

ITT

S100084

Bell & Gossett

Installation, Operation and
Maintenance Instructions
TECHNOFORCE Pump Controller
Variable Speed Pumping Systems

Engineered for life

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1. Introduction and Safety

1.1 Introduction

1.1.0 Purpose of the manual

The purpose of this manual is to provide necessary information for:

- Installation
- Operation
- Maintenance



CAUTION:

Read this manual carefully before installing and using the product. Improper use of the product can cause personal injury and damage to property, and may void the warranty.

NOTICE:

Save this manual for future reference, and keep it readily available at the location of the unit.

The information contained in this manual is intended to assist operating personnel by providing information on the characteristics of the purchased equipment.

It does not relieve the user of the responsibility to adhere to local codes and ordinances and the use of accepted practices in the installation, operation and maintenance of this equipment.

Further information pertaining to the installation, operation, and maintenance of your TechnoForce pump controller can be found in the IOMs for the associated equipment provided Maintenance section for a list of relevant manuals.

Equipment cannot operate well without proper care. To keep this unit at top efficiency, follow the recommended installation and servicing procedures outlined in this manual.

1.2 Safety



WARNING:

- The operator must be aware of safety precautions to prevent physical injury.
 - Any pressure-containing device can explode, rupture, or discharge its contents if it is over-pressurized. Take all necessary measures to avoid over-pressurization.
 - Operating, installing, or maintaining the unit in any way that is not covered in this manual could cause death, serious personal injury, or damage to the equipment. This includes any modification to the equipment or use of parts not provided by ITT. If there is a question regarding the intended use of the equipment, please contact an ITT representative before proceeding.
 - This manual clearly identifies accepted methods of disassembling units. These methods must be adhered to. Trapped liquid can rapidly expand and result in a violent explosion and injury. Never apply heat to impellers, propellers, or their retaining devices to aid in their removal.
 - Do not change the service application without the approval of an authorized ITT representative.
-




1.3 Safety terminology and symbols

1.3.0 About safety messages

It is extremely important that you read, understand, and follow the safety messages and regulations carefully before handling the product. They are published to help prevent these hazards.

- Personal accidents and health problems
- Damage to the product
- Product malfunction

1.3.1 Hazard levels

Hazard level	Indication
 DANGER:	A hazardous situation which, if not avoided, will result in death or serious injury.
 WARNING:	A hazardous situation which, if not avoided, could result in death or serious injury.
 CAUTION:	A hazardous situation which, if not avoided, could result in minor or moderate injury.
NOTICE:	<ul style="list-style-type: none"> • A potential situation which, if not avoided, could result in undesirable conditions. • A practice not related to personal injury.

1.3.2 Hazard categories

Hazard categories can either fall under hazard levels or let specific symbols replace the ordinary hazard level symbols.

Electrical hazards are indicated by the following specific symbol.



Electrical Hazard:

These are examples of other categories that can occur. They fall under the ordinary hazard levels and may use complementing symbols:

- Crush hazard
- Cutting hazard
- Arc flash hazard

1.4 Environmental safety

1.4.0 The work area

Always keep the station clean to avoid and/or discover emissions.

1.4.1 Waste and emissions regulation

Observe these safety regulations regarding waster and emissions:

- Appropriately dispose of all waste.
- Handle and dispose of the processed liquid in compliance with applicable environmental regulations.
- Clean up all spills in accordance with safety and environmental procedures.
- Report all environmental emissions to the appropriate authorities.

1.4.2 Electrical installation

For electrical installation recycling requirements, consult your local electric utility.

1.5 Recycling guidelines

Always follow local laws and regulations regarding recycling.

1.6 User safety

1.6.0 General safety rules

These safety rules apply:

- Always keep the work area clean.
- Pay attention to the risks presented by gas and vapors in the work area.
- Avoid all electrical dangers. Pay attention to the risks of electric shock or arc flash hazards.
- Always bear in mind the risk of drowning, electrical accidents, and burn injuries.

1.6.1 Safety equipment

Use safety equipment according to the company regulations. Use this safety equipment within the work area:

- Helmet
- Safety goggles
- Protective shoes
- Protective gloves
- Gas mask
- Hearing protection
- First-aid kit
- Safety devices

NOTICE:

Never operate a unit unless safety devices are installed. Also see specific information about safety devices in other chapters of this manual.

1.6.2 Electrical connections

Electrical connections must be made by certified electricians in compliance with all international, national, state, and local regulations. For more information about requirements, see sections dealing specifically with electrical connections.

1.6.3 Precautions during work

Observe these safety precautions when you work with the product or are in connection with the product:

- Never work alone.
- Always wear protective clothing and hand protection.
- Stay clear of suspended loads.
- Always lift the product by its lifting device.
- Beware of the risk of a sudden start if the product is used with an automatic level control.
- Beware of the starting jerk, which can be powerful.
- Rinse the components in water after you disassemble the pump.
- Do not exceed the maximum working pressure of the pump.
- Do not open any vent or drain valve or remove any plugs while the system is pressurized. Make sure that the pump is isolated from the system and that pressure is relieved before you disassemble the pump, remove plugs, or disconnect piping.
- Never operate a pump without a properly installed coupling guard.

1.6.4 Wash the skin and eyes

Do the following if chemicals or hazardous fluids have come into contact with your eyes or your skin:

If you need to wash your . . .	Then . . .
Eyes	<ol style="list-style-type: none"> 1. Hold your eyelids apart forcibly with your fingers. 2. Rinse the eyes with eyewash or running water for at least 15 minutes. 3. Seek medical attention.
Skin	<ol style="list-style-type: none"> 1. Remove contaminated clothing. 2. Wash the skin with soap and water for at least one minute. 3. Seek medical attentions, if required.

1.7 Product warranty

1.7.0 Coverage

ITT undertakes to remedy faults in products from ITT under these conditions:

- The faults are due to defects in design, materials, or workmanship.
- The faults are reported to an ITT representative within the warranty period.
- The product is used only under the conditions described in this manual.
- The monitoring equipment incorporated in the product is correctly connected and in use.
- All service and repair work is done by ITT-authorized personnel.
- Genuine ITT parts are used.
- Only Ex-approved spare parts and accessories authorized by ITT are used in Ex-approved products.

1.7.1 Limitations

The warranty does not cover faults caused by these situations:

- Deficient maintenance
- Improper installation
- Modifications or changes to the products and installation made without consulting ITT
- Incorrectly executed repair work
- Normal wear and tear

ITT assumes no liability for these situations:

- Bodily injuries
- Material damages
- Economic losses

1.7.2 Warranty claim

ITT products are high-quality products with expected reliable operation and long life. However, should the need arise for a warranty claim, then contact your ITT representative.

2. Transportation and Storage

2.1 Inspect the delivery

2.1.0 Inspect the package

1. Inspect the package for damaged or missing items upon delivery.
2. Note any damaged or missing items on the receipt and freight bill.
3. File a claim with the shipping company if anything is out of order.
If the product has been picked up at a distributor, make a claim directly to the distributor.

2.1.1 Inspect the unit

1. Remove packing materials from the product.
Dispose of all packing materials in accordance with local regulations.
2. Inspect the product to determine if any parts have been damaged or are missing.
3. If applicable, unfasten the product by removing any screws, bolts, or straps.
For your personal safety, be careful when you handle nails and straps.
4. Contact your sales representative if anything is out of order.

2.2 Transportation guidelines

2.2.0 Lifting methods



WARNING:

- Assembled units and their components are heavy. Failure to properly lift and support this equipment can result in serious physical injury and/or equipment damage. Lift equipment only at the specifically identified lifting points. Lifting devices such as eyebolts, slings, and spreaders must be rated, selected, and used for the entire load being lifted.
 - Crush hazard. The unit and the components can be heavy. Use proper lifting methods and wear steel-toed shoes at all times.
 - Care should be taken to prevent damage due to dropping or jolting when moving the controller. Transportation damage should be brought to the carrier's attention immediately upon receipt.
-

2.3 Storage guidelines

2.3.0 Storage location

The product must be stored in a covered and dry location protected from extreme cold, heat, dirt, and vibrations.

NOTICE:

- Protect the product against humidity, heat sources, and mechanical damage.
 - Do not place heavy weights on the packed products.
-

2.3.1 Long-term storage

If the controller is stored for more than 6 months, these requirements apply:

- Store in a covered and dry location.
- Store the unit free from heat, dirt, and vibrations.

Extended storage of VFDs may require special attention prior to start-up. See manufacturer's IOM for details.

3. Product Description

3.1 General description

3.1.0 Description

The controller is a specific purpose programmable pump controller. This provides:

- Optimum pump control without the cost of general purpose control hardware.
- Software dedicated and established for the unit.
- Unique analog input protection of other members of the control family. In the event of a short circuit condition, the current limit circuitry prevents failure of the analog input components.

NOTICE:

- Your controller should have a safety instruction decal. If the decal is missing or illegible, contact your representative for a replacement.
-

3.2 Operational limits

3.2.0 Temperature and ventilation

All electrical equipment is susceptible to failure if operated in ambient temperatures outside of its rating. The OPERATING temperature range for this unit is 0 to 50°C. The relative humidity should not exceed 90% non-condensing. The unit should not be operated outside these extremes.


3.3 Nameplate information

3.3.0 Important information for ordering

Every pump station has a nameplate that provides information about the pump station. The pump station nameplate is located on the inside of the control enclosure door.

When ordering spare parts, be prepared to identify the nameplate information when contacting the factory.

- Model
- Size
- Serial number
- Item numbers of the required parts

Model Number	
Serial Number	
Station Voltage	
System FLA	
SCCR	
Largest Motor HP	
Station Flow	
Suction Pressure	
Discharge Pressure	
Pump Boost	
Date Code	
 ITT <i>Engineered for life</i>	
Residential & Commercial Water Dallas, Texas, U.S.A. Customer Service 1.800.627.0539 x3	

Nameplate Data	Explanation
Model Number	The manufacturer's number to indicate the particular type of product which has been acquired.
Serial Number	A set of characters that uniquely identifies a single unit and can be used for traceability and warranty purposes.
Station Voltage	The rated voltage at which the station has been designed for. Should match the application site supply voltage.
System FLA	The full-load-amperage at which the station can operate.
SCCR	"Short-Circuit Current Rating". Represents the maximum level of short-circuit current that a component or assembly can withstand.
Largest Motor HP	The rated HP for the largest Pump in the system.
Station Flow	The designed duty point, in GPM, LPH, etc.
Suction Pressure	The line pressure on the input side of the pump station.
Discharge Pressure	The line pressure on the output side of the pump station.
Pump Boost	The difference between the input side of the pump station and the output side of the pump station.
Date Code	Marking of products to indicate their date of manufacture.

3.4 Main parts and functions

3.4.0 Input voltage

The VFD and TechnoForce Pump Controller can be set up to operate across a broad range of voltages. It was factory set to operate on the voltage shown on the nameplate. Check the VFD nameplate for the proper input and output voltages before wiring the VFD.

The voltage tolerance is +10/-5% and phase to phase voltage must not have an imbalance greater than 5 VAC.

3.4.1 Ground connections

A grounding terminal is provided for a dedicated ground wire connection. All provisions of the National Electrical Code and local codes must be followed.



WARNING:

- Conduit grounds are not adequate. A separate ground wire must be attached to the ground lug provided in the enclosure to avoid potential safety hazards.

3.4.2 Power wiring

Power wire types and sizes must be selected based upon conformance with the National Electrical Code and all local codes and restrictions. In addition, only copper (Cu) wire rated for 75°C (minimum) may be used for the power connections. Refer to the input current as listed on the nameplate affixed to the enclosure door when sizing wire.

3.4.3 Output/motor disconnect

It is necessary that any device which can disconnect the motor from the output of the VFD be interlocked to the emergency shutdown circuits of the VFD. This will provide an orderly shutdown if the disconnecting device is open circuited while the VFD is in operation. Failure to provide this interlock may result in damaged components due to improper installation.



CAUTION:

- Metal filings can create electrical short circuits. Do not drill, saw, file or perform any operation on the VFD conduit entry plate while attached to the VFD.

3.4.4 Analog signals

Shielded cable (#22 AWG, Belden type 8762, Alpha #2411, or equal) should be installed for all D.C. control wiring. The shield must be terminated in the Controller panel. Do not connect the shield at the other end of the cable! Insulate the shield so that no electrical connection is made at the other end of the cable. A twisted pair of #22 AWG conductors (Belden 8442, or equal) can be used in place of shielded cable. The cable length must be limited to 5,000 feet for #22 AWG wire.

3.4.5 Field connection diagrams

Refer to the pump Installation, Operation, and Maintenance Manual for specific details unique to the pump.

Refer to the flow sensor/transmitter Installation, Operation, and Maintenance manual for specific details unique to the flow sensor/transmitter.

Job specific wiring and dimensional drawings and typical field connection diagram should be reviewed prior to unit installation and operation.

3.5 Glossary of terms

VFD	Variable Frequency drive; converts a constant power input into a variable power output for the motor; a device for controlling motor speed.
Alternation	Process of determining which pump will serve as lead pump and which pump will serve as lag pump.
Destage	To turn off a lag pump.
EOC	End of curve; point at which a pump is staged or destaged.
Lag pump	Standby pump which activates only when lead pump alone cannot efficiently provide sufficient pressure or flow rate.
Lead pump	Duty pump which runs continuously until a standby pump is required.
LED	Light emitting diode, located on OIP and controller.
OIP	Operator Interface Panel.
PID	Proportional Integral Derivative; 3 variables required for error control.
PV (Process Variable)	Signal generated by a sensor which is set up to control the system.
Proof timer	Minimum time period before controller acknowledges an input; time period for which a signal must be stable before it is accepted by the controller as a sustained and valid signal.
RTC	Real time clock.
Stage	To start a lag pump.
SP	Set point.
HD	Hard Deck.

4. Installation

4.1 Field connections

4.1.0 Diagrams

Review the wiring diagrams and dimensional drawings before you install and operate the unit.

4.1.1 Electrical precautions

**WARNING:**

- Prevent electrical shocks. Disconnect the power supply before beginning installation. **FAILURE TO FOLLOW THESE INSTRUCTIONS COULD RESULT IN SERIOUS PERSONAL INJURY, DEATH AND/OR PROPERTY DAMAGE.**
 - Each motor must have a properly sized drive. Ground fault protection should be sized properly. Refer to local electrical codes for sizing and selection.
 - Refer to the motor manufacturer's IOM for specific installation information.
 - Motor can start automatically. Keep hands away from output shaft until motor is completely stopped and input power is removed from the motor control panel. Lockout main power switch while working near motor shaft.
 - The use of motor disconnect switches is acceptable. Consult the factory for proper interlocking with variable frequency drives.
 - Motor control equipment and electronic controls are connected to hazardous line voltages. When servicing electronic controls, there will be exposed components at or above line potential. Extreme care should be taken to protect against shock. Stand on an insulating pad and make it a habit to use only one hand when checking components. Always use accurate test meters when checking electrical components. Always work with another person in case of an emergency. Disconnect power when performing maintenance. Be sure equipment is properly grounded. Wear safety glasses whenever working on electronic control or rotating equipment.
-

**DANGER:**

- Troubleshooting live control panels exposes personnel to hazardous voltages. Electrical troubleshooting must only be done by a qualified electrician. **FAILURE TO FOLLOW THESE INSTRUCTIONS COULD RESULT IN SERIOUS PERSONAL INJURY, DEATH, AND/OR PROPERTY DAMAGE.**
-

4.2 Earth (ground connections)

**WARNING:**

- Conduit grounds are not adequate. A separate ground wire must be attached to the ground lug provided in the enclosure to avoid potential safety hazards. Failure to follow these instructions could result in serious personal injury or death, property damage.
-

A grounding terminal is provided for a dedicated earth (ground) wire connection. You must follow all provisions of the National Electrical Codes and local codes.

4.3 Sensor and control wiring

The following sections are based on the installation of standard TechnoForce product. Because of customized software and hardware, the installing contractor should base all wiring connections on the wiring diagrams that accompany each controller. These sections are meant to complement, not replace, those wiring diagrams.

Differential pressure switches are installed to sense the increase in pressure between the pump suction and discharge gauge taps and are used to determine whether a pump is running. Each switch should be wired from the normally closed contact.

To control variable frequency drives it is necessary to wire RS485 with each VFD.

With certain bypass and control methods it is necessary to disable the adjustable frequency drive from running. This is accomplished by wiring from the terminals to each VFD's interlock terminals. Should this wiring be required, any jumpers which may be found on the VFD's interlock terminals should be removed.

The control family may be provided with the capability to accept many analog inputs. Typically all analog inputs must be 4-20mA and powered by the 24VDC power supply in the controller. All shields must be grounded in the controller only to prevent ground loops and improper signals.

It is not necessary for all analog inputs to be used to monitor system zones. It is necessary, however, that all zone transmitters be connected consecutively starting with zone 1. Optional transmitters (i.e., other than zones) may be supplied.

Hardwire communications refers to the capability of the Controller to communicate with an energy management system. Standard communication features are listed below:

Remote Start/Stop – Remove the jumper from Terminal 200 and install a switch as indicated on the wiring diagram. CLOSED CONTACT of this switch will provide the start signal.

Remote Alarm Indication – A digital output rated 2.5 AMPs at 240V is supplied. This output closes to indicate an alarm condition exists.

User Configurable I/O – The Controller comes equipped with the capability to define the operation of any unused input or output signal. Refer to System Set Up I/O menus.

4.4 Pump package location guidelines



WARNING:

- Assembled units and their components are heavy. Failure to properly lift and support this equipment can result in serious physical injury and/or equipment damage. Lift equipment only at the specifically identified lifting points. Lifting devices such as eyebolts, slings, and spreaders must be rated, selected, and used for the entire load being lifted.

Guideline	Explanation
Make sure that the space around the pump package is sufficient.	This facilitates ventilation, inspection, maintenance, and service.
If you require lifting equipment such as hoist or tackle, make sure that there is enough space above the pump package.	This makes it easier to properly use the lifting equipment and safely remove and relocate the components to a safe location.
Protect the unit from weather and water damage due to rain, flooding, and freezing temperatures.	This is applicable if nothing else is specified.
Do not install and operate the equipment in closed systems unless the system is constructed with properly-sized safety devices and control devices.	Acceptable devices: <ul style="list-style-type: none"> • Pressure relief valves • Compression tanks • Pressure controls • Temperature controls • Flow controls If the system does not include these devices, consult the engineer or architect in charge before you operate the pump.
Take into consideration the occurrence of unwanted noise and vibration.	The best pump location for noise and vibration absorption is on a concrete floor with subsoil underneath.

4.5 System piping and unit installation – final checklist

1. Check that the unit base is properly leveled, grouted and secured.
2. Check that all lubrication points are properly lubricated.
3. Check that the shut-off valves to the transmitters open.
4. Check that the shut-off valves to the pump suction open.
5. Check that the shut-off valves to the discharge line open.
6. Check that the piping is properly supported to prevent strains on the unit.
7. Check that the system, including pumps and valving, are purged of debris and air.



CAUTION:

- Seal damage may occur. Do not run pumps dry. Fill and vent the pump volute prior to operation. FAILURE TO FOLLOW THESE INSTRUCTIONS COULD RESULT IN PROPERTY DAMAGE AND/OR MODERATE PERSONAL INJURY.
-

4.6 Electrical wiring and control settings – final checklist

1. Check the unit nameplate or motor terminal connection to ensure the feeder line voltage corresponds to the unit voltage



WARNING:

- Electrical shock hazard. Inspect all electrical connections prior to powering the unit. Wiring connections must be made by a qualified electrician in accordance with all applicable codes, ordinances, and good practices. FAILURE TO FOLLOW THESE INSTRUCTIONS COULD RESULT IN SERIOUS PERSONAL INJURY, DEATH, AND/OR PROPERTY DAMAGE.
-

2. Check that feeder wires are correctly sized for the load.
3. Check that the fuses are correctly sized. They must not exceed 1.75 times the full load current of the motor. Usual sizing is 1.15 to 1.5 times the full load current.



DANGER:

- High voltage 3 phase power can kill. Disconnect and lockout power prior to servicing. FAILURE TO FOLLOW THESE INSTRUCTIONS COULD RESULT IN SERIOUS PERSONAL INJURY, DEATH, AND/OR PROPERTY DAMAGE.
-



WARNING:

- Conduit grounds are not adequate. A separate ground wire must be attached to the ground lug provided in the enclosure to avoid potential safety hazards. FAILURE TO FOLLOW THESE INSTRUCTIONS COULD RESULT IN SERIOUS PERSONAL INJURY, DEATH, AND/OR PROPERTY DAMAGE.
-

4. Check that the unit is properly grounded.
5. Make sure all the power terminals in the control panel have been tightened.

4.7 Operator interface panel

4.7.0 Diagrams

The OIP consists of a 4 x 20 character LCD screen and a 26 button keypad with LEDs which display system status. The OIP communicates through a CAN bus to the CPU



4.7.1 Key functionality

The names of the keys on the Operator Interface Panel (OIP) are shown as CAPITAL LETTERS in this manual. Table 1 shows the functionality of the keys on the OIP.

4.7.2 Table 1 Key Functionality

Key Name	Functionality
START/STOP	Starts or stops the system.
AUTO/ MANUAL	Toggles the operation mode. The system must be stopped to change the operation mode.
PUMP 1-6 ENABLE	Enables or disables the corresponding pump. Pumps cannot be disabled while they are failed.
RESET/ SILENCE	This key is used to reset alarms and events. When the A/V Alarm relay output is set. Pressing of this key resets the alarms and events.
HELP	Press the HELP button, from the status screens, to view alarms or events while the HELP LED is flashing. While in the Alarm screen, press the HELP button again to view help messages for active alarms. Press HELP any other time to view screen specific help messages.
PV/1	Press PV from the status screens, to bring up the process variable screen
SETPT/2	Press SET PT from the status screens, to bring up the set point menu shown in section 5.5
SETUP/3	Press SETUP, from the status screens, to bring up the Setup Menu shown in section 4.10
ALT/4	Press ALT, from the status screens, to manually alternate the pump staging sequence.
LOG/5	Press LOG, from the status screens, to bring up the Log Menu, shown in section 6.14.0
QUICK ACCESS/6	Press QUICK ACCESS from the status screens, to bring up the quick access menu, shown in section 5.8.
YES/7	Press YES at OK prompts to accept values and proceed
INFO/8	Press INFO, from the status screens, to bring up the program type and version number shown in section 6.14
NO/0	Press NO at OK prompts to edit the parameters
ENTER	Confirms entries
CLEAR	Clears entries or used to exit some screens
PREV/(◀)	Navigates to neighboring screens
NEXT/(▶)	Navigates to neighboring screens
UP (▲)	Used to modify values and navigate to neighboring screens
DOWN (▼)	Used to modify values and navigate to neighboring screens

Note: Setting the display contrast.

The Contrast on the display is set at the factory. However, the user can make a different contrast setting as desired. To do this press “Enter”. while holding down this key, the “UP” and “DOWN” key can be used to set contrast.

ENTER + UP.. increase contrast

ENTER + DOWN... reduce contrast

4.8 LEDs

Table 2 gives the meaning of the LED states.

LED	Description
START/STOP	On = Start Off = Stop
AUTO/ MANUAL	On = Auto Off = Manual
PUMP 1-6	On = Pump On Off = Pump Disabled Blink = Pump Ready, Blink Fast = Pump Failed
RESET/ SILENCE	Off = OK Blink = Reset Required
HELP	Off = OK Blink = Event/Alarm(press HELP from the status screens to view)

4.9 I/O

4.9.0 Analog Inputs

The TechnoForce Pump Controller is equipped with 4 analog input channels. The analog inputs must provide a 4-20mA signal. Typically, analog inputs will be powered by the 24V power supply within the panel. For analog inputs which source their own power, consult factory.

Shielded 22 AWG cable should be installed for all analog input wiring. The shield must be terminated in the TechnoForce Pump Controller. Do not connect the shield at the other end of the cable! Insulate the shield so that no electrical connection is made at the other end of the cable. A twisted pair of #22 AWG conductors can be used in place of shielded cable. The cable length must be limited to 5,000 feet for #22 AWG wire.

4.9.1 Digital Inputs

The TechnoForce Pump Controller is equipped with (24) 24VDC digital input channels. This signal voltage must be obtained from the 24VDC power supply mounted to the subpanel. It is not recommended that other power sources be used without factory approval. All digital inputs are automatically assigned based on Table 3. See the typical wiring diagram in Appendix.

Table 3: Digital Inputs Functionalities

Functionality	DI #	Description
Start/Stop Sw	1	Remote contact can be used to start/stop the system.
DP 1-6	2-7	Differential pressure switches
Optional DI	8-24	User can select the function of optional input in IO setup, see section 4.10.17.

22 AWG cable should be installed for all field wiring to digital inputs.

4.9.2 Digital Output Module

The digital output consists of 2 normally open and normally close contact for each output rated at 2.5A at 240V. Customer connections are made directly to the terminals mounted on the digital output module. If a relay is defective, the digital output module must be replaced. Refer to section 4.10.17 for relay output setup.

4.10 Set up & features

Note: For many sections of Setup & feature a path has been given for navigation. Example is given below to understand the given path.

Example for system setup path.

Path: Status Screen / Setup(3) / System(3)

To follow the above path press the SETUP/3 key from the system status screen. Then press the SETUP/3 key for number 3 which is a selection number for system and press ENTER key. It will lead to the system setup screen.

Upon powering up the controller, the display will light and show the following screen:

```
<TECHNOFORCE PUMP>
      CONTROLLER
      MM/DD/YY HH:MM:SS A/P
      STOP  MANUAL  NORM
```

The current date and time will be displayed on the third line.

Press the SETUP/3 key once and the following MAIN SET UP menu items will be displayed:

```
SELECTION: #      0=EXIT
1 = SENSORS      4 = TEST
2 = PUMPS        5 = ALRM/EVT
3 = SYSTEM       6 = Q-START
```

4.10.0 Sensor Setup

Press the PV/1 key at the Main Set Up menu display. Then press the ENTER key.

The SENSOR SET UP MENU will be displayed as shown below:

```
AI 1  TYPE: $$$
SPAN= ### ZERO= ##
< OK $ (Y/N) >
```

To accept the current values, press YES/7 key and then press the ENTER key.

To set up each field, press the NO/0 key and then press the ENTER key.

The current TYPE field starts blinking. Press the up (▲) and down (▼) keys to navigate to the desired TYPE and then press the ENTER key to confirm selection.

The following selections are valid:

```
SYS (System Pressure)
SUC (Suction Pressure)
RESYS (Redundant System Pressure)
FLOW (System Flow)
PRESS (For Monitor only)
NONE
```

If RESYS is selected as a desired field, the following screen will get displayed:

```
ACTIVE SENSOR ##
DRIFT THRESHOLD ##%
DRIFT PR TM ###s
OK $ (Y/N)
```

RESYS MENU ITEMS				
Menu Item	Variable	Default	Range	Field Value
RESYS	Active Sensor : ## Enter the active system pressure sensor number	1	1-4	
	Drift Threshold: ##% Pressure difference limit between the active and redundant pressure sensor in %	5	0-100	
	Drift Pr Tm : ##s Proof timer prior to give warning when exceed the drift threshold limit, in seconds	0	0-999	

To set up each field, press the NO/0 key and then press the ENTER key. The ACTIVE SENSOR field will start blinking. Change the current value in Active Sensor field by pressing desired numeric Keys and then press ENTER key to confirm. Press ENTER key to accept the current DRIFT THRESHOLD value. To change the value in DRIFT THRESHOLD field, press the desired Numeric Keys and then press ENTER to confirm. Press ENTER key to accept the current value of DRIFT PR TM. To change the value in DRIFT PR TM field press the desired Numeric Keys and then press ENTER to confirm. To accept the current values, press YES/7 key and then press ENTER key. The screen will go back to the SENSOR SET UP menu displayed above. Press the NEXT/(▶) key if additional sensors need to be set up. Repeat the above steps for all remaining sensors. Pressing YES/7 key and then the ENTER key at the SENSOR SET UP screen will take the display back to the MAIN SET UP screen.

4.10.1 Pump set up

Paths: Status Screens / Set up(3)

Press the SET PT/2 key at the Main Set Up menu screen. Then press the ENTER key.

The PUMP SET UP MENU will get displayed as shown below:

```
SELECTION: #      0= EXIT
1 = NUMBER OF PUMPS
2 = PUMP NAMEPLATE
3 = RESET PUMP TIME
```

To change the values in NUMBER OF PUMPS field, press PV/1 key then press the ENTER key. The following menu will get displayed:

```
TOTAL PUMPS: #
STANDBY PUMPS: #
OK $ (Y/N)
```

To set up each field, press the NO/0 key and ENTER key. Modify the values as desired using the appropriate numeric key. The pump number is limited to the maximum number of pumps.

To accept the current values, press YES/7 key and then press ENTER key.

The screen will go back to the PUMP SET UP MENU display.

To change the values in PUMP NAMEPLATE field, press SET PT/2 key then press the ENTER key. The following menu will get displayed:

```
<PUMP 1      NAMEPLATE>
AMPS:      ###.#  HP: ###.#
VOLTS:      ### Hz: ##
Spd: #####  OK $ (Y/N)
```

To set up each field, press the **NO/0** key and **ENTER** key. Modify the values as desired using the appropriate keys. Modify the values as desired for pump 1.

Note: For example, to enter a value of 3.5 Amps, go to the amps field, press numerical key 3 and press enter. Ten press key 5 and enter.

To change the values for other pumps, press the **NEXT/(▶)** key. This is only applicable if the total numbers of pumps selected in **TOTAL PUMPS: #** field are more than 1.

Note:

All values will be copied to the next screen by pressing **NEXT/(▶)** key. They will only be copied the first time the screens are visited. To edit the values, press the **NO/0** key and **ENTER** key. Modify the values as desired.

To confirm the modified values, press **YES/7** key and then press **ENTER** key.

The screen will go back to the **PUMP SET UP MENU** display.

To change the values in **RESET PUMP TIME** field, press the **SETUP/3** key then press the **ENTER** key. The following menu will get displayed:

```

RESET PUMP TIME?
P1: N   P2: N   P3: N
P4: N   P5: N   P6: N
OK $ (Y/N)

```

To reset the pump(s) run time, press **NO/0** key and **ENTER**.

By default, **N** will be displayed next to the pump fields (P1: , P2: etc.) depending upon number of pumps selected. **N** corresponding to **P1:** field will start blinking. To reset the pump run time for pump 1, press the **YES/7** key and **ENTER**. Similarly modify the values for the rest of the pumps as applicable.

Note: This selection is only valid for the pumps selected. For example, if the number of pumps selected is 2, the following screen will get displayed:

```

RESET PUMP TIME?
P1: N   P2: N   P3: N/A
P4: N/A P5: N/A P6: N/A
OK N (Y/N)

```

To confirm all the selections made, press **YES/7** key and then press **ENTER** key. The screen will go back to the **PUMP SET UP MENU** display.

Pressing the **NO/0** key and then **ENTER** key at the **PUMP SET UP** screen will take the display back to the **MAIN SET UP** screen.

4.10.2 System set up

Paths: Status Screens / Set up(3)

Press the **SETUP/3** key at the Main Set Up menu screen. Then press the **ENTER** key.

The first screen will get displayed as shown below:

```

< SELECTION: # >
1 = STAGE/DESTAGE
2 = VFD
3 = EXERCISE  0 = EXIT

```

Press the **NEXT/(▶)** key to go to the next screen. The display now shows:

```

< SELECTION: # >
4 = ALTERNATION  5=PID
6 = RESET TOTALS
7 = DATE, TIME  0 = EXIT

```

Press the **NEXT/(▶)** key to go to the next screen. The display now shows:

< SELECTION: # >
 8 = PASSWORD 0 = EXIT
 9 = I/O SETUP
 10 = COMMUNICATIONS

Press the NEXT/(▶) key to go to the next screen. The display now shows:

< SELECTION: # >
 11 = SPECIAL FUNCTIONS
 12 = SAVE/LOAD
 13 = DISPLAY 0 = EXIT

Pressing the NEXT/(▶) key again will take the screen back to the first screen.

Use the appropriate numeric key to select the desired menu, then press the ENTER key. A detailed description of each menu follows. For example, to select the STAGE/DESTAGE menu, press the PV/1 key and then press the ENTER key.

4.10.3 Stage/ destage menu

Paths: Status Screens / Set up(3) / System(3) / StageDestage(1)

The first screen has been displayed below:

< SELECTION: # >
 1 = PV STAGE 0=EXIT
 2 = PV DESTAGE
 3 = EOC STAGE

Press the NEXT/(▶) key to go to the next screen.

The display now shows:

< SELECTION: # >
 4=EOC DESTAGE 0=EXIT
 5=FLOW DESTAGE
 6=POWER LIMIT STAGE

By pressing the appropriate numeric key and ENTER key, the setup can be completed.

See the following table for all STAGE/DESTAGE menu items.

STAGE/DESTAGE SETUP MENU ITEMS				
Menu Item	Variable	Default	Range	Field Value
PV Stage	Stg Spd: ##%	95	0-100	
	The maximum speed at which the lead pump will operate prior to starting a lag pump, %.			
	Stg Proof Timer: ### s	30	0-999	
	Proof timer prior to starting lag pump, seconds.			
	Stab Timer: ###s	60	0-999	
	Staging stabilization time, delay prior to calculating destage value, seconds.			

STAGE/DESTAGE SETUP MENU ITEMS (continued)				
Menu Item	Variable	Default	Range	Field Value
PV Destage	Destage: ###%	85	0-100	
	Enter the percentage of the stabilized speed at which the lag pump will stop, %.			
	Destg Pr Timer: ### s	30	0-999	
	Proof timer prior to stopping lag pump, seconds.			
EOC Stage (Flow meter required)	HD Spd: ### %	50	0-100	
	The lowest speed at which parallel pumps will operate prior to destaging the lag pump, %. It must be greater or equal to minimum frequency.			
	HD Pr Tm: ### s	30	0-999	
	The proof timer prior to destaging the lag pump when operating below the HD speed, seconds.			
EOC Stage (Flow meter required)	Pump Max Flow: #####	0	0-65, 535	
	The maximum allowable flow in GPM prior to starting a lag pump. A value of 0 disables this function.			
EOC Destage (Flow meter required)	Stg Proof Tm: ###s	30	0-999	
	Proof timer prior to end of curve staging, seconds.			
Flow DeStage	Destage Flow: ### %	45	0-100	
	Enter the percent of stabilized flow at which the lag pump is destaged, %.			
	Destage Pr TM: ###s	30	0-999	
Flow DeStage	Proof timer prior to destaging lag pump, seconds.			
	Flow Destage: #####Gpm	0	0-65, 535	
	The total flow above which the lag pump will be forced to destage. A value of "0" disables this function			
Power Limit Stage	De-Stage Pr Tm: ###s	30	0-999	
	Proof timer prior to Flow destaging lag pump in seconds			
	Force Destg Tmr: ###m	0	0-999	
Power Limit Stage	The time after which the lag pump will be forced to destage. A value of "0" disables this function			
	Enable Power Stage Limit \$ (Y/N)	N	Y/N	
	Exit: \$(Y/N)			

4.10.4 VFD menu

Paths: Status Screens / Set up(3) / System(3) / VFD(2)

The first screen has been displayed below:

<Selection:# >

1 = VFD Setup

2 = VFD Set Parameter

3 = VFD Read Parameter

Press the NEXT (▶) key to go to the next screen.

The display now shows:

<Selection: # >

4 = All SYS SEN Fail

Use the appropriate numeric key to select the desired menu, then press the ENTER key. See the following table for all VFD menu items.

VFD Menu Items				
Menu Item	Variable	Default	Range	Field Value
VFD Setup	Accel Tm: ## Drive acceleration time in seconds from zero to maximum frequency ramp	5	0-1800	
	Decel Tm: ## Drive acceleration time in seconds from maximum to zero to maximum frequency ramp	5	0-1800	
	Freq Max : ## Enter the maximum limit for the drive output frequency	60	0-60	
	Freq Min : Enter the minimum limit for the drive output frequency	30		
VFD Set Parameter	VFD: # The VFD number in which the parameter needs to be set.	0	0-65, 535	
	ADDRESS: Enter the parameter code from the parameter list available in the ABB user's manual supplied.			
	RESOLUTION: # Enter the value of parameter "Resolution" from the parameter list available in the ABB user's manual supplied.			
	VALUE: Enter the desired parameter value.			
VFD Read Parameter	VFD: # The VFD number from which the parameter needs to be read.	0	0-65, 535	
	ADDRESS: Enter the parameter code from the parameter list available in the ABB user's manual supplied.			
	RESOLUTION: # Enter the resolution from the parameter list available in the ABB user's manual supplied.			
	OFFSET: Enter the lower limit of the parameter "Range" from the parameter list available in the ABB user's manual supplied.			
	READ: Press YES/7 key and ENTER key to read the parameter values			
All Sys Sen Fail	PUMP SPEED: Enter the % speed for the drive(s) to operate at in the event that all system sensor fail.	100	0-100	
	NO OF PUMP RUN: Enter the number of pumps that should operate at the above speed in the event that all system sensor fail.	1	1-6	

Note:

1. Use the (▲) and (▼) keys to select the appropriate resolution values
2. Use the Next/(▶) key and Prev/(◀) key to select the desired sign(+ or -) for VALUE and OFFSET variables

4.10.5 Exercise menu

Paths: Status Screens / Set up(3) / System(3) / Exercise(3)

See the following table for all EXERCISE menu items.

Exercise Menu Items				
Menu Item	Variable	Default	Range	Field Value
EXERCISE	Period : #Hrs Amount of time between automatic exercising of the pumps, in seconds. A value of 0 disables pump exercising	0	0-999	
	Duration : ###s Amount of time pumps will be exercised, all pumps which have not run in the last period will be exercised simultaneously	0	0-999	

Pump exercising will ensure that no pumps go for long periods of time without running. Note that automatic alternation can also provide this functionality. Pump exercising will only occur when the system is started and in automatic operation. All pumps which need exercising will exercise on startup.

4.10.6 Alternation menu

Paths: Status Screens / Set up(3) / System(3) / Alternation(4)

The following ALTERNATION menu options are available:

4.10.7 Timed auto alternation

See the following table for TIMED AUTO ALTERNATION menu items.

Timed Auto Alternation Menu Items				
Menu Item	Variable	Default	Range	Field Value
Timed Auto Alt	Period: #Hrs Time between pump alternations when using “Timed Auto Alternation”, in hours. A value of 0 will disable this function	168	0-999	
	Duration: ###s Amount of time that the running pumps will remain on during alternation, in seconds	10	0-99	

4.10.8 Scheduled auto alternation menu

See the following table for SCHEDULED AUTO ALTERNATION menu items.

Scheduled Auto Alternation Menu Items				
Menu Item	Variable	Default	Range	Field Value
Scheduled Auto Alt	Scheduled Alt: Pump alternates based on the “Period” selected - Daily: alternates daily based on the “Time”; Weekly: alternates weekly based on the “Day” and “Time”; Monthly: alternates monthly based on the “Day” and “Time”.	0	0-3	

Note: At any time, only one of the 3 period based variables can be enabled.

4.10.9 Daily alternation

The Daily Alternation screen is displayed below:

Daily

Alt. Time: HH:MM

Enable: \$ (Y/N)

OK? \$(Y/N)

To edit the alternation time, press the **NO/0** key and **ENTER** key. Modify the values as desired.

Enter the Alternation Time in 24Hr format (range being 0:00-23:59) at which pumps will alternate daily. Press **YES/7** key to enable Daily alternation. Press the **YES/7** key again to confirm the selection.

4.10.10 Weekly alternation

The Weekly Alternation screen is displayed below:

Alt. Day of week: #

1=Mon...7=Sun

Time HH:MM (0-23)

Enable: \$(Y/N)

OK? \$(Y/N)

To edit the displayed values, press the **NO/0** key and **ENTER** key. Modify the values as desired.

Enter the Alternation Day of Week (1= Monday.....7=Sunday) on which the pumps will be alternated.

Enter the Alternation Time in 24Hr format (range being 0:00-23:59).

Press **YES/7** key to enable Monthly alternation. Press the **YES/7** key again to confirm the selection.

4.10.11 Monthly alternation

The Monthly Alternation screen is displayed below:

Alt. Day of Month: #

(1-31)

Time HH:MM (0-23)

Enable: \$(Y/N) OK? \$(Y/N)

To edit the displayed values, press the **NO/0** key and **ENTER** key. Modify the values as desired.

Enter the Alternation Day of Month (1, 2, 3, 4....31 etc.) on which the pumps will be alternated.

Enter the Alternation Time in 24Hr format (range being 0:00-23:59).

Press **YES/7** key to enable Monthly alternation. Press the **YES/7** key again to confirm the selection.

If 29,30 or 31 is entered as the day, the sequence will automatically alternate on the last day of the month.

Note:

In case Timed Auto Alt is in enabled state and Scheduled Auto Alt also gets enabled, Timed Auto Alt will get disabled and a warning message "Timed Alteration will be disabled" will be displayed on the screen. Press **CLEAR** key to go back to the **ALTERNATION** menu.

4.10.12 Alternation basis

See the following table for ALTERNATION BASIS menu items.

Alternation Basis Menu Items				
Menu Item	Variable	Default	Range	Field Value
Alternation Basis	1 = Pump Sequence (The next pump in sequence will become the lead pump after alternation) 2 = Pump Run Time (The pump with the lowest run time will become the lead pump after alternation)	1	1-2	

4.10.13 PID menu

Paths: Status Screens / Set up(3) / System(3) / PID(5)

See the following table for all PID menu items.

PID Menu Items				
Menu Item	Variable	Default	Range	Field Value
PID	PID-P ### Enter the desired proportional value.	300	0-999	
	PID-I ### Enter the desired integral value.	1	0-999	
	PID-D ### Enter the desired derivative value.	15	0-999	
	SP Deviation ### Enter the value for the number of PV units at which a dead band will be created around the setpoint. The PID will be modified within the dead band per the index setting below.	0	0-999	
	Index ### Enter a value to buffer the response of the PID while operating in the dead band defined above. Index = 1 (no impact) Index = 999 (maximum buffer.)	0	0-999	
	Start Up ## Start up delay in seconds	5	0-60	

4.10.14 Reset totals menu

Paths: Status Screens / Set up(3) / System(3) / Reset Totals(6)

See the following table for all RESET TOTALS menu items

Reset Totals Menu Items				
Menu Item	Variable	Default	Range	Field Value
RESET TOTALS	RESET TOTAL KW-HRS \$ Press YES/7 key and ENTER key to reset the total KW-HRS	N	Y or N	
	RESET TOTAL FLOW \$ Press YES/7 key and ENTER key to reset the total Flow	N	Y or N	

4.10.15 Date, time alternation

Paths: Status Screens / Set up(3) / System(3) / Date, Time(7)

See the following table for all DATE, TIME menu items

Date, time Menu Items				
Menu Item	Variable	Default	Range	Field Value
Date/Time	MM Enter the current month using both digits, example Jan. should be entered as 01.			
	DD Enter the current date using both digits, example the 6th should be entered as 06.			
	YYYY Enter the current year using all 4 digits.			
	HH Enter the hours using the 24 hour format, example 9:00 p.m. should be entered as 21.			
	MM Enter the minutes using both digits.			
	Display 24 Hour Fmt: ? (Y/N) Press YES/7 key and ENTER key to display the time in the 24 hour format. Press NO/0 key and ENTER key to display the time in AM/PM format.	N	Y or N	
	Daylite Savings Tm: ?(Y/N) Press YES/7 key and ENTER key for automatic set back during daylight saving time. Press NO/0 key and ENTER key to disable the automatic set back during daylight savings time	N	Y or N	

4.10.16 Password menu

Paths: Status Screens / Set up(3) / System(3) / Password(8)

See the following table for all PASSWORD menu items

Password Menu Items				
Menu Item	Variable	Default	Range	Field Value
Password	ENABLE PASSWORD TO SETUP MENU: ? Press YES/7 key and ENTER key for password protection of the entire setup menu. If the above is set to YES, the user will be prompted to input a password prior to entering the Setup Menu. Upon exiting the above screen, the user will be prompted to define and confirm a new password.	N	Y or N	
	ENABLE PASSWORD TO SET POINT MENU: ? Press YES/7 key and ENTER key for password protection of the entire set point menu.	N	Y or N	
New Password	ENTER NEW PASSWORD > _____< If either of the above are set to yes this screen prompts the user to define the password.	None	0-999999	

Password Menu Items (continued)				
Menu Item	Variable	Default	Range	Field Value
Verify	VERIFY THE PASSWORD PASSWD >_ _ _ _ _ < After entering data in password definition screen this screen requires the user to confirm the requested password. If the confirmed number does not agree with the first number the Enter New Password screen is repeated to allow the user to get both input screens to agree.			

4.10.17 I/O setup menu

Paths: Status Screens / Set up(3) / System(3) / IO Setup(9)

See the following table for all I/O Setup menu items.

NOTE: The total available number of I/O to be configured depends on the system setup. Complete all previous setup screens, specifically pumps and sensors prior to completing the following.

I/O Setup Menu Items				
Menu Item	Variable	Default	Range	Field Value
DI	Opt. DI #### Enter the input to be configured as it appears on the terminal number.	N/A	0-999	
	Avail: ## This screen can not be modified. It is here to advise the user of how many digital inputs can be customized	N/A	0-99	
	* Code: ### Enter the code to define the desired functionality of the input. Valid codes are defined in the Appendix of this manual.	0	0-255	
DO	Total Avail. DO = # This screen can not be modified. It is here to advise the user of how many digital outputs can be customized	N/A	0-99	
	* DO No: #### Enter the output to be configured as it appears on the terminal number.	N/A	0-999	
	* Code: ### Enter the code to define the desired functionality of the output. Valid codes are defined in the Appendix of this manual.	0	0-255	
AO	Total Avail. AO = # This screen can not be modified. It is here to advise the user of how many analog outputs can be customized	N/A	0-99	
	* Code: ### Enter the code to define the desired functionality of the output. Valid codes are defined in the Appendix of this manual.	0	0-255	

NOTE: If a programming error happens, an error message is displayed. An error may be due to reprogramming an input that is currently used by the system or inputting an undefined code number.

4.10.18 Communication menu

Paths: Status Screens / Set up(3) / System(3) / Communication(10)

See the following table for all COMMUNICATION menu items.

Communication Menu Items				
Menu Item	Variable	Default	Range	Field Value
SELECTION	SELECTION: # Select the software protocol to drive the communications on the optional RS-485 port. 1 = BACnet, 2 = JC Metasys, 3 = MODBUS, 0 = EXIT	0	1-3	

4.10.19 BACnet MS/TP

The BACnet MS/TP screen is displayed below:

BACnet MS/TP

38400, 8, 1, 0, N

MAC: ## Inst= ###

AI Ovr: \$OK: \$(Y/N)

The first line confirms setup for the BACnet protocol. The second line defines the 38400 bps baud rate, 8 bit data packets, 1 stop bit, 0 start bit and no parity. The third line requires user input. Obtain the node number from the manufacturer that supplied the device that will communicate with the TechnoForce Controller.

See following table for all BACNET MS/TP menu items.

BACnet MS/TP Menu Items				
Menu Item	Variable	Default	Range	Field Value
BACNET MSTP	Baud: ##### The baud rate is user adjustable parameter	38400	9600, 19200, 38400	
	MAC: ### The MAC address or node number should be supplied by the BMS.	2	1-255	
	Inst: ### Unique instance numbers should be assigned for every device on a BACnet network.	100	0-9999	
	AI Ovr: \$ Select "Y" to override analog inputs through the communications port.	N	Y/N	

4.10.20 JC Metasys N2

The JC Metasys N2 screen is displayed below:

JC Metasys N2

9600, 8, 1, 1, N, VND

Node: # AI Ovr: \$

OK: \$(Y/N)

The first line confirms setup for the Johnson Controls N2 protocol. The second line defines the 9600 bps baud rate, 8 bit data packets, 1 stop bit, 1 start bit and no parity. The third line requires user input. Obtain the node number from the manufacturer that supplied the device that will communicate with the TechnoForce Controller.

See following table for all JC METASYS N2 menu items.

JC Metasys N2 Menu Items				
Menu Item	Variable	Default	Range	Field Value
JC Metasys N2	Node: ### The node number should be supplied by the BMS.	10	0-255	
	AI Ovr = \$ Select "Y" to override analog inputs through the communications port.	N	Y/N	

4.10.21 Modbus

The MODBUS screen is displayed below:

Modbus

9600, 8, 1, 1, N RTU

Node: # AI Ovr: \$

OK: \$(Y/N)

The first line confirms setup for Modbus protocol. The second line defines the 9600 bps baud rate, 1 stop bit, 1 start bits, and no parity. The third line requires user input. Obtain the node number from the manufacturer that supplied the device that will communicate with the Controller.

See following table for all MODBUS menu items.

Modbus Menu Items				
Menu Item	Variable	Default	Range	Field Value
Modbus	Baud: #### The baud rate is user adjustable parameter	9600	9600, 19200, 38400	
	Node: ### The node number should be supplied by the BMS communications port.	10	0-255	
	AI Ovr: \$ Select "Y" to override analog inputs through the communications port.	N	Y/N	

4.10.22 Analog Input Override

If "Y" was entered for "AI Ovr" in any of the communication setup screens above, the following screen will be automatically displayed:

AI Override

AI1: \$ AI2: \$

AI3: \$ AI4: \$

OK \$(Y/N)

Enter a "Y" next to each analog input type that will be overridden through the communications port.

4.10.23 Special function menu

Paths: Status Screens / Set up(3) / System(3) / Special Function(11)

The Special Function menu has been displayed below:

Function Not

Available

Exit \$ (Y/N)

There are no Special Functions required; hence no special function menu is available.

4.10.24 Save/load menu

Paths: Status Screens / Set up(3) / System(3) / SaveLoad(12)

The Save/Load menu has been displayed below:

Selection: # 0=Exit

1=Save to Flash

2=Load from Flash

3=Load Default

Use the appropriate numeric key to select the appropriate menu desired, press the ENTER key. A detailed description of each menu follows.

4.10.25 Save to flash

The Save To Flash screen is displayed below:

SAVE TO FLASH

Previously Saved Data

Will be overwritten!

PROCEED: \$(Y/N)

Press YES and ENTER to save all of the user setup to the flash memory. Saving to flash will overwrite any data that was previously saved. Saving to flash memory will save all setup information to the Flash PROM chip within the controller

A load from flash will have to be performed to recover this saved data. See the following section.

4.10.26 Load from flash

The Load From Flash screen is displayed below:

LOAD FROM FLASH

All Settings will be

Overwritten!

PROCEED: \$ (Y/N)

Press YES/7 and ENTER to overwrite all of the current user setup information with the data that was previously saved to the flash memory. Loading from flash memory will load all setup information that was saved to the Flash PROM chip within the controller.

4.10.27 Load default

The Load Default screen is displayed below:

LOAD DEFAULTS

Settings will be

Overwritten by the

defaults! PROCEED:\$(Y/N)

Press YES/7 and ENTER to overwrite all of the current user setup information with the factory defaults.

4.10.28 Display menu

Paths: Status Screens / Set up(3) / System(3) / Display(13)

The DISPLAY menu has been shown below:

Delay to Display

Status #

Status Line Refresh

Rate \$\$\$ Exit \$(Y/N)

To edit the values, press the NO/0 key and ENTER key. Modify the values as desired.

See following table for all **DISPLAY** menu items.

Display Menu Items				
Menu Item	Variable	Default	Range	Field Value
Display	Delay to Display Status: ## The time in minutes after which the fourth line at initial system status screen will start showing system status if any key has not been pressed	3	0-99	
	Status Line Refresh Rate: ## The time in seconds prior to change the next system status line	10	0-99	

4.10.29 Test set up

Paths: Status Screens / Set up(3) / Test(4)

The TEST menu screen gets displayed:

Test Selection: #

1=DI 4=AO 7=Disp

2=DO 5=LED 8=Comm

3=AI 6=Key 9=VFD Comm

Press the numeric key corresponding to the desired sub-menu, and then press the **ENTER** key.

4.10.30 Digital input test

Paths: Status Screens / Set up(3) / Test(4) / DI(1)

The Digital Input Test screen is displayed below:

Digital Inputs

```
1 2 3 4 5 6
# # # # # #
```

Press Clear to Exit

The 0 below each corresponding input will change to a 1 upon receiving a 24VDC digital input on that channel. Press **CLEAR** key to exit the test.

4.10.31 Digital output test

Paths: Status Screens / Set up(3) / Test(4) / DO(2)

The Digital Output Test screen is displayed below:

Digital Outputs

```
1 2
# #
```

Enter DO# # (0=Exit)

Press the numeric key corresponding to the digital output for which the state is to be changed, and then press **ENTER** to change it. Pressing **ENTER** multiple times will toggle between 0 and 1. A 1 indicates that the corresponding relay is closed. When the relay is closed, the corresponding LED on the digital output module will be lit. Press 0 and **ENTER** to exit the test.

Note: Any device connected to the relay will be energized.

4.10.32 Analog input test

Paths: Status Screens / Set up(3) / Test(4) / AI(3)

The Analog Input Test screen is displayed below:

Analog Inputs

1=###% 3=###%

2=###% 4=###%

The signal received on the corresponding analog input channel will be indicated in percent next to each input. 4mA = 0%, and 20mA = 100%. Analog inputs 1-4 are 4-20mA inputs. Press CLEAR key to exit the test.

4.10.33 Analog output test

Paths: Status Screens / Set up(3) / Test(4) / AO(4)

The Analog Output Test screen is displayed below:

Analog Output Test

AO1=###%

OK: \$(Y/N)

The signal sent through the corresponding analog output channel will be indicated in percent next to each input. 4mA = 0%, and 20mA = 100%. Analog outputs 1-4 are 4-20mA outputs. Press CLEAR key to exit the test.

4.10.34 LED test

Paths: Status Screens / Set up(3) / Test(4) / LED(5)

The LED test screen is displayed below:

LED Test

*** SOLID ***

*** OFF ***

*** FLASHING ***

All of the LED's on the keypad will turn on, off, and then flash. The current status will be displayed on the screen. The LED test is self terminating.

4.10.35 Key test

Paths: Status Screens / Set up(3) / Test(4) / Key(6)

The KEY test screen is displayed below:

Key Test

Press a key to test

Press clear to exit

Press any key except for the CLEAR key, and the display will confirm that the key is working by displaying the key name. Press CLEAR key to exit.

4.10.36 Display test

Paths: Status Screens / Set up(3) / Test(4) / Display(7)

The DISPLAY test screen is shown below:

Press Clear To Exit

< 1 2 3 4 5 6 7 8 9

< 1 2 3 4 5 6 7 8 9

< 1 2 3 4 5 6 7 8 9

The display will show all black characters. Press CLEAR key to exit the test.

4.10.37 Communication test

Paths: Status Screens / Set up(3) / Test(4) / Comm(8)

The COMMUNICATION test screen is shown below:

Communication Test

Read: ####

Write: ####

Press Clear to Exit

If the controller is communicating properly with the building automation system, both numbers will continue increasing in value. For Modbus protocol, the read and write numbers should be equal and increasing with every poll. For BACnet, both numbers should be increasing, but they will not be equal. The write value will increase even when not connected.

For the JC Metasys N2 protocol, both numbers should be increasing but may not be equal. If both numbers are not increasing in value, the controller is not communicating properly. Check the wiring at the terminal blocks. See section 4.10.18 for more information on communications setup. Press CLEAR to exit this test.

4.10.38 VFD comm

Paths: Status Screens / Set up(3) / Test(4) / VFD Comm(9)

The VFDCOMMUNICATION test screen is shown below:

VFD Comm Test

VFD Number: # (Same as Pump number)

Press Clear To Exit

Input the VFD number using the desired numeric keys for which the VFD Communication test needs to be performed and then press the ENTER key. The following screen gets displayed:

VFD # (Same as Pump number)

Write: #####

Read: #####

Press Clear To Exit

If the controller is communicating properly with the VFD selected, both numbers will continue increasing in value.

4.10.39 Alarm/events set up

Paths: Status Screens / Set up(3)

Press the LOG/5 key at the Main Set Up menu display. Then press the ENTER key.

The first screen of Alarm/Events menu gets displayed:

< Selection: # 0=Exit >

1=Pump Failure

2=Low System

3=High System

Press the NEXT/(▶) key to go to the next screen. The display now shows:

< Selection: # 0=Exit >

4=Low Suction

5=High Suction

6=NFS

Press the NEXT/(▶) key to go to the next screen. The display now shows:

< Selection: # 0=Exit >

7=Low Level

8=High Level

9=VFD/Comm

Pressing the NEXT/(▶) key again will take the screen back to the first screen.

Use the appropriate numeric key to select the setup menu desired, then press the ENTER key. A detailed description of each menu follows. For example, to select the Pump Failure menu, press the PV/1 key and then press the ENTER key.

4.10.40 Pump failure

Paths: Status Screens / Set up(3) / AlrmEvt(5) / Pump Failure(1)

The Pump Failure menu is displayed below:

Pump Failure

DP Proof Time: ###s

OK? \$ (Y/N)

See following table for all PUMP FAILURE menu items.

Pump Failure Menu Items				
Menu Item	Variable	Default	Range	Field Value
Pump Failure	DP Proof Time: ###s Proof timer prior to setting a pump fail alarm after receiving a continuous high signal from a DP switch, in seconds. A value of 0 will disable this alarm.	10	0-999	

4.10.41 Low system pressure

Paths: Status Screens / Set up(3) / AlrmEvt(5) / Low System(2)

The Low System Pressure menu is displayed below:

Low Sys Press: ##PSI

Low Sys Pr Tm: ###s

Alarm: \$ Stop Pumps: \$

OK? \$ (Y/N)

See following table for all LOW SYSTEM PRESSURE menu items.

Low System Pressure Menu Items				
Menu Item	Variable	Default	Range	Field Value
Low System Pressure	Low Sys Press: ### PSI The pressure below which an alarm or event will be set, in PSI	32	0-999	
	Low Sys PrTm: ###s The proof timer prior to setting an alarm or event, in seconds. A value of 0 disables this alarm or event.	0	0-999	
	Alarm: \$ Set this value to “Y” to consider low system pressure an alarm, or set it to “N” to consider it an event.	N	Y/N	
	Stop Pumps: \$ Set this value to “Y” to stop all pumps in the event of a low pressure alarm or event. Set it to “N” to continue operation normally during this alarm or event.	N	Y/N	

4.10.42 High system pressure

Paths: Status Screens / Set up(3) / AlrmEvt(5) / High System(3)

The High System Pressure menu is displayed below:

High Sys Press: ##

High Sys Pr Tm: ###s

OK? \$ (Y/N)

See following table for all HIGH SYSTEM PRESSURE menu items.

High System Pressure Menu Items				
Menu Item	Variable	Default	Range	Field Value
High System Pressure	High Sys Press: ### PSI The pressure above which an alarm will be set, in PSI.	112	0-999	
	High Sys Pr Tm: ###s The proof timer prior to setting an alarm, in seconds, A value of 0 will disable this alarm.	20	0-999	

4.10.43 Low suction pressure

Paths: Status Screens / Set up(3) / AlrmEvt(5) / Low Suction(4)

The Low Suction Pressure menu is displayed below:

Low Suct. Press: ##

Pr Tm: ###s Alarm: \$

Auto Rst: \$ Source: \$(AI/DI)

Reset PSI: ## OK: \$ (Y/N)

See following table for all LOW SUCTION PRESSURE menu items.

Low Suction Pressure Menu Items				
Menu Item	Variable	Default	Range	Field Value
Low Suction Pressure	Low Suct Press: ### The pressure below which an alarm or event will be set for the analog input method	5	0-999	
	Pr Tm: ###s The proof timer prior to setting an alarm or event. A value of 0 will disable this alarm. Used for analog input and pressure switch methods.	20	0-999	
	Auto Reset: \$ Select “Y” to allow this alarm or event to be automatically reset. The analog input method resets using the “Reset PSI”. The pressure switch method resets on a low signal on the low suction pressure switch digital input.	Y	Y/N	
	Reset PSI: ### The pressure at which the controller will automatically reset when the suction pressure rises above it. Used for the analog input method only.	10	0-999	
	Alarm: \$ Set this value to “Y” to consider low suction pressure an alarm, or set it to “N” to consider it an event. Used for analog input and pressure switch methods.	N	Y/N	
	Source: \$\$ Select the desired value depending on the source. Use the (▲) Up and (▼) Down arrow keys to change the source value	AI	AI/DI	

4.10.44 High suction pressure

Paths: Status Screens / Set up(3) / AlrmEvt(5) / High Suction(5)

The High Suction Pressure menu is displayed below:

High Suct. Press: ##

High Suct Pr Tm: ##s Alarm: \$

Alarm: \$ Source: \$(AI/DI)

Reset Press: ## OK: \$ (Y/N)

See following table for all HIGH SUCTION PRESSURE menu items.

High Suction Pressure Menu Items				
Menu Item	Variable	Default	Range	Field Value
High Suction Pressure	High Suct Press: ### The pressure above which an alarm or event will be set for analog input method, in PSI.	75	0-999	
	High Suct Pr Tm: ###s The proof timer prior to setting an alarm or event, in seconds. A value of 0 disables this alarm.	0	0-999	
	Reset PSI: ### The controller will automatically reset when the suction pressure falls below the "Reset PSI". Used for analog input method only.	67	0-999	
	Alarm: \$ Set this value to "Y" to consider high suction pressure an alarm, or set it to "N" to consider it an event.	N	Y/N	
	Source: \$\$ Select the desired value depending on the source. Use the (▲) Up and (▼) Down arrow keys to change the source value	AI	AI/DI	

4.10.45 No flow shut down

Paths: Status Screens / Set up(3) / AlrmEvt(5) / NFSD(6)

The No Flow Shut Down menu is displayed below:

NFSD Tst Pr Tmr ###s

Min Spd . Pr Tmr ##s

Restart PSI Drop ##

Min Run ##m OK \$(Y/N)

See following table for all NO FLOW SHUT DOWN menu items.

No Flow Shut Down Menu Items				
Menu Item	Variable	Default	Range	Field Value
No Flow Shut Down	NFSD Tst Pr. Tmr: #s The No Flow Shut Down test proof timer is the amount of time, in seconds, the controller will run the system while the PV is greater then SP. A value of 0 will disable this alarm.	10	0-999	
	Min Spd Pr. Tmr #s The Minimum Speed Proof Timer is the amount of time, in seconds, the system will run at minimum speed before shutting off.	30	0-999	
	Restart PSI Drop ## The Restart PSI Drop is the value the PV variable needs to be less then the SP in order to restart the system.	10	0-999	
	Min Run: ##m Minimum Run is the minimum amount of time, in minutes, that the system will run once it shuts down from a no flow condition and restarts.	1	0-999	

4.10.46 Low level

Paths: Status Screens / Set up(3) / AlrmEvt(5) / LowLevel(7)

The Low Level menu is displayed below:

Low Level Time: ###s

Stop Pumps?: \$(Y/N)

Auto Reset?: \$(Y/N)

OK? \$ (Y/N)

See following table for all LOW LEVEL menu items.

Low level Menu Items				
Menu Item	Variable	Default	Range	Field Value
Low Level	Low Level Time: ###s The proof time, in seconds prior to setting a low level EVENT, see section 4.10.17 to set up the low level digital input. A value of 0 in Low Level Time variable disables the Low Level function.	0	0-999	
	Stop Pumps?: \$(Y/N) Select “Y” to allow pumps in this event to be automatically stopped.	N	Y/N	
	Auto Reset?: \$(Y/N) Select “Y” to allow this event to be automatically reset.	N	Y/N	

4.10.47 High level

Paths: Status Screens / Set up(3) / AlrmEvt(5) / High Level(8)

The High Level menu is displayed below:

High Level Time: ###s

Stop Pumps?: \$(Y/N)

Auto Reset?: \$(Y/N)

OK? \$ (Y/N)

See following table for all HIGH LEVEL menu items.

High level Menu Items				
Menu Item	Variable	Default	Range	Field Value
High Level	High Level Time: ###s The proof time, in seconds prior to setting a high level event, see section 4.10.17 to set up the high level digital input. A value of 0 in High Level Time variable disables the High Level function.	0	0-999	
	Stop Pumps?: \$(Y/N) Select "Y" to allow pumps in this event to be automatically stopped.	N	Y/N	
	Auto Reset?: \$(Y/N) Select "Y" to allow this event to be automatically reset.	N	Y/N	

4.10.48 VFD/Comm Failure

Paths: Status Screens / Set up(3) / AlrmEvt(5) / VFD Comm(9)

The VFD/Comm Failure menu is displayed below:

VFD Proof Time: ###s

VFD COMM Pr Tm: ###s

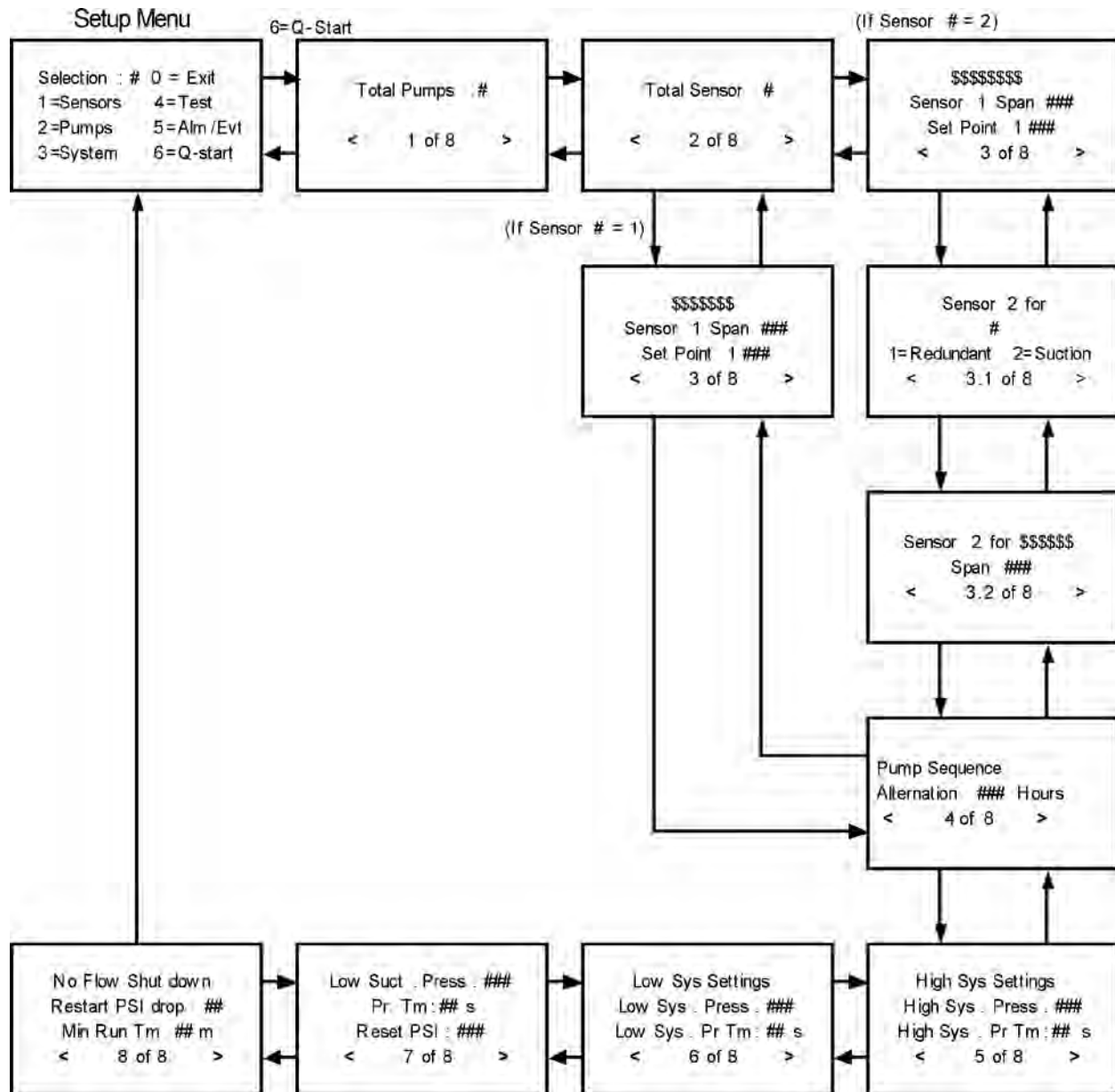
OK: \$(Y/N)

See following table for all VFD/COMM FAILURE menu items.

VFD/Comm Failure Menu Items				
Menu Item	Variable	Default	Range	Field Value
VFD Comm Failure	VFD Proof Time: ###s The proof timer prior to setting the VFD fail alarm, in seconds.	30	30-999	
	VFD COMM Pr Tm: ###s The proof timer prior to setting the VFD communication fail alarm, in seconds.	30	30-999	

4.11 Q-Start Paths: Status Screens / Set up(3)

Press the QuickAccess/6 key at the Main Set Up menu display. Then press the ENTER key.



Q-Start will prompt the user for the parameters required to start up the system quickly. Some of these values will already be correct due to the factory setup that is done for each TechnoForce Pump Controller. Use PREV/(◀) and NEXT/(▶) to navigate through these screens. The new settings will come in effect only if all the screens have been navigated as shown in the flow chart above.

Note: Press Up (▲) and Down (▼) keys together to exit the Q-Start at any point of time. Exiting the Q-start intermittently before the last screen has been navigated, changes made under Q-Start will not come in effect.

5. Operation

5.1 Normal Scrolling Operation

Other screens may be viewed by scrolling from the TechnoForce Pump Controller screen shown below:

```
<TECHNOFORCE PUMP>
      CONTROLLER
MM/DD/YY HH:MM:SS A/P
STAT1  STAT2  STAT3
```

The STAT1 portion of the display indicates the current start/stop status of the system.

The STAT2 portion of the display indicates the current auto/manual mode of operation.

The following table indicates all possible options:

STAT2	Description	Sections for Additional Information
AUTO	Pump Controlled by Controller	5.2
MANUAL	Pumps Controlled by User	5.4

The STAT3 portion of the display indicates the current alarm/event status. If **NORMAL** is displayed there are no alarms. If **ALARM** or **EVENT** is displayed there are alarms/events that may prevent normal operation, refer to Section 5.7 for additional information. In case of no flow shut down it displays *NFSD*.

Press the NEXT/ (▶) key. The display now shows:

```
<          PUMP STATUS          >
P1: RDY      P2: N/A      P3: N/A
P4: N/A      P5: N/A      P6: N/A
STAT1      STAT2      STAT3
```

Press the NEXT/ (▶) key. The display now shows:

```
<Seq 1-2          >
Sys = ###      SP = ###
Suc = ###      Spd = ###%
STAT1  STAT2  STAT3
```

Press the NEXT/ (▶) key. The display now shows:

```
<  Power (KW)      >
P1 :(.#. #) P2: (. #) P3 :(. #)
P4 :(N/A) P5: (N/A) P6 :(N/A)
STAT1  STAT2  STAT3
```

Press the NEXT/ (▶) key. The display now shows:

```
<  Current (A)      >
P1 :(.#. #) P2: (. #) P3 :(. #)
P4 :(N/A) P5: (N/A) P6 :(N/A)
STAT1  STAT2  STAT3
```

Press the NEXT/ (▶) key. The display now shows the following if the system is in **MANUAL** mode:

```
<          >
Manual Speed:    #%
STAT1  STAT2  STAT3
```

Press the NEXT/ (▶) key. The display now shows the following if any of the FLOW or PRESSURE transmitters have been set up:

```
<                                     >
Flow = $$
Pressure = $$
STAT1  STAT2  STAT3
```

Press the NEXT/ (▶) key. The display now returns back to the TechnoForce Pump Controller screen.

Note:

When system is showing any of the above screens and if any key is not pressed for “Delay to Display status” time, then the fourth line will start showing the system status.

5.2 Types Of Programs

There are two operational programs with the TechnoForce family of controls. Refer to the nameplate on the front of the controller to determine which program has been furnished.

No. Of Program	Description
CO	Two Pumps/Two VFDs
	Two 100% duty pumps and VFDs without staging.
DO	Up to 6 Pumps/VFDs
	All pumps may stage and run variable speed.

5.2.0 CO operation

Confirm the setup of the following items:

Section	Item	Value
4.10.1	Total # of pumps	2

5.2.1 Local automatic operation

With the JUMPER connected on Terminal 200 and +24V check that the LED indicators on the Operator Interface Panel (OIP) are as follows:

LED	Condition	Meaning
Start/Stop	Off	System is stopped. No pumps running.
Pump 1 On/Off	Flashing Green	Pump1 is enabled but not on.
Pump 2 On/Off	Flashing Green	Pump2 is enabled but not on.

Take note of the pump sequence. Only the first pump in the sequence will run in normal operation. The second pump is a standby and will run only if the duty fails. To change which pump is the duty pump press the ALT/4 key.

Press the START/STOP key. The Off LED will turn solid green. After a brief delay the duty pump LED will turn solid green indicating that it is running variable speed. It will then try to maintain setpoint by varying pump speed.

5.2.2 Remote automatic operation

With the Remote start/stop contact is connected on Terminal 200 and +24V, check that the LED indicators on the Operator Interface Panel (OIP) are as follows:

LED	Condition	Meaning
Start/Stop	Off	System is stopped. No pumps running.
Pump 1 On/Off	Flashing Green	Pump1 is enabled but not on.
Pump 2 On/Off	Flashing Green	Pump2 is enabled but not on.

If a pump is not running this means the start contact (from the energy management system or other source) is not closed and the controller has not been given a start signal.

Once operating in remote it is possible to stop operation (i.e., override the remote start command) by pressing the **START/STOP** key on the OIP.

5.2.3 DO operation

Confirm the setup of the following items:

Section	Item	Value
4.10.1	Total # of pumps	Up to 6
4.10.3	PV stage speed %	95%
4.10.3	EOC pump max. flow	Max. Pump Flow

5.2.4 Local automatic operation

With the JUMPER connected on Terminal 200 and +24V check that the LED indicators on the Operator Interface Panel (OIP) for two pumps are as follows:

LED	Condition	Meaning
Start/Stop	Off	System is stopped. No pumps running.
Pump 1 On/Off	Flashing Green	Pump1 is enabled but not on.
Pump 2 On/Off	Flashing Green	Pump2 is enabled but not on.

Take note of the pump sequence. Only the first pump in the sequence will run in normal operation. The second pump is a standby and will run only if the duty fails. To change which pump is the duty pump press the 4 key.

Press the **START/STOP** key. The Off LED will turn solid green and the message **START UP** will be displayed. After a start-up delay, the duty pump LED will turn solid green indicating that it is running variable speed. It will then try to maintain setpoint by varying pump speed. The lag pump will stage on if required.

5.2.5 Remote automatic operation

With the Remote start/stop contact is connected on Terminal 200 and +24V, check that the LED indicators on the Operator Interface Panel (OIP) are as follows:

LED	Condition	Meaning
Start/Stop	Off	System is stopped. No pumps running.
Pump 1 On/Off	Flashing Green	Pump1 is enabled but not on.
Pump 2 On/Off	Flashing Green	Pump2 is enabled but not on.

If a pump is not running this means the start contact (from the energy management system or other source) is not closed and the controller has not been given a start signal.

Once operating in remote it is possible to stop operation (i.e., override the remote start command) by pressing the **START/STOP** key on the OIP.

5.3 Pump Rotation

1. It will be necessary to operate all pumps in variable speed to check for proper rotation.
2. Place the TechnoForce into operation as described in previous sections.
3. Run each pump in auto noting rotation in each.
4. If rotation is wrong, exchange the wiring on two motor phases.

NOTE: Changing phase at VFD input does not change output phasing.



DANGER:

- High voltage 3 phase power can kill. Pumps can start automatically. Disconnect and lock-out power prior to servicing pumps. FAILURE TO FOLLOW THESE INSTRUCTIONS COULD RESULT IN SERIOUS PERSONAL INJURY, DEATH, AND/OR PROPERTY DAMAGE.

5.4 Hand Manual Operation

1. If system is running press the **START/STOP** key to stop the system. The solid green LED for start/stop will turn off and any running pumps will stop.
2. Press the **AUTO/MANUAL** key and the screen will display the following:

```

<                               >
Manual Speed:    #0%
STAT1  STAT2  STAT3
    
```

3. If the **PUMP LED** is not flashing green, enable a pump to run in manual by pressing the **PUMP 1** or **PUMP 2** key.
4. Press the **START/STOP** key to run the enabled pump(s) in manual. After a brief time delay the pump(s) starts, and the flashing green LED(s) for pump(s) will turn solid green.
5. Press the **UP (▲)** key to increase pump speed to a maximum of 100% of rated speed. Press the **DOWN (▼)** key to decrease the speed to 0% where the pump will run at the minimum speed configured in the VFD, typically 30 HZ.
6. Press the **START/STOP** key to stop the system. The running pump(s) will stop.

5.5 Setpoint Modification

To modify any of the setpoints for the transmitter configured as the system pressure, press the **SETPT/2** key. The following **SET POINT SELECTION** screen will be displayed:

```

Selection: #    0=Exit
1= Set Point
2= Schedule Set Point
3= Control Set Point
    
```

Use the appropriate numeric key to select the desired menu, then press the **ENTER** key. A detailed description of each menu follows. For example, to select the **SET POINT** menu, press the **PV/1** key and then press the **ENTER** key. The following menu will be displayed:

```

SP1= ##    SP2=##
SP3= ##    SP4=##
Exit: $ (Y/N)
    
```

If you agree with the current setpoint settings press the **YES/7** key followed by **ENTER**. If you would like to modify any of the setpoints press the **NO/0** key followed by **ENTER** at which point the setpoint in the upper left portion of the screen will begin flashing.

Press the numeric key to modify the setpoint and press **ENTER** to proceed to the next setpoint.

After modifying all of the set points, press the **YES/7** key to accept the values and return to the **SET POINT SELECTION** screen.

To select the **SCHEDULE SET POINT** menu, press the **SET PT/2** key and then press the **ENTER** key. The following menu will be displayed:

```
Set Point  1>
Mon – Fri
HH:MM - ##
HH:MM - ##  Exit: $
```

Two different set point values can be scheduled for Set Point 1 from Monday to Friday and similarly for Saturday and Sunday. Press the **NEXT/(▶)** key to schedule the set point values for Saturday and Sunday. The following menu will be displayed:

```
Set Point  1>
Sat – Sun
HH:MM - ##
HH:MM - ##  Exit: $
```

Press the **UP (▲)** and **DOWN (▼)** keys to navigate to other set points.

After scheduling all the set points, press the **YES/7** key to accept the values and return to the **SET POINT SELECTION** screen.

To select the **CONTROL SET POINT** menu, press the **SETUP/3** key and then press the **ENTER** key. The following menu will be displayed:

```
Control Selection: #
1 = Set Point
2 = Schedule Set Point
3 = Com Ovrđ      Exit $(Y/N)
```

The displayed **#** value indicates the current active method for set point. To change the active control method, press the **NO/0** key and then press the **ENTER** key.

The Control Selection field will start blinking. Change the current value by pressing desired numeric Keys and then press **ENTER** key to confirm. Press the **YES/7** key and **ENTER** key to accept the selection and return to the **SET POINT SELECTION** screen.

5.6 Process Variable Monitoring

To view the actual process variable signals that are being sent to the controller press the **PV/1** key.

The following will be displayed:

```
PV1 = #      SP1 = #
PV2 = #      SP2 = #
PV3 = #      SP3 = #
PV4 = #      SP4 = #
```

The **#** symbol will be replaced by the actual value of process variables and set points.

5.7 Alarms/Events

When the controller detects an alarm/event condition, the display will flash *ALARM/EVENT* in the lower right corner of the main screen.

The green LED on the **HELP** key will also flash during an alarm/event condition. Press the **HELP** key for additional information on the alarm(s)/event(s). If there are more than one alarm(s)/event(s), the alarm(s)/event(s) will be listed in order of occurrence.

To view possible causes for alarm/event, press the **HELP** key again after the alarm/event is displayed. Refer to table below for an overview of the possible alarm/event and their respective causes.

Press the **CLEAR** key to return to the main screen. After addressing the source of the alarm/event, press **RESET** to re-start the system and/or clear the alarm/event.

The controller logs alarm/event as they occur to aid in troubleshooting unobserved alarm/event. Refer to Section 6.14.0 for alarm/event logging information

Help Screen Alarm	Help/Help Screen Display	Detailed Description
VFD Failure	“Check communication wiring, and VFD display”	The controller is not receiving a closed run signal from VFD number X after it has been given a start command or communication failure or VFD fault
High Level	“Check setting of level switch”	Check for open or closed contacts, refer to wire diagram for proper connection.
High Suction	“Check setting of the HIGH SUCTION switch” or high suction settings in the ALARM/EVENTS set up	Check for open or closed contacts and high suction settings, refer to wire diagram for proper connection
High System	“Check system pressure – manual RESET required”	Check the pressure setting in the setup menu.
Low System	“Check system pressure”	Check the pressure setting in the setup menu.
Low Suction	“Check setting of the low suction switch” or low suction settings in the ALARM/EVENTS set up	Check for open or closed contacts and low suction settings, refer to wire diagram for proper connection
Low Level	“Check setting of level switch”	Check for open or closed contacts, refer to wire diagram for proper connection.
NFSD	“System will restart automatically when flow occurs”	Check the Reset PSI Drop value and the pressure sensor connections, refer to the wire diagram.
Pump Fail	“Check DP switch, impeller, coupler, motor”	The controller is receiving a closed signal from the differential pressure switch for pump number X after it has been given a start command
Sensor Fail	“Check wiring, piping, polarity, continuity”	The controller is not receiving the proper 4-20mA
Sensor Reading Drift	“Check wiring of both sensors, and compare the pressure reading of both sensors with pressure gauge ”	“Check wiring of both sensors, and compare the pressure reading of both sensors with pressure gauge ”

5.8 Quick Access

Using quick access function user can directly jump to the setup screen need to be setup. To use this function press **QUICK ACCESS/6** key from status screen. The display now shows.

Enter Page #####

Exit \$ (Y/N)

Press **NO/0** to edit the page number. Enter the screen number need to be access and press the **ENTER** key. It will lead to the setup screen entered. Refer the appendix for the quick access screen numbers.

6. Maintenance

6.1 Preface

The following is a description of the hardware, diagnostics, and corrective action to maintain a process being controlled by the Pump Controller.

NOTE: THE FOLLOWING SHOULD NOT BE INTERPRETED AS THE MAXIMUM CONFIGURATION OF THIS CONTROLLER, RATHER THIS DESCRIBES ITS APPLICATION AS A TECHNOFORCE PUMP CONTROLLER ONLY.

6.2 Technical Overview

The Pump Controller is a microprocessor based dedicated pump controller unique to and exclusively manufactured by ITT Bell & Gossett. All aspects of this unit are strictly proprietary to ITT Bell & Gossett.

The CPU is mounted to a rack which allows connection to the analog and digital input/output modules.

6.3 Digital Inputs

The controller has provision for digital inputs with an operating voltage of 24 VDC. This signal voltage must be obtained from the 24 VDC power supply mounted to the subpanel.

It is not recommended that other power sources be used without factory approval.

Customer connections are made directly to the terminals blocks wired to the digital input module.

6.4 Digital Outputs

The controller has provision for relay outputs to control 240V 50/60 HZ devices.

The relays are not removable. If defective, the digital output module must be returned to the factory for repair.

All relays operate as single pole single throw. Components are provided to reduce contact arc and extend electrical life.

Customer connections are made directly to the terminals blocks wired to the digital output module.

6.5 Analog Inputs

Analog inputs are provided for process variables and optional transmitters. All analog inputs operate at 4-20mA. They must be powered from 24 VDC power supply included with the controller

6.6 Memory

The logic is stored in a non-removable flashPROM chip which can only be updated from the RS-232 program port on the CPU. The user setup data is stored in flash memory. While the controller is powered up, the CPU controller provides the power to save the user values.

6.7 CPU

The CPU does not require any maintenance, and cannot be replaced as a field repair.

6.8 Power Supply

The power supply provides 24 VDC for all digital and analog signals as well as the CPU. It is specifically rated only for the controller and other loads should not be applied without factory approval.

The power supply is protected with 2.5 A fuses on the primary and 2 A fuse on the secondary circuits.



DANGER:

- Troubleshooting live control panels exposes personnel to hazardous voltages. Electrical troubleshooting must only be done by a qualified electrician. FAILURE TO FOLLOW THESE INSTRUCTIONS COULD RESULT IN SERIOUS PERSONAL INJURY, DEATH, AND/OR PROPERTY DAMAGE.
-

6.9 Protection

Analog inputs – the analog inputs provided on the TechnoForce Pump Controller must be wired according to the wiring diagram that shipped with the unit.

Protection – all analog inputs are protected from high voltage, crossed wiring, etc. A sustained fault will be limited to 20mA by the current limiting circuit.

Digital Inputs – as long as input power is derived from the integral 24VDC power supply they are protected.

Digital Outputs – each output shall not exceed the ratings on the digital output module.

6.10 Instruments and Their Use

With the diagnostics described herein extensive instruments are not required. However, the instruments used should be quality units to meet the following at a minimum.

Under no circumstances shall any instrument be used to test any on board components. Especially risky is an ohmmeter with battery voltage higher than TTL logic or applied with incorrect polarity.

6.10.0 AC/DC voltmeter

- Input impedance shall not be less than 10 MEGOHM.
- Accuracy - AC $\pm 2\%$ of Full Scale
- DC $\pm 3\%$ of Full Scale
- Rated circuit to ground voltage = 1000V.

6.10.1 Ohmmeter

- Accuracy $\pm 2\%$
- Overload protection voltage = 1000V.

6.10.2 Millimeter

- Accuracy $\pm 2\%$ of Full Scale

6.10.3 Signal generator (analyzer) – recommended

A. Beta calibrator Model 434 20mA signal analyzer.

B. Altek calibrator Model 334 4-20mA loop analyzer.

Either instrument may be purchased from a Local Process Control Distributor.

NOTE: If some other instrument is used it must float above ground, preferably battery powered.

6.11 Field Repair

6.11.0 General

Typical field repair should include: replacing fuses, replacing input/output modules and assuring connections are correct and secure.



DANGER:

- Troubleshooting live control panels exposes personnel to hazardous voltages. Electrical troubleshooting must only be done by a qualified electrician. **FAILURE TO FOLLOW THESE INSTRUCTIONS COULD RESULT IN SERIOUS PERSONAL INJURY, DEATH, AND/OR PROPERTY DAMAGE.**
-

6.12 Program updating

To update to a new version of the program the program must be downloaded through the RS-232 port on the CPU. This can be accomplished by one of the following means:

- 1) Downloaded by factory authorized service technician at the job site.
- 2) Replacing the CPU module with one that was pre-programmed at the factory.
- 3) Downloading the program from the factory to the CPU via factory supplied CD ROM.

Contact your Bell & Gossett representative for the preferred method of upgrading your software.

6.13 Troubleshooting

VFD FAILURE

- a. Remedy:
 - i. Cycle Power to VFD and Station.
 - ii. Check power wiring and fuses for affected VFD.
 - iii. Check all wiring between VFD and PLC.
 - iv. Check to be sure VFD is not in LOC mode.

HIGH LEVEL:

- a. Remedy:
 - i. Check application for legitimate 'high level' fault.
 - ii. Check that PLC is properly programmed for the correct number of switches/sensors.
 - iii. Check for open or closed switch contacts. Refer to wire diagrams for proper connection.

HIGH SUCTION:

- a. Remedy:
 - i. Check application for legitimate 'high suction' pressure fault. Is a PRV necessary?
 - ii. Check that PLC is properly programmed for the correct number of switches/sensors.
 - iii. Check for open or closed switch contacts. Refer to wire diagrams for proper connection.

HIGH SYSTEM (Discharge):

- a. Remedy:
 - i. Check application for high discharge pressure conditions. Does the mechanical gauge on the discharge header match the actual pressure displayed on the PLC?
 - ii. Check suction pressure conditions. Is suction pressure significantly higher than original system design point?
 - iii. Check Ramp Speed settings. Fast ramp speeds can increase the chance of over-pressurizing the system, especially with larger pumps.

LOW SYSTEM (Discharge):

- a. Remedy:
 - i. Check application for low discharge pressure conditions. Does the mechanical gauge on the discharge header match the actual pressure displayed on the PLC?
 - ii. Are the pumps running in the correct direction?
 - iii. Check suction pressure conditions. Is suction pressure significantly lower than original system design point?
 - iv. Is the system drawing a vacuum? Can the water supply keep up with demand?
 - v. Could there be a broken pipe/leak in the system? In other words, does the system seem to be running in a 'open discharge' condition?
 - vi. Check Ramp Speed settings. Slow ramp speeds can increase the chance of a rapid drop in system pressure.

LOW SUCTION:

- a. Remedy:
 - i. Check application for legitimate 'low suction' pressure fault. Is a PRV set incorrectly?
 - ii. Could the system be drawing a vacuum?
 - iii. Check that PLC is properly programmed for the correct number of switches/sensors.
 - iv. Check for open or closed switch contacts. Refer to wire diagrams for proper connection.

6.14 Program type and version number

To check the program type and version number, press the INFO/8 key while at the Pump Controller status screen.

The screen will now display:

```
Sys Info CPU V ###
AS V ### OS ####
Prog Type: #####
Scheme No: # SW# ##
```

Press the CLEAR key to exit this screen.

The # symbol will be replaced by the actual version numbers and program type. If the factory is called for information or service on this unit this information may be requested.

6.14.0 Log menu

To view the LOG MENU, press the LOG/5 key while at the Status Screens.

The LOG MENU screen will be displayed as shown below:

```
<SELECTION: # >
1 = ALARM LOG
2 = PUMP LOG
3 = DATA LOG 0 = EXIT
```

Press the NEXT/(▶) key to go to the next screen. The display now shows:

```
<SELECTION: # >
4 = OPERATION
5 = SERVICE LOG 0 = EXIT
```

Use the appropriate numeric key to select the desired menu, then press the ENTER key. A detailed description of each menu follows. For example

6.14.1 Alarm log

Paths: Status Screens / Log(5)/Alarm Log(1)

The display now shows:

```
MMDD HHMM alarm message
MMDD HHMM alarm message
MMDD HHMM alarm message
MMDD HHMM alarm message
```

Every alarm that occurs will be logged with a date and time stamp. The forty most recent alarms will be stored. The date is displayed in MMDD format and the time in 24 hour HHMM format. The most recent alarm is shown first. Press NEXT/(▶) and PREV/(◀) view more log events. Press CLEAR to exit.

6.14.2 Pump log menu

Paths: Status Screens / Log(5)/Pump Log(2)

The display now shows:

```
Selection: # 0=Exit
1=Pump Log
2=Pump Run Time
3=Pump On/Off Times
```

Use the appropriate numeric key to select the desired sub-menu, then press the ENTER key. A detailed description of each sub-menu appears.

6.14.3 Pump log

Paths: Status Screens / Log(5) / Pump Log (2) / Pump Log(1)

The display now shows:

MMDD HHMM PUMP ON/OFF MESSAGE

MMDD HHMM PUMP ON/OFF MESSAGE

MMDD HHMM PUMP ON/OFF MESSAGE

MMDD HHMM PUMP ON/OFF MESSAGE

Every pump ON/OFF occurrence will be logged along with the date and time. The forty most recent occurrences will be stored. The date is displayed in MMDD format and the time is displayed in HHMM format. The most recent occurrence is shown first. Press NEXT/(▶) and PREV/(◀) view more log events. Press CLEAR to exit.

6.14.4 Pump run time

Paths: Status Screens / Log(5) / Pump Log (2) / Pump Run Time(2)

The display now shows:

Pump Run Time

P1: # P2: #

P3: # P4: #

P5: # P6: #

The pump run time is displayed in total accumulated elapsed time in hours

6.14.5 Pump on/off times

Paths: Status Screens / Log(5) / Pump Log (2) / Pump On Off Times(3)

The display now shows:

Pump On/Off

P1: # P2: #

P3: # P4: #

P5: # P6: #

The pump on/off times are displayed in total accumulated times the pumps are switched on and off.

6.14.6 Data log

Paths: Status Screens / Log(5) / Data Log(3)

The display now shows:

Selection: # 0=Exit

1=Sensor

2= Totalized Value

Use the appropriate numeric key to select the desired sub-menu, then press the ENTER key. A detailed description of each sub-menu appears.

6.14.7 Sensor

Paths: Status Screens / Log(5) / Data Log(3) / Sensor(1)

The display now shows:

```
<SENSOR TYPE MAX: # >
MM/DD/YY      00:00:00
NOW: #        MIN: #
MM/DD/YY      00:00:00
```

The sensor type is displayed along with its current, maximum, minimum values. The times and dates that the max and min values occurred are also displayed. To view other sensors, press the Next Screen button.

Press PV/1 and ENTER keys together to reset the max value.

Press SET PT/2 and ENTER keys together to reset the min value.

6.14.8 Totalized value

Paths: Status Screens / Log(5) / Data Log(3) / Totalized Value(2)

The display now shows:

```
Total KWHR   ###
Total Flow    ###KGal
```

The total accumulated kilowatt hours and Flow is displayed as the Totalized Value

6.14.9 Operation

Paths: Status Screens / Log(5) / Operation(4)

The display now shows:

```
<Selection: # >
1=Op Mode Changes
2=Power Cycles
3=Events
```

Press the NEXT/(▶) key to go to the next screen. The display now shows:

```
<SELECTION: # >
4 = VFD
5 = EXERCISE
6 = Set Point
```

Use the appropriate numeric key to select the desired sub-menu, then press the ENTER key. A detailed description of each sub-menu appears.

6.14.10 Operation mode changes

Paths: Status Screens / Log(5) / Operation(4) / Op Mode Changes(1)

The display now shows:

```
MMDD HHMM   Manual/Auto
MMDD HHMM   Manual/Auto
MMDD HHMM   Manual/Auto
MMDD HHMM   Manual/Auto
```

Every time the AUTO/ MANUAL key is pressed, the event will be logged by showing the state of operation mode. The forty most recent operation mode changes will be stored. The date is displayed in MMDD format and the time in 24 hour HHMM format. The most recent event will be shown first. Press NEXT/(▶) and PREV/(◀) view more log events. Press CLEAR to exit.

6.14.11 Power cycles

Paths: Status Screens / Log(5) / Operation(4) / Power Cycles(2)

The display now shows:

MMDD HHMM Power Up/Down

MMDD HHMM Power Up/Down

MMDD HHMM Power Up/Down

MMDD HHMM Power Up/Down

Each time the controller is powered up or down, the event will be logged. “Power Up” will be shown if powered up, and “Power Down” will be shown if powered down. The forty most recent logs will be stored. The date is displayed in MMDD format and the time in 24 hour HHMM format. The most recent event will be shown first. Press NEXT/(▶) and PREV/(◀) view more log events. Press CLEAR to exit.

6.14.12 Events

Paths: Status Screens / Log(5) / Operation(4) / Events(3)

The display now shows:

Selection: # 0=Exit

1=System On/Off

2=Alternation

3= Sys Rset 4=Events

Use the appropriate numeric key to select the desired sub-menu, then press the ENTER key. A detailed description of each sub-menu appears.

6.14.13 System on/off

Paths: Status Screens / Log(5) / Operation(4) / Events(3) / System On Off(1)

The display now shows:

MMDD HHMM Start/Stop

MMDD HHMM Start/Stop

MMDD HHMM Start/Stop

MMDD HHMM Start/Stop

Every time the START/STOP key is pressed, the event will be logged by showing the system start/stop state. The forty most recent logs will be stored. The date is displayed in MMDD format and the time in 24 hour HHMM format. The most recent event will be shown first. Press NEXT/(▶) and PREV/(◀) view more log events. Press CLEAR to exit.

6.14.14 Alternation

Paths: Status Screens / Log(5) / Operation(4) / Events(3) / Alternation(2)

The display now shows:

MMDD HHMM Seq#

MMDD HHMM Seq#

MMDD HHMM Seq#

MMDD HHMM Seq#

Every time the pump sequence is changed, the event will be logged by showing the sequence. The forty most recent logs will be stored. The date is displayed in MMDD format and the time in 24 hour HHMM format. The most recent event will be shown first. Press NEXT/(▶) and PREV/(◀) view more log events. Press CLEAR to exit.

6.14.15 Sys Rset

Paths: Status Screens / Log(5) / Operation(4) / Events(3) / Sys Rset(3)

The display now shows:

MMDD HHMM Sys Reset Message

MMDD HHMM Sys Reset Message

MMDD HHMM Sys Reset Message

MMDD HHMM Sys Reset Message

Every time the system is reset, the event will be logged by showing the system reset. The forty most recent logs will be stored. The date is displayed in MMDD format and the time in 24 hour HHMM format. The most recent event will be shown first. Press NEXT/(▶) and PREV/(◀) view more log events. Press CLEAR to exit.

6.14.16 Events

Paths: Status Screens / Log(5) / Operation(4) / Events(3) / Events(4)

The display now shows:

MMDD HHMM Event Message

MMDD HHMM Event Message

MMDD HHMM Event Message

MMDD HHMM Event Message

Every time an event occurs, it gets logged. The forty most recent logs will be stored. The date is displayed in MMDD format and the time in 24 hour HHMM format. The most recent event will be shown first. Press NEXT/(▶) and PREV/(◀) view more log events. Press CLEAR to exit.

6.14.17 VFD

Paths: Status Screens / Log(5) / Operation(4) / VFD(4)

The display now shows:

MMDD HHMM VFD Failure Message

MMDD HHMM VFD Failure Message

MMDD HHMM VFD Failure Message

MMDD HHMM VFD Failure Message

Every time VFD failure occurs, it gets logged. The forty most recent logs will be stored. The date is displayed in MMDD format and the time in 24 hour HHMM format. The most recent event will be shown first. Press NEXT/(▶) and PREV/(◀) view more log events. Press CLEAR to exit.

6.14.18 Exercise

Paths: Status Screens / Log(5) / Operation(4) / Exercise(5)

The display now shows:

MMDD HHMM Pump #

MMDD HHMM Pump #

MMDD HHMM Pump #

MMDD HHMM Pump #

Every time a pump is exercised, it gets logged. The forty most recent logs will be stored. The date is displayed in MMDD format and the time in 24 hour HHMM format. The most recent event will be shown first. Press NEXT/(▶) and PREV/(◀) view more log events. Press CLEAR to exit.

6.14.19 Set Point

Paths: Status Screens / Log(5) / Operation(4) / Set Point(6)

The display now shows:

MMDD HHYY Set point change message

MMDD HHYY Set point change message

MMDD HHYY Set point change message

MMDD HHYY Set point change message

Every time setpoint change, it gets logged. The forty most recent logs will be stored. The date is displayed in MMDD format and the time in 24 hour HHMM format. The most recent event will be shown first. Press NEXT/(▶) and PREV/(◀) view more log events. Press CLEAR to exit.

6.14.20 Service log

Paths: Status Screens / Log(5) / Service Log(5)

The display now shows:

Selection: # 0=Exit

1 = Error Log

2 = Operation Hours

3 = Destage Speed

Use the appropriate numeric key to select the desired sub-menu, then press the ENTER key. A detailed description of each sub-menu appears.

6.14.21 Error log

Paths: Status Screens / Log(5) / Service Log(5) / Error Log(1)

The display now shows:

MMDD HHMM Error Code

MMDD HHMM Error Code

MMDD HHMM Error Code

MMDD HHMM Error Code

6.14.22 Operation hours

Paths: Status Screens / Log(5) / Service Log(5) / Operation Hours(2)

The display now shows:

Operating Since

MM/DD/YY HH:MM:SS

Total Hours #####

The start date and time is displayed in the MM/DD/YY and HH:MM:SS format respectively. The total number of hours that the unit has been in operation is also displayed.

Press SETUP/3, QUICK ACCESS/6 and ENTER keys together to reset or start the function. Press CLEAR to exit.

6.14.23 Destage Speed

Paths: Status Screens / Log(5) / Service Log(5) / Destage Speed(3)

The display now shows:

Destage Speed = ### %

It shows the speed at which current lag pump will destage.

6.15 Maintenance (Physical)

6.15.0 Electrical

No maintenance is required for the electrical panel except to keep the modules free of dirt and dust that might hold moisture. Cabinet door should be kept closed, and the components kept dry.

6.15.1 Mechanical

- If a B&G pump was supplied it was lubricated at the factory. Future lubrication should be according to the instructions that came with the pump.
- If there is a danger of freezing, drain the pump. Inspect pump and system piping regularly.
- For leaky seals or gaskets and loose or damaged components, replace or repair as required.

7. Appendix

7.1 Valid I/O Codes

Code	Function Description	I/O Type	Range	Equate to the Signal
101	Pump 1 Status (On/Off)	DO	1/0	On/Off
102	Pump 2 Status (On/Off)	DO	1/0	On/Off
103	Pump 3 Status (On/Off)	DO	1/0	On/Off
104	Pump 4 Status (On/Off)	DO	1/0	On/Off
105	Pump 5 Status (On/Off)	DO	1/0	On/Off
106	Pump 6 Status (On/Off)	DO	1/0	On/Off
111	Pump 1 Failure	DO	1/0	On/Off
112	Pump 2 Failure	DO	1/0	On/Off
113	Pump 3 Failure	DO	1/0	On/Off
114	Pump 4 Failure	DO	1/0	On/Off
115	Pump 5 Failure	DO	1/0	On/Off
116	Pump 6 Failure	DO	1/0	On/Off
121	VFD 1 Failure	DO	1/0	On/Off
122	VFD 2 Failure	DO	1/0	On/Off
123	VFD 3 Failure	DO	1/0	On/Off
124	VFD 4 Failure	DO	1/0	On/Off
125	VFD 5 Failure	DO	1/0	On/Off
126	VFD 6 Failure	DO	1/0	On/Off
140	A-V Alarm Output	DO	1/0	On/Off
171	Low Suction Detected, W/ Proof Time	DI	1/0	On/Off
172	High Suction Detected, W/ Proof Time	DI	1/0	On/Off
173	High Level Alarm Detected, W/ Proof Time	DI	1/0	On/Off
174	Low Level Alarm Detected, W/ Proof Time	DI	1/0	On/Off
175	Push to Silence Switch Input	DI	1/0	On/Off
201	Speed Signal	AO	0-100	4 - 20 ma
202	System Flow Rate	AO	0-Span	4 - 20 ma
203	System KW	AO	0-Span	4 - 20 ma
204	System Pressure	AO	0-Span	4 - 20 ma
205	Suction Pressure	AO	0-Span	4 - 20 ma
211	Analog Input 1	AO	0-Span	4 - 20 ma
212	Analog Input 2	AO	0-Span	4 - 20 ma
213	Analog Input 3	AO	0-Span	4 - 20 ma
214	Analog Input 4	AO	0-Span	4 - 20 ma

7.2 Conformance Statement

BACnet Protocol Implementation Conformance Statement

Date:	10/19/2010
Vendor Name:	ITT Corp
Product Name:	TechnoForce Pump Controller
Product Model Number:	N/A
Applications Software Version:	1.16 or above
Firmware Revision:	N/A
BACnet Protocol Revision:	4.0

Product Description

The TechnoForce Pump Controller is a variable speed pumping system for water booster systems. It operates either as a stand-alone controller or as part of a building-wide integrated system. The BACnet communication interface will provide communication between the TechnoForce pump controller and the BACnet system residing on EIA-485 media.

BACnet Standardized Device Profile (Annex L)

- BACnet Operator Workstation (B-OWS)
- BACnet Building Controller (B-BC)
- BACnet Advanced Application Controller (B-AAC)
- BACnet Application Specific Controller (B-ASC)
- BACnet Smart Sensor (B-SS)
- BACnet Smart Actuator (B-SA)

List all BACnet Interoperability Building Blocks Supported (Annex K)

DS-RP-B	DM-TS-B	DM-DCC-B
DS-WP-B	DM-DDB-B	DM-DOB-B

Segmentation Capability

<input type="checkbox"/> Able to transmit segmented messages	Window Size	N/A
<input type="checkbox"/> Able to receive segmented messages	Window Size	N/A

Standard Object Types Supported

Analog input

Dynamically creatable:	No	
Dynamically deletable:	No	
Optional properties supported:	None	
Writable properties:	Present Value	Conditionally writable
	Out Of Service	
Proprietary properties:	None	
Property range restrictions:	None	

Analog output

Dynamically creatable:	No
Dynamically deletable:	No
Optional properties supported:	None
Writable properties:	Present Value
Proprietary properties:	None
Property range restrictions:	None

Analog value

Dynamically creatable:	No	
Dynamically deletable:	No	
Optional properties supported:	None	
Writable properties:	Present Value	Conditionally writable
	Out Of Service	
Proprietary properties:	None	
	Out Of Service	
Property range restrictions:	None	

Binary input

Dynamically creatable:	No	
Dynamically deletable:	No	
Optional properties supported:	None	
Writable properties:	Present Value	Conditionally writable
	Out Of Service	
Proprietary properties:	None	
Property range restrictions:	None	

Binary output

Dynamically creatable:	No
Dynamically deletable:	No
Optional properties supported:	None
Writable properties:	Present Value
Proprietary properties:	None
Property range restrictions:	None

Binary value

Dynamically creatable:	No	
Dynamically deletable:	No	
Optional properties supported:	None	
Writable properties:	Present Value	Conditionally writable
	Out Of Service	
Proprietary properties:	None	
Property range restrictions:	None	

Device

Dynamically creatable:	No
Dynamically deletable:	No
Optional properties supported:	Local_Date Local_Time Max_Master Max_Info_Frames
Writable properties:	Max_Master
Proprietary properties:	None
Property range restrictions:	None

Data Link Layer Options

- BACnet IP, (Annex J)
- BACnet IP, (Annex J), Foreign Device
- ISO 8802-3, Ethernet (Clause 7)
- ANSI/ATA 878.1, 2.5 Mb. ARCNET (Clause 8)
- ANSI/ATA 878.1, RS-485 ARCNET (Clause 8), baud rate(s) _____
- MS/TP master (Clause 9), baud rate(s): 9600, 19200, 38400
- MS/TP slave (Clause 9), baud rate(s): 9600, 19200, 38400
- Point-To-Point, EIA 232 (Clause 10), baud rate(s):
- Point-To-Point, modem, (Clause 10), baud rate(s):
- LonTalk, (Clause 11), medium: _____
- Other:

Device Address Binding

Is static device binding supported? (This is currently necessary for two-way communication with MS/TP slaves and certain other devices.) Yes No

Networking Options

- Router, Clause 6 - List all routing configurations, e.g., ARCNET-Ethernet, Ethernet-MS/TP, etc.
 - Annex H, BACnet Tunneling Router over IP
 - BACnet/IP Broadcast Management Device (BBMD)
- Does the BBMD support registrations by Foreign Devices? Yes No

Character Sets Supported

Indicating support for multiple character sets does not imply that they can all be supported simultaneously.

- ANSI X3.4 IBM/Microsoft DBCS ISO 8859-1
- ISO 10646 (UCS-2) ISO 10646 (UCS-4) JIS C 6226

If this product is a communication gateway, describe the types of non-BACnet equipment/network(s) that the gateway supports: N/A

7.3 TechnoForce BACnet Communication Objects List for Application Version 1.16 or Above

Object Identifier	Object Name	Range	
Binary Input, 1	P1 Failure	1 = Failure	0 = O.K.
Binary Input, 2	P1 VFD Failure	1 = Failure	0 = O.K.
Binary Input, 3	P1 Off	1 = Alarm	0 = O.K.
Binary Input, 4	P2 Failure	1 = Failure	0 = O.K.
Binary Input, 5	P2 VFD Failure	1 = Failure	0 = O.K.
Binary Input, 6	P2 Off	1 = Alarm	0 = O.K.
Binary Input, 7	P3 Failure	1 = Failure	0 = O.K.
Binary Input, 8	P3 VFD Failure	1 = Failure	0 = O.K.
Binary Input, 9	P3 Off	1 = Alarm	0 = O.K.
Binary Input, 10	P4 Failure	1 = Failure	0 = O.K.
Binary Input, 11	P4 VFD Failure	1 = Failure	0 = O.K.
Binary Input, 12	P4 Off	1 = Alarm	0 = O.K.
Binary Input, 13	P5 Failure	1 = Failure	0 = O.K.
Binary Input, 14	P5 VFD Failure	1 = Failure	0 = O.K.
Binary Input, 15	P5 Off	1 = Alarm	0 = O.K.
Binary Input, 16	P6 Failure	1 = Failure	0 = O.K.
Binary Input, 17	P6 VFD Failure	1 = Failure	0 = O.K.
Binary Input, 18	P6 Off	1 = Alarm	0 = O.K.
Binary Input, 19	System Reset Req	1 = Yes	0 = No
Binary Input, 20	P1 Enabled	1 = Enabled	0 = Disabled
Binary Input, 21	P2 Enabled	1 = Enabled	0 = Disabled
Binary Input, 22	P3 Enabled	1 = Enabled	0 = Disabled
Binary Input, 23	P4 Enabled	1 = Enabled	0 = Disabled
Binary Input, 24	P5 Enabled	1 = Enabled	0 = Disabled
Binary Input, 25	P6 Enabled	1 = Enabled	0 = Disabled
Binary Input, 26	Pump #1 On/Off	1 = On	0 = Off
Binary Input, 27	Pump #2 On/Off	1 = On	0 = Off
Binary Input, 28	Pump #3 On/Off	1 = On	0 = Off
Binary Input, 29	Pump #4 On/Off	1 = On	0 = Off
Binary Input, 30	Pump #5 On/Off	1 = On	0 = Off
Binary Input, 31	Pump #6 On/Off	1 = On	0 = Off
Binary Input, 32	System Start/Stop	1 = Start	0 = Stop
Binary Input, 33	AI #1 Failure	1 = Failure	0 = O.K.
Binary Input, 34	AI #2 Failure	1 = Failure	0 = O.K.
Binary Input, 35	AI #3 Failure	1 = Failure	0 = O.K.
Binary Input, 36	AI #4 Failure	1 = Failure	0 = O.K.
Binary Input, 37	General Alarm	1 = Alarm	0 = O.K.
Binary Input, 38	System Operation Mode	1 = Auto	0 = Manual
Binary Output, 1	Pump Sequence Alternation	1 = Yes	0 = No
Binary Output, 2	System Reset Request	1 = Yes	0 = No
Binary Output, 3	System Start / Stop	1 = Start	0 = Stop

Object Identifier	Object Name	Range
Analog Input, 1	System Pressure	0 to Span (in TechnoForce User Setup Menu)
Analog Input, 2	Suction Pressure	0 to Span (in TechnoForce User Setup Menu)
Analog Input, 3	AI #1	0 to Span (in TechnoForce User Setup Menu)
Analog Input, 4	AI #2	0 to Span (in TechnoForce User Setup Menu)
Analog Input, 5	AI #3	0 to Span (in TechnoForce User Setup Menu)
Analog Input, 6	AI #4	0 to Span (in TechnoForce User Setup Menu)
Analog Input, 7	Setpoint #1	0 to Span (in TechnoForce User Setup Menu)
Analog Input, 8	Setpoint #2	0 to Span (in TechnoForce User Setup Menu)
Analog Input, 9	Setpoint #3	0 to Span (in TechnoForce User Setup Menu)
Analog Input, 10	Setpoint #4	0 to Span (in TechnoForce User Setup Menu)
Analog Input, 11	System Flow	0 to Span (in TechnoForce User Setup Menu)
Analog Input, 12	System Power (KW)	0 to Span (in TechnoForce User Setup Menu)
Analog Input, 13	Drive #1 Current	0 to Span (in TechnoForce User Setup Menu)
Analog Input, 14	Drive #2 Current	0 to Span (in TechnoForce User Setup Menu)
Analog Input, 15	Drive #3 Current	0 to Span (in TechnoForce User Setup Menu)
Analog Input, 16	Drive #4 Current	0 to Span (in TechnoForce User Setup Menu)
Analog Input, 17	Drive #5 Current	0 to Span (in TechnoForce User Setup Menu)
Analog Input, 18	Drive #6 Current	0 to Span (in TechnoForce User Setup Menu)
Analog Input, 19	Drive #1 Power (KW)	0 to Span (in TechnoForce User Setup Menu)
Analog Input, 20	Drive #2 Power (KW)	0 to Span (in TechnoForce User Setup Menu)
Analog Input, 21	Drive #3 Power (KW)	0 to Span (in TechnoForce User Setup Menu)
Analog Input, 22	Drive #4 Power (KW)	0 to Span (in TechnoForce User Setup Menu)
Analog Input, 23	Drive #5 Power (KW)	0 to Span (in TechnoForce User Setup Menu)
Analog Input, 24	Drive #6 Power (KW)	0 to Span (in TechnoForce User Setup Menu)
Analog Input, 25	Speed %	0 to 100
Analog Input, 26	Lead Pump Number	1 to Pump # (in TechnoForce User Setup Menu)
Analog Input, 27	Active Zone Number	1 to Zone # (in TechnoForce User Setup Menu)
Analog Output, 1	AI1_Command	0-65535
Analog Output, 2	AI2_Command	0-65535
Analog Output, 3	AI3_Command	0-65535
Analog Output, 4	AI4_Command	0-65535
Analog Output, 5	SP1_Command	0-65535
Analog Output, 6	SP2_Command	0-65535
Analog Output, 7	SP3_Command	0-65535
Analog Output, 8	SP4_Command	0-65535

7.4 TechnoForce MODBUS Communication Points

Function Code	Points #	Point Description	Range/ Value	Modbus Address	Units
02	1	Pump #1 Failure	1 = Failure 0 = O.K.	10001	
02	2	Pump #1 VFD Failure	1 = Failure 0 = O.K.	10002	
02	3	Pump #1 Off Alarm	1 = Alarm 0 = O.K.	10003	
02	4	Pump #2 Failure	1 = Failure 0 = O.K.	10004	
02	5	Pump #2 VFD Failure	1 = Failure 0 = O.K.	10005	
02	6	Pump #2 Off Alarm	1 = Alarm 0 = O.K.	10006	
02	7	Pump #3 Failure	1 = Failure 0 = O.K.	10007	
02	8	Pump #3 VFD Failure	1 = Failure 0 = O.K.	10008	
02	9	Pump #3 Off Alarm	1 = Alarm 0 = O.K.	10009	
02	10	Pump #4 Failure	1 = Failure 0 = O.K.	10010	
02	11	Pump #4 VFD Failure	1 = Failure 0 = O.K.	10011	
02	12	Pump #4 Off Alarm	1 = Alarm 0 = O.K.	10012	
02	13	Pump #5 Failure	1 = Failure 0 = O.K.	10013	
02	14	Pump #5 VFD Failure	1 = Failure 0 = O.K.	10014	
02	15	Pump #5 Off Alarm	1 = Alarm 0 = O.K.	10015	
02	16	Pump #6 Failure	1 = Failure 0 = O.K.	10016	
02	17	Pump #6 VFD Failure	1 = Failure 0 = O.K.	10017	
02	18	Pump #6 Off Alarm	1 = Alarm 0 = O.K.	10018	
02	19	System Reset Required	1 = Yes 0 = No	10019	
02	20	Pump #1 Enabled	1 = Enabled 0 = Disabled	10020	
02	21	Pump #2 Enabled	1 = Enabled 0 = Disabled	10021	
02	22	Pump #3 Enabled	1 = Enabled 0 = Disabled	10022	
02	23	Pump #4 Enabled	1 = Enabled 0 = Disabled	10023	
02	24	Pump #5 Enabled	1 = Enabled 0 = Disabled	10024	
02	25	Pump #6 Enabled	1 = Enabled 0 = Disabled	10025	
02	26	Pump #1 On/Off	1 = On 0 = Off	10026	
02	27	Pump #2 On/Off	1 = On 0 = Off	10027	
02	28	Pump #3 On/Off	1 = On 0 = Off	10028	
02	29	Pump #4 On/Off	1 = On 0 = Off	10029	
02	30	Pump #5 On/Off	1 = On 0 = Off	10030	
02	31	Pump #6 On/Off	1 = On 0 = Off	10031	
02	32	System Start/Stop	1 = Start 0 = Stop	10032	
02	33	Analog Input #1 Failure	1 = Failure 0 = O.K.	10033	
02	34	Analog Input #2 Failure	1 = Failure 0 = O.K.	10034	
02	35	Analog Input #3 Failure	1 = Failure 0 = O.K.	10035	
02	36	Analog Input #4 Failure	1 = Failure 0 = O.K.	10036	
02	37	General Alarm	1 = Alarm 0 = O.K.	10037	
02	38	System Operation Mode	1 = Auto 0 = Manual	10038	
05	1	Pump Sequence Alternation	1 = Yes 0 = No	00001	
05	2	System Reset Request	1 = Yes 0 = No	00002	
05	3	System Start / Stop	1 = Start 0 = Stop	00003	

TechnoForce MODBUS Communication Points (continued)

Function Code	Points #	Point Description	Range/ Value	Modbus Address	Units
04	1	System Pressure	0 to Span (in TechnoForce User Setup Menu)	30001	PSI
04	2	Suction Pressure	0 to Span (in TechnoForce User Setup Menu)	30002	PSI
04, 06	3	AI #1	0 to Span (in TechnoForce User Setup Menu)	30003, 40003	
04, 06	4	AI #2	0 to Span (in TechnoForce User Setup Menu)	30004, 40004	
04, 06	5	AI #3	0 to Span (in TechnoForce User Setup Menu)	30005, 40005	
04, 06	6	AI #4	0 to Span (in TechnoForce User Setup Menu)	30006, 40006	
04, 06	7	Setpoint #1	0 to Span (in TechnoForce User Setup Menu)	30007, 40007	
04, 06	8	Setpoint #2	0 to Span (in TechnoForce User Setup Menu)	30008, 40008	
04, 06	9	Setpoint #3	0 to Span (in TechnoForce User Setup Menu)	30009, 40009	
04, 06	10	Setpoint #4	0 to Span (in TechnoForce User Setup Menu)	30010, 40010	
04	11	System Flow	0 to Span (in TechnoForce User Setup Menu)	30011	GPM
04	12	System Power (KW)	0 to Span (in TechnoForce User Setup Menu)	30012	KW
04	13	Drive #1 Current	0 to Span (in TechnoForce User Setup Menu)	30013	A
04	14	Drive #2 Current	0 to Span (in TechnoForce User Setup Menu)	30014	A
04	15	Drive #3 Current	0 to Span (in TechnoForce User Setup Menu)	30015	A
04	16	Drive #4 Current	0 to Span (in TechnoForce User Setup Menu)	30016	A
04	17	Drive #5 Current	0 to Span (in TechnoForce User Setup Menu)	30017	A
04	18	Drive #6 Current	0 to Span (in TechnoForce User Setup Menu)	30018	A
04	19	Drive #1 Power (KW)	0 to Span (in TechnoForce User Setup Menu)	30019	KW
04	20	Drive #2 Power (KW)	0 to Span (in TechnoForce User Setup Menu)	30020	KW
04	21	Drive #3 Power (KW)	0 to Span (in TechnoForce User Setup Menu)	30021	KW
04	22	Drive #4 Power (KW)	0 to Span (in TechnoForce User Setup Menu)	30022	KW
04	23	Drive #5 Power (KW)	0 to Span (in TechnoForce User Setup Menu)	30023	KW
04	24	Drive #6 Power (KW)	0 to Span (in TechnoForce User Setup Menu)	30024	KW

Function Code	Points #	Point Description	Range/Value	Modbus Address	Units
04	25	Speed %	0 to 100	30025	%
04	26	Lead Pump Number	1 to Pump # (in TechnoForce User Setup Menu)	30026	
04	27	Active Zone Number	1 to Zone # (in TechnoForce User Setup Menu)	30027	

7.5 TechnoForce Metasys N2 Communication Points

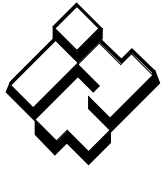
NPT	NPA	Point Description	Range/Value		Units
BI	1	Pump #1 Failure	1 = Failure	0 = O.K.	
BI	2	Pump #1 VFD Failure	1 = Failure	0 = O.K.	
BI	3	Pump #1 Off Alarm	1 = Alarm	0 = O.K.	
BI	4	Pump #2 Failure	1 = Failure	0 = O.K.	
BI	5	Pump #2 VFD Failure	1 = Failure	0 = O.K.	
BI	6	Pump #2 Off Alarm	1 = Alarm	0 = O.K.	
BI	7	Pump #3 Failure	1 = Failure	0 = O.K.	
BI	8	Pump #3 VFD Failure	1 = Failure	0 = O.K.	
BI	9	Pump #3 Off Alarm	1 = Alarm	0 = O.K.	
BI	10	Pump #4 Failure	1 = Failure	0 = O.K.	
BI	11	Pump #4 VFD Failure	1 = Failure	0 = O.K.	
BI	12	Pump #4 Off Alarm	1 = Alarm	0 = O.K.	
BI	13	Pump #5 Failure	1 = Failure	0 = O.K.	
BI	14	Pump #5 VFD Failure	1 = Failure	0 = O.K.	
BI	15	Pump #5 Off Alarm	1 = Alarm	0 = O.K.	
BI	16	Pump #6 Failure	1 = Failure	0 = O.K.	
BI	17	Pump #6 VFD Failure	1 = Failure	0 = O.K.	
BI	18	Pump #6 Off Alarm	1 = Alarm	0 = O.K.	
BI	19	System Reset Required	1 = Yes	0 = No	
BI	20	Pump #1 Enabled	1 = Enabled	0 = Disabled	
BI	21	Pump #2 Enabled	1 = Enabled	0 = Disabled	
BI	22	Pump #3 Enabled	1 = Enabled	0 = Disabled	
BI	23	Pump #4 Enabled	1 = Enabled	0 = Disabled	
BI	24	Pump #5 Enabled	1 = Enabled	0 = Disabled	
BI	25	Pump #6 Enabled	1 = Enabled	0 = Disabled	
BI	26	Pump #1 On/Off	1 = On	0 = Off	
BI	27	Pump #2 On/Off	1 = On	0 = Off	
BI	28	Pump #3 On/Off	1 = On	0 = Off	
BI	29	Pump #4 On/Off	1 = On	0 = Off	
BI	30	Pump #5 On/Off	1 = On	0 = Off	
BI	31	Pump #6 On/Off	1 = On	0 = Off	
BI	32	System Start/Stop	1 = Start	0 = Stop	
BI	33	Analog Input #1 Failure	1 = Failure	0 = O.K.	
BI	34	Analog Input #2 Failure	1 = Failure	0 = O.K.	

NPT	NPA	Point Description	Range/Value	Units
BI	35	Analog Input #3 Failure	1 = Failure 0 = O.K.	
BI	36	Analog Input #4 Failure	1 = Failure 0 = O.K.	
BI	37	General Alarm	1 = Alarm 0 = O.K.	
BI	38	System Operation Mode	1 = Auto 0 = Manual	
BO	1	Pump Sequence Alternation	1 = Yes 0 = No	
BO	2	System Reset Request	1 = Yes 0 = No	
BO	3	System Start / Stop	1 = Start 0 = Stop	
ADI	1	System Pressure	0 to Span (in TechnoForce User Setup Menu)	PSI
ADI	2	Suction Pressure	0 to Span (in TechnoForce User Setup Menu)	PSI
ADI	3	AI #1	0 to Span (in TechnoForce User Setup Menu)	
ADI	4	AI #2	0 to Span (in TechnoForce User Setup Menu)	
ADI	5	AI #3	0 to Span (in TechnoForce User Setup Menu)	
ADI	6	AI #4	0 to Span (in TechnoForce User Setup Menu)	
ADI	7	Setpoint #1	0 to Span (in TechnoForce User Setup Menu)	
ADI	8	Setpoint #2	0 to Span (in TechnoForce User Setup Menu)	
ADI	9	Setpoint #3	0 to Span (in TechnoForce User Setup Menu)	
ADI	10	Setpoint #4	0 to Span (in TechnoForce User Setup Menu)	
ADI	11	System Flow	0 to Span (in TechnoForce User Setup Menu)	GPM
ADI	12	System Power (KW)	0 to Span (in TechnoForce User Setup Menu)	KW
ADI	13	Drive #1 Current	0 to Span (in TechnoForce User Setup Menu)	A
ADI	14	Drive #2 Current	0 to Span (in TechnoForce User Setup Menu)	A
ADI	15	Drive #3 Current	0 to Span (in TechnoForce User Setup Menu)	A
ADI	16	Drive #4 Current	0 to Span (in TechnoForce User Setup Menu)	A
ADI	17	Drive #5 Current	0 to Span (in TechnoForce User Setup Menu)	A
ADI	18	Drive #6 Current	0 to Span (in TechnoForce User Setup Menu)	A
ADI	19	Drive #1 Power (KW)	0 to Span (in TechnoForce User Setup Menu)	KW
ADI	20	Drive #2 Power (KW)	0 to Span (in TechnoForce User Setup Menu)	KW
ADI	21	Drive #3 Power (KW)	0 to Span (in TechnoForce User Setup Menu)	KW
ADI	22	Drive #4 Power (KW)	0 to Span (in TechnoForce User Setup Menu)	KW
ADI	23	Drive #5 Power (KW)	0 to Span (in TechnoForce User Setup Menu)	KW
ADI	24	Drive #6 Power (KW)	0 to Span (in TechnoForce User Setup Menu)	KW
ADI	25	Speed %	0 to 100	%
ADI	26	Lead Pump Number	1 to Pump # (in TechnoForce User Setup Menu)	
ADI	27	Active Zone Number	1 to Zone # (in TechnoForce User Setup Menu)	

7.6 Quick Access Number Table

Screen Name	Quick Access Number	Screen Name	Quick Access Number
Sensor Setup (AI1)	1001	Pump Exercise	3031
Sensor Setup (AI2)	1002	Timed Auto Alt	3041
Sensor Setup (AI3)	1003	Scheduled Auto Alt	3042
Sensor Setup (AI4)	1004	Scheduled Alt Daily	3043
Number of Pumps	2001	Scheduled Alt Weekly	3044
Pump Nameplate (Pump 1)	2002	Scheduled Alt Monthly	3045
Pump Nameplate (Pump 2)	2003	Alternation Basis	3046
Pump Nameplate (Pump 3)	2004	PID	3051
Pump Nameplate (Pump 4)	2005	Reset Totals	3061
Pump Nameplate (Pump 5)	2006	Date, Time	3071
Pump Nameplate (Pump 6)	2007	Password	3081
Reset Pump Time	2008	Spare DI Setup	3091
PV Stage	3011	Spare DO Setup	3092
PV Destage	3012	Spare AO Setup	3093
EOC Stage	3013	Bacnet MS/TP	3101
EOC Destage	3014	JC Metasys N2	3102
Flow Destage	3015	Modbus	3103
Limit Power Stage	3016	Special Function	3111
VFD Setup	3021	Save to Flash	3121
VFD Set Parameter	3022	Load from Flash	3122
VFD Read Parameter	3023	Load Defaults	3123
All Sys Sen Fail	3024	Display	3131

Notes



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