# PumpSmart®
## Control Solutions
## PS200 v5

## Configuration
## & Operation Guide

**ITT**

*Engineered for life*

# IMPORTANT SAFETY REMINDER

*To: Our Valued Customers*

Products manufactured and furnished by ITT Monitoring and Control will provide safe, trouble-free service when properly installed, maintained and operated. We have an extensive network of experienced sales and service professionals to assist in maximizing your satisfaction with our products.

Safe installation, operation and maintenance of ITT's equipment are essential end user responsibilities. The ACS800 Hardware Manual and PS200 Configuration and Operation Guide identify specific safety risks that must be considered at all times during the life of the product. Understanding and adhering to these safety warnings is mandatory to ensure personnel, property and/or the environment will not be harmed. Adherence to these warnings alone, however, is not sufficient; it is expected that the end user will also comply with industry and corporate safety standards. Identifying and eliminating unsafe installation, operation and maintenance practices is the responsibility of all individuals involved in the installation, operation and maintenance of industrial equipment.

Safety Symbol and Signal Word Explanation:

| | |
|---|---|
| ⚡ | **This is the dangerous voltage alert symbol. It warns of high voltage which can cause death or physical injury. Obey all safety messages that follow this symbol to avoid possible injury or death** |
| ⚠ | **This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.** |
| ⚠ **DANGER** | **DANGER indicates a hazardous situation which, if not avoided, will result in death or serious injury.** |
| ⚠ **WARNING** | **WARNING indicates a hazardous situation which, if not avoided, could result in death or serious injury.** |
| ⚠ **CAUTION** | **CAUTION indicates a hazardous situation which, if not avoided, may result in minor or moderate injury.** |
| **NOTICE** | **NOTICE used without the safety alert symbol addresses practices which, if not avoided, may result in property damage.** |

With respect to PumpSmart drives and the operation of pumping equipment the following risks bear reinforcement above and beyond normal safety precautions:

⚠ **DANGER**

**Never work on the PS200 drive, the motor cable or the motor when main power is applied. After switching off the input power, always wait 5 minutes to allow drive internal capacitors to discharge before working on the drive, the motor or the motor cable. Failure to do so will result in serious injury or death.**

⚠ **DANGER**

**Do not work on control cables when power is applied to the drive or to external control circuits. Externally supplied control circuits may cause dangerous voltages inside the drive even if the main power on the drive is switched off. Failure to do so will result in serious injury or death.**

⚠ **WARNING**

**All electrical installation and maintenance work must be undertaken by a qualified electrician only. Failure to do so could result in serious injury or death.**

⚠ **WARNING**

**Operation of any pumping system with a blocked suction and discharge must be avoided in all cases. Operation, even for a brief period under these conditions, can cause superheating of internal pumpage and result in a violent explosion. All necessary measures must be taken by the end user to ensure this condition does not occur. Failure to do so could result in serious injury or death.**

⚠ **WARNING**

**Never operate rotating equipment unless all protective coupling and shaft guards are in place. Personal injury may occur if the driven equipment is operated without coupling and shaft guards. Failure to do so could result in serious injury or death.**

> ## ⚠ WARNING
>
> **Handle the unit carefully. The PS200 is heavy. Do not lift it alone.**
>
> **Wall Mounted Units: Do not lift the PS200 by the front cover. Place the unit only on its back.**
>
> **Floor Mounted Units: Lift the PS200 by the lifting lugs only. Do not tilt the unit. The unit will overturn from a tilt of about 6 degrees. Use extreme caution when maneuvering a unit that has been placed on wheels.**
>
> **Failure to do follow these instructions could result in serious injury or death or damage to the equipment**

Please take the time to review, understand the safe installation, operation and maintenance guidelines provided in the ACS800 Hardware Manual, PS200 Configuration and Operation Guide and the Installation, Operation and Maintenance instructions for the applied driven equipment.

The PS200 has been designed for safe and reliable operation when properly installed, applied and maintained in accordance with the instructions in the ACS800 Hardware Manual and PS200 Configuration and Operation Guide. ITT Monitoring and Control shall not be liable for physical injury, damage or delays caused by failure to follow these instructions.

# Index

# GETTING STARTED

### *How to use this guide*

This guide has been organized to make setting-up and configuration of the PumpSmart PS200 easy. Set-up has been divided into three main sections that include all the information needed to get up-and-running.  The three sections are:

- **Single Pump** - Where one pump is used with a single process instrument to control on pressure, flow, level, or temperature.

- **Multi-Pump** - Where several pumps are used in a coordinated fashion to meet a pressure, flow, level, or temperature setpoint.

- **Speed Control** - Where a speed setpoint or signal is used to control PumpSmart.

Each section has been laid out to speed you through the configuration process, while providing enough background information to help understand the process.

1. Step Number - The step number helps to keep track of where you are in the configuration process when used in conjunction with the process map.

2. Process Map - The process map is a visual guide of what needs to be done in the step.

3. Background Information - This information explains what the upcoming steps are and why they are being performed. Examples are provided to assist in understanding the concept.

4. Special Notes - These highlighted sections contain comments that are important to the configuration process.

5. Key Step - The key step box details the actual parameter that must be entered into PumpSmart. It includes the basic keys necessary to input the information.

6. Keypad View - The keypad view shows what you will see as you perform the configuration outlined in the Key Step.

Following the initial configuration steps, are sections related to tuning the PumpSmart PS200 once its running, enabling additional options and features, and troubleshooting if you are having problems.
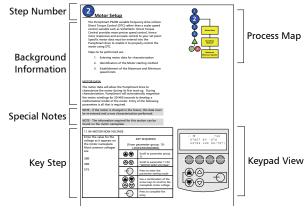


**Figure A - Typical Configuration Page**

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**Language Selection**

The PumpSmart PS200 drive display supports the following languages:

English
English (American) - Default
French (Francais)
German (Deutsch)
Italian (Italiano)
Portuguese
Spanish (Espanol)

Language selection may be performed using parameter 11.01 LANGUAGE, see OPTIONS & FEATURES for further details.

## GETTING STARTED

### PumpSmart Keypad

The PumpSmart keypad serves as the primary means of configuring and operating the drive. It consists of a four-line display and 16 pushbutton keys. After configuration, all of the drive parameters can be saved to the keypad.

### Basic Configuration

Configuring a typical parameter would involve the following key-strokes:

| TYPICAL PARAMETER ENTRY KEY SEQUENCE | |
|---|---|
| *PAR* | Press the Parameter Mode key to enter parameter setting mode. |
| ▲ or ▼ | Use the double arrow keys to scroll through Parameter Groups. |
| △ or ▽ | Use the single arrow keys to scroll through Parameters in each group. |
| *ENTER* | Press to enter the parameter setting mode |
| ▲ or ▼  △ or ▽ | Use a combination of the arrow keys to scroll through selections or enter values. Double arrow keys are used for fast scrolling, while single arrow keys are for slow scrolling. |
| *ENTER* | Press to complete parameter entry |
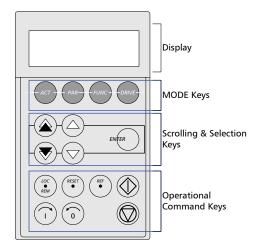


**Figure B - PumpSmart Keypad**

For more detail into using the PumpSmart keypad, see the Appendix section entitled:

KEYPAD USE

## GETTING STARTED

*Before you Start*

Before you begin to field-program your PumpSmart PS200 drive, the following activities are expected to have been completed:

- Pump has been installed, aligned, and prepared for start-up

- PumpSmart drive has been mounted properly *[Refer to the hardware manual for installation details]*

- Power has been properly wired to the drive and from the drive to the motor.

- Process transmitter(s) and optional appurtenances have been installed and correctly wired.

If these steps have not been completed, please stop and complete them before proceeding.

*Once these steps are completed, select the configuration section that applies (SINGLE PUMP, MULTI-PUMP, SPEED CONTROL) and begin with Step 1.*

| ⚠ WARNING |
|---|
| ▪ **Be sure that the drive enclosure is compatible with the installation location. Install the PS200 in a non-hazardous location only. Refer to the ACS800 Hardware Manual.** |
| ▪ **For non-inverter duty motors and/or explosion proof motors consult with the motor manufacturer before applying on VFD service.** |
| ▪ **Observe all CAUTIONS and WARNINGS highlighted in the ACS800 Hardware Manual, PS200 Configuration and Operation Guide and Installation, Operation and Maintenance Guide for the applied driven equipment.** |

**SINGLE PUMP PROCESS CONTROL**

## SINGLE PUMP-PROCESS

This section is devoted to starting your PumpSmart PS200 in single pump process control mode.  In this mode, a single pump is connected to your system with a transmitter (pressure, level, flowmeter, etc.) wired to the PS200 to provide process condition feedback.

| Step | Description | Parameters |
|------|-------------|------------|
| | **Single-Pump Overview** | |
| **1** | **Locks/Passwords**<br><br>This section details the parameter lock function and the selection of the Single Pump operating macro-program. | 10.02 |
| **2** | **Motor Setup**<br><br>Drive data for the First Motor Run ID is entered here in addition to start/stop methods, and MAX and MIN drive speeds | 12.01<br>11.04<br>11.05<br>11.07<br>11.08<br>14.01<br>14.02 |
| **3** | **Operating Mode & Units**<br><br>Selects the mode of operation and the primary process transmitter setup. | 11.03<br>15.01<br>16.03<br>16.04 |
| **4** | **Setpoint** | |
| ➕ | **Pump Protection**<br><br>Protect the pump from operation below minimum flow, dry running or excessive flow using Pump Protection Limit or Advanced Sensorless Pump Protection. | 25.01<br>25.02 |
| ↻ | **Motor Jog**<br><br>Check for proper motor rotation | 12.09 |
| ◈ ⬟ | **Start/Stop** | |

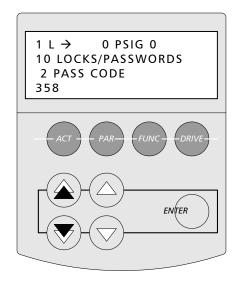| ✓ | **CHECK & GO STEP** |
|---|---------------------|
| | Some parameters may not need to be changed from the default parameters allowing you to speed through the set-up process.  These parameters have been marked with a check mark. |

## SINGLE PUMP PROCESS CONTROL

**1** **Locks and Passwords**

Operating parameters on the PumpSmart PS200 are protected by a 3-digit passcode to prevent casual users or unauthorized users from inadvertently changing the operating and protection limits that have been set.  All PS200 units utilize the same passcode; it cannot be changed by the user/owner.

When the PS200 keypad is locked, functionality is limited to starting, stopping, and changing the operating setpoint.

| 10.02 PASS CODE | | |
|---|---|---|
| To open the Parameter lock, scroll to parameter 10.02 and enter the passcode 358.  The display value will automatically return to 0 after the three-digit code has been entered.<br><br>To check on the status of the parameter lock: scroll to parameter 10.01. After correctly entering the passcode, it will read "OPEN" | KEY SEQUENCE<br>*[From parameter group: 99 INFORMATION]* | |
| | PAR | Press to enter parameter mode |
| | ▲ ▼ | Scroll to parameter group 10 LOCKS / PASSWORDS |
| | △ ▽ | Scroll to parameter 10.02 PASS CODE |
| | ENTER | Press to enter the parameter setting mode |
| | ▲ ▼ △ ▽ | Use a combination of the arrow keys to scroll to the number 358. |
| | ENTER | Press to complete the passcode entry |

```
1 L →     0 PSIG 0
10 LOCKS/PASSWORDS
 2 PASS CODE
358
```

ACT   PAR   FUNC   DRIVE
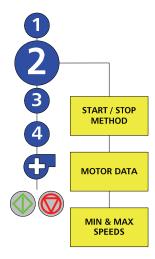
ENTER

***Single Pump Application Macro***

The Single Pump Application Macro is the default setting on new PumpSmart units. If you are re-applying this unit from some other application, check parameter 11.02 APPLICATION MACRO and make sure it is set to SINGLE PUMP

## SINGLE PUMP PROCESS CONTROL

**2** <u>Motor Setup</u>

The PumpSmart PS200 variable frequency drive utilizes Direct Torque Control [DTC] rather than a scalar speed control variable such as Volts/Hertz. Direct Torque Control provides more precise speed control, hence more responsive and accurate control to your set point. Specific motor data must be entered into the PumpSmart drive to enable it to properly control the motor using DTC.

Steps to be performed are:

1. Identification of the motor starting method

2. Entering motor data for characterization

3. Establishment of the maximum and minimum speed limits

**1**
**2**
**3** START / STOP METHOD
**4**
**+** MOTOR DATA

MIN & MAX SPEEDS

## SINGLE PUMP PROCESS CONTROL

*REMOTE START/STOP OPTIONS*

The PumpSmart PS200 has the ability to be remotely started and stopped from an external source.  If the PS200 is only to be started and stopped locally at the keypad then proceed to the next step.

NOTE – The following options only apply when the PS200 is in REMOTE mode.  When in LOCAL mode the start-stop is controlled through the PS200 keypad.  Refer to APPENDIX A-1 KEYPAD USE for further details.

*2-WIRE DI1* – As default the remote start/stop is configured for 2-Wire DI1.  This selection is used to start and stop the drive from a maintained 2-wire switch or contact wired to digital input 1.

*HOA DI1, DI2* - This selection is used to start and stop the drive from a maintained 2-wire switch or contact wired to digital input 1 (DI1-AUTO).  An additional contact can be wired to DI2-HAND to initiate a Speed Override/Motor Jog function in which the PS200 will operate in a speed control mode.  Refer to SPEED OVERRIDE in the Options and Features section for further details.
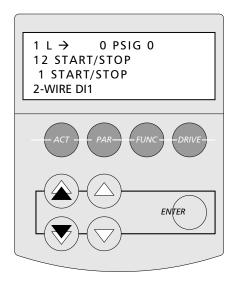
*3-WIRE* – This selection is used to start the PS200 from a normally open momentary contact/switch wired to DI1-START and stop the PS200 from a normally closed momentary contact/switch wired to DI2-STOP.

*FIELDBUS* - This selection is used to start and stop the PS200 from a Control Word which is sent through a digital Fieldbus command. Refer to FIELDBUS COMMUNICATION SECTION for further details.

| 12.01 START/STOP | | |
|---|---|---|
| If you are using a two-wire start-stop method or the keypad only, skip this step and proceed to the next step (Motor Data), otherwise select:<br><br>2-WIRE DI1 *[Default]*<br>3-W DI1P, DI2P<br>HOA DI1, DI2<br>FIELDBUS<br>HOA DI1,2 / DI5<br>DI1P,DI2P / DI5<br>2W DI1, 2W DI5<br>HOA DI1,2 / FB<br>DI1P,DI2P / FB | **KEY SEQUENCE**<br>*[From parameter group: 10 LOCKS / PASSWORDS]* | |
| | ⊼⊽ (ENTER) | Scroll to parameter group 12 START/STOP. Parameter 12.01 will be the first selection |
| | (ENTER) | Press to enter the parameter setting mode |
| | △▽ | Use the arrow keys to scroll to the desired parameter [Example shown – 2-WIRE DI1] |
| | (ENTER) | Press to complete the entry |

NOTE – The PS200 has the ability to be controlled from two separate external commands.  Refer to START STOP OPTIONS in the Options and Features Section.

```
1 L →      0 PSIG 0
12 START/STOP
 1 START/STOP
2-WIRE DI1
```

ACT    PAR    FUNC    DRIVE
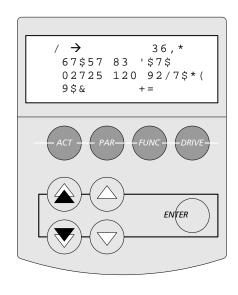
ENTER

# SINGLE PUMP PROCESS CONTROL

## MOTOR DATA

The motor data will allow the PumpSmart drive to characterize the motor prior to its first start-up. During characterization, PumpSmart will automatically magnetize the motor windings for 20 - 60 seconds to develop a mathematical model of the motor. Entry of the following parameters is all that is required.

NOTE - If the motor is changed in the future, this data must be re-entered and a new characterization will be performed.
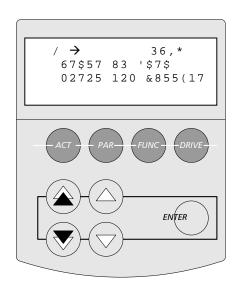
NOTE - The information required for this section can be found on the motor nameplate.

| 11.04 MOTOR NOM VOLTAGE | |
|---|---|
| Enter the value for motor voltage and frequency as found on the motor nameplate. Available selections are<br><br>208 VAC - 60HZ<br>220 VAC - 50 Hz<br>220 VAC - 60 Hz<br>230 VAC - 60 Hz<br>380 VAC - 50 Hz<br>415 VAC - 50 Hz<br>460 VAC - 60 Hz (default)<br>575 VAC - 60 Hz<br>OTHER<br><br>*Selecting OTHER will require entry in parameters 11.06 MOTOR NOM FREQ and 11.12 OTHER MOTOR VOLT.* | **KEY SEQUENCE**<br>*[From parameter group: 12 START / STOP]* |
| | Scroll to parameter group 11 START-UP DATA |
| | Scroll to parameter 11.04 MOTOR NOM VOLTAGE |
| | Press to enter the parameter setting mode |
| | Use a combination of the arrow keys to scroll to the nameplate motor voltage. |
| | Press to complete the entry |

| 11.05 MOTOR NOM CURRENT | |
|---|---|
| Enter the actual full load amps (FLA) of the motor here. Refer to the motor nameplate for the correct value. | **KEY SEQUENCE**<br>*[From parameter: 11.04 MOTOR NOM VOLTAGE]* |
| | Scroll to parameter 11.05 MOTOR NOM CURRENT |
| | Press to enter the parameter setting mode |
| | Use a combination of the arrow keys to scroll to the nameplate motor current. |
| | Press to complete the entry |

## SINGLE PUMP PROCESS CONTROL

| 11.07 MOTOR FL RPM | | |
|---|---|---|
| Enter the full load RPM of the motor. Please note this is the nameplate value of the full load RPM and not the nominal speed of the motor.<br><br>*For Example: An 1800 RPM motor might have a full load RPM of 1770 RPM* | KEY SEQUENCE<br>*[From parameter: 11.05 MOTOR NOM CURRENT]* | |
| | (△) OR (▽) | Scroll to parameter 11.07 MOTOR FL RPM |
| | ENTER | Press to enter the parameter setting mode |
| | (▲) OR (▼)<br>(△) OR (▽) | Use a combination of the arrow keys to scroll to the nameplate full load speed. |
| | ENTER | Press to complete the entry |

| 11.08 MOTOR NOM POWER | | |
|---|---|---|
| Enter the nominal power (HP or kW) of the motor as found on the motor nameplate.<br><br>*If you are using the Default language of ENGLISH(AM), then the units of entry will be Horsepower. Otherwise kW will be the units of entry.* | KEY SEQUENCE<br>*[From parameter: 11.07 MOTOR FL RPM]* | |
| | (△) OR (▽) | Scroll to parameter 11.08 MOTOR NOM POWER |
| | ENTER | Press to enter the parameter setting mode |
| | (▲) OR (▼)<br>(△) OR (▽) | Use a combination of the arrow keys to scroll to the nameplate power. |
| | ENTER | Press to complete the entry |

**SINGLE PUMP PROCESS CONTROL**

# ID MAG REQUIRED

> **This warning is normal, proceed on to the step
> INDENTIFICATION RUN**

*IDENTIFICATION RUN*

PumpSmart uses specific motor detail to create a mathematical motor model. This model enables more accurate motor control and is created with the motor data you have just entered by magnetizing the motor for 20 to 60 seconds at zero speed. This is called a First Start ID Run.

Once all the motor data has been entered, the following warning will be displayed:

<div align="center">

ID MAGN REQ

</div>

This warning indicates that a First Start ID Run is required before the pump may be operated. Now is a good time to perform this run.

> ## ⚠️ WARNING
>
> **The following procedure will energize the motor. All safety precautions must be followed before initiating the ID MAG. Failure to do so could result in serious injury or death.**

With the motor connected to the drive and the keypad in Local (L) mode, press the START button. FOLLOW ALL STANDARD SAFETY PRACTICES FOR STARTING MACHINERY.

> NOTE - ALLOW THE FIRST START ID RUN TO COMPLETE BEFORE STOPPING/RESETTING THE DRIVE. Although the motor may not appear to respond to the start command, it has. A warning message "ID MAGN" will be displayed during the ID. Once the ID run is complete, the message "ID DONE" will be displayed.

> NOTE - If the motor is changed in the future, a First Start ID Run must be performed again to maintain the accuracy of the PumpSmart control.

Once the First Start ID Run has been completed, the following message will appear:

<div align="center">

ID DONE

</div>

Once this appears, proceed on to the next step DRIVE OPERATION LIMITS.

---

### E-Stop/Permissive

The PS200 will not operate unless the E-Stop/Permissive switch [DI1L] is closed. This includes performing the First Start ID Run. If not closed a warning message will appear on the keypad display:

<div align="center">

581 ',6$%/('

</div>

See Appendix A-4, Instrument Wiring, for details on wiring this switch.

NOTE:
The E-Stop/Permissive switch can not be defeated through parameter setting. If your application does not use an E-Stop / Permissive switch, DI1L can be bypassed physically inside the PumpSmart unit. Refer to Appendix A-4, Instrument Wiring, for details.

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## SINGLE PUMP PROCESS CONTROL

*DRIVE OPERATION LIMITS*

Drive operation limits safe-guard the pump and drive system from operating in unstable over-speed and/or low-speed conditions.
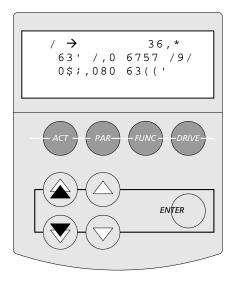
---

### ⚠️ WARNING

**Assure that the system operating conditions are within the capabilities (e.g. - speed, pressure, temperature, power, etc.) of the driven equipment as rated by the manufacturer. Exceeding any of these limits could result in failure of components resulting in serious physical injury and damage to equipment.**

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*Maximum Speed* - The PumpSmart System will adjust the speed of the motor to achieve the desired operating setpoint. Although the PumpSmart system can drive the motor to 2-3 times its nameplate speed, this is generally impractical for several reasons. First, unless the pump and motor are designed for overspeed operation, they could prematurely wear or even catastrophically fail. Second, centrifugal pumps generate pressure by the square of the speed and overspeed operation may overpressure the pump or surrounding piping system.

| 14.01 MAXIMUM SPEED | |
|---|---|
| Enter the maximum speed that the pump, motor, and system can operate at.  In most cases, the maximum speed will be the same as the previously entered full load RPM.<br><br>MAX SPEED ≤ Full Load Motor RPM and ≤ Pump maximum speed<br><br>*The default value is the speed set in parameter 11.07 MOTOR FL RPM* | **KEY SEQUENCE**<br>*[From parameter group: 11 START UP DATA]* |
| | Scroll to parameter group14, SPD LIM/STRT LVL. Parameter 14.01 will be the first selection. |
| | Press to enter the parameter setting mode |
| | Use a combination of the arrow keys to scroll to the maximum speed. |
| | Press to complete the entry |

## SINGLE PUMP PROCESS CONTROL

Minimum Speed - As the demand on the pump decreases, PumpSmart will decrease the pump speed to match the new demand. This Minimum Speed parameter sets the minimum speed that the pump can operate at. It is also used to define the safe speed to run the pump during a pump protection fault. The default value for minimum speed is 25% of 11.07 MOTOR FL RPM.

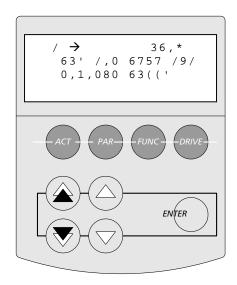When determining a minimum speed, consider the following:

- Motor Minimum Speed [Turndown ratio] - Due to motor loading and thermal effects, the motor minimum speed on centrifugal pumps should not be less than 1/10th its full-load speed.

- Pump Minimum Speed - Some pumps have minimum speed requirements, such as multistage pumps (>2 stages) and sleeve bearing pumps. Consult your pump operation manual to see if there is a minimum speed limit for your pump. **Note - 1& 2 stage pumps do not normally have minimum speed requirements.**

- Static Head Conditions (minimum flow) - The minimum speed should be set to assure that the pump generates enough head to overcome static resistance. In some cases, this can cause overheating and possible vaporization of the liquid in the pump casing.

## NOTICE

**Operation below the pump safe minimum speed could result in damage to equipment and/or property.**

| 14.02 MINIMUM SPEED | | |
|---|---|---|
| Enter the minimum speed that the pump and motor can safely operate at.<br><br>Consider-<br><br>- Turndown ratio<br>- Pump minimum speed<br>- Minimum flow<br><br>*The default value is 25% of the speed set in parameter 11.07 MOTOR FL RPM* | KEY SEQUENCE<br>*[From parameter group: 14.01 MAXIMUM SPEED]* | |
| | ⬆ or ⬇ | Scroll to parameter 14.02 MINIMUM SPEED |
| | ENTER | Press to enter the parameter setting mode |
| | ⬆ or ⬇<br>△ or ▽ | Use a combination of the arrow keys to scroll to the minimum speed. |
| | ENTER | Press to complete the entry |

NOTE - The default settings will stop the pump if the process demand requires the pump to operate below the minimum speed. In pressure of level control modes a SLEEP WARNING will be displayed in this case. The Sleep Function will suspend the PS200 until process demand increase as defined by the RESTART VALUE (parameter 14.07). Once the Restart Value has been achieved for longer then the restart delay the pump will automatically restart to maintain the process setpoint. In flow control modes a LOW DEMAND fault will occur in which case the PS200 will have to be reset. Alternatively the drive may be set to operate at a minimum speed until it is manually shut-off (parameter 14.05).
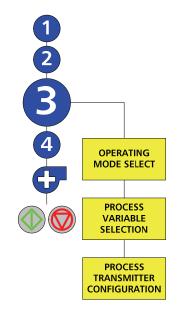
# SINGLE PUMP PROCESS CONTROL

**3** **Select Operating Mode and Units**

In this section, the operating mode is selected and the primary process transmitter is configured.

*OPERATING MODE*

There are five modes for operating the PumpSmart PS200: Pressure, Flow, Level, or Temperature/Other. This selection pre-selects the defaults for units and PI control settings [See TUNING].
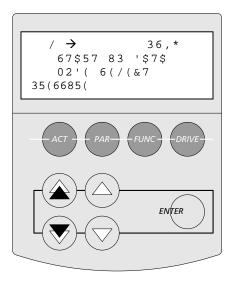
- Pressure – PumpSmart will work to maintain a pressure setpoint based on a pressure transmitter signal.

- Flow – PumpSmart will work to maintain a flow setpoint based on an external flowmeter signal.

- SMART$^{FLOW}$ – PumpSmart will work to maintain a flow setpoint based on an internal flow calculation.

- Level – used to maintain a defined tank level based on a level transmitter feedback, although a pressure transmitter at the pump suction can also be used.  PumpSmart can control the level in either a suction or discharge tank.

- Temperature/OTHER – used to maintain defined temperature of a process stream based on a temperature transmitter signal.  Also use this selection if a 4-20 ma signal from a different type of transmitter is used.

**OPERATING MODE SELECT**

**PROCESS VARIABLE SELECTION**

**PROCESS TRANSMITTER CONFIGURATION**

**11.03 MODE SELECT**

| Select the control mode for your application. If the control mode is PRESSURE, skip to the next step (Process Variable selection).<br><br>Options:<br><br>Pressure<br>Flow<br>Level<br>Temperature/Other<br>SMARTFLOW | KEY SEQUENCE<br>*[From parameter group: 14.02 MINIMUM SPEED]]* |
|---|---|
| | Scroll to parameter group 11 START-UP DATA |
| | Scroll to parameter 11.03 "OPERATING MODE" |
| ENTER | Press to enter the parameter setting mode |
| | Scroll to selection *Example – Pressure* |
| ENTER | Press to complete the entry |

NOTE - If the operating mode requires PumpSmart to control to suction side level or suction pressure control the drive must be set to INVERSE in parameter 21.01 REGULATION MODE.

# SINGLE PUMP PROCESS CONTROL

## PROCESS VARIABLE SELECTION

The process variable unit selection identifies what units your operating mode is in. This parameter sets the units that are used in the actual signal and setpoint display. The defaults are shown for ENGLISH [AM] selection.

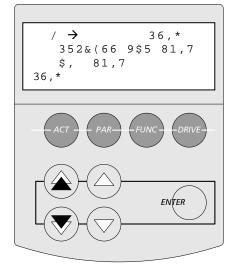| Operating Mode | Available Units Selection |
|---|---|
| Pressure | PSIG [default]<br>BAR<br>FT– Feet<br>M– Meters<br>% |
| Flow | GPM – Gallons Per Minute [default]<br>M3Hr – Cubic meters per hour<br>% |
| Level | PSIG<br>BAR<br>FT-Feet [default]<br>IN - Inches<br>CM - Centimeters<br>M– Meters<br>% |
| Temperature | °F – Degrees Fahrenheit [default]<br>°C – Degrees Celsius |

AI2 refers to the Analog Input channel No. 2. This is the default location where your primary process transmitter should be physically connected.

| 15.01 AI2 UNIT | | |
|---|---|---|
| Select the proper units of the operating mode.<br><br>Skip to the next step if the default unit is okay, otherwise select:<br><br>BAR      FT<br>GPM     IN<br>PSIG    CM<br>M3/HR  M<br>%       °F<br>         °C | KEY SEQUENCE<br>*[From parameter group 11.03 MODE SELECT]* | |
| | (▲)-(▼) | Scroll to parameter group 15 PROCESS VAR UNIT. Parameter 15.01 will be the first selection |
| | ENTER | Press to enter the parameter setting mode |
| | (△)-(▽) | Scroll to the appropriate measurement units. Example shown is PSIG |
| | ENTER | Press to complete the entry |

NOTE - FOR PRESSURE/LEVEL MODES

If units of FT, IN, M or CM are used and Specific Gravity [SG] is constant but other than 1.0, parameter 29.15 must be completed. If Specific Gravity varies parameters 29.12 – 29.18 must be completed. See Specific Gravity Setup - Options & Features.

## SINGLE PUMP PROCESS CONTROL
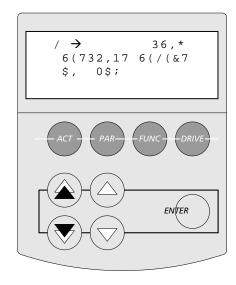
<u>*PROCESS TRANSMITTER CONFIGURATION*</u>

The primary process transmitter is the device that will measure your process conditions. The PS200 requires information to properly scale the 4-20 mA signal that the transmitter sends.

AI2 MAX - This refers to the process value that your transmitter is calibrated to at its max signal [20 mA]. Refer to your transmitter calibration sheet, or the instrument nameplate, for this value.

> *Example - a direct reading flowmeter [e.g. magmeter, vortex flowmeter, etc…] that has a range of  0 - 2000 GPM would be calibrated such that at 2000 GPM, the output of the transmitter would be 20 mA. Parameter 16.03 would be set to 2000 in this case. The units of 16.03 are the same as selected in parameter 15.01.*

NOTE - Differential pressure flowmeters [e.g. orifice plate, venturi] do not produce 4-20 mA signals that are linear with the flow-rate. **PumpSmart cannot accommodate these types of flowmeters**.

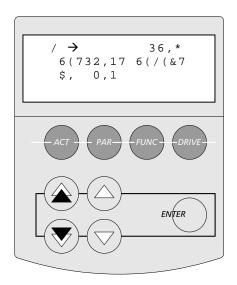| 16.03 AI2 MAX | |
|---|---|
| Enter the reading of the primary process transmitter that corresponds to its 20 mA signal.<br><br>Units are the same as entered in 15.01. | **KEY SEQUENCE**<br>*[From parameter group: 15.01 AI2 UNIT]* |
| | Scroll to parameter group 16 SETPOINT SELECT |
| | Scroll to parameter 16.03 AI2 MAX |
| | Press to enter the parameter setting mode |
| | Use a combination of the arrow keys to scroll to the correct value. Example shown - 300 PSIG |
| | Press to complete the entry |

## SINGLE PUMP PROCESS CONTROL

AI2 MIN - This is the process value that corresponds to the transmitter's minimum signal [4 mA]. This value is normally zero on a pressure or flow transmitter. Refer to your transmitter calibration sheet, or the instrument nameplate, for this value.

NOTE - Most pressure and flow transmitters are configured for a reading of 0 [PSIG, GPM, etc…] at 4 mA. If so, this step may be omitted since the default of parameter 16.04 is 0.

| 16.04 AI2 MIN | |
|---|---|
| Enter the reading of the primary process transmitter that corresponds to its 4-mA signal.<br><br>If your transmitter signal is zero (0) at 4mA, skip to the next section (Enter Setpoint).<br><br>Units are the same as entered in 15.01. | **KEY SEQUENCE**<br>*[From parameter group: 16.03 AI2 MAX]* |
| | Scroll to parameter 16.04 AI2 MIN |
| | Press to enter the parameter setting mode |
| | Use a combination of the arrow keys to scroll to the correct value. Example shown - 0 PSIG |
| | Press to complete the entry |

## SINGLE PUMP PROCESS CONTROL

# 4 Enter Setpoint

The final step before starting the PumpSmart system in a basic process control mode is to enter the operating setpoint.

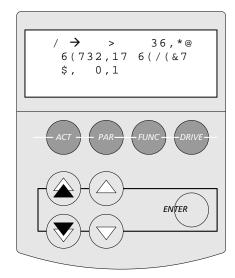| SETPOINT | | |
|---|---|---|
| Enter the operating setpoint. | KEY SEQUENCE | |
| | REF ● | Press REF button to highlight the setpoint value |
| | ▲ OR ▼  △ OR ▽ | Use a combination of the arrow keys to scroll to the desired setpoint. Example shown is 100 PSIG. |
| | ENTER | Press to complete the entry |

NOTE(S) -

There are alternative ways to enter the setpoint. Refer to the OPTIONS AND FEATURES section for configuration detail.

Remote setpoint – An analog input signal may be used to send setpoints to the PumpSmart unit from a remote location.

Variable Setpoint- A second process transmitter [2-10VDC or 4-20 mA] may be used to vary the setpoint. The setpoint can be linear, inverse linear, or offset, to this signal. See OPTIONS & FEATURES for details.

Multiple setpoint - The PumpSmart system can be programmed with two setpoints and the drive can toggle between the two setpoints based upon a digital switch  [e.g. flow switch, level switch, manual switch, etc…]. Multiple setpoints can be set through either the keypad, Analog Input or via the DCS.

Fieldbus - The setpoint can be programmed and changed remotely by way of digital communication with optional filedbus communication modules.  Modules are available for Modbus RTU, Profibus DP, DeviceNet, ControlNet, and Ethernet.

## SINGLE PUMP PROCESS CONTROL

# ⊞ Recommended Option: Pump Protection Limit

The Pump Protection Limit adds significant protection to the PumpSmart PS200 system through a simple setup. With the pump protection limit enabled, the PS200 system will be able to provide dry run (loss of, or blocked suction) protection in **Pressure and Flow Control Only**. It will also be able to provide run-out flow protection when in pressure control mode.

For any other control modes Advanced Pump Protection must be enabled.  For further details refer to Pump Protection in the Options and Features Section.
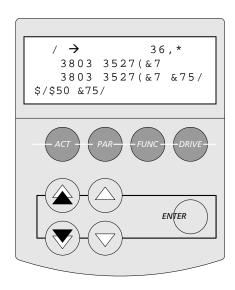
For the highest level of protection it is recommended to use the Advanced Pump Protection Feature which provides dry run, min-flow and run-out protection using SMART[FLOW], sensorless flow function, and a pump self calibration feature.

The pump protection limit works by identifying conditions where the pump is unable to meet the protection limit when at maximum speed.

The first step in enabling the Pump Protection function is to select how you would prefer PumpSmart to respond if the protection limit conditions occur. There are three options:

1.    ALARM & CONTROL [Recommended]- In this response, PumpSmart will issue a warning and then either shut down or reduce speed depending upon your settings.  These settings may be found in the OPTIONS & FEATURES section under MINIMUM SPEED OPTIONS.

2.    ALARM only - In this response, PumpSmart will simply issue an alarm/warning, but continue to operate. The alarm only mode may result in damage to the pump if a protection limit fault occurs and no manual intervention is taken.

3.    DISABLED (Default Setting) - In this response, there is no protection limit functionality.  If a closed suction valve (or similar) condition exists, there may be damage to the pump, and there will be no alarm warning the user.

| 25.01 PUMP PROTECT CTRL | | |
|---|---|---|
| Select the how PumpSmart should respond in the event a Protection Limit condition exists. | KEY SEQUENCE | |
| | △→▽ | Scroll to parameter 25.01 PUMP PROTECT CTRL |
| | ENTER | Press to enter the parameter setting mode |
| Options-<br><br>DISABLED (Default)<br><br>ALARM | △→▽ | Use the arrow key to scroll to the desired response. Example shown is ALARM & CTRL. |
| ALARM & CTRL<br><br>*We highly recommend ALARM & CTRL* | ENTER | Press to complete the entry |

## SINGLE PUMP PROCESS CONTROL

NOTE - The PumpSmart keypad will display an alarm or fault message "Pump Protect" when the protection limit condition exists. The Pump Protection feature may also be configured to warn via DCS [optional Fieldbus module] or sonic or visual alarms through the digital relay output. See Option and Features for details.

The next step is setting the protection limit. This setting should be just below your minimum acceptable setpoint value. PumpSmart Control Solutions recommends 2-3% below your setpoint for initial settings.

The Pump Protection Limit is expressed in terms of % of setpoint.
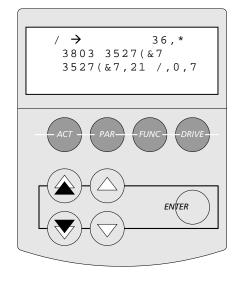
*Example - If you had a setpoint of 100 PSIG (or GPM, or Ft, etc…) the recommended protection limit would be 97%. The Pump Protection warning/fault would occur if the pump was at maximum speed and pressure fell below 97 PSIG.*

If operating in flow control, the protection limit will protect against minimum flow faults. In this case, the protection limit will be set much lower.

*Example - If you had a setpoint of 100 GPM and a recommended minimum flow of 60 GPM, the protection limit would be 60%. The Pump Protection warning/fault would occur if the pump was at maximum speed and flow fell below 60 GPM.*

| 25.02 PROTECTION LIMIT | |
|---|---|
| Enter the pump protection limit as a percentage of the setpoint.<br><br>Example: From the above example, the entry would be "97". | **KEY SEQUENCE**<br>*[From parameter: 25.01 PUMP PROTECT CTRL]* |
| | PAR — Press PAR button to enter the Parameter Menu |
| | ▲ OR ▼ — Press the double arrow key to go to parameter group 25, PUMP PROTECT |
| | △ OR ▽ — Press the single arrow key to go to parameter 25.02, PROTECTION LIMIT |
| | ENTER — Press to enter the parameter setting mode |
| | ▲ OR ▼ / △ OR ▽ — Use a combination of the arrow keys to scroll to the desired protection limit. Example shown is 97%. |
| | ENTER — Press to complete the entry |

NOTE - A delay can be set so that the PumpSmart PS200 waits to respond if the process variable falls below the protection limit. This will prevent the PumpSmart unit from shutting down prematurely due to momentary system upsets. See the OPTIONS section for further detail.

## SINGLE PUMP PROCESS CONTROL

|  | **Recommended Step: Parameter Upload** *See KEYPAD USE* |
|---|---|
| Save your parameters in the keypad. In the unlikely event that the PS200 parameters are lost, the keypad can be used to restore the configuration.  It can also be used to program sister units that use the same or similar program settings. ||

| **Recommended Option: Drive Locking** *See OPTIONS & FEATURES* |
|---|
| The keypad can be "locked" to prevent unauthorized personnel from making operational changes or changes to the parameter groups. See  LOCKING in OPTIONS & FEATURES. |

## SINGLE PUMP PROCESS CONTROL
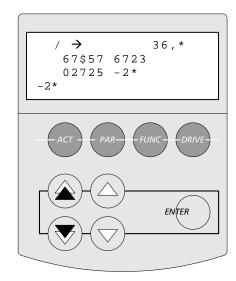
## Jogging the Motor

Checking the motor for rotation can be accomplished through the Motor Jog function in which the pump will rotate for 10 seconds at 60rpm.

| 12.09 MOTOR JOG | |
|---|---|
| Selecting JOG and pressing the enter key will initiate the motor to rotate.  Once completed the parameter value will default back to DISABLE. | **KEY SEQUENCE**<br>*[From parameter: 25.02 PROTECTION LIMIT]* |
| | PAR — Press PAR button to enter the Parameter Menu |
| | Press the double arrow key to go to parameter group 12 |
| | Press the single arrow key to go to parameter 12.09, MOTOR JOG |
| | ENTER — Press to enter the parameter setting mode |
| | Use the single arrow key to scroll to JOG |
| | ENTER — Press to complete the entry |

If pump rotation is incorrect then two of the <u>output phases</u> must be swapped on the drive terminals U2, V2 or W2.  Swapping two of the input phases will not change the rotation of the drive.

### ⚠ DANGER

**Never work on the PS200 drive, the motor cable or the motor when main power is applied. After switching off the input power, always wait 5 minutes to allow drive internal capacitors to discharge before working on the drive, the motor or the motor cable. Failure to do so will result in serious injury or death.**
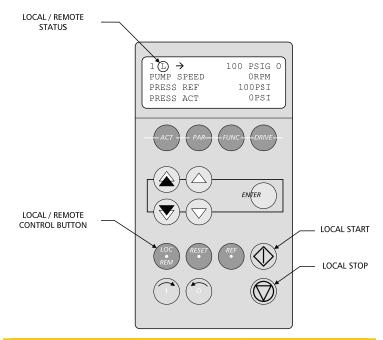
## SINGLE PUMP PROCESS CONTROL

# Starting & Stopping

The PumpSmart system is now ready to start. Starting and stopping the PumpSmart unit is possible through the keypad when in LOCAL mode and through a remote signal as defined in parameter 12.01 when in REMOTE mode.

LOCAL and REMOTE control modes can be changed via the LOC/REM button located on the keypad. To verify if the drive is in LOCAL an "L" will appear in the top right hand corner of the keypad. If the drive is in REMOTE mode an "R" will appear or the space will appear blank if the drive is in REMOTE mode and the setpoint is being controlled remotely.

LOCAL / REMOTE STATUS

```
1 (L)  →         100 PSIG 0
PUMP SPEED            0RPM
PRESS REF          100PSI
PRESS ACT            0PSI
```

ACT   PAR   FUNC   DRIVE

ENTER

LOCAL / REMOTE CONTROL BUTTON

LOC/REM   RESET   REF

I   O

LOCAL START

LOCAL STOP

### ⚠ WARNING

**Never operate rotating equipment unless all protective coupling and shaft guards are in place. Personal injury may occur if the driven equipment is operated without coupling and shaft guards.**

### ⚠ WARNING

**Observe all CAUTIONS and WARNINGS highlighted in the ACS800 Hardware Manual, PS200 Configuration and Operation Guide and Installation, Operation and Maintenance Guide for the applied driven equipment prior to starting.**

---

### E-Stop/Permissive

The PS200 will not operate unless the E-Stop/Permissive switch [DI1L] is closed. This includes performing the First Start ID Run. If not closed a warning message will appear on the keypad display:

581 ',6$%/('

See Appendix A-4, Instrument Wiring, for details on wiring this switch.

NOTE:
The E-Stop/Permissive switch can not be defeated through parameter setting. If your application does not use an E-Stop / Permissive switch, DI1L can be bypassed physically inside the PumpSmart unit. Refer to Appendix A-4, Instrument Wiring, for details.

---

# SINGLE PUMP PROCESS CONTROL

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# MULTI PUMP-PROCESS CONFIGURATION

The PumpSmart PS200 system can control up to four pumps in a coordinated fashion to meet system demand and maximize pump performance and reliability. This is referred to as MULTI-PUMP operation.

| Step | Description | Parameters |
|------|-------------|------------|
| | **Multi-Pump Overview** | |
| 1 | **Locks/Passwords & Operating Macro**<br><br>This section details the parameter lock function and the selection of the Multi-pump operating macro-program. | 10.02<br>11.02 |
| 2 | **Motor Setup**<br><br>Drive data for the First Motor Run ID is entered here in addition to start/stop methods, and MAX and MIN drive speeds | 12.01<br>11.04<br>11.05<br>11.07<br>11.08<br>14.01<br>14.02 |
| 3a | **Operating Mode & Units**<br><br>Selects the mode of operation and the primary process transmitter setup. | 11.03<br>15.01<br>16.03<br>16.04 |
| 3b | **Multi-pump Settings**<br><br>Selects how the multiple pumps will work together to satisfy the system demand. | 22.01<br>22.02<br>22.03<br>22.04<br>22.08<br>22.09<br>22.17 |
| 4 | **Setpoint** | |
| | **Pump Protection**<br><br>Protect the pump from operation below minimum flow, dry running or excessive flow using Advanced Sensorless Pump Protection or Secondary Pump Protection features. | 25.06 |
| | **Configuration Additional Drives** | 22.13<br>17.21 |
| | **Motor Jog**<br><br>Check for proper motor rotation | 12.09 |
| | **Start/Stop** | |

## MULTI PUMP-PROCESS CONFIGURATION

## <u>Overview - Multi-Pump Applications</u>

The following is an overview of the different Multi-pump applications:

*Synchronous Mode*

In synchronous mode, a lead drive starts initially and regulates to the set point.  If the unit is unable to meet the setpoint conditions, the lead PS200 will start a second PS200 pump and regulate both units to the same speed or torque to meet the setpoint.  If the setpoint conditions are still not met a third and fourth pump can be started and similarly be regulated to the same speed. Similarly, when demand drops, PumpSmart will de-stage pumps that are no longer required to meet the setpoint.

PumpSmart can automatically switch between lead and lag pumps to ensure that they all wear evenly.
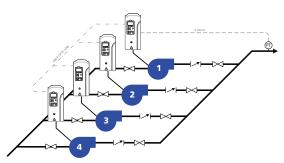
*Back-up Mode*

In cases where a backup pump exists and each pump is sized to handle all the anticipated process demands, backup mode may be used to provide automatic lead-lag switching to provide uniform wear. In addition, in the event of a Pump Protection or VFD fault, the backup unit will be automatically started.

NOTE - It is possible to use dissimilar pumps in Synchronous mode. Caution should be exercised however to ensure that pump head curves are similar to prevent operation at shut-off or check valve chatter on the lower head pump(s).

IT IS RECOMMENDED THAT ALL PUMPS BE IDENTICAL IN PERFORMANCE

### ⚠ WARNING

**Do not operate the pump at zero flow condition. This condition may result in overheating due to vaporization of liquid in the pump casing and can result in pump failure and physical injury.**



**Typical Multipump Arrangement**

**What's Lead and What's Lag?**

A LEAD pump is the pump that runs before all others are activated. This may sometimes be referred to as the *PRIMARY* unit.
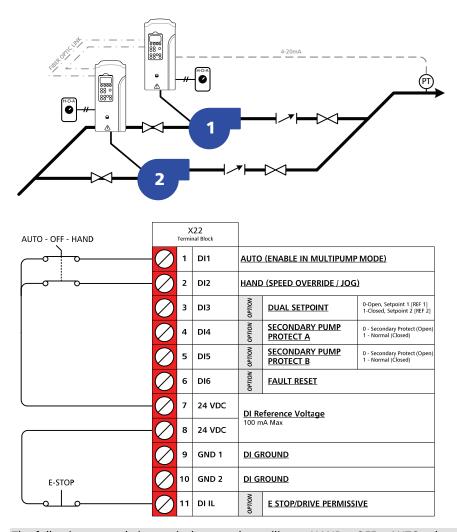
A LAG pump starts only when the demand on the system becomes greater than what the lead pump can handle. This is sometimes called the *BACKUP* or *SECONDARY* unit.

LEAD's and LAG's can be switched to allow for uniform wear. See OPTIONS & FEATURES for details.

# MULTI PUMP-PROCESS CONFIGURATION

### Note - Multi-Pump Wiring

When installing and wiring a multi-pump system, each drive **MUST** include a remote START/STOP command in the form of either a two-wire "OFF-AUTO" switch, a 3-wire pulse start/stop or remote Fieldbus start/stop command.  When starting a multi-pump system, all slave units must be set to "AUTO" or pulse start and the keypad set in REMOTE.

THE DRIVES WILL NOT OPERATE IN MULTIPUMP CONTROL MODE IN LOCAL CONTROL USING THE LOCAL START STOP KEYS AT THE KEYPAD.





| X22 Terminal Block | | | | |
|---|---|---|---|---|
| 1 | DI1 | | AUTO (ENABLE IN MULTIPUMP MODE) | |
| 2 | DI2 | | HAND (SPEED OVERRIDE / JOG) | |
| 3 | DI3 | OPTION | DUAL SETPOINT | 0-Open, Setpoint 1 [REF 1] 1-Closed, Setpoint 2 [REF 2] |
| 4 | DI4 | OPTION | SECONDARY PUMP PROTECT A | 0 - Secondary Protect (Open) 1 - Normal (Closed) |
| 5 | DI5 | OPTION | SECONDARY PUMP PROTECT B | 0 - Secondary Protect (Open) 1 - Normal (Closed) |
| 6 | DI6 | OPTION | FAULT RESET | |
| 7 | 24 VDC | | DI Reference Voltage 100 mA Max | |
| 8 | 24 VDC | | | |
| 9 | GND 1 | | DI GROUND | |
| 10 | GND 2 | | DI GROUND | |
| 11 | DI IL | OPTION | E STOP/DRIVE PERMISSIVE | |

AUTO - OFF - HAND

E-STOP

The following example is a typical set up that utilizes a HAND – OFF – AUTO selector switch where in AUTO the drives will operate in multipump process control mode and in HAND the drives operate in speed override mode.   For SPEED OVERRIDE options refer to the Options and Features Section.

## MULTI PUMP-PROCESS CONFIGURATION
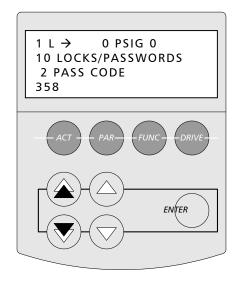
# 1 Locks & Multi-Pump Application Macro

This configuration guide is structured to program the MASTER drive first, and then program the SLAVE drives using the upload/download function on the PumpSmart keypad. In multi-pump applications, any PS200 can be the MASTER. The MASTER drive will control the staging and de-staging of the SLAVE pumps.

**Select one pump to be your MASTER and start configuring it first.**

Operating parameters on the PumpSmart PS200 are protected by a 3-digit passcode to prevent casual users or unauthorized users from inadvertently changing the operating and protection limits that have been set.  All PS200 units utilize the same passcode; it cannot be changed by the user/owner.

When the PS200 keypad is locked, functionality is limited to starting, stopping, and changing the operating setpoint.
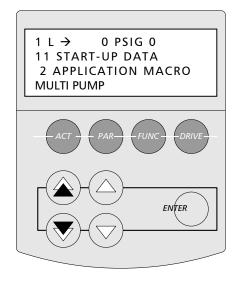
| 10.02 PASS CODE | |
|---|---|
| To open the Parameter lock, scroll to parameter 10.02 and enter the passcode 358.  The display value will automatically return to 0 after the three-digit code has been entered.<br><br>To check on the status of the parameter lock: scroll to parameter 10.01. After correctly entering the passcode, it will read "OPEN" | **KEY SEQUENCE**<br>*[From parameter group: 99 INFORMATION]* |
| | Press to enter parameter mode |
| | Scroll to parameter group 10 LOCKS / PASSWORDS |
| | Scroll to parameter 10.02 PASS CODE |
| | Press to enter the parameter setting mode |
| | Use a combination of the arrow keys to scroll to the number 358. |
| | Press to complete the passcode entry |

```
1 L →      0 PSIG 0
10 LOCKS/PASSWORDS
 2 PASS CODE
358
```

ACT   PAR   FUNC   DRIVE

ENTER

# MULTI PUMP-PROCESS CONFIGURATION

*Multi-pump application macro*

The default application macro on the PumpSmart PS200 is SINGLE PUMP; parameter 11.02 needs to be set to MULTI PUMP.

| 11.02 APPLICATION MACRO | | |
|---|---|---|
| Select the multi-pump application macro. | KEY SEQUENCE *[From parameter group 10.02 LOCKS.PASSWORDS]* | |
| | ▲/▼ | Scroll to parameter group 11 START-UP DATA |
| | △/▽ | Scroll to parameter 11.02 APPLICATION MACRO |
| | ENTER | Press to enter the parameter setting mode |
| | △/▽ | Scroll to the MULTI PUMP selection |
| | ENTER | Press to complete the entry |

```
1 L →      0 PSIG 0
11 START-UP DATA
 2 APPLICATION MACRO
MULTI PUMP
```

ACT   PAR   FUNC   DRIVE

ENTER

## MULTI PUMP-PROCESS CONFIGURATION
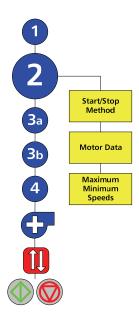
**2** **Motor Setup**

The PumpSmart PS200 variable frequency drive utilizes Direct Torque Control [DTC] rather than a scalar speed control variable such as Volts/Hertz. Direct Torque Control provides more precise speed control, hence more responsive and accurate control to your set point. Specific motor data must be entered into the PumpSmart drive to enable it to properly control the motor using DTC.

Steps to be performed are:

1. Identification of the motor starting method

2. Entering motor data for characterization

3. Establishment of the maximum and minimum speed limits

| ✔ | CHECK & GO STEP |
|---|---|
| Some parameters may not need to be changed from the default parameters allowing you to speed through the set-up process. These parameters have been marked with a check mark. | |

## MULTI PUMP-PROCESS CONFIGURATION

*REMOTE Start/Stop Options*

The PumpSmart PS200 has the ability to be remotely started and stopped from an external source.

*2-WIRE DI1* – As default the remote start/stop is configured for 2-Wire DI1.  This selection is used to start and stop the drive from a maintained 2-wire switch or contact wired to digital input 1.

*HOA DI1, DI2* - This selection is used to start and stop the drive from a maintained 2-wire switch or contact wired to digital input 1 (DI1-AUTO).  An additional contact can be wired to DI2-HAND to initiate a Speed Override/Motor Jog function in which the PS200 will operate in a speed control mode.  Refer to SPEED OVERRIDE in the Options and Features section for further details.
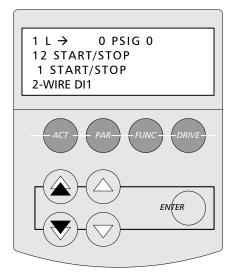
*3-W DI1P, DI2P* – This selection is used to start the PS200 from a normally open momentary contact/switch wired to DI1-START and stop the PS200 from a normally closed momentary contact/switch wired to DI2-STOP.

*FIELDBUS* - This selection is used to start and stop the PS200 from a Control Word which is sent through a digital Fieldbus command.  Refer to FIELDBUS COMMUNICATION SECTION for further details.

| 12.01 START/STOP | | |
|---|---|---|
| If you are using a two-wire start-stop method or the keypad only, skip this step and proceed to the next step (Motor Data), otherwise select: | KEY SEQUENCE *[From parameter group: 10 LOCKS / PASSWORDS]* | |
| | (▲)→(▼) | Scroll to parameter group 12 START/STOP. Parameter 12.01 will be the first selection |
| 2-WIRE DI1 *[Default]* | ENTER | Press to enter the parameter setting mode |
| 3-W DI1P, DI2P | | |
| HOA DI1, DI2 | (△)→(▽) | Use the arrow keys to scroll to the desired parameter [Example shown - 2 WIRE DI1] |
| FIELDBUS | | |
| HOA DI1,2 / DI5 | | |
| DI1P,DI2P / DI5 | | |
| 2W DI1, 2W DI5 | ENTER | Press to complete the entry |
| HOA DI1,2 / FB | | |
| DI1P,DI2P / FB | | |

NOTE – The PS200 has the ability to be controlled from two separate external commands.  Refer to START/STOP OPTIONS in the Options and Features Section.

```
1 L →      0 PSIG 0
12 START/STOP
 1 START/STOP
2-WIRE DI1
```

ACT    PAR    FUNC    DRIVE

ENTER

# MULTI PUMP-PROCESS CONFIGURATION
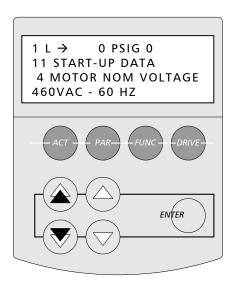
### *Motor Data*

The motor data will allow the PumpSmart drive to characterize the motor prior to its first start-up.  During characterization, PumpSmart will automatically magnetize the motor windings for 20 - 60 seconds to develop a mathematical model of the motor. Entry of the following parameters is all that is required.

NOTE - If the motor is changed in the future, this data must be re-entered and a new characterization will be performed.
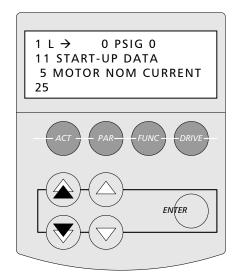
NOTE - The information required for this section can be found on the motor nameplate.
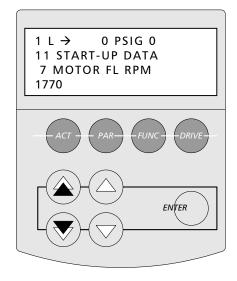
| 11.04 MOTOR NOM VOLTAGE | |
|---|---|
| Enter the value for motor voltage and frequency as found on the motor nameplate. Available selections are<br><br>208 VAC - 60HZ<br>220 VAC - 50 Hz<br>220 VAC - 60 Hz<br>230 VAC - 60 Hz<br>380 VAC - 50 Hz<br>415 VAC - 50 Hz<br>460 VAC - 60 Hz (default)<br>575 VAC - 60 Hz<br>OTHER<br><br>*Selecting OTHER will require entry in parameters 11.06 MOTOR NOM FREQ and 11.12 OTHER MOTOR VOLT.* | **KEY SEQUENCE**<br>*[From parameter group: 12 START / STOP]*<br><br>⬆️⬇️ Scroll to parameter group 11 START-UP DATA<br><br>△▽ Scroll to parameter 11.04 MOTOR NOM VOLTAGE<br><br>ENTER Press to enter the parameter setting mode<br><br>⬆️OR⬇️ △OR▽ Use a combination of the arrow keys to scroll to the nameplate motor voltage.<br><br>ENTER Press to complete the entry |

```
1 L →      0 PSIG 0
11 START-UP DATA
 4 MOTOR NOM VOLTAGE
460VAC - 60 HZ
```

ACT   PAR   FUNC   DRIVE

ENTER

| 11.05 MOTOR NOM CURRENT | |
|---|---|
| Enter the actual full load amps (FLA)  of the motor here.  Refer to the motor nameplate for the correct value. | **KEY SEQUENCE**<br>*[From parameter: 11.04 MOTOR NOM VOLTAGE]*<br><br>△OR▽ Scroll to parameter 11.05 MOTOR NOM CURRENT<br><br>ENTER Press to enter the parameter setting mode<br><br>⬆️OR⬇️ △OR▽ Use a combination of the arrow keys to scroll to the nameplate motor current.<br><br>ENTER Press to complete the entry |

```
1 L →       0 PSIG 0
11 START-UP DATA
 5 MOTOR NOM CURRENT
25
```

ACT   PAR   FUNC   DRIVE

ENTER

## MULTI PUMP-PROCESS CONFIGURATION

| 11.07 MOTOR FL RPM | |
|---|---|
| Enter the full load RPM of the motor. Please note this is the nameplate value of the full load RPM and not the nominal speed of the motor.<br><br>*For Example: An 1800 RPM motor might have a full load RPM of 1770 RPM* | **KEY SEQUENCE**<br>*[From parameter: 11.05 MOTOR NOM CURRENT]* |
| | △ OR ▽  Scroll to parameter 11.07 MOTOR FL RPM |
| | ENTER  Press to enter the parameter setting mode |
| | ▲ OR ▼ / △ OR ▽  Use a combination of the arrow keys to scroll to the nameplate full load speed. |
| | ENTER  Press to complete the entry |

```
1 L →     0 PSIG 0
11 START-UP DATA
 7 MOTOR FL RPM
1770
```

ACT   PAR   FUNC   DRIVE

ENTER

| 11.08 MOTOR NOM POWER | |
|---|---|
| Enter the nominal power (HP or kW) of the motor as found on the motor nameplate.<br><br>*If you are using the Default language of ENGLISH(AM), then the units of entry will be Horsepower. Otherwise kW will be the units of entry.* | **KEY SEQUENCE**<br>*[From parameter: 11.07 MOTOR FL RPM]* |
| | △ OR ▽  Scroll to parameter 11.08 MOTOR NOM POWER |
| | ENTER  Press to enter the parameter setting mode |
| | ▲ OR ▼ / △ OR ▽  Use a combination of the arrow keys to scroll to the nameplate power. |
| | ENTER  Press to complete the entry |

```
1 L →     0 PSIG 0
11 START-UP DATA
 8 MOTOR NOM POWER
50
```

ACT   PAR   FUNC   DRIVE

ENTER

**MULTI PUMP-PROCESS CONFIGURATION**

# ID MAGN REQ

> **This warning is normal, proceed on to the step**
> **INDENTIFICATION RUN**

*Identification run*

PumpSmart uses specific motor detail to create a mathematical motor model. This model enables more accurate motor control and is created with the motor data you have just entered by magnetizing the motor for 20 to 60 seconds at zero speed. This is called a First Start ID Run.

Once all the motor data has been entered, the following warning will be displayed:

<div align="center">ID MAGN REQ</div>

This warning indicates that a First Start ID Run is required before the pump may be operated. Now is a good time to perform this run.

> ### ⚠ WARNING
>
> **The following procedure will energize the motor. All safety precautions must be followed before initiating the ID MAG. Failure to do so could result in serious injury or death.**

With the motor connected to the drive and the keypad in Local (L) mode, press the START button. FOLLOW ALL STANDARD SAFETY PRACTICES FOR STARTING MACHINERY.

> NOTE - ALLOW THE FIRST START ID RUN TO COMPLETE BEFORE STOPPING/RESETTING THE DRIVE. Although the motor may not appear to respond to the start command, it has. A warning message "ID MAGN" will be displayed during the ID. Once the ID run is complete, the message "ID DONE" will be displayed.

> NOTE - If the motor is changed in the future, a First Start ID Run must be performed again to maintain the accuracy of the PumpSmart control.

Once the First Start ID Run has been completed, the following message will appear:

<div align="center">ID DONE</div>

Once this appears, proceed on to the next step DRIVE OPERATION LIMITS.

---

### E-Stop/Permissive

The PS200 will not operate unless the E-Stop/Permissive switch [DI1L] is closed. This includes performing the First Start ID Run. If not closed a warning message will appear on the keypad display:

<div align="center">RUN DISABLED</div>

See Appendix A-4, Instrument Wiring, for details on wiring this switch.

NOTE:
The E-Stop/Permissive switch can not be defeated through parameter setting. If your application does not use an E-Stop / Permissive switch, DI1L can be bypassed physically inside the PumpSmart unit. Refer to Appendix A-4, Instrument Wiring, for details.

## MULTI PUMP-PROCESS CONFIGURATION

*Drive Operation Limits*

Drive operation limits safe-guard the pump and drive system from operating in unstable over-speed and/or low-speed conditions.
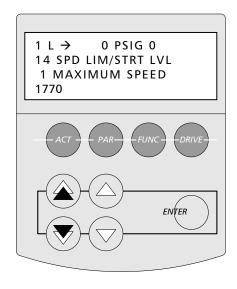
> ⚠ **WARNING**
>
> **Assure that the system operating conditions are within the capabilities (e.g. - speed, pressure, temperature, power, etc.) of the driven equipment as rated by the manufacturer. Exceeding any of these limits could result in failure of components resulting in serious physical injury and damage to equipment.**

*Maximum Speed* - The PumpSmart System will adjust the speed of the motor to achieve the desired operating setpoint. Although the PumpSmart system can drive the motor to 2-3 times its nameplate speed, this is generally impractical for several reasons. First, unless the pump and motor are designed for overspeed operation, they could prematurely wear or even catastrophically fail. Second, centrifugal pumps generate pressure by the square of the speed and overspeed operation may overpressure the pump or surrounding piping system.

| 14.01 MAXIMUM SPEED | | |
|---|---|---|
| Enter the maximum speed that the pump, motor, and system can operate at.  In most cases, the maximum speed will be the same as the previously entered full load RPM. <br><br> MAX SPEED ≤ Full Load Motor RPM and ≤ Pump maximum speed <br><br> *The default value is the speed set in parameter 11.07 MOTOR FL RPM* | **KEY SEQUENCE** <br> *[From parameter group: 11 START UP DATA]* | |
| | ▲ or ▼ | Scroll to parameter group14, SPD LIM/STRT LVL. Parameter 14.01 will be the first selection. |
| | ENTER | Press to enter the parameter setting mode |
| | ▲ or ▼ or △ or ▽ | Use a combination of the arrow keys to scroll to the maximum speed. |
| | ENTER | Press to complete the entry |

Display panel:
```
1 L →      0 PSIG 0
14 SPD LIM/STRT LVL
 1 MAXIMUM SPEED
1770
```
ACT   PAR   FUNC   DRIVE

ENTER

## MULTI PUMP-PROCESS CONFIGURATION

Minimum Speed - As the demand on the pump decreases, PumpSmart will decrease the pump speed to match the new demand.  This Minimum Speed parameter sets the minimum speed that the pump can operate at.   It is also used to define the safe speed to run the pump during a pump protection fault. The default value for minimum speed is 25% of 11.07 MOTOR FL RPM.

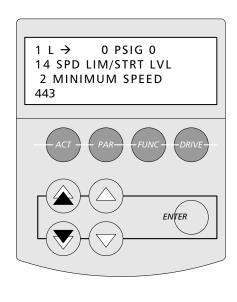When determining a minimum speed, consider the following:

- Motor Minimum Speed [Turndown ratio] - Due to motor loading and thermal effects, the motor minimum speed on centrifugal pumps should not be less than 1/10th its full-load speed.

- Pump Minimum Speed - Some pumps have minimum speed requirements, such as multistage pumps (>2 stages) and sleeve bearing pumps. Consult your pump operation manual to see if there is a minimum speed limit for your pump. **Note - 1& 2 stage pumps do not normally have minimum speed requirements.**

- Static Head Conditions (minimum flow) - The minimum speed should be set to assure that the pump generates enough head to overcome static resistance. In some cases, this can cause overheating and possible vaporization of the liquid in the pump casing.

| NOTICE |
|---|
| Operation below the pump safe minimum speed could result in damage to equipment and/or property. |

```
1 L →      0 PSIG 0
14 SPD LIM/STRT LVL
 2 MINIMUM SPEED
443
```



| 14.02 MINIMUM SPEED | |
|---|---|
| Enter the minimum speed that the pump and motor can safely operate at.<br><br>Consider-<br>- Turndown ratio<br>- Pump minimum speed<br>- Minimum flow<br><br>*The default value is 25% of the speed set in parameter 11.07 MOTOR FL RPM* | **KEY SEQUENCE**<br>*[From parameter group: 14.01  MAXIMUM SPEED]* |
| | Scroll to parameter 14.02 MINIMUM SPEED |
| | Press to enter the parameter setting mode |
| | Use a combination of the arrow keys to scroll to the minimum speed. |
| | Press to complete the entry |

NOTE - The default settings will stop the pump if the process demand requires the pump to operate below the minimum speed.  In pressure of level control modes a SLEEP WARNING will be displayed in this case.  The Sleep Function will suspend the PS200 until process demand increase as defined by the RESTART VALUE (parameter 14.07). Once the Restart Value has been achieved for longer then the restart delay the pump will automatically restart to maintain the process setpoint.  In flow control modes a LOW DEMAND fault will occur in which case the PS200 will have to be reset.  Alternatively the drive may be set to operate at a minimum speed until it is manually shut-off (parameter 14.05).

## MULTI PUMP-PROCESS CONFIGURATION

# 3a Select Operating Mode , Units, and Transmitter Configuration

In this section, the operating mode is selected and the primary process transmitter is configured.
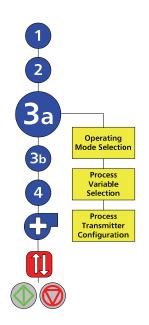
*Operating Mode*

There are four modes for operating the PumpSmart PS200: Pressure, Flow, Level, or Temperature/Other. This selection pre-selects the defaults for units and PI control settings [See TUNING].

- Pressure – PumpSmart will work to maintain a pressure setpoint based on a pressure transmitter signal.

- Flow – PumpSmart will work to maintain a flow setpoint based on an external flowmeter signal.

    NOTE - SMART^FLOW PID can not be used as a control mode in Multi-pump.  The SMART^FLOW function can used on the pumps individually for monitoring flow and for pump protection.

- Level – used to maintain a defined tank level based on a level transmitter feedback, although a pressure transmitter at the pump suction can also be used.  PumpSmart can control the level in either a suction or discharge tank.

- Temperature/OTHER – used to maintain defined temperature of a process stream based on a temperature transmitter signal.  Also use this selection if a 4-20 ma signal from a different type of transmitter is used.
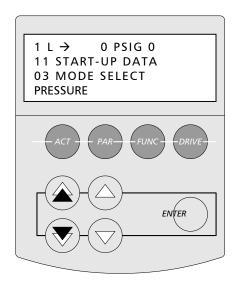
| 11.03 MODE SELECT | |
|---|---|
| Select the control mode for your application. If the control mode is PRESSURE, skip to the next step (Process Variable selection).<br><br>Options:<br><br>Pressure<br>Flow<br>Level<br>Temperature/Other | **KEY SEQUENCE**<br>*[From parameter group: 14.02 MINIMUM SPEED]]* |
| | ▲ ▼    Scroll to parameter group 11 START-UP DATA |
| | △ ▽    Scroll to parameter 11.03 "OPERATING MODE" |
| | ENTER    Press to enter the parameter setting mode |
| | △ ▽    Scroll to selection |
| | ENTER    Press to complete the entry |

NOTE - If the operating mode requires PumpSmart to control to suction side level or suction pressure control the drive must be set to INVERSE in parameter 21.01 REGULATION MODE.

*Process Variable Selection*

The process variable unit selection identifies what units your operating mode is in. This parameter sets the units that are used in

# MULTI PUMP-PROCESS CONFIGURATION

the actual signal and setpoint display. The defaults are shown for ENGLISH [AM] selection.

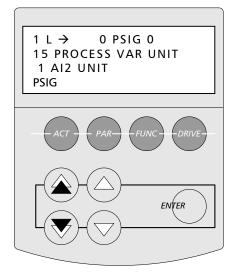| Operating Mode | Available Units Selection |
|---|---|
| Pressure | PSIG [default]<br>BAR<br>FT– Feet<br>M– Meters<br>% |
| Flow | GPM – Gallons Per Minute [default]<br>M3Hr – Cubic meters per hour<br>% |
| Level | PSIG<br>BAR<br>FT-Feet [default]<br>IN - Inches<br>CM - Centimeters<br>M– Meters<br>% |
| Temperature | °F – Degrees Fahrenheit [default]<br>°C – Degrees Celsius |

AI2 refers to the Analog Input channel No. 2. This is the default location where your primary process transmitter should be physically connected.

✔

| 15.01 AI2 UNIT | |
|---|---|
| Select the proper units of the operating mode.<br><br>Skip to the next step if the default unit is okay, otherwise select:<br><br>BAR    FT<br>GPM   IN<br>PSIG   CM<br>M3/HR  M<br>%     °F<br>        °C | **KEY SEQUENCE**<br>*[From parameter group 11.03 MODE SELECT]* |
| | ▲ - ▼    Scroll to parameter group 15 PROCESS VAR UNIT. Parameter 15.01 will be the first selection |
| | ENTER    Press to enter the parameter setting mode |
| | △ - ▽    Scroll to the appropriate measurement units. Example shown is PSIG |
| | ENTER    Press to complete the entry |

NOTE - FOR PRESSURE/LEVEL MODES

If units of FT, IN, M or CM are used and Specific Gravity [SG] is constant but other than 1.0, parameter 29.15 must be completed. If Specific Gravity varies parameters 29.12 – 29.18 must be completed. See Specific Gravity Setup - Options & Features.

```
1 L →      0 PSIG 0
15 PROCESS VAR UNIT
 1 AI2 UNIT
PSIG
```

ACT   PAR   FUNC   DRIVE

ENTER

## MULTI PUMP-PROCESS CONFIGURATION
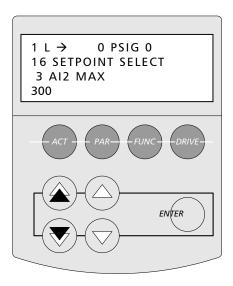
*Process Transmitter Configuration*

The primary process transmitter is the device that will measure your process conditions. The PS200 requires information to properly scale the 4-20 mA signal that the transmitter sends.

AI2 MAX - This refers to the process value that your transmitter is calibrated to at its max signal [20 mA]. Refer to your transmitter calibration sheet, or the instrument nameplate, for this value.

> *Example - a direct reading flowmeter [e.g. magmeter, vortex flowmeter, etc…] that has a range of 0 - 2000 GPM would be calibrated such that at 2000 GPM, the output of the transmitter would be 20 mA. Parameter 16.03 would be set to 2000 in this case. The units of 16.03 are the same as selected in parameter 15.01.*

NOTE - Differential pressure flowmeters [e.g. orifice plate, venturi] do not produce 4-20 mA signals that are linear with the flow-rate. **PumpSmart cannot accommodate these types of flowmeters.**

| 16.03 AI2 MAX | | |
|---|---|---|
| Enter the reading of the primary process transmitter that corresponds to its 20 mA signal.<br><br>Units are the same as entered in 15.01. | KEY SEQUENCE<br>*[From parameter group: 15.01 AI2 UNIT]* | |
| | ⬆⬇ | Scroll to parameter group 16 SETPOINT SELECT |
| | △▽ | Scroll to parameter 16.03 AI2 MAX |
| | ENTER | Press to enter the parameter setting mode |
| | ⬆ OR ⬇<br>△ OR ▽ | Use a combination of the arrow keys to scroll to the correct value. Example shown - 300 PSIG |
| | ENTER | Press to complete the entry |

```
1 L →     0 PSIG 0
16 SETPOINT SELECT
 3 AI2 MAX
300
```

ACT   PAR   FUNC   DRIVE
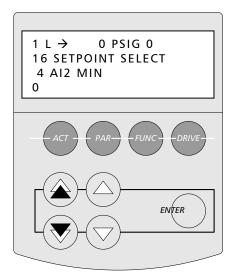
ENTER

## MULTI PUMP-PROCESS CONFIGURATION

AI2 MIN - This is the process value that corresponds to the transmitter's minimum signal [4 mA]. This value is normally zero on a pressure or flow transmitter. Refer to your transmitter calibration sheet, or the instrument nameplate, for this value.

NOTE - Most pressure and flow transmitters are configured for a reading of 0 [PSIG, GPM, etc…] at 4 mA. If so, this step may be omitted since the default of parameter 16.04 is 0.

| 16.04 AI2 MIN | | |
|---|---|---|
| Enter the reading of the primary process transmitter that corresponds to its 4-mA signal.<br><br>If your transmitter signal is zero (0) at 4mA, skip to the next section (Enter Setpoint).<br><br>Units are the same as entered in 15.01. | KEY SEQUENCE | |
| | *[From parameter group: 16.03 AI2 MAX]* | |
| | △ ▽ | Scroll to parameter 16.04 AI2 MIN |
| | *ENTER* | Press to enter the parameter setting mode |
| | ▲ or ▼<br>△ or ▽ | Use a combination of the arrow keys to scroll to the correct value. Example shown - 0 PSIG |
| | *ENTER* | Press to complete the entry |

```
1 L →     0 PSIG 0
16 SETPOINT SELECT
 4 AI2 MIN
0
```

ACT   PAR   FUNC   DRIVE

ENTER

## MULTI PUMP-PROCESS CONFIGURATION

**3b**   <u>Multi-pump Control Settings</u>

This section configures the PumpSmart PS200 as to how the multiple pumps will be sequenced. There are three main steps:

1. Selection of operating mode

2. Adding pumps (staging)

3. De-staging pumps.

<u>22.01 MULTI-PUMP CONTROL MODE</u>

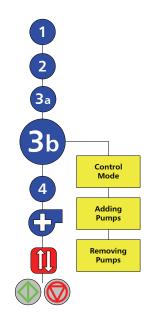Refer to the Multi-Pump Overview section for help with determining which operating mode you want to use.

The most common multi-pump control mode is SYNCHRONOUS, where lead and lag drives will operate at the same speed.
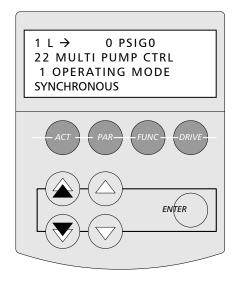
| 22.01 OPERATING MODE | |
|---|---|
| Select the multi-pump operating mode.<br><br>If your desired operation is SYNCHRONOUS, skip to the next step.<br><br>Options:<br><br>SYNCHRONOUS (Default)<br>BACKUP | **KEY SEQUENCE**<br>*[From parameter group 16.04 AI2 MIN]* |
| | Scroll to parameter group 22, MULTI PUMP CTRL. Parameter 22.01 will be the first selection |
| | Press to enter the parameter setting mode |
| | Scroll to the desired control mode. |
| | Press to complete the entry |

<u>BACKUP MODE</u>

*If backup mode is selected, skip to the setup of parameter 22.17 TX CONFIG.*

Control Mode

Adding Pumps

Removing Pumps

```
1 L →      0 PSIG0
22 MULTI PUMP CTRL
 1 OPERATING MODE
SYNCHRONOUS
```

ACT   PAR   FUNC   DRIVE

ENTER

# MULTI PUMP-PROCESS CONFIGURATION
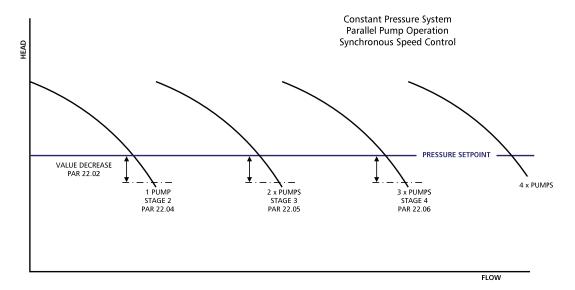
## ADDING PUMPS (STAGING)

PumpSmart will automatically start a lag pump when it is unable to maintain the process setpoint with the current pumps. It does this by starting a lag pump when the process variable [e.g. pressure, flow, level] drops by a prescribed amount, referred to as VALUE DECREASE and the pump(s) are operating at or above the STAGE SPEED.

For a pump to Stage On the following conditions must exist:

1. The process variable must drop by the parameter 22.02 VALUE DECREASE.

   NOTE - When 21.01 REGULATION MODE is set to INVERSE such as in Suction Side Level Control the process variable must increase by the VALUE DECREASE setting.

2. The pump speed must be at or above at the STAGE speed, parameter 22.04 – 22.06.  Each lag pump can be assigned a different STAGE speed.

3. The pump must be at or above the STAGE speed for longer then the PROOF TIME, parameter 22.08.



Constant Pressure System
Parallel Pump Operation
Synchronous Speed Control

Example – In a two pump constant pressure system with two identical pumps with a maximum operating speed (par 14.01 MAXIMUM SPEED) of 3560 rpm and a pressure setpoint of 200 psi. If par 22.02 VALUE DECREASE is set to 5% and par 22.04 STAGE 2 is set to 98%, pump 2 will turn on when the pressure has dropped 5% from the setpoint to 190 psi and pump 1 speed is at or above 98% of maximum speed, 3489 rpm.

## MULTI PUMP-PROCESS CONFIGURATION

| 22.02 VALUE DECREASE | |
|---|---|
| Enter the percentage the process variable can decrease before activating a lag unit.<br><br>Value is in % of setpoint<br><br>*Default - 5% of setpoint* | **KEY SEQUENCE**<br>*[From parameter group 22.01 MODE]* |
| | △-▽    Scroll to parameter 22.02 VALUE DECREASE |
| | ENTER    Press to enter the parameter setting mode |
| | △-▽    Set the desire value. *Note- the double arrows may be used for large values.* Example shown is 5% |
| | ENTER    Press to complete the entry |

```
1 L →      0 PSIG0
22 MULTI PUMP CTRL
 2 VALUE DECREASE
5%
```
ACT  PAR  FUNC  DRIVE
▲ △
▼ ▽   ENTER

22.03 VALUE INCREASE - The actual process setting will decrease by the VALUE DECREASE with each additional pump that is added. To compensate for this the VALUE INCREASE parameter increases the setpoint for each pump that is added.
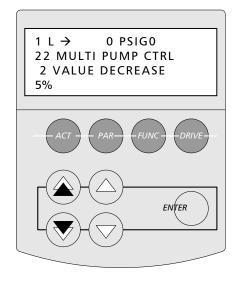
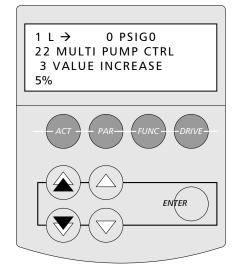Required Setpoint = Original Setpoint - VALUE DECREASE + VALUE INCREASE

*Example - If the original setpoint was 200 PSIG and the VALUE DECREASE was 5%, a second pump would be activated at 190 PSIG. A VALUE INCREASE of 5% would result in both pumps continuing to maintain constant pressure of 200 PSIG.*

The VALUE INCREASE can be set higher than the VALUE DECREASE to compensate for added frictional losses that occur with increased flow see PRESSURE BOOST in the Options and Features Section for further details.

| 22.03 VALUE INCREASE | |
|---|---|
| Enter the percentage the setpoint should increase with each additional pump. It is recommended this value at a minimum is equal to the par 22.03 VALUE DECREASE.<br><br>Value is in % of setpoint.<br><br>*Default - Value selected in 22.02 VALUE DECREASE* | **KEY SEQUENCE**<br>*[From parameter group 22.02 VALUE DECREASE]* |
| | △-▽    Scroll to parameter 22.03 VALUE INCREASE |
| | ENTER    Press to enter the parameter setting mode |
| | △-▽    Set the desire value. *Note- the double arrows may be used for large values.* Example shown is 5% |
| | ENTER    Press to complete the entry |

```
1 L →      0 PSIG0
22 MULTI PUMP CTRL
 3 VALUE INCREASE
5%
```
ACT  PAR  FUNC  DRIVE
▲ △
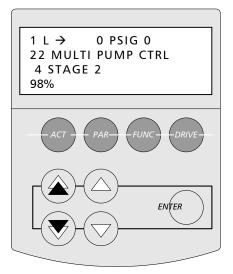▼ ▽   ENTER

## MULTI PUMP-PROCESS CONFIGURATION

PumpSmart can stage the number of pumps to be turned on at different operating speeds. This feature can be beneficial when operating multiple pumps on a highly frictional system curve.

NOTE - For standard constant pressure systems it is generally recommended that the STAGE speed for all pumps is identical.
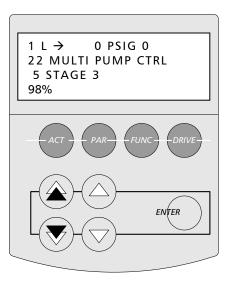
| 22.04 STAGE 2 (2 Pump Operation) | |
|---|---|
| Enter the minimum speed that the Lead pump must be at before multi-pump operation is allowed for the first lag pump.<br><br>Generally set to 98% of MAXIMUM SPEED. This is the default setting. | **KEY SEQUENCE**<br>*[From parameter group 22.03 VALUE INCREASE]* |
| | ⏶-⏷  Scroll to parameter 22.04 STAGE 2 |
| | ENTER  Press to enter the parameter setting mode |
| | ⏶-⏷  Set the desire value. *Note- the double arrows may be used for large values. Example shown is 98%.* |
| | ENTER  Press to complete the entry |

```
1 L →    0 PSIG 0
2 2  MULTI PUMP CTRL
 4  STAGE 2
98%
```

*If operating a 2 pump system skip to par 22.08 Proof Time*

| 22.05 STAGE 3 (3 Pump Operation) | |
|---|---|
| Enter the minimum speed that the Lead and Lag 1 pumps must be at before multi-pump operation is allowed for the second lag pump.<br><br>Generally set to 98% of MAXIMUM SPEED. This is the default setting. | **KEY SEQUENCE**<br>*[From parameter group 22.04 STAGE 2]* |
| | ⏶-⏷  Scroll to parameter 22.05 STAGE 3 |
| | ENTER  Press to enter the parameter setting mode |
| | ⏶-⏷  Set the desire value. *Note- the double arrows may be used for large values. Example shown is 98%.* |
| | ENTER  Press to complete the entry |

```
1 L →    0 PSIG 0
2 2  MULTI PUMP CTRL
 5  STAGE 3
98%
```

## MULTI PUMP-PROCESS CONFIGURATION

*If operating a 3 pump system skip to par 22.08 Proof Time*

<table>
<tr><td colspan="2">22.06 STAGE 4 (4 Pump Operation)</td></tr>
<tr>
<td rowspan="4">Enter the minimum speed that the Lead, Lag 1 and Lag 2 pumps must be at before multi-pump operation is allowed for the third lag pump.<br><br>Generally set to 98% of MAXIMUM SPEED. This is the default setting.</td>
<td colspan="2" align="center">KEY SEQUENCE<br>*[From parameter group 22.05 STAGE 3]*</td>
</tr>
<tr>
<td>⬆-⬇</td>
<td>Scroll to parameter 22.06 STAGE 4</td>
</tr>
<tr>
<td>ENTER</td>
<td>Press to enter the parameter setting mode</td>
</tr>
<tr>
<td>⬆-⬇</td>
<td>Set the desire value. *Note- the double arrows may be used for large values. Example shown is 98%.*</td>
</tr>
<tr>
<td></td>
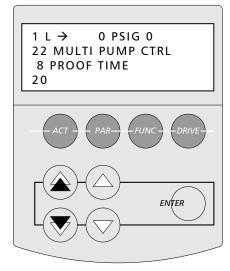<td>ENTER</td>
<td>Press to complete the entry</td>
</tr>
</table>

```
1 L →     0 PSIG 0
22 MULTI PUMP CTRL
 6 STAGE 4
98%
```

ACT   PAR   FUNC   DRIVE

ENTER

To prevent the pumps from frequently cycling on and off a Proof Time can be set to delay pumps from staging and de-staging for a set time period.

<table>
<tr><td colspan="2">22.08  PROOF TIME</td></tr>
<tr>
<td rowspan="4">Enter the time period for which conditions for staging/de-staging must occur before a pump is actually staged or de-staged.<br><br>The default setting is 20 seconds. The setting range is 0 – 360 seconds.</td>
<td colspan="2" align="center">KEY SEQUENCE<br>*[From parameter group 22.06 STAGE 4]*</td>
</tr>
<tr>
<td>⬆-⬇</td>
<td>Scroll to parameter 22.08 PROOF TIME</td>
</tr>
<tr>
<td>ENTER</td>
<td>Press to enter the parameter setting mode</td>
</tr>
<tr>
<td>⬆-⬇</td>
<td>Set the desire value. *Note- the double arrows may be used for large values. Example shown is 20 sec.*</td>
</tr>
<tr>
<td></td>
<td>ENTER</td>
<td>Press to complete the entry</td>
</tr>
</table>

```
1 L →     0 PSIG 0
22 MULTI PUMP CTRL
 8 PROOF TIME
20
```

ACT   PAR   FUNC   DRIVE

ENTER

## MULTI PUMP-PROCESS CONFIGURATION

_REMOVING (DE-STAGING) PUMPS_

As the system demand decreases, the need for additional pumps will also decrease. The DESTAGE parameters identify when pumps are de-staged (shutdown) in normal multi-pump control. The lag pump is De-staged if the DESTAGE value is met for the 22.08 PROOF TIME.

The primary consideration here is to ensure that when a lag pump is shutdown, the remaining pumps are capable of meeting the setpoint demand. The DESTAGE settings define how much of a speed decrease will occur before one pump can be de-staged. The following are recommendations for the DESTAGE settings:

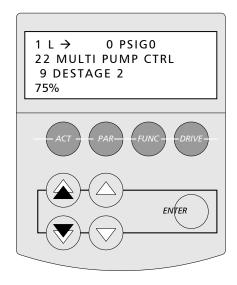| NUMBER OF PUMPS | | 1 | 2 22.09 DESTAGE 2 | 3 22.10 DESTAGE 3 | 4 22.11 DESTAGE 4 |
|---|---|---|---|---|---|
| SYNCHRONOUS | DESTAGE SPEED | NOT USED | 75% of MAXIMUM SPEED | 85% of MAXIMUM SPEED | 92% of MAXIMUM SPEED |

NOTE(S) -

If during operation a lag pump shuts off and then is restarted shortly after, consider lowering the DESTAGE SETTING for the respective lag pump.

If during operation a lag pumps fails to shut off when demand is low consider increasing the DESTAGE SETTING for the respective lag pump.
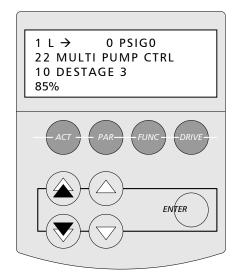
| 22.09 DESTAGE 2 | |
|---|---|
| Enter the speed at which the first LAG pump will turn off.<br><br>Values may range between 0 - 100 %<br><br>Recommended values are automatically set. | **KEY SEQUENCE**<br>_[From parameter group: 22.08 PROOF TIME]_ |
| | Scroll to parameter 22.09 DESTAGE 2 |
| | Press to enter the parameter setting mode |
| | Use the arrow key to scroll to the correct speed selection |
| | Press to complete the entry |

```
1 L →      0 PSIG0
22 MULTI PUMP CTRL
 9 DESTAGE 2
75%
```

ACT   PAR   FUNC   DRIVE

ENTER

## MULTI PUMP-PROCESS CONFIGURATION

*If operating a 2 pump system skip to par 22.17 TX CONFIG.*
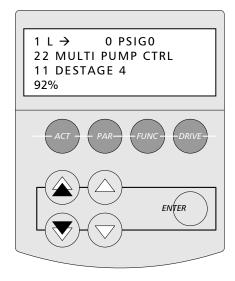
| 22.10 DESTAGE 3 | |
|---|---|
| Enter the speed at which the second LAG pump will turn off.<br><br>Values may range between 0 - 100 %<br><br>Recommended values are automatically set. | **KEY SEQUENCE**<br>*[From parameter group: 22.09 DESTAGE 2]* |

| | | |
|---|---|---|
| | △ - ▽ | Scroll to parameter 22.10 DESTAGE 3 |
| | ENTER | Press to enter the parameter setting mode |
| | ▲ OR ▼<br>△ OR ▽ | Use the arrow key to scroll to the correct speed selection |
| | ENTER | Press to complete the entry |

```
1 L →      0 PSIG0
2 2  M U L T I  P U M P  C T R L
1 0  D E S T A G E  3
8 5 %
```

ACT — PAR — FUNC — DRIVE

ENTER

*If operating a 3 pump system skip to par 22.17 TX CONFIG.*

| 22.11 DESTAGE 4 | |
|---|---|
| Enter the speed at which the third LAG pump will turn off.<br><br>Values may range between 0 - 100 %<br><br>Recommended values are automatically set. | **KEY SEQUENCE**<br>*[From parameter group: 22.10 DESTAGE 3]* |

| | | |
|---|---|---|
| | △ - ▽ | Scroll to parameter 22.11 DESTAGE 4 |
| | ENTER | Press to enter the parameter setting mode |
| | ▲ OR ▼<br>△ OR ▽ | Use the arrow key to scroll to the correct speed selection |
| | ENTER | Press to complete the entry |

```
1 L →      0 PSIG0
2 2  M U L T I  P U M P  C T R L
1 1  D E S T A G E  4
9 2 %
```

ACT — PAR — FUNC — DRIVE

ENTER

# MULTI PUMP-PROCESS CONFIGURATION
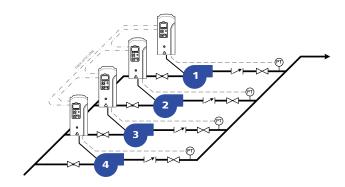
## Transmitter Configuration

There are three ways to wire the process transmitter into PumpSmart and depending upon the method chosen parameter 22.17 TX CONFIG will require setting. The following options are available:

### TRANSMITTER on **ALL DRIVES**

In this selection, each PumpSmart unit has its own process transmitter wired directly into the drive. In the event a process transmitter fails, the remaining units will continue to control to the setpoint.

This method is pre-selected when PRESSURE is selected in parameter 11.03 MODE SELECT.

This method should not be used on FLOW (Volumetric or Mass) applications.



**TX ALL DRIVES** – Each PS200 has a dedicated process transmitter individually wired to each drive.

### TRANSMITTER from **ONE MASTER** drive

PumpSmart can also transmit the process transmitter signal to all of the slave drives via the fiber-optic cables that link all the drives. In this configuration, the 4-20 mA signal is wired into the master drive and parameter 22.17 TX CONFIG is set to TX ONE MASTER.

This configuration makes wiring very simple, however in the event a lag drive is disconnected from the main power, the remaining lag drives will lose the process signal as well.

In this mode it is recommended that the drives control board is powered with external 24VDC.  For further details refer to the Options and Features Section CONTROL BOARD EXTERNAL POWER SUPPLY.

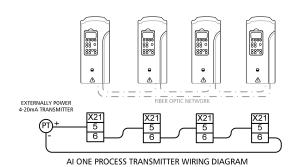This method may be used for all control modes.



**TX ONE MASTER** – One process transmitter is wired to the dedicated master drive and the signal is shared to the slave drive over the fiber optic network.

### TRANSMITTER with **ONE AI**

One process transmitter can be shared between multiple PumpSmart units. In this case, the drives would be wired in series to form a loop with the transmitter signal cable.

Although the onboard power supply of PumpSmart can still provide power to the transmitter, an external power supply should also be considered to provide uninterrupted service if the drive supplying the loop power is disconnected from the main power.
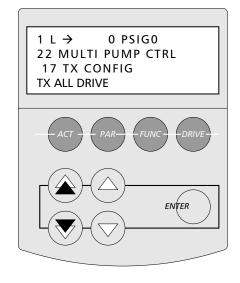
This method may be used for all control modes.



AI ONE PROCESS TRANSMITTER WIRING DIAGRAM

**ONE AI** – One 4-20mA externally powered process transmitter is wired in series to each drive.

## MULTI PUMP-PROCESS CONFIGURATION

| 22.17 TX CONFIG | |
|---|---|
| Select how you have wired in your process transmitter(s).<br><br>TX ONE MASTER – The transmitter signal is sent digitally through the fiber optic cables.<br><br>TX ALL DRIVE – Each drive has a transmitter<br><br>TX ONE AI – Each PS200 is wired in series with the transmitter.<br><br>*The default is based upon the selection made in 11.03 MODE SELECT* | **KEY SEQUENCE**<br>*[From parameter group: 22.09 DESTAGE 2* |
| | △ ▽    Scroll to parameter 22.17 TX CONFIG |
| | ENTER    Press to enter the parameter setting mode |
| | △ ▽    Use the arrow key to scroll to the correct transmitter selection |
| | ENTER    Press to complete the entry |

```
1 L →      0 PSIG0
22 MULTI PUMP CTRL
 17 TX CONFIG
TX ALL DRIVE
```

ACT   PAR   FUNC   DRIVE

ENTER

# MULTI PUMP-PROCESS CONFIGURATION

## Recommended Option: Advanced Pump Protection

In the event of a fault condition the PumpSmart Multi-pump logic will automatically recognize that a pump is unavailable for service and revert to the next available pump.

For pump protection it is recommended to use the Advanced Pump Protection Feature which provides dry run, min-flow and run-out protection using the SMART$^{FLOW}$ sensorless flow feature.

Advanced Pump Protection allows flexibility to either fault the pump, go to a safe speed or trigger an alarm when a particular process upset condition occurs.  It is recommended at a minimum the protection is set up to WARN.  By setting the protection features to warn no action will be taken by the PS200.  Only a warning will be issued and stored in the drive's fault log.  This will allow the pump history to be tracked in the event of a process upset condition that could cause pump failure.

For further details on how to set up ADVANCED PUMP PROTECTION refer to the Option and Features Section.

*SECONDARY PROTECTION*

An alternative secondary protection feature may be used to provide protection from dry-running or operation against a closed discharge valve. However, additional process condition inputs (e.g. level switch, pressure switch, flow switch, etc…) are required to alert PumpSmart of conditions that require the protection of the pump.

Refer to SECONDARY PROTECTION in the Options and Features Section for further details.

**MULTI PUMP-PROCESS CONFIGURATION**

## Program Lag Units

Once the first PumpSmart drive is programmed, the remaining drives can be quickly programmed by uploading the parameters that have just been entered into the PumpSmart keypad, downloading the parameters into the remaining drives and adjusting a few parameters.
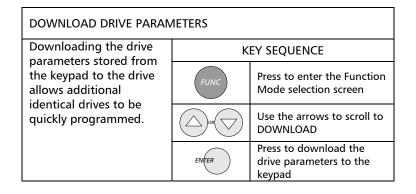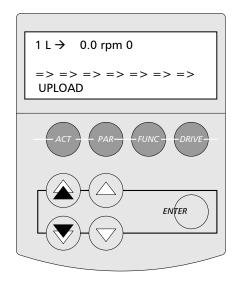
Considerations for using the upload and download feature:

1. Before downloading the lag units the drives should be unlocked by entering the passcode 358 in parameter 10.02 PASSCODE and the Multipump Macro must be selected in parameter 11.02 APPLICATION MACRO.

2. After the download is complete any parameter changes must be made to all drives. The parameter values DO NOT transfer over the fiber optic cables.

3. To UPLOAD refers to uploading the parameters from the drives internal control board to the keypads on board memory. While DOWNLOAD refers to downloading the parameter values stored in the keypad to the drive.

4. Never DOWNLOAD to the drive if you are not certain of what parameters have been stored to the keypad. If you accidentally DOWNLOAD to the drive then it is recommended that you restore the drive to its original defaults. Passcode 564, parameter 11.11 APPLIC RESTORE.
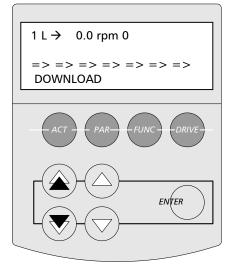
## MULTI PUMP-PROCESS CONFIGURATION

*UPLOAD AND DOWNLOAD PROCEDURE*

| UPLOAD DRIVE PARAMETERS | |
|---|---|
| Uploading the drive parameters to the keypad allows additional identical drives to be quickly programmed. | **KEY SEQUENCE** |
| | FUNC — Press to enter the Function Mode selection screen |
| | △ OR ▽ — Use the arrows to scroll to UPLOAD |
| | ENTER — Press to upload the drive parameters to the keypad |

With the drive parameters successfully loaded to the keypad, remove it from the drive and connect it to the next drive in place of the original keypad. Using the same basic process as uploading the parameters, download the parameters to the new drive, and replace the original keypad.

| DOWNLOAD DRIVE PARAMETERS | |
|---|---|
| Downloading the drive parameters stored from the keypad to the drive allows additional identical drives to be quickly programmed. | **KEY SEQUENCE** |
| | FUNC — Press to enter the Function Mode selection screen |
| | △ OR ▽ — Use the arrows to scroll to DOWNLOAD |
| | ENTER — Press to download the drive parameters to the keypad |

```
1 L →    0.0 rpm 0

=> => => => => => =>
 UPLOAD
```

ACT   PAR   FUNC   DRIVE

ENTER

```
1 L →    0.0 rpm 0

=> => => => => => =>
 DOWNLOAD
```

ACT   PAR   FUNC   DRIVE

ENTER

## MULTI PUMP-PROCESS CONFIGURATION

After the download is complete the drive will prompt a warning:

<div align="center">ID MAGN REQ</div>

As performed earlier on the master drive a First Start ID Run must be completed on each lag drive.  If the motor data is dissimilar between the lead and lag pumps then the motor data will have to be re-entered per the correct motor nameplate data as outlined in STEP 2 of Multipump Configuration.

NOTE(S) -

If only one process transmitter is wired to the master drive as defined by TX ONE MASTER mode then after a download is completed the lag units will prompt a warning:
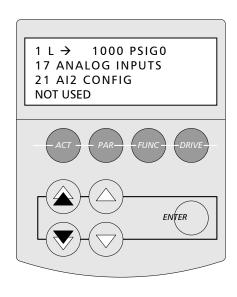
<div align="center">PROC XT FAULT</div>

This is only an indication that the drive does not detect a process transmitter on AI2 which is normal because only the master drive has a transmitter.  To clear this fault RESET the drive and change parameter 17.21 AI2 CONFIG to NOT USED.

If TX ALL DRIVES or TX ONE AI is selected from parameter 22.17 TX CONFIG, skip this step.

| 17.21 AI2 CONFIG | |
|---|---|
| If TX ONE MASTER was selected in parameter 22.17 TX CONFIG, set to NOT USED. | **KEY SEQUENCE** *[From parameter group: 22.13 PUMP ADDRESS]* |
| | ▲ ▼   Scroll to parameter group 17 ANALOG INPUTS |
| | △ ▽   Scroll to parameter 17.21 AI2 CONFIG |
| | ENTER   Press to enter the parameter setting mode |
| | △ ▽   Use the arrow keys to select transmitter configuration |
| | ENTER   Press ENTER to complete the addressing |

```
1 L →    1000 PSIG0
17 ANALOG INPUTS
21 AI2 CONFIG
NOT USED
```

ACT    PAR    FUNC    DRIVE

ENTER

## MULTI PUMP-PROCESS CONFIGURATION

After a download in completed a mandatory change to parameter 22.13 PUMP ADDRESS is required to identify the different drives to each other.

NOTE - It is recommended that parameter settings be verified after completion of each download.

| 22.13 PUMP ADDRESS | | |
|---|---|---|
| The PUMP ADDRESS tells the drives in multi-pump control which they are. | KEY SEQUENCE *[From parameter group: 25.06 SEC PROTECT A]* | |
| | PAR | Press to enter parameter mode |
| | ▲ or ▼ | Scroll to parameter group 22 MULTI PUMP CTRL |
| | △ or ▽ | Scroll to parameter 22.13 PUMP ADDRESS |
| | ENTER | Press to enter the parameter setting mode |
| | △ or ▽ | Use the arrow keys to identify the pump (#2-#4) |
| | ENTER | Press ENTER to complete the addressing |

```
1 L →    1000 PSIG0
22 MULTI PUMP CTRL
 13 PUMP ADDRESS
2
```

ACT    PAR    FUNC    DRIVE

ENTER

NOTE -

Once the Pump Address is changed the slave drives will be looking for communication from the master drive. If the following warning is displayed after changing the pump address:

NO PUMP 1 COM

It is an indication that the slave drives are not communicating with the master drive. Verify that the fiber optic cables are wired properly between the drives (See Wiring Diagrams in Appendix A-4). Certain fiber optic cables may have different colored connector ends which can commonly lead to the cables being connected improperly.

## MULTI PUMP-PROCESS CONFIGURATION

# 4 Enter Setpoint

The final step before starting the PumpSmart system in a basic process control mode is to enter the operating setpoint.

The Setpoint can only be changed at the Master Drive and will shared to the slave drives through the fiber optic network.

| SETPOINT | | |
|---|---|---|
| Enter the operating setpoint. | KEY SEQUENCE | |
| | REF ● | Press REF button to highlight the setpoint value |
| | ▲ OR ▼  △ OR ▽ | Use a combination of the arrow keys to scroll to the desired setpoint. Example shown is 100 PSIG. |
| | ENTER | Press to complete the entry |

```
1 L →   [100 PSIG]0
16 SETPOINT SELECT
 4 AI2 MIN
0
```

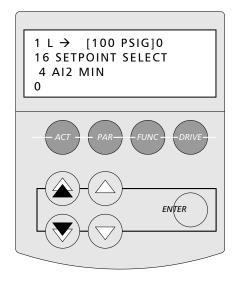ACT    PAR    FUNC    DRIVE

ENTER

NOTE(S) -

There are alternative ways to enter the setpoint. Refer to the OPTIONS AND FEATURES section for configuration detail.

Remote setpoint – An analog input signal may be used to send setpoints to the PumpSmart unit from a remote location.

Variable Setpoint- A second process transmitter [2-10VDC or 4-20 mA] may be used to vary the setpoint. The setpoint can be linear, inverse linear, or offset, to this signal. See OPTIONS & FEATURES for details.

Multiple setpoint - The PumpSmart system can be programmed with two setpoints and the drive can toggle between the two setpoints based upon a digital switch  [e.g. flow switch, level switch, manual switch, etc…]. Multiple setpoints can be set through either the keypad, Analog Input or via the DCS.

Fieldbus - The setpoint can be programmed and changed remotely by way of digital communication with optional filedbus communication modules.  Modules are available for Modbus RTU, Profibus DP, DeviceNet, ControlNet, and Ethernet.

## MULTI PUMP-PROCESS CONFIGURATION

| | **Recommended Step: Parameter Upload** *See KEYPAD USE* |
|---|---|
| | Save your parameters in the keypad. In the unlikely event that the PS200 parameters are lost, the keypad can be used to restore the configuration.  It can also be used to program sister units that use the same or similar program settings. |

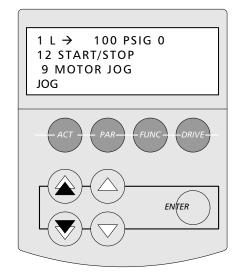| **Recommended Option: Drive Locking** *See OPTIONS & FEATURES* |
|---|
| The keypad can be "locked" to prevent unauthorized personnel from making operational changes or changes to the parameter groups. See  LOCKING in OPTIONS & FEATURES. |

## MULTI PUMP-PROCESS CONFIGURATION

### Jogging the Motor

Checking the motor for rotation can be accomplished through the Motor Jog function in which the pump will rotate for 10 seconds at 60rpm.

| 12.09 MOTOR JOG | | |
| --- | --- | --- |
| Selecting JOG and pressing the enter key will initiate the motor to rotate.  Once completed the parameter value will default back to DISABLED. | **KEY SEQUENCE** *[From parameter: 25.02 PROTECTION LIMIT]* | |
| | PAR | Press PAR button to enter the Parameter Menu |
| | | Press the double arrow key to go to parameter group 12 |
| | | Press the single arrow key to go to parameter 12.09, MOTOR JOG |
| | ENTER | Press to enter the parameter setting mode |
| | | Use the single arrow key to scroll to JOG |
| | ENTER | Press to complete the entry |

If pump rotation is incorrect then two of the <u>output phases</u> must be swapped on the drive terminals U2, V2 or W2.  Swapping two of the input phases will not change the rotation of the drive.

---

### ⚠ DANGER

**Never work on the PS200 drive, the motor cable or the motor when main power is applied. After switching off the input power, always wait 5 minutes to allow drive internal capacitors to discharge before working on the drive, the motor or the motor cable. Failure to do so will result in serious injury or death.**

```
1 L →     100 PSIG 0
12 START/STOP
 9 MOTOR JOG
JOG
```

ACT — PAR — FUNC — DRIVE

ENTER

## MULTI PUMP-PROCESS CONFIGURATION

# Starting & Stopping

The PumpSmart system is now ready to start.

Since all drives should be configured with an external start/stop switch, place all drives in "REMOTE". Press the LOC-REM button until "R" is displayed in the upper left status row on all of the drives. You are now ready to start from a remote location.

| KEY SEQUENCE | |
|---|---|
| **LOC ● REM** | Press LOC/REM button until "R" is displayed in the status row on the MASTER and all of the LAG drives. |
| START | Enable the lead unit using the external start/stop switch. |
| OFF-AUTO | Enable all the lag units using the external Start/Stop switch. |
| STOP | Stop the lead or lag units using the external start/stop switch. |

NOTE - When shutting down the system, all drive external switches must be set to off.

LOCAL / REMOTE STATUS

```
1 Ⓡ →        100 PSIG 0
PUMP SPEED        0RPM
PRESS REF       100PSI
PRESS ACT         0PSI
```

LOCAL / REMOTE CONTROL BUTTON

## ⚠ WARNING

**Never operate rotating equipment unless all protective coupling and shaft guards are in place. Personal injury may occur if the driven equipment is operated without coupling and shaft guards.**

## ⚠ WARNING

**Observe all CAUTIONS and WARNINGS highlighted in the ACS800 Hardware Manual, PS200 Configuration and Operation Guide and Installation, Operation and Maintenance Guide for the applied driven equipment prior to starting.**
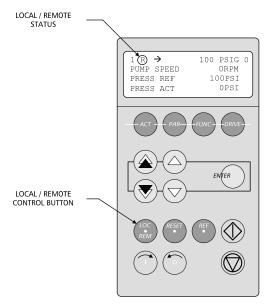
### E-Stop/Permissive

The PS200 will not operate unless the E-Stop/Permissive switch [DI1L] is closed. If not closed a warning message will appear on the keypad display:

RUN DISABLED

See Appendix A-4, Instrument Wiring, for details on wiring this switch.

NOTE:
The E-Stop/Permissive switch can not be defeated through parameter setting. If your application does not use an E-Stop / Permissive switch, [DI1L] can be bypassed physically inside the PumpSmart unit. Refer to Appendix A-4, Instrument Wiring, for details.

# SPEED CONTROL CONFIGURATION

An external PID controller can be used to feed the PS200 with a reference speed signal in lieu of the standard single pump operating modes. In this set-up, the drive output frequency will be directly proportional to the reference signal. A speed setpoint can also be input via the keypad or Fieldbus.

| Step | Description | Parameters |
|------|-------------|------------|
| | **Speed Control Overview** | |
| 1 | **Locks/Passwords** | 10.02<br>11.02 |
| 2 | **Motor Setup**<br><br>Drive data for the First Motor Run ID is entered here in addition to start/stop methods, and MAX and MIN drive speeds | 12.01<br>11.04<br>11.05<br>11.07<br>11.08<br>14.01<br>14.02 |
| 3 | **Speed Control Setup**<br><br>Selects the units of operation and the operational limits | 16.02<br>16.03<br>16.04 |
| 4 | **Setpoint** | |
| | **Pump Protection**<br><br>Protect the pump from operation below minimum flow, dry running or excessive flow using Advanced Sensorless Pump Protection or Secondary Pump Protection features. | |
| | **Motor Jog**<br><br>Check for proper motor rotation | 12.09 |
| | **Start/Stop** | |

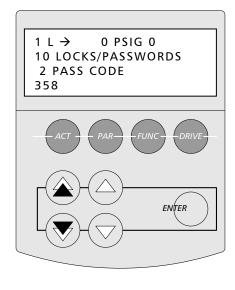| ✔ | **CHECK & GO STEP** |
|---|---------------------|
| Some parameters may not need to be changed from the default parameters allowing you to speed through the set-up process. These parameters have been marked with a check mark. | |

## SPEED CONTROL CONFIGURATION

# 1 Locks and Passwords

Operating parameters on the PumpSmart PS200 are protected by a 3-digit passcode to prevent casual users or unauthorized users from inadvertently changing the operating and protection limits that have been set.  All PS200 units utilize the same passcode; it cannot be changed by the user/owner.

When the PS200 keypad is locked, functionality is limited to starting, stopping, and changing the operating setpoint.
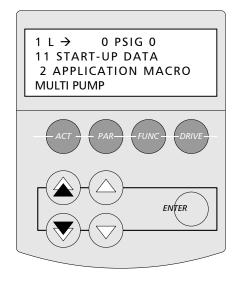
| 10.02 PASS CODE | | |
|---|---|---|
| To open the Parameter lock, scroll to parameter 10.02 and enter the passcode 358.  The display value will automatically return to 0 after the three-digit code has been entered.<br><br>To check on the status of the parameter lock: scroll to parameter 10.01. After correctly entering the passcode, it will read "OPEN" | KEY SEQUENCE<br>*[From parameter group: 99 INFORMATION]* | |
| | PAR | Press to enter parameter mode |
| | ▲ ▼ | Scroll to parameter group 10 LOCKS / PASSWORDS |
| | △ ▽ | Scroll to parameter 10.02 PASS CODE |
| | ENTER | Press to enter the parameter setting mode |
| | ▲ ▼ △ ▽ | Use a combination of the arrow keys to scroll to the number 358. |
| | ENTER | Press to complete the passcode entry |

```
1 L →     0 PSIG 0
10 LOCKS/PASSWORDS
 2 PASS CODE
358
```

ACT   PAR   FUNC   DRIVE

ENTER

## SPEED CONTROL CONFIGURATION

*Multi-pump application macro*

The default application macro on the PumpSmart PS200 is SINGLE PUMP; parameter 11.02 needs to be set to SPEED CONTROL.

| 11.02 APPLICATION MACRO | | |
|---|---|---|
| Select the SPEED CONTROL application macro. | KEY SEQUENCE *[From parameter group 10.02 LOCKS.PASSWORDS]* | |
| | ⏫⏬ | Scroll to parameter group 11 START-UP DATA |
| | △▽ | Scroll to parameter 11.02 APPLICATION MACRO |
| | ENTER | Press to enter the parameter setting mode |
| | △▽ | Scroll to the SPEED CONTROL selection |
| | ENTER | Press to complete the entry |

```
1 L →     0 PSIG 0
11 START-UP DATA
 2 APPLICATION MACRO
MULTI PUMP
```

ACT   PAR   FUNC   DRIVE

ENTER

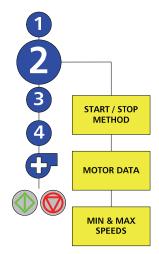## SPEED CONTROL CONFIGURATION

# 2 Motor Setup

The PumpSmart PS200 variable frequency drive utilizes Direct Torque Control [DTC] rather than a scalar speed control variable such as Volts/Hertz. Direct Torque Control provides more precise speed control, hence more responsive and accurate control to your set point. Specific motor data must be entered into the PumpSmart drive to enable it to properly control the motor using DTC.

Steps to be performed are:

1. Identification of the motor starting method

2. Entering motor data for characterization

3. Establishment of the maximum and minimum speed limits

START / STOP
METHOD

MOTOR DATA

MIN & MAX
SPEEDS

## SPEED CONTROL CONFIGURATION

### REMOTE Start/Stop Options

The PumpSmart PS200 has the ability to be remotely started and stopped from an external source.  If the PS200 is only to be started and stopped locally at the keypad then proceed to the next step.

NOTE – The following options only apply when the PS200 is in REMOTE mode.  When in LOCAL mode the start-stop is controlled through the PS200 keypad.  Refer to APPENDIX A-1 KEYPAD USE for further details.

2-WIRE DI1 – As default the remote start/stop is configured for 2-Wire DI1.  This selection is used to start and stop the drive from a maintained 2-wire switch or contact wired to digital input 1.

HOA DI1, DI2 - This selection is used to start and stop the drive from a maintained 2-wire switch or contact wired to digital input 1 (DI1-AUTO).  An additional contact can be wired to DI2-HAND to initiate a Speed Override/Motor Jog function in which the PS200 will operate in a speed control mode.  Refer to SPEED OVERRIDE in the Options and Features section for further details.
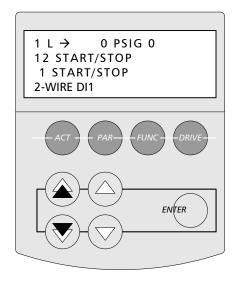
3-WIRE – This selection is used to start the PS200 from a normally open momentary contact/switch wired to DI1-START and stop the PS200 from a normally closed momentary contact/switch wired to DI2-STOP.

FIELDBUS - This selection is used to start and stop the PS200 from a Control Word which is sent through a digital Fieldbus command.  Refer to FIELDBUS COMMUNICATION SECTION for further details.

| 12.01 START/STOP | | |
|---|---|---|
| If you are using a two-wire start-stop method or the keypad only, skip this step and proceed to the next step (Motor Data), otherwise select:<br><br>2-WIRE DI1 *[Default]*<br>3-W DI1P, DI2P<br>HOA DI1, DI2<br>FIELDBUS<br>HOA DI1,2 / DI5<br>DI1P,DI2P / DI5<br>2W DI1, 2W DI5<br>HOA DI1,2 / FB<br>DI1P,DI2P / FB | KEY SEQUENCE<br>*[From parameter group: 10 LOCKS / PASSWORDS]* | |
| | (▲)-(▼) | Scroll to parameter group 12 START/STOP. Parameter 12.01 will be the first selection |
| | ENTER | Press to enter the parameter setting mode |
| | (△)-(▽) | Use the arrow keys to scroll to the desired parameter [Example shown – 2-WIRE DI1] |
| | ENTER | Press to complete the entry |

NOTE – The PS200 has the ability to be controlled from two separate external commands.  Refer to START STOP OPTIONS in the Options and Features Section.

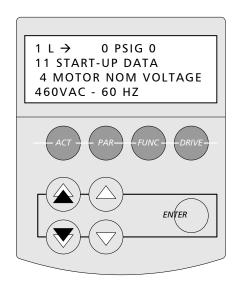## SPEED CONTROL CONFIGURATION

### Motor Data

The motor data will allow the PumpSmart drive to characterize the motor prior to its first start-up. During characterization, PumpSmart will automatically magnetize the motor windings for 20 - 60 seconds to develop a mathematical model of the motor. Entry of the following parameters is all that is required.

NOTE - If the motor is changed in the future, this data must be re-entered and a new characterization will be performed.
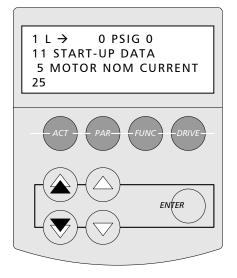
NOTE - The information required for this section can be found on the motor nameplate.
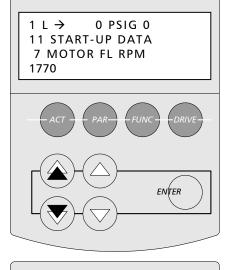
| 11.04 MOTOR NOM VOLTAGE | |
|---|---|
| Enter the value for motor voltage and frequency as found on the motor nameplate. Available selections are<br><br>208 VAC - 60HZ<br>220 VAC - 50 Hz<br>220 VAC - 60 Hz<br>230 VAC - 60 Hz<br>380 VAC - 50 Hz<br>415 VAC - 50 Hz<br>460 VAC - 60 Hz (default)<br>575 VAC - 60 Hz<br>OTHER<br><br>*Selecting OTHER will require entry in parameters 11.06 MOTOR NOM FREQ and 11.12 OTHER MOTOR VOLT.* | **KEY SEQUENCE**<br>*[From parameter group: 12 START / STOP]* |
| | Scroll to parameter group 11 START-UP DATA |
| | Scroll to parameter 11.04 MOTOR NOM VOLTAGE |
| | Press to enter the parameter setting mode |
| | Use a combination of the arrow keys to scroll to the nameplate motor voltage. |
| | Press to complete the entry |

```
1 L →     0 PSIG 0
11 START-UP DATA
 4 MOTOR NOM VOLTAGE
460VAC - 60 HZ
```

ACT   PAR   FUNC   DRIVE

ENTER

| 11.05 MOTOR NOM CURRENT | |
|---|---|
| Enter the actual full load amps (FLA) of the motor here. Refer to the motor nameplate for the correct value. | **KEY SEQUENCE**<br>*[From parameter: 11.04 MOTOR NOM VOLTAGE]* |
| | Scroll to parameter 11.05 MOTOR NOM CURRENT |
| | Press to enter the parameter setting mode |
| | Use a combination of the arrow keys to scroll to the nameplate motor current. |
| | Press to complete the entry |

```
1 L →      0 PSIG 0
11 START-UP DATA
 5 MOTOR NOM CURRENT
25
```

ACT   PAR   FUNC   DRIVE

ENTER

# SPEED CONTROL CONFIGURATION

| 11.07 MOTOR FL RPM | |
|---|---|
| Enter the full load RPM of the motor. Please note this is the nameplate value of the full load RPM and not the nominal speed of the motor.<br><br>*For Example: An 1800 RPM motor might have a full load RPM of 1770 RPM* | **KEY SEQUENCE**<br>*[From parameter: 11.05 MOTOR NOM CURRENT]* |
| | Scroll to parameter 11.07 MOTOR FL RPM |
| | Press to enter the parameter setting mode |
| | Use a combination of the arrow keys to scroll to the nameplate full load speed. |
| | Press to complete the entry |

```
1 L →      0 PSIG 0
11 START-UP DATA
 7 MOTOR FL RPM
1770
```

```
   ACT    PAR    FUNC    DRIVE
                          ENTER
```

| 11.08 MOTOR NOM POWER | |
|---|---|
| Enter the nominal power (HP or kW) of the motor as found on the motor nameplate.<br><br>*If you are using the Default language of ENGLISH(AM), then the units of entry will be Horsepower. Otherwise kW will be the units of entry.* | **KEY SEQUENCE**<br>*[From parameter: 11.07 MOTOR FL RPM]* |
| | Scroll to parameter 11.08 MOTOR NOM POWER |
| | Press to enter the parameter setting mode |
| | Use a combination of the arrow keys to scroll to the nameplate power. |
| | Press to complete the entry |

```
1 L →      0 PSIG 0
11 START-UP DATA
 8 MOTOR NOM POWER
50
```

```
   ACT    PAR    FUNC    DRIVE
                          ENTER
```

## SPEED CONTROL CONFIGURATION

# ID MAGN REQ

> **This warning is normal, proceed on to the step**
> **INDENTIFICATION RUN**

*Identification run*

PumpSmart uses specific motor detail to create a mathematical motor model. This model enables more accurate motor control and is created with the motor data you have just entered by magnetizing the motor for 20 to 60 seconds at zero speed. This is called a First Start ID Run.

Once all the motor data has been entered, the following warning will be displayed:

<div align="center">ID MAGN REQ</div>

This warning indicates that a First Start ID Run is required before the pump may be operated. Now is a good time to perform this run.

> ⚠**WARNING**
>
> The following procedure will energize the motor.  All safety precautions must be followed before initiating the ID MAG. Failure to do so could result in serious injury or death.

With the motor connected to the drive and the keypad in Local (L) mode, press the START button. FOLLOW ALL STANDARD SAFETY PRACTICES FOR STARTING MACHINERY.

NOTE - ALLOW THE FIRST START ID RUN TO COMPLETE BEFORE STOPPING/RESETTING THE DRIVE. Although the motor may not appear to respond to the start command, it has. A warning message "ID MAGN" will be displayed during the ID. Once the ID run is complete, the message "ID DONE" will be displayed.

NOTE - If the motor is changed in the future, a First Start ID Run must be performed again to maintain the accuracy of the PumpSmart control.

Once the First Start ID Run has been completed, the following message will appear:

<div align="center">ID DONE</div>

Once this appears, proceed on to the next step DRIVE OPERATION LIMITS.

---

**E-Stop/Permissive**

The PS200 will not operate unless the E-Stop/Permissive switch [DI1L] is closed. This includes performing the First Start ID Run. If not closed a warning message will appear on the keypad display:

<div align="center">RUN DISABLED</div>

See Appendix A-4, Instrument Wiring, for details on wiring this switch.

NOTE:
The E-Stop/Permissive switch can not be defeated through parameter setting. If your application does not use an E-Stop / Permissive switch, DI1L can be bypassed physically inside the PumpSmart unit. Refer to Appendix A-4, Instrument Wiring, for details.

## SPEED CONTROL CONFIGURATION

### *Drive Operation Limits*

Drive operation limits safe-guard the pump and drive system from operating in unstable over-speed and/or low-speed conditions.
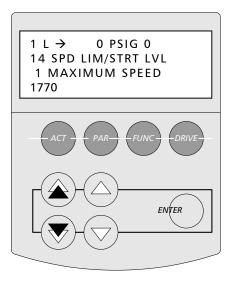
> ⚠️ **WARNING**
>
> **Assure that the system operating conditions are within the capabilities (e.g. - speed, pressure, temperature, power, etc.) of the driven equipment as rated by the manufacturer. Exceeding any of these limits could result in failure of components resulting in serious physical injury and damage to equipment.**

*Maximum Speed* - The PumpSmart System will adjust the speed of the motor to achieve the desired speed setpoint. Although the PumpSmart drive can drive the motor to 2-3 times its nameplate speed, this is impractical for several reasons. First, unless the pump and motor are designed for overspeed operation, they could prematurely wear or even catastrophically fail. Second, centrifugal pumps generate pressure by the square of the speed and overspeed operation may overpressure the pump and surrounding piping system.

| 14.01 MAXIMUM SPEED | |
|---|---|
| Enter the maximum speed that the pump, motor, and system can operate at.  In most cases, the maximum speed will be the same as the previously entered full load RPM.<br><br>MAX SPEED ≤ Full Load Motor RPM and ≤ Pump maximum speed<br><br>*The default value is the speed set in parameter 11.07 MOTOR FL RPM* | **KEY SEQUENCE**<br>*[From parameter group: 11 START UP DATA]* |
| | Scroll to parameter group14, SPD LIM/STRT LVL. Parameter 14.01 will be the first selection. |
| | Press to enter the parameter setting mode |
| | Use a combination of the arrow keys to scroll to the maximum speed. |
| | Press to complete the entry |

```
1 L →      0 PSIG 0
14 SPD LIM/STRT LVL
 1 MAXIMUM SPEED
1770
```

ACT   PAR   FUNC   DRIVE

ENTER

## SPEED CONTROL CONFIGURATION

Minimum Speed - The Minimum Speed parameter sets the minimum speed that the pump can operate at. It is also used to define the safe speed to run the pump during a secondary pump protection fault if the pump protection is programmed this way. The default value for minimum speed is 25% of 11.07 MOTOR FL RPM

When determining a minimum speed, consider the following:

- Motor Minimum Speed [Turndown ratio] - Due to motor loading and thermal effects, the motor minimum speed on centrifugal pumps should not be less than 1/10th its full-load speed.

- Pump Minimum Speed - Some pumps have minimum speed requirements, such as multistage pumps (>2 stages) and sleeve bearing pumps. Consult your pump operation manual to see if there is a minimum speed limit for your pump. **Note - 1& 2 stage pumps do not normally have minimum speed requirements.**

- Static Head Conditions (minimum flow) - The minimum speed should be set to assure that the pump generates enough head to overcome static resistance. In some cases, this can cause overheating and possible vaporization of the liquid in the pump casing.
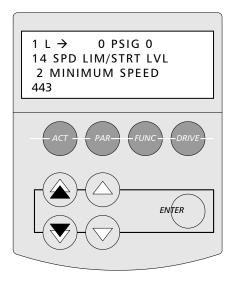
## NOTICE

**Operation below the pump safe minimum speed could result in damage to equipment and/or property.**

| 14.02 MINIMUM SPEED | |
|---|---|
| Enter the minimum speed that the pump and motor can safely operate at.<br><br>Consider-<br><br>• Turndown ratio<br>• Pump minimum speed<br>• Minimum flow<br><br>*The default value is 25% of the speed set in parameter 11.07 MOTOR FL RPM* | **KEY SEQUENCE**<br>*[From parameter group: 14.01  MAXIMUM SPEED]* |
| | (△) or (▽) — Scroll to parameter 14.02 MINIMUM SPEED |
| | ENTER — Press to enter the parameter setting mode |
| | (▲) or (▼) (△) or (▽) — Use a combination of the arrow keys to scroll to the minimum speed. |
| | ENTER — Press to complete the entry |

1 L → 0 PSIG 0
14 SPD LIM/STRT LVL
 2 MINIMUM SPEED
443

ACT   PAR   FUNC   DRIVE

ENTER

NOTE – If the speed signal drops below the minimum speed setting the drive will operate at minimum speed until it is manually shut off. If the speed signal increases above the min speed setting PumpSmart will resume normal operation of the speed signal reference.

## SPEED CONTROL CONFIGURATION



# 3    Speed Control Setup

*Speed Signal Configuration*

In speed control, the desired running speed may be selected in one of frour ways:

- Keypad entry (default)
- Speed Reference (4-20ma) via Analog Input AI2
- Speed Reference (0-10VDC) via Analog Input AI1
- Fieldbus control

The following details the use of a speed signal to set the operating speed of the pump. This section covers setting a speed reference locally at the keypad or sending a speed reference via a 4-20mA signal wired to AI2.
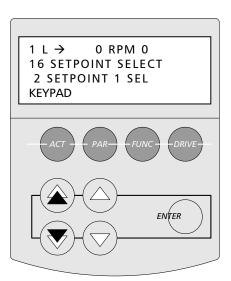
If you are using a Fieldbus Command reference please refer to the Options and Features Section, FIELDBUS SETUP

Additionally if you are using a 0-10VDC speed potentiometer to change the speed reference refer to the Options and Features Section, SETPOINTS, POTENTIOMETER.

SIGNAL SOURCE – Using parameter 16.02, select where the speed signal will originate.

<table>
<tr><td colspan="2">16.02 SETPOINT 1 SEL</td></tr>
<tr>
<td rowspan="5">Select the speed signal source.<br><br>Options:<br><br>Keypad (default) – A manually entered value<br><br>Analog Input – A 4-20mA signal is sent to PumpSmart (Via AI-2)<br><br>Fieldbus – An operating speed is issued from DCS via a digital bus.</td>
<td colspan="2" align="center">KEY SEQUENCE<br>*[From parameter group: 14.02 MINIMUM SPEED]*</td>
</tr>
<tr><td>⬆️⬇️</td><td>Scroll to parameter group 16 SETPOINT SELECT</td></tr>
<tr><td>△▽</td><td>Scroll to parameter 16.02 SETPOINT 1 SEL</td></tr>
<tr><td>ENTER</td><td>Press to enter the parameter setting mode</td></tr>
<tr><td>⬆️⬇️ OR △▽</td><td>Use a combination of the arrow keys to scroll to the correct value. Example shown – ANALOG INPUT</td></tr>
<tr><td></td><td>ENTER</td><td>Press to complete the entry</td></tr>
</table>



```
1 L →      0 RPM 0
16 SETPOINT SELECT
 2 SETPOINT 1 SEL
KEYPAD
```

NOTE - SETTING AI2 MAX (16.03) AND AI2 MIN (16.04) IS STILL REQUIRED IF USING KEYPAD OR FIELDBUS CONTROL

# SPEED CONTROL CONFIGURATION

If you are using an analog speed signal to set the operating speed of the pump, signal MAX and MIN settings are required to properly scale the signal.

Analog Input AI2 is the default channel for receiving an analog input speed signal. This channel is designed to accept a 4-20 mA current signal. In this case, setting of parameters 16.03 AI2 MAX and 16.04 AI2 MIN is required.

AI2 MAX - This refers to the speed value that corresponds to the max signal [20 mA].

> *Example- if you want your process to run at 3600 RPM when the 4-20 mA speed signal is 20 mA, then you would enter in 3600 into parameter 16.03*

> *Example (2) - If you are using Keypad or Fieldbus speed entry method, a value here would limit the entry value. If the AI2 MAX parameter was set at 3000, then a keypad speed entry of 3600 would not be permitted.*

| 16.03 AI2 MAX | | |
|---|---|---|
| Enter the speed value that corresponds to a 20 mA signal.<br><br>Units are in RPM | KEY SEQUENCE<br>*[From parameter group: 16.02 SETPOINT 1 SEL]* | |
| | △ ▽ | Scroll to parameter 16.03 AI2 MAX |
| | ENTER | Press to enter the parameter setting mode |
| | ▲ OR ▼<br>△ OR ▽ | Use a combination of the arrow keys to scroll to the correct value. Example shown - 3600 RPM |
| | ENTER | Press to complete the entry |

```
1 L →      0 RPM 0
16 SETPOINT SELECT
 3 AI2 MAX
3600 RPM
```
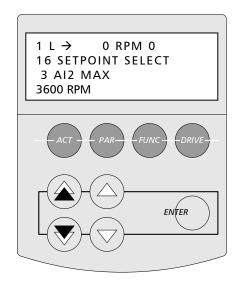
ACT   PAR   FUNC   DRIVE

ENTER

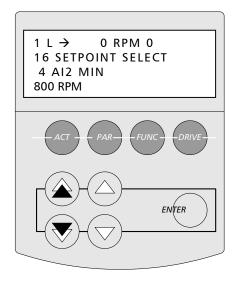AI2 MIN - This refers to the speed value that corresponds to the minimum signal [4 mA].

> *Example- If you want your process to run at 800 RPM when the 4-20 mA speed signal is 4 mA, then you would enter in "800" into parameter 16.04*

✓

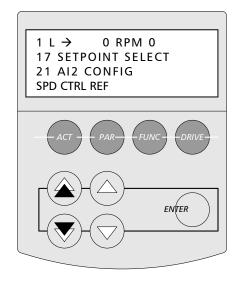| 16.04 AI2 MIN | | |
|---|---|---|
| Enter the speed value that corresponds to a 4 mA signal<br><br>Units are in RPM<br><br>*Default value is 0* | KEY SEQUENCE<br>*[From parameter group: 16.03 AI2 MAX]* | |
| | △ | Scroll to parameter 16.04 AI2 MIN |
| | ENTER | Press to enter the parameter setting mode |
| | ▲ OR ▼<br>△ OR ▽ | Use a combination of the arrow keys to scroll to the correct value. Example shown - 800 RPM |
| | ENTER | Press to complete the entry |

**If you are not using a 4-20mA Speed Reference skip this page.**

```
1 L →      0 RPM 0
16 SETPOINT SELECT
 4 AI2 MIN
800 RPM
```

ACT   PAR   FUNC   DRIVE

ENTER

## SPEED CONTROL CONFIGURATION

When using a 4-20mA speed reference the analog input that the signal is wired to must be defined in the drive.

| 17.21 AI2 CONFIG | | |
|---|---|---|
| By selecting SPEED CTRL REF AI2 is defined as the location for the speed reference. | **KEY SEQUENCE** *[From parameter group: 16.04 AI2 MIN]* | |
| | △ | Scroll to parameter 17.21 AI2 CONFIG |
| | ENTER | Press to enter the parameter setting mode |
| | ▲ OR ▼  △ OR ▽ | Use a combination of the arrow keys to scroll SPD CTRL REF |
| | ENTER | Press to complete the entry |

```
1 L →     0 RPM 0
17 SETPOINT SELECT
21 AI2 CONFIG
SPD CTRL REF
```

ACT   PAR   FUNC   DRIVE

ENTER

## SPEED CONTROL CONFIGURATION

#  Recommended Option: Advanced Pump Protection

For pump protection it is recommended to use the Advanced Pump Protection Feature which provides dry run, min-flow and run-out protection using the SMART$^{FLOW}$ sensorless flow feature.

Advanced Pump Protection allows flexibility to either fault the pump, go to a safe speed or trigger an alarm when a particular process upset condition occurs. It is recommended at a minimum the protection is set up to WARN. By setting the protection features to warn no action will be taken by the PS200. Only a warning will be issued and stored in the drive's fault log. This will allow the pump history to be tracked in the event of a process upset condition that could cause pump failure.

For further details on how to set up ADVANCED PUMP PROTECTION refer to the Option and Features Section.

*SECONDARY PROTECTION*

An alternative secondary protection feature may be used to provide protection from dry-running or operation against a closed discharge valve. However, additional process condition inputs (e.g. level switch, pressure switch, flow switch, etc…) are required to alert PumpSmart of conditions that require the protection of the pump.

Refer to SECONDARY PROTECTION in the Options and Features Section for further details.

## SPEED CONTROL CONFIGURATION

**4** **Enter Setpoint**

This step is only required if you are using the Keypad for entry of a running speed. If you are using an analog speed signal or Fieldbus control, skip this section.

| SETPOINT | |
|---|---|
| Enter the operating setpoint. | **KEY SEQUENCE** |
| | REF — Press REF button to highlight the setpoint value |
| | ▲ OR ▼ / △ OR ▽ — Use a combination of the arrow keys to scroll to the desired setpoint. Example shown is 3000 RPM. |
| | ENTER — Press to complete the entry |

```
1 L →  [3000] RPM 0
16 SETPOINT SELECT
 4 AI2 MIN
800
```

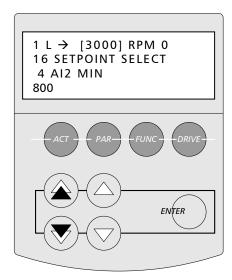ACT   PAR   FUNC   DRIVE

ENTER

NOTES -

There are several alternate ways to enter a speed setpoint. Refer to the OPTIONS AND FEATURES section for configuration detail.

Remote setpoint - A analog signal (e.g. 4-20 mA) may be used to send a speed signal to the PumpSmart unit from a remote location via Analog Input.

Multiple setpoint - The PumpSmart system can be programmed with two speed setpoints and the drive can toggle between the two setpoints based upon a digital switch  [e.g. flow switch, level switch, manual switch, etc…]. Multiple setpoints can also be set through either the keypad, Analog Input, or via the DCS.

DCS Fieldbus - The speed setpoint can be programmed and changed remotely by way of digital communication from a DCS system with optional bus communication modules.  Modules are available for Modbus, Profibus DP, Device Net, ControlNet, and Ethernet.

If using a remote setpoint (through Analog Input or DCS) the speed signal must be sent prior to starting the unit.

**SPEED CONTROL CONFIGURATION**

| | **Recommended Step: Parameter Upload** *See KEYPAD USE* |
|---|---|
| | Save your parameters in the keypad. In the unlikely event that the PS200 parameters are lost, the keypad can be used to restore the configuration.  It can also be used to program sister units that use the same or similar program settings. |

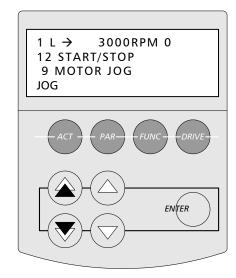| **Recommended Option: Drive Locking** *See OPTIONS & FEATURES* |
|---|
| The keypad can be "locked" to prevent unauthorized personnel from making operational changes or changes to the parameter groups. See  LOCKING in OPTIONS & FEATURES. |

## SPEED CONTROL CONFIGURATION

### Jogging the Motor

Checking the motor for rotation can be accomplished through the Motor Jog function in which the pump will rotate for 10 seconds at 60rpm.

| 12.09 MOTOR JOG | | |
|---|---|---|
| Selecting JOG and pressing the enter key will initiate the motor to rotate. Once completed the parameter value will default back to DISABLE. | **KEY SEQUENCE**<br>*[From parameter: 25.02 PROTECTION LIMIT]* | |
| | **PAR** | Press PAR button to enter the Parameter Menu |
| | ▲ and ▼ | Press the double arrow key to go to parameter group 12 |
| | △ and ▽ | Press the single arrow key to go to parameter 12.09, MOTOR JOG |
| | ENTER | Press to enter the parameter setting mode |
| | △ and ▽ | Use the single arrow key to scroll to JOG |
| | ENTER | Press to complete the entry |

If pump rotation is incorrect then two of the <u>output phases</u> must be swapped on the drive terminals U2, V2 or W2. Swapping two of the input phases will not change the rotation of the drive.

---

### ⚠ DANGER

**Never work on the PS200 drive, the motor cable or the motor when main power is applied. After switching off the input power, always wait 5 minutes to allow drive internal capacitors to discharge before working on the drive, the motor or the motor cable. Failure to do so will result in serious injury or death.**

```
1 L →    3000RPM 0
12 START/STOP
 9 MOTOR JOG
JOG
```

ACT    PAR    FUNC    DRIVE
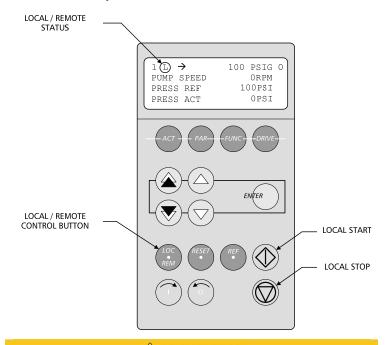
ENTER

## SPEED CONTROL CONFIGURATION

# Starting & Stopping

The PumpSmart system is now ready to start. Starting and stopping the PumpSmart unit is possible through the keypad when in LOCAL mode and through a remote signal as defined in parameter 12.01 when in REMOTE mode.

LOCAL and REMOTE control modes can be changed via the LOC/REM button located on the keypad. To verify if the drive is in LOCAL an "L" will appear in the top right hand corner of the keypad. If the drive is in REMOTE mode an "R" will appear or the space will appear blank if the drive is in REMOTE mode and the setpoint is being controlled remotely.

LOCAL / REMOTE
STATUS

```
1 L  →           100 PSIG 0
PUMP SPEED          0RPM
PRESS REF         100PSI
PRESS ACT           0PSI
```

ACT   PAR   FUNC   DRIVE

ENTER

LOCAL / REMOTE
CONTROL BUTTON

LOC
REM   RESET   REF

I   O

LOCAL START

LOCAL STOP

### ⚠ WARNING

**Never operate rotating equipment unless all protective coupling and shaft guards are in place. Personal injury may occur if the driven equipment is operated without coupling and shaft guards.**

### ⚠ WARNING

**Observe all CAUTIONS and WARNINGS highlighted in the ACS800 Hardware Manual, PS200 Configuration and Operation Guide and Installation, Operation and Maintenance Guide for the applied driven equipment prior to starting.**

---

### E-Stop/Permissive

The PS200 will not operate unless the E-Stop/Permissive switch [DI1L] is closed. This includes performing the First Start ID Run. If not closed a warning message will appear on the keypad display:

RUN DISABLED

See Appendix A-4, Instrument Wiring, for details on wiring this switch.

NOTE:
The E-Stop/Permissive switch can not be defeated through parameter setting. If your application does not use an E-Stop / Permissive switch, DI1L can be bypassed physically inside the PumpSmart unit. Refer to Appendix A-4, Instrument Wiring, for details.

## OPTIONS & FEATURES

## OPTION & FEATURES MENU

## OPTIONS & FEATURES

### *Analog Input Configuration*

The PumpSmart PS200 Analog Input default settings may be altered if required.

| Parameter | Name | Value/Range | NOTES |
|---|---|---|---|
| 17.20 | AI1 CONFIG | PROC TRANS 2 | Defines analog input as the secondary process transmitter for NPSH / Cavitation Control Function. |
| | | PROC TRANS 1 | Defines analog input as an alternate source for the primary process transmitter. |
| | | EXT SETPOINT | Defines analog input as an external setpoint reference for single pump or multipump process control. |
| | | CONDITION 1 | Defines analog input as Condition 1 reference |
| | | CONDITION 2 | Defines analog input as Condition 2 reference. |
| | | SPD CTRL REF | Defines analog input as an external speed reference for speed control mode. |
| | | FLOWMETER | Defines analog input as the flowmeter source if selected for use with Advanced Pump Protection. |
| | | SG/TEMP | Defines analog input as Specific Gravity reference or temperature transmitters for Specific Gravity calculation. |
| | | SPD OVRRD | Defines analog input as the Speed Override external reference source. |
| | | NOT USED *[default]* | Defines analog input as being not used which disables Sensor Failure Protection for the analog input. |
| 17.21 | AI2 CONFIG | PROC TRANS 1 *[default] for Single and Multipump Mode* | Defines analog input as the primary process variable source for single pump and multipump process control. |
| | | SPD CTRL REF | Defines analog input as an external speed reference for speed control mode. |
| | | NOT USED *[default] for Speed Control Mode* | Defines analog input as being not used which disables Sensor Failure Protection for the analog input. |
| 17.22 | AI3 CONFIG | Same as Parameter 17.20 | |

NOTES(s):
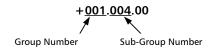
Analog input channel AI1 is a 2-10 VDC input - 4-20 mA signals may be used if converted to 2-10 VDC signals using a 500 Ohm resistor bridging the input. Resistors should be ± 1% 1/4 W.

Analog input channels AI2 & AI3 are 4-20 mA inputs

## OPTIONS & FEATURES

### Analog Output Configuration

The PS200 has two 4-20mA configurable analog outputs. These analog outputs may be configured to any signal in Group 1 VFD Actual Signals or Group 2 Pump Actual Signals found in Appendix A-3. For wiring of the analog outputs reference the detailed wiring diagram in Appendix A-4

The analog outputs are configured by source selection parameters (pointers) in the following format:

$$+\underline{001}.\underline{004}.00$$

Group Number          Sub-Group Number

In the above example 001 represents Group 1 VFD Actual Signals and 004 represents the sub-group field. For example +001.004.00 represents parameter 1.04 MOTOR CURRENT.

NOTE(S) -

+ is the inversion field. The inversion field will always be positive for PumpSmart applications.

00, the last two digits, is the bit field. This is not used in PumpSmart applications.

**PARAMETER NAVIGATION**

To navigate within parameters 20.01 and 20.06 use the enter key to select the parameter, the double arrow key to switch between the Group and Sub-Group, single arrows to change the value and enter key to save the parameter setting.

**PARAMETER SCALING**

The analog output scale that corresponds to 20mA must be configured as it relates to the unit value of the parameter. The scale of each parameter can be found in the PumpSmart Actual Signals tables.

For example if SMART$^{FLOW}$ is required to be outputted on Analog Input 1 (AO1). The scale of parameter 2.20 SMARTFLOW as referenced from Group 2 Pump Actual Signals is: 10 = 1 unit. If the maximum flow for the pump is 500gpm then parameter 20.05 SCALE AO1 must be set to 5000. This corresponds to a value of 20mA = 500.0 gpm.

Defaults have been set for 2.07 Pump Speed, 1.04 Motor Current, 1.05 Motor Torque, 1.06 Motor Power, and 2.12 Energy Savings.

| Parameter | Name | Value/Range | Note |
|---|---|---|---|
| 20.01 | ANALOG OUT 1 | +002.007.00 [default]<br><br>C 00000 [not used] | Source selection parameters (pointers) are used to configure a signal for analog output. See explanation above. |
| 20.05 | SCALE AO1 | 0 [default] | Scale is automatically set for common analog output configurations as shown in the above table. All other configurations default to 0 and must be manually set. |
| 20.06 | ANALOG OUT 2 | +001.004.00 [default]<br><br>C 00000 [not used] | Source selection parameters (pointers) are used to configure a signal for analog output. See explanation above. |
| 20.10 | SCALE AO2 | 0 [default] | Scale is automatically set for common analog output configurations as shown in the above table. All other configurations default to 0 and must be manually set. |

## OPTIONS & FEATURES

### *Auto Restart Functions*

The PS200 can be configured to automatically restart on conditions such as Power Failure, VFD faults, Process Sensor fault, and Pump Protection faults.  If a given fault condition has not cleared after an automatic restart the PS200 will attempt to reset the fault a set number of times.  If the number of resets has been exhausted in the designated time trial the PS200 will fault and the fault will have to be manually reset before the drive can be restarted.

> ⚠ **WARNING**
>
> **By enabling 12.01 AUTO RESTART, 28.01 AUTO RESET TRIALS or 25.04 ERROR RESET functions the driven equipment will automatically restart from either a power failure or fault condition if a start signal is present. All precautions should be taken to ensure the driven equipment can be automatically restarted.  Failure to follow these instructions may result in physical injury or equipment damage.**

#### *Power Failure Reset*

The PS200 can be configured to start automatically following a power failure by enabling AUTO RESTART to ON.

| Parameter | Name | Value/Range | Note |
|---|---|---|---|
| 12.02 | AUTO RESTART | OFF *[default]*<br>ON | Must be set to ON to enable function Auto Restart function. |

NOTE – Parameter 24.03 Keypad Failure must be set to Last Speed.

#### *VFD & Process Sensor Auto Fault Reset*

The PS200 can be configured to automatically reset certain VFD related faults and process sensor faults.  These particular faults can be reset up to a maximum of fives times with in the trial time before the drive faults and has to be manually restarted.

| Parameter | Name | Value/Range | Note |
|---|---|---|---|
| 28.01 | AUTO RESET TRIALS | 0 – 5<br>0 *[default]* | Defines the number of automatic resets allowed. A setting of zero disables this function. |
| 28.02 | TRIAL TIME | 1 – 180 sec<br>180 *[default]* | Defines the allowable time period for counting and resetting a fault. This parameter limits the number resets in Parameter 28.01 which can occur within this time period. |
| 28.03 | VFD RESET DELAY | 0 – 250 sec<br>15 sec *[default]* | Defines the time that the PS200 will wait before attempting an auto reset of a VFD or Process Sensor Fault. |
| 28.04 | OVERCURRENT | ENABLE<br>DISABLE *[default]* | Activates/deactivates Auto Reset for an Overcurrent fault |
| 28.05 | OVERVOLTAGE | ENABLE<br>DISABLE *[default]* | Activates/deactivates Auto Reset for an Overvoltage fault |
| 28.06 | UNDERVOLTAGE | ENABLE<br>DISABLE *[default]* | Activates/deactivates Auto Reset for an Undervoltage fault |
| 28.07 | PROCESS SENSOR | ENABLE<br>DISABLE *[default]* | Activates/deactivates Auto Reset for a Process Sensor fault. |

## OPTIONS & FEATURES

### *Pump Fault Auto Reset - Alarm & Control Setting Only*

The PS200 can auto reset a pump related fault due to an upset condition.  When a pump upset condition is detected the drive can be configured to either go to a safe minimum speed or fault the pump.  It can then be configured to automatically restart after a set time delay.  If the condition has cleared the pump will resume normal operation.  If the condition has not cleared then the drive will attempt to automatically reset a set number of times before it requires a manual reset. This feature only applies to the pump specific faults configured in parameter 25.01 PUMP PROTECT CTRL and 25.11 MIN FLOW CTRL.  Any parameter set to FAULT must be manually reset.

Note: Parameter 14.05 CONFIG SPEED MIN also determines how the PS200 will react to a low demand condition.  If the Sleep Function is enabled 14.05 CONFIG SPEED MIN must be set to SPD=0.  Refer to the MINIMUM SPEED SLEEP Function in the Options and Features Section for details.

| Parameter | Name | Value/Range | Note |
|---|---|---|---|
| 14.05 | CONFIG SPEED MIN | SPD=MINSPD<br>SPD=0 *[default]* | Selecting SPD=MINSPD will result in the drive staying at minimum speed when an ALARM & CONTROL condition exists between resets.  Selecting SPD=0 will result in the drive shutting down when an ALARM & CONTROL condition exists. |
| 25.04 | ERROR RESET | 1-19<br>0 *[default]* | If the PumpSmart unit faults on Pump Protection, this parameter will reset the fault up to the selected number of times before completely shutting off the drive. |
| 25.05 | PUMP RESET DELAY | 0-250 seconds<br>60 *[default]* | The automatic reset of protection faults can be delayed. |

## OPTIONS & FEATURES

### Condition Monitoring

The PS200 has the ability to monitor up to two channels of information.  This information can be from an external transmitter such as bearing vibration, temperature, suction pressure, tank level or any analog (4-20mA or 2-10VDC) process sensor.  Additionally the condition monitoring function can be used as a supervisory function to monitor select VFD and PUMP ACTUAL signals from parameter Groups 1 and 2.  The following internal signals can be monitored:

| | |
|---|---|
| 1.02 MOTOR SPEED | 1.14 OP HRS SINCE RST |
| 1.03 MOTOR FREQUENCY | 1.15 KWH SINCE RST |
| 1.04 MOTOR CURRENT | 1.43 MOTOR RUN TIME |
| 1.05 MOTOR TORQUE | 2.04 PRESS ACT |
| 1.06 MOTOR POWER | 2.06 TEMP ACT |
| 1.10 VFD TEMP | 2.17 PROC XT2 |

The condition monitoring function can be configured to monitor both a high and low condition.  There are two levels of protection available; the first is a warning level and the second is an alarm level.  If the condition exceeds the HI or falls below the LO alarm level for longer then condition response delay (par 22.13 COND RESP DELAY) then PumpSmart can be configured to take the following actions:

*ALARM ONLY* – PumpSmart will issue a Keypad or DCS notice and will trigger a Relay Output (if configured) if an ALRM LIM HI or ALRM LIM LO condition is detected. No further action is taken.

*MIN SPD* - Selecting MIN SPD will configure PumpSmart to drop to 14.02 MIN SPEED and issue a Keypad or DCS notice and trigger a Relay Output (if configured) if an ALRM LIM HI or ALRM LIM LO condition is detected.  If the alarm does not reset itself after the MIN SPD STP DLY (parameter 23.14) the PS200 will fault.

*SLEEP* - The PS200 will shut down and go into a sleep mode if an ALRM LIM HI or ALRM LIM LO condition is detected. Refer to Sleep Mode Functions for further details.

*FAULT* - The PS200 faults if an ALRM LIM HI or ALRM LIM LO condition is detected.  A Keypad or DCS notice is issued and a Relay Output is triggered (if configured).

If the condition to be monitored is an external transmitter then it should be wired to either A13 or AI1.  As standard AI3 is calibrated to receive a 4-20mA signal where as AI1 is calibrated to receive a 2(0)-10VDC signal.  Analog Inputs must be configured for units (Group 15), scale (Group 16) and location (Group 17).  If using an external analog sensor for condition monitoring then the following parameters must be configured.

If using an internal signal for Group 1 or 2 for condition monitoring proceed to the next set of parameters.

| Parameter | Name | Value/Range | NOTES |
|---|---|---|---|
| 15.02<br>15.03 | AI1 UNIT<br>AI3 UNIT | RPM, %, HZ, BAR, GPM, PSIG, M3/HR, FT, M, F DEG, C DEG, IN, CM, IN/SEC, MM/SEC | Select the units for the type of transmitter wired to AI1 or AI3. |
| 16.06<br>16.08 | AI1 MAX<br>AI3 MAX | Range: 0-18000 | Enter the process value that corresponds to a 20mA or 10 VDC signal as read from the GENERAL CONDITION transmitter. |
| 16.07<br>16.09 | AI1 MIN<br>AI3 MIN | Range: -200 - 18000<br>0 [default] | Enter the process value that corresponds to a 4mA or 2 VDC signal as read from the GENERAL CONDITION transmitter. |
| 17.20<br>17.22 | AI1 CONFIG<br>AI3 CONFIG | CONDITION 1<br>CONDITION 2 | Any unused analog input channel (exception AI2) may be used for the GENERAL CONDITION signal |

## OPTIONS & FEATURES

The follow steps are a guide to configure the condition monitoring function.

| Parameter | Name | Value/Range | NOTES |
|---|---|---|---|
| 23.01<br>23.07 | COND 1 SOURCE<br>COND 2 SOURCE | AI1, AI3, 1.02–1.06, 1.10-1.15, 1.43, 2.04, 2.06, 2.07, 2.17 | Select the source of the signal to be monitored.  The source can either be from an external transmitter wired to AI1 or AI3 or it can be an internal signal as selected by the parameter number. |
| 23.02<br>23.08 | COND 1 WRN LIM HI<br>COND 2 WRN LIM HI | 0-9999<br>0 [default] | The high value of the warning limit. A warning occurs if the monitored signal rises above this value for longer than the response delay (par 23.13) . Inactive if set to 0. |
| 23.03<br>23.09 | COND 1 WRN LIM LO<br>COND 2 WRN LIM LO | ±9999<br>0 [default] | The low value of the warning limit. A warning occurs if the monitored signal drops below this value for longer than the response delay (par 23.13). Inactive if set to 0. |
| 23.04<br>23.10 | COND 1 ALARM<br>COND 2 ALARM | DISABLED [default] | Protection is inactive. |
| | | ALARM ONLY | Selecting ALRM ONLY will configure PumpSmart to issue a Keypad or DCS notice and will trigger a Relay Output (if configured) if an ALRM LIM HI or ALRM LIM LO condition is detected. No further action is taken. |
| | | MIN SPD | Selecting MIN SPD will configure PumpSmart to drop to 14.02 MIN SPEED and issue a Keypad or DCS notice and trigger a Relay Output (if configured) if an ALRM LIM HI or ALRM LIM LO condition is detected.  If the alarm does not reset itself after the MIN SPD STP DLY (parameter 23.14) the PS200 will fault. |
| | | SLEEP | The PS200 will shut down and go into a sleep mode if an ALRM LIM HI or ALRM LIM LO condition is detected. Refer to Sleep Mode Functions for further details. |
| | | FAULT | The PS200 faults if an ALRM LIM HI or ALRM LIM LO condition is detected.  A Keypad or DCS notice  is issued and a Relay Output is triggered (if configured). |
| 23.05<br>23.11 | COND 1 ALRM LIM HI<br>COND 2 ALRM LIM HI | 0-9999<br>0 [default] | The high value of the alarm limit. An alarm occurs if the monitored signal rises above this value for longer than the condition response delay (par 23.13). Inactive if set to 0. |
| 23.06<br>23.12 | COND 1 ALRM LIM LO<br>COND 2 ALRM LIM LO | ±9999<br>0 [default] | The low value of the alarm limit. An alarm occurs if the monitored signal drops below this value for longer than the response delay (par 23.13). Inactive if set to 0. |
| 23.13 | COND RESP DELAY | 0-300 sec<br>20 sec [default] | The delay period prior to activation of a COND 1 or COND 2 WRN OR ALRM |
| 23.14 | MIN SPD STP DLY | 0-1800 sec<br>60 sec [default] | The time period which the PS200 will operate at min speed during an alarm condition if the alarm condition does not reset. If the time period expires the PS200 will fault. |

## OPTIONS & FEATURES

### Critical Speed Windows

The PumpSmart PS200 can be configured to avoid certain operating speed ranges, or windows to avoid undesirable resonances while in the Speed Control Macro. These resonances, or critical speeds, are more common to multistage pumps such as vertical turbine pumps.

Refer to the pump manufacturer to determine if the pump being controlled by PumpSmart has a critical speed within your defined operating speed range (between 14.01 MAX SPEED and 14.02 MIN SPEED).

If the function is selected, PumpSmart will respond in the following manner when confronted with operation within the critical speed window:

- If the commanded speed falls within the critical speed bandwidth and the drive is accelerating it will run at a speed just below the critical speed window until the commanded speed rises above the window.

- If the commanded speed falls within the critical speed bandwidth and the drive is decelerating it will run at a speed just above the critical speed window until the commanded speed falls below the window.

| Parameter | Name | Value/Range | Note(s) |
|-----------|------|-------------|---------|
| 14.10 | CRITICAL SPEED 1 | 0 – 9999 RPM<br>0- Disabled [default] | Refer to the pump manufacturer for first critical speed. |
| 14.11 | CRITICAL SPEED 2 | 0 – 9999 RPM<br>0- Disabled [default] | Refer to the pump manufacturer for second critical speed. |
| 14.12 | NCR WIDTH | 0 – 1000 RPM<br>0- [default] | This is the total critical speed bandwidth (½ above and ½ below) of the value set for Critical Speed 1 and 2. |

### Energy Savings Calculator

The PS200 can calculate the energy savings as compared to a constant speed pump application. To enable this function to perform properly, local energy costs and comparative application information must be entered.

Enter the local energy cost in $ (local currency) per kWh into parameter 26.01and then enter the average nominal power rating of the comparable fixed speed pump into parameter 26.02. This can be determined from the fixed speed pump performance curve at the rated condition of the pump.

One of the benefits of using PumpSmart is its ability to automatically shut down the pump when demand is not present. Parameter 26.04 SAVINGS OPTION 2 allows these PumpSmart be computed during an automatic shutdown while SAVINGS OPTION 1 only computes the energy savings while the pump is running.

| Parameter | Name | Value/Range | Note(s) |
|-----------|------|-------------|---------|
| 26.01 | $/kWh | 0-1.00<br>0 [default] | Example: If the utility cost per energy unit is $0.06 per kWh then a value of 0.06 would be entered. |
| 26.02 | BASELINE POWER | 0-1000 Hp<br>0 [default] | Enter the average nominal power of the comparable fixed speed pump. |
| 26.04 | ENERGY SAVE METHOD | SAVINGS OP 1 [default]<br>SAVINGS OP 2 | Defines if the savings should be tracked only when the pump is running (OP1) or also during automatic shut down (OP2). |
| 26.05 | ENERGY SAVE RESET | DISABLED [default]<br>RESET | Allows resetting the savings to zero. |
| 20.05<br>20.10 | SCALE AO1<br>SCALE AO2 | 0 – 65536<br>1 = $1 | Defines the scale of total savings if this value is to be communicated via an analog output or Fieldbus word.<br>Example: Scale setting of 10000 = $10,000. |

NOTE – For languages other then English AM 26.02 BASELINE POWER is entered in KW and 26.01 is Euro/KW.

# OPTIONS & FEATURES

## *Fieldbus Control*

The PumpSmart PS200 may be integrated into existing Distributive Control Systems [DCS] in two ways; analog input/output signals and via optional Fieldbus control modules. The use of analog I/O signals decreases the amount of information that can be exchanged between PumpSmart and the DCS system, although may be sufficient in some cases (See Analog Outputs). The use of Fieldbus control modules allows selected PumpSmart parameters and operating signals to be accessed and modified.

Fieldbus control modules are available in numerous communication protocols, including: DeviceNet, Modbus RTU, Profibus, ControlNet and Ethernet.

With the control module installed, set parameter 30.01 FIELDBUS to FIELDBUS. If a Modbus Adapter (RMBA) is used, set 30.01 FIELDBUS to STD MODBUS. For FIELDBUS selection, parameter Groups 31 MODULE TYPE, 90 D SET REC ADDR and 92 D SET TR ADDR are opened. For Std Modbus selection, parameter Groups 52 STD MODBUS, 90 D SET REC ADDR AND 92 D SET TR ADDR are opened. These parameter groups define the addresses and data sets that are exchanged between PumpSmart and the DCS. The optional Fieldbus module is installed in option Slot 1 of the drive.

Refer to the ABB Hardware Manual and Control Module manual that accompanies each Fieldbus module. For detailed instructions on setting up the PS200 for Fieldbus communication refer to the PS200 Fieldbus Configuration Guide. To download these manuals visit www.ittmc.com .

| Parameter | Name | Value/Range | Note(s) |
|---|---|---|---|
| 30.01 | FIELDBUS | NO *[default]*<br>FIELDBUS<br>ADVANT<br>STD MODBUS<br>CUSTOMIZED | |
| 31.01 | MODULE TYPE | | This parameter configures the module automatically by the fieldbus adapter. No action is required by the user unless changes to the default settings are desired. |
| 90 | D SET REC ADDR | | Parameter group is opened once Parameter 30.01 is changed to Fieldbus or Std Modbus |
| 92 | D SET TR ADDR | | Parameter group is opened once Parameter 30.01 is changed to Fieldbus or Std Modbus |
| 52 | STD MODBUS | | This Group is opened once 30.01 is set to Std Modbus. |

Any parameter changes that are made using a Fieldbus control system must be saved to the drive.

| Parameter | Name | Value/Range | Note(s) |
|---|---|---|---|
| 10.04 | PARAMETER SAVE | DONE *[default]*<br>SAVE | Parameters that are manually entered through the keypad are automatically saved, only parameters entered through a Fieldbus connection must be saved. To save, select SAVE and press the ENTER key or write to parameter 10.04 using digital communication to SAVE. |

## OPTIONS & FEATURES

### *Jogging*

Checking the motor for rotation can be accomplished through the Motor Jog function in which the pump will rotate for 10 seconds at 60rpm.  This will allow time for the pump rotation to be verified while maintaining a slow enough speed so as not to damage the pump in the event rotation is reversed.

If pump rotation is reversed then two of the output phases must be swapped on the drive output terminals U2, V2 or W2.  Swapping two of the input phases will not change the rotation of the driver.

| Parameter | Name | Value/Range | Note(s) |
|---|---|---|---|
| 12.09 | MOTOR JOG | JOG<br>OFF *[default]* | Selecting JOG and pressing the enter key will initiate the motor to rotate. Once completed the parameter value will default back to OFF. |

### *Language*

The PumpSmart system fully supports 6 languages; English (AM), French, German, Italian, Portuguese and Spanish.  Portions of the PumpSmart parameters are also available in Dutch, Danish, Finnish, Swedish, Czech, Polish and Russian.

English(AM) refers to American English and is the default language. Units of power are in HP. English without the (AM) notation refers to British English, with units of power in kW.

| Parameter | Name | Value/Range | Note(s) |
|---|---|---|---|
| 11.01 | LANGUAGE | ENGLISH(AM) *[default]*<br>ENGLISH<br>DEUTSCH<br>ITALIANO<br>ESPANOL<br>PORTUGUESE<br>NEDERLANDS<br>FRANCAIS<br>DANSK<br>SUOMI<br>SVENSKA<br>CESKY<br>POLSKI<br>PO-RUS | ENGLISH (AM) defines units power in HP. |

### *Local Speed Control*

When in LOCAL control mode the PS200 can be switched from Single Pump Process Control or External Speed Control mode to operate in local speed control through the PS200 keypad.  By selecting SPEED RPM/HZ in parameter 16.10 total control of the drive can be achieved when in LOCAL mode.  This includes controlling both the start/stop function and the manual speed setting through the keypad.  When in REMOTE mode the PS200 will operate in the primary control mode as configured.

Refer to Appendix A-1 Keypad use regarding keypad operation and toggling between LOCAL and REMOTE control modes.

| Parameter | Name | Value/Range | Note(s) |
|---|---|---|---|
| 16.10 | LOC  REF SELECT | SPEED RPM/HZ<br>PROC VAL *[default]* | Defines the reference to be controlled when the drive is in LOCAL mode. SPEED/HZ will operate the PS200 in local speed control.  PROC VAL will operate the PS200 in the primary control mode in both REMOTE and LOCAL mode. |

## OPTIONS & FEATURES

### Locking

The PS200 has two levels of keypad locking; LOCAL LOCK and PARAMETER LOCK.

1.  PARAMETER LOCK - In parameter lock, parameters may be viewed, however they cannot be changed. Starting, Stopping, setpoint changes and drive fault resets may still be performed using the keypad.

2.  LOCAL LOCK - In local lock, starting and stopping are prevented. Resetting of drive faults is still possible.

To change the drive parameters, including 10.03 LOCAL LOCK, the parameter lock must be opened. To open the parameter lock, go to parameter 10.02 PASS CODE and scroll to the number 358 and press ENTER. Parameter 10.01 PARAMETER LOCK will read OPEN.

NOTE - If power to the drive is lost [power failure, disconnect, etc…] parameter 10.01 PARAMETER LOCK will automatically reset to LOCKED.

| Parameter | Name | Value/Range | Note(s) |
|---|---|---|---|
| 10.01 | PARAMETER LOCK | LOCKED [default] OPEN | This parameter displays the status of the parameter lock and can be used to lock the parameters when necessary. To OPEN the parameter lock, use parameter 10.02. |
| 10.02 | PASS CODE | -0- | Using the arrow keys, scroll to the number "358" and press enter.  This will open the parameter lock. Note - The number entry will disappear once ENTER has been pressed. |
| 10.03 | LOCAL LOCK | OFF [default] ON | This parameter disables local control of the drive (Start/Stop). |

## ⚠ WARNING

**It is not possible to stop the drive through the keypad with LOCAL LOCK set to ON. Serious physical injury and/or equipment damage may result if the drive cannot be stopped.**
1. **Use LOCAL LOCK only with a remote (external) stop/start method.**
2. **Keypad must be set in REMOTE before enabling LOCAL LOCK.**

### Maximum Current Limit

The PS200 has the ability to limit the output current to the motor to prevent overloading the motor.  The PS200 reacts by overriding the process signal command and limiting the speed of the motor if the maximum current limit is reached.   This allows for the pumps maximum output to be achieved while protecting the motor from overcurrent.

Note: Limiting the current to the motor will protect the motor from overload however it may not protect the pump from a run-out condition.

| Parameter | Name | Value/Range | Note(s) |
|---|---|---|---|
| 25.20 | MAXIMUM CURRENT | 0-200% 200% [default] | The value is entered in a % of the drives heavy duty current, $I_{2hd}$, rating which can be found in the ACS800 Hardware Manual under Technical Data. |

## OPTIONS & FEATURES

### Motor Thermal Protection

The motor can be protected against overheating by the motor thermal protection function. The default method of protection is a motor temperature thermal model created by the PS200. The PS200 calculates the temperature of the motor assuming an ambient temperature of 30°C (86°F) when power is applied to the PS200. The thermal model can be user adjusted if the ambient temperature exceeds 30°C (86°F). Refer to your PumpSmart Applications group for guidance.

NOTE - Parameters 24.05 and 24.06 are in the Advanced Parameter Group accessible by User Pass Code 564.

| Parameter | Name | Value/Range | Notes |
|---|---|---|---|
| 24.05 | MOTOR THERM PROT | WARNING [default] FAULT NO | This parameter defines the reaction of PumpSmart when it calculates a potential motor thermal fault. FAULT will shut the pump down. NO will result in no warning or fault shutdown. |
| 24.06 | MOTOR THERM PMODE | DTC [default] USER MODE THERMISTOR | This defines how PumpSmart will determine a motor thermal fault. DTC uses the ABB DTC control algorithm while THERMISTOR uses a physical thermistor placed in the motor. |

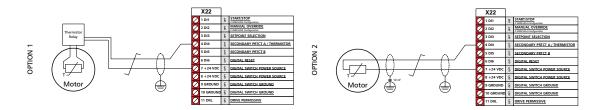| **NOTICE** | **Selecting DTC or User Mode may not protect the motor from damage if it does not cool properly from dust or dirt.** |
|---|---|

An alternate method of detecting motor overheating is by use of a motor thermistor. The thermistor or a break contact of a thermistor relay is connected between the PS200 internal +24 VDC voltage supply and digital input 4 (DI4). Under normal motor temperature operation the thermistor resistance should be less than 1.5kohm (current 5 mA). The PS200 will warn the user or fault (see parameter 24.05) if the thermistor resistance exceeds 4 kOhm. If using a motor thermistor, parameter 25.06 Secondary Protect A must be set to "Thermistor".

NOTE - Parameter 24.06 Motor Thermal P Mode will automatically update to the Thermistor setting.

| Parameter | Name | Value/Range | Notes |
|---|---|---|---|
| 25.06 | SECONDARY PRTCT A | DISABLED [default] ALARM & CTRL THERMISTOR | Select THERMISTOR when a motor thermistor is wired at DI4 |

| ⚠ **WARNING** |
|---|
| **According to IEC664, the connection of the motor thermistor to a digital input requires double or reinforced insulation between motor live parts and the thermistor. Reinforced insulation entails a clearance and creeping distance of 8 mm (0.31 in) for 400/500 VAC input voltages. If the thermistor assembly does not fulfill the requirement, the other I/O terminals of the drive must be protected against contact, or a thermistor relay must be used to isolate the thermistor from the digital input. Failure to follow these instructions may result in physical injury and/or equipment damage.** |

## OPTIONS & FEATURES

### Multipump Options

#### External Powering the Control Board

The PS200 control board (RMIO board) can be externally powered with a 24VDC power supply.  This allows the PS200 to maintain the fiber optic communication network between the drives during a period in which one of the drives may have been powered down for service.  In a multipump configuration the PS200 will recognize main power to a drive is not available and look at the next drive in sequence.

Refer to the ACS800 Hardware Manual for installations instructions of the external power supply.

| NOTICE | Loss of communication can result in process interruption.  Loss of communication can be caused by a break in fiber optic communication, loss of power to any drive or drive failure. |
|---|---|

It is recommended that the control board be externally powered when only one process transmitter has been provided to the master drive or there are 3 or more pumps in service.  By externally powering the control board the process transmitter will remain powered and communicate the process signal to the slave drives while the master drive has been isolated and powered down.

The RMIO board requires 24VDC ±10%, typical current consumption is 250mA and maximum current consumption with optional modules is 1200mA.

When externally powering the control board parameter 11.13 CTRL BOARD SUPPLY must be set to EXTERNAL 24VDC to avoid a PPC LINK FAULT when the main supply power has been cut.

| Parameter | Name | Value/Range | Notes |
|---|---|---|---|
| 10.02 | PASSCODE | 564 | To access parameter 11.13 CRTL BOARD SUPPLY the advanced passcode 564 must be entered. |
| 11.13 | CTRL BOARD SUPPLY | INTERNAL 24VDC [default] EXTERNAL 24VDC | By selecting EXTERNAL 24 the PS200 is instructed that the control board is being externally powered. |

#### Lead-Lag Switching

Automatically alternating the Lead-Lag responsibilities of the drives in multi-pump control may be accomplished by setting the parameter 22.07 SWITCH LEAD LAG to the desired switching period.  The lead-lag switch will occur based upon the number of hours the unit has been running.

NOTE - This function may be tested by setting the value to 0.1 hr (6 minutes).

| Parameter | Name | Value/Range | Notes |
|---|---|---|---|
| 22.07 | SWITCH LEAD | 0-10,000 Hours 48 [default] | This is the number of hours that a pump is running before switching the LEAD designation to the next pump. Setting "0" disables the switching function, including automatic switching during a drive or pump protection fault. |

## OPTIONS & FEATURES

### Pressure Boost

Automatically PumpSmart multipump logic is designed to stage pumps on and off to meet changes in demand. As demand increases in a pump system the frictional losses increase with a flow squared relationship ~ $Q^2$. In a constant pressure system often times the highest pressure setpoint is set to compensate for the maximum frictional losses at maximum flow. This practice will ensure that every user on the system receives the required pressure no matter what the flow rate. However in times of normal or reduced capacity, excess pressure is generated that provides little useful work and reduces the overall Flow Economy of the pumps.

To optimize a constant pressure multipump system a pressure boost can be added to the pressure setpoint as pumps are staged on and off. As each lag pump is brought online, indicating an increase in flow, PumpSmart will automatically increase the pressure setpoint as set by parameter 22.03 VALUE INCREASE. The amount of pressure increase to the setpoint is determined by the following formula:
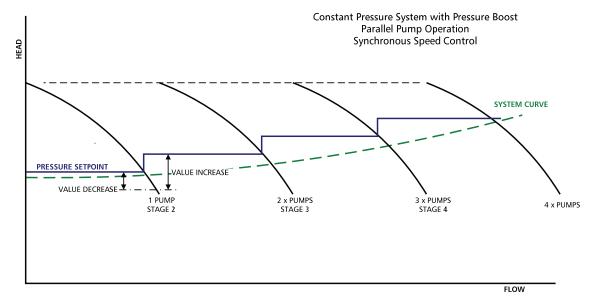
$$(1 + \text{VALUE INCREASE} - \text{VALUE DECREASE})$$

EXAMPLE: In a 4 pump system the setpoint is 100psi, the VALUE INCREASE is 10% and the VALUE DECREASE is 5%. Based on the formula the setpoint increase equals = 1+0.10-0.05 = 1.05

When 2 pumps are running the pressure setpoint = 100psig x 1.05 = 105psi.

When 3 pumps are running the pressure setpoint = 105psi x 1.05 = 110psi.

When 4 pumps are running the pressure setpoint = 110psi x 1.05 = 116psi.



Constant Pressure System with Pressure Boost
Parallel Pump Operation
Synchronous Speed Control

| Parameter | Name | Value/Range | Notes |
|-----------|------|-------------|-------|
| 22.02 | VALUE DECREASE | 0-100%<br>5% [default] | Drop in setpoint required before lag pump is started. |
| 22.03 | VALUE INCREASE | 0-100%<br>Defaults to same value as 22.02 VALUE DECREASE | Increase in setpoint when a lag pump is started. To maintain a constant setpoint as a minimum the VALUE INCREASE should be equal to the VALUE DECREASE. To increase the pressure setpoint the VALUE INCREASE should be higher then the VALUE DECREASE. |

## OPTIONS & FEATURES

### Process Control Functions

Pump specific algorithms are provide as standard to improve pump system efficiency, protect the pump from process upsets and improve overall pump reliability.  This section will review the configuration of these functions.
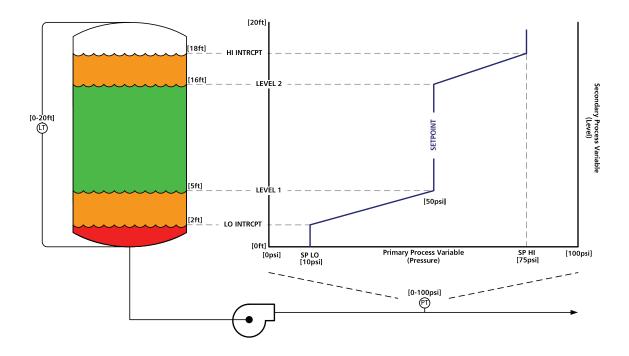
### Multivariable Control / Cavitation Control

The Multivariable Control function can be used to vary the setpoint using a secondary process transmitter wired to either AI-1 or AI-3.  This might be used in blending applications, or in situations where suction pressure varies and cavitation control is sought. This functionality can be used in the Speed Control, Single Pump or Multipump Macros.

*EXAMPLE – A pump configured for constant pressure draws from a tank. The level in the tank varies greatly, and occasionally drops enough that the pump begins to cavitate. Although the PumpSmart protection functionality will ultimately protect the pump by sending it to minimum speed or shutting it down, the use of the Multivariable Control feature would allow for continued pumping, albeit at a reduced rate.*

*A suction pressure transmitter would need to be added and wired into AI1 or AI3. This signal would then be configured such that when the suction pressure is sufficient, the PumpSmart unit would run to the entered setpoint. When the suction pressure dropped below a certain value, it would scale the setpoint back.*

When configuring the Multivariable Control function, it is helpful to plot how you want your setpoint to behave in relation to the analog input signal:



*EXAMPLE – In the above diagram, the setpoint is 50psi. When the secondary process transmitter (TX2) is below 5ft (LEVEL 1) of tank level , it will begin to scale back the setpoint linearly from 50psig to 10psi (SP LO) at 2ft (LO INTRCPT).  When the secondary process transmitter (TX2) reaches 16ft of tank level, it will increase the setpoint linearly from 50psi to 75psi (SP HI) at 18ft (HI INTRCPT).*

## OPTIONS & FEATURES

The following configuration steps must be completed after the primary control mode (Single Pump, Speed Control or Multipump) has been configured. The analog input for the secondary process transmitter must be configured prior to enabling the Multivariable Control functionality.  If the secondary transmitter is a 4-20mA process signal then AI3 would be the recommended analog input to use.

| Parameter | Name | Value/Range | Default |
|---|---|---|---|
| 15.02 or 15.03 | AI1 UNIT AI3 UNIT | NONE *[default]*, RPM,%, HZ, BAR, GPM, PSIG, M3/HR, FT, M, F DEG, C DEG, IN, CM | Enter the units that correspond to the secondary process variable. |
| 16.06 or 16.08 | AI1 MAX AI3 MAX | Range: 0-18000 | Enter the process value that corresponds to a 20mA or 10 VDC signal as read from the second process transmitter. |
| 16.07 or 16.09 | AI1 MIN AI3 MIN | Range: -200 - 18000 0 *[default]* | Enter the process value that corresponds to a 4mA or 2 VDC signal as read from the second process transmitter. |
| 17.20 or 17.22 | AI1 CONFIG AI3 CONFIG | PROC TRANS 2 NOT USED *[default]* | Define the analog input that the secondary process transmitter is wired to by setting the analog input configuration to PROC TRANS 2. |

Multivariable set-up is performed via parameter group 21.

| Parameter | Name | Value/Range | Notes |
|---|---|---|---|
| 21.02 | MULTIVAR CTL | OFF *[default]* ON | Set to "ON" to enable the Multivariable functionality |
| 21.03 | LEVEL 1 | Range: 0-9999 0 *[default]* | This is the first level in which the Multivariable control function will scale the setpoint as it is defined by the LO INTRCPT value and SP LO value.  LEVEL 1 is defined in units of the secondary process variable. |
| 21.04 | SP LO | Range: ±20000 0 *[default]* | This is the lower limit setpoint as related to LO INTRCPT.  SP LO is defined in units of the primary process variable or RPM when in speed control. |
| 21.05 | LO INTRCPT | Range: 0-9999 0 *[default]* | This is the lower limit level in which the Multivariable function will scale the setpoint as defined by the SP LO value. LO INTRCPT is defined in units of the secondary process variable. |
| 21.06 | LEVEL 2 | Range: 0-9999 100 *[default]* | This is the upper level in which the Multivariable control function will scale the setpoint as it is defined by the HI INTRCPT value and SP HI value.  LEVEL 2 is defined in units of the secondary process variable. |
| 21.07 | SP HI | Range: ±20000 0 *[default]* | This is the upper limit setpoint as related to HI INTRCPT.  SP HI is defined in units of the primary process variable or RPM when in speed control. |
| 21.08 | HI INTRCPT | Range: 0-9999 0 *[default]* | This is the upper limit level in which the Multivariable function will scale the setpoint as defined by the SP HI value. HI INTRCPT is defined in units of the secondary process variable. |

## OPTIONS & FEATURES

### Regulation Mode – (Suction Side Level Control)

The regulation mode can either be NORMAL or INVERSE.  The common selection is NORMAL, where the drive anticipates an increase in the process condition when pump speed is increased. If the regulation mode is set to INVERSE, the process condition is expected to increase with a decrease in pump speed.

*EXAMPLE – If a PumpSmart unit is trying to control the level in a suction-side tank or sump, the regulation mode would be set to INVERSE.  As the level in the sump increased, PumpSmart would respond by increasing pump speed to maintain a constant level.*

| Parameter | Name | Value/Range | Notes |
|---|---|---|---|
| 21.01 | REGULATION MODE | NORMAL *[default]*<br>INVERSE | Inverse is normally used for control of suction side systems. |

### Sleep Function

The PS200 has the ability to automatically shut down the pump based on low demand in the system.  When a low demand condition exists the PS200 can be configured to go into a suspended sleep mode.  Once demand increases the PS200 will automatically restart the pump to maintain the setpoint.  The PS200 has two different methods to determine when the pump should enter into Sleep Mode.

NOTE: By default settings in Single and Multipump Modes if the minimum speed is reached the pump will automatically shut down and go into sleep mode.  To keep the pump running at minimum speed in a low demand condition 14.05 CONFIG SPEED MIN must be set to SPD=MINSPD.

**Method 1 – Minimum Speed Sleep**

For the PS200 to shut down into Sleep Mode the following two conditions must occur simultaneously; the pump must be at minimum speed (parameter 14.02) and the setpoint must be satisfied. This method is commonly used for a Constant Pressure System.  For Level Control refer to Method 2 Condition Sleep.

| Parameter | Name | Value/Range | Notes |
|---|---|---|---|
| 14.02 | MIN SPEED | 0-18000 RPM<br>25% Motor Nominal Speed *[default]* | This is the speed the pump must be at before it goes into Speed Mode. |
| 14.05 | CONFIG SPEED MIN | SPD=0 *[default]*<br>SPD=MINSPD | Selecting SPD=0 will result in the PS200 coming to a stop when minimum speed is reached.  It will fault on Low Demand unless 14.07 RESTART VALUE is entered.  If SPD=MINSPD is selected the PS200 will stay at minimum speed until it is manually shut-off, process demand increases, a secondary protection fault is cleared, or a pump protection fault forces it to shutdown. |
| 14.06 | STP DELAY MIN SPD | 0-1800s<br>5 *[default]* | This parameter enables the drive to remain at minimum speed in Low Demand or Secondary Protect conditions for a period (up to 1800 seconds) before faulting on Low Demand or going into Sleep Mode. |
| 14.07 | RESTART VALUE | 0-500%<br>*Default is 90% for normal regulation mode and 110% for inverse regulation mode.* | If the drive is shutdown by CONFIG SPEED MIN (14.05) due to no system demand the drive will sleep until the process actual value drops below the restart value (14.07).  If operating in inverse mode (21.01) the drive will sleep until the process variable rises above the restart value.<br><br>*Example: if the pressure setpoint is 100psi and the Restart Value is 90% then the PS200 will restart when the pressure drops below 90psig.*<br><br>To disable the Sleep function enter 0%. |
| 14.08 | RESTART DELAY | 0-1800S<br>1 *[default]* | This is the length of time the PS200 waits before it will restart from Sleep Mode once the Restart Value has been met. |

## OPTIONS & FEATURES

**Method 2 – Condition Sleep**

The PS200 can also be put into a suspended Sleep Mode by monitoring a high or low condition such as level or suction pressure. This method may be independent of pump operating speed and process setpoint. The most common application for this sleep method would be level control.

In this method the level in which PumpSmart will go into sleep mode is determined by either the COND ALARM HI or COND ALRAM LO value. The level in which PumpSmart will "wake" is determined by parameter 14.07 RESTART VALUE.

*EXAMPLE: In a suction side level control application the pump can be put to sleep when the level reaches a low setpoint as configured in the COND ALARM LO. The pump can then by restarted once the level reaches the COND ALARM LO value x RESTART VALUE.*

| Parameter | Name | Value/Range | Notes |
|---|---|---|---|
| 23.01 OR 23.07 | COND 1 SOURCE COND 2 SOURCE | 2.04 PRES ACT 2.06 TEMP ACT 2.17 PROC XT2 | Defines the source of the process variable that will invoke the sleep function. If the primary process variable such as level is being used as the sleep variable then 2.04 PRES ACT should be selected. If the sleep variable is the secondary process variable or temperature then 2.17 PROC XT2 or 2.06 TEMP ACT should be selected.<br><br>*NOTE: 2.06 TEMP ACT and 2.17 PROC XT2 selections must be independent of speed and setpoint.* |
| 23.04 OR 23.10 | COND 1 ALARM COND 2 ALARM | SLEEP | The drive will shut down and go into a sleep mode if an ALRM LIM HI or ALRM LIM LO condition is detected. A Keypad or DCS notice is issued and a Relay Output is triggered (if configured). If the signal meets the RESTART VALUE (par 14.07) above the LO or below the HI COND ALRAM LIM the drive will come out of sleep mode and resume normal operation. |
| 23.05 OR 23.11 | COND 1 ALRM LIM HI COND 2 ALRM LIM HI | 0-9999 0 *[default]* | The high value of the sleep limit. The drive will go to sleep if the monitored signal rises above this value for longer than the condition response delay (par 23.13). Inactive if set to 0. |
| 23.06 OR 23.12 | COND 1 ALRM LIM LO COND 2 ALRM LIM LO | ±9999 0 *[default]* | The low value of the sleep limit. The drive will go to sleep if the monitored signal drops below this value for longer than the response delay (par 23.13). Inactive if set to 0. |
| 23.13 | COND RESP DELAY | 0-300 sec 20 sec *[default]* | The delay period prior to activation of the drive going into sleep mode. |
| 14.07 | RESTART VALUE | 0.0-500% *Default is 90% for normal regulation mode and 110% for inverse regulation mode.* | The drive will sleep until the sleep variable (23.01) reaches the Restart Value. The Wake-up level is expressed in terms of % of the sleep value.<br><br>*Example if COND 1 ALRM LIM LO is 2ft and RESTART VALUE is 400% the drive will restart at 8ft.* |
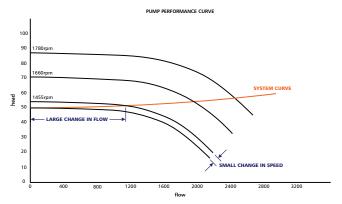
NOTE(S) -

If the sleep variable is the secondary process variable then the process variable must be configured as PROC XT2 as outlined in the Analog Input Configuration in the Options and Features Section.
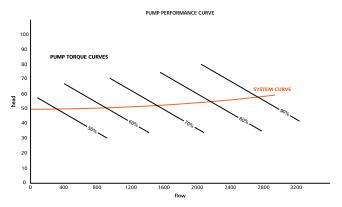
If 23.01/23.07 COND 1/2 SOURCE is set to 2.04 PRESS ACT and the Condition Sleep function is enabled by selecting either in parameter 23.04 COND 1 ALARM or 23.10 COND 2 ALARM the Minimum Speed Sleep function will not be enabled. In a process low demand situation the drive will run at minimum speed until the process demand is restored.

## OPTIONS & FEATURES

### SMART<sup>CONTROL</sup> - Torque Based Pump Control

When changing the speed of the pump with a relatively flat head-capacity curve a small speed change can result in a large swing in flow.  This type of system can result in un-stable flow making control very difficult.

PUMP PERFORMANCE CURVE

PumpSmart is able to increase and decrease pump flow by changing the pump torque rather then the pump speed.  Controlling to pump torque can change a relatively flat pump performance curve into a steep, easy to control pump performance curve.

PUMP PERFORMANCE CURVE

NOTE - SMART<sup>CONTROL</sup> is only functional when using the drive's internal PID regulator when in Single or Multipump Modes.

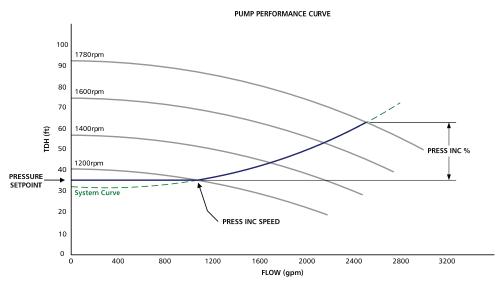| Parameter | Name | Value/Range | NOTES |
|---|---|---|---|
| 13.08 | CONTROL PARAM | SPEED *[default]* <br> TORQUE | Defines which variable the internal PID regulator uses for control. |

NOTE – In Multipump Process Control if TORQUE is selected in parameter 13.08 the staging / de-staging of the lag units will be based on 1.05 MOTOR TORQUE %.  All PS200 drives will regulate at the same Torque.  All motors must be the <u>same</u> size and speed.

## OPTIONS & FEATURES

### Advanced Pressure Control

The PS200 system can automatically compensate for system friction losses due to increased flow in single pump operation or multi-pump backup modes. Tables are available in most pump catalogs to assist in determining the amount of friction loss that can be expected for various pipe sizes and flow rates on simple systems.

The diagram below illustrates a typical system curve in relation to pump speed.

PUMP PERFORMANCE CURVE



The pressure setpoint will be maintained until the pump speed increases to the PRESS INC SPEED, in this example 1200rpm.  If demand in the system increases, forcing the pump to speed up beyond the PRESS INC SPEED the PS200 will automatically increase the pressure setpoint to match the system resistance curve.  The rate of increasing pressure is determined by the PRESS INC % which is the increase in the pressure setpoint at maximum speed (parameter 14.01).

*EXAMPLE - If the setpoint is 15psig [34.65ft @ 1.0 SG] and the system resistance increases 10psig at the maximum flow rate, or roughly 67% of the setpoint, parameter 21.10 would be set as 67%.*

| Parameter | Name | Value/Range | Notes |
|---|---|---|---|
| 21.09 | PRESS INCR SPEED | 0-3600 RPM<br>1200 RPM [default] | This is the speed at which system curve compensation begins. At speeds below this, no compensation for increased resistance is made. |
| 21.10 | PRESS INCR % | 0-100%<br>0% [default] | This is the amount that PumpSmart will have increased the setpoint at maximum speed. |

### Priming Delay

This feature is designed to allow self-priming pumps sufficient time to prime themselves before the PumpSmart Pump Protection logic becomes active. The delay period is applied only if the pump is being started from a zero-speed condition.  Once the priming delay is complete, the PROTECTION DELAY (25.03) becomes active, if set.

This function acts as a Start-Up Delay in which the pump may momentary be started up against a cracked discharge valve in which the pump is not maintaining minimum flow on the initial start-up.

| Parameter | Name | Value/Range | Notes |
|---|---|---|---|
| 14.09 | PRIMING DELAY | 0-6000 Seconds<br>0 [default] | This delay is only active on initial start up. |

## OPTIONS & FEATURES

### *Pump Cleaning Sequence (PCS)*

The main function of the pump cleaning system (PCS) is to automatically detect and remove clogging substances from the pump impeller. The drive can detect clogging that occurs during operation by monitoring the pump motor torque. The actual signal 1.05 MOTOR TORQUE value is compared to a reference value 34.03 TORQUE REF that has been set in the PS200. If due to clogging, the actual value exceeds the reference value for a certain time period (34.04 TON REQ), the pump cleaning sequence can be executed. The pump cleaning sequence can also be executed at run time intervals (34.05 RUN TIME REQ), counting from zero at every pump start. The execution of the PCS at run time intervals can be used as a preventive measure and a complement to the automatic detection and removal of debris in clog prone applications.

The PCS is controlled in a way that is referred to as "request" and "execute". The control is defined by the settings of parameters 34.01 EXE P CLEAN SEQ and 34.02 REQ P CLEAN SEQ.  The PCS can be executed:

- Automatically at the detection of clogging and/or at regular run time intervals set in the PS200.

- Manually by the pump controller at the detection of clogging by the PS200 and/or by the pump controller at regular run time intervals set in the PS200.

- Manually by the pump controller at any time.

| NOTICE | Do not use the Pump Cleaning System for pumps which have threaded on impellers or rotating shaft parts which can loosen or jam during reverse rotation. Failure to follow these instructions could result in equipment damage. |
|---|---|

### *Basic Operating Rules for the PCS*

The basic operating rules for controlling the PCS are described below:

**Start command in Remote control**

The PS200 must be in Remote control, given a start command and run indicated by an energized relay output to accept a request and execution of the Pump Cleaning Sequence (PCS). When the 34.01 EXE P CLEAN SEQ is enabled Group 19 Relay Outputs are automatically set as follows 19.01 RO1 set to "Running", 19.04 RO2 set to "PCS REQ" and 19.07 RO3 set to "PCS EXE". In Local Control, the PCS cannot be requested or executed at all, whereas in remote control the PCS can be requested and executed provided there is a preceding start command. Consequently, if a request of the PCS is not answered by executing the PCS before a stop command is issued (indicated by a de-energized 19.01 RO1). The request of the PCS is cancelled.

**Interrupting the PCS**

When the PCS is executed, it will interrupt before completion if the drive is given a stop command. This means, the pump is actually stopped. However, the pump can be restarted to normal operation immediately by a new start command. There is also another method of stopping the PCS but without the need to stop the PS200. This can be accomplished by the pump controller setting DI3 from 0 to 1 while the PCS is executing (RO3 is energized). This will stop the execution of the PCS and the PS200 will resume normal operation. DI3 is then reset from 1 to 0 by the pump controller as the PS200 resumes normal operation (RO2/RO3 De-energized).

**Blocked PCS**

The request and execution of the PCS is blocked for 3 seconds after every start command and after every completed PCS. This way normal dynamic motor load during acceleration will not falsely request or execute a PCS.

**Disabling the PCS**

In order to completely disable the PCS, parameter 34.01 EXE P CLEAN SEQ must be set to "NOT SEL".

**PCS in Multipump Applications**

In Multipump Synchronous control applications if parameter 34.01 is set to PS200 and a PCS is being executed by a drive and a request for a PCS is made by another pump (due to torque or run time), only one pump shall be permitted to execute the PCS at a time. The other pump(s) shall be held in queue with RO2 "PCS REQ" energized until available to execute the PCS. When cleared to execute the PCS (no other pumps are executing a PCS), Relay Output RO3 "PCS EXE" shall energize after the expiration of the 34.16 SEQUENCE TIMER. When the PCS begins to execute Relay Output RO2 "PCS REQ" shall remain energized until the PCS has completed execution. Once the PCS is complete both RO2 and RO3 de-energize and normal operation resumes. Note if 34.01 is set to P CTRL DI3 the external controller will coordinate the execution of the PCS. If a stop command or Run Disable is issued before the PCS is executed then the request of the PCS is cancelled.

In the Multipump BACKUP setting if 34.01 is set to PS200 and a PCS is being executed by the primary drive the backup drive shall not start unless the primary unit faults, receives a stop command or Run Disable. Note if 34.01 is set to P CTRL DI3 the external controller will coordinate the execution of the PCS. If a stop command is issued before the PCS is executed then the request of the PCS is cancelled

## OPTIONS & FEATURES

**Parameter Setup**

The following parameter settings are especially important in order to achieve reliable speed regulated wastewater pumping.

NOTE -  When parameter 34.02 is set to TORQ or TORQ OR RUN TIME it is strongly recommended that a torque test be done to assure that the setting for parameter 34.03 TORQUE REQ suits the application. The test can be done as follows:

- Set the PS200 in Local Control. Start the PS200 with the correct shaft rotation and set the speed to the 14.01 MAXIMUM SPEED reference. This can be done either by placing the pump in Speed Override or Local Speed Control (see Options and Features Section).

- Be sure that the pump is pumping at a relevant physical level in the sump according to the application and delivering a stable flow.

- Read the 1.05 MOTOR TORQUE value in %. Multiply this value by 1.2 (e.g. 50% x1.2=60%). The factor 1.2 corresponds to a torque contribution that can be expected when clogging occurs.

- Stop the PS200 and set this value in parameter 34.03 TORQUE REQ. Return the PS200 to Remote control and continue configuring the PCS parameters.

| PARAMETER | NAME | Value/Range | DESCRIPTION |
|---|---|---|---|
| 14.01 | MAXIMUM SPEED | 0-18000 RPM Motor Nominal Speed [default] | Defines the allowable maximum speed. Default setting is parameter 11.07 Motor FL Rpm.  No higher value that the full load rpm should be used or the pump motor may overheat. |
| 14.02 | MINIMUM SPEED | 0-18000 RPM 25% Motor Nominal Speed [default] | Defines the minimum speed range. No lower value than 60% of nominal speed shall be set, since the risk of clogging increases with reduced speed. |
| 13.01 | ACCEL TIME | 0-18000 Seconds 5 [default] | Defines the fast acceleration time.  No lower value than 2.0 sec shall be set, since stress on the impeller and shaft increases with reduced ACCEL TIME. |
| 13.02 | DECEL TIME | 0-18000 Seconds 5 [default] | Defines the fast deceleration time.  No lower value than 4.0 sec shall be set, since stress on the impeller and shaft increases with reduced DECEL TIME. |
| 34.01 | EXE P CLEAN SEQ | | Defines how the cleaning sequence is executed. Drive relay output R03 energizes upon execution. RO3 remains energized during the cleaning sequence. The PCS operates in REMOTE mode only. |
| | | NOT SEL (DEFAULT) | The pump cleaning sequence is disabled. |
| | | P CTRL DI3 | The pump cleaning system is executed by the pump controller setting the drive digital input DI3 from 0 to 1. |
| | | PS200 | The pump cleaning system is executed by the PS200 itself. |

## OPTIONS & FEATURES

| PARAMETER | NAME | Value/Range | DESCRIPTION |
|---|---|---|---|
| 34.02 | REQ P CLEAN SEQ | | Defines what triggers the request of the pump cleaning sequence. Upon request the relay output RO2 energizes and remains energized until the execution of the sequence is completed. |
| | | NOT SEL (DEFAULT) | The pump cleaning sequence is disabled if 34.01 is set to PS200 and 34.02 is set to NOT SEL. If 34.01 is set to P CTRL DI3 and 34.02 is set to NOT SEL the pump controller and pump controller logic are used to control the PCS – thus the drive's capability to analyze torque and/or run time are not utilized. |
| | | TORQ | The request is triggered when 1.05 MOTOR TORQUE exceeds the value set in 3403 TORQ REQ for the 3404 TON REQ. The fulfillment is monitored and analyzed by the drive. |
| | | RUN TIME | This request is triggered when 1.45 PMP CLN RUN TIME exceeds the value set in 3405 RUN TIME REQ. The fulfillment is monitored and analyzed by the drive. |
| | | TORQ OR RUN TIME | This request is triggered when either motor torque or run time is fulfilled as described above. |
| 34.03 | TORQUE REQ | 0.0-200.0%<br>120% [default] | Defines the motor torque threshold value in % of nominal motor torque which is required to trigger a pump cleaning sequence. |
| 34.04 | TON REQ | 0-100 Seconds<br>5s [default] | The motor torque must exceed the 34.03 TORQUE REQ for this time period before the pump cleaning sequence can be triggered. |
| 34.05 | RUN TIME REQ | 0.1-100.0 Hours<br>2hrs [default] | Defines the run time which must be met before the pump cleaning sequence can be requested if configured in 34.02 REQ P CLEAN SEQ. The 1.45 PMP CLN RUN TIME is reset to zero after every stop command and after every completed cleaning sequence. |
| 34.06 | NUM OF CYCLES | 1-10<br>2 [default] | Defines the number of cycles the pump cleaning system performs for each execution. |
| 34.07 | FWD RUN SPD | 0.0-100.0%<br>100% [default] | Defines the forward running speed in % of 14.01 MAXIMUM SPEED. |
| 34.08 | FWD RUN TIME | 0.0-100.0 Seconds<br>7s [default] | Defines the forward running time of the cleaning sequence. |
| 34.09 | FWD RUN ACC | 0.0-100.0 Seconds<br>0.3s [default] | Defines the forward acceleration in the cleaning cycle. |
| 34.10 | FWD RUN DEC | 0.0-100.0 Seconds<br>2s [default] | Defines the forward deceleration in the cleaning cycle. No lower value than 2 sec shall be set to avoid overstress of the impeller and shaft. |
| 34.11 | ZERO SPEED PAUSE | 0.0-100.0 Seconds<br>7s [default] | Defines the zero speed pause in the cleaning sequence when switching from forward to reverse rotation. |
| 34.12 | REV RUN SPD | 0.0-100.0%<br>80% [default] | Defines the reverse running speed in % of 14.01 MAXIMUM SPEED. No higher value than 80% shall be set to avoid overstress of the impeller and shaft. |
| 34.13 | REV RUN TIME | 0.0-100.0 Seconds<br>7s [default] | Defines the reverse running time of the cleaning sequence. |

## OPTIONS & FEATURES

| PARAMETER | NAME | Value/Range | DESCRIPTION |
|---|---|---|---|
| 34.14 | REV RUN ACC | 0.0-100.0 Seconds<br>0.3s *[default]* | Defines the reverse acceleration in the cleaning cycle. No higher value than 2 sec shall be set to avoid overstress of the impeller and shaft. |
| 34.15 | REV RUN DEC | 0.0-100.0 Seconds<br>0.3s *[default]* | Defines the reverse deceleration in the cleaning cycle. |
| 34.16 | SEQUENCE TIMER | 0-100 Seconds<br>30s *[default]* | Applies to 34.01 setting of PS200 only. If the time period for requesting a new PCS (after a PCS sequence has been completed) is less than the SEQUENCE TIMER setting then the 34.17 SEQUENCE COUNTER shall be enabled. |
| 34.17 | SEQUENCE COUNTER | 0-10<br>5 *[default]* | Applies to 34.01 setting of PS200 only. The maximum number of sequences which are allowed after the SEQUENCE COUNTER has been activated. If the drive requests another PCS after the maximum allowed sequences has been attained then the 34.18 SEQUENCE EXCEED function shall be activated. |
| 34.18 | SEQUENCE EXCEED |  | Applies to 34.01 setting of PS200 only. After the 34.17 SEQUENCE COUNTER has reached the maximum allowed sequences and a new PCS is requested this settable action is initiated. Default is Fault. |
|  |  | DISABLED | The SEQUENCE EXCEED function is disabled and there is no limitation on the number of PCS requests and executions. |
|  |  | WARNING | The Keypad displays a warning PUMP CLOGGED and the PCS function is disabled. The drive continues to function in its normal configured state. A relay output is energized and Fieldbus 3.11 PS Condition Word Bit 02 "PUMP CLOGGED" is set (if configured). |
|  |  | FAULT *[default]* | The drive faults and must be manually reset The Keypad displays a fault PUMP CLOGGED. A relay output is energized, Fieldbus 3.11 PS Condition Word Bit 02 "PUMP CLOGGED", 3.10 PS ALARM WORD Bit 06 "VFD FAULT/WRN" and 3.11 PS CONDITION WORD Bit 11 "VFD FAULT/WRN" are set (if configured). |

## OPTIONS & FEATURES

### *Control Principle 1 – Pump Controller Executing the PCS*

When parameter 34.01 EXE P CLEAN SEQ is set to P CTRL DI3 and parameter 34.02 REQ P CLEAN SEQ is set to "Torque", "Run Time" or "Torque or Run Time" the PS200 can request the pump controller to execute the PCS when the Torque and/or Run Time condition is fulfilled as monitored and analyzed by the drive. The PS200 requests the PCS by energizing RO2 "PCS REQ". When the pump controller receives the energized RO2 signal from the PS200, the pump controller makes the decision when to execute the PCS. When the pump controller decides to execute the PCS, the pump controller sets digital input DI3 of the PS200 from 0 to 1. When DI3 is set from 0 to 1, the PCS is executed and the drive energizes RO3 "PCS EXE". The very moment that the pump controller receives the energized RO3 signal from the PS200, the pump controller resets DI3 from 1 to 0. During the PCS both RO2 and RO3 remain energized. When the last cycle of the PCS ends the PCS sequence is complete and both RO2 and RO3 de-energize and normal operation continues.

When parameter 34.01 is set to P CTRL DI3 and parameter 34.02 is set to "Not Sel", "Torque", "Run Time", or "Torque or Run Time" it is also possible for the pump controller to execute the PCS at any time without any preceding request coming from the PS200. Again, the pump controller executes the PCS by setting DI3 of the drive from 0 to 1. When the PCS is executed both RO2 and RO3 remain energized. The very moment that the pump controller receives the energized RO3 signal from the PS200, the pump controller must reset DI3 from 1 to 0. During the PCS both RO2 and RO3 remain energized. When the last cycle of the PCS ends the PCS sequence is complete and both RO2 and RO3 de-energize and normal operation continues.

When parameter 34.01 is set to P CTRL DI3 and parameter 34.02 is set to "Not Sel" only the pump controller and pump controller logic are used to control the PCS – thus the capability of the PS200 to analyze torque and/or run time is not utilized.

### *Control Principle 2 – PS200 Executing the PCS*

When parameter 34.01 EXE P CLEAN SEQ is set to PS200 and parameter 34.02 REQ P CLEAN SEQ is set to "Torque", "Run Time" or "Torque or Run Time" the PS200 requests itself to directly execute the PCS when the "Torque" and/or "Run Time" condition is fulfilled as monitored and analyzed by the PS200. The very moment that the PCS is executed, both relay outputs RO2 and RO3 of the PS200 energize. During the PCS both RO2 and RO3 remain energized. When the last cycle of the PCS ends both RO2 and RO3 de-energize and normal operation continues. Control principle 2 is applied when only the PS200 capability to monitor and analyze "Torque" and/or "Run Time" is to control the PCS- thus the parameters analyzed by the pump controller and the logic of the pump controller are not utilized.

If parameter 34.01 EXE P CLEAN SEQ is set to PS200, parameter 34.02 REQ P CLEAN SEQ is set to "Torque", "Run Time" or "Torque or Run Time" and if parameter 34.18 SEQUENCE EXCEED is set to other than "NOT SEL" the following limitation will apply on the PCS in order to prevent a clogged impeller which cannot be unclogged from continuously cycling:

Let's say a PCS is requested when the "Torque" and/or "Run Time" condition is fulfilled as monitored and analyzed by the PS200 and a sequence is requested and executed according to Control Principle 2. When the sequence is complete as indicated when RO2 and RO3 are de-energized a sequence timer will begin. If a new PCS is requested before the timer elapsed time has reached the 34.16 SEQUENCE TIMER setting the 34.17 SEQUENCE COUNTER shall begin to count the sequence executions. Note the sequence timer resets to zero at the beginning of each sequence (RO2/RO3 energized) and starts again when each sequence is complete (RO2/RO3 de-energized). Also note that the 34.17 SEQUENCE COUNTER is reset to zero if the time set in the 34.16 SEQUENCE TIMER has been exceeded and there hasn't been another request for the PCS. However, if additional PCS requests continue to be made before the timer elapsed time has reached the 34.16 SEQUENCE TIMER  setting (as referenced from the previous execution) and the number of counted sequences exceed the 34.17 SEQUENCE COUNTER setting the PS200 will react according to the 34.18 SEQUENCE EXCEED function setting. Note if a PCS is interrupted as described above or requested at a time period greater than the 34.16 SEQUENCE TIMER setting both the sequence timer and sequence counter will reset to zero and there is no action by the 34.18 SEQUENCE EXCEED function. If the 34.18 SEQUENCE EXCEED setting is set to "Disabled" there is no limit on the number of PCS executions and the 34.16 SEQUENCE TIMER and 34.17 SEQUENCE COUNTER are inactive. If set to either "WARNING" or "FAULT" the PS200 behaves as described in the parameter description 34.18 SEQUENCE EXCEED above.

## OPTIONS & FEATURES

### *Pump Protection*

#### Advanced Pump Protection (APP)

The Advanced Pump Protection feature protects a pump from operating in underload conditions such as dry-run, dead-head and minimum flow and warns of overload conditions such as excessive flow [run-out] without the need for external sensors.  APP was designed specifically for a variable torque load and should only be used on centrifugal pumps.  The Advanced Pump Protection feature can be configured to be used with either an external flow meter or using PumpSmart's sensorless flow function SMART$^{FLOW}$.

Note: If an external flow meter is not going to be used with Advanced Pump Protection, then SMART$^{FLOW}$ must be configured before proceeding with this section.  To ensure the most accurate form of protection it is recommended that the Tune Function be enabled.  Refer to the Option and Features for further details.

Advanced Pump Protection can be set up in the following simple steps.

#### STEP 1 – CONFIGURE FLOW REFERENCE SOURCE

Advanced Pump Protection is designed to be used with either SMART$^{FLOW}$ or an external flow meter.

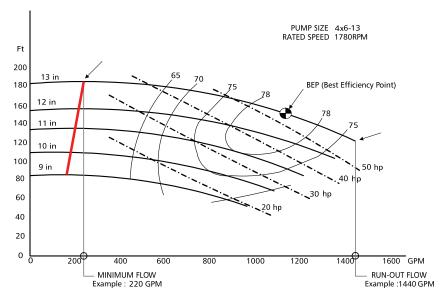| Parameter | Name | Value/Range | NOTES |
|---|---|---|---|
| 25.10 | Q ACT SOURCE | SMART FLOW *[default]* EXT FLOWMETER | Identifies the source of the flow readings used for Advanced Pump Protection. |

Note: If an external flow meter is being used for pump protection and it is not the primary process variable then the flow meter must be configured.  The external flow meter must be wired to the next available analog input (AI1 or AI3) and configured so it can be identified by the PS200 as outlined in Analog Input Configuration.

#### STEP 2 – DETERMINE MINIMUM AND MAXIMUM FLOWS

A pump is designed to maintain a minimum flow to ensure adequate cooling of the pump and to prevent the onset of low flow recirculation.  The pump safe allowable minimum flow is normally based on hydraulic considerations such as suction or discharge recirculation, minimum flow data and is available from the pump manufacturer. However, certain applications with low specific heat liquids may require a greater thermal minimum flow be used.

When a pump produces excessive flow this is commonly called a run-out condition.  The pump type and NPSHa (Net Positive Suction Head Available) will determine the run-out flow rate.  As a conservative estimate a run-out condition typically occurs at 110-125% of the Best Efficiency Flow Point (BEP).  BEP is the optimal flow rate the pump was designed for and is defined as the flow that yields the highest efficiency on the pump performance curve.

The following is an example of a pump performance curve where the minimum flow and run-out conditions can typically be located.

## OPTIONS & FEATURES

### STEP 3 – SELECT CONTROL RESPONSE FOR UPSET CONDITIONS

The PS200 has the ability to identify between the different process upset conditions and react to each condition separately.  If a condition has occurred for longer then the pump protection delay then the PS200 will react as configured to that particular condition.  The options in which the PS200 will react are as follows:

*DISABLE – No action will occur.*

*WARN – The PS200 will issue an alarm on the keypad, a relay output will energize if configured to Pump Fault and a Fieldbus alarm will be issued.  No physical action will be taken.*

*ALARM AND CONTROL – The PS200 will issue an alarm and will take control of the pump and either go to minimum speed or come to a complete stop (fault) depending on the setting of parameter 14.05 CONFIG SPD MIN.  In Alarm and Control mode the PS200 can be configured to automatically restart the pump as outlined in the Options and Features Section – PUMP FAULT AUTO RESET*

*FAULT - The PS200 will issue an alarm, fault the pump and bring it to a complete stop.  The fault can only be manually reset.  The PUMP FAULT AUTO RESET function  will not automatically restart if set to FAULT.*

| Parameter | Name | Value/Range | NOTES |
|---|---|---|---|
| 25.03 | PROTECTION DELAY | 0 – 200 SEC<br>0 *[default]* | This is the protection delay period prior to activation of a Pump Protection Warning, Alarm or Fault. Applies to Pump Protect, Secondary Protect A/B, Min Flow, Dry Run and Runout Ctrl. |
| 25.10 | Q ACT SOURCE | SMART FLOW *[default]*<br>EXT FLOWMETER | Identifies the source of the flow readings used for Advanced Pump Protection. |
| 25.11 | MIN FLOW CTRL | DISABLED *[default]*<br>WARNING<br>ALARM AND<br>CONTROL | Defines how the PS200 will react to a minimum flow condition. |
| 25.12 | MIN FLOW | 0 – 99999<br>0 *[default]* | Defines the safe minimum operating flow of the pump. This minimum flow correlates to the 29.03 N Rated. For English(Am) the default flow units are in GPM; for all other languages the default flow units are in M3/hr. |
| 25.13 | DRY RUN CTRL | DISABLED *[default]*<br>WARNING<br>FAULT | Defines how the PS200 will react to a dry-run condition. |
| 25.14<br>*[ACCESS BY 564 PASSCODE]* | DRY RUN FACTOR | 0 – 2.0<br>0.95 *[default]* | If PumpSmart faults on dry run prematurely adjust this value to be less than 1.0. If PumpSmart does not fault on dry run adjust value above 1.0. |
| 25.15 | RUNOUT CTRL | DISABLED *[default]*<br>WARNING | Defines how the PS200 will react to a run-out condition. |
| 25.16 | RUNOUT FLOW | 0 – 99999<br>0 *[default]* | Defines the maximum flow of the pump. This maximum flow correlates to the 29.03 N Rated. For English(Am) the default flow units are in GPM; for all other languages the default flow units are in M3/hr |

NOTE – If a MIN FLOW warning occurs during start up set a 5 second delay in 14.09 PRIMING DELAY.

### Advanced Pump Protection Limitations

When using SMART$^{FLOW}$ as the flow reference for pump protection consideration must be taken into account for the limitations as outlined in the SMART$^{FLOW}$ Section.

## OPTIONS & FEATURES

### Positive Displacement Pump Protection

A positive displacement or progressive cavity pump are different from a centrifugal pump in that they are considered constant torque loads. The torque for this type of pump is independent of the operating speed. In general the torque is directly proportional to discharge head which makes monitoring for high torque an effective method of dead-head / shut-off pump protection. Additionally certain types of pumps use the fluid being pumped as lubrication. When a pump is exposed to a dry-run condition the internal parts can rub also causing high torque. Pump Protection for constant torque loads can be accomplished with the Condition Monitoring Function.

NOTE - When operating a constant torque load the drive must be rated for heavy duty use. This generally requires going to the next larger PS200 size.
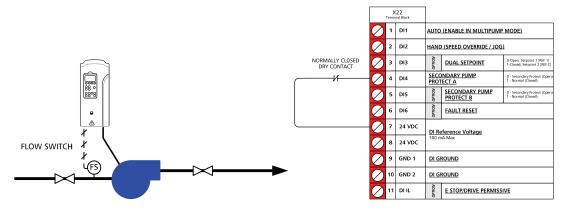
### ⚠ WARNING

**This functionality is designed to compliment and be in addition to the existing pressure relieving safety devices. This form of protection is not intended to substitute the pump manufacture's recommended pressure relief protection. Failure to follow these instructions may result in physical injury or equipment damage.**

The Condition Monitoring function has the ability to monitor the motor torque. High and low limits can be configured to warn and ultimately fault the pump. To determine the proper torque limits consult the pump manufacture's for recommended guidelines.

| Parameter | Name | Value/Range | NOTES |
|---|---|---|---|
| 23.01 OR 23.07 | COND 1 SOURCE COND 2 SOURCE | 1.05 MOTOR TORQUE | This value is a % of motor nominal torque. |
| 23.02 OR 23.08 | COND 1 WRN LIM HI COND 2 WRN LIM HI | 0-9999 0 [default] | The high value of the warning limit. A warning occurs if the monitored signal rises above this value for longer than the response delay (par 23.13) . Inactive if set to 0. |
| 23.03 OR 23.09 | COND 1 WRN LIM LO COND 2 WRN LIM LO | ±9999 0 [default] | The low value of the warning limit. A warning occurs if the monitored signal drops below this value for longer than the response delay (par 23.13). Inactive if set to 0. |
| 23.04 OR 23.10 | COND 1 ALARM COND 2 ALARM | DISABLED [default] | Protection is inactive. |
| | | ALARM | Selecting ALRM ONLY will configure PumpSmart to issue a Keypad or DCS notice and will trigger a Relay Output (if configured) if an ALRM LIM HI or ALRM LIM LO condition is detected. No further action is taken |
| | | FAULT | The PS200 faults if an ALRM LIM HI or ALRM LIM LO condition is detected. A Keypad or DCS notice is issued and a Relay Output is triggered (if configured). |
| 23.05 OR 23.11 | COND 1 ALRM LIM HI COND 2 ALRM LIM HI | 0-9999 0 [default] | The high value of the alarm limit. An alarm occurs if the monitored signal rises above this value for longer than the condition response delay (par 23.13). Inactive if set to 0. |
| 23.06 OR 23.12 | COND 1 ALRM LIM LO COND 2 ALRM LIM LO | ±9999 0 [default] | The low value of the alarm limit. An alarm occurs if the monitored signal drops below this value for longer than the response delay (par 23.13). Inactive if set to 0. |
| 23.13 | COND RESP DELAY | 0 sec 20 sec [default] | The delay period prior to activation of a COND I or COND 2 WRN OR ALRM. It is recommended that this interval be set to zero. |

## OPTIONS & FEATURES

*Secondary Protection*

To protect the pump with an external switch or contact such as a flow switch, pressure switch or level switch Secondary Protection may be used.  This feature may also be used to provide inter-lock capabilities, such as for lubrication system starting.



Once wired, parameter 25.06 SECONDARY PROTECT A or 25.07 SECONDARY PROTECT B must be set to ALARM or ALARM AND CONTROL. The response being:

1.  ALARM & CONTROL- In this response, PumpSmart will issue a warning and then either shut down or reduce speed depending on the setting of 14.05 CONFIG SPD MIN.  Once the Secondary Protect Fault has cleared and the digital input is reset to a normally closed state the PS200 will automatically restart.  Alarm & Control is the recommended setting.

2.  ALARM only - In this response, PumpSmart will simply issue an alarm/warning, but continue to operate. The alarm only mode may result in damage to the pump if a protection limit fault occurs.

| Parameter | Name | Value/Range | Notes |
|---|---|---|---|
| 25.06<br>25.07 | SECONDARY PROTECT A<br>SECONDARY PROTECT B | DISABLED *[default]*<br>ALARM & CONTROL<br>ALARM | |
| 14.09 | PRIMING DELAY | 0-6000s<br>0 *[default]* | When the pump is off a flow switch or pressure switch is indicate low flow or pressure which will trip the pump and not allow the pump to start.  A priming delay allows the PS200 to ignore the SEC PROTECT fault condition during the initial start up of the drive. |

⚠ **CAUTION**

**The pump will automatically restart once the Secondary Protection Fault has cleared and the digital input contact is closed.**

## OPTIONS & FEATURES

### Relay Outputs

The PS200 has three relay outputs that are configurable for different operating and fault conditions. Relays will revert to original states once warnings or faults are reset or cleared.

**Relay Output Technical Information**

| | |
|---|---|
| Switching capacity | 8A at 24 VDC or 250 VAC<br>0.4 at 120 VDC |
| Maximum continuous current | 2 A RMS |

*Refer to the ACS800 Hardware Manual for complete technical details.*

| Parameter | Name | Value/Range | NOTES |
|---|---|---|---|
| 19.01<br>19.04<br>19.07 | RELAY R01 OUTPUT<br>RELAY R02 OUTPUT<br>RELAY R03 OUTPUT | READY<br>RUNNING<br>NOT USED | Default for RO1<br>Default for RO2<br>Default for RO3 |
| | | VFD FLTS/WRNGS | A VFD related warning or fault has occurred |
| | | PUMP FLTS/WRNGS | A general pump related warning or fault has occurred |
| | | ALL FLTS/WRNGS | A pump and/or VFD related warning or fault has occurred |
| | | SECND PRTECT A | Secondary Protect A activation |
| | | SECND PRTECT B | Secondary Protect B activation |
| | | PUMP PROTECT | Pump protection activation |
| | | HI CONDITION 1 | HI Condition 1 protection activation |
| | | HI CONDITION 2 | HI Condition 2 protection activation |
| | | LO CONDITION 1 | LO Condition 1 protection activation |
| | | LO CONDITION 2 | LO Condition 2 protection activation |
| | | LOC/REM | Drive is in Remote operation |
| | | PROC TX ERR | Process transmitter protection activation |
| | | START DELAY | Start Delay function has been activated |
| | | SLEEP | Activates when drive is in a sleep state |
| | | SPEED OVERRIDE | Activates when drive is placed in speed override via digital input |
| | | RUN DISABLED | Drive permissive DI1L is not closed |
| | | FAULT | Activates for any fault |
| | | FAULT(INV) | Activates when no fault exists. De-activates when a fault occurs. |
| | | PUMP CLOGGED | Activate when a pump clog is detected. |
| | | PCS REQ | A pump cleaning sequence has been requested. The relay remains energized until the completion of the cleaning sequence. |
| | | PCS EXE | A pump cleaning sequence is being executed. The relay remains energized until the completion of the cleaning sequence. |

## OPTIONS & FEATURES

### Sensor Failure

In the event of a process transmitter failure, PumpSmart has been configured to run the pump at an average speed of the minute preceding the instrument failure. This functionality can be disabled, or configured to result in a drive fault.

A sensor failure is determined by:

| | |
|---|---|
| AI-1 Signal | <1.5 VDC or >10.1 VDC [<3 mA or > 20.2 mA] |
| AI-2 Signal | <3 mA or > 20.2 mA |
| Vibration Sensor(s) | <3 mA or > 20.2 mA |
| Keypad | Communication with keypad interrupted |

Optional fault responses:

*LAST SPEED - PumpSmart will average the pump speed of the 60 seconds prior to the instrument failing and run at the calculated speed and issue a warning message.*

*DISABLED - No protection is provided and PumpSmart will attempt to run as close to the failed sensor signal as possible.*

*FAULT - Upon sensing an instrument failure, PumpSmart will trip (stop) the drive and issue a fault message. This type of fault can be automatically reset, refer to section on Automatic Reset (VFD Faults & Process Sensor Fault).*

⚠ **WARNING**

**Selecting disabled may cause the pump to accelerate to Maximum Speed (14.01) if the transmitter fails low. This may result in excessive speed of the driven equipment. Serious injury or equipment damage may result.**

| Parameter | Name | Value/Range | Notes |
|---|---|---|---|
| 24.01 | PROC SENSOR FAILURE | DISABLED<br>FAULT<br>LAST SPEED*[default]* | Applies to process transmitter inputs and analog setpoint inputs. Failure messages indicate which transmitter is failing based upon input channel setup:<br>EXT SP – Setpoint input failure<br>PROC XT1 – Primary process input<br>PROC XT2 – Secondary process input<br>SPD REF – External speed ref input<br>SPD OVRRD – Speed override reference<br>FLOWMETER – External Flowmeter<br>SG/TEMP – Specific Gravity signal or Temperature Transmitter |
| 24.02 | COND SENSR FAILURE | DISABLED<br>WARNING *[default]* | Applies to either single or double condition sensor applications.<br>Fault messages:<br>COND 1–General condition sensor 1<br>COND 2–General condition sensor 2 |
| 24.03 | KEYPAD FAILURE | DISABLED<br>FAULT *[default]*<br>LAST SPEED | Fault message - "PANEL LOSS" |

⚠ **WARNING**

**If KEYPAD FAILURE parameter 24.03 is set to DISABLED an external start/stop switch (drive in remote mode) or E-Stop must be provided to stop the drive in the event of a keypad failure or if the keypad is removed. Failure to follow these instructions could result in serious personal injury or equipment damage.**

## OPTIONS & FEATURES

### Setpoints, Dual

The PumpSmart PS200 can toggle between two fixed setpoints or one fixed point and a variable setpoint. The toggling between setpoints may be accomplished using a digital switch or through a Fieldbus command.
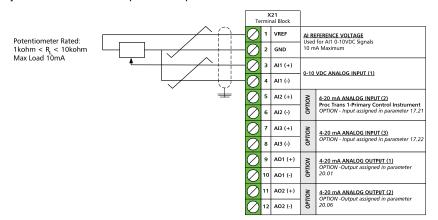
| Parameter | Name | Value/Range | Notes |
|---|---|---|---|
| 16.01 | SET1/SET2 SELECT | SETPOINT 1 [default]<br>DI3<br>FIELDBUS | This parameter defines the source that toggles the PumpSmart unit between Setpoint 1 or Setpoint 2.<br>Setpoint 1 [default] indicates that only setpoint 1 is being used.<br>DI3 is a digital input where "0" (Open) selects Setpoint 1 and "1" (Closed) selects Setpoint 2. |
| 16.02<br>16.05 | SETPOINT 1 SEL<br>SETPOINT 2 SEL | KEYPAD [default]<br>ANALOG INPUT<br>FIELDBUS | This selects where the value for Setpoint-1or 2 is coming from.<br>KEYPAD - a number [e.g. 100] will be manually entered via the keypad.<br>ANALOG INPUT - The setpoint is entered using a signal through a configured analog input channel to establish the setpoint.<br>Selecting ANALOG INPUT will require entry of parameters 16.03-16.04 and 17.20 or 17.22 (dependent upon input channel configuration) |

EXAMPLE - An application requires 150 GPM for a wash-down application in one case and 100 GPM in another case. PumpSmart could be setup as follows:

| Parameter | Value | Notes |
|---|---|---|
| 16.01 | DI3 | A switch would be wired into DI3 to toggle between setpoint 1 and setpoint 2 |
| 16.02 | KEYPAD | The setpoint would be manually entered using the PumpSmart keypad.<br>When the switch [DI3] is set to "0" (Open), the setpoint would be entered as "150" using the keypad "REF" button. |
| 16.05 | KEYPAD | The setpoint would be manually entered using the PumpSmart keypad.<br>When the switch [DI3] is set to "1" (Closed), the setpoint would be entered as "100" using the keypad "REF" button. |

## OPTIONS & FEATURES
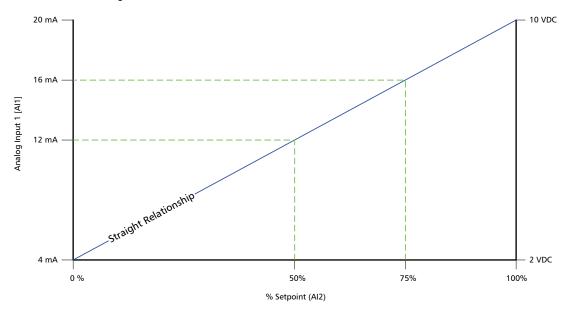
### *Setpoints, Potentiometer*

The PS200 has one analog input AI1 that can accept a 0-10VDC reference from a potentiometer.  This signal can be used to vary the Process Control Setpoint or a Speed Reference.



| Parameter | Name | Value/Range | Notes |
|---|---|---|---|
| 17.05 | MINIMUM AI1 | 0VDC<br>2VDC *[default]* | In order to utilize the full range of the reference voltage AI1 Minimum must be set to 0VDC. |
| 24.01 | PROC SENSOR FAILURE | DISABLED<br>FAULT<br>LAST SPEED*[default]* | When setting 17.05 to 0VDC then the process sensor failure must be set to DISABLED. |
| 17.20 | AI1 CONFIG | EXT SETPOINT<br>SPD CTRL REF<br>SPD OVRD | The potentiometer can be used to change the reference for three different operating modes.<br><br>EXT SETPOINT will change the setpoint when in Single or Multipump Process Control.  For scaling see the Variable Setpoints Section.<br><br>SPD CTRL REF will change the speed reference when in Speed Control Mode. For scaling see the Variable Setpoints Section.<br><br>SPD OVRD will change the speed override reference when in Speed Override Mode. |
| 16.02 OR 16.05 | SETPOINT 1 SELECT<br>SETPOINT 2 SELECT | ANALOG INPUT | If either EXT SETPOINT or SPD CTRL REF is selected in 17.20 then the SETPOINT source must be configured for an ANALOG INPUT.  Refer to Dual Setpoints to determine which SETPOINT to select. |
| 12.12 | SPD OVERRIDE REF | AI1 | If SPD OVRD is selected in 17.20 and the potentiometer is being used to change the speed reference when in Speed Override Mode parameter 12.12 must be set to AI1.  Refer to the Speed Override Section for details. |

## OPTIONS & FEATURES

### Setpoints, Variable

Variable setpoints are possible with the PumpSmart PS200 system using a 2-10 VDC or 4-20 mA input signal. The signal affects only the setpoint. Motor speed continues to be varied by the primary transducer reading the demand change. A example application is sending a setpoint from a control room to the PumpSmart unit using a 2-10VDC or 4-20 mA signal.



The effect is a straight relationship with the maximum setpoint value corresponds to the maximum signal [i.e. 20 mA or 10 VDC] while the minimum setpoint value corresponds to the minimum signal [4mA or 2 VDC].

| Parameter | Name | Value/Range | NOTES |
|---|---|---|---|
| 16.02 | SETPOINT 1 SEL | KEYPAD [default]<br>ANALOG INPUT<br>FIELDBUS | Change to ANALOG INPUT if using an analog signal.<br>Select FIELDBUS if a variable setpoint is being introduced through a DCS system |
| 16.03 | AI-2 MAX | Range: 0-18000<br>0 [default] | Enter the process value that corresponds to a 20mA or 10 VDC signal as read from AI-2 |
| 16.04 | AI-2 MIN | Range: 0-18000<br>0 [default] | Enter the process value that corresponds to a 4mA or 2 VDC signal as read from AI2 |

## OPTIONS & FEATURES

### SMART<sup>FLOW</sup> Sensorless Flow

*SMART*<sup>*FLOW*</sup> *Sensorless Flow*

PumpSmart can calculate the flow of a centrifugal pump based on power and speed feedback derived from the drive. By comparing these values against the pump's flow vs power curve PumpSmart can calculate the flow of the pump with in ±5% of the pump's maximum rated flow. With only four pieces of data from the published pump performance curve PumpSmart can establish the flow vs power curve of the pump. Although factory performance test curve data can be used it is not required. A Tune Function calibrates the flow vs power curve to compensate for mechanical losses, volumetric efficiency, casting defects, pump wear, eddy current losses and general pump performance defects that can have an affect on the total pump efficiency.
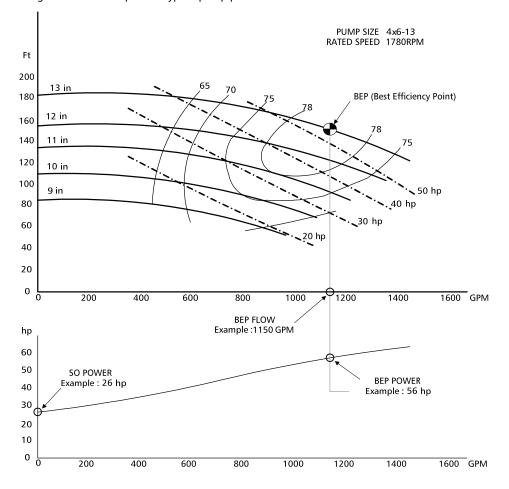
### STEP 1 – PUMP PARAMETER SETUP

The first step in setting up the SMART<sup>FLOW</sup> function is to define the pump characteristics in the drive. The required pump data should be set up for the maximum operating speed and at the rated impeller diameter of the pump. To setup SMART<sup>FLOW</sup> the pump type must be defined as one of the flowing choices:

- SS CENTRIFUGAL – Single Suction Centrifugal

- DS CENTRIFUGAL – Double Suction Centrifugal

- MAG DRIVE – Magnetic Drive Pump with a metallic containment shell. For a magnetic drive pump with a non-metallic containment shell select SS CENTRIFUGAL as pump type.

To define the pump performance curve four pieces of information are required from the pump performance curve; BEP Flow, BEP Power, Shut-Off Power and Rated Speed.

NOTE – The Rated Speed must be equal to the setting in parameter 14.01 MAXIMUM SPEED. Correspondingly the BEP FLOW, BEP POWER and SO POWER must be calculated for this speed.

The following chart is an example of a typical pump performance curve.

## OPTIONS & FEATURES

From the pump performance curve enter the required pump data to establish the flow vs power curve.  For reference on where to locate the correct pump performance data refer to the chart below.

| Parameter | Name | Value/Range | Notes |
|---|---|---|---|
| 29.01 | TYPE | DISABLED [default] | Defines the type of pump being used. |
| | | SS CENTRIFUGAL | Single Suction Centrifugal |
| | | DS CENTRIFUGAL | Double Suction Centrifugal |
| | | MAG DRIVE | Magnetic Drive Centrifugal |
| 29.02 | BEP FLOW | 0-99999<br>100 [default] | Best efficiency point flow at rated speed and viscosity. Units are GPM for English (AM) and M3/HR for all other languages. |
| 29.03 | RATED SPD | 0 – 18000 | Speed at which QBEP, P BEP and P SO are entered. This value should equal the maximum operating speed as defined in parameter 14.01 MAXIMUM SPEED which is the default value. |
| 29.04 | BEP POWER | 0 – 3000.00 | Power at the best efficiency flow at rated speed and viscosity at SG = 1.0. Units are BHP for English (AM) and kW for all other languages. Default is 80% of 11.08 Motor Nominal Power. |
| 29.05 | SO POWER | 0 – 3000.00 | Power at closed valve condition at rated speed and viscosity at SG = 1.0. Units are BHP for English (AM) and kW for all other languages. Default is 36 % of 11.08 Motor Nominal Power. |

**STEP 2 – APPLICATION DATA**

If the pump is magnetic driven with a metallic containment shell then the eddy current losses are required to be configured in parameter 29.10 P MAG CORR.  The eddy current losses should be provided by the pump manufacturer.

The default value for Specific Gravity is 1.0.  For SG different then 1.0 parameter 29.15 SG RATE must be configured.  Specific Gravity must be constant unless Specific Gravity Correction is enabled as outlined in the Options & Features Section.

| Parameter | Name | Value/Range | Notes |
|---|---|---|---|
| 29.10 | P MAG CORR | 0.0 [default] – 100.0 | Eddy current correction factor for magnetic drive pumps at rated speed. Visible only if 29.01 setting is Mag Drive. Units are BHP for English (AM) and kW for all other languages. |
| 29.15 | SG RATE | 0.0-10.0<br>1.0 [default] | Enter rated specific gravity. |

# OPTIONS & FEATURES

### STEP 3 – TUNE FUNCTION

To compensate for inaccuracies of the published pump performance curve data, the effects of mechanical losses, volumetric efficiencies, casting defects, pump wear, and any general pump defects that can compromise pump performance at reduced speeds a Tune Function can be performed to calibrate the pump.

The Tune Function requires the pump to be ramped up against a closed discharge valve for a maximum of 35 seconds. For pumps less then or equal to 50hp (35kW) the pump will be ramped up to full speed and for pumps greater then 50hp (37kw) the pump will be ramped up to a maximum of 60% speed. With this tune function PumpSmart is able to calibrate the flow vs power curve to compensate for the various conditions that can affect overall pump performance.

*General comments regarding the tune function:*

- Once the tune function is complete the pump will automatically shut down and must be manually restarted. This feature prevents prolonged operation against a closed discharge valve and can not be defeated.

- The tune function can not be engaged if the pump is running. The pump must be at a complete stop before the tune function can be started.

- A built in safety feature will automatically shut down the pump if the tune is not completed in less then 35 seconds. The drive will display a "TUNE FAIL" fault if the tune is not completed in time. The most common occurrence for this fault is having too long an acceleration rate as defined in parameter 13.01 ACCEL TIME which limits the drives ability to accelerate to speed. If the ACCEL TIME has been increased beyond the defaults settings and the drive can not complete a tune lower the ACCEL TIME back to the factory default of 5 seconds. After the tune has completed, the ACCEL TIME can be restored to the desired setting.

- Smaller pumps of 15hp (11kW) or less tend to have higher bearing and seal losses upon a cold start. It is recommended that the pump is run for 15-20 minutes at rated flow prior to performing the tune function.

- The Tune Function is enabled by selecting TUNE in parameter 29.08 CALC SO SOURCE.

*Application guidelines for the use of the tune function:*

- Do not use the Tune Function if the product of the pumped liquid Specific Gravity x its Specific Heat is less than 0.5.

- The liquid NPSHR must be adequate to prevent cavitation and flashing during tuning.

- Always follow the pump manufacturer's instructions as to whether operation against a closed discharge valve is allowable. This is especially important for sealless pumps having liquid lubricated bearings.

- For applications which fall outside of these guidelines use the "Affinity" setting in parameter 29.08 CALC SO SOURCE for the sensorless flow calculation.

| ⚠ WARNING |
|---|
| **Failure to follow the guidelines in this section can result in serious physical injury, death and/or equipment damage.** |

## OPTIONS & FEATURES

### STEP 4 – PERFORMING THE TUNE FUNCTION

To perform the tune function the following procedure is required.

1) Confirm pump data has been entered in STEP 1 and 2.

2) Shut down the pump and verify it is not running.

3) Close the discharge valve of the pump.

4) Confirm the pump suction is clear and the suction valve is open.

5) Confirm the pump is fully primed.

6) Go to parameter 29.08 CALC SO SOURCE and select TUNE.

| Parameter | Name | Value/Range | Notes |
|---|---|---|---|
| 29.08 | CALC SO SOURCE | AFFINITY [default] | Estimates power at closed valve condition using the Affinity laws. SO EXPNT can be adjusted in parameter 29.09. |
| | | TUNE | PumpSmart estimates power at closed valve condition by increasing speed and capturing power at several speeds. A warning message is displayed on the keypad WARNING TUNING. Once the tune process is complete the drive will shutdown and must be manually started. |
| | | TUNED VALUE | Uses the shutoff power characteristic developed during the tune function. |

7) Once TUNE is selected in parameter 29.08 a "TUNE" warning will appear on the keypad.

8) With the drive in LOCAL [LOC/REM] start the PS200 from the keypad [▷]

9) The drive will flash a warning "TUNE" and begin ramping up in speed to collect the data. Once the tune function is complete the drive will come to a stop.

10) Open the pump discharge valve.

11) The tune function has now been completed.

---

### ⚠ WARNING

**The suction valve must be wide open. Operation under closed valve conditions can cause superheating of internal pumpage and may result in a violent explosion. These conditions can lead to serious physical injury and/or equipment damage.**

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### ⚠ WARNING

**Never operate rotating equipment unless all protective coupling and shaft guards are in place. Personal injury may occur if the driven equipment is operated without coupling and shaft guards.**

**Observe all CAUTIONS and WARNINGS highlighted in the ACS800 Hardware Manual, PS200 Configuration and Operation Guide and Installation, Operation and Maintenance Guide for the applied driven equipment prior to starting.**

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### ⚠ WARNING

**If the motor does not automatically stop after 35 seconds it must be stopped manually and discharge valve opened.**

**After the TUNING PROCESS is completed OPEN THE PUMP DISCHARGE VALVE before attempting to restart the unit. Continuous operation at closed discharge valve condition may result in overheating due to vaporization of liquid in the pump casing and can result in pump failure and physical injury.**

---

## OPTIONS & FEATURES

### SMART<sup>FLOW</sup> Limitations

- The pump power curve must be constantly rising from closed discharge valve condition at all speeds. The ratio between shutoff power to BEP power must be in the range of 0.30 - 0.75.

- Flow accuracy in most cases will be ±5% of maximum rated flow over a speed range of 40 – 100% of rated speed.

- Viscosity must be constant. Flow accuracy will be directly influenced by the accuracy of corrections to viscous performance.

- Mechanical rubbing of pump internal components shall not occur as this will reduce flow accuracy.

- Pump shall not be cavitating.

- Solid particles shall be non-abrasive. Solid content by volume 2.5% maximum and by weight 1.5% maximum.

## *SMART<sup>FLOW</sup> PID Control*

PumpSmart can regulate to a flow setpoint with out the use of an external flow meter.  This is possible with the use of the internal PID controller and the SMART<sup>FLOW</sup> Sensorless Flow function.  To set up SMART<sup>FLOW</sup> PID Control:

- Configure the PS200 for Single Pump Process Control as outlined in Section 2A.

- Select SMARTFLOW in parameter 11.03 MODE SELECT.

- Configure the SMART<sup>FLOW</sup> Function as outline in the Options and Features Section.

- Configure the proper pump protection per the Advanced Pump Protection Section.

## OPTIONS & FEATURES

### Specific Gravity Correction

A pump may be subjected to varying Specific Gravity of the process fluid.  This can occur when the pump is designed to handle different types of fluids.  Additionally Specific Gravity can be affected by changes in temperature of the process fluid.  When using SMART$^{FLOW}$ and Advanced Pump Protection significant changes in S.G. can have an impact on the performance and accuracy of these functions.

If the changes in S.G are directly related to changes in temperature then PumpSmart can monitor a temperature transmitter and automatically correct the S.G. based on the temperature of the fluid.  To calculate the S.G based on temperature six points of data are required; TEMP MAX @ S.G. MAX, TEMP RATE @ S.G. RATE and TEMP MIN @ S.G. MIN.  This data can be found in most fluid handling property manuals.

If the S.G. is changing because of different process fluids being pumped then the S.G. can be manually changed by a 4-20mA input.  The S.G. is linearly scaled from the AI MIN (4mA) to the AI MAX (20mA) values as entered in Group 16.

As an alternative a digital input (DI5) can be used to toggle between two pre-defined S.G. as entered in SG MIN (DI5 open) and SG MAX (DI5 closed).

If S.G. is constant then SG RATE should be selected in 29.12 SG SELECT and the actual Specific Gravity value should be entered in 29.15 SG RATE if other than 1.0.

| Parameter | Name | Value/Range | Notes |
|---|---|---|---|
| 29.12 | SG SELECT | SG RATE [default] | Used for applications where S.G. is constant. |
| | | SG CALC (T) | Use for applications where S.G. varies. A temperature measuring instrument must be wired to an open analog input channel. |
| | | AI | S.G. is sent via an external analog input signal |
| | | DI | S.G. is toggled between two values (SG MIN and SG MAX) via Digital Input 5. SG MIN = DI5 open, SG MAX = DI5 closed.  Selecting DI in 29.12 automatically configures DI5 in parameter 25.07 to SG SELECT. |
| 29.13 | SG MIN | 0.0 [default] | Setting range is 0 – 10.0. |
| 29.14 | SG MAX | 1.0 [default] | Setting range is 0 – 10.0. |
| 29.15 | SG RATE | 1.0 [default] | Setting range is 0 – 10.0. |
| 29.16 | T MIN | 0°F  English(AM) 0°C All Other Languages | Temperature of pumped liquid at SG MIN. Setting range:  -200 to 1000. |
| 29.17 | T MAX | 212°F  English(AM) 100°C All Other Languages | Temperature of pumped liquid at SG MAX. Setting range:  -200 to 1000. |
| 29.18 | T RATE | 104°F  English(AM) 50°C All Other Languages | Temperature of pumped liquid at SG RATE. Setting range:  -200 to 1000 |

If a temperature transmitter or analog input is to be used to adjust the Specific Gravity then the appropriate analog input channel must be configured as outlined.

| Parameter | Name | Value/Range | Notes |
|---|---|---|---|
| 15.02 OR 15.03 | AI1 UNIT AI3 UNIT | F DEG C DEG | Enter the units for the temperature transmitter |
| 16.06  OR 16.08 | AI1 MAX AI3 MAX | 0 – 18000.0 | Enter the transmitter maximum temperature at 20 mA |
| 16.07  OR 16.09 | AI1 MIN AI3 MIN | -200.0 TO 18000.0 | Enter the transmitter minimum temperature at 4 mA |
| 17.20 OR 17.22 | AI1 CONFIG AI3 CONFIG | SG/TEMP | A temperature transmitter is used for S.G. calculation. |

NOTE – If the Specific Gravity is being changed by a proportional analog input signal by selecting AI in 29.13 SG SELECT then the signal is scaled by parameters 29.13 SG MIN (4mA) and 29.14 SG MAX (20mA).

## OPTIONS & FEATURES

### *Speed Override*

Certain times a pump may be required to operate in a manual speed mode to empty a sump, pressurize a header, back wash filters, make manual adjustments, jog the pump for rotation, etc.  The Speed Override function allows a user to override the all other control algorithms and take manual control of the speed.

The PS200 can be taken out of the primary control mode (speed, single pump, multi-pump) that it was originally configured for and put into a Speed Override mode.  This function allows the control to be manually taken over and operate the pump at either a preset speed, from a remote speed reference via an analog input or from a Fieldbus command.

The Speed Override function can either be initiated by an HOA function (hand mode), a digital input or a Fieldbus command.  If desired the Pump Protection Algorithms can be disabled when the Speed Override Function is active.

When in Speed Override the keypad will display the message: WARNING SPEED OVERRIDE.

| Parameter | Name | Value/Range | Notes |
|---|---|---|---|
| 12.11 | SPEED OVERRIDE | | Select the source that will activate the Speed Override function. |
| | | Disabled *[Default]* | Disabled |
| | | DI5 | Enabled when digital input DI5 is closed [1]. |
| | | DI5(INV) | Enabled when digital input DI5 is open [0].  When closed [1] primary control mode is active. |
| | | DI3 | Enabled when digital input DI3 is closed [1]. |
| | | DI3(INV) | Enabled when digital input DI3 is open [0].  When closed [1] primary control mode is active. |
| | | HOA | Enabled when the Hand function is initiated by closing [1] digital input DI2. HOA must be configured in 12.01 START/STOP. |
| | | Fieldbus | Speed Override is enabled by a Fieldbus command.  Refer to Fieldbus Manual for details. |
| 12.12 | SPD OVERRIDE REF | | Select the source of the Speed Override Reference. |
| | | Keypad *[Default]* | Defines the keypad as the speed override reference. If KEYPAD is selected and the drive is running when Speed Override is enabled the current operating speed will be the Speed Override Reference. |
| | | AI1 AI3 | Defines analog input AI1 or AI3 as the speed override reference.  The corresponding analog input must be configured for SPD OVRRD in parameters 17.20 AI1 CONFIG or 17.22 AI3 CONFIG. |
| | | Fieldbus | Speed Override reference is defined by a Fieldbus command.  Refer to Fieldbus Manual for details. |
| 12.13 | SPD OVRD DFLT-SP | 0-3600 | When KEYPAD has been selected in par 12.12 SPD OVERRID REF this defines the preset speed the pump will operate at when Speed Override is active.  Initial default is minimum speed (14.02). |
| 12.14 | SP OVRRD PMP PROT | Enabled *[Default]* Disabled | Enables or disables pump protection warnings and faults when speed override is activated. |

Note: DI3 also serves as the digital input source for both Dual Setpoints and External 1 – External 2 Start/Stop. These features can be used in conjunction with Speed Override.

| NOTICE | When placing the drive in Speed Override and disabling pump protection functionality all pump protection except E-stop/permissive and keypad failure become inactive. Make sure override speed is not excessive for the application. |
|---|---|

## OPTIONS & FEATURES

### Stall Function (Locked Rotor Protection)

The stall function selects how the motor will react in a locked rotor condition. A locked rotor condition can occur if operating the pump in reverse rotation (threaded impeller spins off), binding of parts (due to misalignment) or foreign debris.

NOTE - The Stall function can be found in the Advanced Parameter section accessible by the 564 User Pass Code.

| Parameter | Name | Value/Range | Notes |
|---|---|---|---|
| 24.11 | STALL FUNCTION | Warning<br>Fault<br>No [default] | PS200 reaction when a locked rotor condition occurs for the stall time |
| 24.12 | STALL FREQ HI | 0.5 – 50 HZ<br>20 HZ [default] | Default setting recommended |
| 24.20 | STALL TIME | 10 – 400 sec<br>20 sec [default] | Recommended setting is 10 sec |

### Start Delay

This feature is designed to delay the pump from starting once a remote start command has been received.  When a remote start signal is received the drive will delay starting by a set amount of time and can be configured to energize a relay output for the duration of the time delay.

*For example a pump must be primed prior to being started.  The pump casing has been tapped and flush water is available which is controlled by an on/off regulating valve.  The pump casing requires 30s to fully prime before starting.  The PS200 can be configured to wait 30s once the remote start signal is received.  At the same time the start signal is received a Relay Output will energize which will send a start command to the priming valve.  After the 30s has expired the pump will start and the relay will de-energize closing the priming valve.*

| Parameter | Name | Value/Range | Notes |
|---|---|---|---|
| 12.10 | START DELAY | 0-9999 Seconds<br>0 *[default]* | This is the time period the drive will delay starting the pump once a REMOTE start signal is received. |
| 19.01<br>19.04<br>19.07 | RELAY R01 OUTPUT<br>RELAY R02 OUTPUT<br>RELAY R03 OUTPUT | START DELAY | The relay will energize once the REMOTE start signal is received.  After the Start Delay in parameter 12.10 has expired the relay will de-energize. |

## OPTIONS & FEATURES

### *Start/Stop Options*

PumpSmart can be configured for starting and stopping the drive from two external control locations, EXT1 and EXT2. Typically one location is local to the pump or drive usually in the form of an HAND – OFF – AUTO selector switch.  The second location is typically from a remote location such as the DCS / SCADA system.

To activate external location 2 (EXT2) DI3 must be closed.  When DI3 is open external location 1 (EXT1) is active.  Both EXT 1 and EXT 2 are only functional when the drive is in REMOTE mode.

*In the following wiring example a HAND – OFF – AUTO switch is located locally at the pump and 12.01 START/STOP has been configured for 2W DI1 – 2W DI5.   When the selector switch is put in AUTO DI3 is closed which activates EXT 2.  The drive will now start once the remote contact wired to DI5 is closed.  When the selector switch is put in HAND mode the drive will start immediately because DI3 is open which activates EXT 1 and DI1 is closed.*

| X22 Terminal Block | | | |
|---|---|---|---|
| 1 | DI1 | EXTERNAL 1 START/STOP 2W DI1 | |
| 2 | DI2 | HAND (SPEED OVERRIDE / JOG) | |
| 3 | DI3 | EXTERNAL1 / EXTERNAL 2 | 0-Open, Setpoint 1 [REF 1] 1-Closed, Setpoint 2 [REF 2] |
| 4 | DI4 | SECONDARY PUMP PROTECT A | 0 - Secondary Protect (Open) 1 - Normal (Closed) |
| 5 | DI5 | EXTERNAL 2 START/STOP 2W DI5 | 0 - Secondary Protect (Open) 1 - Normal (Closed) |
| 6 | DI6 | FAULT RESET | |
| 7 | 24 VDC | DI Reference Voltage 100 mA Max | |
| 8 | 24 VDC | | |
| 9 | GND 1 | DI GROUND | |
| 10 | GND 2 | DI GROUND | |
| 11 | DI IL | E STOP/DRIVE PERMISSIVE | |

For additional wiring example refer to the wiring diagrams in Appendix A-4.

## ⚠ WARNING

**The drive can still be started locally at the keypad when put into LOCAL mode.  Installing a remote HAND – OFF – AUTO switch and putting it in the OFF position does not completely lock the drive from starting.  Only the Drive Permissive Digital Input DIL can disable the drive in both REMOTE and LOCAL modes.**
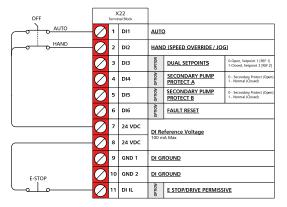
NOTE - If two external start/stop locations are selected in 12.01 START/STOP, parameter 16.01 SET1/SET2 SELECT will automatically default to DI3 which enables the Dual Setpoint function.  If only one setpoint reference is required then parameters 16.02 and 16.05 must be set to the same value.  Refer to the Dual Setpoints Section for additional information.

| Parameter | Name | Value/Range | Notes |
|---|---|---|---|
| 12.01 | START/STOP | 2 WIRE DI1 *[default]* | Control at one external location via 2-Wire switch at DI1 |
| | | 3W DI1P,2P | Control at one external location via 3-Wire pulse start DI1 and pulse stop DI2. |
| | | HOA DI1,2 | Control Used for Hand-Off-Auto.  DI1 activates Auto, DI2 activates the Hand/Speed Override function. at one external location. |
| | | HOA DI1,2 – DI5 | Control at two external locations. EXT1: Hand-Off-Auto. DI1 activates Auto, DI2 activates the Hand/Speed Override function. EXT2: 2-Wire switch at DI5. |
| | | DI1P,2P- DI5 | Control at two external locations. EXT1: 3-W pulse start DI1 and pulse stop DI2. EXT2: 2-Wire start/stop switch at DI5. |
| | | HOA DI1,2 –FB | Control at two external locations. EXT1: Hand-Off-Auto. DI1 activates Auto, DI2 activates the Hand/Speed Override function. EXT2: Fieldbus is the second control location. |
| | | 2W DI1 – 2W DI5 | Control at two external locations. EXT1: 2-Wire switch at DI1.  EXT2: 2-Wire switch at DI5 |
| | | FIELDBUS | Start via Fieldbus control word. External control location 1 only. |
| | | DI1P,2P - FB | Control at two external locations. EXT1: 3-Wire pulse start DI1 and pulse stop DI2. EXT2: Fieldbus control word. |

NOTE – If using two external start/stop locations where DI5 is selected as the 2nd external location then 25.07 SECONDARY PROTECT B must be set to disabled.

## OPTIONS & FEATURES

### HAND(JOG) – OFF – AUTO

One of the most common control requirements for starting and stopping a pump is the HAND – OFF – AUTO or AUTO – OFF – JOG function.  When placed in AUTO the PS200 will operate in the primary control mode.  By placing the PS200 in HAND mode the Speed Override Function can be enabled which runs the pump in manual speed control mode.  In Speed Override the drive can be configured to operate at a fixed speed, follow a remote 4-20mA speed reference, follow a speed potentiometer reference or follow a Fieldbus command.  Refer to the Speed Override Section for further details.



The following parameters must be configured for basic HAND – OFF – AUTO operation.

| Parameter | Name | Value/Range | Notes |
|---|---|---|---|
| 12.01 | START/STOP | HOA DI1,2 | Used for Hand-Off-Auto. DI1 activates Auto, DI2 activates the Hand/Speed Override function. |
| 12.11 | SPEED OVERRIDE | HOA | Enabled when the Hand function is initiated by closing [1] digital input DI2. This parameter is automatically updated to HOA when HOA is selected in 12.02 START/STOP. |

### ⚠ WARNING

**The drive can still be started locally at the keypad when put into LOCAL mode.  Installing a remote HAND – OFF – AUTO switch and putting it in the OFF position does not completely lock the drive from starting.  Only the Drive Permissive Digital Input DIL can disable the drive in both REMOTE and LOCAL modes.**

### Stop Function

Parameter 12.08 selects how the motor will stop when the stop button is pushed. If a fault occurs the PS200 will coast stop.

| Parameter | Name | Value/Range | Notes |
|---|---|---|---|
| 12.08 | STOP FUNCTION | RAMP STOP [default] COAST STOP | Selects how the motor will stop. |

## OPTIONS & FEATURES

### *Tuning*

If the pump appears to oscillate in speed (i.e. hunting), cannot maintain a uniform setpoint, has a constant setpoint offset, or shuts off too quickly or too slowly it may need to have the integral time or proportional gain settings tuned to the system.

When an operating mode is selected [i.e., flow, pressure, level etc.] PumpSmart engages factory default settings for the rate that the drive adjusts to meet the setpoint demand. In many cases these settings will not require adjustment. The most common exceptions are complex systems, process instruments with slow response times, large full-scale value compared to setpoint or level control applications where variables such as tank size have a significant effect on tuning response.

When the PumpSmart system is adjusting speed to meet the setpoint, it does so using a Proportional Gain and Integral Time (PI) setting. The proportional gain setting adds corrective action that is proportional to the difference between the setpoint and the process condition. This difference is commonly referred to as error. A low gain setting will yield a small corrective action that may stabilize at a position that is offset from the setpoint. Conversely, if the gain setting is too high, speed oscillations may occur.

The integral time setting makes corrective actions to compensate for the offset created by the proportional control. The corrective action of the integral function accounts for the error present over a period of time (Integral Time). The smaller the Integral time, the faster speed adjustments are made, at the risk of speed oscillations occurring. If the Integral time is set too long, prolonged offsets are likely.

It is important to note that the final values for the Proportional gain and Integral time should be determined not only for system changes but also for startup conditions. For example, a system tuned for system operating changes may be out of tune during startup conditions.

NOTE - Air in the system may cause a condition that looks like oscillation or hunting. Be sure all air is purged from the system before attempting tuning.

### Accel Time

ACCELeration TIME is the rate at which motor speed is increased when a control correction is required. ACCEL TIME is expressed as the time, in seconds, it would take to reach maximum speed (parameter 14.01) from zero speed. In Single Pump and Multipump, the drive response can be made slower by increasing the ACCEL TIME

| Parameter | Name | Value/Range | Notes |
|-----------|------|-------------|-------|
| 13.01 | ACCEL TIME | 0-1800 Seconds<br>*5 [default]* | |

### Decel time

DECELeration TIME is the rate at which motor speed is decreased when a control correction is required or upon shutting down. DECEL TIME is expressed as the time, in seconds, it would take to reach zero speed from maximum speed (parameter 14.01). As with ACCEL TIME, drive response may be slowed using this parameter.

| Parameter | Name | Value/Range | Notes |
|-----------|------|-------------|-------|
| 13.02 | DECEL TIME | 0-1800 Seconds<br>*5 [default]* | |

### Proportional Gain

The PROPORTIONAL GAIN setting adds corrective action that is proportional to the error. A low gain setting will yield a small corrective action that may stabilize at a position that is offset from the setpoint. A high gain setting may result in speed oscillations.

| Parameter | Name | Value/Range | Notes |
|-----------|------|-------------|-------|
| 13.03 | P - GAIN | 0-100 | Pressure  *[default]* - 0.30<br>Flow *[default  ]*- 0.20<br>SMARTFLOW *[default]* - 0.20<br>Level & Temp *[default]* - 5 |

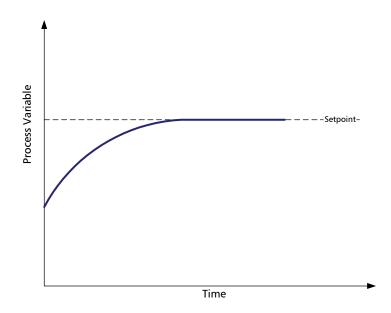## OPTIONS & FEATURES

### Integral Time

The integral time setting compensates for offset between the process variable and the setpoint. The integral time produces a rate of change in output speed that is proportional to the deviation in process variable from the setpoint. The smaller the integral time the faster the speed adjustments are made. If the integral time is set too short speed oscillations may occur, if set too long a prolonged time period is likely prior to achieving the setpoint value.

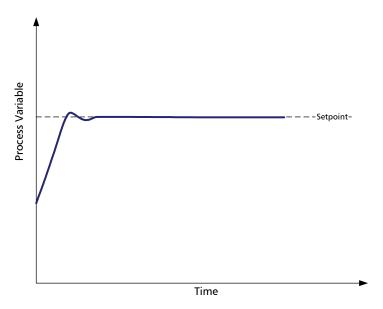| Parameter | Name | Value/Range | Notes |
|---|---|---|---|
| 13.04 | I - Time | 0-320 Sec | Pressure  *[default]*- 1.25<br>Flow *[default]*- 1.75<br>SMARTFLOW *[default]* – 2.25<br>Level & Temp *[default]*- 320 |

### Recommended Guidelines

Although there is no tuning procedure that will give optimum results for every system, there are certain guidelines that will facilitate the tuning process in the event the default settings require adjustment. The following figures show both normally tuned systems and improperly tuned systems. The first two figures "Normally Tuned" and "Tuned" show examples of properly tuned systems. Note the second figure, "Tuned" has a better dynamic response then the first system, but at the expense of a small overshoot in the setpoint. The last two figures show examples of poorly tuned systems that result in an unstable undesirable response.
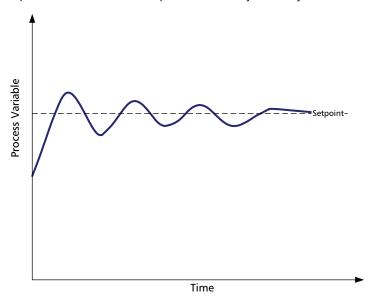
- Normally the default settings for FAST ACCEL and FAST DECEL do not require adjustment unless the drive response during ramp up or ramp down to the setpoint is unsatisfactory for the particular process.

- If the default settings result in an unsatisfactory drive response the following rules of thumb can be applied:

  - If rapid oscillations occur about the setpoint try increasing the value of the integral time (parameter 13.04) first. If the oscillations still continue or the time to drop to the setpoint is too long the proportional gain (parameter 13.03) should also be lowered.
  - If the amount of overshoot is unacceptable increase the integral time and lower the proportional gain.
  - If there is a low offset in the setpoint the proportional gain should be increased.
  - If there is a lengthy time period before achieving the final setpoint the integral time should be decreased.
  - In level control applications if speed oscillations occur increase the integral time.

- Once the tuning is fairly close several iterations between the values of proportional gain and integral time may be required to obtain optimum results.

- It is important to note that the final values for the proportional gain and integral time should be determined not only for system changes but also for startup conditions.
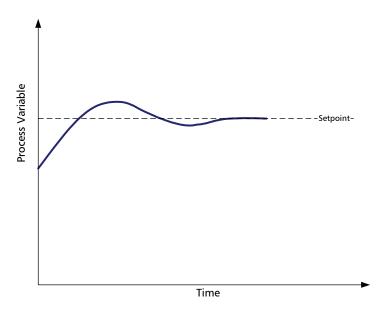
## OPTIONS & FEATURES

**Normally tuned system**: This system has appropriate gain and integration times resulting in a smooth transition towards the setpoint.



**Tuned system**: This system tuning is also acceptable. There is a slight overshoot to the setpoint, however the response rate is better than the previous "Normally Tuned" system.



**Over-Compensated system**: In this case, the drive is over-compensating to the error in the setpoint resulting in an oscillation. The proportional gain is too high and the integration time is too short.

## OPTIONS & FEATURES



**Under-Compensated system**: In this case, the drive is under-compensating to the error in the setpoint. The integration time in this case is too long.

*Derivative response*

NOTE - The Derivative function can be found in the Advanced Parameter section accessible by the 564 User Pass Code.

Derivative action completes the PID controller capability and is useful in systems where there is a sudden change in process variable. Derivative action will respond to a sudden change in process variable with a response similar to a high proportional gain but after this initial response behaves similar to a PI controller. Derivative action will respond to a sudden change in process variable faster then by just using PI control. In most pump applications PI control will be sufficient. However, PID control may be very useful in some level and temperature control applications.

| Parameter | Name | Value/Range | Notes |
|-----------|------|-------------|-------|
| 13.05 | D - TIME | 0-10 sec<br>*0 [default]* | Defines the derivation time of the PID controller. |
| 13.06 | PID DERIV FILTER | 0.4-10 sec<br>*1 [default]* | Defines the time constant of the filter used to smooth the derivative component of the process PID controller |
| 13.08 | CONTROL PARAM | SPEED [default] | Speed is the manipulated value in the PID controller |
| | | TORQUE | Motor torque is the manipulated value in the PID controller. |

## APPENDIX A-1 KEYPAD USE

# KEYPAD USE

Programming and operation of the PumpSmart PS200 may be done completely through the keypad located on the front of the controller. PumpSmart PS200 is programmable through a set of user friendly parameters. This section describes the operation of the PumpSmart keypad to program parameters, review actual signals and control the PS200. The following is an overview of its use.

The keypad has five different display modes:

- Identification display
- Actual Signal Display Mode
- Parameter Mode
- Function Mode
- Drive Selection Mode.

*IDENTIFICATION DISPLAY*

When the panel is connected for the first time or power is applied to the PS200, the identification display appears as shown below:

> ACS800 0006_5SR
> ITT Goulds  PS200
> ID – Number 1

After two seconds the display will clear and the actual signals display mode will appear.
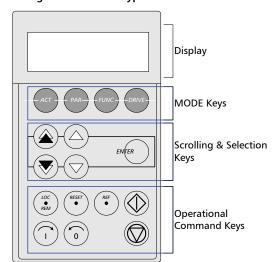
**Figure A - PS200 Keypad**

# APPENDIX A-1 KEYPAD USE

**Table 1 - Mode Key Overview**

| Key | Description | Key function | | Screen Display | |
|---|---|---|---|---|---|
| ACT | ACTUAL DISPLAY<br><br>Displays current process/drive conditions or faults | Select between actual signal and fault displays. | ▲ OR ▼ | Status Row -<br>Actual Signals-<br>Actual signals-<br>Actual signals- | 1 L → 0.0 RPM 0<br>FLOW ACTUAL 0.0 GPM<br>PUMP SPEED 0.0 RPM<br>ENERGY SAVINGS $0 |
| | | Scroll through the recent fault listings and actual signals | △ OR ▽ | Status row-<br>Fault ID-<br>Fault Description-<br>Fault time- | 1 L → 0.0 RPM 0<br>1 LAST FAULT<br>+PANEL LOST<br>20 H 49 MIN 56 S |
| | | Enter the selection mode. Accept new parameter. | ENTER | | |
| PAR | PARAMETER MODE<br><br>Displays parameter settings | Parameter group selection<br>Fast Scroll | ▲ OR ▼ | Status Row -<br>Parameter group-<br>Parameter no.-<br>Value- | 1 L → 0.0 RPM 0<br>10 LOCKS/PASSWORDS<br>02 PASSCODE<br>358 |
| | | Parameter selection<br>Slow scroll | △ OR ▽ | | |
| | | Enter selection mode<br>Accept new parameter | ENTER | | |
| FUNC | FUNCTION MODE<br><br>Program upload / download and contrast setting | Row selection | △ OR ▽ | Status Row -<br>Selectable func.-<br>Selectable func.-<br>Selectable func.- | 1 L → 0.0 RPM 0<br>UPLOAD < = < =<br>DOWNLOAD = > = ><br>CONTRAST |
| | | Function start | ENTER | | |
| DRIVE | DRIVE MODE<br><br>Drive identification | Drive/ID selection | △ OR ▽ | Base Device -<br>PS200 Label-<br>SW Version-<br>Drive No.- | ACS800 0006_5SR<br>ITT GOULDS PS200<br>REV 5.0<br>ID – NUMBER1 |
| | | Enter change mode<br>Accept new value | ENTER | | |

## APPENDIX A-1 KEYPAD USE

ACT

### *ACTUAL SIGNAL DISPLAY MODE*

This mode includes two displays:

1. Actual signal display
2. Fault history display.

During normal operation, the actual signal display appears and displays up to three process and/or drive conditions. There are approximately 43 different signals that can be selected from. A complete listing of PS200 Actual Signals can be found in Appendix A.

A typical Actual Signal display might be:

| | |
|---|---|
| Status Row - | 1 L →    100 GPM 0 |
| Actual Signal 2.02 - | Flow Actual  100 GPM |
| Actual Signal 2.07 - | Pump speed  3325 RPM |
| Actual Signal 2.12 - | Energy Savings $1325 |

If the PumpSmart PS200 is in a fault condition the Fault Display will be shown first.  The Fault Display includes a history of the 64 most recent faults that have occurred. The name of the fault and total power-on time is displayed. When a fault or warning occurs in the PS200, the message will be displayed immediately. **To display an active fault press the ACT key. To reset a fault press the Reset key.**

An Active Fault warning does not prevent the viewing and setting of parameters. The Active Fault warning will remain until the condition that caused the fault has been cleared and the RESET key has been pressed.

**Table 2 - How to display a fault and reset the fault history**

| Step | Function/Description | Key Sequence | Display after key is pressed |
|---|---|---|---|
| 1 | Press the ACT key to enter the Actual Signal display mode. If an active fault exists, it will be displayed first. | ACT | 1 L →   0.0 RPM 0<br>FLOW ACTUAL  0.0 GPM<br>PUMP SPEED   0.0 RPM<br>FLOW REF    0.0 GPM |
| 2 | Press the double arrow key to enter the Fault History Display. | ▲ OR ▼ | 1 L →   0.0 RPM 0<br>1 LAST FAULT<br>+PANEL LOST<br>   20  H 49 MIN 56 S |
| 3 | To select (scroll) through the fault history list, use the single arrow keys. To clear all the faults from the Fault History, press the RESET key. | △ OR ▽<br><br>RESET • | 1 L →   0.0 RPM 0<br>2 LAST FAULT<br>+OVERCURRENT<br>   12 H 49 MIN 10 S<br><br>1 L →   0.0 RPM 0<br>2 LAST FAULT<br>+PANEL LOST<br>H 49 MIN 56 S |
| 4 | To return to the Actual Signal display mode, press the double-arrow keys. | ▲ OR ▼ | 1 L →   0.0 RPM 0<br>FLOW ACTUAL  0.0 GPM<br>PUMP SPEED   0.0 RPM<br>FLOW REF    0.0 GPM |

## APPENDIX A-1 KEYPAD USE

**Table 3 – Changing the displayed signals**

| Step | Function/Description | Key Sequence | Display after key is pressed |
|---|---|---|---|
| 1 | Press the ACT key to enter the Actual Signal display mode | ACT | 1 L →   0.0 RPM 0<br>FLOW ACTUAL  0.0 GPM<br>PUMP SPEED   0.0 RPM<br>FLOW REF     0.0 GPM |
| 2 | Using the arrow keys, move the blinking cursor to the line that is to changed | △ OR ▽ | 1 L →   0.0 RPM 0<br>FLOW ACTUAL  0.0 GPM<br>PUMP SPEED   0.0 RPM<br>FLOW REF     0.0 GPM |
| 3 | Press the ENTER key to enter the ACTUAL SIGNALS parameter groups. | ENTER | 1 L →   0.0 RPM 0<br>1  VFD ACTUAL SIGNALS<br>02 MOTOR SPEED<br> 0.0 RPM |
| 4 | Press the double arrow key to toggle between parameter group 01 VFD ACTUAL SIGNALS and group 02 PUMP ACTUAL SIGNALS | ▲ OR ▼ | 1 L →   0.0 RPM 0<br>2  PUMP ACTUAL SIGNALS<br>01 FLOW REF<br> 0.0 GPM |
| 5 | Use the arrow keys to scroll through the available selections. | △ OR ▽ | 1 L →   0.0 RPM 0<br>2  PUMP ACTUAL SIGNALS<br>12 ENERGY SAVINGS<br> 0.00 $ |
| 6 | Press and hold ENTER to accept the selection. Display will revert back to the normal display mode with selected parameter shown. | ENTER | 1 L →   0.0 rpm 0<br>Flow Actual  0.0 GPM<br>Pump speed   0.0 RPM<br>Energy Savings $0.00 |

NOTE - When parameter changes are made that will affect the ACTUAL SIGNAL display (e.g. unit changes), pressing the ACT key will update the display.

## APPENDIX A-1 KEYPAD USE

( PAR )

<u>PARAMETER MODE</u>

The parameter mode is used to enter/change the PS200 programming parameters.

NOTE - The user password must be entered prior to attempting to write to a parameter. If not entered, the following warning will be displayed:

```
          **WARNING**
      WRITE ACCESS DENIED
  PARAMETER SETTING NOT POSSIBLE
```

NOTE - Some parameters may not be changed while the pump is operating.  If the above message is displayed and the parameter lock is OPEN, stop the pump and then make the desired parameter change.

A typical Keypad display is shown below for parameter 11.06.

| | |
|---|---|
| Status Row - | 1 L →    100 GPM 0 |
| Parameter Group - | 11 START-UP DATA |
| Parameter number and name - | 06 MOTOR NOM FREQ |
| Parameter value - | 60 HZ |

For a listing and description of the PS200 parameters refer to the Appendix A-3.

**Table 4 - How to select a parameter and change the value**

| Step | Function/Description | Key Sequence | Display after key is pressed |
|---|---|---|---|
| 1 | Enter the Parameter Mode Selection | PAR | 1 L →   0.0 rpm 0<br>99 INFORMATION<br>01 SOFTWARE VERSION<br>REV 5.00 |
| 2 | To select another parameter group<br>While holding the arrow down, only the group name and number are displayed. When the key is released, name, number and value of the first parameter in the group is displayed | ▲ OR ▼ | 1 L →   0.0 rpm 0<br>10 LOCKS/PASSWORDS<br><br>1 L →   0.0 rpm 0<br>10 LOCKS/PASSWORDS<br>01 PARAMETER LOCK<br> LOCKED |
| 3 | To select an index.<br>While holding the arrow down, only the group name and number are displayed. When the key is released, name, number and value of the first parameter in the group is displayed | △ OR ▽ | 1 L →   0.0 rpm 0<br>10 LOCKS/PASSWORDS<br>01 PARAMETER LOCK<br><br>1 L →   0.0 rpm 0<br>10 LOCKS/PASSWORDS<br>02 PASSCODE<br> 0 |
| 4 | To enter the parameter setting mode | ENTER | 1 L →   0.0 rpm 0<br>10 LOCKS/PASSWORDS<br>02 PASSCODE<br>[0] |
| 5 | To change the parameter<br><br>Double arrows – fast change<br><br>Single arrows – slow change | ▲ OR ▼<br>△ OR ▽ | 1 L →   0.0 rpm 0<br>10 LOCKS/PASSWORDS<br>02 PASSCODE<br>[358] |
| 6 | To send and save a  new value to the drive<br>*Note - In this example, the passcode automatically returns to zero after successfully entering the passcode.*<br>*To cancel the new setting and keep the original value press one of the mode keys PRIOR to pressing the ENTER key. The selected Keypad Mode is entered* | ENTER<br>ACT   PAR<br>OR<br>FUNC   DRIVE | 1 L →   0.0 rpm 0<br>10 LOCKS/PASSWORDS<br>02 PASSCODE<br> 0<br><br>1 L →   0.0 rpm 0<br>10 LOCKS/PASSWORDS<br>02 PASSCODE<br> 0 |

## APPENDIX A-1 KEYPAD USE

FUNC

_FUNCTION MODE_

The function mode is used to:

1. Upload parameters,
2. Download parameters
3. Set the contrast of the keypad.

_Uploading/Downloading_ - The PS200 allows the user to store all programmed parameters to the flash memory of the keypad, which can be used to download to the drive.   Parameter upload will copy existing parameters from the PS200 drive to the keypad.   Parameter download will copy parameters stored in the keypad to the PS200 drive.  This feature serves two purposes: 1) Provides a backup of your settings in the event that settings are inadvertently changed or if a drive or component failure occurs and reprogramming is required, 2) If you have more than one PS200 with the same or similar programming, you can program one unit, upload the keypad, then move the keypad to a sister unit to download all of your settings.  Any unique setting can then be adjusted if necessary. The table below shows how to select and perform an upload or download.

Note: The drive to be downloaded must be set in the same Application Macro (parameter 11.02) as the drive which had the upload. It is recommended that parameter settings be verified after completion of each download.

**Table 5 Typical Function Selection**

| Step | Function/Description | Key Sequence | Display after key is pressed |
|---|---|---|---|
| 1 | Enter the Function Mode Selection | FUNC | 1 L →  0.0 rpm 0<br>UPLOAD       <=<=<br>DOWNLOAD    =>=><br>CONTRAST |
| 2 | To select a function. | △ OR ▽ | 1 L →  0.0 rpm 0<br>UPLOAD       <=<=<br>DOWNLOAD    =>=><br>CONTRAST |
| 3 | To activate the selected function | ENTER | 1 L →  0.0 rpm 0<br><br>=> => => => => => =><br> DOWNLOAD |
| 4 | Loading Complete - The display will return to the Actual Signals display mode. | | 1 L →  0.0 rpm 0<br>FREQ     0.00 Hz<br>CURRENT    0.00 A<br>POWER     0.0 % |

If downloading is attempted before uploading is performed the following warning will be displayed:

```
          WARNING
        NOT UPLOADED
  DOWNLOADING NOT POSSIBLE
```

The parameters can be uploaded and downloaded only if the software version of the source drive is the same as the software version of the destination drive. Otherwise the following warning will be displayed:

```
        **WARNING**
     DRIVE INCOMPATIBLE
  DOWNLOADING NOT POSSIBLE
```

NOTE- the drive must be stopped during the downloading process. If the PS200 is running and downloading is selected the following warning is displayed:

```
        **WARNING**
      DRIVE IS RUNNING
  DOWNLOADING NOT POSSIBLE
```

_Setting the Contrast_ – if the control panel display is not clear enough, the contrast can be reset as shown in the following table.

## APPENDIX A-1 KEYPAD USE

**Table 6 - How to set the contrast of the display**

| Step | Function/Description | Key Sequence | Display after key is pressed |
|------|---------------------|--------------|------------------------------|
| 1 | To enter the Function Mode Selection | FUNC | 1 L →   0.0 rpm 0<br>UPLOAD       <=<=<br>DOWNLOAD    =>=><br>CONTRAST    0 |
| 2 | To select a function. | △ OR ▽ | 1 L →   0.0 rpm 0<br>UPLOAD       <=<=<br>DOWNLOAD    =>=><br>CONTRAST    0 |
| 3 | To enter the contrast setting mode | ENTER | 1 L →   0.0 rpm 0<br>CONTRAST    [0] |
| 4 | To set the contrast | △ OR ▽ | 1 L →   0.0 rpm 0<br>CONTRAST    [7] |
| 5 | To send a new value to the drive<br><br>To cancel the new setting and keep the original value press one of the mode keys PRIOR to pressing the ENTER key. The selected Keypad Mode is entered | ENTER<br>ACT  PAR<br>OR<br>FUNC  DRIVE | 1 L →   0.0 rpm 0<br>UPLOAD       <=<=<br>DOWNLOAD    =>=><br>CONTRAST    7<br><br>1 L →   0.0 rpm 0<br>UPLOAD       <=<=<br>DOWNLOAD    =>=><br>CONTRAST    0 |

DRIVE

_DRIVE SELECTION MODE_

In normal use the features in Drive Selection Mode are not required for the PS200. The software release date can be found by pressing the DRIVE key. The display will appear as follows:
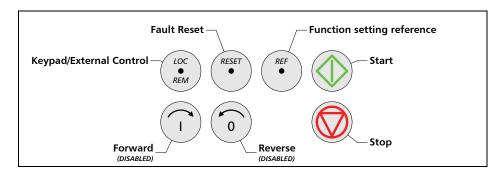
```
ACS800 0006_5SR
ITT GOULDS PS200
VERSION 5.00
ID – NUMBER1
```

_The software version and date can be found in parameters 99.01 and 99.02, respectively._

# APPENDIX A-1 KEYPAD USE

## OPERATIONAL COMMANDS

Operational commands control the operation of the PS200 these include starting and stopping the PS200 and adjusting the setpoint. The Setpoint value is used for controlling the process variable (speed, pressure, flow, level or temperature).
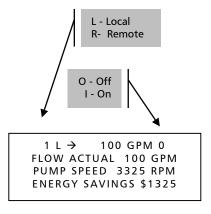
**Figure B - Operational commands of the keypad**



All operational commands such as start, stop and Setpoint can be given pressing the appropriate key on the keypad when the control location is local. This is indicated by an L (Local Control) in the upper left hand corner of the status row.

Remote control is indicated by an R in the upper left hand corner of the status row. This indicates a start/stop command given by an external source such as 2 wire or 3 wire start/stop. When in remote control the Setpoint can be changed from the keypad but the start/stop commands must be given by the external source.

An empty field in the upper left hand corner of the status row indicates external control from an overriding system such as a Digital Communication System. Operational commands cannot be given from the keypad when in external control.

The control is changed between Local and External/Remote control by pressing the LOC/REM key on the keypad.



| L - Local |
| R- Remote |

| O - Off |
| I - On |

```
  1 L →      100 GPM 0
FLOW ACTUAL  100 GPM
PUMP SPEED  3325 RPM
ENERGY SAVINGS $1325
```
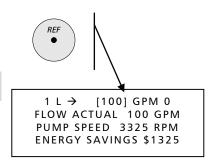
| ⚠ | **WARNING** |
|---|---|

**If the keypad is in remote mode the drive cannot be stopped by the keypad.  An E-Stop should be installed near the PS200 if the external start/stop source is remotely located. Failure to follow these instructions could result in serious personal injury or equipment damage.**

## SETTING THE SETPOINT VIA THE KEYPAD

Press the REF to enter the setpoint setting mode. A bracket appears in the upper right corner of the status row. Use the double arrows for a fast change of the setpoint and the single arrows for a slow change. Once the value is set, press the enter key to enable it (the bracket disappears).

Note the Direction commands (← →) shown on the keypad have been disabled in the PS200 to prevent inadvertent changes in rotation.



```
  1 L →    [100] GPM 0
FLOW ACTUAL  100 GPM
PUMP SPEED  3325 RPM
ENERGY SAVINGS $1325
```

## APPENDIX A-2 FAULT TRACING

# FAULT TRACING

This section explains the PS200 fault tracing procedure using the keypad.

| ⚡ | WARNING |
|---|---|
| | All electrical installation and maintenance work must be undertaken by a qualified electrician only. Failure to do so could result in serious injury or death. |

The PumpSmart PS200 is equipped with advanced protection features that continuously guard the unit against damage and down time due to incorrect operating conditions and electrical and mechanical malfunctions.

All Warning and Fault messages are presented in tables below and include information on the cause and remedy for each case. Most Warning and Fault conditions can be identified and cured with this information. If not, contact an ITT - Goulds Pumps service representative.

*Do not attempt any measurement, parts replacement or other service procedure not described in the installation or programming guide. Such action will void guarantee, endanger correct operation, and increase downtime and expense.*

The Warning message will disappear when any of the keypad keys are pressed. The Warning will reappear in one minute if conditions remain unchanged. If the frequency converter is operated with the keypad detached, the red LED in the keypad mounting platform indicates Fault condition.

### Fault Resetting

An active fault can be reset either by pressing the keypad *RESET* key, by digital input or Fieldbus, or switching the supply voltage off for a while. When the fault has been removed, the motor can be started.

A digital fault reset is available. Refer to the Options and Features section.

| ⚠ | CAUTION |
|---|---|
| | If a start command is present and 25.04 ERROR RESET or 28.01 AUTO RESET TRIALS is set to greater than zero, the PS200 will start immediately after fault reset. If the fault has not been removed, the PS200 will trip again. |

### Fault History

When a Fault is detected, it is stored in the Fault History. The last 64 Faults and Warnings are stored with the time the Fault was detected.

The Fault History can be viewed by pressing ⏶⏷ in the Actual Signal Display Mode. The Fault History can then be scrolled with △▽. To exit the Fault History press ⏶⏷. The Fault History can be cleared by pressing the *RESET* key.

### Fault and Warning Messages

The following Tables show the warning and fault messages.

## APPENDIX A-2 FAULT TRACING

Table A- 1 PS200 Warning Messages

| WARNING | CAUSE | WHAT TO DO |
|---|---|---|
| **AMBIENT TEMP** | I/O Control board temperature is lower than -5°C (23° F) or exceeds 82° C (180° F). | • Check air flow and fan operation. |
| **ACS800 TEMPERATURE** | The PS200 internal temperature is excessive. A warning is given if inverter module temperature exceeds 115 ° C (239° F.) | • Check ambient conditions.<br>• Check air flow and fan operation.<br>• Check heatsink fins for dust pick-up.<br>• Check motor power against unit power. |
| **COND 1 WRN**<br>**COND 2 WRN** | The signal level for General Condition Sensor 1 or 2 has exceeded 23.02/08 COND 1/2 WRN LIM HI or 23.03/23.09 COND 1/2 WRN LIM LO. | • Investigate cause of condition<br>• Check parameter settings of 23.02/08 COND 1/2 WRN LIM HI or 23.03/09 COND 1/2 WRN LIM LO. |
| **COND 1 ALM**<br>**COND 2 ALM** | The signal level for General Condition Sensor 1 or 2 has exceeded 23.05/11 COND 1/2 ALRM LIM HI or 23.06/23.12 COND 1/2 ALRM LIM LO. | • Investigate cause of condition<br>• Check parameter settings of 23.05/11 COND 1/2 ALRM LIM HI or 23.06/12 COND 1/2 ALRM LIM LO. |
| **COMM MODULE**<br>(programmable Fault Function) | Cyclical communication between PS200 and Fieldbus/PS200 Master is lost. The fault function is in use in remote control when the control place used is controlled from communication module. | • Check the status of communication module. See the appropriate Fieldbus Manual.<br>• Check parameter settings of Group 51, 52, 90 & 92.<br>• Check connections between control system and adapter module.<br>• Check if the bus master is not communicating or configured.<br>• Check that parameter 30.01 Fieldbus or Standard Modbus is selected. |
| **COND 1/2 ERR**<br><br>Programmable Function 24.02 | The analog signal at the general condition transmitter(s) has fallen below the allowed value or 3 mA (1.5 V) or has exceeded 20.2 mA (10.1 V) for 2 sec. Activation is dependent upon analog input channel configuration. | • Check for proper analog control signal levels. Refer to Actual Signal Group I (1.18/1.19/1.20) to identify which analog input is affected.<br>• Check the control wiring.<br>• Check if the transmitter is defective. |
| **DC OVERVOLT** | Intermediate circuit DC voltage is excessive. DC overvoltage trip limit is 1.3 • $^U$1max, where $^U$1max is the maximum value of the input power line voltage range. For 400 V units, $^U$ 1max is 415V. For 500 V units, $^U$ 1max is 500 V. The actual voltage in the intermediate circuit corresponding to the input power line voltage trip level is 728 VDC. for 400 V units and 877 VDC for 500 V units. | • Check that the overvoltage controller is on Parameter 25.22.<br>• Check mains for static or transient overvoltages.<br>• Check Braking Chopper and Resistor (if used).<br>• Check deceleration time.<br>• Use Coasting for Stop Function (12.08).<br>• Retrofit the frequency converter with a Braking Chopper and a Braking Resistor. |
| **DC UNDERVOLT** | Intermediate circuit DC voltage is not sufficient. This can be caused by a missing mains phase, a blown fuse or a rectifier bridge internal fault.<br><br>DC undervoltage trip limit is 0.65 • $^U$ 1min, where $^U$ 1min is the minimum value of the mains voltage range. For 400 V and 500 V units, $^U$1 min is 380V. The actual voltage in the intermediate circuit corresponding to the mains voltage trip level is 334 VDC | • Check input power supply and fuses. |
| **DRIVE IS RUNNING DOWNLOADING NOT POSSIBLE** | Downloading is not possible while motor is running. | • Stop the motor. Perform the downloading. |
| **EARTH FAULT**<br>(programmable Fault Function 24.18) | The load on the incoming power distribution system is out of balance. This can be caused by a ground fault in the motor, motor cable or an internal malfunction. | • Check motor.<br>• Check motor cable.<br>• Check there are no power factor correction capacitors or surge absorbers in the motor cable connected to the drive output. |
| **DOWNLOAD FAILED** | Download function of the keypad failed. No data was copied from the Keypad to the PS200. | • Retry (there might be interference on the link). Contact an ABB representative. |
| **DRIVE INCOMPATIBLE DOWNLOADING NOT POSSIBLE** | Program versions in the Keypad and in the PS200 do not correspond. It is not possible to copy data from Keypad to the PS200. | • Check the program versions (see Parameter Group 99 information). |
| **DRY RUN**<br>(programmable Fault Function 25.13) | The pump is operating in a dry running condition (loss of suction). | • Open the suction valve<br>• Check tank level<br>• Check suction line or conditions (debris, clogged strainer, check valve not opened).<br>• Check setting of parameter 25.14 |
| **I/O CONFIG** | Parameter 30.01 is set to "FIELDBUS" but no Fieldbus module has been installed.<br><br>A duplicate analog input configuration has been detected in AI Config parameters 17.20, 17.21 or 17.22. | • Install the Fieldbus module.<br>• Eliminate the AI Config duplication.<br>• The function can be disabled by setting parameter 24.22 to NOT SEL. |

## APPENDIX A-2 FAULT TRACING

| WARNING | CAUSE | WHAT TO DO |
|---|---|---|
| **ID DONE** | The PS200 has performed the motor identification magnetization and is ready for operation.  This warning belongs to the normal start-up procedure. | • Continue drive operation. |
| **ID MAGN** | Motor identification magnetization is on.  This warning belongs to the normal start-up procedure. | • Wait until the drive indicates that motor identification is completed. |
| **ID MAGN REQ** | Motor identification is required.  This warning belongs to the normal start-up procedure. | • To start the ID magnetization:<br>• Press the Start key. |
| **ID NBR CHANGED** | The ID number of the drive has been changed from 1 in Drive Selection Mode (the change is not shown on the display). | • To change the ID number back to 1 go to Drive Selection Mode by pressing DRIVE.  Press ENTER.  Set the ID number to 1.  Press ENTER. |
| **ID RUN FAIL** | The Motor ID Run is not completed successfully. | • Check the maximum speed (Parameter 14.01)  It should be at least 80% of the nominal speed of the motor (Parameter 11.07). |
| **ID RUN SEL** | Motor Identification Run is selected, and the drive is ready to start the ID Run.  This warning belongs to the ID Run procedure. | • Press Start key to start the Identification Run. |
| **ID RUNNING** | Motor Identification Run is on. | • Wait until the drive indicates that Identification Run is completed. |
| **INV OVERLOAD** | Inverter overload condition; i.e., load is higher than 200% of $/_{2hd}$ 2 seconds every 15 second or 150% of $/_{2hd}$ 1 minute every 10 minutes.<br>Indication to the supervisory system is given. | • Check Torque and Current limit settings.<br>• Check ramp time setting (13.01 to 13.02) and Fieldbus RATE signal.<br>• Check brake operation. |
| **KEYPAD FAIL**<br>(programmable Fault Function 24.03) | A Keypad or Drives Window selected as active control location for the PS200 has ceased communicating. | • Check Keypad connector.<br>• Re-insert Keypad mounting platform.<br>• Check Keypad Fail Fault Function parameters.<br>• Check Drives Window connection. |
| **LINK or HWCP** | The fiber optic link to the NINT board is faulty or the change rate of the output current has exceeded the hardware overcurrent limit. | • Check fiber optic cables between NINT and NGDR boards.<br>• Check motor load.<br>• Check acceleration time.<br>• Check motor and motor cable.<br>• Check that there are no power factor correction capacitors or surge absorbers in the motor cable connected to the drive output. |
| **LOCAL CTRL LOSS** | Keypad or Drives Window selected as active control location has ceased communicating. | • Check Keypad connector.<br>• Reinsert Keypad in the mounting platform.<br>• Check Drives Window connection. |
| **LOW DEMAND** | The setpoint value requires regulation below minimum speed. | • Check for closed valve (downstream). |
| **MACRO CHANGE** | Macro is restoring or user Macro is being saved. | • Please wait. |
| **SPEED OVERRIDE** | Speed override function has been enabled.  Either through digital input or Fieldbus. | • Check state of digital input or Fieldbus control word selected in 12.11<br>• Check 12.12 Speed Override Reference is being sent |
| **MIN FLOW**<br>(programmable Fault Function 25.11) | The pump is operating below the safe continuous flow rate. | • Open the discharge check valve<br>• Check discharge line for blockages (debris, check valve not opened).<br>• Check setting of parameter 25.12. |
| **MOTOR PHASE**<br>(programmable Fault Function 24.17) | One of the motor phases is lost.  This can be caused by a fault in the motor, the motor cable, a thermal relay (if used) or an internal fault. | • Check motor and motor cable.<br>• Check thermal relay (if used).<br>• Check MOTOR PHASE Fault Function parameters.  Disable this protection. |
| **MOTOR STALL**<br>(programmable Fault Function 24.11 - 24.13) | Motor is operating in the stall region.  This can be caused by excessive load, locked rotor or insufficient motor power. | • Check if pump shaft has seized.<br>• Check motor load and the PS200 ratings.<br>• Check MOTOR STALL Fault Function parameters. |
| **MOTOR STARTS** | Motor Identification Run starts.  This warning belongs to the IR Run procedure. | • Wait until the drive indicates that motor identification is completed. |
| **MOTOR TEMP**<br>(programmable Fault Function 24.05 … 24.10) | Motor temperature is too high (or appears to be too high).  This can be caused by excessive load, insufficient motor power, inadequate cooling or incorrect start-up data. | • Check motor ratings, load and cooling.<br>• Check start-up data.<br>• Check MOTOR TEMP Fault Function parameters. |

## APPENDIX A-2 FAULT TRACING

| WARNING | CAUSE | WHAT TO DO |
|---|---|---|
| NO COMMUNICATION (X) | Cabling problem or a hardware malfunction on the Panel Link | • Check Panel Link connections.<br>• Press RESET key.  The panel reset may take up to half a minute, please wait. |
|  | (4) = Panel type not compatible with version of the drive application program. | • Check panel type and version of the drive application program.  The panel type is printed on the cover of the panel.  The application program version is stored in parameter 99.01. |
| NO FREE ID NUMBERS ID NUMBER SETTING NOT POSSIBLE | All identification numbers are in use in the Panel Link. | • The amount of stations on the Panel Link is 31.  No additional drives can be connected. |
| NO MTR DATA | Motor data is not given or motor data does not match with inverted data. | • Check the motor data given by Parameters 11.04-11.08.<br>• If using a 3-wire start/stop method change parameter 12.01 to 3-Wire. |
| NO PMP 1 COMM - WARNING | Warning message will display in multi-pump macro when follower pumps (2 – 4) do not receive data from the Master pump within four seconds. | • Check the fiber optic DDCS link at CH 2 is wired properly.<br>• Check that the fiber optic cables are not damaged.<br>• Check that all pumps have been configured for multi-pump operation.<br>• Check for non-functioning keypad(s).<br>• Check for faulty RDCO module. |
| NOT UPLOADED DOWNLOADING NOT POSSIBLE | No upload function has been performed.  It is not possible to download data from the Keypad to the PS200. | • Perform the Upload function.  PS200 Programming Manual. |
| OVERCURRENT | Output current is excessive.  The software overcurrent trip limit 2x Ihd.  Where Ihd is the heavy duty use current of the ACS800. | • Check motor load.<br>• Check acceleration time.<br>• Check motor and motor cable (including phasing).<br>• Check there are no power factor correction capacitors or surge absorbers in the motor cable connected to the drive output. |
| OVERFREQ | Motor is turning faster than the highest allowed speed.  This can be caused by an incorrectly set minimum/maximum speed, insufficient braking torque or changes in the load when using torque reference.<br><br>The trip level is 40 Hz over the operating range absolute maximum speed limit  (Direct Torque Control mode active) or frequency limit (Scalar Control active).  The operating range limits are set by Parameter 14.01 (DTC mode) 14.03 (Scalar mode). | • Check minimum/maximum speed settings.<br>• Check adequacy of motor braking torque.<br>• Check applicability of torque control.<br>• Check the need for a Braking Chopper and Resistor(s). |
| OVERSPEED | Motor is turning faster than the highest allowed speed set with Parameter 14.01 OVERSPEED LIM.  This can be caused by an incorrectly set minimum/maximum speed, insufficient braking torque or changes in the load when using torque reference. | • Check minimum/maximum speed settings.<br>• Check adequacy of motor braking torque.<br>• Check applicability of torque control.<br>• Check if braking chopper and resistor (s) are needed. |
| PARAM LOCK | This message will display when any parameter is attempted to be changed and a password is not entered. | • The user must enter the password and open the parameter lock prior to changing parameters. |
| PPCC LINK | The fiber optic link to the NINT board is faulty. | • Check the fiber optic cables connected to the power plates. |
| PUMP CLOGGED | The number of cleaning sequences has exceeded the value set in parameter 34.17 Sequence Counter and the pump clog has not cleared. | • Run additional cleaning sequences.<br>• Dismantle pump and clean manually. |
| PUMP PROTECT – ALARM OR FAULT<br>Programmable Fault Function 25.01 | The actual process value is lower than protection limit (25.02) for protection delay (25.03) and the PS200 is at max speed (14.01) for the protection delay. | • Open the suction valve.<br>• Open the discharge valve.<br>• Check suction conditions (dry running, low level).<br>• Check suction line for blockages (clogged strainer, debris, check valve not open).<br>• Check discharge line for blockages (debris, check valve not open).<br>• Check if flow rate is excessive (cavitation condition).<br>• Check for operation below minimum flow. |
| EXT SP ERR<br>PROC XT1 ERR<br>PROC XT2 ERR<br>SPD REF ERR<br>SPD OVRRD<br>FLOWMETER<br>SG/TEMP<br>- ALARM OR  FAULT<br>Programmable Fault Function 24.01 | The process transmitter(s) or external setpoint signal value has fallen below 1.5V (AI1) or 3 mA (AI2/3) or has exceeded 10.1V or 20.2 mA for 2 seconds. Activation is dependent upon analog input channel configuration. | • Check for proper analog control signal levels. Refer to Actual Signal Group I (1.18/1.19/1.20) to identify which analog input is affected. Check the control wiring. Check if the transmitter is defective. |
| REPLACE FAN | Running time of the inverter cooling fan has exceeded its estimated life time | • Change the fan.  Reset fan run time counter. |

## APPENDIX A-2 FAULT TRACING

| WARNING | CAUSE | WHAT TO DO |
|---|---|---|
| **RUN DISABLED** | E-Stop/Permissive switch has not been closed | • Reset or enable the E-Stop or permissive switch.<br>• If no E-stop is required, this function may be disabled by wiring DI1L closed inside the drive. See the Appendix A-4, Instrument Wiring, for details. |
| **RUNOUT**<br>Programmable WARNING<br>Function 25.15 | The pump is operating at an excessive flow rate. | • Check if discharge valves are opened excessively<br>• Check system resistance curve<br>• Check setting of parameter 25.16 |
| **SECND PROTECT A**<br>**SECND PROTECT B– ALARM OR FAULT**<br>Programmable Fault Function 25.06 and 25.07 | Loss of digital input 4 (DI4) or digital input 5 (DI5) for protection delay (25.03). | • Instrumentation wired to digital input 4 or 5 (pressure switch, level switch, flow switch, temperature switch., etc) has tripped.<br>• If Level Switch, Pressure Switch or Flow Switch is used at DI4/DI5:<br>  - Open the suction valve.<br>  - Check suction conditions (dry running, low level).<br>  - Check suction line for blockages (clogged strainer, debris, check valve not open).<br>• If Flow Switch is used at DI4/DI5:<br>  - Open the discharge valve.<br>  - Check discharge line for blockages (debris, check valve not open).<br>• If Temperature Switch is used at DI4/DI5:<br>  - Check for excessive process temperature. |
| **SHORT CIRC** | Short circuit in the motor cable or motor.<br><br><br>Output bridge of the inverter is faulty. | • Check the motor and motor cable.<br>• Check that there are no power factor correction capacitors or surge absorbers in the motor cable connected to the drive output.<br>• Consult PumpSmart Applications Group |
| **SLEEP MODE - WARNING**<br>Programmable Function 14.07/14.08 or 23.04/23.10 | If the drive is shutdown by CONFIG SPEED MIN (14.05) (pressure or level control) the drive will SLEEP until the process actual value drops below a set restart value (14.07) for longer than the restart delay (14.08). If operating in inverse mode (21.01) the drive will sleep until the process variable rises above the restart value.<br><br>If the condition signal rises above the HI LIMIT (23.05/23.11) or drops below the LO LIMIT (23.06/23.12)for longer than the response delay (23.13) the drive will sleep until the condition signal rises above the Lo Limit or drops below the Hi Limit. | • Wait until the process actual value drops below the Restart Value or above Restart Value if set to Inverse Mode (21.01).<br>• To disable the Restart Value function enter  "0%".<br>• Wait until the Condition Signal rises above the LO LIMIT (23.06/23.12) plus the RESTART VALUE (14.07) or drops below the HI LIMIT (23.05/23.11) minus the RESTART VALUE. To disable the function set 23.04/23.10 to "DISABLED". |
| **SMARTFLOW NOT CONFIGRD** | Parameter 11.03 Mode select is set to SMARTFLOW and Group 29 SMART FLOW parameters have not been configured. | • Configure Group 29 SMARTFLOW parameters. |
| **START INHIBIT** | Optional start inhibit hardware logic is activated. | • Check the start inhibit circuit (NGPS board). |
| **SUPPLY PHASE** | Intermediate circuit DC voltage is oscillating.  This can be caused by a missing input power line phase, a blown fuse or a rectifier bridge internal fault.<br>A trip occurs when the DC voltage ripple is 13 percent (%) of the DC voltage. | • Check input power line fuses.<br>• Check for mains supply imbalance. |
| **SYNCHRO SPEED** | The value of the motor nominal speed set to parameter 11.07 is not correct. The value is too near the synchronous speed of the motor. The tolerance is 0.1%. | • Check full load speed from motor rating plate and set parameter 11.07 accordingly. |
| **THERMAL MODE** | Motor thermal protection mode is set to DTC for a high-power motor. | • See parameter 24.05. |
| **TUNE FAIL** | The tuning time period has exceeded the automatic shutdown timer. | • Decrease the ramp setting for parameter 13.01. |
| **UNDERLOAD**<br>(programmable Fault Function 24.14 - 24.16) | Motor load is too low.  This can be caused by a release mechanism in the driven equipment. | • Check for a problem in the driven equipment.<br>• Check UNDERLOAD Fault Function parameters. |
| **UPLOAD FAILED** | Upload function of the keypad failed.  No data was copied form the PS200 to the Keypad. | • Retry (there might be interference on the link).  Contact an ITT/Goulds representative. |
| **VFD TEMP** | The PS200 internal temperature is excessive.  The trip level of inverter module temperature is 125° C (257° F). | • Check ambient conditions.<br>• Check air flow and fan operation.<br>• Check heatsink fins for dust pick-up.<br>• Check motor power against unit power. |
| **WRITE ACCESS DENIED PARAMETER SETTING NOT POSSIBLE** | Certain parameters do not allow changes while motor is running.  If tried, no change is accepted, and a warning is displayed.<br><br>Parameter lock is on. | • Stop the motor.  Change the parameter value.<br><br><br>• Open the parameter lock (see Parameter 10.01 PARAMETER LOCK |
| **WRITE PROECT** | Warning message will display if drive is running and certain parameters such as motor data (11.04-11.08) are attempted to be changed. | • In order to change these parameters the PS200 must first be shutdown. |

## APPENDIX A-2 FAULT TRACING

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## APPENDIX A-3 PARAMETER LISTING

# PUMPSMART ACTUAL SIGNALS

| Speed Control | Single Pump | Multi-pump | Group 01 | VFD ACTUAL SIGNALS | Scale | Description |
|---|---|---|---|---|---|---|
| X | X | X | 1.02 | MOTOR SPEED | 20000 = 14.01 Max Spd | Calculated motor speed , RPM |
| X | X | X | 1.03 | MOTOR FREQUENCY | 100 = 1 Hz | Calculated VFD output frequency, Hz |
| X | X | X | 1.04 | MOTOR CURRENT | 10 = 1 A | Measured Motor Current, A |
| X | X | X | 1.05 | MOTOR TORQUE | 10000 = 100% | Calculated Motor Torque, %. 100% is the motor nominal torque |
| X | X | X | 1.06 | MOTOR POWER | 1000 = 100% | Motor Power, %. 100% is the motor nominal power |
| X | X | X | 1.07 | DC BUS VOLTAGE | 1 = 1V | Measured intermediate circuit voltage, V |
| X | X | X | 1.08 | MAINS VOLTAGE | 1 = 1V | Calculated supply voltage, V |
| X | X | X | 1.09 | MOTOR VOLTAGE | 1 = 1V | Calculated motor voltage, V |
| X | X | X | 1.10 | VFD TEMP | 1 = 1 Deg C | VFD Temp, Deg C |
| X | X | X | 1.14 | OP HRS SINCE RST | 1 = 1Hr | Elapsed time counter; runs when the RMIO board is powered, Hrs (since last reset). Re-settable by parameter 26.05. |
| X | X | X | 1.15 | KWH SINCE RST | 1 = 100 KWH | kWh counter, kWh (since last reset). Re-settable by parameter 26.05. |
| X | X | X | 1.17 | DI7-1 STATUS | | Status of digital inputs. Example: 1000000= DI 1L is on, DI1-DI6 are off |
| X | X | X | 1.18 | AI1[V] | 1 = 0.001 V | Value of analog input 1, V |
| | X | X | 1.19 | AI2[MA] PROC FDBK | 1 = 0.001 mA | Value of analog input 2, mA |
| X | X | X | 1.20 | AI3[MA] | 1 = 0.001 mA | Value of analog input 3, mA |
| X | X | X | 1.21 | RO3-1 STATUS | | Status of relay outputs. Example: 0000001=RO1 is energized, RO2 & RO3 are de-energized |
| X | X | X | 1.22 | AO1[MA] | 1 = 0.001 mA | Value of analog output 1, mA |
| X | X | X | 1.23 | AO2[MA] | 1 = 0.001 mA | Value of analog output  2, mA |
| X | X | X | 1.37 | MOTOR TEMP EST | 1 = 1 Deg C | Estimated motor temperature, Deg C |
| X | X | X | 1.43 | MOTOR RUN TIME | 1 = 10 Hrs | Motor run time counter, Hrs (since last reset). The counter runs when the inverter modulates. Re-settable by parameter 26.05. |
| X | X | X | 1.44 | FAN ON-TIME | 1 = 10 Hrs | Fan Operating hrs. Resettable by parameter 145.13 if fan is replaced. |
| X | X | X | 1.45 | PMP CLN RUN TIME | 1 = 10 Hrs | Run timer for the pump cleaning sequence when run time is selected in 34.02 REQ P CLEAN SEQ. Resets to zero after a stop command and after completion of a cleaning sequence. |

| Speed Control | Single Pump | Multi-pump | Group 02 | PUMP ACTUAL SIGNALS | Scale | Description |
|---|---|---|---|---|---|---|
| | X | X | 2.01 | Flow Ref | 1 = 1 unit | Setpoint for flow control (if parameter 15.01AI2 UNIT is Gpm, M3/hr, Kg/hr, lbm/sec or lbm/min) |
| | X | X | 2.02 | Flow Actual | 1 = 1 unit | Actual flow feedback (if parameter 15.01AI2 UNIT is Gpm, M3/hr,Kg/hr, lbm/sec or lbm/min) |
| | X | X | 2.03 | Press Ref | 1 = 1 unit | Setpoint used for pressure or level control (if parameter 15.01AI2 UNIT is Psig, Bar, M, Ft, In or Cm) |
| | X | X | 2.04 | Press Actual | 1 = 1 unit | Actual pressure or level feedback (if parameter 15.01AI2 UNIT is Psig, Bar, M,  Ft, In or Cm) |
| | X | X | 2.05 | Process Temp Ref | 1 = 1 unit | Setpoint used for temperature control (if parameter 15.01AI2 UNIT is F deg or C deg) |
| | X | X | 2.06 | Process Temp Act | 1 = 1 unit | Actual temperature feedback (if parameter 15.01AI2 UNIT is F deg or C deg) |
| X | X | X | 2.07 | Pump Speed | 1 = 1 Rpm | Actual speed of motor, Rpm |
| | X | X | 2.08 | Specific Gravity | 1000 = 1 | Specific Gravity of pumped liquid. |
| X | X | X | 2.09 | Wire to Water Power | 10 = 1 Unit | Overall kW includes pump, motor and VFD, |
| X | X | X | 2.10 | Setpoint #1 | 1= 1 Unit | Setpoint #1; unit determined by parameter 15.01AI2 UNIT |
| X | X | X | 2.11 | Setpoint #2 | 1 = 1 Unit | Setpoint #2; unit determined by parameter 15.01AI2 UNIT |
| X | X | X | 2.12 | Energy Savings | 1 = 1 Unit | Calculated PS200 savings (option 1 or 2) since last reset. Savings are compared to conventional system ($ or Euro). Re-settable by parameter 26.05. |
| X | X | X | 2.15 | Condition Lvl #1 | 100 = 1 Unit | Condition level  in units selected |
| X | X | X | 2.16 | Condition Lvl #2 | 100 = 1 Unit | Condition level  in units selected |
| X | X | X | 2.17 | Proc XT2 | 10 = 1 Unit | Current value of Process Transmitter 2 (Multivariable Control Feature) |
| X | X | X | 2.19 | SMARTFLOW | 10 = 1 Unit | Internal flow calculation. Units are GPM for English(Am) and M3/Hr for all other languages. |
| X | X | X | 2.20 | FLOW ECONOMY | 10 = 1 Unit | A relative measure of pumping efficiency. Equal to flow/wire – water power (KW). |

## APPENDIX A-3 PARAMETER LISTING

| Speed Control | Single Pump | Multi-pump | Group 03 | STATUS WORDS | Description |
|---|---|---|---|---|---|
| x | x | x | 3.01 | Main Ctrl Word | Digital communication Control Word as received from control system |
| x | x | x | 3.02 | Main Status Word | Drive status word that is issued to control system |
| x | x | x | 3.03 | Aux Status Word | Not Used PS200 Logic |
| x | x | x | 3.04 | Limit Word 1 | Not Used PS200 Logic |
| x | x | x | 3.05 | Fault Word 1 | Drive Fault Words |
| x | x | x | 3.06 | Fault Word 2 | Drive Fault Words |
| x | x | x | 3.07 | System Fault | System Fault Words |
| x | x | x | 3.08 | Alarm Word 1 | Drive Alarm Words |
| x | x | x | 3.09 | Alarm Word 2 | Drive Alarm Words |
| x | x | x | 3.10 | PS Alarm Words | PumpSmart Pump Protection Alarms |
| x | x | x | 3.11 | PS Condition Words | PumpSmart condition monitoring words |

| Group 03 Parameter | STATUS WORD BIT | NAME | VALUE | Description |
|---|---|---|---|---|
| 3.01 MAIN CTRL WORD | 0 | Reserved | | |
| | 1 | ENABLE | 1 | Enabled |
| | | | 0 | Coast to stop |
| | 2 | Reserved | | |
| | 3 | START/STOP | 1 | Start |
| | | | 0 | Stop according to parameter 12.08 STOP FUNCTION |
| | 4 | Reserved | | |
| | 5 | Reserved | | |
| | 6 | Reserved | | |
| | 7 | Reserved | | |
| | 8 | RESET FAULT | 0→1 | Reset drive / pump fault |
| | 9 - 12 | Reserved | | |
| | 13 | SPEED OVERRIDE | 0 | Speed Override Disabled |
| | | | 1 | Speed Override Enabled |
| | 14 - 15 | Reserved | | |

| Group 03 Parameter | STATUS WORD BIT | NAME | VALUE | Description |
|---|---|---|---|---|
| 3.02 MAIN STATUS WORD | 0 | READY | 1 | Ready to start |
| | | | 0 | Initializing or initializing error |
| | 1 | ENABLE | 1 | Enabled |
| | | | 0 | Coast to stop |
| | 2 | Reserved | | |
| | 3 | RUNNING | 1 | Running with selected Setpoint |
| | | | 0 | Stopped |
| | 4 | Reserved | | |
| | 5 | REMOTE | 1 | Drive in remote mode |
| | | | 0 | Drive in local mode |
| | 6 | Reserved | | |
| | 7 | AT_SETPOINT | 1 | Drive at Setpoint |
| | | | 0 | Drive not at Setpoint |
| | 8 | FAULTED | 1 | A fault is active |
| | | | 0 | No faults active |
| | 9 | WARNING | 1 | A warning is active |
| | | | 0 | No warning are active |
| | 10 | LIMIT | 1 | Drive at a limit |
| | | | 0 | Drive not at a limit |
| | 11-15 | Reserved | | |

## APPENDIX A-3 PARAMETER LISTING

| Group 03 Parameter | STATUS WORD BIT | NAME | Description |
|---|---|---|---|
| 3.05 FAULT WORD 1 | 0 | SHORT CIRCUIT | For possible causes and remedies, refer to the section FAULT TRACING |
| | 1 | OVERCURRENT | |
| | 2 | DC OVERVOLT | |
| | 3 | ACS800 TEMP | |
| | 4 | EARTH FAULT | |
| | 5 | THERMISTOR | |
| | 6 | MOTOR TEMP | |
| | 7 | SYSTEM_FAULT | |
| | 8 | UNDERLOAD | |
| | 9 | OVERFREQ | |
| | 10-15 | Reserved | |

| Group 03 Parameter | STATUS WORD BIT | NAME | Description |
|---|---|---|---|
| 3.06 FAULT WORD 2 | 0 | SUPPLY PHASE | For possible causes and remedies, refer to the section FAULT TRACING |
| | 1 | NO MOTOR DATA | |
| | 2 | DC UNDERVOLT | |
| | 3 | Reserved | |
| | 4 | RUN DISABLED | For possible causes and remedies, refer to the section FAULT TRACING |
| | 5 | ENCODER FLT | |
| | 6 | I/O COMM | |
| | 7 | CTRL B TEMP | |
| | 8 | EXTERNAL FLT | |
| | 9 | OVER SWFREQ | |
| | 10 | AI<MIN FUNC | |
| | 11 | PPCC LINK | |
| | 12 | COMM MODULE | |
| | 13 | PANEL LOSS | |
| | 14 | MOTOR STALL | |
| | 15 | MOTOR PHASE | |

| Group 03 Parameter | STATUS WORD BIT | NAME | Description |
|---|---|---|---|
| 3.08 ALARM WORD 1 | 0 | START INHIBIT | For possible causes and remedies, refer to the section FAULT TRACING |
| | 1 | PUMP CLOGGED | |
| | 2 | THERMISTOR | |
| | 3 | MOTOR TEMP | |
| | 4 | ACS800 TEMP | |
| | 5 | ENCODER ERR | |
| | 6 | T MEAS ALM | |
| | 7-11 | Reserved | |
| | 12 | COMM MODULE | For possible causes and remedies, refer to the section FAULT TRACING |
| | 13 | Reserved | |
| | 14 | EARTH FAULT | |
| | 15 | Reserved | |

## APPENDIX A-3 PARAMETER LISTING

| Group 03 Parameter | STATUS WORD BIT | NAME | Description |
|---|---|---|---|
| 3.09 ALARM WORD 2 | 0 | Reserved | For possible causes and remedies, refer to the section FAULT TRACING |
| | 1 | UNERLOAD | For possible causes and remedies, refer to the section FAULT TRACING |
| | 2-3 | Reserved | |
| | 4 | ENCODER | For possible causes and remedies, refer to the section FAULT TRACING |
| | 5-6 | Reserved | |
| | 7 | PWFAIL FILE | Error in restoring POWERFAIL.ddf |
| | 8 | ALM (OS_17) | Error in restoring POWERDOWN.ddf |
| | 9 | MOTOR STALL7121 | For possible causes and remedies, refer to the section FAULT TRACING |
| | 10 | AI<MIN FUNC | |
| | 11-12 | Reserved | |
| | 13 | PANEL LOSS | For possible causes and remedies, refer to the section FAULT TRACING |
| | 14-15 | Reserved | |

| Group 03 Parameter | STATUS WORD BIT | NAME | Description |
|---|---|---|---|
| 3.10 PS ALARM WORDS | 0 | PUMP PROTECT WARN | For possible causes and remedies, refer to the section FAULT TRACING |
| | 1 | SLEEP WARNING | |
| | 2 | DRY RUN WARNING | |
| | 3 | MIN FLOW  WARNING | |
| | 4 | RUNOUT FLOW WARNING | |
| | 5 | TUNING WARNING | |
| | 6 | VFD FAULT/WRNG | |
| | 7 | COND 1  WARN | |
| | 8 | COND 1 ALARM/FAULT | |
| | 9 | CONDI 2 WARN | |
| | 10 | COND 2 ALARM/FAULT | |
| | 11 | SPEED OVERRIDE | |
| | 12 | TX/AI ERR | |
| | 13 | SECONDARY PRTCT A WARN | |
| | 14 | SECONDARY PRTCT B WARN | |
| | 15 | RUN DISABLED | |

| Group 03 Parameter | STATUS WORD BIT | NAME | Description |
|---|---|---|---|
| 3.11 PS ALARM WORDS | 0 | MIN FLOW FAULT | For possible causes and remedies, refer to the section FAULT TRACING |
| | 1 | DRY RUN FAULT | |
| | 2 | NOT USED | |
| | 3 | TUNING FAULT | |
| | 4 | COND 1 WARN | |
| | 5 | COND 1 ALARM/FAULT | |
| | 6 | COND 2 WARN | |
| | 7 | COND 2 ALARM/FAULT | |
| | 8 | SECONDARY PRTCT A FAULT | |
| | 9 | SECONDARY PRTCT B FAULT | |
| | 10 | PUMP PROTECT FAULT | |
| | 11 | VFD FAULT/WRNG | |
| | 12 | LOW DEMAND FAULT | |
| | 13 | NO PUMP 1 COM | |
| | 14 | MOTOR TEMP | |
| | 15 | START DELAY | |

## APPENDIX A-3 PARAMETER LISTING

# PUMPSMART CONFIGURATION PARAMETERS

The following pages detail the parameters most commonly used for the configuration of your PumpSmart system. Basic configuration parameters may be accessed using the passcode 358 entered into parameter 10.02 PASS CODE. More advanced parameters are shown with asterisks (**) following the parameter ID and may be accessed using the passcode 564.

| Speed Control | Single Pump | Multi-pump | Group 10 | LOCKS/PASSWORDS | Description |
|---|---|---|---|---|---|
| X | X | X | 10.01 | PARAMETER LOCK | Selects the state of the parameter lock. The lock prevents parameters from being changed. |
| | | | | OPEN | The lock is open. Parameter values can be changed. |
| | | | | LOCKED [default] | Parameter values cannot be changed from the keypad. The lock can be opened by entering the valid password in parameter 10.02. When the keypad is locked the PS200 keypad functionality is limited to starting, stopping and changing the setpoint. |
| X | X | X | 10.02 | PASS CODE | Password setting 358 opens the lock and returns the value to zero on the display. The password relocks when power is disconnected. Range = 0 -30000. To re-lock the keypad reset parameter 10.01 to "Locked". |
| X | X | X | 10.03 | LOCAL LOCK | Disables local control on the keypad. **Warning** - Before activating, ensure that the control panel is not needed for stopping the drive. |
| | | | | OFF [default] | Local control allowed |
| | | | | ON | Local control disabled |
| X | X | X | 10.04 | PARAMETER SAVE | Saves the parameter values to the permanent memory. |
| | | | | DONE [default] | Parameters entered via the keypad are automatically saved. Parameters are not automatically saved when altered through the Fieldbus connection. |
| | | | | SAVE | Used for manually saving parameters that have been altered through the Fieldbus connection. |

# APPENDIX A-3 PARAMETER LISTING

| Speed Control | Single Pump | Multi-pump | Group 11 | START UP DATA | Description |
|---|---|---|---|---|---|
| | | | | LANGUAGE | Selects the display language |
| | | | | ENGLISH | British English. If selected the unit of power is kW. |
| | | | | ENGLISH (AM) *[default]* | American English. If selected the unit of power is hp. |
| | | | | DEUTSCH | German (full translation) |
| | | | | ITALIANO | Italian (full translation) |
| | | | | ESPANOL | Spanish (full translation) |
| | | | | PORTUGUES | Portuguese (full translation) |
| X | X | X | 11.01 | NEDERLANDS | Dutch (partial translation) |
| | | | | FRANCAIS | French (full translation) |
| | | | | DANSK | Danish (partial translation) |
| | | | | SUOMI | Finnish (partial translation) |
| | | | | SVENSKA | Swedish (partial translation) |
| | | | | CESKY | Czech (partial translation) |
| | | | | POLSKI | Polish (partial translation) |
| | | | | PO - RUS | Russian (partial translation) |
| | | | | APPLICATION MACRO | Selects the application macro |
| | | | | SINGLE PUMP *[default]* | One PS200 regulating to a setpoint |
| X | X | X | 11.02 | MULTI PUMP | Backup or two to four PS200's regulating to a setpoint |
| | | | | SPEED CONTRL | PS200 follows a speed Setpoint only. Pump protect (25.01)fault function is inactive. |
| | | | | MODE SELECT | Sets the control parameter. Pre-selects default values for parameters 13.01 – 13.06. Not applicable to the Speed Ctrl macro. |
| | | | | PRESSURE (DEFAULT) | Control parameter is Pressure. |
| | X | X | 11.03 | FLOW | Control parameter is Flow. |
| | | | | LEVEL | Control parameter is Level. |
| | | | | TEMPERATURE | Control parameter is Temperature. |
| | | | | SMARTFLOW | Control parameter is  SMARTFLOW. |
| X | X | X | 11.04 | MOTOR NOM VOLTAGE | Defines the motor voltage. Equal to the value on the motor nameplate. Selections are: 460VAC– 60Hz (default), 220VAC-50Hz, 208VAC-60Hz, 220VAC-60Hz, 230VAC-60Hz, 380VAC-50Hz, 415VAC-50Hz, 575VAC-60Hz and Other. |
| X | X | X | 11.05 | MOTOR NOM CURRENT | Defines the motor current. Equal to the value on the motor nameplate. |
| | | | | MOTOR NOM FREQ | Visible only if  "Other" is selected in 11.04. Defines the motor nominal frequency. Equal to the value on the motor nameplate. |
| | | | | 60 HZ | Nominal frequency is 60 Hz – This parameter is automatically populated by selection in 11.04. If  "Other" is selected in 11.04 user makes manual selection for 11.06. |
| X | X | X | 11.06 | 50 HZ | Nominal frequency is 50 Hz - This parameter is automatically populated by selection in 11.04. If  "Other" is selected in 11.04 user makes manual selection for 11.06. |
| | | | | 40 HZ | Nominal frequency is 40 Hz. If  "OTHER" is selected in 11.04 user makes manual selection for 11.06. |
| X | X | X | 11.07 | MOTOR FL RPM | Defines the motor FL speed. Equal to the value on the motor nameplate. |
| X | X | X | 11.08 | MOTOR NOMINAL POWER | Defines the motor power (hp). Equal to the value on the nameplate. |
| X | X | X | 11.09 ** | MOTOR CTRL MODE | Default is DTC. Other Options is Scalar |
| | | | | MOTOR ID RUN | Selects the type of motor identification. During the identification, the drive will identify the characteristics of the motor for optimum motor control. |
| | | | | NO *[default]* | Default ID Run style. Motor will not rotate during ID MAGN. |
| X | X | X | 11.10 ** | STD | Best ID run for accuracy. Motor must be uncoupled.  Motor does rotate at full speed for approximately 1 minute. Not available if parameter 11.09 MOTOR CTRL MODE is SCALAR. |
| | | | | REDUCED | Alternate ID run if motor is coupled.  Motor does rotate at partial speed for approximately 1 minute. Not available if parameter 11.09 MOTOR CTRL MODE is SCALAR |

# APPENDIX A-3 PARAMETER LISTING

| Speed Control | Single Pump | Multi-pump | Group 11 | START UP DATA | Description |
|---|---|---|---|---|---|
| | | | | APPLIC RESTORE | Restores the original defaults of the application macro |
| X | X | X | 11.11** | NO [default] | No restoring |
| | | | | YES | Restoring |
| X | X | X | 11.12 | OTHER MOTOR VOLT | Visible if "Other" is selected in 11.04. The User inputs the voltage value. |
| | | | | CTRL BOARD SUPPLY | Defines the source of the control board power |
| X | X | X | 11.13** | INTERNAL 24 [default] | Uses internal power supply for control board |
| | | | | EXTERNAL 24 | Optional control board powering method. |

| Speed Control | Single Pump | Multi-pump | Group 12 | START/STOP | Description |
|---|---|---|---|---|---|
| | | | | START/STOP | Defines the connections and source of the start/stop commands |
| | | | | 2 WIRE DI1 (DEFAULT) | Start/Stop through DI1. 0 = stop, 1 = start. After a fault reset, the drive will restart only if auto restart (12.02) is set to on. If auto restart is off the start signal must be removed and reapplied. External control location 1 only. |
| | | | | 3 W DI1P,2P | Pulse start through digital input DI1. 0>1: Start. Pulse stop through digital input 2 DI2. 1>0: Stop. External control location 1 only. |
| | | | | HOA DI1,2 | Used for Hand-Off-Auto DI1 activates Auto and DI2 activates the Hand function. External control location 1 only. |
| | | | | HOA DI1,2 – DI5 | Toggles between two external control locations via digital input 3. HOA is external location 1. Auto is assigned to DI1 and Hand is assigned to DI2. 2 wire start/stop is assigned to DI5 external location 2 (25.07 Secondary Protect B cannot be set to other than disabled when this selection is made and vice versa ). |
| X | X | X | 12.01 | DI1P,2P – DI5 | Toggles between two external control locations via digital input 3. 3 Wire (external location 1) is assigned to DI1 (pulse start) and DI2 (pulse stop). 2 wire start/stop (external location 2) is assigned to DI5 (25.07 Secondary Protect B cannot be set to other than disabled when this selection is made and vice versa ). |
| | | | | HOA DI1,2 – FB | Toggles between two external control locations via digital input 3. HOA is external location 1. Auto is assigned to DI1 and Hand is assigned to DI2. Start via fieldbus (external location 2) control word. |
| | | | | 2W DI1 - 2W DI5 | Toggles between two external control locations via digital input 3. 2W (ext control location 1) is assigned to DI1 and 2 W (external control location 2) is assigned to DI5 |
| | | | | FIELDBUS | Start via fieldbus control word. External control location 1 only |
| | | | | DI1P,2P – FB | Toggles between two external control locations via digital input 3. DI1P,2P (3W) is external location 1. Start via fieldbus (external location 2) control word. |
| | | | | AUTO RESTART | Selects whether the PS200 will automatically restart after a power failure. |
| X | X | X | 12.02 | OFF [default] | Not selected |
| | | | | ON | Selected. The PS200 will automatically restart if conditions permit. Be sure that parameter 24.03 KEYPAD FAILURE is not set to "FAULT". |
| | | | | STOP FUNCTION | Selects how the motor should stop during normal shutdown. |
| X | X | X | 12.08 | RAMP [default] | Pump shuts down using the ramp rate defined in 13.02 DECEL TIME |
| | | | | COAST | Power is cut immediately to motor allowing it to coast to a stop. |
| | | | | MOTOR JOG | Jogs motor for 10 sec @ 60 rpm to check for motor rotation. |
| X | X | X | 12.09 | DISABLED [default] | Motor jog is not active. |
| | | | | JOG | Jogs motor for 10 sec at 60 rpm. After jog is complete this parameter setting returns to disabled. |
| | | | | START DELAY | Once a start command is given the start delay will energize a relay which can be used to turn-on an auxiliary lubrication system or other aux equipment prior to starting the motor. Once the start delay has expired the PS200 will start the motor. The start delay does not function in local control. |
| X | X | X | 12.10 | 0 -9999 SEC | Default = 0. |

# APPENDIX A-3 PARAMETER LISTING

| Speed Control | Single Pump | Multi-pump | Group 12 | START/STOP | Description |
|---|---|---|---|---|---|
| X | X | X | 12.11 | SPEED OVERRIDE | When active selects between PID control and Speed Control. |
| | | | | DISABLED (DEFAULT) | PID control mode is active. |
| | | | | DI5 | Activates speed override mode via a digital input 5. |
| | | | | DI5(INV) | Activates speed override mode via a digital input 5 inverse operation. |
| | | | | DI3 | Activates speed override mode via a digital input 3. Note if DI3 is selected to activate the speed override mode and parameter 12.01 is set to toggle between two external control locations (via DI3) both functions work simultaneously. |
| | | | | DI3(INV) | Activates speed override mode via a digital input 3 inverse operation. Note if DI3 is selected to activate the speed override mode and parameter 12.01 is set to toggle between two external control locations (via DI3) both functions work simultaneously. |
| | | | | HOA | Activates speed override mode via digital input 2 hand function. Note HOA must be configured as a start/stop method in parameter 12.01. |
| | | | | FIELDBUS | A fieldbus control word is used to activate the speed override mode. PS alarm word 3.10 bit 11 is set. Fieldbus is selected by Bit 13 of the Main Command Word. |
| X | X | X | 12.12 | SPD OVERRIDE REF | Defines the location of the override speed reference |
| | | | | AI1 | Selects analog input 1 as the override speed reference.  17.20 must be set to SPD OVRRD. |
| | | | | AI3 | Selects analog input 3 as the override speed reference.  17.22 must be set to SPD OVRRD. |
| | | | | KEYPAD (DEFAULT) | Selects the keypad as the speed reference |
| | | | | FIELDBUS | Selects fieldbus as the speed reference set by Main Ref 1. |
| X | X | X | 12.13 | SPD OVRD DFLT SP | Default setpoint for Speed override invoked when the PS200 is placed into Speed Override from zero speed (not running). Note If Speed Override is activated while the drive is running the speed setpoint is the current operating speed. It can then be adjusted up/down using the keypad buttons. This parameter applies to a Keypad setting only for parameter 12.12. |
| | | | | 0 – 3600 RPM | Initial default is 14.02 Min Speed. |
| X | X | X | 12.14 | SP OVRRD PMP PROT | Selects if pump protection warnings and faults (23.02,23.03,23.05,23.06, 23.08, 23.09,23.11,23.12, 24.01, 25.01, 25.06, 25.07, 25.11, 25.13 and 25.15) are enabled or disabled when speed override is activated. Will not override an E-Stop/Permissive function. |
| | | | | ENABLED (DEFAULT) | Pump protection is enabled |
| | | | | DISABLED | Pump protection is disabled |

## APPENDIX A-3 PARAMETER LISTING

| Speed Control | Single Pump | Multi-pump | Group 13 | RAMPS | Description |
|---|---|---|---|---|---|
| X | X | X | 13.01 | ACCEL TIME | Defines the fast acceleration time (Range = 0 – 1800 sec). Default = 5 sec. Pre-populated by setting of 11.03 MODE SELECT. |
| X | X | X | 13.02 | DECEL TIME | Defines the fast deceleration time (Range = 0 – 1800 sec). Default = 5 sec. Pre-populated by setting of 11.03 MODE SELECT. |
| | X | X | 13.03 | P-GAIN | Defines the proportional gain for the PID regulator (range 0.00 – 100.00). Defaults based on control modes are Pressure= 0.3, Flow= 0.2, SmartFlow =0.2, Level/Temperature= 5. Pre-populated by setting of 11.03 MODE SELECT. |
| | X | X | 13.04 | I-TIME | Defines the integral time for the PID regulator (range 0.00 – 320.00). Defaults based on control modes are Pressure= 1.25, Flow= 1.75, SmartFlow = 2.25, Level/Temperature= 320. Pre-populated by setting of 11.03 MODE SELECT. |
| | X | X | 13.05** | D-TIME | Defines the derivation time of the PID regulator (range = 0 – 10 sec). Default = 0 deactivates the "D" time |
| | X | X | 13.06** | PID DERIV FILTER | Defines the constant of the filter used to smooth the derivation component of the process PID regulator (range = 0.04 – 10 sec). Default is 1 sec. |
| | X | X | 13.07** | PID INTEGRATION | Activates the integration function of the PID regulator. Choices are 'ON" (default) and "OFF". |
| | X | X | 13.08 | CONTROL PARAM | Defines what the PID manipulated variable is in the drive. |
| | | | | SPEED (DEFAULT) | Speed is the manipulated variable in the PID regulator. |
| | | | | TORQUE | Torque is the manipulated variable in the PID regulator. |

| Speed Control | Single Pump | Multi-pump | Group 14 | SPD LIM/STRT LVL | Description |
|---|---|---|---|---|---|
| X | X | X | 14.01 | MAXIMUM SPEED | Defines the allowable maximum speed. Default setting is parameter 11.07 MOTOR FL RPM. |
| X | X | X | 14.02 | MINIMUM SPEED | Defines the minimum speed range. Default setting is 25% of parameter 11.07 MOTOR FL RPM. |
| X | X | X | 14.03 | MAXIMUM FREQUENCY | Defines the maximum allowable frequency when operating in scalar mode. This parameter is not shown unless parameter 11.09 MOTOR CTRL MODE is set to SCALAR. Default setting is parameter 11.06 MOTOR NOM FREQ. |
| X | X | X | 14.04 | MINIMUM FREQUENCY | Defines the minimum allowable frequency when operating in scalar mode. This parameter is not shown unless parameter 11.09 MOTOR CTRL MODE is set to SCALAR. Default setting is 25% of parameter 11.06 MOTOR NOM FREQ. |
| X | X | X | 14.05 | CONFIG SPEED MIN | Defines the reaction of the drive when the PS200 tries to regulate at a speed at or below 14.02 MINIMUM SPEED. |
| | | | | SPD = MINSPD | The PS200 will stay at this speed until the transient clears or unit is manually shutdown; unless a fault occurs. |
| | | | | SPD = 0 [default] | The drive will stay at minimum speed until 14.06 STP DELAY MIN SPD times-out and then it will shutdown. |
| | X | X | 14.06 | STP DELAY MIN SPD | The time period the drive will stay at 14.05 MINIMUM SPEED before stopping. Range = 0 –1800 sec. (Default is 5 sec). Functions when 14.05 is set to SPD=0. Becomes active if setpoint would result in regulation below min speed, closed valve condition in pressure control and Secondary Protect A & B. |
| X | X | X | 14.07 | RESTART VALUE | If the drive is shutdown by 14.05 CONFIG SPEED MIN due to no system demand (pressure/level control only) the drive will sleep until the process actual value drops below a set 14.07 RESTART VALUE for longer than 14.08 RESTART DELAY. If operating in inverse mode (21.01) the drive will sleep until the process variable rises above the restart value. Wake-up level in % of setpoint value = 0 – 500%. To disable the Restart Value function in both normal and inverse settings enter "0%". Defaults: Regulation Mode Normal = 90%, Regulation Mode Inverse =110%. |
| | X | X | 14.08 | RESTART DELAY | Time delay for 14.07 RESTART VALUE. Range = 0 –1800 sec. Default = 1 second |
| X | X | X | 14.09 | PRIMING DELAY | Setting range is 0-6000 sec. When the drive is starting from 0 RPM this parameter delays pump protection faults (23.04, 23.10, 25.01, 25.06, 25.07, 25.11,25.13, 25.15) for the setting time. Default is "0". Once the priming delay time is complete, 25.03 PROTECTION DELAY becomes functional. During the priming delay the pump runs at 14.01 MAXIMUM SPEED since it cannot achieve the setpoint. |

## APPENDIX A-3 PARAMETER LISTING

| Speed Control | Single Pump | Multi-pump | Group 14 | SPD LIM/STRT LVL | Description |
|---|---|---|---|---|---|
| X | | | 14.10 | CRITICAL SPEED 1 | Value range: 0-9999 Rpm. Default is "0". If setting of CRITICAL SPEED 1 = "0" then the Critical Speed functionality is disabled. |
| X | | | 14.11 | CRITICAL SPEED 2 | Value range: 0-9999 rpm. Default is "0". If setting of CRITICAL SPEED 2 = "0" then the Critical Speed functionality is disabled. |
| X | | | 14.12 | NCR WIDTH | Value Range: 0-1000 Rpm.  Default is "0". This is the total critical speed bandwidth (½ above and ½ below) of the value set for Critical Speed 1 and 2. If the setpoint falls in the critical speed zone the drive runs at a setpoint just above or below the critical speed envelope if slowing down or ramping up to the setpoint, respectively. |

| Speed Control | Single Pump | Multi-pump | Group 15 | PROCESS VAR UNIT | Description |
|---|---|---|---|---|---|
| X | X | X | 15.01 | AI2 UNIT<br>RPM<br>%<br>HZ<br>BAR<br>GPM<br>PSIG [default]<br>M3/HR<br>FT<br>M<br>F DEG<br>C DEG<br>IN<br>CM | Selects the units (default is pressure) for the primary process transmitter feedback located at AI2. In speed control macro default unit is rpm. |
| X | X | X | 15.02 | AI1 UNIT<br>NONE [default]<br>RPM<br>%<br>HZ<br>BAR<br>GPM<br>PSIG<br>M3/HR<br>FT<br>M<br>F DEG<br>C DEG<br>IN<br>CM<br>IN/SEC<br>MM/SEC | Selects the units for  transmitter feedback at AI1 (when used). |
| X | X | X | 15.03 | AI3 UNIT<br>NONE [default]<br>RPM<br>%<br>HZ<br>BAR<br>GPM<br>PSIG<br>M3/HR<br>FT<br>M<br>F DEG<br>C DEG<br>IN<br>CM<br>IN/SEC<br>MM/SEC | Selects the units for transmitter feedback at AI3 (when used). |

# APPENDIX A-3 PARAMETER LISTING

| Speed Control | Single Pump | Multi-pump | Group 16 | SETPOINT SELECT | Description |
|---|---|---|---|---|---|
| | | | | SET1/SET2 SELECT | Defines the source from which the drive reads the signal that selects the setpoint. |
| X | X | X | 16.01 | SETPOINT 1 [default] | Setpoint 1 is being used only |
| | | | | DI3 | Digital Input 3 selects setpoint 1 or setpoint 2. 0pen = Setpoint 1, Closed = Setpoint 2 |
| | | | | FIELDBUS | The setpoint is sent via Fieldbus control word. |
| | | | | SETPOINT 1 SELECT | Selects the signal source for Setpoint1. |
| X | X | X | 16.02 | KEYPAD [default] | The setpoint is selected from the keypad |
| | | | | ANALOG INPUT | The setpoint is selected by an analog input (AI1, AI2 or AI3). |
| | | | | FIELDBUS | The setpoint is selected via Fieldbus control word |
| X | X | X | 16.03 | AI2 MAX | For single pump and multi-pump macros this parameter defines the full-scale feedback (20 mA setting) of the primary process transmitter at AI2. This parameter also correlates to the maximum value of Setpoint(s) 1 and 2. For the Speed Control macro this parameter scales the maximum (20 mA or keypad) Spd Ctrl Ref setting. Note when units are in Ft, M, In or Cm: AI2 Max is always based on a specific gravity = 1. Actual pressure signals in Ft, M, In or Cm are corrected for specific gravity by the firmware. Signal is linear only. |
| X | X | X | 16.04 | AI2 MIN | For single pump and multi-pump macros this parameter defines the value (normally zero) of the 4 mA setting for the primary process transmitter at AI2. This parameter also correlates to the minimum value of Setpoint(s) 1 and 2. For the Speed Control macro this parameter scales the value (normally zero) of the (4 mA or keypad) Spd Ctrl Ref setting. Note when units are in Ft, M, In or Cm: AI2 Min is always based on a specific gravity = 1. Actual pressure signals in Ft, M, In or Cm are corrected for specific gravity by the firmware. Signal is linear only. |
| | | | | SETPOINT 2 SELECT | Selects the signal source for Setpoint1 (setpoint #2) |
| X | X | X | 16.05 | KEYPAD [default] | The setpoint is selected from the keypad |
| | | | | ANALOG INPUT | The setpoint is selected by an analog input (AI1, AI2 or AI3). |
| | | | | FIELDBUS | The setpoint is selected via Fieldbus control word |
| X | X | X | 16.06 | AI1 MAX | Defines the full scale value for a 10 VDC/20 mA signal when a Condition Transmitter, Spd Ovrd, Spd Ctrl Ref, Ext Setpt, SG/Temp, Flowmeter (used for Advanced Pump Protection, Primary Process Transmitter(alternate location when configured in 17.20) or Second Process Transmitter are used at AI1. Note when units are in Ft, M, In or Cm: AI1 Max is always based on a specific gravity =1. Actual pressure signals in Ft, M, In or Cm are corrected for specific gravity by the firmware. Signal can be linear only. |
| X | X | X | 16.07 | AI1 MIN | Defines the minimum value for a 2 VDC/4 mA signal when a Condition Transmitter, Spd Ovrd, Spd Ctrl Ref, Ext Setpt, SG/Temp, Flowmeter (used for Advanced Pump Protection, Primary Process Transmitter(alternate location when configured in 17.20) or Second Process Transmitter are used at AI1. Note when units are in Ft, M, In or Cm: AI1 Min is always based on a specific gravity =1. Actual pressure signals in Ft, M, In or Cm are corrected for specific gravity by the firmware. Signal can be linear only. |
| X | X | X | 16.08 | AI3 MAX | Defines the full scale value for a 20 mA signal when a Condition Transmitter, Spd Ovrd, Spd Ctrl Ref, Ext Setpt, SG/Temp, Flowmeter (used for Advanced Pump Protection, Primary Process Transmitter (alternate location when configured in 17.22)) or Second Process Transmitter is used at AI3. Note when units are in Ft, M, In or Cm: AI3 Max is always based on a specific gravity =1. Actual pressure signals in Ft, M, In or Cm are corrected for specific gravity by the firmware. Linear signal only. |
| X | X | X | 16.09 | AI3 MIN | Defines the minimum value for a 4 mA signal when a Condition Transmitter, Spd Ovrd, Spd Ctrl Ref, Ext Setpt, SG/Temp, Flowmeter (used for Advanced Pump Protection, Primary Process Transmitter(alternate location when configured in 17.22) or Second Process Transmitter are used at AI3. Note when units are in Ft, M, In or Cm: AI3 Min is always based on a specific gravity =1. Actual pressure signals in Ft, M, In or Cm are corrected for specific gravity by the firmware. Linear signal only. |

# APPENDIX A-3 PARAMETER LISTING

| Speed Control | Single Pump | Multi-pump | Group 16 | SETPOINT SELECT | Description |
|---|---|---|---|---|---|
| X | X | | 16.10 | LOCAL REF SELECT | Selects the reference to be controlled in local control. Allows the operator to control to a keypad reference when in local control (including starting/stopping the drive from the keypad) or when switched to remote mode the reference looks at parameters 16.01, 16.02 and 16.05 for the reference and the 12.01 start method. If parameter 11.09 is set to DTC units are rpm; if Scalar units are Hz. |
| | | | | SPEED RPM/HZ | Uses a keypad speed reference when in local control. Applicable to Single Pump and Speed Control. When switching from remote to local control the current operating speed is used as the reference. The switch between remote and local control can be made while the unit is running or not. |
| | | | | PROC VAL (DEFAULT) | Sets the reference based on parameters 15.01 AI2 Units, 16.03 AI2 Max and 16.04 AI2 Min and sends the reference based on settings for 16.01, 16.02 and 16.05. For single pump the reference is in PID units for Speed Control the reference is Rpm/Hz.  With this selection the reference (setpoint) origin and units are the same as in remote mode. |

## APPENDIX A-3 PARAMETER LISTING

| Speed Control | Single Pump | Multi-pump | Group 17 | ANALOG INPUTS | Description |
|---|---|---|---|---|---|
| | | | | MINIMUM AI1 | Defines the minimum value for analog input AI1. |
| | | | | 0VDC | Do not use. A 0VDC signal will activate a Sensor Failure fault function unless 24.01 and 24.02 are disabled. |
| | | | | 2VDC *[default]* | 2VDC is selected as the minimum value |
| X | X | X | 17.05 | TUNED VALUE | Select tuned value after the tune function has been completed. This will select the tuned value for the minimum value of AI1. |
| | | | | TUNE | This parameter sets the minimum value of the signal to be applied to AI1. When tune is selected and enter is pressed the tuned value for AI1 is set to the actual AI1 value when the tune function was activated. This function is useful for zeroing out any system hysteresis. |
| | | | | MAXIMUM AI1 | Defines the maximum value for analog input AI1. |
| | | | | 10VDC *[default]* | Maximum scaled setting is at 10 VDC |
| X | X | X | 17.06** | TUNED VALUE | Select tuned value after the tune function has been completed. This will select the tuned value for the maximum value of AI1. |
| | | | | TUNE | This parameter sets the maximum value of the signal to be applied to AI1. When TUNE is selected and ENTER is pressed the tuned value for AI1 is set to the actual AI1 value when the tune function was activated. This function is useful for zeroing out any system hysteresis. |
| X | X | X | 17.07 ** | SCALE AI1 | Scales AI1. Default = 100% |
| X | X | X | 17.08** | FILTER AI1 | Defines the filter time constant for AI1. Default is 0.1 sec. Note the signal is also filtered due to the signal interface hardware (10ms time constant). This cannot be changed by any parameter. |
| | | | | INVERT AI1 | Activates/deactivates the inversion of analog input signal AI1. |
| | | | | NO | No inversion |
| X | X | X | 17.09** | YES | Inversion is active. The maximum value of the analog input signal (10V/20 mA) corresponds to AI1 MIN (16.07) and the minimum value of the analog input signal (2V/4mA) corresponds to AI1 MAX (16.06) |
| | | | | MINIMUM AI2 | Defines the value for analog input AI2. |
| | | | | 0 MA | Do not use. A 0-mA signal will activate a Sensor Failure fault function unless 24.01 and 24.02 are disabled. |
| | | | | 4 MA *[default]* | 4 mA is selected as the minimum value |
| X | X | X | 17.10 | TUNED VALUE | Select tuned value after the tune function has been completed. This will select the tuned value for the minimum value of AI2. |
| | | | | TUNE | This parameter sets the minimum value of the signal to be applied to AI2. When tune is selected and enter is pressed the tuned value for AI2 is set to the actual AI2 value when the tune function was activated. This function is useful for zeroing out any system hysteresis. |
| | | | | MAXIMUM AI2 | Defines the maximum value for analog input AI2. |
| | | | | 20 MA *[default]* | Maximum scaled setting is at 20 MA |
| X | X | X | 17.11** | TUNED VALUE | Select tuned value after the tune function has been completed. This will select the tuned value for the maximum value of AI2. |
| | | | | TUNE | This parameter sets the maximum value of the signal to be applied to AI2. When TUNE is selected and ENTER is pressed the tuned value for AI2 is set to the actual AI2 value when the tune function was activated. This function is useful for zeroing out any system hysteresis. |
| X | X | X | 17.12** | SCALE AI2 | Scales AI2. Default = 100% |
| X | X | X | 17.13** | FILTER AI2 | Defines the filter time constant for AI2. Default is 0.1 sec. Note the signal is also filtered due to the signal interface hardware (10ms time constant). This cannot be changed by any parameter. |
| | | | | INVERT AI2 | Activates/deactivates the inversion of analog input signal AI2. |
| | | | | NO | No inversion |
| X | X | X | 17.14** | YES | Inversion is active. The maximum value of the analog input signal (20 mA) corresponds to 16.04 AI2 MIN and the minimum value of the analog input signal (4mA) corresponds to 16.03 AI2 MAX |
| | | | | MINIMUM AI3 | Defines the value for analog input AI3. |
| | | | | 0 MA | Do not use. A 0-mA signal will activate a Sensor Failure fault function unless 24.01 and 24.02 are disabled. |
| | | | | 4 MA *[default]* | 4 mA is selected as the minimum value. |
| X | X | X | 17.15 | TUNED VALUE | Select tuned value after the tune function has been completed. This will select the tuned value for the minimum value of AI3. |
| | | | | TUNE | This parameter sets the minimum value of the signal to be applied to AI3. When tune is selected and enter is pressed the tuned value for AI3 is set to the actual AI3 value when the tune function was activated. This function is useful for zeroing out any system hysteresis. |

## APPENDIX A-3 PARAMETER LISTING

| Speed Control | Single Pump | Multi-pump | Group 17 | ANALOG INPUTS | Description |
|---|---|---|---|---|---|
| X | X | X | 17.16** | MAXIMUM AI3 | Defines the maximum value for analog input AI3. |
| | | | | 20 MA *[default]* | Maximum scaled setting is at 20 MA |
| | | | | TUNED VALUE | Select tuned value after the tune function has been completed. This will select the tuned value for the maximum value of AI3. |
| | | | | TUNE | This parameter sets the maximum value of the signal to be applied to AI3. When TUNE is selected and ENTER is pressed the tuned value for AI3 is set to the actual AI3 value when the tune function was activated. This function is useful for zeroing out any system hysteresis. |
| X | X | X | 17.17** | SCALE AI3 | Scales AI3. Default = 100% |
| X | X | X | 17.18** | FILTER AI3 | Defines the filter time constant for AI3. Default is 0.1 sec. Note the signal is also filtered due to the signal interface hardware (10ms time constant). This cannot be changed by any parameter. |
| X | X | X | 17.19** | INVERT AI3 | Activates/deactivates the inversion of analog input signal AI3. |
| | | | | NO | No inversion |
| | | | | YES | Inversion is active. The maximum value of the analog input signal (20 mA) corresponds to 16.09 AI3 MIN and the minimum value of the analog input signal (4mA) corresponds to 16.08 AI3 MAX |
| X | X | X | 17.20 | AI1 CONFIG | Defines the configuration for AI1 |
| | | | | PROC TRANS 2 | Used with Multivariable control. |
| | | | | PROC TRANS 1 | Alternate source for the primary process transmitter (single pump and multi-pump macros) where AI2 becomes unusable. The units for 15.01 and transmitter scaling 16.06 AI1 Max and 16.07 AI1 Min must also be set. |
| | | | | EXT SETPOINT | Used when fixed or variable setpoint is sent via an external source in single pump or multi-pump. |
| | | | | CONDITION 1 | Used when Condition 1 is selected |
| | | | | CONDITION 2 | Used when Condition 2 is selected |
| | | | | SPD CTRL REF | Used in Speed Macro when an external speed reference is present. |
| | | | | FLOWMETER | Used when a flowmeter is selected for use with Advanced Pump Protection, |
| | | | | SG /TEMP | Used if setting SG directly using an analog input, or if using a temperature transmitter for SG calculation |
| | | | | SPD OVRD | Used when setting a speed override reference |
| | | | | NOT USED | AI1 not used (Default) |
| X | X | X | 17.21 | AI2 CONFIG | Defines the configuration for AI2 |
| | | | | PROC TRANS 1 | Default setting for single pump and multipump |
| | | | | SPD CTRL REF | Used in speed macro when an external speed reference is present. |
| | | | | NOT USED | AI2 not used (default for speed macro) |
| X | X | X | 17.22 | AI3 CONFIG | Defines the configuration for AI3. |
| | | | | PROC TRANS 1 | Alternate source for the primary process transmitter (single pump and multi-pump macros) where AI2 becomes unusable. The units for 15.03 and transmitter scaling 16.08 AI3 Max and 16.09 AI3 Min must also be set. |
| | | | | SPD CTRL REF | Used in Speed Macro when an external speed reference is present. |
| | | | | CONDITION 1 | Used when Condition 1 is selected |
| | | | | CONDITION 2 | Used when Condition 2 is selected |
| | | | | PROC TRANS 2 | Used with Multivariable control. |
| | | | | EXT SETPOINT | Used when fixed or variable setpoint is sent via an external source in single pump or multi-pump. |
| | | | | FLOWMETER | Used when a flowmeter is selected for use with Advanced Pump Protection, |
| | | | | SG /TEMP | Used if setting SG directly using an analog input, or if using a temperature transmitter for SG calculation |
| | | | | SPD OVRD | Used when setting a speed override reference |
| | | | | NOT USED | AI3 not used (Default) |

# APPENDIX A-3 PARAMETER LISTING

| Speed Control | Single Pump | Multi-pump | Group 19 | RELAY OUTPUTS | Description |
|---|---|---|---|---|---|
| | | | | RELAY RO# OUTPUT | Selects the PS200 status to be indicated through relay output 1, 2 or 3 (RO1, RO2, RO3). The relay energizes when the status meets the setting. Relay warnings are reset automatically, faults must be manually reset (unless reset by 25.04 ERROR RESET). |
| | | | | READY (DEFAULT 19.01) | The output indicates that power is supplied to the drive and it is awaiting a start command. |
| | | | | RUNNING (DEFAULT 19.04) | The output indicates the drive is running. |
| | | | | VFD FLTS/WRNGS | A VFD related warning or fault has occurred (includes Keypad fault). Not active for a process or condition sleep. |
| | | | | PUMP FLTS/WRNGS | A general pump related warning or fault has occurred e.g. Pump Protect, Low Demand, Secondary Pump Protect A or B, Condition 1 or 2 fault, Min Flow fault, Dry Run fault, Runout warning or Process or Condition Sensor fault. Not active for a process or condition sleep. |
| | | | | ALL FLTS/WRNGS | Both VFD and pump related warning or faults are identified |
| | | | | SECND PRTECT A | The Secondary Protection A warning or fault function has been activated. DI4 is low for the Protection Delay (25.03) setting. closed = normal, open = Secondary Protect A fault function is active. |
| | | | | SECND PRTECT B | The Secondary Protection B warning or fault function has been activated. DI5 is low for the Protection Delay (25.03) setting. closed = normal, open = Secondary Protect B fault function is active. |
| | | | | PUMP PROTECT | The pump protection (25.01, 25.11, 25.13, 25.15) or Low Demand warning or fault function has been activated. A Speed Override warning by digital input (see parameter 12.11) shall not activate this setting. |
| | | | | HI CONDITION 1 | Condition 1 has exceeded the limit (23.02 or 23.05) for the 23.13 condition response delay or longer. |
| X | X | X | 19.01 19.04 19.07 | HI CONDITION 2 | Condition 2 has exceeded the limit (23.08 or 23.11) for the 23.13 condition response delay or longer. |
| | | | | LO CONDITION 1 | Condition 1 is below the limit (23.03 or 23.06) for the 23.13 condition response delay or longer. |
| | | | | LO CONDITION 2 | Condition 2 is below the limit (23.09 or 23.12) for the 23.13 condition response delay or longer. |
| | | | | LOC/REM | Relay changes state when the drive is switched to remote operation |
| | | | | PROC TX ERR | The process transmitter ProcTX1, Proc TX2, Spd Ctrl Ref, Flowmeter, SG/Temp or Ext Setpoint has been triggered by 24.01. If warnings clear relay resets; faults require manual reset. |
| | | | | START DELAY | The 12.10 Start Delay function has been enabled. |
| | | | | SLEEP | The drive is in a Sleep state awaiting a demand change |
| | | | | SPEED OVERRIDE | The drive has been placed in Speed Override by digital input (see parameter 12.11) |
| | | | | RUN DISABLED | The Run Disable switch has not been closed or jumpered |
| | | | | FAULT (DEFAULT 19.07) | Relay energizes for any pump or VFD fault condition. This setting does not include warnings. |
| | | | | FAULT (INV) | Relay is energized during non-fault conditions and de-energizes for any pump or VFD fault condition.. This setting does not include warnings. |
| | | | | PCS REQ | A pump cleaning sequence has been requested. The relay remains energized until the completion of the cleaning sequence. |
| | | | | PCS EXE | A pump cleaning sequence is being executed. The relay remains energized until the completion of the cleaning sequence. |
| | | | | PUMP CLOGGED | The pump is clogged. The number of cleaning sequences has exceeded the value set in the 34.17 SEQUENCE COUNTER. |
| X | X | X | 19.02** | RO1 TON DELAY | Defines the operation delay for relay output RO1. Setting Range 0-3600 sec. Default =0 sec. |
| X | X | X | 19.03** | RO1 TOFFDELAY | Defines the release delay for relay output RO1. Setting Range 0-3600 sec. Default =0 sec. |
| X | X | X | 19.05** | RO2 TON DELAY | Defines the operation delay for relay output RO2. Setting Range 0-3600 sec. Default =0 sec. |
| X | X | X | 19.06** | RO2 TOFFDELAY | Defines the release delay for relay output RO2. Setting Range 0-3600 sec. Default =0 sec. |
| X | X | X | 19.08** | RO3 TON DELAY | Defines the operation delay for relay output RO3. Setting Range 0-3600 sec. Default =0 sec. |
| X | X | X | 19.09** | RO3 TOFFDELAY | Defines the release delay for relay output RO3. Setting Range 0-3600 sec. Default =0 sec. |

# APPENDIX A-3 PARAMETER LISTING

| Speed Control | Single Pump | Multi-pump | Group 20 | ANALOG OUTPUTS | Description |
|---|---|---|---|---|---|
| X | X | X | 20.01 | ANALOG OUTPUT 1 | Connects a PS200 signal to analog output 1 (AO1) |
| | | | | +.002.007.000 (DEFAULT PUMP SPEED) <br><br> C  00000 (NOT USED) | Uses pointers to select an analog output e.g.: [+001.002.000] is motor speed. Inversion field is always + for analog signals. Bit field (last 3 digits are always 000 for analog signals. The constant value setting [C  00000] sets a constant value in mA but is not used for PumpSmart analog outputs. |
| X | X | X | 20.02** | INVERT AO1 | Inverts the AO1 signal. The analog signal is at the minimum level when the indicated drive signal is at its maximum level and vice versa.  (Default = No) |
| X | X | X | 20.03** | MINIMUM AO1 | Defines the minimum value of AO1. Default = 4 mA |
| X | X | X | 20.04** | FILTER AO1 | Defines the filtering time constant for AO1 Range is 0 – 10000. Default = 100 which represents 0.1 sec. |
| X | X | X | 20.05** | SCALE AO1 | Scales AO1 signal. Default values are Speed (parameter 14.01 Max speed value), Torque (10000), Power (1000), Current (10 x parameter 11.05) Energy Savings (10000). All other scaling default to 1 and must be manually set. Energy savings uses scale setting of 10000 = $10,000. |
| X | X | X | 20.06 | ANALOG OUTPUT 2 | Connects a PS200 signal to analog output 2 (AO2) ) |
| | | | | +.001.004.000 (DEFAULT MOTOR CURRENT) <br><br> C  00000 (NOT USED) | Uses pointers to select an analog output e.g.: [+001.002.000] is motor speed. Inversion field is always + for analog signals. Bit field (last 3 digits are always 000 for analog signals. The constant value setting [C  00000] sets a constant value in mA but is not used for PumpSmart analog outputs. |
| X | X | X | 20.07** | INVERT AO2 | Inverts the AO2 signal. The analog signal is at the minimum level when the indicated drive signal is at its maximum level and vice versa. (Default = No) |
| X | X | X | 20.08** | MINIMUM AO2 | Defines the minimum value of AO2. Default = 4 mA |
| X | X | X | 20.09** | FILTER AO2 | Defines the filtering time constant for AO2. Range is 0 – 10000. Default = 100 which represents 0.1 sec. |
| X | X | X | 20.10** | SCALE AO2 | Scales AO2 signal. Default values are Speed (parameter 14.01 Max speed value), Torque (10000), Power (1000), Current (10 x parameter 11.05) Energy Savings (10000). All other scaling default to 1 and must be manually set. Energy savings uses scale setting of 10000 = $10,000. |

## APPENDIX A-3 PARAMETER LISTING

| Speed Control | Single Pump | Multi-pump | Group 21 | REG/MULTVAR | Description |
|---|---|---|---|---|---|
| | X | X | 21.01 | REGULATION MODE | Selects the type of PS200 control with falling process variable signal. |
| | | | | NORMAL [default] | Increases the output speed with falling process variable signal. For level control applications the tank is on the discharge side. |
| | | | | INVERSE | Decreases the output speed with falling process variable signal. For level control applications the tank is on the suction side. |
| X | X | X | 21.02 | MULTIVAR CTL | Selects the PS200 Multivariable Control feature. Utilizes one auxiliary process transmitter to offset the setpoint. |
| | | | | OFF [default] | Disables Multivariable control |
| | | | | ON | Multivariable control is active |
| X | X | X | 21.03 | LEVEL 1 | Process Transmitter 2 low value offset @ Level 1. Below this value is where offset begins for TX2. Units are selected in Group 15.<br>*Default =0*<br>*Range= 0-9999* |
| X | X | X | 21.04 | SPT LO | Setpoint corresponding to the Lo Intercept. For single pump and multi-pump units are as selected in AI2. For Speed Control unit is RPM.<br>*Default = 0*<br>*Range: ±20,000 rpm for speed control. Applicable PID units for single pump and multi-pump.* |
| X | X | X | 21.05 | LO INTRCPT | This is the Process Transmitter 2 value that SPT LO is given for (at Level 1). Units are selected in Group 15.<br>*Default = 0,*<br>*Range: 0 – 9999* |
| X | X | X | 21.06 | LEVEL 2 | Process Transmitter 2 high value offset @ Level 2. Above this value is where offset begins for TX2. Units are selected in Group 15.<br>*Default = 100*<br>*Range: 0 – 9999* |
| X | X | X | 21.07 | SPT HI | Setpoint corresponding to the Hi Intercept. For single pump and multi-pump units are as selected in AI2. For Speed Control unit is RPM.<br>*Default = 0*<br>*Range: ±20,000 rpm for speed control. Applicable PID units for single pump and multi-pump.* |
| X | X | X | 21.08 | HI INTRCPT | This is the Process Transmitter 2 value that SP HI is given for (at Level 2). Units are selected in Group 15.<br>*Default = 0*<br>*Range: 0 – 9999* |
| | X | X | 21.09 | PRESS INCR SPEED | Sets the speed for which additional pressure is added to compensate for system frictional losses at increased flow. Setting range = 0 –3600 rpm. Used for single pump and backup modes only. Default = 1200 Rpm. |
| | X | X | 21.10 | PRESS INCR % | The amount, in % of setpoint, which is added to the setpoint to compensate for frictional losses with increases in speed. Setting range = 0 – 100%. Used for single pump and backup modes only. Note the full setpoint increase (%) is achieved at maximum speed (14.01). Default = 0. |

# APPENDIX A-3 PARAMETER LISTING

| Speed Control | Single Pump | Multi-pump | Group 22 | MULTIPUMP CTRL | Description |
|---|---|---|---|---|---|
| | | X | 22.01 | MODE | Selects how multiple PS200 units operate together to satisfy the setpoint. |
| | | | | SYNCHRONOUS [default] | Lag pumps start as needed and all pumps regulate to the setpoint at the same speed. Note: it is recommended that all pumps be identical. |
| | | | | BACKUP | This is similar to single pump control but automatically starts the backup unit if the primary unit fails. Parameters 22.02 – 22.06 and 22.08 - 22.12 are nonfunctional with "Backup". Note parameters 21.01 through 21.10 are functional with "Backup". |
| | | X | 22.02 | VALUE DECREASE | Defines how much the setpoint can drop before the next lag pump is started. Setting range = 0 – 100% of setpoint. Used for synchronous control only. Default = 5%. |
| | | X | 22.03 | VALUE INCREASE | Defines the increase in setpoint when a lag pump starts. This value is cumulative with each lag pump that turns on. Setting range = 0 – 100% of setpoint. Used for synchronous control only. The default setting for 22.03 is equal to the value set in 22.02. Default = 5%. |
| | | X | 22.04 | STAGE 2 | Selects the control parameter value at which lag pump 1 should be turned on. Setting range = 0 – 100% of parameter 14.01 MAXIMUM SPEED (13.08 set for Speed) or 0-100% of MOTOR NOM TORQUE (13.08 set for Torque). Applies to synchronous. Default is 98% |
| | | X | 22.05 | STAGE 3 | Selects the control parameter value at which lag pump 2 should be turned on. Setting range = 0 – 100% of parameter 14.01 MAXIMUM SPEED (13.08 set for Speed) or 0-100% of MOTOR NOM TORQUE (13.08 set for Torque). Applies to synchronous. Default is 98% |
| | | X | 22.06 | STAGE 4 | Selects the control parameter value at which lag pump 3 should be turned on. Setting range = 0 – 100% of parameter 14.01 MAXIMUM SPEED (13.08 set for Speed) or 0-100% of MOTOR NOM TORQUE (13.08 set for Torque). Applies to synchronous. Default is 98% |
| | | X | 22.07 | SWITCH LEAD | Defines the time the lead unit will run before a new unit is deemed the lead unit. Note if set to zero the switching function is disabled (including switching during a fault). Setting range 0 – 10,000 hrs. Default setting is 48 hrs. |
| | | X | 22.08 | PROOF TIME | Time in which conditions for staging / destaging must occur before pump is actually staged or destaged. Stage value and value decrease or Destage value must be met. |
| | | | | 0 – 360 SEC | Default is 20 seconds. |
| | | X | 22.09 | DESTAGE 2 | Selects the control parameter value at which lag pump 1 should be turned off. Setting range = 0 – 100% of parameter 14.01 MAXIMUM SPEED (13.08 set for Speed) or 0-100% of MOTOR NOM TORQUE (13.08 set for Torque). Applies to synchronous. Default is 75% |
| | | X | 22.10 | DESTAGE 3 | Selects the control parameter value at which lag pump 2 should be turned off. Setting range = 0 – 100% of parameter 14.01 MAXIMUM SPEED (13.08 set for Speed) or 0-100% of MOTOR NOM TORQUE (13.08 set for Torque). Applies to synchronous. Default is 85%. |
| | | X | 22.11 | DESTAGE 4 | Selects the control parameter value at which lag pump 3 should be turned off. Setting range = 0 – 100% of parameter 14.01 MAXIMUM SPEED (13.08 set for Speed) or 0-100% of MOTOR NOM TORQUE (13.08 set for Torque). Applies to synchronous. Default is 92% |
| | | X | 22.12 | MIN PUMPS ON | Defines the minimum number of pumps which are to be running when demand is present and a start command is issued. Default =1, Range = 1-4. Applies to Synchronous Control only. |
| | | X | 22.13 | PUMP ADDRESS | Defines the pump address for multi-pump systems. Address range = 1 –4 where address 1 is designated as the master. |
| | | X | 22.14** | M/F COMM L DELAY | The time delay before a M/F Comm Loss is declared. Default = 4 sec. This parameter cannot be changed. |
| | | X | 22.15** | CH2 COM LOS CTRL | Defines the reaction of the drive in the event a fiber-optic communication loss occurs. Access using pass code 564. |
| | | | | COAST STOP [default] | Pump stops, coast stop. |
| | | | | RAMP STOP | Pump stops, ramp stop. |
| | | | | AUTO CTRL | Pumps operate similar to single pump mode and regulate to set point. Not valid if using 22.17 TX ONE MASTER. Do not use in 22.01 BACKUP mode |
| | | | | LAST SPEED | Pumps run at average speed during last minute of operation. Can be used with 22.17 TX one master setting. |

# APPENDIX A-3 PARAMETER LISTING

| Speed Control | Single Pump | Multi-pump | Group 22 | MULTIPUMP CTRL | Description |
|---|---|---|---|---|---|
| | | X | 22.16 | MANUAL SWITCH | Selections are DISABLED *[default]*, 1, 2, 3 and 4. Manual switch of lead-lag pumps; after manual switch occurs this parameter returns to disabled. Manual switch shall function through the master keypad. |
| | | | | TX CONFIG | Applies to Synchronous Control and Backup only. Defines if lag pumps have their own transmitter. |
| | | | | TX ALL DRIVES | Default when parameter 11.03 MODE SELECT is set to pressure. Each pump has its own transmitter. This selection can be used for pressure control only. |
| | | X | 22.17 | TX ONE AI | Default when parameter 11.03 MODE SELECT is set for level, flow or temperature. Only one transmitter is used. The transmitter must be wired in series to the other drives. Parameters 22.04 – 22.11 function normally. Can be used for all selections in parameter 11.03 MODE SELECT. |
| | | | | TX ONE MASTER | Used for pressure, level, flow or temperature where one transmitter is used. The transmitter signal is transmitted via fiber optic cables to other drives. Parameters 22.04 – 22.11 function normally. |

| Speed Control | Single Pump | Multi-pump | Group 23 | CONDITION SETUP | Description |
|---|---|---|---|---|---|
| X | X | X | 23.01 | COND 1 SOURCE | Defines the location of the Condition 1 signal to monitor.  Selectable choices can either be an analog input AI1, AI3, or it can be from the following actual signal from Groups 1 or 2: 1.02- 1.06, 1.10-1.15, 1.43, 2.04, 2.06 and 2.17. |
| X | X | X | 23.02 | COND1 WRN LIM HI | Range is 0 – 9999. This is the High Warning Limit. Units are selected in Group 15 or defined by the drive actual signal selected in Parameter 23.01. Transmitter scaling is set in Group 16.  The PS200 generates a warning message "COND 1 WARNING" when the COND 1 signal is greater then the WARN LIMIT HI for longer than the response delay. No further action is taken unless relay outputs are configured. COND 1 WARNING is only activated when a value greater then 0 is entered. Default is 0 which disables Hi Limit function. |
| X | X | X | 23.03 | COND1 WRN LIM LO | Range is ±9999. This is the Low Warning Limit. Units are selected in Group 15 or defined by the drive actual signal selected in parameter 23.01. Transmitter scaling is set in Group 16.  The PS200 generates a warning message "COND 1 WARNING" when the COND 1 signal is less then the WARN LIMIT LO for longer than the response delay. No further action is taken unless relay outputs are configured. COND 1 WARNING is only activated when a value greater then 0 is entered. Default is 0  which disables Lo Limit function. |
| | | | | COND 1 ALARM | The COND 1 signal meets the COND 1 alarm setting for longer than the response delay. |
| | | | | DISABLED (DEFAULT) | Protection is inactive. |
| | | | | ALARM ONLY | The PS200 generates an alarm message "COND 1 ALARM" when the COND 1 signal is greater then the COND 1 ALARM LIMIT HI or less then the COND 1 ALARM LIMIT LO for longer than the response delay.  No further action is taken unless relay outputs are configured. |
| X | X | X | 23.04 | MIN SPD | The PS200 drops to 14.02 Minimum Speed if the COND 1 signal is greater then the COND 1 ALARM LIMIT HI or less then the COND 1ALARM LIMIT LO for longer than the response delay. If at any time the COND 1 signal rises above the ALARM LIMIT LO or drops below the ALARM LIMIT HI the PS200 will resume normal operation. The PS200 generates an alarm message "COND 1 ALARM". If the alarm condition does not reset itself after the 23.10 MIN SPD STP DLY expires the PS200 will fault. Relay Outputs are activated if configured. |
| | | | | SLEEP | The PS200 goes to 0 speed if the COND 1 signal is greater than the COND 1ALARM LIMIT HI or less then the COND 1 ALARM LIMIT LO for longer than the response delay.  If at any time the COND 1 signal rises above the ALARM LIMIT LO or drops below the ALARM LIMIT HI the PS200 based on the 14.07 restart value will start and resume normal operation.  The PS200 generates a alarm message "COND 1 ALARM" and "SLEEP" Warning. |
| | | | | FAULT | The PS200 faults if the COND 1 signal is greater than the COND 1 ALARM LIMIT HI or less then the COND 1ALARM LIMIT LO for longer than the response delay.  The PS00 generates a fault message "COND 1 FAULT". |
| X | X | X | 23.05 | COND1 ALRM LIM HI | Range is 0 – 9999. This is the ALARM LIMIT HI value. Default is 0 which disables Hi Limit function. units are selected in Group 15 or defined by the drive actual signal selected in parameter 23.01. Transmitter scaling is set in Group 16.  COND 1 ALARM LIMIT HI is not active if set to 0. |

# APPENDIX A-3 PARAMETER LISTING

| Speed Control | Single Pump | Multi-pump | Group 23 | CONDITION SETUP | Description |
|---|---|---|---|---|---|
| X | X | X | 23.06 | COND1 ALRM LIM LO | Range is ±9999. This is the COND 1ALARM LIMIT LO value. Default is 0 which disables Lo Limit function. Units are selected in Group 15 or defined by the drive actual signal selected in parameter 23.01. Transmitter scaling is set in Group 16. ALARM LIMIT LO is not active if set to 0. |
| X | X | X | 23.07 | COND 2 SOURCE | Defines the location of the Condition 2 signal to monitor. Selectable choices can either be an analog input AI1, AI3, or it can be from the following actual signal from Groups 1 or 2: 1.02- 1.06, 1.10-1.15, 1.43, 2.04, 2.06 and 2.17. |
| X | X | X | 23.08 | COND2 WRN LIM HI | Range is 0 – 9999. This is the High Warning Limit. Units are selected in Group 15 or defined by the drive actual signal selected in Parameter 23.07. Transmitter scaling is set in Group 16. The PS200 generates a warning message "COND 2 WARNING" when the COND 2 signal is greater then the WARN LIMIT HI for longer than the response delay. No further action is taken unless relay outputs are configured. COND 2 WARNING is only activated when a value greater then 0 is entered. Default is 0 which disables Hi Limit function. |
| X | X | X | 23.09 | COND2 WRN LIM LO | Range is ±9999. This is the Low Warning Limit. Units are selected in Group 15 or defined by the drive actual signal selected in parameter 23.07. Transmitter scaling is set in Group 16. The PS200 generates a warning message "COND 2 WARNING" when the COND 2 signal is less then the WARN LIMIT LO for longer than the response delay. No further action is taken unless relay outputs are configured. COND 2 WARNING is only activated when a value greater then 0 is entered. Default is 0 which disables Lo Limit function |
| X | X | X | 23.10 | COND 2 ALARM | The COND 2 signal meets the COND 2 alarm setting for longer than the response delay. |
| | | | | DISABLED (DEFAULT) | Protection is inactive. |
| | | | | ALARM ONLY | The PS200 generates an alarm message "COND 2 ALARM" when the COND 2 signal is greater then the COND 2 ALARM LIMIT HI or less then the COND 2 ALARM LIMIT LO for longer than the response delay. No further action is taken unless relay outputs are configured. |
| | | | | MIN SPD | The PS200 drops to 14.02 Minimum Speed if the COND 2 signal is greater then the COND 2 ALARM LIMIT HI or less then the COND 2ALARM LIMIT LO for longer than the response delay. If at any time the COND 2 signal rises above the ALARM LIMIT LO or drops below the ALARM LIMIT HI the PS200 will resume normal operation. The PS200 generates an alarm message "COND 2 ALARM". If the alarm condition does not reset itself after the 23.10 MIN SPD STP DLY expires the PS200 will fault. Relay Outputs are activated if configured. |
| | | | | SLEEP | The PS200 goes to 0 speed if the COND 2 signal is greater than the COND 2 ALARM LIMIT HI or less then the COND 2 ALARM LIMIT LO for longer than the response delay. If at any time the COND 2 signal rises above the ALARM LIMIT LO or drops below the ALARM LIMIT HI the PS200 based on the 14.07 restart value will start and resume normal operation. The PS200 generates a alarm message "COND 2 ALARM" and "SLEEP" Warning. |
| | | | | FAULT | The PS200 faults if the COND 2 signal is greater than the COND 2 ALARM LIMIT HI or less then the COND 2ALARM LIMIT LO for longer than the response delay. The PS00 generates a fault message "COND 2 FAULT". |
| X | X | X | 23.11 | COND2 ALRM LIM HI | Range is 0 – 9999. This is the ALARM LIMIT HI value. Default is 0 which disables Hi Limit function. Units are selected in Group 15 or defined by the drive actual signal selected in parameter 23.07. Transmitter scaling is set in Group 16. COND 2 ALARM LIMIT HI is not active if set to 0. |
| X | X | X | 23.12 | COND2 ALRM LIM LO | Range is 0 – 9999. This is the ALARM LIMIT LO value. Default is 0 which disables Lo Limit function. Units are selected in Group 15 or defined by the drive actual signal selected in parameter 23.07. Transmitter scaling is set in Group 16. COND 2 ALARM LIMIT LO is not active if set to 0. |
| X | X | X | 23.13 | COND RESP DELAY | The delay period prior to activation of a CONDITION 1 or 2 warning or alarm. Range is 0 – 300 sec. Default is 20 sec. |
| X | X | X | 23.14 | MIN SPD STP DLY | This is the time period for which the PS200 will operate at Min Spd during an alarm condition if the alarm condition does not reset itself. Once this time period expires the PS200 will fault. Range is 0 – 1800 sec. Default is 60 sec. |

# APPENDIX A-3 PARAMETER LISTING

| Speed Control | Single Pump | Multi-pump | Group 24 | FAULT FUNCTIONS | Description |
|---|---|---|---|---|---|
| | | | | PROC SNSR FAILURE | Selects the PS200 reaction when Ext SP, Proc XT1, Spd Ref, Proc XT2, Flowmeter, Spd Ovrrd or SG/TEMP analog signal falls below 1.5V or 3 mA or above 10.1V or 20.2 mA (for 2 sec). Note, the sensor failure warning is identified as to which particular sensor has failed based on the analog input configuration settings given in parameters 17.20, 17.21, 17.22 |
| X | X | X | 24.01 | DISABLED | Protection is inactive |
| | | | | FAULT | The drive trips on fault and the motor coasts to a stop. A fault message is generated "Ext SP, Proc XT1, Spd Ref, Flowmeter, Spd Ovrd, SG/TEMP or Proc XT2" Err and sets fieldbus 3.10 Bit 12. |
| | | | | LAST SPEED [default]) | The drive generates a warning ""Ext SP, Proc XT1, Spd Ref, Flowmeter, Spd Ovrrd, SG/TEMP or Proc XT2" ERR", freezes the speed to the average speed the drive was operating at over the last 60 seconds and sets fieldbus 3.10 Bit 12. Warning: be sure it is safe to continue to operate with a bad sensor. |
| | | | | COND SNSR FAILURE | Selects how the PS200 will react when Cond 1, Cond 2, signal falls below 1.5V or 3 mA or above 10.1V 20.2 mA (for 2 sec). Note, the sensor failure warning is identified as to which particular sensor has failed based on the analog input configuration settings given in parameters 17.20, 17.22. |
| X | X | X | 24.02 | DISABLED | Protection is inactive |
| | | | | WARNING [default] | The PS200 generates a warning "Cond 1, Cond 2 Sgnl" Err. |
| | | | | KEYPAD FAILURE | Selects how the PS200 will react to a keypad communication break. |
| | | | | DISABLED | Protection is inactive |
| X | X | X | 24.03 | FAULT [default] | The drive trips on fault and the motor coasts to a stop. A fault message is generated "PANEL LOSS". If an external start/stop switch is used and the reference is sent via analog input, no fault will occur if the keypad fails. |
| | | | | LAST SPEED | The drive generates a warning "PANEL LOSS" and freezes the speed to the average speed the drive was operating at over the last 60 seconds. |
| | | | | DIGIT RST CONFIG | Allows drive faults to be reset using an external switch wired into DI6 if condition that caused the fault has been corrected. Following a fault reset the drive must be manually restarted. |
| X | X | X | 24.04 | PUMP FAULTS | Resets pump faults: PUMP PROTECT, LOW DEMAND, DRY RUN, MIN FLOW, COND 1 and 2 and PROCESS SENSOR. |
| | | | | VFD FAULTS | Resets a keypad fault or VFD fault |
| | | | | BOTH [default] | Resets both Pump faults and VFD faults. |
| X | X | X | 24.05** | MOTOR THERM PROT | Selects how the drive reacts when the motor overtemperature is detected by the function defined by parameter 24.06 MOTOR THERM P MODE. Default = WARNING. Other choices: FAULT, NOT SELECTED. |
| X | X | X | 24.06** | MOTOR THERM P MODE | Selects the thermal protection mode of the motor. When overtemperature is detected the drive reacts as defined by parameter 24.05 MOTOR THERM PROT. Default = DTC. Other choices: USER MODE and THERMISTOR. Thermistor is wired into DI-4. Automatically updates to THERMISTOR when thermistor is selected in parameter 25.06. |
| X | X | X | 24.07** | MOTOR THERM TIME | Defines the thermal time constant for the user defined thermal model. |
| X | X | X | 24.08** | MOTOR LOAD CURVE | Defines the load curve together by parameters 24.09 ZERO SPEED LOAD and 24.10 BREAK POINT. The load curve is used in the user defined thermal model. |
| X | X | X | 24.09** | ZERO SPEED LOAD | Defines the load curve together by 24.08 and 24.10. |
| X | X | X | 24.10** | BREAK POINT | Defines the load curve together by 24.08 and 24.09. |
| X | X | X | 24.11** | STALL FUNCTION | Selects how the drive reacts to a motor stall condition. Default = NOT SEL. Other choices: WARNING, FAULT. |
| X | X | X | 24.12** | STALL FREQ HI | Defines the frequency limit for the stall function. |
| X | X | X | 24.13** | STALL TIME | Defines the time for the stall function. |
| X | X | X | 24.14** | UNDERLOAD FUNC | Selects how the drive reacts to underload. Default = NOT SEL. Other choices: WARNING or FAULT. |
| X | X | X | 24.15** | UNDERLOAD TIME | Time limit for the underload function. |
| X | X | X | 24.16** | UNDERLOAD CURVE | Selects the load curve for the underload function. |
| X | X | X | 24.17** | MOTOR PHASE LOSS | Activates the motor phase loss supervisory function. Default = NOT SEL. Other choices: FAULT. |
| X | X | X | 24.18** | GROUND FAULT | Selects how the drive reacts when an earth fault is detected in the motor or the motor cable. Default = FAULT. Other choice: WARNING. |
| X | X | X | 24.19** | COMM FLT FUNC | Selects how the drive reacts in a fieldbus comm break i.e; if the drive fails to receive the main ref data set or the aux ref data set. The time delays are given by parameters 24.20 and 24.21. Default = LAST SPEED. Other choices: NOT SELECTED, FAULT. |
| X | X | X | 24.20** | MAIN REF DS T-OUT | Defines the time delay for the main ref data set supervision. Default = 3 Sec |
| X | X | X | 24.21** | AUX DS T- OUT | Defines the time delay for the aux ref data set supervision. Default = 3 Sec |
| X | X | X | 24.22** | IO CONFIG FUNC | Selects how the drive reacts in case of improper selection of the I/O or if "FIELDBUS" is selected in 30.01 and no fieldbus module is present. Default = WARNING. Other choice:. NOT SEL |

# APPENDIX A-3 PARAMETER LISTING

| Speed Control | Single Pump | Multi-pump | Group 25 | PUMP PROTECT | Description |
|---|---|---|---|---|---|
| | X | X | 25.01 | PUMP PROTECT CTRL | Actual process value is lower than 25.02 PROTECTION LIMIT for 25.03 PROTECTION DELAY and the PS200 is at maximum speed for the protection delay. Do not use if 13.08 Control parameter selection is Torque. |
| | | | | DISABLED [default] | Protection is disabled |
| | | | | ALARM | The PS200 generates a warning only "PUMP PROTECT". Relay outputs may be configured to activate. No other action is taken. |
| | | | | ALARM AND CONTROL | The PS200 generates a warning "Pump Protect" and controls according to the setting of 14.05 CONFIG SPEED MIN. The fault is re-settable if (25.04) Error Reset is active. |
| | X | X | 25.02 | PROTECTION LIMIT | This is the value, in % of the setpoint, at which 25.01 PUMP PROTECT CTRL activates when pump is at max speed for the protection delay. Setting range: 0 – 100% of setpoint. The default setting is 97%. |
| X | X | X | 25.03 | PROTECTION DELAY | This is the period prior to the activation of 25.01 PUMP PROTECT CTRL. Also applies to SECONDARY PROTECT A/B, MIN FLOW, DRY RUN and RUNOUT CTRL. Setting = 0 – 200 sec. Default: 0 seconds. |
| X | X | X | 25.04 | ERROR RESET | Indicates number of fault resets. Selection range is 0 – 19. Default is "0". When set to "0" ERROR RESET is disabled. Time between resets is set by 25.05 PUMP RESET DELAY. Manual intervention is required if fault is still active after set number of resets has been achieved. The counter will reset if a stop command is issued, fault is manually reset or the drive has been operating normally for 5 minutes. The drive reaction to the fault will be according to 14.05 CONFIG SPEED MIN. Reset action is applicable to parameters 25.01 and 25.11. |
| X | X | X | 25.05 | PUMP RESET DELAY | The period of time that the PS200 will wait after an alarm and control condition before attempting an error reset. Setting Range: 250 sec. Default: 60 sec. |
| X | X | X | 25.06 | SECONDARY PROTECT A | Loss of digital input 4 (DI4) for 25.03 PROTECTION DELAY. |
| | | | | DISABLED [default] | Protection is disabled |
| | | | | ALARM | The PS200 generates a warning only "SECONDARY PROTECT A". Relay outputs may be configured to change. No other action is taken. |
| | | | | ALARM AND CONTROL | The PS200 generates a warning "SECONDARY PROTECT A"and controls according to the setting of 14.05 CONFIG SPEED MIN. If DI4 closes following a fault condition the PS200 will restart. |
| | | | | THERMISTOR | Allows the use of a motor thermistor at DI4. Parameter 24.06 MOTOR THERM P MODE is automatically updated to "THERMISTOR". |
| X | X | X | 25.07 | SECONDARY PROTECT B | Loss of digital input 5 (DI5) for 25.03 PROTECTION DELAY. |
| | | | | DISABLED [default] | Protection is disabled |
| | | | | ALARM | The PS200 generates a warning only "SECONDARY PROTECT B". Relay outputs may be configured to change. No other action is taken. |
| | | | | ALARM AND CONTROL | The PS200 generates a warning "SECONDARY PROTECT B" and controls according to the setting of 14.05 CONFIG SPEED MIN. If DI5 closes following a fault condition the PS200 will restart. |
| | | | | SG SELECT | Automatically set if 29.12 SG SELECT is set to "DI". Digital Input 5 then becomes a toggle for SG selection. |
| X | X | X | 25.10 | Q ACT SOURCE | Identifies the source of the flow readings used for the pump protection feature. |
| | | | | SMARTFLOW (Default) | Logic uses the PumpSmart calculated flow value |
| | | | | EXT FLOWMETER | Logic uses an external flow meter that is configured in group 17. |
| X | X | X | 25.11 | MIN FLOW CTRL | If enabled and the actual flow is less than the 25.12 Min Flow (corrected for speed) for the 25.03 Protection Delay a minimum flow condition is detected. |
| | | | | DISABLED [default] | PROTECTION IS DISABLED. |
| | | | | WARNING | The PS200 generates a "Min Flow Warning" only; no other action is taken unless relay outputs are configured. |
| | | | | ALARM AND CONTROL | The PS200 generates a "Min Flow" warning or fault and controls according to the setting of Config Spd Min (14.05). The fault is re-settable if (25.04) Error Reset is active. Relay Outputs may be configured to activate. |
| X | X | X | 25.12 | MIN FLOW | Defines the safe minimum flow of the pump. This minimum flow correlates to the 29.03 N Rated. For other speeds the allowable min flow is corrected proportionally to the change in speed (Q1/Q2 = N1/N2 where Q=Flow and N=Speed). For English(Am) the default flow units are in GPM; for all other languages the default flow units are in M3/hr. |
| X | X | X | 25.13 | DRY RUN CTRL | If enabled and the actual flow is less than the dry run criteria for the protection delay (25.03) a dry run condition is detected. Minimum Flow Control must also be enabled for Dry Run Ctrl to be enabled. |
| | | | | DISABLED (DEFAULT) | Protection is disabled. |
| | | | | WARNING | The PS200 generates a Dry Run warning only; no other action is taken unless Relay Outputs are configured. |
| | | | | FAULT | The drive faults and the motor coasts to a stop. A fault message is generated "Dry Run". This fault is not resettable by Error Reset (25.04). Relay Outputs may be configured to activate. |
| X | X | X | 25.14** | DRY RUN FACTOR | Coefficient for determining dry-run power, Default: = 0.95 Range= 0.00 – 2.00 |

## APPENDIX A-3 PARAMETER LISTING

| Speed Control | Single Pump | Multi-pump | Group 25 | PUMP PROTECT | Description |
|---|---|---|---|---|---|
| X | X | X | 25.15 | RUNOUT CTRL | If enabled and the actual flow is greater than the runout flow (corrected for speed) for the protection delay 25.03, a RUNOUT condition is detected. |
| | | | | DISABLED *[default]* | Protection is disabled. |
| | | | | WARNING | The PS200 displays the message "RUNOUT". Relay outputs may be configured to change. No other action is taken. |
| X | X | X | 25.16 | RUNOUT FLOW | Defines the maximum flow of the pump. This maximum flow correlates to the 29.03 N Rated. For other speeds the allowable runout flow is corrected proportionally to the change in speed (Q1/Q2 = N1/N2 where Q=Flow and N=Speed). For English(Am) the default flow units are in GPM; for all other languages the default flow units are in M3/hr |
| X | X | X | 25.20** | MAXIMUM CURRENT | Defines the allowed maximum motor current in % of rated heavy duty use output current. |
| X | X | X | 25.21** | MAXIMUM TORQUE | Defines the maximum torque limit of the drive |
| X | X | X | 25.22** | OVERVOLTAGE CONTROL | Activates (default)/deactivates the overvoltage control of the intermediate DC link. |
| X | X | X | 25.23** | UNDERVOLTAGE CONTROL | Activates (default)/deactivates the undervoltage control of the intermediate DC link. |
| X | X | X | 25.24** | P MOTORING LIM | Defines the allowed maximum power fed by the inverter to the motor. |
| X | X | X | 25.25** | P GENERATING LIM | Defines the allowed maximum power fed by the motor to the inverter. |

| Speed Control | Single Pump | Multi-pump | Group 26 | ENERGY SAVINGS | Description |
|---|---|---|---|---|---|
| X | X | X | 26.01 | $/KWHR | Cost of energy in local currency. Setting range = 0.000 - 1.000 |
| X | X | X | 26.02 | BASELINE POWER | Baseline HP for a conventional fixed speed system. Setting range = 0 – 1000 hp. |
| X | X | X | 26.04 | ENERGY SAVE METHD | Selections: Savings Op 1 (default), Savings Op 2 |
| X | X | X | 26.05 | ENERGY SAVE RESET | Selections: Disabled (default), Reset (note after resetting, parameter 26.05 returns to disabled. |
| X | X | X | 26.06 | KWH AT RESET | Total kWh since last reset. Add to parameter 1.15 KWH SINCE RST to obtain total kWh. Viewable only. |
| X | X | X | 26.07 | OP HRS AT RESET | Total Op Hrs since last reset. Add to parameter 1.14 OP HRS SINCE RST to obtain total hrs RMIO board has been powered. Viewable only. |

| Speed Control | Single Pump | Multi-pump | Group 28 | VFD AUTORESET | Description |
|---|---|---|---|---|---|
| X | X | X | 28.01 | AUTO RESET TRIALS | Defines the number of automatic fault resets for Overcurrent, Overvoltage, Undervoltage and Process Sensor faults. Range is 0 – 5. A setting of 0 disables the functionality. Default = 0. Note if the number of resets during the trial time equals the value set in 28.01 the drive will fault until manually reset. If the number of resets during the trial time is less than the value set in 28.01 reset will still be active. |
| X | X | X | 28.02 | TRIAL TIME | This parameter sets the time period for counting and resetting a fault. This time period limits the number of faults which can be reset to the number set in parameter 28.01. Range is 1 – 180 sec. Default is 180 sec |
| X | X | X | 28.03 | VFD RESET DELAY | Defines the time that the PS200 will wait before attempting an Auto Reset. Range is 0 – 250 sec. Default = 15 sec |
| X | X | X | 28.04 | OVERCURRENT | Activates/deactivates Auto Reset for an OVERCURRENT fault. |
| | | | | ENABLE | Enables Auto Reset of an OVERCURRENT fault |
| | | | | DISABLE *(default)* | Auto Reset is disabled |
| X | X | X | 28.05 | OVERVOLTAGE | Activates/deactivates Auto Reset for an OVERVOLTAGE fault. |
| | | | | ENABLE | Enables Auto Reset of an OVERVOLTAGE fault |
| | | | | DISABLE *(default)* | Auto Reset is disabled |
| X | X | X | 28.06 | UNDERVOLTAGE | Activates/deactivates Auto Reset for an UNDERVOLTAGE fault. |
| | | | | ENABLE | Enables Auto Reset of an UNDERVOLTAGE fault |
| | | | | DISABLE *(default)* | Auto Reset is disabled |
| X | X | X | 28.07 | PROCESS SENSR ERR | Activates/deactivates Auto Reset for a PROCESS SENSR ERR fault. This effects the following sensor faults: EXT SP, PROC XT1, SPEED REF, FLOWMETER, SG/TEMP AND PROC XT2. |
| | | | | ENABLE | Enables Auto Reset of a PROCESS SENSR fault |
| | | | | DISABLE *(default)* | Auto Reset is disabled |

# APPENDIX A-3 PARAMETER LISTING

| Speed Control | Single Pump | Multi-pump | Group 29 | SMARTFLOW | Description |
|---|---|---|---|---|---|
| | | | | TYPE | Defines the type of pump being used |
| | | | | DISABLED (DEFAULT) | Disables the SMARTflow function |
| X | X | X | 29.01 | SS CENTRIFUGAL | Centrifugal type loads – use for single suction impellers |
| | | | | DS CENTRIFUGAL | Centrifugal type loads – use for double suction impellers |
| | | | | MAG DRIVE | Centrifugal type loads with magnetic drive (eddy current) losses |
| | | | | PD | Do not use. |
| X | X | X | 29.02 | BEP FLOW | Flow at the pumps Best Efficiency Point (BEP) at rated speed and viscosity if a centrifugal load. If a PD application, then QBEP is the flow (with no slip) at rated speed listed in parameter 29.03 N RATED.  Range: 0-9999 Default 100<br>If 29.01 TYPE = PD, then QBEP becomes the displacement capacity<br>If 11.01 LANGUAGE = ENGLISH (AM), the units are in GPM. M$^3$/Hr for all other languages. |
| X | X | X | 29.03 | RATED SPD | Speed at which pump data ($Q_{BEP}$, $P_{BEP}$, and $P_{SO}$) is entered. Range 0 – 18000 Default 14.01 MAXIMUM SPEED. |
| X | X | X | 29.04 | BEP POWER | Power at the pumps Best Efficiency Point (BEP) at rated speed and viscosity at SG = 1.0. Range 0 – 3000.00. Default 80% of 11.08 MOTOR NOM POWER.<br>If 11.01 LANGUAGE = ENGLISH (AM), the units are in BHP. KW for all other languages. |
| X | X | X | 29.05 | SO POWER | Power at the pump shut-off condition (SO) at rated speed and viscosity at SG = 1.0. Range 0 – 3000.00. Default 36% of 11.08 MOTOR NOM POWER<br>If 11.01 LANGUAGE = ENGLISH (AM), the units are in BHP. KW for all other languages. |
| X | X | X | 29.06** | HYD EFF FACTOR | Hydraulic Efficiency Factor, Range: 0.0 – 10.0, Default = 0.7 |
| X | X | X | 29.07** | HYD EFF EXPNT | Hydraulic Efficiency power. Range: 0.0 – 10.0, Default = 1.0 |
| | | | | CALC SO SOURCE | Defines source for KSO factor. |
| X | X | X | 29.08 | AFFINITY (DEFAULT) | Estimates power at shut-off using the affinity laws. Default value for KSO =3. KSO can be adjusted in parameter 29.09. |
| | | | | TUNE | PumpSmart estimates power for a shut-off characteristic curve by increasing speed and monitoring power while pump is held with a closed discharge valve. A warning message is displayed on the keypad WARNING TUNING. A relay output is activated and Fieldbus Alarm Word 3.11 Bit 03 is set (if configured). The motor must be off in order to begin the tuning process. Once the Tune process is complete the drive will shutdown and must be manually restarted. |
| | | | | TUNED VALUE | Use the power at shut-off characteristic curve developed during the tune function. |
| X | X | X | 29.09 | SO EXPNT | Power Factoring exponent for shutoff power. Range: 0.00-5.00. Default=3.00 |
| X | X | X | 29.10 | P MAG CORR | Eddy current correction factor for magnetic drive pumps at rated speed (29.03). Visible only if 29.01 TYPE = MAG DRIVE. Range: 0.0 – 100.0. Default = 0<br>If 11.01 LANGUAGE = ENGLISH (AM), the units are in BHP. KW for all other languages. |
| X | X | X | 29.11** | QACT FILTER | Defines the filter time constant for QACT. Default is 1.0 sec. Range is 0.0-10.0 sec |
| | | | | SG SELECT | Selects SG source |
| | | | | SG RATE | Uses the value 29.15 SG RATE |
| X | X | X | 29.12 | SG CALC (T) | Calculates SG as a function of temperature using the SG Calculation logic. |
| | | | | AI | SG is set via an analog input (refer to Group 17 setup). Linear scale: 4mA = SG MIN, 20mA = SG MAX. |
| | | | | DI | SG can be toggled between 29.13 SG MIN and 29.14 SG MAX via digital input (DI5). This selection automatically configures SG SELECT in 25.07. |
| X | X | X | 29.13 | SG MIN (SG$_{MIN}$) | Specific Gravity, Minimum, default = 0, Range is 0.0 – 10.0. |
| X | X | X | 29.14 | SG MAX (SG$_{MAX}$) | Specific Gravity, Maximum, default = 1, Range is 0.0 – 10.0. |
| X | X | X | 29.15 | SG RATE (SG$_{RATED}$) | Specific Gravity, Rated, default = 1, Range is 0.0 – 10.0. |
| X | X | X | 29.16 | T MIN (T$_{MIN}$) | Temperature, minimum. If 11.01 LANGUAGE = ENGLISH (AM), the units are in F Deg. (default = 0), C Deg (default = 0) for all other languages.. Range is -200 to 1000. |
| X | X | X | 29.17 | T MAX (T$_{MAX}$) | Temperature, Maximum. If 11.01 LANGUAGE = ENGLISH (AM), the units are in F Deg. (default = 212), C Deg (default = 100) for all other languages. Range is -200 to 1000. |
| X | X | X | 29.18 | T RATE (T$_{RATE}$) | Temperature, Rated. If 11.01 LANGUAGE = ENGLISH (AM), the units are in F Deg (default = 104), C Deg (default = 50) for all other languages. Range is -200 to 1000. |

## APPENDIX A-3 PARAMETER LISTING

| Speed Control | Single Pump | Multi-pump | Group 30 | OPTION MODULES | Description |
|---|---|---|---|---|---|
| | | | | FIELDBUS | Activates the optional external DCS and selects the interface. Refer to the ABB IOM chapter on Fieldbus control. |
| | | | | NO *[default]* | No Fieldbus communication |
| | | | | FIELDBUS | The drive communicates with a Fieldbus adapter module in option Slot 1 or via CH 0 Fieldbus adapter link. Note when "Fieldbus" is selected Parameter Groups 31, 90 and 92 are unlocked. |
| X | X | X | 30.01 | ADVENT | The drive communicates with an ABB Advent OCS System via channel 0 on the RDCO board. Note when "Advent" is selected, parameter Groups 90, and 92 are unlocked. |
| | | | | STD MODBUS | The drive communicates with a Modbus controller via the Modbus Adapter Module (RMBA) in option Slot 1 of the drive. Note when "Std Modbus" is selected, parameter Groups 52, 90, and 92 are unlocked. |
| | | | | CUSTOMIZED | The drive communication via a customer specified link. The control sources are defined by 90.04 and 90.05. |
| X | X | X | 30.03 | COMM PROFILE | This parameter becomes visible if FIELDBUS or STD MODBUS is selected in 30.01 FIELDBUS. This defines the profile on which the communication with the fieldbus is based. Default: CSA2.8/3.0. Other choices are ABB DRIVES and GENERIC. For LonWorks, use GENERIC setting. |

| Speed Control | Single Pump | Multi-pump | Group 31 | FIELDBUS SETUP | Description |
|---|---|---|---|---|---|
| X | X | X | 31.01 | MODULE TYPE | This parameter configures the module type automatically by the fieldbus adapter. No action is required unless changes to default settings are desired. Refer to the fieldbus manual. This parameter becomes visible when "FIELDBUS" is selected in parameter 30.01 FIELDBUS. |

# APPENDIX A-3 PARAMETER LISTING

| Speed Control | Single Pump | Multi-pump | Group 34 | PUMP CLEAN SEQUENCE | Description |
|---|---|---|---|---|---|
| X | X | X | 34.01 | EXE P CLEAN SEQ | Defines how the cleaning sequence is executed. Drive relay output R03 energizes upon execution. RO3 remains energized during the cleaning sequence. The PCS operates in REMOTE mode only. |
|  |  |  |  | NOT SEL (DEFAULT) | The pump cleaning sequence is disabled. |
|  |  |  |  | P CTRL DI3 | The pump cleaning system is executed by the pump controller setting the drive digital input DI3 from 0 to 1. |
|  |  |  |  | PS200 | The pump cleaning system is executed by the PS200 itself. |
| X | X | X | 34.02 | REQ P CLEAN SEQ | Defines what triggers the request of the pump cleaning sequence. Upon request the relay output RO2 energizes and remains energized until the execution of the sequence is completed. |
|  |  |  |  | NOT SEL (DEFAULT) | The pump cleaning sequence is disabled if 34.01 is set to PS200 and 34.02 is set to NOT SEL. If 34.01 is set to P CTRL DI3 and 34.02 is set to NOT SEL the pump controller and pump controller logic are used to control the PCS – thus the drive's capability to analyze torque and/or run time are not utilized. |
|  |  |  |  | TORQ | The request is triggered when 1.05 MOTOR TORQUE exceeds the value set in 3403 TORQ REQ for the 3404 TON REQ. The fulfillment is monitored and analyzed by the drive. |
|  |  |  |  | RUN TIME | This request is triggered when 1.45 PMP CLN RUN TIME exceeds the value set in 3405 RUN TIME REQ. The fulfillment is monitored and analyzed by the drive. |
|  |  |  |  | TORQ OR RUN TIME | This request is triggered when either motor torque or run time is fulfilled as described above. |
| X | X | X | 34.03 | TORQUE REQ | Defines the motor torque threshold value in % of nominal motor torque which is required to trigger a pump cleaning sequence. Range: 0.0 – 200.0%. Default is 120% |
| X | X | X | 34.04 | TON REQ | The motor torque must exceed the 34.03 TORQUE REQ for this time period before the pump cleaning sequence can be triggered. Range is 0 - 100 sec. Default is 5 sec. |
| X | X | X | 34.05 | RUN TIME REQ | Defines the run time which must be met before the pump cleaning sequence can be requested if configured in 34.02 REQ P CLEAN SEQ. The 1.45 PMP CLN RUN TIME is reset to zero after every stop command and after every completed cleaning sequence. Range: 0.1 – 100.0 hrs. Default is 2 hrs. |
| X | X | X | 34.06 | NUM OF CYCLES | Defines the number of cycles the pump cleaning system performs for each execution. Range: 1 – 10. Default is 2. |
| X | X | X | 34.07 | FWD RUN SPD | Defines the forward running speed in % of 14.01 MAXIMUM SPEED. Range: 0.0 – 100.0%. Default is 100% |
| X | X | X | 34.08 | FWD RUN TIME | Defines the forward running time of the cleaning sequence. Range: 0.0 – 100.0 sec. Default is 7 sec |
| X | X | X | 34.09 | FWD RUN ACC | Defines the forward acceleration in the cleaning cycle. Range: 0.0 – 100.0 sec. Default is 0.3 sec |
| X | X | X | 34.10 | FWD RUN DEC | Defines the forward deceleration in the cleaning cycle. Range: 0.0 – 100.0 sec. Default is 2 sec. No lower value than 2 sec shall be set to avoid overstress of the impeller and shaft. |
| X | X | X | 34.11 | ZERO SPEED PAUSE | Defines the zero speed pause in the cleaning sequence when switching from forward to reverse rotation. Range: 0.0 – 100 sec. Default is 7 sec |
| X | X | X | 34.12 | REV RUN SPD | Defines the reverse running speed in % of 14.01 MAXIMUM SPEED. No higher value than 80% shall be set to avoid overstress of the impeller and shaft. Range: 0.0 – 100.0%. Default is 80% |
| X | X | X | 34.13 | REV RUN TIME | Defines the reverse running time of the cleaning sequence. Range: 0.0 – 100.0 sec. Default is 7 sec |
| X | X | X | 34.14 | REV RUN ACC | Defines the reverse acceleration in the cleaning cycle. No higher value than 2 sec shall be set to avoid overstress of the impeller and shaft.  Range: 0.0 – 100.0 sec. Default is 2 sec |
| X | X | X | 34.15 | REV RUN DEC | Defines the reverse deceleration in the cleaning cycle. Range: 0.0 – 100.0 sec. Default is 0.3 sec. |
| X | X | X | 34.16 | SEQUENCE TIMER | Applies to 34.01 setting of PS200 only. If the time period for requesting a new PCS (after a PCS sequence has been completed) is less than the  SEQUENCE TIMER setting  then the 34.17 SEQUENCE COUNTER shall be enabled. Range: 0 – 100 Sec, default = 30 Sec. |

# APPENDIX A-3 PARAMETER LISTING

| Speed Control | Single Pump | Multi-pump | Group 34 | PUMP CLEAN SEQUENCE | Description |
|---|---|---|---|---|---|
| X | X | X | 34.17 | SEQUENCE COUNTER | Applies to 34.01 setting of PS200 only. The maximum number of sequences which are allowed after the SEQUENCE COUNTER has been activated. If the drive requests another PCS after the maximum allowed sequences has been attained then the 34.18 SEQUENCE EXCEED function shall be activated. Range: 0 – 10 sequences. Default = 5 |
| X | X | X | 34.18 | SEQUENCE EXCEED | Applies to 34.01 setting of PS200 only. After the 34.17 SEQUENCE COUNTER has reached the maximum allowed sequences and a new PCS is requested this settable action is initiated. Default is Fault. |
| | | | | DISABLED | The SEQUENCE EXCEED function is disabled and there is no limitation on the number of PCS requests and executions. |
| | | | | WARNING | The Keypad displays a warning PUMP CLOGGED and the PCS function is disabled. The drive continues to function in its normal configured state. A relay output is energized and Fieldbus 3.11 PS Condition Word Bit 02 "PUMP CLOGGED" is set (if configured). |
| | | | | FAULT | The drive faults and must be manually reset The Keypad displays a fault PUMP CLOGGED. A relay output is energized, Fieldbus 3.11 PS Condition Word Bit 02 "PUMP CLOGGED", 3.10 PS ALARM WORD Bit 06 "VFD FAULT/WRN" and 3.11 PS CONDITION WORD Bit 11 "VFD FAULT/WRN" are set (if configured). |

| Speed Control | Single Pump | Multi-pump | Group 50 | MOTOR CONTROL | Speed Controller & Other Motor Variables<br>*These functions are not used when in Scalar Mode* |
|---|---|---|---|---|---|
| X | X | X | 50.01** | START FUNCTION | Selects the motor starting method. Default = DC MAGN. Other choices: CONSTANT DC MAGN, AUTO. |

| Speed Control | Single Pump | Multi-pump | Group 52 | STD MODBUS | Settings for standard Modbus (RMBA) Link. See chapter on fieldbus control in ABB manual.<br>*Group 52 is unlocked when Std Modbus is selected in parameter 30.01* |
|---|---|---|---|---|---|
| X | X | X | 52.01 | STATION NUMBER | Defines the address of the device. Two units with the same address are not allowed on-line. 1 – 247  Default =1 |
| X | X | X | 52.02 | BAUD RATE | Defines the transfer rate of the link. 600 (default), 1200, 2400, 4800, 9600 and 19200 bit/sec |
| X | X | X | 52.03 | PARITY | Defines the use of parity and stop bit(s). The same setting must be used on all on-line stations. |
| | | | | ODD | Odd parity indication, one stopbit (Default) |
| | | | | EVEN | Even parity indication, one stopbit |
| | | | | NONE1STOPBIT | No parity bit, one stop bit |
| | | | | NONE2STOPBIT | No parity bit, two stop bits |

# APPENDIX A-3 PARAMETER LISTING

| Speed Control | Single Pump | Multi-pump | Group 90 | D SET REC ADDR | Description<br><br>*Addresses of the parameters into which the received Fieldbus data are written. Refer to the Fieldbus Control section of the ABB manual and specific Fieldbus adapter manual for details on Fieldbus addressing.* |
|---|---|---|---|---|---|
| X | X | X | 90.01 | MAIN DS REF2 | Selects the address into which the value of Fieldbus reference Ref 2 is written. |
| X | X | X | 90.02 | AUX DS REF3 | Selects the address into which the value of Fieldbus reference Ref 3 is written. |
| X | X | X | 90.03 | AUX DS REF4 | Selects the address into which the value of Fieldbus reference Ref 4 is written. |
| X | X | X | 90.04 | AUX DS REF5 | Selects the address into which the value of Fieldbus reference Ref 5 is written. |
| X | X | X | 90.05 | MAIN DS SOURCE | Defines the data set from which the PS200 reads the control word, reference Ref 1 and reference Ref 2. |
| X | X | X | 90.06 | AUX DS SOURCE | Defines the data set from which the PS200 reads, references Ref 3, Ref 4 and Ref 5. |

| Speed Control | Single Pump | Multi-pump | Group 92 | D SET TR ADDR | Description<br><br>*Main and auxiliary data sets which the PS200 sends to the Fieldbus master station. Refer to the Fieldbus Control section of the ABB manual and specific Fieldbus adapter manual for details on Fieldbus addressing.* |
|---|---|---|---|---|---|
| X | X | X | 92.01 | MAIN DS STATUS WORD | Stores the address from which the Main Status Word is read from. This is a fixed value and is not visible or accessible to the user. |
| X | X | X | 92.02 | MAIN DS ACT1 | Selects the address from which the Actual Signal 1 is read to the main data set. |
| X | X | X | 92.03 | MAIN DS ACT2 | Selects the address from which the Actual Signal 2 is read to the main data set. |
| X | X | X | 92.04 | AUX DS ACT3 | Selects the address from which the Actual Signal 3 is read to the auxiliary data set. |
| X | X | X | 92.05 | AUX DS ACT4 | Selects the address from which the Actual Signal 4 is read to the auxiliary data set. |
| X | X | X | 92.06 | AUX DS ACT5 | Selects the address from which the Actual Signal 5 is read to the auxiliary data set. |

| Speed Control | Single Pump | Multi-pump | Group 99 | INFORMATION | Description |
|---|---|---|---|---|---|
| X | X | X | 99.01 | SOFTWARE VERSION 5.0 | Version of the software loaded to the PS200 |
| X | X | X | 99.02 | SOFTWARE DATE: DAY-MONTH-YEAR | Software Release Date (e.g.: 022803) |

# PS200 BASIC WIRING

## Multiple Transmitters/Jumpers

**JUMPERS**
When PumpSmart is powering a process transmitter, The power supply ground must be connected to the negative terminal (-) of each transmitter. Rather than run separate wires from the ground connection [X23-2], use smaller "jumpers".
Jumper size: 16-20 Guage

Jumper

Example: Pressure Control Application w/ Vibration Tx

**X21 Terminal Block**
| 1 | VREF |
| 2 | GND |
| 3 | AI1 (+) |
| 4 | AI1 (-) |
| 5 | AI2 (+) |
| 6 | AI2 (-) |
| 7 | AI3 (+) |
| 8 | AI3 (-) |
| 9 | AO1 (+) |
| 10 | AO2 (-) |
| 11 | AO2 (+) |
| 12 | AO2 (-) |

**X23 Terminal Block**
| 1 | 24 VDC |
| 2 | GND |

## OPTION - 2nd 4-20 mA Process Transmitter OR external signal for Variable Setpoint Control Connected at AI1

Resistor 500 OHM +/- 1% 1/4 Watts

Example: Pressure Control Application

**X21 Terminal Block**
| 1 | VREF |
| 2 | GND |
| 3 | AI1 (+) |
| 4 | AI1 (-) |
| 5 | AI2 (+) |
| 6 | AI2 (-) |
| 7 | AI3 (+) |
| 8 | AI3 (-) |
| 9 | AO1 (+) |
| 10 | AO2 (-) |
| 11 | AO2 (+) |
| 12 | AO2 (-) |

**X23 Terminal Block**
| 1 | 24 VDC |
| 2 | GND |

## Externally Powered Instruments

NOT REQUIRED IF 2-10 VDC SIGNAL
500 OHM Resistor [+/- 1%, 1/4 Watts]

4-20 mA Signal Power Externally [E.g. Vibration or Condition Monitoring Instrument, 2nd process Transmitter etc...]

4-20 mA Signal Power Externally Primary Process Instrument

**X21 Terminal Block**
| 1 | VREF |
| 2 | GND |
| 3 | AI1 (+) |
| 4 | AI1 (-) |
| 5 | AI2 (+) |
| 6 | AI2 (-) |
| 7 | AI3 (+) |
| 8 | AI3 (-) |
| 9 | AO1 (+) |
| 10 | AO2 (-) |
| 11 | AO2 (+) |
| 12 | AO2 (-) |

## Instruments Loop Powered By PumpSmart

**NOTICE**
All instrumentation shielding must be terminated at grounding lugs provided by the PS200. Do not terminate Shielding at sensor end.

Expose the shield of the control wire cable and slide a conductive clamp onto the cable. Connect clamp to the grounding lugs

Example: Pressure Control Application

**X21 Terminal Block**

| 1 | VREF | OPTION | **AI REFERENCE VOLTAGE** Used for AI1 2-10VDC Signals 10 mA Maximum |
| 2 | GND | | |
| 3 | AI1 (+) | OPTION | **2-10 VDC ANALOG INPUT (1)** 4-20mA transmitters may be used with 500 ohm resistor. *OPTION - Input assigned in parameter 17.20* |
| 4 | AI1 (-) | | |
| 5 | AI2 (+) | OPTION | **4-20 mA ANALOG INPUT (2)** **Proc Trans 1-Primary Control Instrument** *OPTION - Input assigned in parameter 17.21* |
| 6 | AI2 (-) | | |
| 7 | AI3 (+) | OPTION | **4-20 mA ANALOG INPUT (3)** *OPTION - Input assigned in parameter 17.22* |
| 8 | AI3 (-) | | |
| 9 | AO1 (+) | OPTION | **4-20 mA ANALOG OUTPUT (1)** *OPTION -Output assigned in parameter 20.01* |
| 10 | AO1 (-) | | |
| 11 | AO2 (+) | OPTION | **4-20 mA ANALOG OUTPUT (2)** *OPTION -Output assigned in parameter 20.06* |
| 12 | AO2 (-) | | |

## COMMON CONFIGURATIONS

Example 2 Wire START/STOP

E-Stop

**X22 Terminal Block**

| 1 | DI1 | OPTION | **2 WIRE START/STOP (AUTO)** |
| 2 | DI2 | OPTION | **HAND/JOG** |
| 3 | DI3 | OPTION | **DUAL SETPOINT** | 0-Open, Setpoint 1 [REF 1] 1-Closed, Setpoint 2 [REF 2] |
| 4 | DI4 | OPTION | **SECONDARY PUMP PROTECT A** | 0 - Secondary Protect (Open) 1 - Normal (Closed) |
| 5 | DI5 | OPTION | **SECONDARY PUMP PROTECT B** | 0 - Secondary Protect (Open) 1 - Normal (Closed) |
| 6 | DI6 | OPTION | **FAULT RESET** |
| 7 | 24 VDC | | **DI Reference Voltage** 100 mA Max |
| 8 | 24 VDC | | |
| 9 | GND 1 | | **DI GROUND** |
| 10 | GND 2 | | **DI GROUND** |
| 11 | DI IL | OPTION | **E STOP/DRIVE PERMISSIVE** |

**!! NOTE !!**
DIIL Must be closed for the drive to operate. If your application does not require an E-Stop/Drive Permissive, DIIL may be bypassed by jumping DIIL to X22 connections #7 or #8

**X23 Terminal Block**
| 1 | 24 VDC | **PROCESS TRANSMITTER POWER** 24VDC 250 mA Maximum |
| 2 | GND | |

SHIELD
Grounding Clamp
Shielded control wire

**X25 Terminal Block**
| 1 | RO1 NC | OPTION | **ASSIGNABLE RELAY [RO1]** The output of this relay is assignable from parameter 19.01 *Default : Ready* |
| 2 | RO1 COM | | |
| 3 | RO1 NO | | |

**X26 Terminal Block**
| 1 | RO2 NC | OPTION | **ASSIGNABLE RELAY [RO2]** The output of this relay is assignable from parameter 19.04 *Default : Running* |
| 2 | RO2 COM | | |
| 3 | RO2 NO | | |

**X27 Terminal Block**
| 1 | RO3 NC | OPTION | **ASSIGNABLE RELAY [RO3]** The output of this relay is assignable from parameter 19.07 *Default : Not Used* |
| 2 | RO3 COM | | |
| 3 | RO3 NO | | |

## Configuration Notes

17.20 AI1 CONFIG
PROC TRANS 2 - Secondary process transmitter
PROC TRANS 1 – Primary process transmitter
EXT SETPOINT – External setpoint input
CONDITION 1 – General condition transmitter 1
CONDITION 2 - General condition transmitter 2
SPEED CTRL REF - Speed signal reference
FLOWMETER – External flowmeter for pump protection
SG/TEMP – Specific gravity
SPEED OVERRIDE – Speed override reference
NOT USED

17.21 AI2 CONFIG
PROC TRANS 1 - Primary process transmitter
SPEED CTRL REF. – Speed signal reference
NOT USED

17.22 AI3 CONFIG
PROC TRANS 1 - Primary process transmitter
SPEED CTRL REF. – Speed signal reference
CONDITION 1 - General condition transmitter 1
CONDITION 2 – General condition transmitter 2
PROC TRANS 2 - Secondary process transmitter
EXT SETPOINT – External Setpoint input
FLOWMETER – External flowmeter for pump protection
SG/TEMP – Specific gravity
SPEED OVERRIDE – Speed override reference
NOT USED

20.01 AO1 CONFIG
20.06 AO2 CONFIG
+ 000.000.00  NOT USED
Select any Group 1 / Group 2 signal
Common Settings are:
+ .002.007.00  pump speed (RPM)
+ .001.003.00  motor-frequency (HZ)
+ .001.004.00  motor current (A)
+ .001.005.00  motor torque (%)
+ .001.006.00  motor power (%)

View of I/O Connection Board (RMIO) (Simplified Representation)

X26
X21
X22
X23
X25
X26
X27

19.01 RELAY R01 OUTPUT
19.04 RELAY R02 OUTPUT
19.07 RELAY R03 OUTPUT

READY
RUNNING
VFD FAULT/WRNGS
PUMP FAULT/WRNGS
ALL FAULTS/WRNGS
SECONDARY PROTECT A/B
PUMP PROTECT
HIGH CONDITION 1
HIGH CONDITION 2
LOW CONDITION 1
LOW CONDITION 2
LOC/REM
PROC TX ERR
START DELAY
SLEEP
SPEED OVERRIDE
RUN DISABLE
FAULT                      PCS    REQ.
FAULT (INV)                PCS    EXE.

ITT

# PS200 – DIGITAL INPUT WIRING

**PUMP**SMART

## Start / Stop Options - Single External Control Locations

### 2 Wire Start /Stop

START / STOP

X22 Terminal Block

| 1 | DI1 |
| 2 | DI2 |
| 3 | DI3 |
| 4 | DI4 |
| 5 | DI5 |
| 6 | DI6 |
| 7 | 24 VDC |
| 8 | 24 VDC |
| 9 | GND 1 |
| 10 | GND 2 |
| 11 | DI IL |

E-Stop

!! NOTE !!

DIIL Must be closed for the drive to operate. If your application does not require an E-Stop/Drive Permissive, DIIL may be bypassed by jumping DIIL to X22 connections #7 or #8

Note: Set parameter 12.01 to 2 Wire DI1

### 2 Wire H-O-A

AUTO
OFF
HAND

X22 Terminal Block

| 1 | DI1 |
| 2 | DI2 |
| 3 | DI3 |
| 4 | DI4 |
| 5 | DI5 |
| 6 | DI6 |
| 7 | 24 VDC |
| 8 | 24 VDC |
| 9 | GND 1 |
| 10 | GND 2 |
| 11 | DI IL |

E-Stop

!! NOTE !!

DIIL Must be closed for the drive to operate. If your application does not require an E-Stop/Drive Permissive, DIIL may be bypassed by jumping DIIL to X22 connections #7 or #8
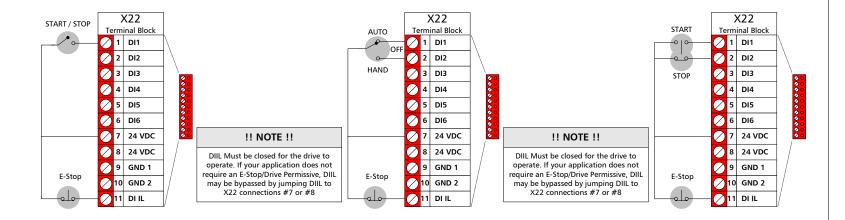
Note: Set parameter 12.01 to HOA DI1,2

### 3 Wire Start /Stop

START
STOP

X22 Terminal Block

| 1 | DI1 |
| 2 | DI2 |
| 3 | DI3 |
| 4 | DI4 |
| 5 | DI5 |
| 6 | DI6 |
| 7 | 24 VDC |
| 8 | 24 VDC |
| 9 | GND 1 |
| 10 | GND 2 |
| 11 | DI IL |

E-Stop

Note: Set parameter 12.01 to 3W DI1P, D12P

## Optional Thermistor For Motor Protection

### Option 1: Motor Thermistor Relay

Thermistor Relay

X22 Terminal Block

| 1 | DI1 |
| 2 | DI2 |
| 3 | DI3 |
| 4 | DI4 |
| 5 | DI5 |
| 6 | DI6 |
| 7 | 24 VDC |
| 8 | 24 VDC |
| 9 | GND 1 |
| 10 | GND 2 |
| 11 | DI IL |

Motor

### Option 2: Motor Thermistor

X22 Terminal Block

| 1 | DI1 |
| 2 | DI2 |
| 3 | DI3 |
| 4 | DI4 |
| 5 | DI5 |
| 6 | DI6 |
| 7 | 24 VDC |
| 8 | 24 VDC |
| 9 | GND 1 |
| 10 | GND 2 |
| 11 | DI IL |

Motor        10nf

Note: Set Parameter 25.06 to Thermistor

⚠ **WARNING**

According to IEC664, the connection of the motor thermistor to a digital input requires double or reinforced insulation between motor live parts and the thermistor. Reinforced insulation entails a clearance and creeping distance of 8 mm (0.31 in ) for 400/500 VAC input voltages. If the thermistor assembly does not fulfill the requirements, the other I/O terminals of the drive must be protected against contact, or a thermistor relay must be used to isolate the thermistor from the digital input. Failure to follow these instructions may result in serious personal injury and/or equipment damage.

## Start / Stop Options - Dual External Control Locations

### Example: Localized Pump Start when H-O-A switch in HAND Mode

This configuration enables the user to toggle between two different control locations. An example of this would be if the customer has one Start /Stop switch in the field (by the pump) and the another in the control room. Using digital input 3 the user can toggle between the two control locations.

AUTO
OFF
HAND

LOCALIZED / REMOTE SELECTOR SWITCH
DI3 OPEN = LOCAL
DI3 CLOSED = REMOTE

REMOTE START / STOP

E-Stop

X22 Terminal Block

| 1 | DI1 |
| 2 | DI2 |
| 3 | DI3 |
| 4 | DI4 |
| 5 | DI5 |
| 6 | DI6 |
| 7 | 24 VDC |
| 8 | 24 VDC |
| 9 | GND 1 |
| 10 | GND 2 |
| 11 | DI IL |

!! NOTE !!

DIIL Must be closed for the drive to operate. If your application does not require an E-Stop/Drive Permissive, DIIL may be bypassed by jumping DIIL to X22 connections #7 or #8

Note:
Set parameter 12.01 to 2W DI 1- 2WDI5

### Example : Speed Override when H-O-A switch in Hand Mode

This configuration enables the user to toggle between two different control locations. An example of this would be if the customer has a Hand-Off-Auto switch in the field (by the pump) and requires that in hand mode the pump be run from the local station and in Auto mode the pump be controlled by a remote location

AUTO
OFF
HAND

START/STOP from Control Room

E-Stop

X22 Terminal Block

| 1 | DI1 |
| 2 | DI2 |
| 3 | DI3 |
| 4 | DI4 |
| 5 | DI5 |
| 6 | DI6 |
| 7 | 24 VDC |
| 8 | 24 VDC |
| 9 | GND 1 |
| 10 | GND 2 |
| 11 | DI IL |

!! NOTE !!

DIIL Must be closed for the drive to operate. If your application does not require an E-Stop/Drive Permissive, DIIL may be bypassed by jumping DIIL to X22 connections #7 or #8

Note:
Set parameter 12.01 to HOA DI1,2-D15
Set parameter12.11 to H-O-A

### Speed Override Option

Alternate Location At DI3

X22 Terminal Block

| 1 | DI1 |
| 2 | DI2 |
| 3 | DI3 |
| 4 | DI4 |
| 5 | DI5 |
| 6 | DI6 |
| 7 | 24 VDC |
| 8 | 24 VDC |
| 9 | GND 1 |
| 10 | GND 2 |
| 11 | DI IL |

Note:
Set Parameter 12.11 to either DI5, DI5 (INV), DI3 or DI3 (INV)
*Inverse setting activates speed override when switch is open*

### Digital Specific Gravity Selection ( SG Select )

Toggles between minimum and maximum SG values

Open = SG Min.
Closed = SG Max.

X22 Terminal Block

| 1 | DI1 |
| 2 | DI2 |
| 3 | DI3 |
| 4 | DI4 |
| 5 | DI5 |
| 6 | DI6 |
| 7 | 24 VDC |
| 8 | 24 VDC |
| 9 | GND 1 |
| 10 | GND 2 |
| 11 | DI IL |

Note:
Set Parameter 29.12 to DI

| PS200 Basic Wiring PS200 v5 | | | |
| --- | --- | --- | --- |
| B05436A | SHEET 2 OF 2 | REV 1 | Issue - |
| Drawing is not to scale Dimensions in inches [mm] | | Drawn: AI 0-02-06 | |
| | | Checked: AES 6-23-06 | |

# PS200 – Multi-Pump Connections

**ITT**  **PUMPSMART**

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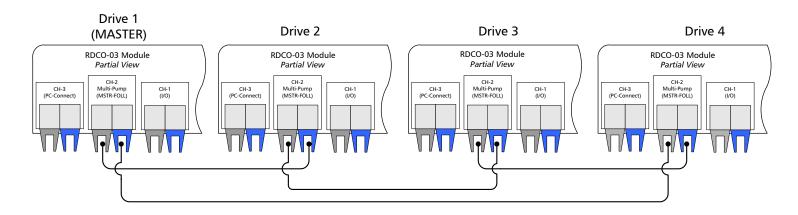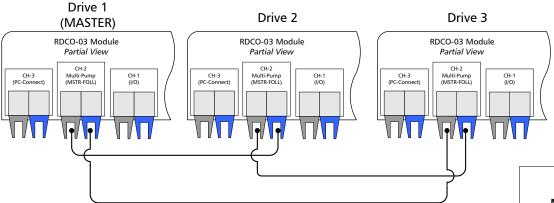
## Fiber-Optic Connections between PS200 Controllers

### 4-Drive Arrangement

**Drive 1 (MASTER)** — RDCO-03 Module *Partial View*
CH-3 (PC-Connect) | CH-2 Multi-Pump (MSTR-FOLL) | CH-1 (I/O)

**Drive 2** — RDCO-03 Module *Partial View*
CH-3 (PC-Connect) | CH-2 Multi-Pump (MSTR-FOLL) | CH-1 (I/O)

**Drive 3** — RDCO-03 Module *Partial View*
CH-3 (PC-Connect) | CH-2 Multi-Pump (MSTR-FOLL) | CH-1 (I/O)

**Drive 4** — RDCO-03 Module *Partial View*
CH-3 (PC-Connect) | CH-2 Multi-Pump (MSTR-FOLL) | CH-1 (I/O)

### 3-Drive Arrangement

**Drive 1 (MASTER)** — RDCO-03 Module *Partial View*
CH-3 (PC-Connect) | CH-2 Multi-Pump (MSTR-FOLL) | CH-1 (I/O)

**Drive 2** — RDCO-03 Module *Partial View*
CH-3 (PC-Connect) | CH-2 Multi-Pump (MSTR-FOLL) | CH-1 (I/O)

**Drive 3** — RDCO-03 Module *Partial View*
CH-3 (PC-Connect) | CH-2 Multi-Pump (MSTR-FOLL) | CH-1 (I/O)

### 2-Drive Arrangement

**Drive 1 (MASTER)** — RDCO-03 Module *Partial View*
CH-3 (PC-Connect) | CH-2 Multi-Pump (MSTR-FOLL) | CH-1 (I/O)

**Drive 2** — RDCO-03 Module *Partial View*
CH-3 (PC-Connect) | CH-2 Multi-Pump (MSTR-FOLL) | CH-1 (I/O)



---

**The RDCO-03 DDCS COMMUNICATION MODULE is to be mounted in the DDCS slot and affixed with (2) screws provided**

**Fiber Optic Cables**
-Light colored connector to light colored receptical.
-Dark colored connector to dark colored receptical
-MINIMUM BEND RADIUS: 2 Inches

Extra cable may be looped and stored within the drive. Maintain minimum bend radius.
Fiber optic cable ends are not the same color.

**Fiber Optic Cable Kit Part Numbers**
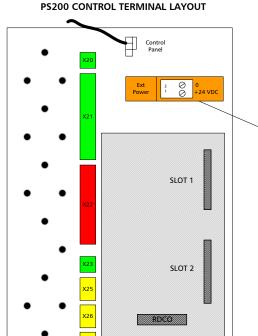
2 Pumps - 800MP2
3 Pumps - 800MP3
4 Pumps - 800MP4

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## External 24VDC Power Supply Arrangement for Multi-Pump Applications

PURPOSE:
TO PROVIDE EXTERNAL POWER TO CONTROL BOARDS IN MULTI-PUMP APPLICATIONS. THIS WILL PERMIT THE MULTI-PUMP SYSTEM TO COMMUNICATE WHEN THE MAIN INPUT POWER IS DISCONNECTED FROM THE DRIVE DURING PUMP MAINTAINANCE.

EXTERNAL POWER SUPPLY REQUIREMENTS
(24VDC) < 1A PER DRIVE.

**PS200 CONTROL TERMINAL LAYOUT**



Control Panel
X20
Ext Power — 2 / 1 — 0 +24 VDC
X21
LOCATION 'A' TERMINAL X34
X22
SLOT 1
X23
X25
X26
SLOT 2
X27
RDCO

EXAMPLE R2 FRAME (ACTUAL LOCATION OF TERMINAL X34 WILL VARY DEPENDING ON FRAME SIZE.)

PROCEEDURE:

STEP 1: CHANGE PARAMETER 11.13 CONTROL BOARD SUPPLY TO EXTERNAL 24V

STEP 2: DISCONNECT ALL POWER TO THE DRIVES.
BREAK OFF AND REMOVE THE PLASTIC TAB AT LOCATION "A" TO ACCESS TERMINAL X34.
THE EXISTING 24 VDC X34 CONNECTOR IS TO BE DISCONNECTED FROM INTERNAL 24 VDC POWER SUPPLY AND DISCARDED. THE WIRES ARE TO BE INSULATED AND SECURED FROM CONTACT.

STEP 3: CONNECT WIRING HARNESS FROM THE OUTPUT OF THE 24 VDC EXTERNAL POWER SUPPLY TO LOCATION "A" AS ILLUSTRATED ABOVE FOR EACH DRIVE. NOTE THE ELECTRICAL CONNECTOR IS IDENTIFIED AS X34.

STEP 4: SET THE VOLTAGE SELECTOR SWITCH ON THE FRONT OF THE EXTERNAL POWER SUPPLY TO THE APPROPRIATE INPUT VOLTAGE. CONNECT THE POWER CORD FROM THE EXTERNAL POWER SUPPLY TO THE POWER SOURCE.

---

| PS200 Multi-Pump Connections | | | |
|---|---|---|---|
| B05433A | SHEET 1 OF 1 | REV 0 | Issue - |
| Drawing is not to scale Dimensions in inches [mm] | Drawn: JCS 6-23-06 | | |
| | Checked: AES 6-23-06 | | |

## NO DIRECT SUNLIGHT

3300 ft (1000 M)

104 °F (40 °C) MAX

5°F (-15°C) MIN

5-95% RELATIVE HUMIDITY
NO CONDENSATION
NO CORROSIVE GASES

Refer to Hardware Manual Technical Data for application guidelines outside of the above listed limits

IP21~NEMA1
IP55~NEMA 12

A

7.9" [200] TYP

B

2.0" [51] TYP

Free Space Required for Ventilation

cable connection box

12" [305]

W

H

Mounting template cut from shipping package
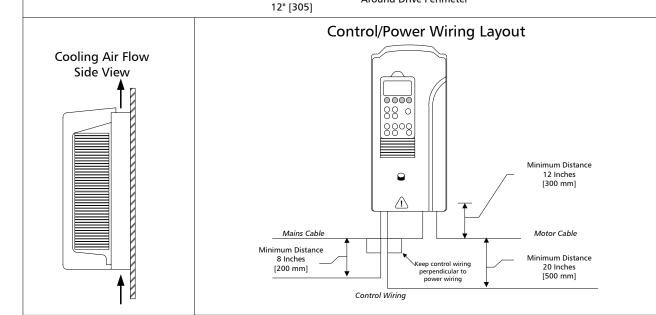
### NEMA1(IP21)[1] Free Space Requirements / Drill Pattern (All Enclosures)

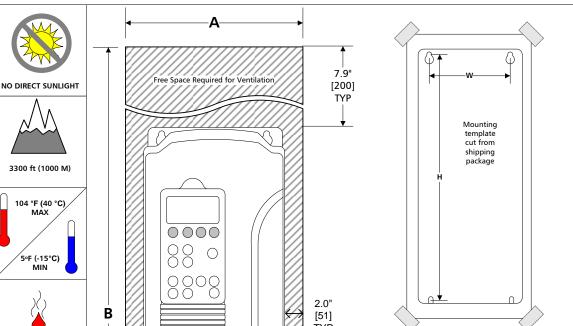| Frame Size | A Inches [mm] | B Inches [mm] | H Inches [mm] | W Inches [mm] |
|---|---|---|---|---|
| R2 | 10.5 [266] | 34.5 [876] | 14.17 [360] | 4.92 [125] |
| R3 | 10.8 [274] | 36.4 [925] | 16.06 [408] | 4.92 [125] |
| R4 | 13.5 [343] | 39.2 [996] | 18.70 [475] | 8.39 [213] |
| R5 | 14.5 [368] | 43.6 [1107] | 23.15 [588] | 9.37 [238] |
| R6 | 15.8 [401] | 47.5 [1207] | 26.57 [675] | 10.35 [263] |

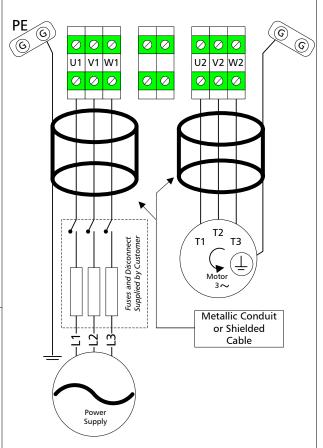1. For NEMA 12 (IP55) Free Space Requirement is 2" (50) Around Drive Perimeter

## Cooling Air Flow Side View

## Control/Power Wiring Layout

Minimum Distance 12 Inches [300 mm]

Mains Cable

Motor Cable

Minimum Distance 8 Inches [200 mm]

Keep control wiring perpendicular to power wiring

Minimum Distance 20 Inches [500 mm]

Control Wiring

---

The information provided on this sheet is for installation reference only. Please refer to the ACS800 Installation Manual for additional installation details

## Mains /Power Wiring

PE

U1 V1 W1      U2 V2 W2

T2
T1   T3
Motor 3~

L1  L2  L3

Fuses and Disconnect Supplied by Customer

Metallic Conduit or Shielded Cable

Power Supply

### General Notes:
1. 360° Grounded terminations are required
2. Ultra-rapid fuses are required to protect drive.
3. Fuse operating time is to be less than 0.5 sec.
4. Refer to Technical Data section for details

---

## Cable Entry

| Frame Size | NEMA 1/ NEMA 12 | | | | | | IP21 / IP55 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | U1/V1/W1-U2/V2/W2 R +,R-Terminals | | | Earthing PE Terminals | | | U1/V1/W1-U2/V2/W2 R +,R-Terminals | | | | Earthing PE Terminals | |
| | Max. Wire Size AWG | Max. Wire Dia. NEMA 1 inches | Tightening Torque Lbf-ft | Max. Wire Size AWG | Tightening Torque Lbf-ft | | Max. Wire Size mm² | Max. Wire Dia. IP21 mm | Max. Wire Dia. IP55 mm | Tightening Torque Nm | Max. Wire Size mm² | Tightening Torque Nm |
| R2 | 6* | 0.8 | 0.09-1.1 | 8 | 1.1 | | To 16* | 21 | 14-20 | 1.2-1.5 | 10 | 1.5 |
| R3 | 6* | 0.8 | 0.09-1.1 | 8 | 1.1 | | To 16* | 21 | 14-20 | 1.2-1.5 | 10 | 1.5 |
| R4 | 4 | 1.14 | 1.5-3.0 | 5 | 2.2 | | To 25 | 29 | 23-25 | 2-4 | 16 | 3 |
| R5 | 10...2/0 | 1.39 | 11.1 | 10...2/0 | 11.1 | | 6...70 | 35 | 23-25 | 15 | 6...70 | 15 |
| R6 | 3/0...350 MCM** | 2.09 | 14.8-29.5 | 4/0 | 5.9 | | 95...185** | 53 | 30-45 | 20-40 | 95 | 8 |

\* 6 AWG (16 mm²) rigid solid cable, 8 AWG (10 mm²) flexible stranded cable
\*\* With cable lugs 6..2/0 AWG (16...70 mm²) tightening torque 14.8..29.5 Lbf-Ft (20...40 Nm.) Cable lugs are not included

## Basic Dimensions

| Frame Size | Basic Drive Dimensions NEMA 1 / IP21 | | | | Basic Drive Dimensions NEMA 12 / IP55 | | | |
|---|---|---|---|---|---|---|---|---|
| | Height [1] Inches [mm] | Width Inches [mm] | Depth Inches [mm] | Weight Lbm [kg] | Height Inches [mm] | Width Inches [mm] | Depth Inches [mm] | Weight Lbm [kg] |
| R2 | 15.96 [405] | 6.50 [165] | 8.90 [226] | 20 [9] | 20.8 [528] | 10.35 [263] | 9.49 [241] | 35 [16] |
| R3 | 18.54 [471] | 6.81 [173] | 10.43 [265] | 31 [14] | 20.8 [528] | 10.35 [263] | 10.74 [273] | 41 [18] |
| R4 | 23.87 [607] | 9.45 [240] | 10.79 [274] | 57 [26] | 30.49 [774] | 14.84 [377] | 10.94 [278] | 73 [33] |
| R5 | 29.09 [739] | 10.43 [265] | 11.26 [286] | 75 [34] | 30.49 [775] | 14.84 [377] | 12.14 [308] | 112 [51] |
| R6 | 34.65 [880] | 11.81 [300] | 15.75 [399] | 148 [67] | 36.34 [923] | 16.54 [420] | 16.54 [420] | 170 [77] |

1. Includes cable conn. box

## Installation Checklist

### MECHANICAL
1. Check that the ambient operating conditions are suitable [Technical Data].
2. Check that drive enclosure is suitable for installation location. Install in a non-hazardous location only.
3. Check that the unit is mounted properly on a vertical non-flammable wall [Mechanical Installation]
4. Check that cooling air flows freely
5. Check the applicability of the motor and the driven equipment [Electrical Installation]

### ELECTRICAL
6. If the PS200 is connected to an ungrounded power system or a high resistance grounded power system (over 30 Ohms), check that the EMC filter capacitors are disconnected.
7. The capacitors are reformed if stored over 1 year.
8. Check that the drive is grounded properly
9. Check that the input voltage matches the drive nominal input voltage
10. Check that the input power connections at U1, V1, and W1 are OK
11. Check that the appropriate line fuses are installed
12. Check that motor connections at U2, V2, and W2 are okay
13. Check the motor cable routing
14. Check that there are no power factor compensation capacitors connected between the drive and the motor.
15. Review and check that control connections inside the drive are properly wired [See control wiring diagrams].
16. Check that there are no tools or foreign objects left inside the drive.
17. With bypass connection, check that input line voltage cannot be applied to the output of the PumpSmart PS200.
18. Drive, motor connection box and other covers are in place.

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### PS200 Installation Quick Reference Wall Mount Units

# PS200 UL INSTALLATION QUICK REFERENCE - Floor Mount Units (ACS800-PC)
## NEMA1 / NEMA12

**ITT** **PUMP**SMART

### Environmental icons (left column)

- NO DIRECT SUNLIGHT
- 3300 ft (1000 M)
- NEMA1/NEMA12
  - 104°F (40°C) MAX
  - 5°F (-15° C) MIN
- 5-95% RELATIVE HUMIDITY — NO CONDENSATION NO CORROSIVE GASES
- Refer to Hardware Manual Technical Data for application guidelines outside of the above listed limits — NEMA1 / NEMA12

ACS800-PC NEMA 1

ACS800-PC NEMA 12

### ⚠ WARNING

Review the entire hardware manual prior to installation. Failure to follow these instructions may result in serious personal injury, death and/or equipment damage
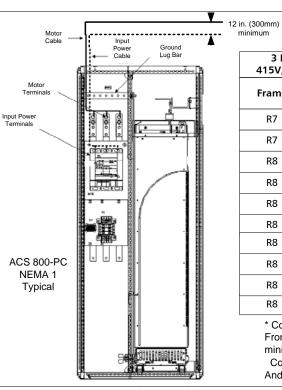
The information provided on this sheet is for installation reference only. Please refer to ACS800-PC Installation Manual for additional installation details

ACS 800-PC NEMA 1 Typical

12 in. (300mm) minimum

| 3 Phase Supply 380V, 400V 415V, 440V, 460V, 480V or 500V | | | Fuse (600v) | |
|---|---|---|---|---|
| Frame | Size | Input Current (A) | UL Class T (A) | Bussmann Type |
| R7 | -0170-5 | 175 | 300 | JJS - 300 |
| R7 | -0210-5 | 220 | 300 | JJS - 300 |
| R8 | -0270-5 | 293 | 400 | JJS - 400 |
| R8 | -0300-5 | 331 | 400 | JJS - 400 |
| R8 | -0320-5 | 397 | 600 | JJS - 600 |
| R8 | -0400-5 | 467 | 600 | JJS - 600 |
| R8 | -0440-5 | 501 | 800 | JJS - 800 |
| R8 | -0490-5 | 542 | 800 | JJS - 800 |
| R8 | -0550-5 | 614 | 800 | JJS - 800 |
| R8 | -0610-5 | 661 | 800 | JJS - 800 |

\* Control cables shall be 8 in. (200mm) minimum From input power cable and 20 in. (500mm) minimum from motor cable.
Control cables shall cross perpendicular to power And motor cables

Input and Motor Cable terminal sizes (per phase) and tightening torques are given below. Two hole cable lugs (½ inch diameter) can be used.

| FRAME SIZE | U1,V1,W1,U2,V2,W2 | | | EARTHING PE | |
|---|---|---|---|---|---|
| | Max Cable Kcmil/AWG | Screw Size | Tightening torque lbf ft | Screw Size | Tightening torque lbf ft |
| R7 | 2 x 250 MCM | ½ inch | 37...55 | 3/8 inch | 22...32 |
| R8 | 3 x 350 MCM | ½ inch | 37...55 | 3/8 inch | 22...32 |

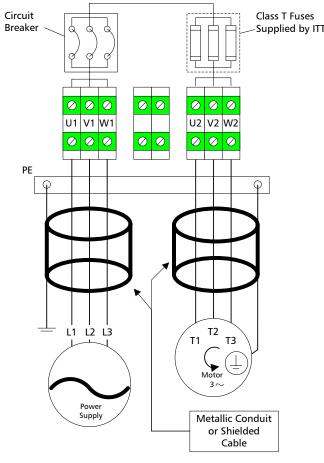### ACS800-PC NEMA 1 and NEMA 12 Dimensions

| Frame Size | A Inches [mm] | NEMA 1 B Inches [mm] | NEMA 12 B1 Inches [mm] | C Inches [mm] | NEMA 1 Lbm [kg] | NEMA 12 Lbm [kg] |
|---|---|---|---|---|---|---|
| R7 | 31.7 [806] | 85.9 [2181] | 93.6 [2377] | 25.9 [659] | 695 [315] | 740 [336] |
| R8 | 31.7 [806] | 85.9 [2181] | 93.6 [2377] | 25.9 [659] | 945 [429] | 990 [449] |

*(Header columns: A; NEMA 1 B; NEMA 12 B1; C; Weight: NEMA 1 Lbm, NEMA 12 Lbm)*

### Mains / Power Wiring Schematic

Circuit Breaker
Class T Fuses Supplied by ITT

U1 V1 W1 — U2 V2 W2

PE

L1 L2 L3
T1 T2 T3
Motor 3 ~

Power Supply

Metallic Conduit or Shielded Cable

### General Notes:
1. -360 Grounded terminations are required
2. Standard T type fuses or Ultra-rapid fuses are required to Protect drive. Fuse operating times should be less than 0.5 Sec. Refer to Technical Data Section for details

### (Mounting / clearance diagrams)
- 15 in. — UL Type 1 — Top clearance
- 12 in. for fan replacement — UL Type 12
- Fastening points when installed back against wall
- Fastening points when Installed back against back To another cabinet
- Space Requirement For Door Opening — 31.5 in (800mm)
- L-bracket, M12 bolt, Cabinet top
- Fastening cabinet at top using L-bracket (side view) Alternate (when fastening at back is not possible)

### Installation Checklist

#### MECHANICAL
1. Check that the ambient operating conditions are suitable [Technical Data].
2. Check that drive enclosure is suitable for installation location. Install in a non-hazardous location only.
3. Check that the unit is mounted properly on a vertical non-flammable wall [Mechanical Installation].
4. Check that cooling air flows freely.
5. Check the applicability of the motor and the driven equipment [Electrical Installation].

#### ELECTRICAL
5. If the PS200 is connected to an IT (ungrounded) power system, check that the EMC filter capacitors are disconnected.
6. The Capacitors are reformed if stored over 1 year.
7. Check that the drive is grounded properly.
8. Check that the input voltage matches the drive nominal input voltage.
9. Check that the input power connections at L1, L2, and L3 and tightening torques are OK.
10. Check that the appropriate line fuses and disconnect means are installed.
11. Check that motor connections at U2, V2, and W2 and tightening torques are okay.
12. Check the motor cable routing.
13. Check that there are no power factor compensation capacitors connected between the drive and the motor.
14. Review and check that control connections inside the drive are properly wired [See control wiring diagrams].
15. Set the fan voltage transformer and NEMA 12 Fan Transformer (if present).
16. Check that there are no tools or foreign objects or dust from drilling left inside the drive.
17. With bypass connection, check that input line voltage cannot be applied to the output of the PumpSmart PS200.
18. Drive, motor connection box and other covers are in place.

### PS200 UL Installation Quick Reference ACS800-PC Floor Mount Units

| Rev1 Format Update | Drawing is not to scale Dimensions in inches [mm] | Drawn: JCS 6-2-06 | SHEET 1 OF 1 | B05414A | REV 1 | Issue - |
|---|---|---|---|---|---|---|
| | | Checked: 6-2-06 | | | | |

**ITT**

**PUMP**SMART

NO DIRECT SUNLIGHT

3300 ft (1000 M)

NEMA1/NEMA12

104°F (40°C) MAX

5°F (-15° C) MIN

5-95% RELATIVE HUMIDITY
NO CONDENSATION
NO CORROSIVE GASES
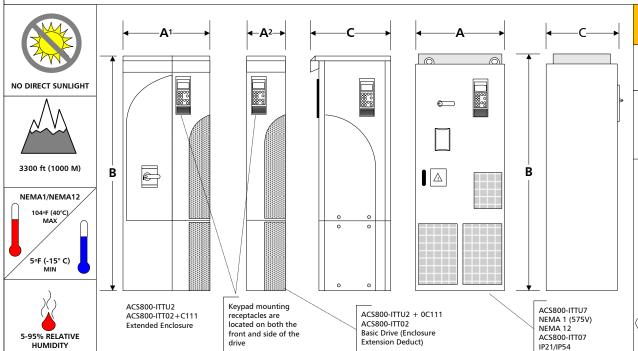
Refer to Hardware Manual Technical Data for application guidelines outside of the above listed limits

IP21~NEMA1
IP55~NEMA 12

A¹   A²   C   A   C

B

ACS800-ITTU2
ACS800-ITT02+C111
Extended Enclosure

Keypad mounting receptacles are located on both the front and side of the drive

ACS800-ITTU2 + 0C111
ACS800-ITT02
Basic Drive (Enclosure Extension Deduct)

ACS800-ITTU7
NEMA 1 (575V)
NEMA 12
ACS800-ITT07
IP21/IP54

## ⚠ WARNING

Review the entire hardware manual prior to installation. Failure to follow these instructions may result in serious personal injury, death and/or equipment damage

The information provided on this sheet is for installation reference only. Please refer to applicable ACS800 Installation Manual for additional installation details

8" Minimum [200 mm]
Control Wiring
Mains Cable
20" Minimum [500 mm]
Motor Cable
90°
PE Connection
12" Minimum [300 mm]

Refer to installation manual for detail wiring diagram

W2
V2
U2
Not Used
U1  V1  W1

ACS800-ITTU2
NEMA1
Typical

I/O Boards
Terminal Blocks
Relay Contacts

Drive Options

Line Fuse

Motor Cables should be spaced at least 12 inches [300 mm] from input power[MAINS] cable

Standard Cable Entry
NEMA1/NEMA12
- ACS800-ITTU2+0C111 is bottom entry/exit
- ACS800-ITTU2 and ACS800-ITTU7 are top entry/exit
IP21/IP54
ACS800-ITT02
ACS800-ITT02+C111 and ACS800-ITT07 are all bottom Entry/exit

### Copper cables with IEC concentric copper shield / Copper cables with NEC concentric copper shield

| Max Load Current A | Cable Type mm² | Max. Load Current A | Cable Type AWG/ Kcmil |
|---|---|---|---|
| 215 | 3x120 | 224 | 250MCM or 2x1 |
| 249 | 3x150 | 251 | 300MCM or 2x1/0 |
| 284 | 3x185 | 273 | 350MCM or 2x2/0 |
| 335 | 3x240 | 295 | 400MCM or 2x2/0 |
| 358 | 3x(3x50) | 334 | 500MCM or 2x3/0 |
| 371 | 2x(3x95) | 370 | 600MCM or 2x4/0 or 3x1/0 |
| 431 | 2x(3x120) | 405 | 700MCM or 2x4/0 or 3x2/0 |
| 459 | 3x(3x70) | 449 | 2x250MCM or 3x2/0 |
| 498 | 2x(3x150) | 502 | 2x300MCM or 3x3/0 |
| 557 | 3x(3x95) | 546 | 2x350MCM or3x4/0 |
| 568 | 2x(3x185) | 590 | 2x400MCM or3x4/0 |
| 646 | 3x(3x120) | 669 | 2x500MCM or 3x250MCM |
| 671 | 2x(3x240) | 739 | 2x600MCM or 3x300MCM |
| 746 | 3x(3x150) | 810 | 2x700MCM or 3x350MCM |
| 852 | 3x(3x185) | 884 | 3x400MCM or 4x250MCM |
| 1006 | 3x(3x240) | 1003 | 3x500MCM or 4x300MCM |
| 1109 | | | 3x600MCM or 4x400MCM |
| 1214 | | | 3x700MCM or 4x500MCM |

Input and Motor Cable terminal sizes (per phase) and tightening torques are given below. Two hole cable lugs (½ inch diameter) can be used for U2/U7 models. For U2+0C111 models one hole cable lugs (½ inch diameter) can be used. The maximum allowed width of the cable lug is 1.5 inches.

## Mains / Power Wiring

PE
G G
U1 V1 W1    U2 V2 W2
G G

** Fuses and Disconnect Supplied by ITT Goulds

T1 T2 T3
Motor 3~

L1 L2 L3

Power Supply

Metallic Conduit or Shielded Cable

**Disconnect / fusing provided by ITT on extended enclosure (ACS800-ITTU2/U7, ACS800-ITT02+C111 and ACS800-ITT07). Customer supplied disconnect/fusing is required for Basic Drive (ACS800-ITTU2+0C111 and ACS800-ITT02)

### ACS800-ITTU2 and U2 + 0C111 NEMA 1 and ACS800-ITT02 and 02+C111, IP21 Dimensions / Weight

| Frame Size | A¹ Inches [mm] | A² Inches [mm] | B Inches [mm] | C Inches [mm] | Basic Lbm [kg] | Std Lbm [kg] |
|---|---|---|---|---|---|---|
| R7 | 23.7 [602] | 9.8 [250] | 59.3 [1507] | 20.6 [524] | 243 [110] | 430 [195] |
| R8 | 31.2 [793] | 13.66 [347] | 81.63 [2074] | 24.5 [622] | 529 [240] | 827 [375] |

### ACS800-ITTU7/ACS800-ITT07 Dimensions / Weight

| Frame Size | A * Inches (mm) | B Inches (mm) NEMA1(IP21) | B Inches (mm) NEMA12(IP54) | C Inches (mm) | Std Lb (kg) |
|---|---|---|---|---|---|
| R7 | 32.7 (830) | 84.2 (2130) | 91.1 (2315) | 27.3 (689) | 900 (400) |
| R8 | 32.7 (830) | 84.2 (2130) | 91.1 (2315) | 27.3 (689) | 1100 (500) |

* For R7 add 7.87 in (200 mm) for EMC Filter
  For R8 add 5.75 in (400 mm) for EMC Filter

ACS800-ITTU2+0C111
ACS800-ITT02
Free Space
FS

ACS800-ITTU2+0C111
ACS800-ITT02
Free Space
FX

(Drive lifted from above)

ACS800-ITTU2
ACS800-ITT02+C111
Free Space
FS

ACS800-ITTU7
ACS800-ITT07
Free Space
FS

31.5 in (800mm)

Required Free Space
Wall fixing point
Keypad Mounting Slot
Air Inlet Surface

Door Opening Space Requirements (R7/R8)

| Frame Size | FS¹ Inches [mm] | FX¹,² Inches [mm] | Free Space Above Unit Inches (mm) |
|---|---|---|---|
| R7 | 20 [500] | 7.9 [200] | 7.9 [200] |
| R8 | 24 [600] | 12 [300] | 12 [300] |

¹ - Does not include room for installer
² - Additional space may be required for fan/capacitor replacement

For ACS800-ITTU7/-07
* Free space in front of unit for cooling 5.91 in (150mm)
* Free space above unit measured from baseplate of cabinet top: 15.75 in (400mm)
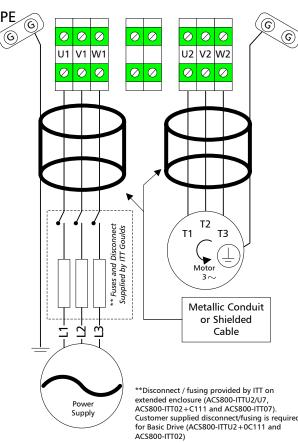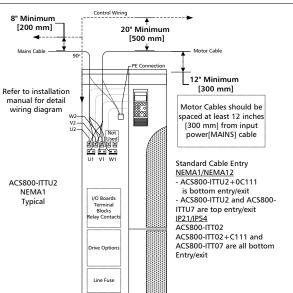* IP54, NEMA12 : Allow additional 12.28 in (320mm) For Fan Replacement

### ACS800-ITTU2 and U2+0C111

| Frame Size | U1,V1,W1,U2,V2,W2 Screw Size | U1,V1,W1,U2,V2,W2 Tightening Torque lbf ft | EARTHING PE Screw Size | EARTHING PE Tightening Torque lbf ft |
|---|---|---|---|---|
| R7 | ½ inch | 37...55 | 5/16 inch | 11...16 |
| R8 | ½ inch | 37...55 | 5/16 inch | 11...16 |

### ACS800-ITTU7

| Frame Size | Max. Cable | U1,V1,W1,U2,V2,W2 Screw Size | Tightening Torque lbf-ft | EARTHING PE Screw Size | Tightening Torque lbf-ft |
|---|---|---|---|---|---|
| R7 | 2x250 MCM | ½ in. | 37-55 | 3/8 in. | 22-32 |
| R8 | 3x700 MCM | ½ in. | 37-55 | 3/8 in. | 22-32 |

### ACS800-ITT02 and 02+C111

| Frame Size | Number of Holes per Phase | Cable Dia mm | Screw Size | Torque Nm | Earthing PE Screw Size | Earthing PE Torque Nm |
|---|---|---|---|---|---|---|
| R7 | 2 | 58 | M12 | 50...75 | M8* | 15...22 |
| R8 | 3 | 58 | M12 | 50...75 | M8* | 15...22 |

### ACS800-ITT07

| Frame Size | Number of Holes per Phase | Hole Dia. mm | Max Wire Size mm² | Screw Size | Tightening Torque Nm | Earthing PE Screw Size | Tightening Torque Nm |
|---|---|---|---|---|---|---|---|
| R7 | 3 | 60 | 1x240 2x185 | M12 | 50-75 | M10 | 30-44 |
| R8 | 3 | 60 | 3x240 | M12 | 50-75 | M10 | 30-44 |

* M10 in the extended enclosure; 30...44 Nm tightening torque
The maximum width of cable lug is 38mm.

### INSTALLATION CHECKLIST

**MECHANICAL**

1. Check that the ambient operating conditions are suitable [Technical Data].
2. Check that drive enclosure is suitable for installation location. Install in a non-hazardous location only.
3. Check that the unit is mounted properly on a vertical non-flammable wall [Mechanical Installation]
4. Check that cooling air flows freely
5. Check the applicability of the motor and the driven equipment [Electrical Installation]

**ELECTRICAL**

6. If the PS200 is connected to an ungrounded power system or a high resistance grounded power system (over 30 Ohms), check that the EMC filter capacitors are disconnected.
7. The Capacitors are reformed if stored over 1 year.
8. Check that the drive is grounded properly.
9. Check that the input voltage matches the drive nominal input voltage.
10. Check that the input power connections at U1, V1, and W1 are OK.
11. Check that the appropriate line fuses are installed.
12. Check that motor connections at U2, V2, and W2 are okay.
13. Check the motor cable routing.
14. Check that there are no power factor compensation capacitors connected between the drive and the motor.
15. Review and check that control connections inside the drive are properly wired [See control wiring diagrams].
16. Set the fan voltage transformer and  NEMA 12 (IP54) Fan Transformer (if present.)
17. Check that there are no tools or foreign objects or dust from drilling left inside the drive.
18. With bypass connection, check that input line voltage cannot be applied to the output of the PumpSmart PS200.
19. Drive, motor connection box and other covers are in place.

### General Notes:

1. - 360° Grounded terminations are required
2.  Ultra-rapid fuses are required to protect drive. Fuse operating times should be less than 0.5 sec.
   - UL-Standard T/L type fuses
   - IEC- Standard gG type fuses
   Refer to Technical Data Section for details

## PS200 Installation Quick Reference Floor Mount Units

| Rev2 Updated format Rev3 Added 02 & 07 | Drawing is not to scale Dimensions in inches [mm] | Drawn: AI 091003 | SHEET 1 OF 1 | B04934A | REV 3 | Issue - |
|---|---|---|---|---|---|---|
| | | Checked: Tony Stavale | | | | |

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