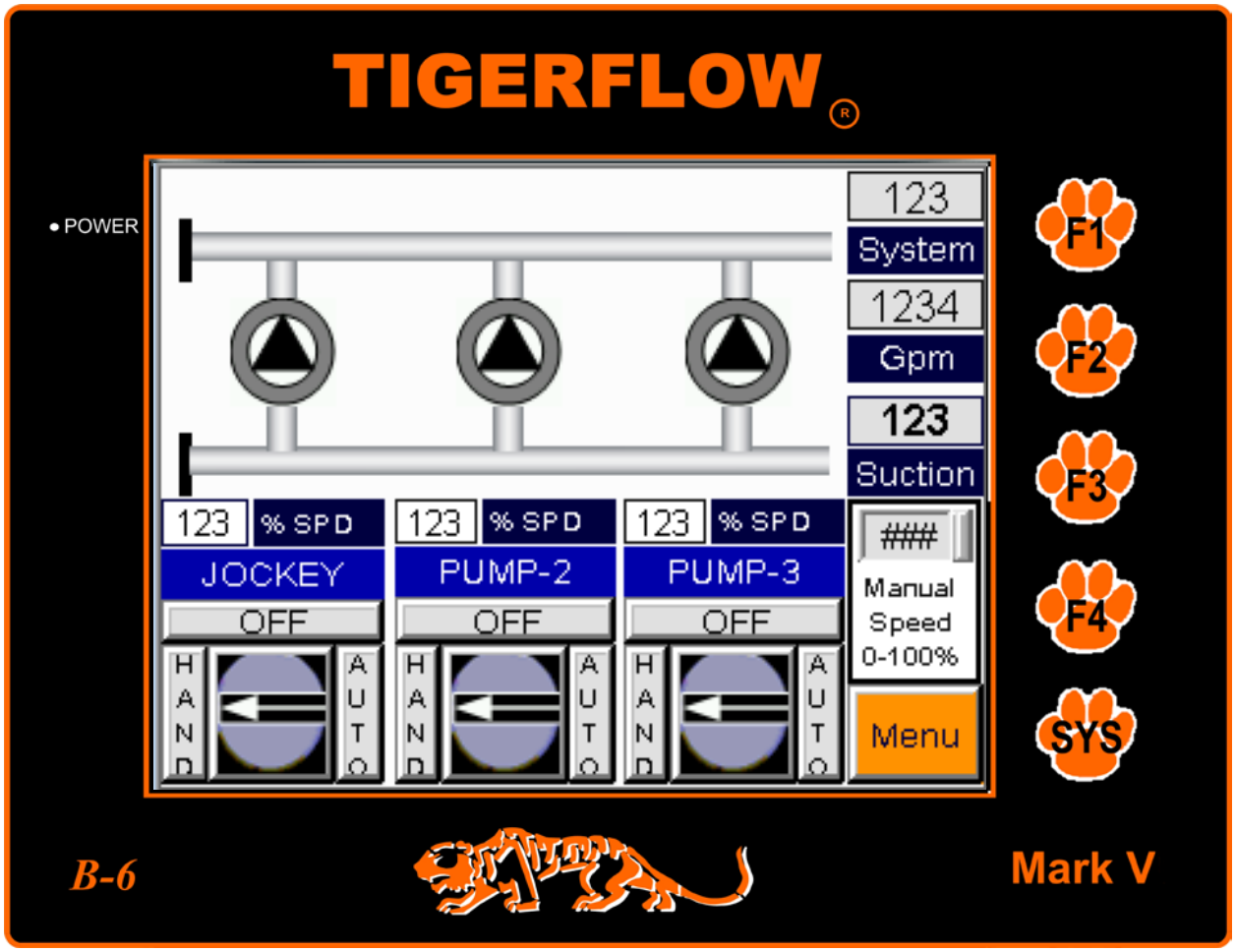
User's Manual



TIGER'S EYE

E-Series – Mark V Jockey

TIGERFLOW Systems, Inc.
4034 Mint Way
Dallas, Texas 75237
214-337-8780
www.tigerflow.com

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Introduction

The E-Series - Mark V Jokey is a variable speed booster system with a PLC based controller. This system is capable of controlling three pumps in a package system. The controller employs a user-friendly color touchscreen HMI (Human Machine Interface) to monitor the system conditions, and adjust the system settings.

This system monitors the system discharge pressure via a 4-20 mA signal pressure transducer. This provides a precise pressure control and user flexibility. In addition to this sensor, a suction pressure transducer and/or a flow meter can be added to extend the control and flexibility of the system.

The main objective of this pumping package is to maintain a constant pressure, adjusting the speed and amount of pumps to run according to the building's demand.

The system is capable of staging pumps on and off based on pressure and/or flow, while alternating pumps to keep the run times balanced between them.

Keeping the energy savings in mind, the pumps will only run when are needed, and while the pressure will be maintained the energy used is kept to a minimum.

In the following text, all the capabilities and options of this system will be discussed.

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Sequence of Operation

Overview:

The system is capable of controlling three variable speed pumps, one jockey and two main pumps, controlling the run commands and speed of each pump. The controller consists of an Eaton PLC and a color touchscreen HMI. All System settings can be adjusted via the HMI and includes the following:

- HOA switches for all pumps
- Pump run times
- Pump run status and speed
- Flow (optional)
- Discharge pressure
- Suction pressure (Optional)
- Alarms and status
- Events history

Pump Control Features:

Each pump has an HOA switch on the main display of the touch screen HMI. Touching an HOA switch toggles the switch between Hand-Off-Auto-Off positions.

In the HAND position the pump runs a fixed user defined speed, the pump is shutdown in OFF position and in the AUTO position the pump is available for automatic operation, in case the pump does not have an active failure alarm.

Auto pump speed is control based on the pressure error (difference between setpoint and current pressure).

Manual Operation:

To set a pump in the HAND position, touch a pump HOA switch on the left side to select the mode. The pump will start after a 2 second delay. This delay prevents a pump from attempting to start while the HOA switch passes through the **Hand** position to reach other modes. The pump will run at the preset manual speed setting located in the lower right corner of the main operating screen. To change the speed, select the Manual Speed value, enter the desired % speed and touch ENTER. Pumps running in Hand will accelerate or decelerate to the new speed setting.

Only the Low Suction Alarm shuts down a pump running in Hand mode. If the pump does not start after the delay, touch **Menu** and then **System Status**. If the Low Suction alarm is active, touch **Alarm Reset** button to deactivate the alarm.

CAUTION: Running pumps in hand position overrides all system safeties and alarm shutdown features with except of low suction.

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NOTE: % speed is a percentage of 60 Hz. A pump running at 30 Hz is running at 50% speed. This percentage also relates the 0-10 V DC speed signal being transmitted to a drive.75% speed equates to a 7.5 V DC speed reference signal to the drive. 100% speed equates to a 10.0 V DC speed reference signal to the drive.

Automatic operation:

WARNING: Do not run pumps in automatic prior to proper system setup. Failure to do so could over pressurize building piping.

The automatic operation begins when one or all pumps HOA switches are in the AUTO position. The user defines the pressure that is needed to maintain, as well as the setpoints at which the pumps will stage on and off. When the pumps are in the auto position, the jockey pump will be commanded to start after an on-time delay (field adjustable) and increase the speed until the minimum required pressure is achieved.

WARNING: If the jockey pump is disabled during automatic operation (by failure, or switching of the HOA switch), then the lag pump will take the Lead position and the jockey pump will be decommissioned. To restore automatic operation, reset all alarms and toggle the HOA switches to the OFF position and back to the AUTO positon.

Failing to do so could create anomalies to the automatic sequencing of the pumps.

When starting automatically, the lead pump will ramp immediately to the *Lead Pump Starting Speed* setting. After starting speed is reached, the speed will automatically increase and decrease as necessary to satisfy the system pressure demand. However, the pump speed will NEVER run slower than the **minimum pump speed** setting.

CAUTION: Pump speed will NEVER be lower than the minimum auto speed setting. This setting is intended to be the speed required to produce the desired boost under no-flow conditions. Failure to take into account the maximum suction pressure conditions while adjusting this setting will result in high pressure alarms. When in doubt set minimum speed 15-20% below the expected no flow speed. Speed control is equipped with a slowdown routine that slowly ramps the pump to a minimum speed under no flow conditions. Therefore, even a 0% minimum speed setting is permissible and will allow lead pump shutdown.

Additional pumps are started based on the pressure error or flow. If the jockey pump is running at full speed and the pressure is still below lag start setpoint (adjustable), the lag pump will be commanded to start and the jockey pump to stop.

If the pressure is still below the Lag 2 pump start setpoint, the second main pump will staged on to maintain pressure.

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The on and off time delays, and the setpoints for starting and stopping each lag pumps can be adjusted to meet the demand.

Lag pumps can also start on flow to protect pumps from running at the end of the pump curve. The Lag pumps start on flow setpoints are user defined via the HMI. When the flow reaches the Lag start setpoint for the on-time delay, the pump will start and ramp up to the Lead pump speed.

Pump operation is monitored via a VFD run contact on each drive. When commanded to run, a drive is given 30 seconds to close the run contact, in case this fails to happen the VFD / pump is considered to be failed and the next Auto available pump will start. All time delays are field adjustable.

Pump alternation is provided between auto available pumps. Alternation options include auto, manual and timed alternation. The auto alternation will occur each time all pumps are off (pressure above the setpoint), the manual alternation is operator initiated and the timed alternation allows pumps to be alternated either daily, weekly or monthly on a specified day and time.

The alternation will only affect the lag pumps, as the jockey will always be the one that initiates the operation.

Pump Stop:

Lag pump stops after the lag stop pressure is achieved and the flow rate is lower than the flow start setting for the off-delay time period. When all lag pumps are stopped, the jockey pump will restart and if the pressure is still being maintained, the pump will shut down after the off-time delay.

Recommendation: Many customers are accustomed to setting long lead (jockey) pump off-time delay. This is not recommended for the E-Series Mark V. When the minimum auto speed setting is set properly the lead pump will only shutdown during low / no flow conditions. A short lead pump off-time delay setting of 10-30 seconds is recommended to take full advantage of the energy savings and increase pump seal life. A longer off-delay may be useful in a system with a hydro-pneumatic tank to charge.

To better facilitate lead pump shutdown with minimum user setup time, the Mark V is equipped with an auto slow down routine. If only the lead pump is running, pump stop pressure is satisfied, and no automatic speed changes have been made for a time period equal to the lead pump OFF-delay setting, then pump speed is reduced 1% each response time cycle until either the minimum pump speed is achieved or an automatic speed change is made. When minimum pump speed is reached and maintained with the system pressure satisfied for the lead off-delay time, the lead pump stops.

If *Never Stop Lead Pump* [found on the *Speed Control* & *System Settings* menu screen] is selected, the jockey pump only stops when the lag pumps are running.

Alarms

The E-Series Mark V controller includes monitoring and alarming when the pressure goes outside the ideal operation conditions, these alarms are the following:

- Low Suction Pressure
- Low System (Discharge pressure)

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- High System (Discharge pressure)

Each alarm has independent settings and time delays, as well as the manual or automatic reset option setting.

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System Setup

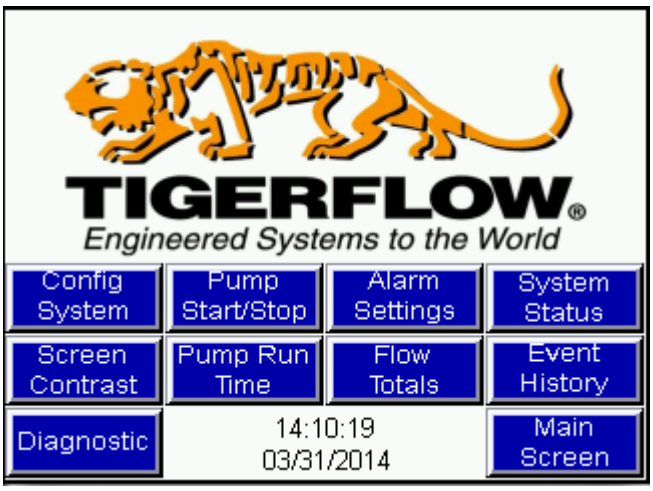
Control Setup:

IMPORTANT: Before powering up control panel verify incoming power meets system design requirements. These requirements can be found inside the control panel door in the lower left corner. Starting system with other than the design power could result in damage to controls and motors. This damage VOIDS the TIGERFLOW warranty.

Once proper power feed has been verified, turn ON control power and drive disconnects. After the HMI has powered up, the screen will show the menu screen.

Setting Pump Start / Stop Pressures

To set pump start and stop pressures, touch the **Pump Start / Stop** button.



The **Pump Start/Stop** screen displays a table showing pump Start/Stop pressures and ON/OFF time delay settings for the lead and lag pumps. When the system pressure is less or equal than the pump start pressure for the on-time delay, the pump will start. Likewise, when the system pressure is greater or equal than the pump stop pressure for the off-time delay the pump stops.

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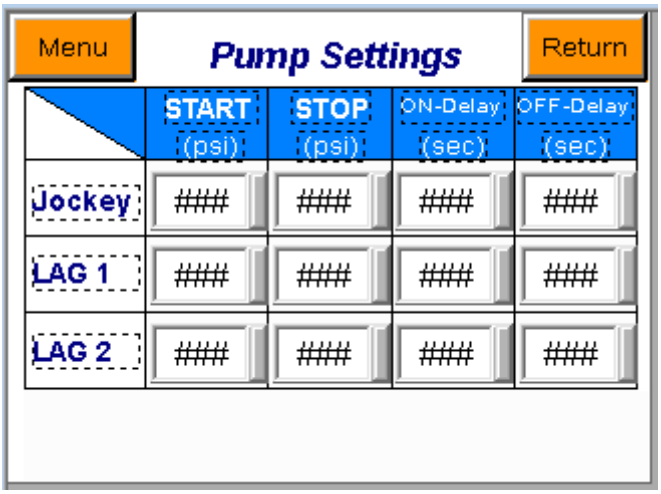


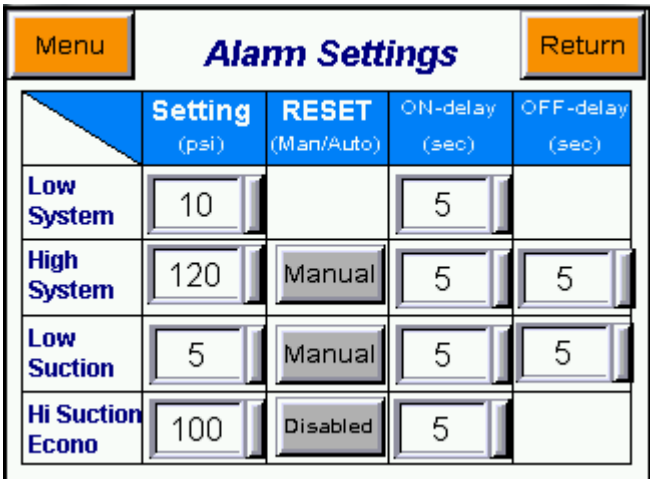
To change the pump start/stop settings simply touch the number to be modified. A numeric keypad appears. Enter the desired value and press Enter.

The Lead pump stop pressure should be the desired system pressure. TIGERFLOW recommends staging on pumps in approximately 5% decrements based on the desired pressure. Lead pump start pressure should be 5% less than Lead pump stop pressure. Set lag (lag1) pump start pressure 5% less than lead pump start pressure, etc.

After all pump start/stop settings have been made, touch **Menu** or **Return** button to return to the menu screen.

Alarm Setup

Set all alarm settings by touching **Alarm Settings** button on the **Menu** screen. This button brings up a table showing Alarm pressures, reset mode (Manual/Auto) and ON/OFF delay settings.



Pressure related Alarms:

Low Suction Alarm:
This alarm prevents the pumps from running dry, or cavitation conditions. In case a pressure transducer is not used on the suction line, then a pressure switch or a level switch indicating there's enough water to run the pumps must be used.

Low System Pressure:
If one or more pumps are running and the pressure is still below a certain level, it's considered that a major fault in the water distribution piping happened and the pumps are shut down.

This alarm doesn't have the auto reset option available, the user must manually reset the alarm before restoring the operation of the system.

High System Pressure:
To avoid over pressurization of the system, the pumps will shut down if the pressure is higher that the setting for the on time delay.

Recommendation: To provide maximum over pressure protection, set high system alarm 5-10 psi below building relief valve settings (remember to take elevation differences into account) with a one second on-delay. Set the alarm for AUTO reset with a 2 second off-delay (reset).

Econo mode:
This mode is provided for systems which occasionally have sufficient suction pressure to supply the system/building demand. This feature maximizes pump energy savings. When the suction pressure reaches the Econo Mode pressure setting for the on-time delay all pumps shut down. When the suction pressure drops below the Econo Mode pressure setting for the off-delay time period, the pumps return to normal operation.

Disable the Econo Mode feature on systems where suction pressure will never be adequate to supply the system. If the Econo Mode Enable / Disable button is labeled "Disable," then Econo Mode is disabled and not further action is required. If this button already shows "Enabled", simply touching the button will change it to "Disabled."

RECOMMENDATION: If suction pressure will never be adequate to supply the building, disable Econo Mode.

Other Alarms:

Pump Failure:
If the pump is commanded to run and the VFD fails to close the running contact, the pump is considered to be failed and will be disabled for running until the alarm condition is no longer present and the alarm is reset.

All alarms shutdown pumps running in **Auto**. Only the Low Suction alarm shuts down pumps running in **Hand**. Manual alarm reset requires an operator acknowledgement of the alarm at the touch screen

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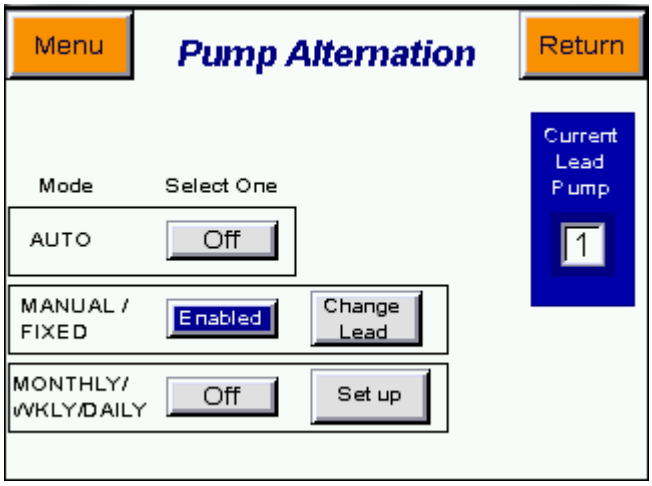
panel for alarm reset. Auto reset will automatically reset the alarm once the alarm condition is no longer present for the set off-delay time period.

Pump Alternation

Three types of pump alternation options are available.

1. Automatic
2. Manual
3. Timed



Automatic alternation alternates the lead pump after all pumps shutdown. If alternation is desired and **Never Stop Lead Pump** is selected, do not use this option.

If **Manual Alternation** is selected a **Change Lead** button appears. The lead pump alternates when the operator touches the **Change Lead** button. This option should be selected if automatic alternation is not desired.

Timed alternation alternates the lead pump at a specified time interval at a specific time of day. Options include daily, weekly and monthly alternation. Daily alternation occurs each day at the specified time. Weekly alternation occurs on the day of the week and time specified. Monthly alternation occurs during the first week of the month at the time and day specified.

To setup pump alternation touch **MENU** button on main screen. Touch the **Pump Alternation** button and select desire alternation mode. If **Mthly/Wkly/Daily** is selected, a **Setup** button appears. Once this button is pressed a screen appears to set alternation day and time.

Factory Default settings

The Mark V controller can be easily returned to factory default settings. To do this, simply change the lead pump start and stop settings to “0” and restart the PLC.

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There are two methods to restart the PLC. If the enclosure is open, flipping PLC run switch from RUN to STOP and back to RUN restarts the PLC. Restart can also be accomplished with the enclosure door closed by cycling control power (turning control power OFF and back ON).

Bladder Tank Setup:

Proper bladder tank setup is necessary to maximize pump shutdown times during periods of low flow. To setup a bladder tank:

1. Close main tank fill valve to isolate tank from pumps and system.
2. Open tank drain valve and verify all water has been evacuated.
3. Read tank pressure. Ideal pressure is 5 psi less than the desired system pressure.
4. To adjust pressure, unscrew Schrader valve cover on top of tank (1-1/2 pipe plug).
5. Reduce pressure by pressing in the valve stem pin.
6. Increase pressure by connecting an air compressor or other air source to Schrader valve.
7. Close drain valve once pressure is adjusted to 5 psi below system set point.
8. Open main tank fill valve.

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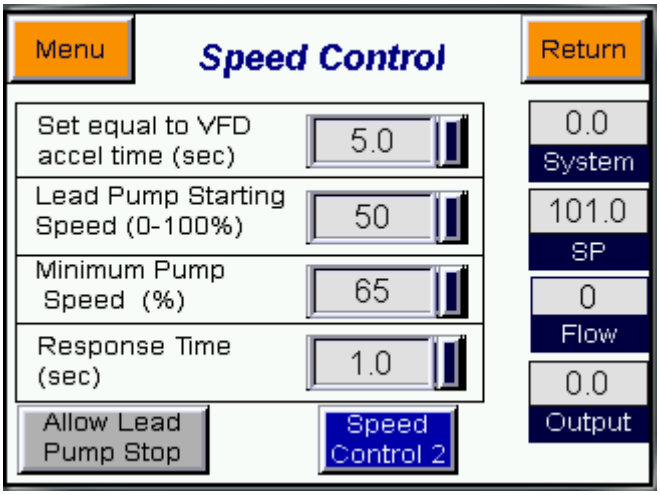
System Startup

Once the system pressure and alarm settings have been entered, the system is now ready for operation. Touch each pump HOA button on the right side until it rotates to the **Auto** position. When the System pressure falls below the lead pump start pressure for the on-delay time, the lead pump will start and immediately ramp to the minimum auto speed setting. The pump should stop when the system pressure exceeds the stop pressure for the off-delay time period.

Pump Speed Control:

User adjustable speed control parameters are provided to fine tune system response to the building demand. Settings are found from the main screen by touching **MENU**, **CONFIG SYSTEM** and **SPEED CONTROL**.



VFD Accel time:

Enter the acceleration time setting being used in the VFDs. This entry does not set or change the acceleration/deceleration time in the VFDs. This value is required for the controls to calculate the time required for the lead pump to accelerate from stop to the defined lead pump starting speed. Automatic speed control does not begin until lead pump has had sufficient time to reach the Start Speed setting.

Lead Pump Starting Speed:

When the lead pump starts, it is immediately commanded to run at this speed. The ideal speed setting is the speed at which the pump produces the design pressure boost under no-flow conditions.

Minimum Auto Speed:

The purpose of this setting is to prevent pumps from running at non-productive speeds (no flow). It reduces pump cycling, helps prevent motor/pump from overheating and when set properly shuts down pumps during no flow conditions.

How does it work? When the lead pump starts in AUTO, it ramps to the starting auto speed as quickly as possible. The time required to reach this speed is dependent on the drive's acceleration and deceleration time settings. Drive acceleration / deceleration times are the required for a drive to go from stop to full speed and vice versa. For instance, if the minimum auto speed is 50% (30 Hz) and the

drive accel time is 5 seconds, then the minimum auto speed will be achieved in 2.5 seconds. Once this speed is achieved, the pump speed increases and decreases as necessary to maintain the system pressure. However, the pump(s) will never run at a speed less than the **minimum auto speed**.

CAUTION: Pump speed will NEVER be lower than the **minimum auto speed** setting. This setting is intended to be the speed required to produce the desired boost under no-flow conditions. Failure to take into account the maximum suction pressure conditions while adjusting this setting will result in high pressure alarms.

System Response Time:

This setting defines how often the controller makes speed adjustments. When the system pressure transducers are located on the pump package, the setting is typically set between 1 and 2 seconds. Increasing this setting makes system respond slower to pressure fluctuations. Decreasing the system response time makes it respond quicker.

In some instances the customer may desire to relocate the system pressure transducer to the top of the building. Since TIGERFLOW use 4-20 mA pressure sensors, this is not a problem. However, a system response time adjustment will be required. Response time must be increased to allow pressure changes to reach the sensor before additional changes are made. Therefore, a system controlled by remote mounted pressure sensors will always be less responsive than a system with local pressure sensors.

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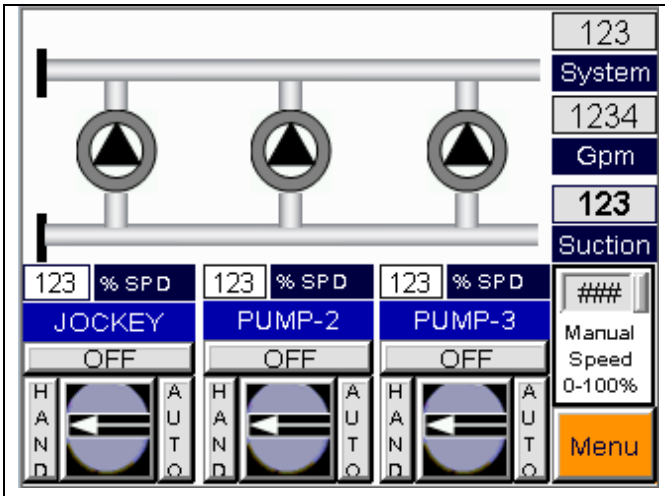
HMI Operating Screens

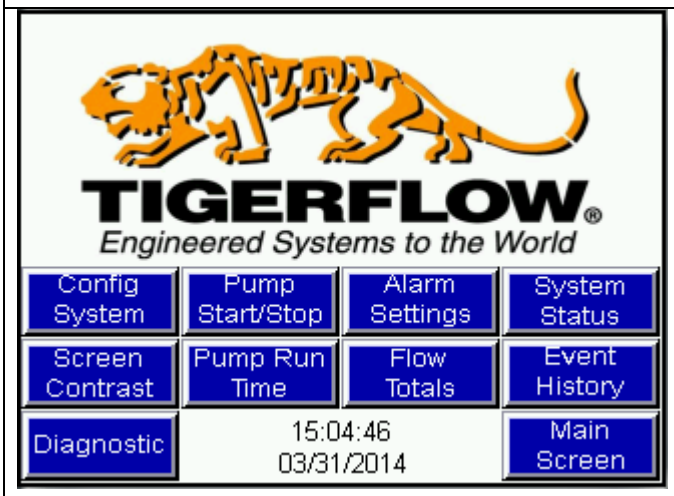


Main Screen:
The main screen shows System and Suction pressures, flow and pump run status. Pump status includes the pump operating mode; hand, off, auto.

To change a pump mode, touch a HOA switch to change it to hand, off, or auto.

After putting a pump in Hand mode, the pump will start after a 2 second delay.

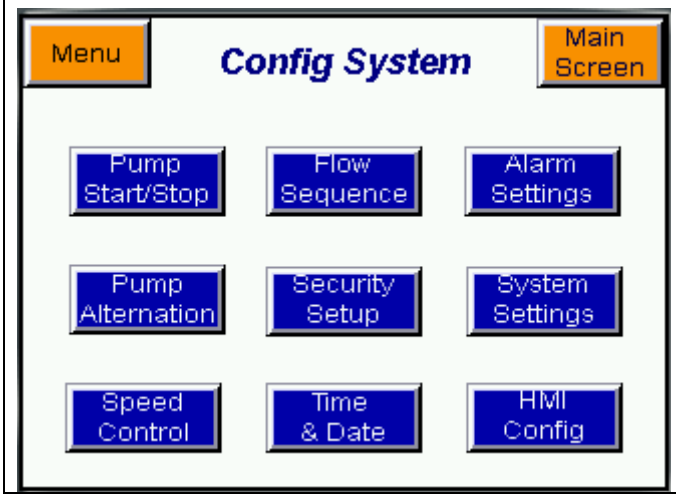
% SPD = Current speed signal to drives
Manual speed = % speed of pump in hand mode



Menu Screen:
The menu screen provides direct access to all system settings and operational information. Touching a button will cause the screen to go to a sub-screen for the option selected.

Config System, Pump Start/Stop, Alarm Settings, and Time & Date buttons are password protected. All other buttons can be accessed without a password.

Touching Main Screen returns to the Main operating screen.



Config System Screen:
Screen is designed to provide quick access to all system settings during initial startup.

Access requires a password and should only be accessed by the facility manager or authorized TIGERFLOW representative.

Settings exclusive to this screen include number of pumps, alternation, and sensor ranges.

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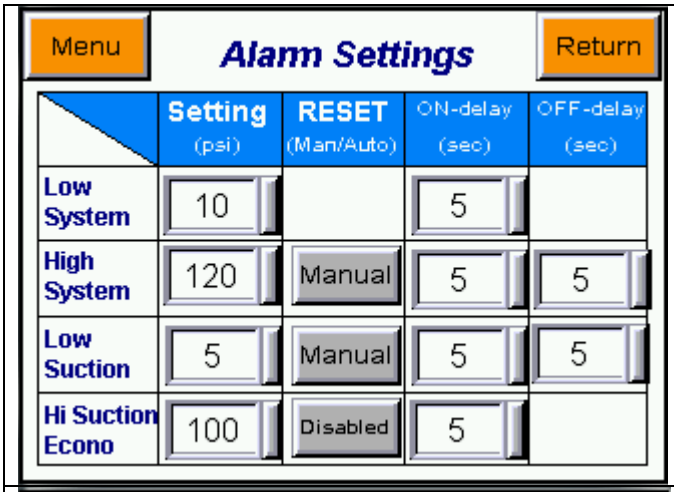
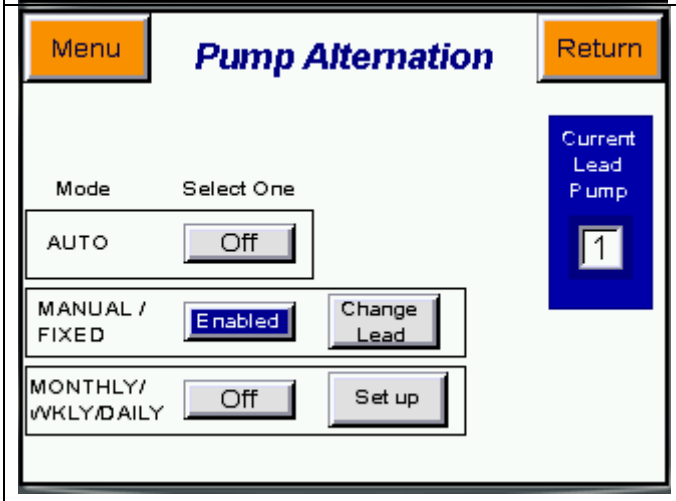


Alarm Settings Screen:
Set all the setpoints for the different alarms. Auto/Manual reset and on/off time delays

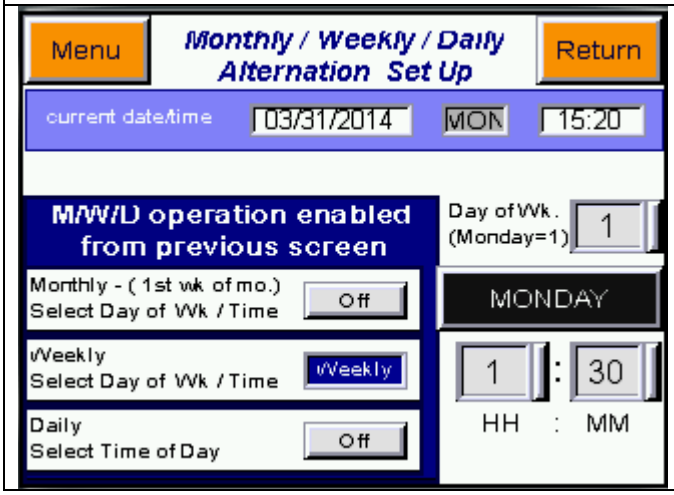


Pump Alternation Screen:
Provides the options of automatic, manual or timed alternation. Auto is the default mode.

Touch the OFF button to the right of MANUAL / FIXED, to select the manual alternation mode.

Touching the Change Lead button causes pumps to alternate. When alternation occurs the new lead pump comes up to speed before the old lead pump shuts down.

Touch the OFF button to the right of MONTHLY / WKLY / DAILY to select the timed alternation mode. Touch the Setup button to configure this option.



Timed Alternation Set Up Screen:
As shown (weekly option selected), pumps will alternate every Monday at 1:30 am. Selecting the monthly option will cause the pumps to alternate the first Monday of the month at 1:30 am.

Adjust the day of the week by touching the current setting.

Adjust the time touching the hour or minute value and key in the desired time.

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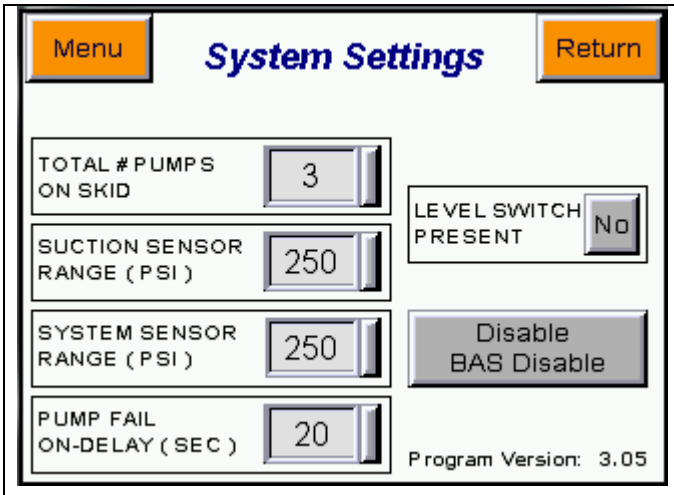


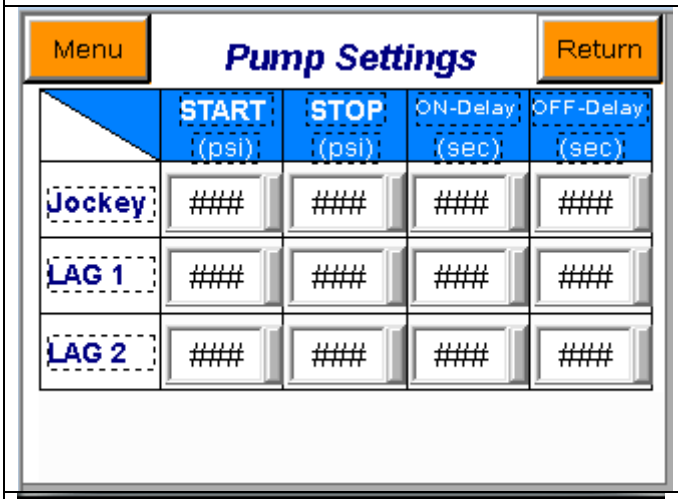
System Settings Screen:

Allows setup of maximum suction and system sensor ranges, number of pumps on the skid and the pump failure ON-delay.

Selecting "level switch present" allows low suction alarm to be controlled with a float switch or pressure switch rather than a suction sensor. If "level switch present" is not selected a suction sensor must be used.

Pump failure uses VFD drive status or overload wiring. The ON-delay is the time allowed to verify a pump is running.

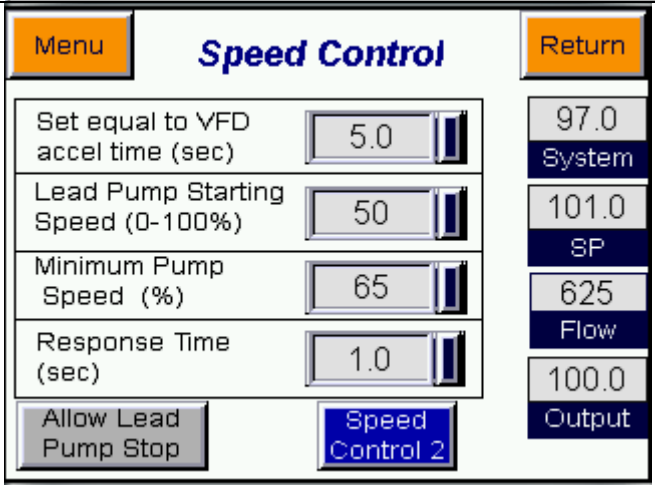
The BAS control can be disabled to run the system locally.



Pump Settings Screen:

Set pump start and stop pressures, as well as, ON and OFF delay times.

Setting stop pressures for Lag pumps less than the lead pump stop pressure will help insure Lag pumps will not continue to run when not needed.



Speed Control Screen:

VFD accel time is the accel / decel setting for the drive being controlled. *This setting does not change VFD settings.*

Minimum Pump Speed is the minimum speed a pump will run in automatic.

Lead Pump Starting Speed is the initial run speed for the lead pump auto start.

Response Time is the frequency in which speed changes are made.

System Is the current system pressure

SP is the current system pressure set point.

Output is the current % speed signal to drive. 50% speed is equivalent to 30 Hz.

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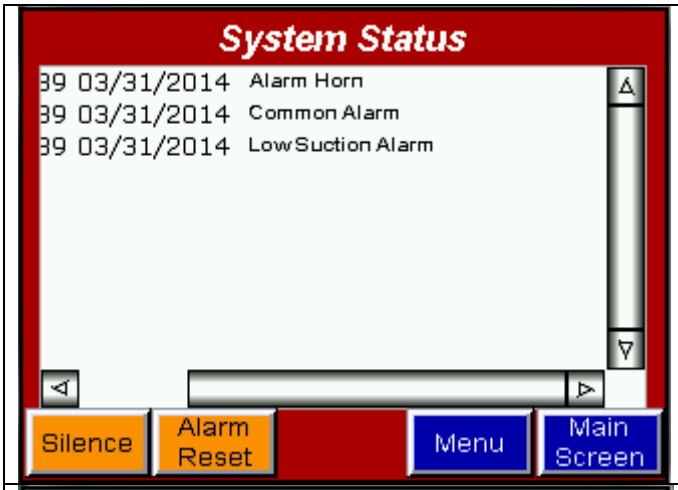
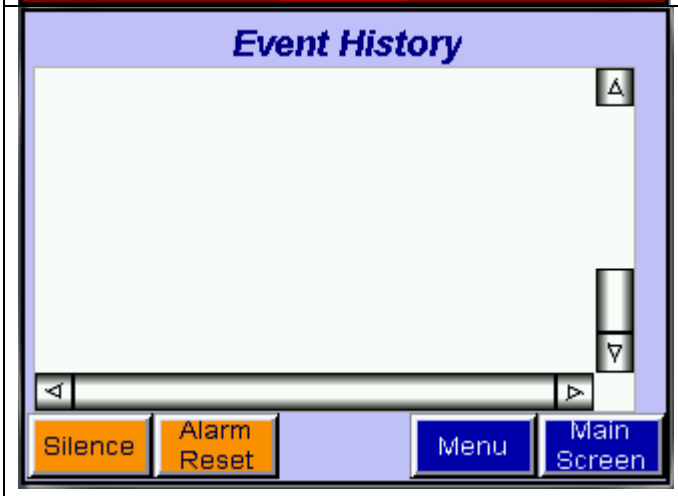


Alarm Status Screen:
Provides a list of all active system alarms.

Each alarm is recorded with the time and date when the alarm began.

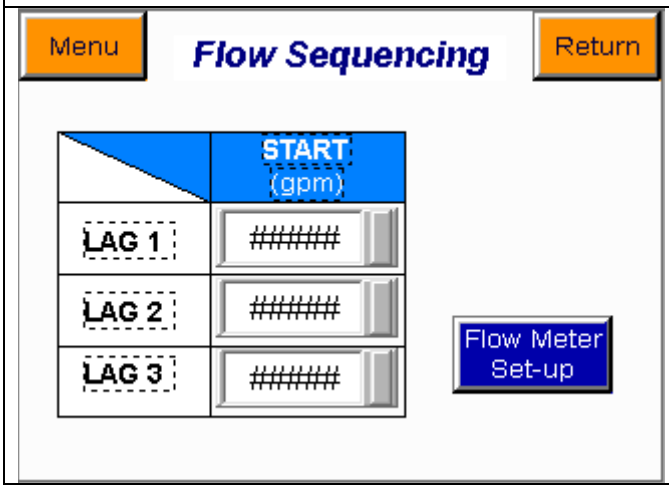
Touch Silence button to acknowledge an alarm condition and silence horn. Touch Alarm Reset to reset alarm condition.



Event History Screen:
Provides a history of the past system event. An event includes:

Pump starts and stops
Alarms
Alarm acknowledgement / silence
Alarm reset
Econo Mode
System disable

Each event is recorded with time and date. Event or Alarm will indicate when event began or happened.



Flow Sequencing:
The flow setpoints, at which the lag pumps are to be staged on and off, can be configured in this screen.

Even if the pressure is met, if the flow increases above each setpoint, the according lag pump will run.

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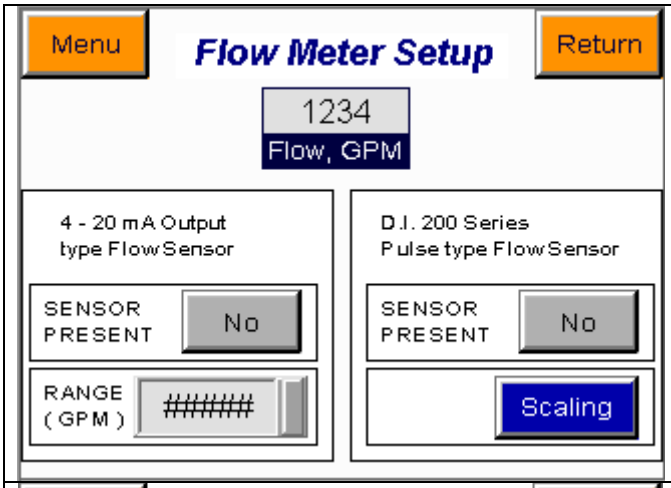
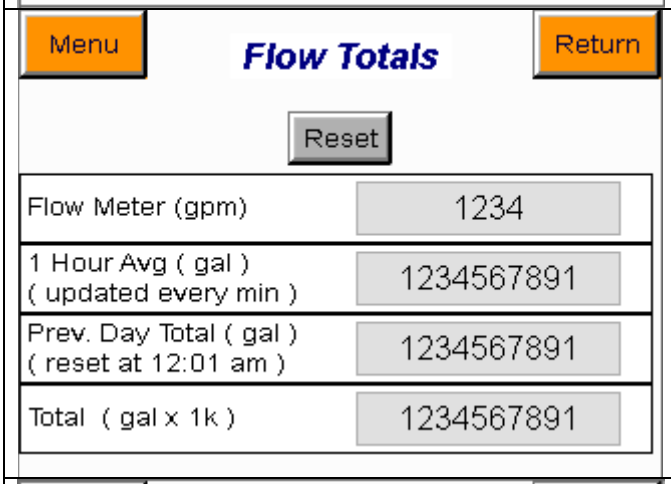


Flow Meter Setup:
In this screen can be selected if a 4-20 mA signal flow meter is used, or if it's a pulse type sensor and a signal converter.

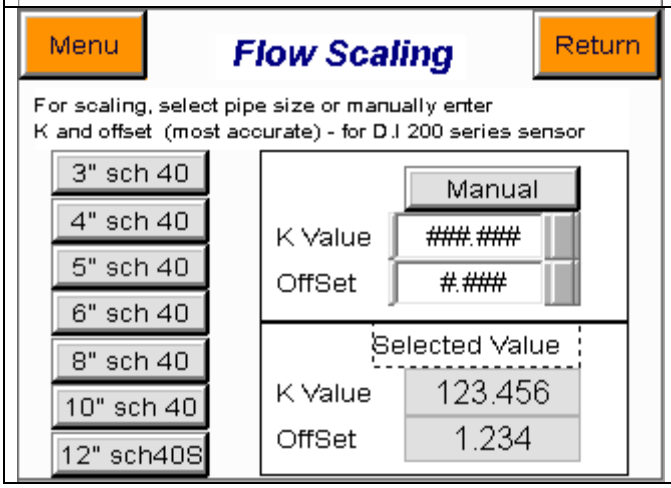
This type of meter can be scaled according the building piping.

Simply select NO in both options if there is no flow meter present.



Flow Totals:
Flow totalization is available for monitoring. Read current, 1 hour average, 1 day total or the full amount for the system.

Reset these values, by touching the reset button.



Flow Scaling:
When using the pulse type flow meter, select the pipe size where the meter is located, or use manual K and offset values to calibrate the reading.

Please contact your TIGERFLOW representative in case of any doubts.

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Troubleshooting

Code	Problem	Possible causes	Recommended Actions
TE-1	No display/Black screen	**A.** Display screen saver is active.	Touch Screen to restore display
		B. No 120 VAC control power	**1**. Verify control power disconnect is in ON position, and that the control power light is on.
			2. Verify if the voltage between terminal 102 and 200 is 120 V. If not, verify there is power to the control panel. If power is present, turn control disconnect OFF and check control transformer fuses. If power is not present, investigate the cause of the outage.
			3. If power to panel is present and transformer fuses are not blown, replace control transformer.
		C. No DC control voltage	**1.** Measure DC voltage at the power supply (on most systems "+24V" and "0V" terminals). Voltage should be 24 V DC.
			2. If no DC power is present, check 1 amp glass fuse on AC side of power supply and replace if blown (factory provided a spare in the fuse holder for your convenience).
			3. If DC power is present at the power supply, check voltage between terminals 402 and 400. If no power is found, check 1 amp glass fuse on DC side of power supply. Replace if blown (factory provided a spare in the fuse holder for your convenience.). If fuse is good, check for loose connections at terminals 402 and 400. Check for loose power connection at HMI.

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Code	Problem	Possible causes	Recommended Actions
TE-2	Touch screen not responding or not responding correctly to touch	**A.** Screen needs to be recalibrated	Contact your TIGERFLOW Representative.
		B. Screen is defective	Reset screen by cycling control power. NOTICE: Cycling control power will shut down all pumps! If pump cannot be shutdown, unplug and re-plug DC power plug on back of touch screen (HMI). If problem still exists, contact your TIGERFLOW Representative.
TE-3	PLC not found	**A.** Loose RS232 Communication Cable	1. Verify the RJ11 connector is securely attached to COM1 on back side of HMI (touch screen).
			2. Verify round serial plug is securely plugged into ELC-PB14NNDR.
		B. PLC not running	1. Verify green power LED is illuminated on each ELC module. If not, check DC control voltage. **See TE-1.C**
			2. Verify ELC-PB14NNDR run/stop switch is in the RUN position. If it is not, slide it up to RUN Position.
			3. If problem still exists, contact your TIGERFLOW representative.
TE-4	System / suction pressure reading does not match gauge(s).	**A.** Incorrect pressure transducer range	From main screen touch MENU, then CONFIG SYSTEM and SYSTEM SETTING. Verify maximum ranges shown for suction and system pressure transducers match the actual ranges of the installed transducers. Requires password.
		B. Transducer problem	Check signal (2-10 V DC) by measuring the voltage between 203 and 400 (system pressure) or between 204 and 400 (suction pressure). Volt should be 2 V DC for 0 PSI and 10 V DC for max range, psi. Pressure is proportional to this signal, i.e., 6 V DC is 50% of max range, psi.
TE-5	Pressure transducer reading maximum value OR Transducer	**A.** Pressure at or above transducer upper limit	1. Does pressure match gauge pressure? If not, check pressure signal
			2. Check signal (2-10 V DC) by measuring the voltage between 203 and 400 (system pressure) or between 204 and 400 (suction pressure). Voltage should be 10 V DC if pressure is reading full range. If reading is 24 V DC see **TE-3.B**.

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Code	Problem	Possible causes	Recommended Actions
	Failure Alarm	**B.** Loose termination	1. Check wire terminations at terminals 203, 204 and 400. Insert screw driver under resistor between 203 and 400. Gentle pull resistor away from terminal strip. If either leg of the resistor moves, re-insert the leg into the terminal and re-tighten terminal. Repeat this procedure for resistor between 204 and 400.
			2. Check transducer wire connection to terminal 402.
		C. Faulty pressure transducer	If recommended actions for TE-5. A and B do not correct the problem, replace the pressure transducer

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Code	Problem	Possible causes	Recommended Actions
TE-6	Pump does not run when HMI display shows it running	**A.** Drive disconnect OFF	Check pump disconnect. Turn ON, if it is OFF.
		B. Drive in Alarm state.	Press RESET button or cycle drive power.
		C. Drive short circuit fuse(s) blown.	If this is the case, drive disconnect will be ON and drive will not be powered. Check fuses and replace if necessary.
		D. Drive does not have run permission.	1. Check terminations on run permissive cable(s): Drive 1 = cable 231 Drive 2 = cable 233 Drive 3 = cable 235 Drive 4 = cable 237
			2. Jump drive run permissive
			3. If relay is energized, check AC volts to ground on relay terminals 11 and 14. Power should be present at all times on terminal 11, even when relay is not energized. Power should only be present on terminal 14 when either the relay is energized or the pump emergency override switch is ON.
		E. Drive does not have a speed reference.	1. Check terminations on dive speed reference cable(s): Drive 1 = cable 251 Drive 2 = cable 252 Drive 3 = cable 253 Drive 4 = cable 254
			2. Change pump in question to hand and set hand speed to 50%. Speed reference voltage (0-10 V DC) between following terminals: Drive 1 between terminals 251 and 400 Drive 2 between terminals 252 and 400 Drive 3 between terminals 253 and 400 Drive 4 between terminals 254 and 400 Speed reference for the drive in question should be 5.0 Volts DC. If Voltage is not found verify: - PLC is in Run position and has power (Green LEDs illuminated) - There are no active alarms. If problem still exists, contact your TIGERFLOW Representative.

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Code	Problem	Possible causes	Recommended Actions
TE-7	Pump does not run. Controls are not calling for pump to run.	Alarm Condition	Touch MENU and SYSTEM STATUS. Check for alarm messages. Touch RESET to clear alarms. If alarm re-occurs, check alarm settings and see if alarm is valid. If alarm is valid, take actions to correct the condition. If alarm is not valid, contact your TIGERFLOW Representative.
		Pumps Turned OFF	Verify pump HOA switch is in HAND or AUTO position. Switch position is changed by touching the switch.

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