 VDC to GND (x11)

Transducer Input: 4-20 mA, 80-ohm load

Outputs:

Relay Outputs: 120 VAC, 60Hz, 3A (x6)

Analog Output: 4-20 mA, Sourcing

Loop Power Supply: 24 VDC, 25 mA max.



TERMINAL BLOCK J3

16	+24 VDC OUT
15	ANALOG INPUT
14	AI COM
13	SHIELD
12	PUMP 3 RUNNING
11	PUMP 2 RUNNING
10	PUMP 1 RUNNING
9	PUMP 3 FAULT
8	PUMP 2 FAULT
7	PUMP 1 FAULT
6	FLOAT 5
5	FLOAT 4
4	FLOAT 3
3	FLOAT 2
2	FLOAT 1
1	COM

TERMINAL BLOCK J1

1	N/C
2	N/C
3	0V
4	+24VDC
5	D+
6	D-
7	SHIELD
8	A OUT
9	AO COM
10	N/C
11	GND
12	GND

TERMINAL BLOCK J2

1	HIGH
2	PROGRAM RELAY 1
3	PROGRAM RELAY 2
4	PUMP 1
5	PUMP 2
6	PUMP 3
7	
8	
9	
10	
11	
12	

TPC-5F I/O TABLE

J1 POWER AND COMMUNICATIONS		
PIN	NAME	DESCRIPTION
1	N/C	- NO CONNECTION -
2	N/C	- NO CONNECTION -
3	0V	RETURN FOR +24 VDC SUPPLY
4	+24 VDC	19 - 28 VDC SUPPLY
5	D+	MODBUS (RS-485 NON-INVERTING)
6	D-	MODBUS (RS-485 INVERTING)
7	SHIELD	
8	A OUT	4-20 mA LOOP, POWER SUPPLIED
9	AO COM	4-20 mA LOOP RETURN
10	N/C	- NO CONNECTION -
11	GND	PROTECTIVE EARTH GROUND
12	GND	PROTECTIVE EARTH GROUND

J2 RELAY OUTPUTS		
PIN	NAME	DESCRIPTION
1	HIGH	HIGH ALARM RELAY CONTACTS
2		
3	PRG RELAY 1	PROGRAMMABLE RELAY 1 CONTACTS
4		
5	PRG RELAY 2	PROGRAMMABLE RELAY 2 CONTACTS
6		
7	PUMP 1	PUMP 1 RELAY CONTACTS
8		
9	PUMP 2	PUMP 2 RELAY CONTACTS
10		
11	PUMP 3	PUMP 3 RELAY CONTACTS
12		

J3 DIGITAL INPUTS		
PIN	NAME	DESCRIPTION
1	COM	INPUT COMMON RETURN
2	FLOAT 1	FLOAT 1 INPUT
3	FLOAT 2	FLOAT 2 INPUT
4	FLOAT 3	FLOAT 3 INPUT
5	FLOAT 4	FLOAT 4 INPUT
6	FLOAT 5	FLOAT 5 INPUT
7	P1 FAULT	PUMP 1 GENERAL FAULT INPUT
8	P2 FAULT	PUMP 2 GENERAL FAULT INPUT
9	P3 FAULT	PUMP 3 GENERAL FAULT INPUT
10	P1 RUNNING	PUMP 1 RUNNING INPUT
11	P2 RUNNING	PUMP 2 RUNNING INPUT
12	P3 RUNNING	PUMP 3 RUNNING INPUT
13	SHIELD	
14	AI COM	4-20 mA LOOP RETURN
15	AI LEVEL	4-20 mA LOOP INPUT
16	+24 VDC OUT	4-20 mA TRANSMITTER SUPPLY

Note:

Pins J1-3, J1-7, J1-11, J1-12, J3-1, J3-13 and J3-14 are all internally connected, and should be wired to Protective Earth Ground at terminal J1-11 or J1-12.

Use copper conductors, rated 60°C (140°F).

Apply Torque Value of 4.5 In-lbs to Field Wiring Terminals.

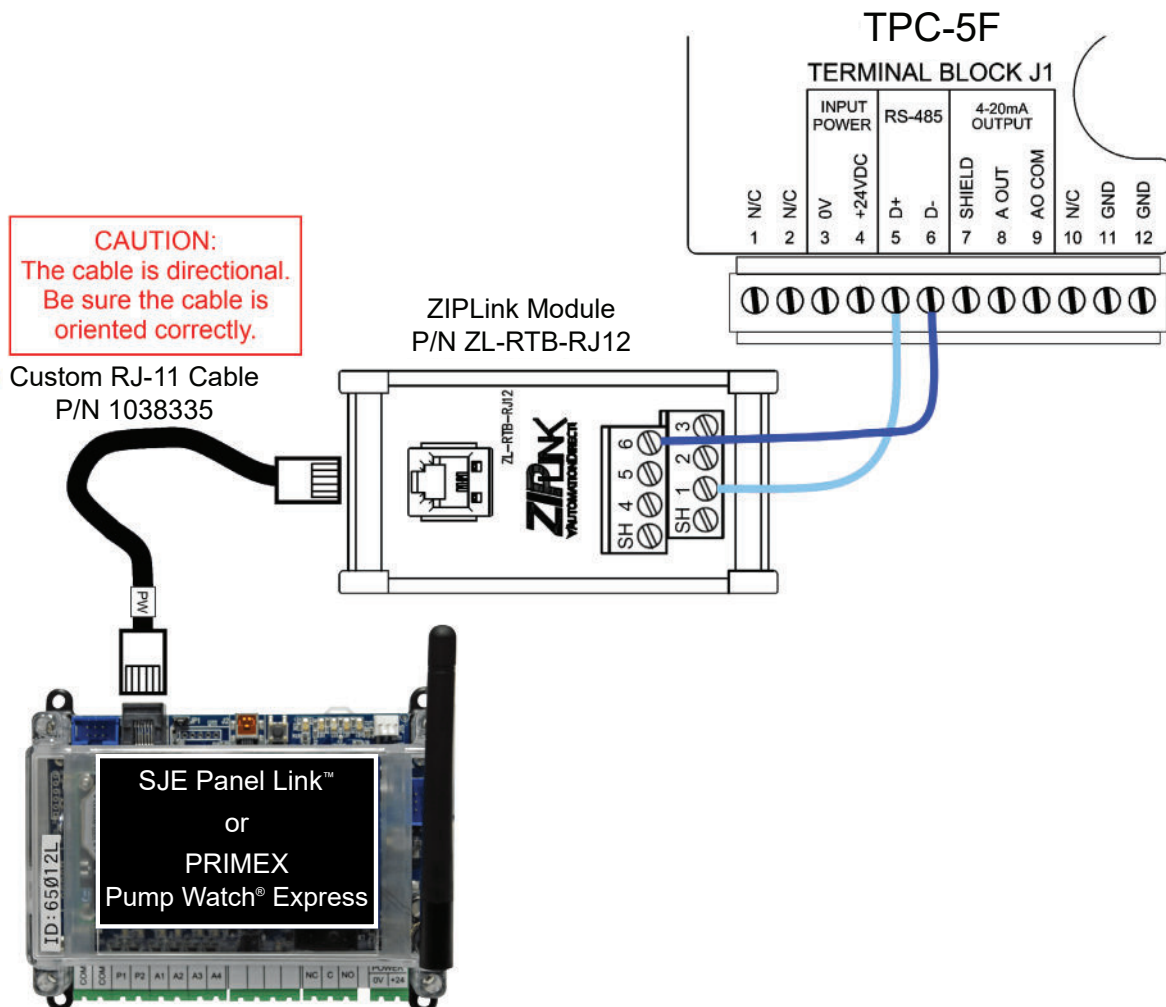
MODBUS COMMUNICATION

The TPC-5F controller is equipped with Modbus RTU support using the D+ and D- RS-485 terminals. The Modbus registers and communications specifications are designed work with an SJE Panel Link™ Gateway or PRIMEX Pump Watch® Express right out of the box.

- Baud Rate: 9600 baud
- Data Bits: 8 bits
- Stop Bits: 1 bit
- Parity: None
- Node Address: 1
- Modbus Function Codes Supported:
 - Read Holding Registers (0x03)
 - Write Single Register (0x06)
 - Write Multiple Registers (0x10)

Anytime the TPC-5F controller receives a valid Modbus request, a “Modbus Communication Active” icon () will appear on the Main Screen for 60 seconds. If the Modbus master device is sending a Modbus request more often than once every 60 seconds, the icon will effectively be displayed continuously.

To connect the TPC-5F controller and the SJE Panel Link™ Gateway or PRIMEX Pump Watch® Express, follow the connection diagram below:



The following is a list of all accessible Modbus registers.

Access Type	Holding Register Number	Holding Register Address	Bit	Description	Unit of Measure (Other Notes)
Read/Write	2001	42002		Pump Data - HP	
Read/Write	2002	42003		Pump Data - Voltage	
Read/Write	2003	42004		Pump Data - FLA	Tenths of Amps
Read	2004	42005		Station In-flow	GPM (*)
Read	2005	42006		--not used--	
Read	2006	42007		Pump 1 Amps	Tenths of Amps
Read	2007	42008		Pump 2 Amps	Tenths of Amps
Read	2008	42009		Pump 3 Amps	Tenths of Amps
Read	2009	42010		--not used--	
Read	2010	42011		Pump 1 Flow	The unit will be the unit selected on the controller.
Read	2011	42012		Pump 2 Flow	The unit will be the unit selected on the controller.
Read	2012	42013		Pump 3 Flow	The unit will be the unit selected on the controller.
Read	2013	42014		--not used--	
Read	2014	42015		Pump1 Starts/24 hrs	(**)
Read	2015	42016		Pump2 Starts/24 hrs	(**)
Read	2016	42017		Pump3 Starts/24 hrs	(**)
Read	2017	42018		--not used--	
Read	2018	42019		Pump 1 Run Time Per 24 hrs	Minutes (**)
Read	2019	42020		Pump 2 Run Time Per 24 hrs	Minutes (**)
Read	2020	42021		Pump 3 Run Time Per 24 hrs	Minutes (**)
Read	2021	42022		--not used--	
Read	2022	42023		Station Inflow Per 24 hrs	Hundreds of Gallons (**)
Read	2023	42024	0	Pump 1 Running	
			1	Pump 1 General Fault	
			2	Pump 1 Available	(Pump available to be called = 1, Otherwise = 0)
			3	Pump 2 Running	
			4	Pump 2 Fault	
			5	Pump 2 Available	(Pump available to be called = 1, Otherwise = 0)
			6	Pump 3 Running	
			7	Pump 3 Fault	
			8	Pump 3 Available	(Pump available to be called = 1, Otherwise = 0)
			9	Pump 1 Max Cycle Time	
			10	Pump 2 Max Cycle Time	
			11	Pump 3 Max Cycle Time	
			12	PSE Fault/Low Amps	(1 if any PSE or low amp alarm is present, otherwise 0)
			13	--not used--	
			14	--not used--	
			15	--not used--	

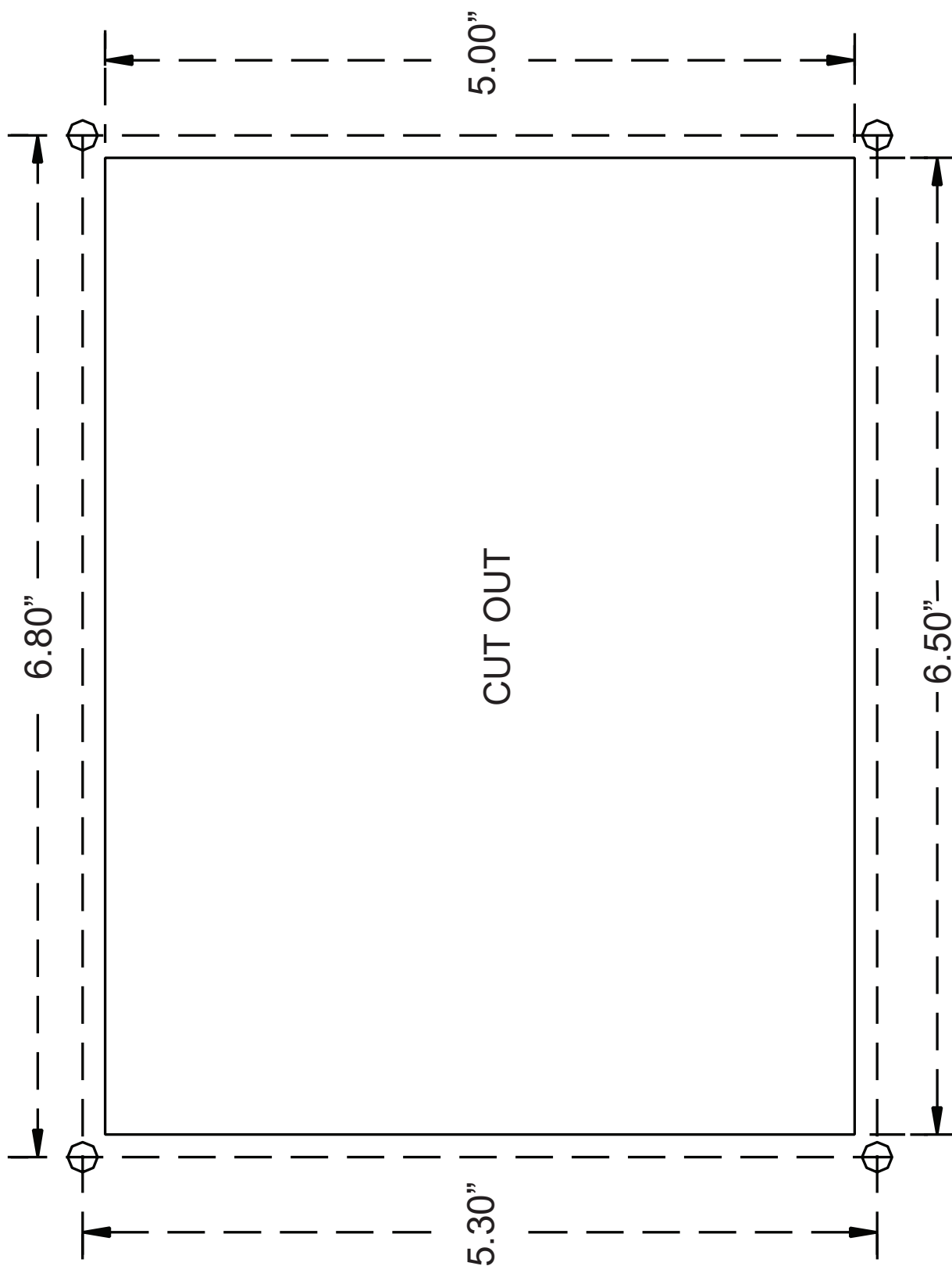
* Register list continued on next page

Access Type	Holding Register Number	Holding Register Address	Bit	Description	Unit of Measure (Other Notes)
Read	2024	42025	0	--not used--	
			1	--not used--	
			2	General Station Fault/Alarm	
			3	--not used--	
			4	Low Level Alarm	
			5	Float 1 Input Status	(Closed Input = 1, Open Input = 0)
			6	Float 2 Input Status	(Closed Input = 1, Open Input = 0)
			7	Float 3 Input Status	(Closed Input = 1, Open Input = 0)
			8	Float 4 Input Status	(Closed Input = 1, Open Input = 0)
			9	Float 5 Input Status	(Closed Input = 1, Open Input = 0)
			10	High Level Alarm	
			11	--not used--	
			12	Max Cycle or Septic Prevention Timeout	
			13	Transducer Short/Open	
			14	General Float Failure	
			15	--not used--	
Read	2025	42026		--not used--	
Read	2026	42027		--not used--	
Read	2027	42028	0	Pump 1 Clog/Dry Run or Pump 1 Low Amp Alarm	
			1	Pump 2 Clog/Dry Run or Pump 2 Low Amp Alarm	
			2	Pump 3 Clog/Dry Run or Pump 3 Low Amp Alarm	
			3	--not used--	
			4	3 pumps used in this lift station	
			5	Flow monitoring enabled	
			6	Current monitoring enabled	
			7-9	--not used--	
			10	P1 High Amp Alarm	
			11	P2 High Amp Alarm	
			12	P3 High Amp Alarm	
			13-15	--not used--	

* Holding Register numbers 2010 through 2012 hold the calculated GPM of each pump for that pump's last completed pumping cycle as the lead pump. Likewise, Holding Register 2004 holds the calculated GPM of the station inflow for the most recently completed fill cycle.

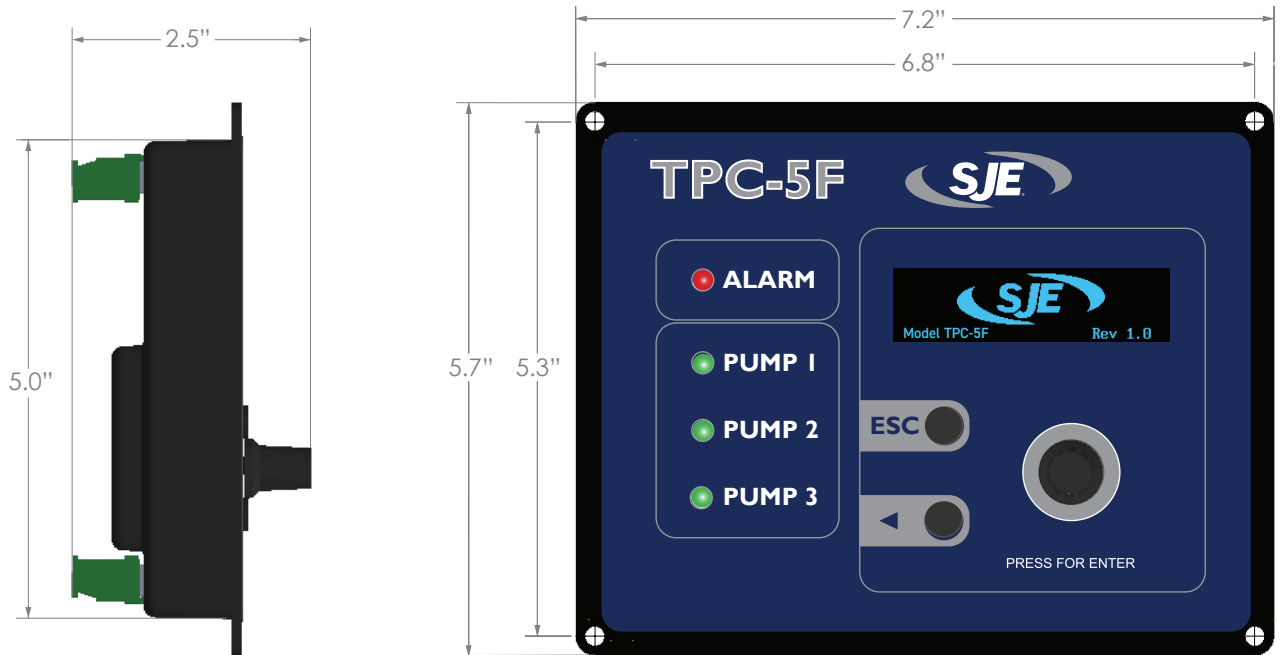
** Holding Register numbers 2014 through 2022 hold totals for the most recently completed 24-hour period. A 24-hour period begins at power-on, and ends 24 hours later, at which time the next 24-hour period begins. (When powering off, TPC-5F saves to memory where it was in the 24-hour timing cycle, and then when powered up, the timing picks back up where it left off.)

MOUNTING DIMENSIONS

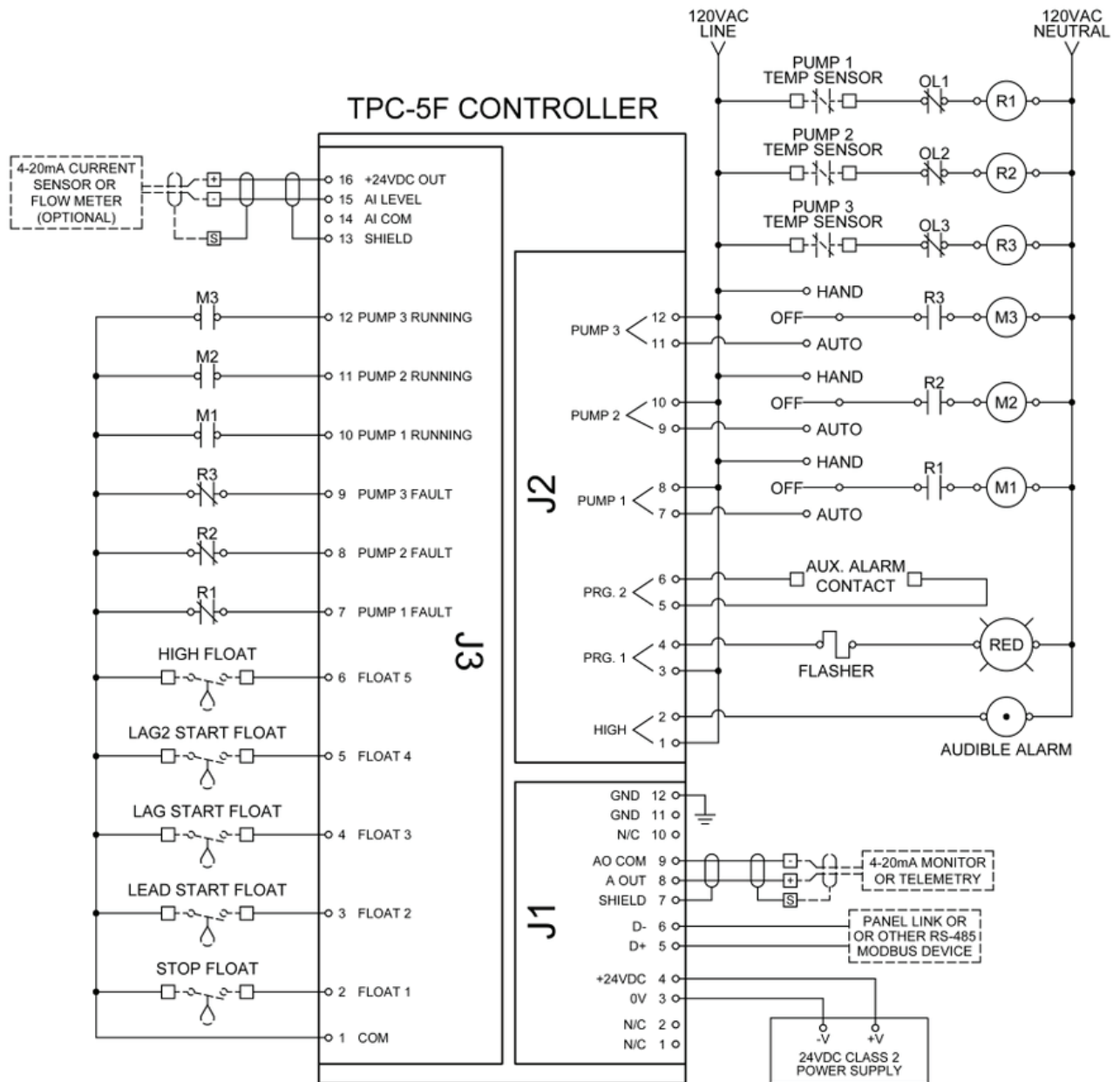


Not to scale. Do not use as a template.

CONTROLLER DIMENSIONS



ELECTRICAL WIRING DIAGRAM



EXAMPLE DEPICTS
FLOAT CONFIGURATION 5

TPC-5F CONTROLLER SETTINGS LIST

STATION NAME:	
START UP DATE:	
CONTROLLER REV:	

		MIN	MAX	DEFAULT VALUE	USER SETTING
MAIN MENU					
	Alternation	List		Alternate	
FLOAT SET UP					
	Float Configuration	List		Float Config 1	
	High Float Contact	List		N.O.	
	High Alarm Delay	0	120	3 sec	
	High Float Pump Run	List		On Float Fail	
	High Float Pump Run Time	5	999	20 sec	
	Float Fault Detection	Enabled/Disabled		Enabled	
PUMP SYSTEM PROTECTION					
	Starter Run Feedback	Enabled/Disabled		Enabled	
	Fail To Start Time	1	99	5 sec	
	Fault Input Monitor	List		Manual Reset	
	Clog/Fail Detection	Enabled/Disabled		Enabled	
	Pump System Efficiency (PSE)	Enabled/Disabled		Disabled	
	Max Cycle Time Alarm	List		Alarm Only	
	Max Cycle Time	1	999	20 min	
	Septic Prevention Timer	0	999	0 hr	
	Disable Pump	List		None	
	Exercise After Idle	0	60	0 day	
	Exercise Duration	5	999	10 sec	
	Cleanout Frequency	0	9999	0 cycle	
	Cleanout Duration	5	999	120 sec	
TIMED DOSE					
	Pump 1 OFF Time	00:00	99:59	20:00	
	Pump 1 ON Time	00:00	99:59	2:00	
	Pump 1 Peak OFF Time	00:00	99:59	20:00	
	Pump 1 Peak ON Time	00:00	99:59	2:00	
	Pump 2 OFF Time	00:00	99:59	20:00	
	Pump 2 ON Time	00:00	99:59	2:00	
	Pump 2 Peak OFF Time	00:00	99:59	20:00	
	Pump 2 Peak ON Time	00:00	99:59	2:00	
	Pump 3 OFF Time	00:00	99:59	20:00	
	Pump 3 ON Time	00:00	99:59	2:00	
	Pump 3 Peak OFF Time	00:00	99:59	20:00	
	Pump 3 Peak ON Time	00:00	99:59	2:00	

Table continued on next page.

		MIN	MAX	DEFAULT VALUE	USER SETTING
ANALOG CONFIG					
	Analog Input Selection	List		Disabled	
	Units	List		GPM	
	Transmitter 4mA	0.0	999.9	0.0	
	Transmitter 20mA	0.0	999.9	100.0	
	High Amp Alarm	1.0	999.9	50 A	
	High Amp Alarm Delay	0	999	5 sec	
	Low Amp Alarm	0.00	999.9	10 A	
	Low Amp Alarm Delay	0	999	15 sec	
	4-20mA Output	List		Level	
VOLUMETRIC FLOW CALCULATION					
	Mode	List		Disabled	
	Units	List		GPM	
	Tank Diameter	1.0	999.9	5.0 ft	
	Tank Length	0.5	999.9	5.0 ft	
	Tank Width	0.5	999.9	5.0 ft	
	Start-Stop Height	1.0	999.9	12.0 in	
PROGRAMMABLE RELAYS					
	Relay 1	List		General Alarm	
	Relay 2	List		High Alarm	
ADVANCED SETTINGS					
	Float Detect Time	1	30	2 sec	
	Max Pumps On At Once	1	3	2	
	Pump ON Delay	1	250	5 sec	
	Pump OFF Delay	1	250	5 sec	
	Lag2 On Delay Time	1	250	20 sec	
STATION DATA					
	Pump Horsepower	0	999	0 Hp	
	Pump Voltage	0	999	0 V	
	Pump FLA	0	999.9	0.0 FLA	

Manufactured by: SJE Inc.
 Technical support: +1-800-746-6287
 techsupport@sjeinc.com

www.csicontrols.com

www.primexcontrols.com

www.sjerhombus.com