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SAFETY INSTRUCTIONS

Hazard Messages

This manual includes safety precautions and other important information in the following formats:

**DANGER**
Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

**WARNING**
Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

**CAUTION**
Indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate personal injury.

**NOTICE**
Indicates a potentially hazardous situation which, if not avoided could result in damage to equipment or other property.

**IMPORTANT:** Identifies information that controls correct assembly and operation of the product.

**NOTE:** Identifies helpful or clarifying information.

This symbol alerts the user to the presence of dangerous voltage inside the product that might cause harm or electrical shock.

This symbol alerts the user to the presence of hot surfaces that might cause fire or personal injury.

**Before Getting Started**

This equipment should be installed and serviced by technically qualified personnel. Failure to comply with national and local electrical codes and within Franklin Electric recommendations may result in electrical shock or fire hazard, unsatisfactory performance, or equipment failure.

Read and follow instructions carefully to avoid injury and property damage. Do not disassemble or repair unit unless described in this manual.

Failure to follow installation/operation procedures and all applicable codes may result in the following hazards:

**WARNING**
High voltages capable of causing severe injury or death by electrical shock are present in this unit.

- To reduce risk of electrical shock, disconnect power before working on or around the system. More than one disconnect switch may be required to de-energize the equipment before servicing.
- Make sure the ground terminal is connected to the motor, control enclosures, metal plumbing, and other metal near the motor or cable using wire no smaller than motor cable wires.

**CAUTION**
Risk of bodily injury, electric shock, or equipment damage.

- This equipment must not be used by children or persons with reduced physical, sensory or mental abilities, or lacking in experience and expertise, unless supervised or instructed. Children may not use the equipment, nor may they play with the unit or in the immediate vicinity.
- Equipment can start automatically. Lockout-Tagout before servicing equipment.
- Permanent magnet motors need to have a check valve (reverse flow preventer) installed above the pump to prevent dangerous voltages from generating on the motor leads when the pump spins backwards. This will also limit the pump/motor from running in up thrust conditions at every startup. Operation of this equipment requires detailed installation and operation instructions provided in this manual for use with this product.
- Read entire manual before starting installation and operation.
- End User should receive and retain manual for future use.
BASIC SETUP CHECKLIST

Please refer to the remainder of this manual for specific installation and setup details.

Wiring

⚠️ WARNING Disconnect and lock out all power before installing or servicing equipment.

High Voltage Connections

1. Connect the three-phase input power leads to L1, L2, and L3 terminals on the disconnect breaker located in the upper right corner of the panel.
   Input voltage should be 60hz-480v three-phase power (480-5%/500vac+10%).
2. For proper rotation, connect the motor lead wires to the drive panel—Black = U2/T1, Yellow = V2/T2, Red = W2/T3.
3. Connect the motor and service grounds into the PE (Protective Earth) terminal or the ground lug on the back panel.

Control Circuit Connections

The user terminal block is setup to connect:

1. A potentiometer between +10vdc, V1+ and V1- (used for speed pot control/additional programing required).
2. 4-20 ma (non-powered) transducer between +24v and I.
4. Over pressure switch (N.C.) in place of the JBX jumper, terminals 2 and PSW. This will trigger an external fault if opened.
5. The other connections on the terminal block are used for the internal panel thermostat and vent fans.
6. Set the thermostat to 75 degrees F to turn on the panel vent fans.

Parameter Settings

At initial power-up, press the BACK/RESET button to display the Main Menu. From there, use the arrow keys to open the Parameters menu and navigate to the settings below.

⚠️ NOTICE DO NOT select Quick Setup or drive programming will be erased. If this occurs, refer to “Setting Basic Parameters” on page 10.

When all changes have been made, save as follows: User Settings>Parameter Backup>Save to Keypad.

1. P3.1.1.4 Parameters>Motor Settings>Motor Nameplate>Motor Nominal Current: The default motor nominal current is set to the max SFA of the motor. This current setting will need to be changed to the maximum current seen when the installed pump is running at 115hz and surfacing water under normal conditions. This is done to scale the true load on the motor to the drive—Do Not increase current setting above the default setting.
   • Turn the HOA switch to Hand mode to run the motor at 115 Hz with the default motor nominal current setting. Read the drive motor current and torque when you are surfacing water under normal conditions and record.
   • Switch HOA to Off and enter this current into P3.1.1.4 Motor Nominal Current, if it is less than the preset maximum amperage of 22.5, 46, or 80, as listed on the motor nameplate.
   • Rerun the motor at 115 Hz and see that the drive output current matches the new nominal current setting and the motor torque is in the 90%-100% range.
### BASIC SETUP CHECKLIST

1. **P3.1.3.1 Parameters > Motor Setting > Current limit:** Default 22.5/46/80 amps. When using a smaller pump this can be lowered just above motor nominal current.

2. **P3.2.11 Parameters > Start/Stop Setup > Restart Delay:** Default = 5 minutes.

3. **P3.3.1.1 Parameters > References > Frequency Ref > MinFreqReference:** Default = 60.00. Set minimum speed for the pump. The setpoint is 2x shaft speed.

4. **P3.3.1.8 Parameters > References > Frequency Ref > Keypad Reference:** Default = 115.

5. **P3.9.3.4 Parameters > Protections > Motor Stall > Stall Freq Limit:** Default = 90.00. The default trip frequency is set to 90 Hz. This setting needs to be changed if P3.3.1.1 Parameters > References > Frequency Ref > MinFreqReference is set above 90Hz.

6. **P3.3.1.1 Parameters > References > Frequency Ref > MinFreqReference:** Set maximum speed for the pump. The setpoint is 2x shaft speed.

7. **P3.9.3.3 Parameters > Protections > Stall Time Limit:** Default = 5 seconds.

8. **P3.9.4.2 Parameters > Protections > Underload > Fieldweak Load:** Default = 70%.

9. **P3.9.8.1 Parameters > Protections > AI Low Protection:** Default = Enabled Run/Stop. Set to Disabled if no analog sensor is being used in the system.

10. **P3.13.1.4 Parameters > PID Controller > Basic Settings > ProcessUnitSel:** Default = PSI. Set the units for the PID control. PSI, Feet, GPM etc.

11. **P3.13.1.6 Parameters > PID Controller > Basic Settings > ProcessUnitMax:** Default = 100.00. Set to sensor full scale for pressure and flow, set to sensor full scale x 2.31 for water level sensor to convert the pressure to feet.

12. **P3.13.1.8 Parameters > PID Controller > Basic Settings > Error Inversion:** Default = 0 (Normal). Set to Inverted for water level control. Set to Normal for surface pressure and flow control.

13. **P3.13.1.2 Parameters > PID Controller > Setpoints > Keypad SP 1:** Default = 50.00. Set pressure, level, or flow setpoint/target level.

14. **P3.4.2.2 Parameters > Ramps and Breaks > Accel Time 2:** To adjust the acceleration, adjust only time 2. Accel Time 1 must be set to 1 second to protect the motor.

15. **P3.4.2.3 Parameters > Ramps and Breaks > Decel Time 2:** To adjust deceleration, adjust only Time 2. Decel Time 1 must be set to 1 second to protect the motor.

16. **P3.13.5.1 Parameters > PID Controller > Sleep Function > SP 1 Sleep Freq:** Default = 90.00. Set above the minimum frequency to sleep. When the setpoint is maintained, the motor output frequency will decrease. When output is below the sleep frequency for the P3.13.5.2 Sleep Delay Time, the drive will go to sleep. Sleep frequency must be above P3.3.1.1 Parameters > References > Frequency Ref > MinFreqReference.

17. **P3.13.5.3 Parameters > PID Controller > Sleep Function > SP 1 WakeUpLevel:** Default = 10.00. Set pressure or level to restart motor. When the drive is asleep (stopped) it will restart when the pressure falls below setting or the water rises above setting.

18. **Set the time/date/year/daylight savings as follows:**
   - **P5.5.2 I/O and Hardware > Real Time Clock > Time:** (05:40:37).
   - **P5.5.3 I/O and Hardware > Real Time Clock > Date:** (27.3 = Day/month).
   - **P5.5.4 I/O and Hardware > Real Time Clock > Year:** (2018).
   - **P5.5.5 I/O and Hardware > Real Time Clock > Daylight Saving:** (3 = US).

### Identification Run

Drive ID-Run can fine-tune settings for the installed motor if V4.6.1 Diagnostics > Software info > Software Package is FW0159V020 or greater. If the software package is earlier, refer to the table under “Identification Run” on page 12 for settings for the installed motor. To activate ID-Run:

1. Set P3.2.9 Parameters > Start/Stop Setup > Start Delay and P3.2.11 Parameters > Start/Stop Setup > Restart Delay to 0.
2. Set P3.1.2.4 Parameters > Motor Settings > Motor Control > Identification to standstill.
3. Press the Green Start button within 5 seconds after the previous step.

The drive front light will turn solid green and when ID-Run is complete the green light will flash. If the ID-Run fails, the light will blink red.
PRODUCT INFORMATION

Applications

This instruction describes installation and setup procedures for using a MagForce PM Drive panel with a Vacon drive. This panel is intended for use with Franklin Electric MagForce permanent magnet (PM) motors.

For additional drive information, refer to the following manuals: Vacon 100 industrial, 100 flow, 100 x, AC drives, Modbus TCP/UDP and Modbus RTU user manual, Document ID: DPD00156D Rev. D.

Component Identification

1. Vacon Drive
2. Disconnect
3. Input Fuse Block
4. Output Sinewave Filter and Motor Connections
5. Terminal Block
6. Line Reactor
7. Fans
8. HOA Switch
INSTALLATION AND SETUP

Electrical Installation

Incoming Power Connections

1. Verify power is off before installing incoming power wires.
2. Connect the three-phase input power leads to the disconnect breaker located in the upper right corner of the panel. Connect to L1, L2, and L3 terminals.
3. Input voltage is intended for 60hz-480v three-phase power (480-5%/500vac+10%)

Motor Connections

1. For proper rotation connect the motor lead wires to the drive panel as shown—black = U2/T1, yellow = V2/T2, red = W2/T3.
2. The motor and service ground wire will connect into the PE (Protective Earth) terminal. If there is not a PE ground connection on the output filter connect the motor and service ground to the ground lug on the back panel.

WARNING

Contact with hazardous voltage could result in death or serious injury.

- Disconnect and lock out all power before installing or servicing equipment.
- Connect the motor, the panel, metal plumbing, and all other metal near the motor or cable to the power supply ground terminal using wire no smaller than motor cable wires.
- Install and wire in accordance with all applicable local and national electrical construction codes.
Control Circuit Connections

The user terminal block is setup to connect:

1. A potentiometer between +10vdc, V1+ and V1- (used for speed pot control). Connect center wiper to V1+. Set the AI1 DIP switch next to the terminals to the UP position for voltage. If speed decreases when it should increase, switch potentiometer leads on +10 and V1-. Refer to “Potentiometer Control Mode” on page 12.
2. 4-20 ma (non-powered) transducer between +24v and I.
3. Start switch (relay contacts) (N.C.) in place of the JRS jumper, terminals 1 and 2. Closed = run, Open = stop. To be used in HAND or Auto modes.
4. Over pressure switch (N.C.) in place of the JBX jumper, terminals 2 and PSW. This will trigger an external fault if opened.
5. The other connections on the terminal block are for the internal panel thermostat and the vent fans.
6. Set the thermostat to 75 degrees F to turn on the panel vent fans.

Drive Configuration

The drive is preset from the factory to run Franklin Electric Permanent Magnet motors. However, some drive parameters may need to be adjusted to setup your specific application. These changes can be made using the keypad on the front of the drive or by using Vacon Live software on a computer communicating with the drive through an Ethernet connection.

Refer to “Vacon Live” on page 17.

Using the Control Interface

1. STATUS BAR: Run/Stop, Rotation Direction, Ready/Not Ready/Fault, Alarm, Control location—PC/IO/Keypad/Fieldbus.
2. MENU ITEMS.
3. BACK/RESET: Navigate between menu screens. When faulted, hold down for 3 seconds to reset drive to Ready. Press repeatedly to return to the Main Menu screen.
4. FUNCT: Use to change directions or get to the control screen for the mode selected.
5. ARROWS: (Up/Down) scroll up/down within a menu, (Left/Right) add characters for correct input.
6. OK: To accept input.
7. GREEN BUTTON: Start function (hand or local mode).
8. RED TRIANGLE: Stop function (hand or local mode).
INSTALLATION AND SETUP

Drive Configuration

Setting Basic Parameters

**NOTICE**

Risk of property damage, or drive malfunction can occur.
- DO NOT select Quick Setup or drive programming will be erased.
- If programming is lost, refer to the following procedure.

**IMPORTANT:** If Quick Setup is entered, or basic programming becomes corrupted, it can be restored by reloading Set 1 or Set 2 before making other changes to the drive.

- From the Main Menu, use the down arrow to go to User Settings > Parameter Backup > Restore from Set 1.

**Drive Setup for a Specific PM Application**

At initial power-up, press the BACK/RESET button to display the Main Menu. From there, use the arrow keys to open the Parameters menu and navigate to the settings below (P3.1.1.4 numbers refer to menu levels and sub-levels).

When all changes have been made, save the new settings to the keypad as follows:

- From the Main Menu, use the down arrow to go to User Settings > Parameter Backup > Save to Keypad.

**P3.1.1.4 Parameters>Motor Settings>Motor Nameplate>Motor Nominal Current:** The default motor nominal current is set to the max SFA of the motor. This current setting will need to be changed to the maximum current seen when the installed pump is running at 115 Hz and surfacing water under normal conditions. This is done to scale the true load on the motor to the drive—Do Not increase current setting above the default setting. If the pump load tries to draw more current than the default setting, the output frequency will automatically decrease to keep the motor current from exceeding the **P3.1.3.1 Parameters>Motor Setting>Current limit**.

- In HAND mode, run the motor at 115 Hz with the default motor nominal current setting. (Refer to “Control Functions” on page 15 for operating instructions.) Read the drive motor current and torque when you are surfacing water under normal conditions and record.
  - Motor current = 
  - Motor torque = 

- Enter this current into **P3.1.1.4 Motor Nominal Current**, if it is less than the preset maximum amperage of 22.5, 46, or 80, as listed on the motor nameplate.
- Rerun the motor at 115 Hz and see that the drive output current matches the new nominal current setting and the motor torque is in the 90%-100% range.

**P3.2.11 Parameters>Start/Stop Setup>Restart Delay:** Default = 5 minutes. Set the restart delay to minimize cycle time on the motor.

**P3.3.1.1 Parameters>References>Frequency Ref>MinFreqReference:** Default = 60.00. Set the minimum speed the pump should run. To make sure you are surfacing water at the minimum flow limit. The setpoint is 2x shaft speed the pump will run at synchronous speed.

**NOTE:** The motor shaft speed will be half the drive output speed. For example, a 60 Hz output frequency from the drive will equal a 30 Hz 1800 rpm motor shaft speed.
**P3.3.1.8 Parameters>References>Frequency Ref>Keypad Reference:** Default = 115. This setting controls the motor speed in Hand mode.

**P3.4.2.2 Parameters>Ramps and Breaks>Accel Time 2:** To adjust the acceleration, adjust only time 2. Accel Time 1 must be set to 1 second to protect the motor.

**P3.4.2.3 Parameters>Ramps and Breaks>Decel Time 2:** To adjust deceleration, adjust only Time 2. Decel Time 1 must be set to 1 second to protect the motor.

**P3.9.3.4 Parameters>Protections>Motor Stall>Stall Freq Limit:** Default = 90.00. Set the stall trip frequency.

- If the motor current is at the current limit, the output frequency will fold back to keep the motor current from exceeding the current limit. When the stall frequency is exceeded for the **P3.9.3.3 Parameters>Protections>Motor Stall>Stall Time Limit** (default = 5 seconds), the drive will produce a stall fault.
- The default trip frequency is set to 90 Hz. This setting needs to be changed if the **P3.3.1.1 MinFreqReference** is set above 90Hz.

**P3.9.4.2 Parameters>Protections>Underload>Fieldweak Load:** Default = 70 %. The field-weak load point defines when the drive will trip on underload.

- The default is set to (70) % and will follow the curve below. If the % torque falls below the torque level shown for the **P3.9.4.4 Parameters>Protections>Underload>Time limit** (default = 10 seconds), the drive will trip on underload.
- Increase the % to make the detection more sensitive. If you decrease the %, make sure the drive still trips on dry run condition.

**P3.9.8.1 Parameters>Protections>Al Low Protection:** Default = Enabled Run/Stop.

- Set to Disabled if no analog sensor is being used in the system.

**P3.13.1.4 Parameters>PID Controller>Basic Settings>ProcessUnitSel:** Default = PSI. Set to:

- PSI for surface pressure sensor
- Feet for level sensor
- GPM for flow sensor.

**P3.13.1.6 Parameters>PID Controller>Basic Settings>ProcessUnitMax:** Default = 100.00.

- Set to sensor full scale for pressure and flow, set to sensor full scale x 2.31 for water level sensor to convert the pressure to feet.

**P3.13.1.8 Parameters>PID Controller>Basic Settings>Error Inversion:** Default = 0 (Normal).

- Set to Inverted for water level control. Set to Normal for surface pressure and flow control.

**P3.13.2.1 Parameters>PID Controller>Setpoints>Keypad SP 1:** Default = 50.00.

- Set pressure, level, or flow setpoint.
INSTALLATION AND SETUP

Drive Configuration

P3.13.5.1 Parameters>PID Controller>Sleep Function>SP 1 Sleep Freq: Default = 90.00.

- Set above the minimum frequency to sleep. When the setpoint is maintained, the motor output frequency will decrease. When the frequency is below the sleep frequency for the P3.13.5.2 Sleep Delay Time (default = 15 seconds), the drive will go to sleep.

P3.13.5.3 Parameters>PID Controller>Sleep Function>SP 1 WakeUpLevel: Default = 10.00.

- Set pressure or level to restart motor. When the drive is asleep (stopped) it will restart when the pressure falls below a level or the water raises above a level.

Set the time/date/year/daylight savings below.

P5.5.2 I/O and Hardware>Real Time Clock>Time: (05:40:37).
P5.5.3 I/O and Hardware>Real Time Clock>Date: (27.3 = Day/month). P5.5.4 I/O and Hardware>Real Time Clock>Year: (2018).
P5.5.5 I/O and Hardware>Real Time Clock>Daylight Saving: (3 = US).

Potentiometer Control Mode

This feature enables use of a potentiometer to control motor speed. When the HOA is in Auto, the motor will run at the potentiometer % setting between P3.3.1.1 MinFreqReference (0%) and P3.3.1.2 MaxFreqReference (100%). To use this feature, connect a potentiometer as described in “Control Circuit Connections” on page 9. Then, set the following parameters:

P3.3.1.5 Parameters>References>Frequency Ref>I/O A Ref Sel: change from PID to AI1.
P3.2.2 Parameters>Start/Stop Setup>Local/Remote: Remote.
V2.4.4 Monitor>I/O>Analog input1: Monitor potentiometer signal 0-100%.

If speed decreases when it should increase, switch potentiometer leads on +10 and V1-.

Identification Run

The drive ID-Run was preset from the factory and will work as is. For more precise settings, use the Id-Run procedure when the motor and pump are installed.

Note: Use the automated ID-Run procedure if the drive firmware, V4.6.1 Diagnostics>Software Info>Software Package, is FW0159V020 or greater. If the software package is prior to FW0159V020, use the default settings in the table below.

1. Make sure P3.2.9 Parameters>Start/Stop Setup>Start Delay and P3.2.11 Parameters>Start/Stop Setup>Restart Delay are set to 0.
2. Set P3.1.2.4 Parameters>Motor Settings>Motor Control>Identification to standstill.
3. Press the Green Start button within 5 seconds after the previous step.

The drive front light will turn solid green and when ID-Run is complete the green light will flash. If the ID-Run fails, the light will blink red.

<table>
<thead>
<tr>
<th>Affected Parameter Defaults</th>
<th>15 hp - 2360809566E</th>
<th>30 hp - 2360849566E</th>
<th>60 hp - 2360862166E</th>
</tr>
</thead>
<tbody>
<tr>
<td>P3.1.2.15 - Rs voltage drop</td>
<td>4</td>
<td>4</td>
<td>3.3</td>
</tr>
<tr>
<td>P3.1.2.16 - Ls voltage drop</td>
<td>42</td>
<td>59</td>
<td>47</td>
</tr>
<tr>
<td>P3.1.4.2 - Field WeakeningPnt</td>
<td>130.43</td>
<td>130.53</td>
<td>130.52</td>
</tr>
<tr>
<td>P3.1.4.3 - Voltage at FWP</td>
<td>108.7</td>
<td>108.7</td>
<td>108.7</td>
</tr>
<tr>
<td>P3.1.4.4 - U/f mid freq</td>
<td>3.8</td>
<td>2.64</td>
<td>2.34</td>
</tr>
<tr>
<td>P3.1.4.4 - U/f mid voltage</td>
<td>4.5</td>
<td>3.11</td>
<td>2.76</td>
</tr>
<tr>
<td>P3.1.4.6 - Zero freq voltage</td>
<td>3.2</td>
<td>2.2</td>
<td>1.95</td>
</tr>
</tbody>
</table>
Option Board for PT100 Temperature Sensor

An Option Board is available for the Vacon drive to allow connection of a PT100 motor temperature sensor.

- Option Board part number: 308170202
- PT100 Sensor part number: 305327903

Installation

To install the Option Board:

- Open the outer cover of the drive.
- Open the inner cover to reveal the option board slots.
- Install the temperature sensor option board into the left most slot as shown.

Connect sensor leads to the Option Board:

- Connect the gray wire to terminal 1.
- Connect the brown wire to terminal 2.
- Connect the black wire to terminal 3.

NOTE: If the wire colors on the sensor you have do not match these colors, the Brown and Black wires will be the two wires with the lowest resistance between them compared to the third wire.
**Drive Parameter Setup**

**P5.2.3.1 I/O and Hardware>OPTBH>Parameters>Sensor 1 type**: Set to PT100.

**P3.9.6.1 Parameters>Protections>Temp.Input Fault1>Temperat.Signals1**: Enter a check into box Temperature signal 1.

**P3.6.9.2 Parameters>Protections>Temp.Input Fault1>Alarm Limit 1**: Set alarm temperature.

**P3.6.9.3 Parameters>Protections>Temp.Input Fault1>Fault Limit 1**: Set Fault temperature. Use the following chart for guidance.

<table>
<thead>
<tr>
<th>Conditions</th>
<th>Water Temp without motor operation</th>
<th>Max. Trip Temp/Resistance Setting (for standard lead length)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motor operating at nameplate output with 0.16 m/sec flow past the motor.</td>
<td>10 °C</td>
<td>40 °C/115.5 Ω</td>
</tr>
<tr>
<td></td>
<td>15 °C</td>
<td>44 °C/117.0 Ω</td>
</tr>
<tr>
<td></td>
<td>20 °C</td>
<td>48 °C/118.6 Ω</td>
</tr>
<tr>
<td></td>
<td>25 °C</td>
<td>51 °C/119.7 Ω</td>
</tr>
<tr>
<td></td>
<td>30 °C</td>
<td>55 °C/121.3 Ω</td>
</tr>
<tr>
<td>Motor that has been derated with 1 m/sec flow past the motor.</td>
<td>35 °C</td>
<td>59 °C/122.8 Ω</td>
</tr>
<tr>
<td></td>
<td>40 °C</td>
<td>63 °C/124.3 Ω</td>
</tr>
<tr>
<td></td>
<td>45 °C</td>
<td>66 °C/125.5 Ω</td>
</tr>
<tr>
<td></td>
<td>50 °C</td>
<td>70 °C/127.0 Ω</td>
</tr>
</tbody>
</table>

**P3.6.9.4 Parameters>Protections>Temp.Input Fault1>Fault Limit Response**: Set to Fault.

**V2.5.1 Monitor>Temperat.Inputs>Temperature Input 1**: View sensor temperature.

When the alarm temperature is reached the drive Alarm will turn on and the drive will continue to run.

When the fault temperature is reached the drive Fault will turn on and the motor will be stopped. The drive will need a manual reset to restart the motor.
CONTROL FUNCTIONS

Controller Defaults

The drive has been setup to work in HAND or AUTO modes.

- In HAND mode, a fixed manual speed is selected from the Keypad. When the HOA Switch is set to **HAND**, motor Start and Stop can be controlled using the **Green** or **Red** buttons on the Keypad.
- In AUTO mode the speed is controlled through a PI loop regulating from a pressure, flow or water level transducer. The setpoint can be changed using the Keypad. Motor Start is automatic when the HOA switch is set to **Auto**. Setting the HOA switch to **Stop** stops the motor.
- In both modes, motor Start and Stop can be controlled remotely by replacing the JRS jumper with a switch or relay.

The drive can also be controlled from Fieldbus, but will require additional setup. Refer to “Fieldbus Communications” on page 20.

Hand Mode

1. When the HOA Switch is set to **Hand**, the motor will start and run at the Keypad Reference speed shown on the display. Use the up arrow to highlight the speed reference and press the **OK** button to change the frequency. Use the up and down arrows to raise and lower the motor speed between the programmed minimum and maximum frequencies. Press **OK** to save the new setting.

   The speed can be adjusted while the motor is running.

   To stop the motor, turn the HOA Switch to **STOP**, or press the **Red** stop button on the keypad.

2. The display will also show Output Frequency, Motor Current, Motor Torque, and Motor Voltage.

3. If these views are not selected highlight the box, press **OK** to select the parameter you wish to view. This will stay the same when in hand or auto modes.
OPERATION
Monitoring Functions

Auto Mode
When the HOA Switch is set to Auto, the drive will start and regulate the motor as required to maintain the Keypad Setpoint shown on the display. Use the up arrow to highlight the setpoint and press the OK button to change the setting. Use the up and down arrows to raise and lower the setpoint. Press OK to save the new setting.

To stop the motor, turn the HOA Switch to STOP.

Fault Reset
In either Hand or Auto mode, if the drive stops the motor because of a fault, the fault can be reset by switching the HOA to OFF and then back to Hand or Auto. A fault can also be reset by pressing the Back/Reset button for 3 seconds. If the fault is still present, the drive will trip again.

Monitoring Functions
To display more information than the standard screens, the drive offers a Multimonitor display.

• To display the Multimonitor, use the Back/Reset button to get to the Main Menu and then navigate to Monitor > Multimonitor.
• Each box on the screen can be changed to display what you want to see by highlighting the box and pressing OK.

Other useful monitoring information is available through these screens:
• Main Menu > Diagnostics > Active Faults
• Main Menu > Diagnostics > Fault History.
COMMUNICATIONS

Vacon Live

Download and Install Software

Vacon Live software provides the ability to view, change and save all parameters of the drive to your computer. When the motor is powered you can also monitor drive parameters.

- Follow this link to download Vacon Live: http://drivesliterature.danfoss.com/showDetails.action;jsessionid=C6BCC8DECB0CEA166786E8A58ECC1DC?doc-type=ZSW&docid=0000000000003000000008367&version=A3&language=000#.

- Click on the download zip at the bottom right.
- Install the Vacon Live software on your computer.

Setup Ethernet Connection

After installing Vacon Live on your computer, use the following procedure to connect to the drive.

1. Connect Cat5 Ethernet cable to your computer and to the drive to the left of the I/O terminal blocks. Power the drive.
2. Disable your computer’s Wifi and start the Vacon Live software. When the software starts it will ask if you want to connect online or offline. Select Online.

3. The next screen will display “Searching for connected drives.” Click Cancel.
4. When the **Communications Settings** screen appears, make sure Ethernet is selected and delete all the added IP addresses by clicking on the X next to the added IP addresses. Press **Scan** and wait for the drive name to appear. Highlight the drive name and press **Connect to Selected**.

![Communication settings](image)

5. The parameters of the drive will start filling into Vacon Live. Wait for the parameters to fully load before accessing the menus or changing parameters.

![Using Vacon Live](image)

**Using Vacon Live**

**Side Tab**

The Side Tab Control is located on the left side of the program window. It provides a list of all open files and connected drives.

The Side Tab includes status LEDs to the left of each drive name, which allows the user to monitor multiple drives at the same time.

The status LEDs provide the following information from left to right:

- **Online Status**
- **Ready Status**
- **Motor Status**
- **Fault Status**
- **Alarm Status**
Menu Bar and Tool Bar

Typical software operation includes selecting an item from the Menu Bar on the left, and then using an icon from the Tool Bar across the top to perform an action. The main screen to the right displays the available options for each menu item.

For example:

1. Click on **Monitor > 2.3 Basic**
2. Click on the **Refresh** icon (blue ball)
3. The current drive values are displayed in real time.
Fieldbus Communications

To program the drive to run with Fieldbus control, set the following parameters:

- **P3.2.1 Parameters>Start/Stop Setup>Rem Control Place**: Set to fieldbus.
- **P3.2.2 Parameters>Start/Stop Setup>Local/Remote**: Set to Remote.
- **P3.3.1.10 Parameters>References>Fieldbus Ref Sel**: Set to where you want the reference signal to come from. PID, Keypad, Fieldbus etc.
- **P3.13.2.1 PID Controller>Setpoints>Keypad SP1**: Set the PID setpoint.

For more information on setting up Fieldbus, refer to the Modbus TCP/UDP and Modbus RTU user manual, Document ID: DPD00156D Rev. D; or, call the Franklin Electric technical hot line.
## MAINTENANCE

### Troubleshooting

### Diagnostic Fault Codes


<table>
<thead>
<tr>
<th>Fault</th>
<th>Possible Cause</th>
<th>Corrective Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motor Underload</td>
<td>• Over-pumped well</td>
<td>• System is drawing down to pump inlet (out of water)</td>
</tr>
<tr>
<td></td>
<td>• Broken shaft or coupling</td>
<td>• Cycle pump, lower speed</td>
</tr>
<tr>
<td></td>
<td>• Blocked screen, worn pump</td>
<td>• Check pump rotation by switching output wire orientation</td>
</tr>
<tr>
<td></td>
<td>• Air/gas locked pump</td>
<td>• Air/gas locked pump - if possible, set deeper in well to reduce</td>
</tr>
<tr>
<td></td>
<td>• Pump running backwards</td>
<td>• Set motor nominal current to the current seen when the pump is running at maximum frequency surfacing water normally.</td>
</tr>
<tr>
<td></td>
<td>• Motor Nominal Current setting incorrect</td>
<td>• Check Underload Sensitivity setting</td>
</tr>
<tr>
<td></td>
<td>• Underload Sensitivity setting incorrect</td>
<td></td>
</tr>
<tr>
<td>Undervoltage</td>
<td>• Low line voltage</td>
<td>• Check incoming power connections and correct or tighten if necessary</td>
</tr>
<tr>
<td></td>
<td>• Misconnected input leads</td>
<td>• Measure incoming line voltage when drive is started and running</td>
</tr>
<tr>
<td></td>
<td>• Loose connection at breaker or panel</td>
<td>• Correct incoming voltage - check circuit breaker or fuses, contact power company</td>
</tr>
<tr>
<td>Overcurrent or Locked Pump</td>
<td>• Motor and/or pump misalignment</td>
<td>• Measure motor cable phase to phase resistance (remove cable from drive)</td>
</tr>
<tr>
<td></td>
<td>• Dragging motor and/or pump</td>
<td>• Reduce motor cable length. Adhere to Maximum Motor Cable Length table</td>
</tr>
<tr>
<td></td>
<td>• Motor and/or pump locked</td>
<td>• Reverse direction of pump to unlock</td>
</tr>
<tr>
<td></td>
<td>• Abrasives in pump</td>
<td>• Set carrier frequency to 4 khz for sine filter and 2.5 khz for DV/DT filter.</td>
</tr>
<tr>
<td></td>
<td>• Excess motor cable length</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Carrier frequency too low</td>
<td></td>
</tr>
<tr>
<td>Open Phase</td>
<td>• Loose connection</td>
<td>• Open reading on DC test at start.</td>
</tr>
<tr>
<td></td>
<td>• Defective motor or drop cable</td>
<td>• Check drop cable and motor resistance, tighten output connections, repair or replace as necessary</td>
</tr>
<tr>
<td>Short Circuit</td>
<td>• When fault is indicated immediately after power-up, short circuit due to loose connection, defective cable, splice or motor</td>
<td>• Incorrect output wiring, phase to phase short, phase to ground short in wiring or motor</td>
</tr>
<tr>
<td></td>
<td>• If fault is present after resetting and removing motor leads, replace drive</td>
<td></td>
</tr>
<tr>
<td>Overheated Drive</td>
<td>• High ambient temperature</td>
<td>• Position panel so that sun shines on the side, not front or back</td>
</tr>
<tr>
<td></td>
<td>• Direct sunlight</td>
<td>• Add a sun shield</td>
</tr>
<tr>
<td></td>
<td>• Obstruction of airflow</td>
<td>• Make sure vent fan thermostat is set correctly</td>
</tr>
<tr>
<td></td>
<td>• Fan blocked or inoperable</td>
<td>• Replace fan or relocate drive as necessary</td>
</tr>
<tr>
<td></td>
<td>• Ambient above 122 °F (50 °C)</td>
<td>• Remove debris from fan intake/exhaust</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Remove and clean air filters</td>
</tr>
</tbody>
</table>
### MAINTENANCE
#### Troubleshooting

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<tr>
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</thead>
<tbody>
<tr>
<td>Overvoltage</td>
<td>• High line voltage&lt;br&gt;• Internal voltage too high&lt;br&gt;• Deceleration rate too quick</td>
<td>• Check incoming power connections and correct or tighten if necessary&lt;br&gt;• Measure incoming line voltage when drive is started and running&lt;br&gt;• If line voltage is stable, below specification, and problem persists, contact your Franklin Electric Service Personnel</td>
</tr>
<tr>
<td>Ground Fault</td>
<td>• Motor output cable is damaged or exposed to water&lt;br&gt;• Phase to ground short</td>
<td>• Check motor cable insulation resistance with megger (while not connected to drive). Replace motor cable if needed.</td>
</tr>
</tbody>
</table>
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