PumpSmart

Configuration & Operation Manual

PumpSmart® Control Solutions PS220 v6.05

Congratulations on the purchase of your PumpSmart® PS220 .

Leveraging our 160+ years in pump design, manufacture, and operation, ITT Gould's Pumps has one goal: improving the profitability of your plant operations. Our products and services target your biggest issues to increase process uptime, reduce maintenance costs, and lower operating energy costs.

The PumpSmart® PS220 integrates a world leading ABB variable frequency drive with decades of pump control logic, that has been field tested on tens of thousands of applications worldwide. The PumpSmart® PS220 variable speed pump control system provides real-time control and protection of your pumps while also providing valuable process insight. By protecting against unplanned pump failure due to process upsets, ITT Gould's Pumps can keep your process running longer and reduce and may eliminate unplanned repair activities. In addition, through the "Right-Sizing" of your pump to your system, we can reduce not only your energy consumption, but the wear and tear on your pumps and process system.

Since 1999 the PumpSmart® patented logic has been the world leader in changing process control with pump protection for pumping systems. From single pump applications to multi-pump applications, the PumpSmart® PS220 can accurately control to Pressure, Flow, SmartFlow®, TDH, Level, and temperature with up to 6 pumps working together.

For additional information on the PumpSmart PS220 please take the time to review, and understand the safe installation, operation and maintenance guidelines provided in the ABB ACS880 Hardware Manual or visit www.ITTMC.com.

The PS220 has been designed for safe and reliable operation when properly installed, applied, and maintained in accordance with the instructions in the ACS880 Hardware Manual and PS220 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.

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IMPORTANT SAFETY REMINDER

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 ACS880 Hardware Manual and PS220 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 PS220 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 PS220 is heavy. Do not lift it alone.

Wall Mounted Units: Do not lift the PS220 by the front cover. Place the unit only on its back.

Floor Mounted Units: Lift the PS220 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

PumpSmart PS220 Wizard Menu

The PumpSmart PS220 utilizes a time saving versatile range of configurations to make initial setup incredibly easy. The PS220 wizards have been designed to cover a wide range of common applications for pumping systems used around the world.

The table below lists all of the Wizards that are in this section. Each section will describe the steps that you will need to follow to properly configure the function(s) and will show step by step screen shots as you progress from beginning to end. Additional information may also be shown, to assist you along the way, such as the table of all parameters used with the function.

A thorough detailed explanation of each functions capability and use are in the individual Features & Function section in this manual.

Details on functionality not covered in the Wizards are listed in the Functions and Features sections.

When reconfiguring the PumpSmart PS220 it is highly recommended to restore the parameters to the original factory default settings. Please use the PARAMATER RESTORE assistant shown in the Menu Tree below.

PS220 Wizard Menu Tree

- Basic Startup
- I/O Configuration
- SmartFlow
- Parameter Lock
- Process Control
- Miscellaneous
- Pump & VFD Protection
- Function & Features
- Multi-pump
- Fault Tracing
- Multivariable
- Parameter Listing
- Water Functions

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1. Basic Startup Wizard

The PumpSmart PS220's default mode of operation utilizes the Electric Motor connected and will run the Pump using the Basic Speed Control Functionality. The Basic Startup will configure the PumpSmart PS220 with the language you select, allow you to define the motor characteristic, execute a Motor ID, and verify correct motor rotation. You will then select the start/stop method, the operating speed range, and the method used to send the speed set point reference for the system to work.

This procedure provides a baseline for all the PumpSmart functionality to properly perform. It must be performed prior to any other functionality can be configured.

This functionality can only be configured with the PumpSmart PS220 Configuration Wizard.
To access this Wizard, from the Home Screen follow the path:
Menu>PS220 Configuration>Basic Startup>

The steps that you will perform are as follows:

1. Configure the Motor Parameters.
2. Configure Basic Drive Setup information.

The Screen Shots that follow will show you step by step, from start to finish as you progress, how to configure this functionality.

1.1 Motor Parameter Configuration Wizard

The PumpSmart PS220 will not operate unless the Electric Motor connected is configured with all necessary information required.

To access this Wizard, from the Home Screen follow the path: Menu>PS220 Configuration>Basic Startup>Edit Motor Parameters>

The steps that you will perform are as follows:
1. Configure the Motor Setup
2. Perform the Motor ID Run
3. Perform a Motor Jog for Direction

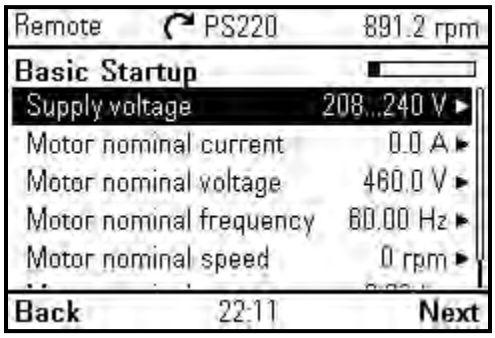
The Screen Shots that follow will show you step by step, from start to finish as you progress, how to configure this functionality.

1. Configure the Motor Information

All this information can usually be found on the Motor Nameplate that should be physically attached to the Motor.

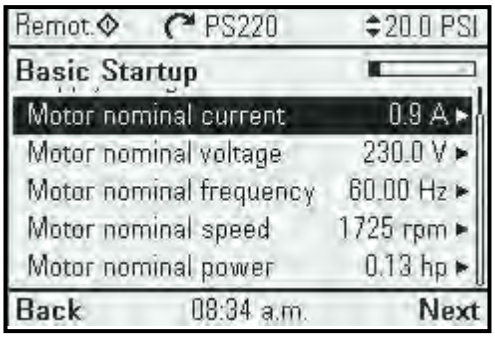
If the Nameplate is not available, you cannot proceed to any of the next steps.

1. Configure the Supply voltage



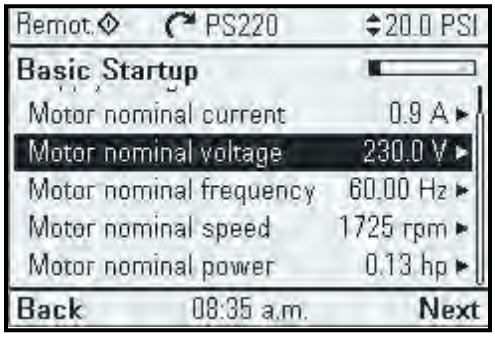
1. "ARROW RIGHT" To change
2. "ARROWS" to change value
3. "Save"
4. "ARROW DOWN"

2. Configure the Motor Full Load Amps/Current (FLA)



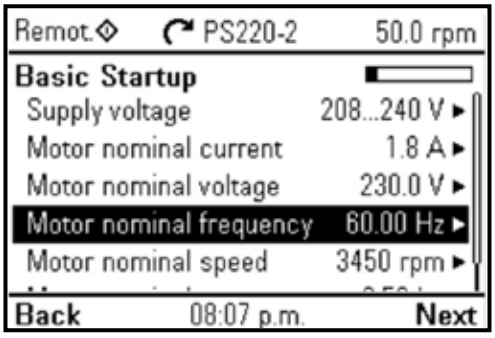
1. "ARROW RIGHT" To change
2. "ARROWS" to change value
3. "Save"
4. "ARROW DOWN"

3. Configure the Motor Voltage



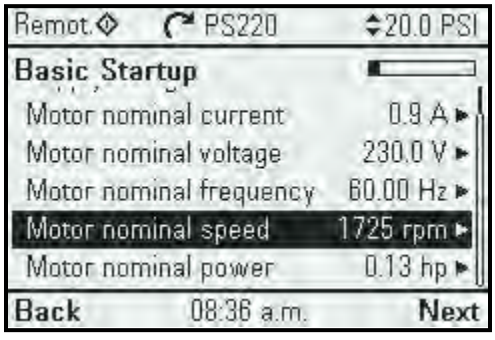
1. "ARROW RIGHT" To change
2. "ARROWS" to change value
3. "Save"
4. "ARROW DOWN"

4. Configure the Motor frequency (50 or 60Hz)



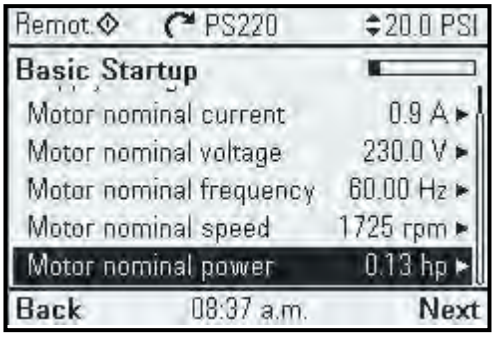
1. "ARROW RIGHT" To change
2. "ARROWS" to change value
3. "Save"
4. "ARROW DOWN"

5. Configure the Motor full load RPM (Slip Speed)



1. "ARROW RIGHT" To change
2. "ARROWS" to change value
3. "Save"
4. "ARROW DOWN"

6. Configure the Motor nominal power



1. "ARROW RIGHT" To change
2. "ARROWS" to change value
3. "Save"
4. "Next"

2. Perform a Motor ID RUN

The PumpSmart PS220 drive uses specific motor details to create a mathematical model. This model enables more accurate motor control and is created using the motor data you have just entered. The PS220 will be magnetizing the motor from 20 to 60 seconds at zero speed. This is called a Standstill ID run as the motor will not turn. It is also called a MAG ID, or ID Run. Once all the motor data has been entered, you will be prompted as follows:

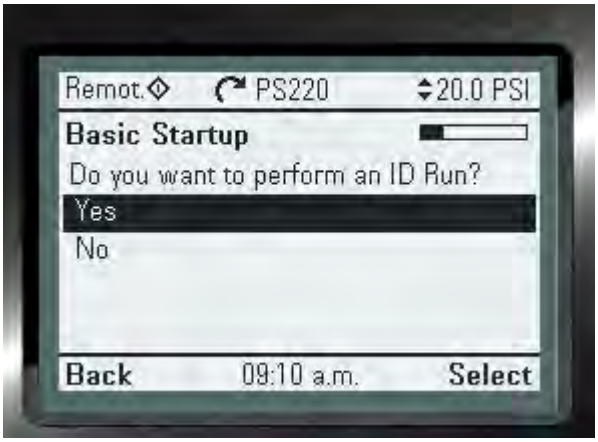
Note – Although the motor may not appear to respond to the start command. There may be an audible high-pitched sound coming from the motor which is normal.

Note – If the motor is repaired or replaced in the future, a Motor Identification run must be performed again to maintain the accuracy of the PumpSmart drive.

⚠ WARNING

The following procedure, while not spinning the motor, will energize the motor. All safety precautions must be followed before initiating the Motor ID run. Failure to do so could result in serious injury or death.

1. Request to perform a Motor ID Run.



1. "Select"

2. Run the ID.

1. Push the "Green Start Button"

3. Wait

2. Perform a Motor Jog for Direction

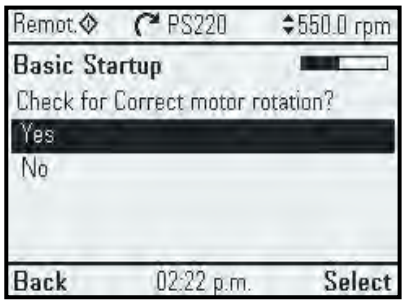
Jogging the pump motor for correct rotation can be accomplished through the Motor Jog function. The PumpSmart PS220 will rotate at 60 RPM and continue to do so until the rotation is confirmed to be correct (or incorrect). If incorrect the drive will prompt you to correct the rotation and then ask you to start it again to then confirm that rotation is correct. It will always only operate at 60RPM.

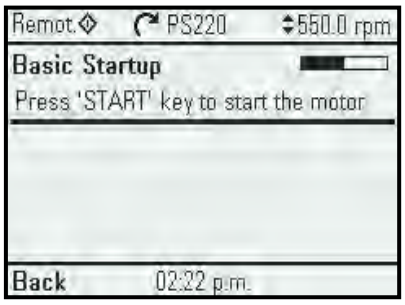
Note. There is no need to change any wiring on the (motor) load side of the PS220 to correct the rotation. It is all done by an internal PumpSmart PS220 setting.

⚠ DANGER

Never work on the PumpSmart PS220, 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 may result in serious injury or death.

The Screen Shots below follow the sequence when the initial rotation is incorrect. If it is correct the only screens 1, 2, 3, and 8 will apply.

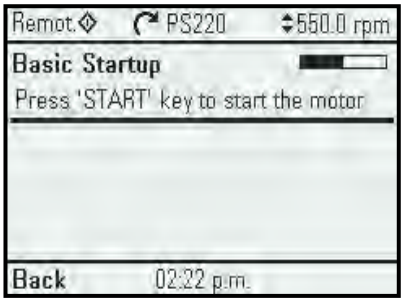
1.


2.


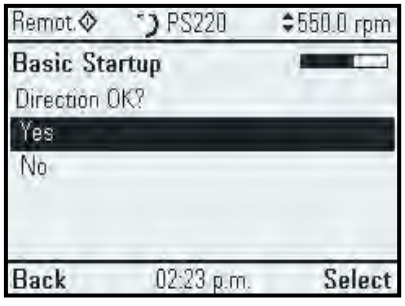
3.


4.


5.


6.


7.


8.


1.2. Basic Drive Setup Configuration Wizard

Refer the index in this manual for a more detailed description of the Functions that will be configured with this Wizard. When this Wizard is completed, you will be able to run the PS220 coupled to the motor in Basic Speed control mode.

This wizard will guide you, step by step as you progress, how to configure this function for use. To access this Wizard, from the Home Screen follow the path: Menu>PS220 Configuration>Basic Startup>Basic Drive Setup

This functionality should only be configured with the PumpSmart PS220 Configuration Wizard.

Steps to be performed will be as follows:
1. Configure a Start and Stop source.
2. Configure the Min Speed.
3. Configure the Max Speed.
4. Confirm the operating mode for Speed
5. Configure a Setpoint Source
6. Exit the Wizard

The Screen Shots that follow will show you step by step, from start to finish as you progress, how to configure this functionality.

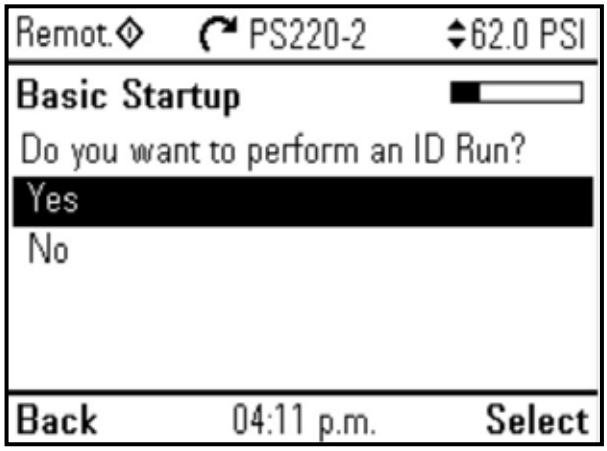
Starting the system in Speed control can be done after this configuration is completed.

⚠ WARNING

The following procedure, while not spinning the motor, will energize the motor. All safety precautions must be followed before initiating the Motor ID run. Failure to do so could result in serious injury or death.

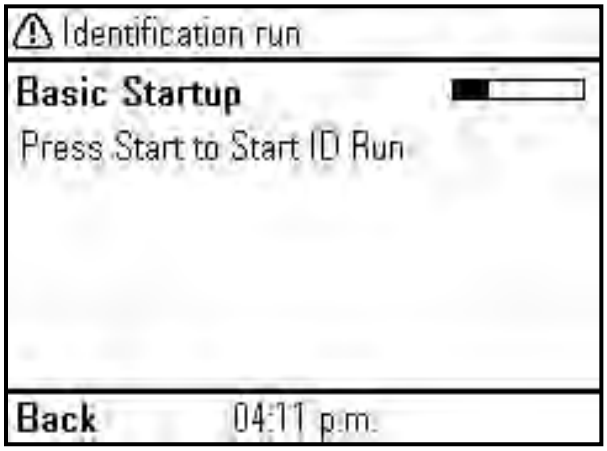
The PumpSmart PS220 drive uses specific motor details to create a mathematical model. This model enables more accurate motor control and is created using the motor data you have just entered. The PS220 will be magnetizing the motor from 20 to 60 seconds at zero speed. This is called a Standstill ID run as the motor will not turn. It is also called a MAG ID, or ID Run. Once all the motor data has been entered, you will be prompted as follows:

1. Request to perform a Motor ID Run.



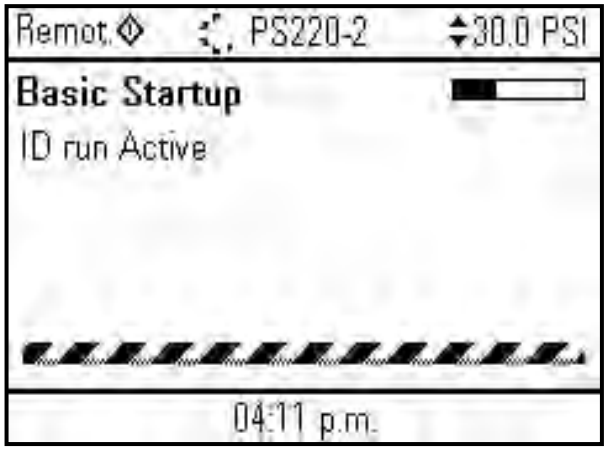
1. "Select"

2. Run the ID.



1. Push the "Green Start Button"

3. Wait



Note. Although the motor may not appear to respond to the start command. There may be an audible high-pitched sound coming from the motor which is normal.

Note. If the motor is repaired or replaced in the future, a Motor Identification run must be performed again to maintain the accuracy of the PumpSmart drive.

Safe Torque Off

The PS220 will not run the motor unless the Safe Torque Off (STO) is closed. The Safe Torque Off inputs are typically used for the external E-Stop circuit. If the E-Stop is active (STO open) the keypad will display:

The PS220 drive will come from the factory with jumpers installed between the STO Output and Inputs 1 and 2. If an E-Stop push button is installed in the STO circuit be sure the E-Stop is not activated.

DIIL Permissive

The PS220 will not run the motor unless the Permissive input [DIIL] is closed (24Vdc). This includes performing the Motor ID Run. If not closed a warning message will appear on the keypad display:

⚠ Run enable missing

The PS220 drive will come from the factory with a jumper between the DIIL input and 24Vdc. See Appendix A-4, Instrument Wiring, for details on wiring this switch.

2. Perform a Motor Jog for Direction

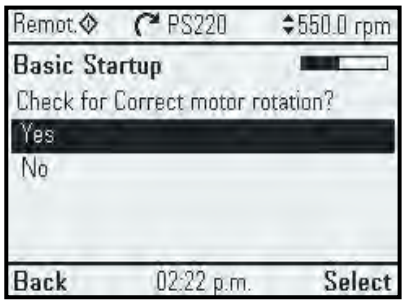
Jogging the pump motor for correct rotation can be accomplished through the Motor Jog function. The PumpSmart PS220 will rotate at 60 RPM and continue to do so until the rotation is confirmed to be correct (or incorrect). If incorrect the drive will prompt you to correct the rotation and then ask you to start it again to then confirm that rotation is correct. It will always only operate at 60RPM.

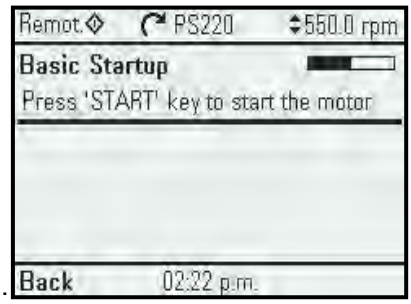
Note. There is no need to change any wiring on the (motor) load side of the PS220 to correct the rotation. It is all done by an internal PumpSmart PS220 setting.

⚠ DANGER

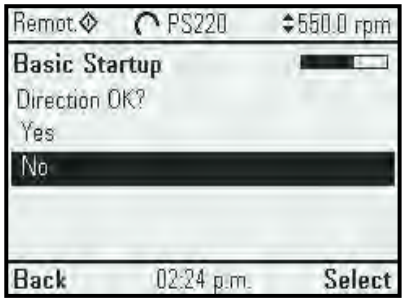
Never work on the PumpSmart PS220, the motor cable or the motor when main power is applied. After switching off the input power, always wait 5 minutes to allow drive internal capacitors to discharge before working on the drive, the motor, or the motor cable. Failure to do so may result in serious injury or death.

The Screen Shots below follow the sequence when the initial rotation is incorrect. If it is correct the only screens 1, 2, 3, and 8 will apply.

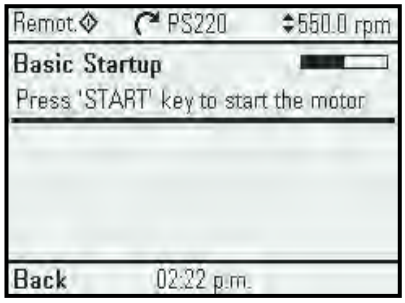
1.


2.


3.


4.


5.


6.


7.


8.


1. Configure the Start and Stop source.

The PumpSmart PS220 drive will start and stop by using the Keypad as the default selection. The Green Button starts it and the Red button stops it. Other choices are available. Refer to the "Start/Stop" section in this manual for the details on these choices.

1. "ARROW RIGHT" to change
2. "ARROW UP/DOWN" To change.
3. "SAVE"
4. "Next"

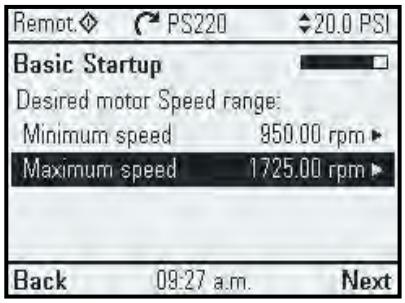
2. Configure the Minimum Speed.

By default, the minimum speed is set to 25% of the motor nameplate speed. Since pumps only develop pressure at the square of the operating speed caution should be taken to make sure that the minimum speed is high enough to prevent the pump from "dead heading". The "Dead Head Test" can be performed, or you can contact your authorized Pump Sales Engineer to determine this speed if you are unsure. Refer the section "Dead Head" in this manual for more details on this topic.

1. "ARROW RIGHT" To change
2. "ARROWS" to change value
3. "Save"
4. "ARROW DOWN"

3. Configure the Maximum Speed.

The Maximum Speed by default is configure to the motor nameplate speed. Since pumps develop pressure at the square of the operating speed, and the Power consumed at the cube of the speed, caution should be taken to make sure that the maximum speed is within all limits of the pumping system to prevent damage that may occur. Contact your authorized Pump Sales Engineer to determine this speed if you are unsure.



A. "ARROW RIGHT" To change
B. "SAVE" to continue.
C. "Next"

⚠ 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.

4. Confirm the Operating Mode for Speed.

1. "ARROW UP/DOWN" Highlight Speed Control
2. "Select"

5. Configure a Setpoint Source (Speed Control Reference).

The PumpSmart PS220 can be configured for the setpoint to be sourced in one of three ways:

1. Keypad
2. Analog Input (AI1, AI2, or optional additional AI)
3. Fieldbus Control

Please refer to the index in this manual for a detailed explanation of each of these sources.

1. Keypad:

This is the default setting when configuring the PumpSmart PS220 for the first time.

1. "ARROW RIGHT" to change
2. "ARROW UP/DOWN" To change.
3. "Select"
4. "Next"

2. Analog Input:

An analog signal can be sent into the PumpSmart PS220, from a PLC, DCS or another form of controller.

1. "ARROW UP/DOWN" To change.
2. "Select"
3. "Next"

Notes:

1. The signal will need to be wired into any unused analog input AI. Refer to the Analog Input section in the Index for more information on this configuration step.

2. When Selecting the Analog Input make sure that it is connected to the correct input. Refer to the wiring diagrams in this manual for more information.

For ANALOG AI:
"AI1/AI2 scaled at AI1/AI2 min" refers to the speed value that corresponds to the minimum of the signal or the 4mA scaled value. This is defaulted to 0 RPM.

"AI1/AI2 scaled at AI1/AI2 max" refers to the speed value that corresponds to the maximum of the signal or the 20mA scaled value. This is typically the motor nameplate speed or slip speed.

NOTE: If your Analog Input's wired signal provided is DC Voltage, please refer to the options and features section for proper parameter settings of the drive. A Jumper connection on the hardware will need to be moved. (J1, or J2)

1. Scale the AI Minimum Speed

1. "ARROW RIGHT" to change
2. "ARROW UP/DOWN" To change.
3. "SAVE"
4. "ARROW DOWN"

2. Scale the AI Maximum Speed

1. "ARROW RIGHT" to change
2. "ARROW UP/DOWN" To change.
3. "SAVE"
4. "Next"

3. Fieldbus

"Select"

Please refer to the Function and Features in this manual.

6. Exit the Basic Startup Wizard

Note:
If you are configuring the use of Dual Setpoints please refer to this Function in this manual.

SmartFlow Configuration Wizard

The Basic PumpSmart PS220 utilizes a complex algorithm that will calculate the actual flow of the pump. External sensors are not required. Any manufacturers pump will work with Smartflow. There are two distinct forms of Smartflow. These are:

1. Basic SmartFlow

Basic SmartFlow is designed for low to medium specific speed pumps, under 3000NS. A pump with a specific speed under 3000 will have the following characteristics.

1. Power rises as flow increases with no “dips or bumps” in the power curve.
2. The power value at shut off is at least 15% less than the power at BEP (Best Efficiency Point).

2. Advanced SmartFlow

The PumpSmart PS220 can be utilized on pumps that do meet the criteria mentioned previously for Basic Smart Flow. It will require configuring Advanced Smartflow.
To configure the Advanced Smartflow Functionality, additional pumping system information will be required. Suction and discharge pressures readings are required for the advanced algorithms to function successfully.
This information is also used to configure the information needed for the Smart TDH functionality, which is described in this manual.

Please refer to the Features & Functions section in this manual for a detailed explanation of the Smartflow functionality. This Wizard will show the step-by-step instructions to configure this functionality for use.

To access this Wizard, from the Home Screen follow the path: Menu>PS220 Configuration>Smartflow

The Screen Shots that follow will show you step by step as you progress, from start to finish as you progress, how to configure this functionality

The steps to be performed are:
1A. Configure Basic Smartflow
or
1B. Configure Advanced Smartflow
2. Execute a Smartflow tune.
3. Exit the Wizard.

2.1. Configure Basic SmartFlow

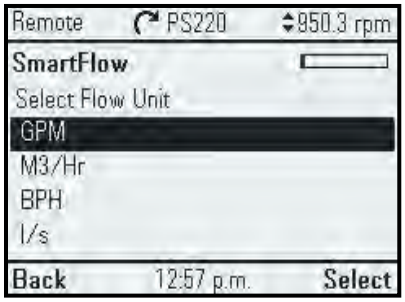
1. Highlight "Basic Smartflow"
2. "Select"

The next steps to be performed are:
1. Configure the Flow Unit
2. Configure the Pump Specific Properties
3. Configure Fluid Specific Gravity
4. Execute a Smartflow Tune
5. Exit the Wizard

1. Configure the Flow Unit

The SmartFlow unit selection identifies what units SmartFlow will display in. It also will be used for providing the necessary Pump Protection and input to other internal functions when required.

Note – The SmartFlow unit can be set independently from units that may have already been used for the language selected at first startup.



1. "ARROW UP/DOWN" to select unit
2. "Select"
3. "Next"

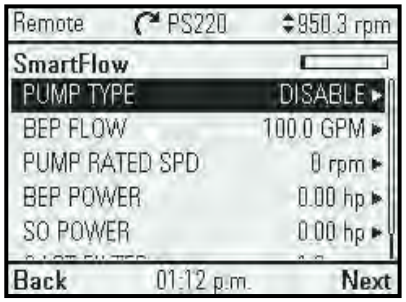
2. Configure the Pump Specific Properties

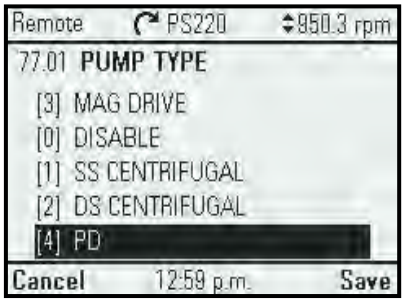
1. Configure the Pump Type.
2. Configure the BEP FLOW value.
3. Configure the PUMP RATED SPEED value.
4. Configure the BEP POWER value.
5. Configure the SO POWER value.

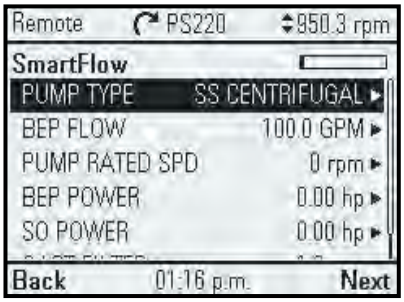
The information required for this configuration should be able to be found on the Pump Performance Curve. See the Diagram below (page 36) as an example of a typical Pump Performance Curve.

1. Configure the Pump Type

1. SS Centrifugal – Single Suction Centrifugal
2. DS Centrifugal – Double Suction Centrifugal
3. Mag Drive – Magnetic Drive Pump
4. PD Pump – Positive Displacement (Gear Pump) FUNCTIONALITY NOT AVAILABLE YET





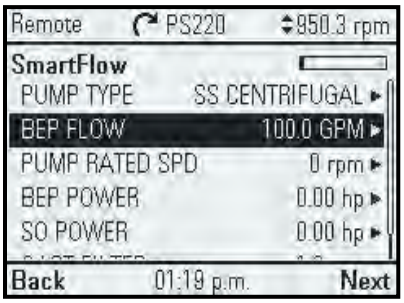


1. "ARROW RIGHT" to change
2. "ARROWS" to change value
3. "Save"
4. "ARROW DOWN"

Notes:

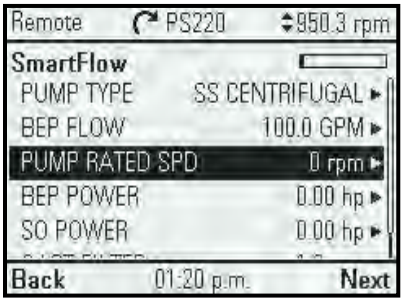
1. For magnetic drive pumps with metallic containment shell select Mag Drive.
2. For non-metallic shells select SS Centrifugal.

2. Configure the BEP FLOW value.



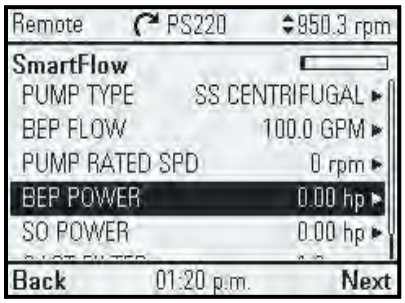
1. "ARROW RIGHT" to change
2. "ARROWS" to change value
3. "Save"
4. "ARROW DOWN"

3. Configure the PUMP RATED SPEED value.



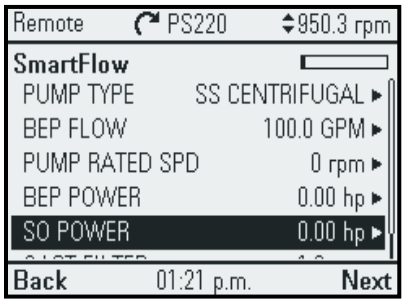
1. "ARROW RIGHT" to change
2. "ARROWS" to change value
3. "Save"
4. "ARROW DOWN"

4. Configure the BEP POWER value.



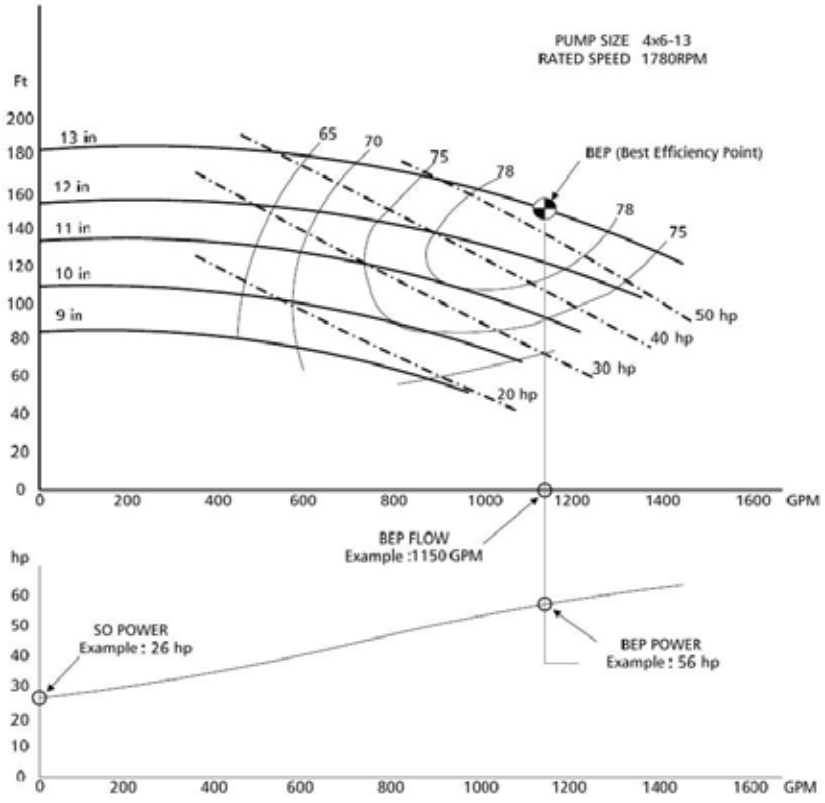
1. "ARROW RIGHT" to change
2. "ARROWS" to change value
3. "Save"
4. "ARROW DOWN"

5. Configure the SO POWER value.



1. "ARROW RIGHT" to change
2. "ARROWS" to change value
3. "Save"
4. "ARROW DOWN"

Figure 2.1: Pump Performance Curve



Note:
1. The RATED SPEED must be less than, and no more than 10% greater than the speed used during "Edit motor parameters". If it is greater, you will need to adjust parameter 30.12 upward (Maximum speed) to allow the tune function to work properly.
2. All values entered MUST be at Specific Gravity (SG) 1.0 or water-like.

3. Configure the Fluids Specific Gravity's Source

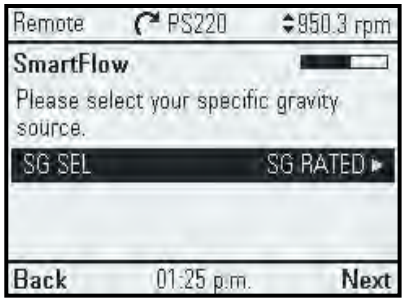
Please refer to Specific Gravity in this manual for more detailed explanation.

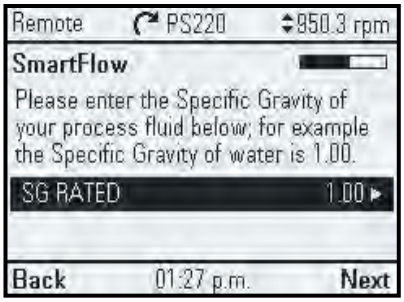
A. SG RATED (Fixed)

The default value for Specific Gravity [SG] is 1.0.

NOTES:

1. This value should only be changed now if you choose to bypass the "Smartflow Tune" function.
2. If the Specific Gravity varies by more than 5%, a correction method will be necessary.





1. "ARROW RIGHT" to change
2. "ARROWS UP/DOWN" to change value
3. "Save"
4. "Next"

B. Specific Gravity (Variable)

1. Fluid Temperature measured with Transmitter:

When changes to the SG are directly related to a change in the fluid's temperature, the PumpSmart PS220 can monitor these changes using a temperature transmitter. This transmitter will need to be connected and configured to an available Analog Input. The corrected values then can be used with the internal Smartflow calculations.

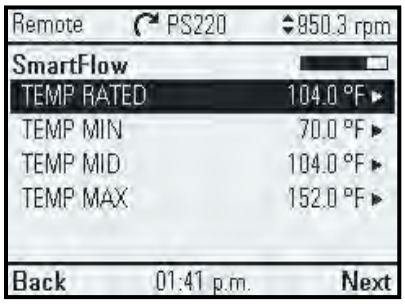
NOTE: YOU WILL NEED TO CONFIGURE THE AVAILABLE ANALOG INPUT THAT WILL BE USED. THIS WIZARD DOES NOT PROVIDE FOR THIS. COMPLETING THIS CAN BE ACCOMPLISHED BY GOING TO:
Menu>PS220 Configuration>I/O Configuration>Select the Analog Input #>

1. Configure Specific Gravity measurement with a Temperature Transmitter:

1. "Save"

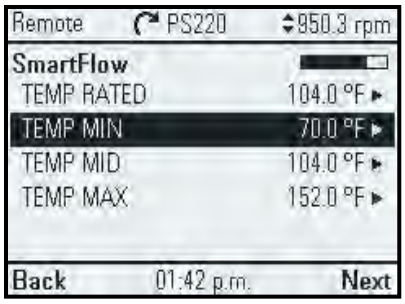
1. "Next"

1. Configure fluid TEMP RATED.



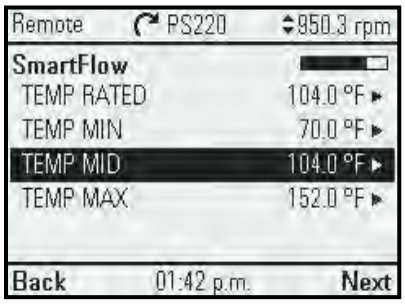
1. "ARROW RIGHT" to change
2. "ARROWS" to change value
3. "Save"
4. "ARROW DOWN"

2. Configure fluid TEMP MIN.



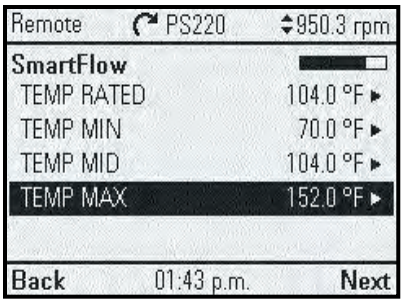
1. "ARROW RIGHT" to change
2. "ARROWS" to change value
3. "Save"
4. "ARROW DOWN"

3. Configure fluid TEMP MID.



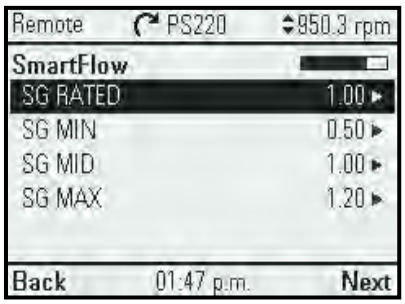
1. "ARROW RIGHT" to change
2. "ARROWS" to change value
3. "Save"
4. "ARROW DOWN"

4. Configure fluid TEMP MAX.



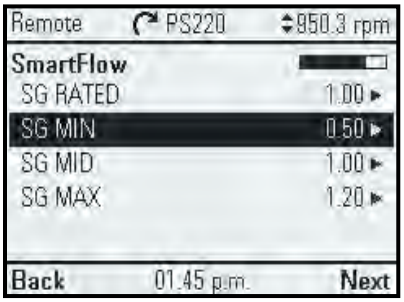
1. “ARROW RIGHT” to change
2. “ARROWS” to change value
3. “Save”
4. “ARROW DOWN”

5. Configure fluid SG Rated.



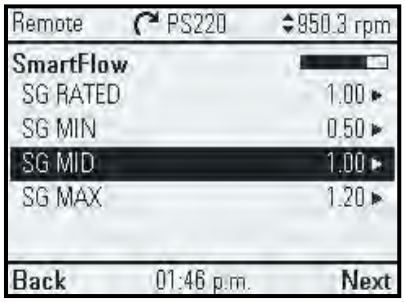
1. “ARROW RIGHT” to change
2. “ARROWS” to change value
3. “Save”
4. “ARROW DOWN”

6. Configure fluid SG MIN.



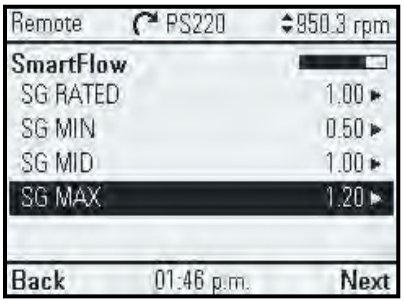
1. “ARROW RIGHT” to change
2. “ARROWS” to change value
3. “Save”
4. “ARROW DOWN”

7. Configure fluid SG MID.



1. “ARROW RIGHT” to change
2. “ARROWS” to change value
3. “Save”
4. “ARROW DOWN”

8. Configure fluid SG MAX



1. “ARROW RIGHT” to change
2. “ARROWS” to change value
3. “Save”
4. “ARROW DOWN”

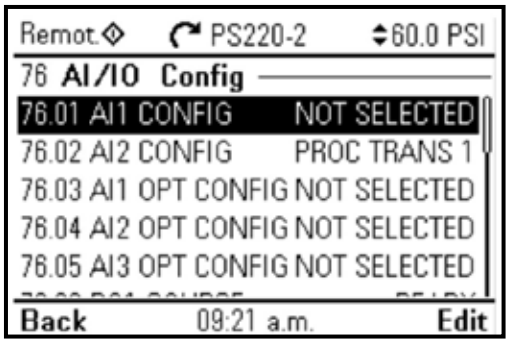
2. Specific Gravity measured directly with a Transmitter:

When Specific Gravity values vary linearly, and can be measured directly with a transmitter, the PumpSmart PS220 can monitor these changes using a Density transmitter. This transmitter will need to be connected and configured to an available Analog Input. The corrected values then can be used with the internal Smartflow calculations.
NOTES:

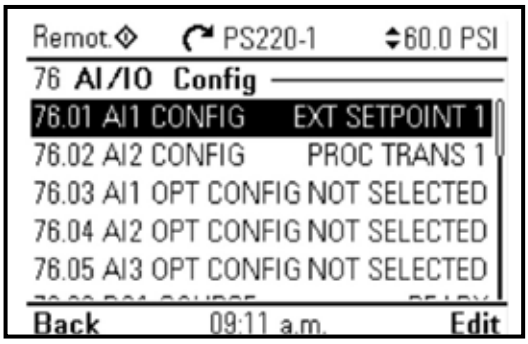
1. YOU WILL NEED TO MANUALLY CONFIGURE THE "IDENTITY ONLY" OF THE AI USED WHEN YOU ARE FINISHED> YOU CAN ACCESS THIS BY GOING TO:
Menu>PS220 Configuration>I/O Configuration>Analog I/O>

2. An unused AI will need to be used for either of these 2 choices to function correctly. Please check the settings of the Analog Inputs in use by going to: Menu>Parameters> Complete List>Scroll down to Group 76>Select and View 76.01&02. If available, they will show "NOT SELECTED". You may have to add an Extension Card to use an additional input. (Not provided as standard) See examples:

AI1 is available:

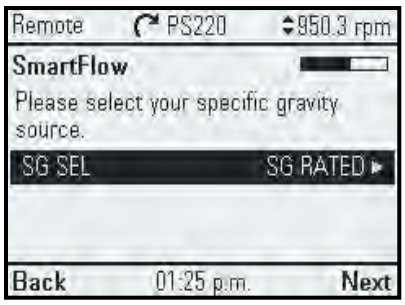


AI1& 2 are in used. Extension card is required:



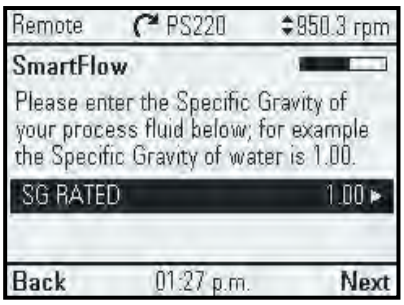
The steps you will need to perform are:
1. Configure the measurement source as an AI.
2. Configure the Identity of the AI to be used.
3. Configure the Min scaled value of the SG.
4. Configure the Max scaled value of the SG.

1. Configure the measurement source as an AI.



1 "ARROW RIGHT"

1. "ARROW UP/DOWN"
2. "Save"

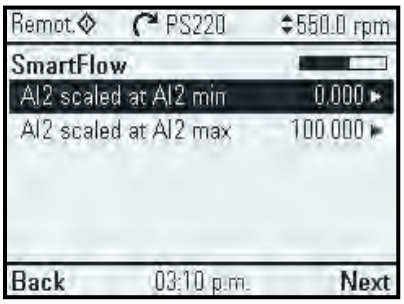


1 "NEXT"

2. Configure the Identity of Analog Source of the AI to be used.

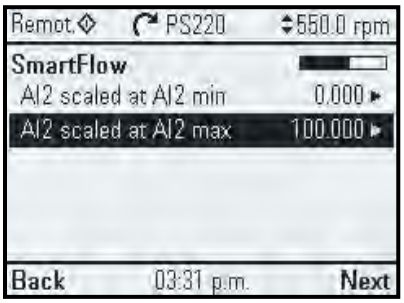
1. "ARROW UP/DOWN"
2. "Select"

3. Configure the Min scaled value of the SG.



1. "ARROW RIGHT" to change
2. "ARROWS" to change value
3. "Save"
4. "ARROW DOWN"

4. Configure the MAX scaled value of the SG.



1. "ARROW RIGHT" to change
2. "ARROWS" to change value
3. "Save"
4. "Next"

1. "No"
2. "Select"

3. Two Rated Specific Gravities (Dual):

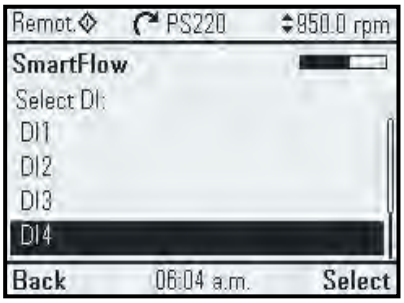
Any available unused digital input can be configured to toggle between two predefined Specific Gravity values. SG 1 and SG 2.

The steps you will need to perform are:
1. Configure the Digital Input to be used:
2. Configure the Min SG value (SG1)
3. Configure the Min SG value (SG2)
4. Proceed to SmartFlow Tune

1. Configure the Digital Input to be used.

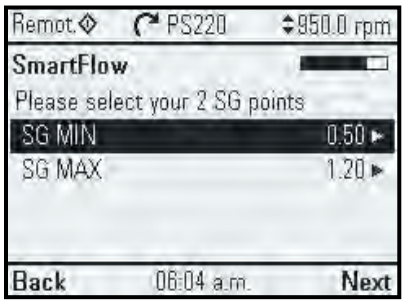
1. "ARROW UP/DOWN" Highlight "DI"

1. "Next"



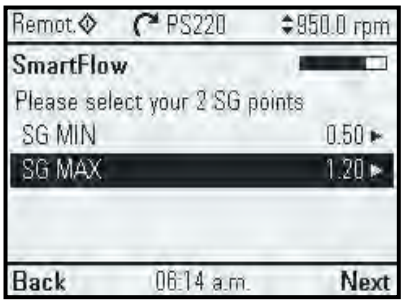
1. "ARROW UP/DOWN"
2. "Select"Up"

2. Configure the Min SG value.



1. "ARROW RIGHT" to change
2. "ARROWS" to change value
3. "Save"
4. "Arrow Down"

3. Configure the Max SG:



1. "ARROW RIGHT" to change
2. "ARROWS" to change value
3. "Save"
4. "Next"

4. Proceed to SmartFlow Tune

1. "No" Or "Yes" to proceed to Smartflow Tune
2. "Select"

2.2. Advanced SmartFlow & Smart TDH Configuration Wizard

Please refer to the Features & Functions section in this manual for a detailed explanation of this functionality. This Wizard will show the step-by-step instructions to configure this functionality for use.

To access this Wizard, from the Home Screen follow the path: Menu>PS220 Configuration> Smartflow> Advanced Smartflow>

1. The steps to be performed to configure Advanced SmartFlow and for SmartTDH are:

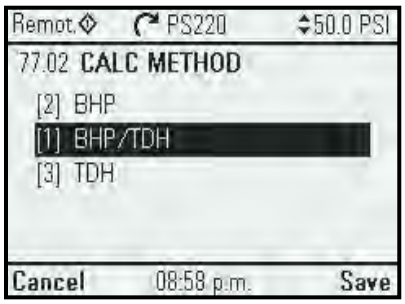
1. Configure the Flow Unit (Same as Basic)
2. Configure the Pump Specific Properties (Same as Basic)
3. Configure the Calculation Method (Specific for Advanced)
4. Configure the Pumping System Information (More Info Required)
5. Configure Transmitter(s) and Analog Input(s) (More info required)
6. Configure Fluid Specific Gravity (Same as Basic)

Note: Steps 1, 2, & 6 will not be shown as they are identical to the Basic Smartflow configuration. These steps are not shown below. Please refer to Basic Smartflow for additional detailed information in the Index, or you can start with the Basic Smartflow Configuration Wizards and add these steps as you progress.

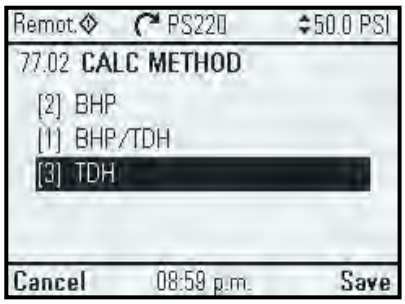
The Screen Shots that follow will show you step by step as you progress, from start to finish, how to configure this functionality.

3. Configure the Calculation Method

1. Brake Horsepower/ Total Dynamic Head



2. Total Dynamic Head



Choice #1: BHP/TDH
This choice will calculate the SmartFlow flow value using a combination of the BHP and TDH. This should be used if the power curve has "dips or bumps". See Smartflow limitations

Choice#2:
Not a valid option for Advanced Smartflow

Choice #3 TDH:
This choice will calculate flow utilizing the differential pressure of the system. This should be used if your power curve is very flat. See Smartflow limitations.

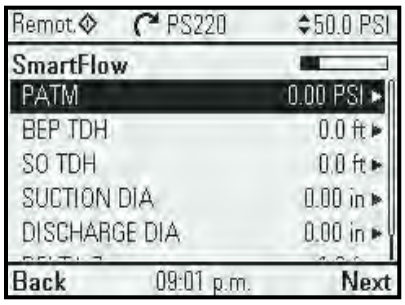
NOTE:
Both choices will require either a Differential Pressure transmitter (Discharge-Suction) or separate Suction and Discharge transmitters.

4. Configure the Pumping System Information

Note: Please note the "Units of Measure" required for each step below.

1. Configure the PATM.

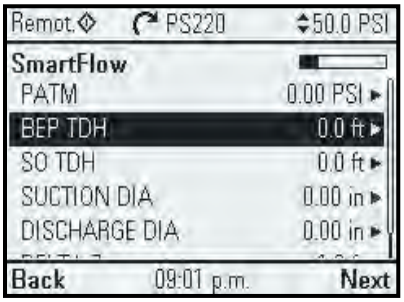
This is the local Atmospheric (barometric) Pressure for the installation location of the equipment. (14.7 psi is normal)



1. "ARROW RIGHT" to change
2. "ARROWS" to change value
3. "Save"
4. "ARROW DOWN"

2. Configure the BEP TDH

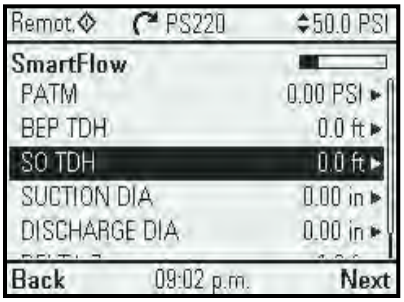
This is the Total Dynamic Head at the Best Efficiency Flow AND at the rated speed of the Pump.



1. “ARROW RIGHT” to change
2. “ARROWS” to change value
3. “Save”
4. “ARROW DOWN”

3. Configure the SO TDH.

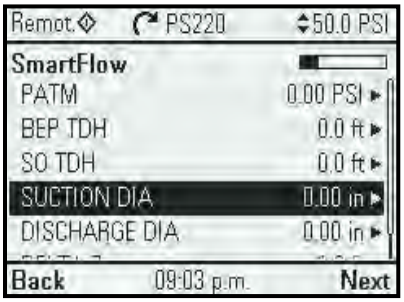
The pump Total Dynamic Head at the Shutoff (zero flow) condition AND at rated speed.



1. “ARROW RIGHT” to change
2. “ARROWS” to change value
3. “Save”
4. “ARROW DOWN”

4. Configure the SUCTION DIA.

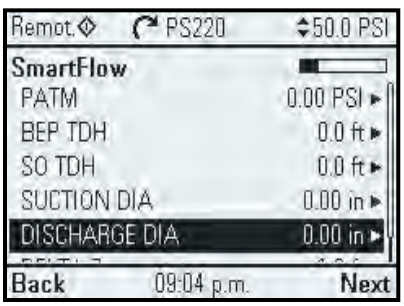
The pumps Suction Flange Diameter.



1. “ARROW RIGHT” to change
2. “ARROWS” to change value
3. “Save”
4. “ARROW DOWN”

5. Configure the DISCHARGE DIA.

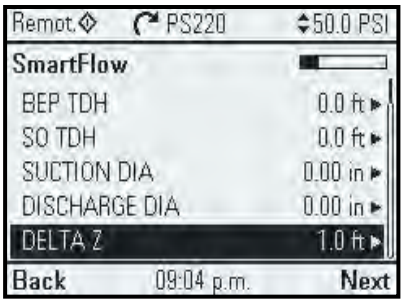
The pumps Discharge Flange Diameter



1. “ARROW RIGHT” to change
2. “ARROWS” to change value
3. “Save”
4. “ARROW DOWN”

6. Configure the DELTA Z.

The discharge pressure gauges height above the centerline of the suction.



1. "ARROW RIGHT" to change
2. "ARROWS" to change value
3. "Save"
4. "ARROW DOWN"

5. Configure the Transmitter(s) and the associated Analog Inputs to be used for the TDH calculations.

Notes:

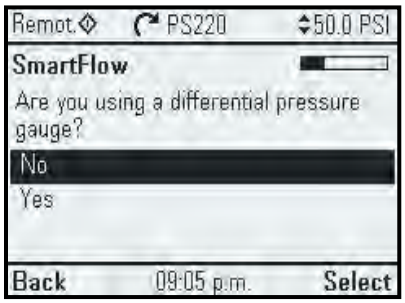
1. If you have already used the Process Control Wizard, a suction or discharge pressure transmitter will be shown as PROC TRANS1. There is no need to re-configure these. Please move on to the next screen.

An unused Analog Input (AI) will need to be used for either of these 2 choices to function correctly. Please check the settings of the Analog Inputs currently in use by going to: Menu>PARAMATERS> Complete List>Scroll down to Group 76>Select and View 76.01&02. If available, they will show "NOT SELECTED". You may have to add an Extension Card to use additional inputs. (Not provided as standard

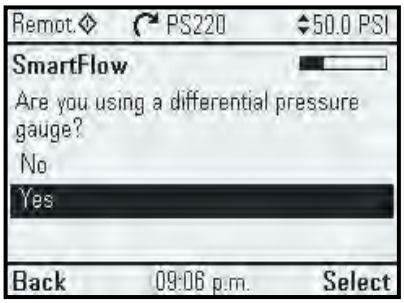
Note:

1. There are 2 selection choices for this setup:
2. A simple "Yes" or "No" response will allow you to continue through various steps.

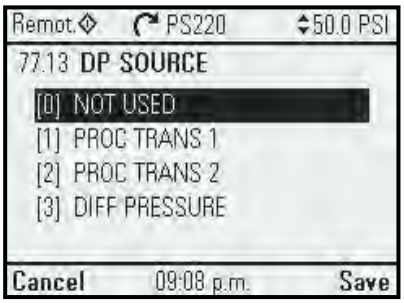
Selection 1. Configure the use of a Differential Pressure Transmitter. This wizard will completely configure the instrumentation required for use.



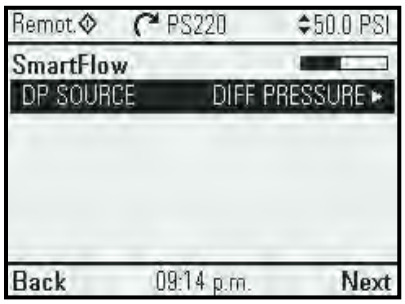
1. "ARROW DOWN"
2. "Yes"



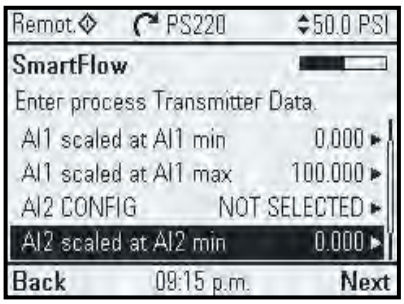
1. "Select"



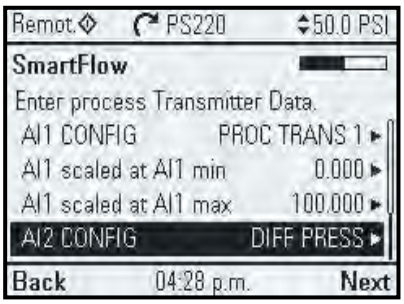
1. "ARROW DOWN"
2. "SAVE"



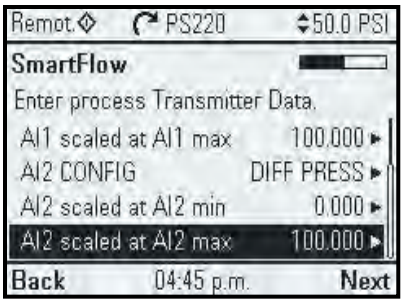
1. "Next"



1. "ARROW DOWN" to the AI to be used.
2. "ARROW RIGHT"

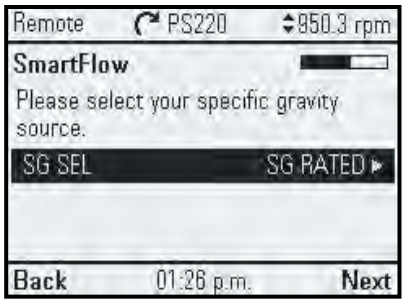


1. Select "DIFF PRESS"



1. Scale AI2 Min
2. Scale AI2 Max

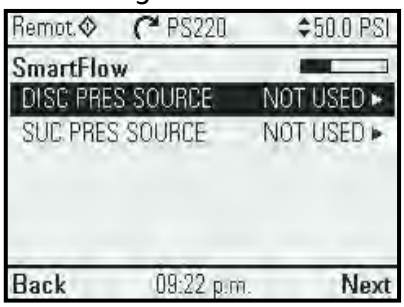
Refer to Analog Input Configuration if necessary.

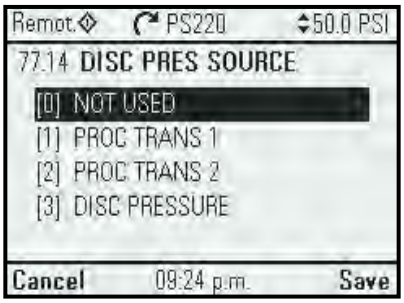


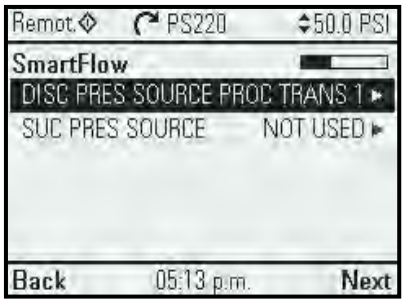
Refer to Specific Gravity.

Selection 2: Configure the use of a separate Discharge AND Suction Transmitter

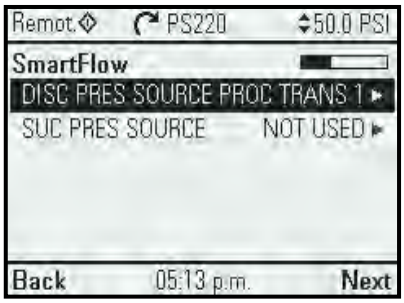
1. Discharge Transmitter.

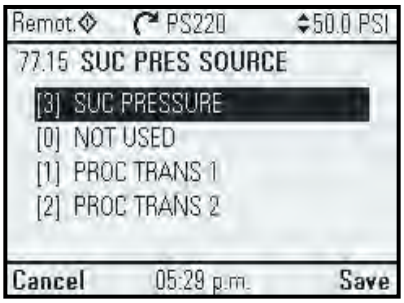


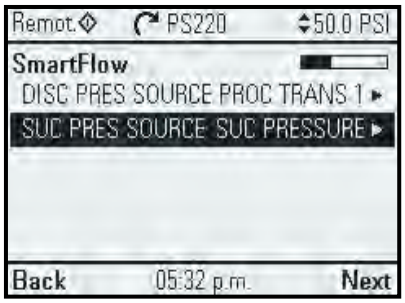


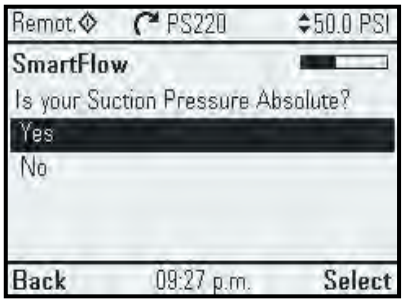


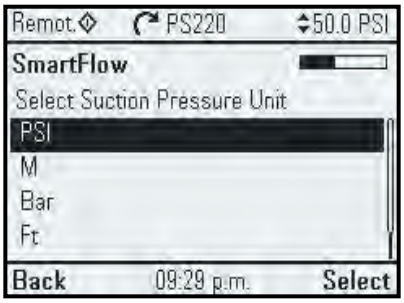
2. Suction Transmitter

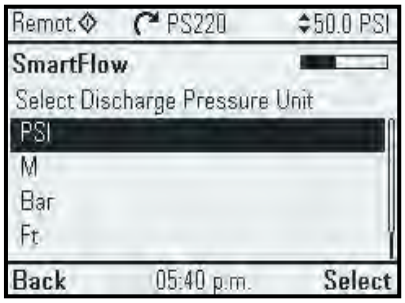


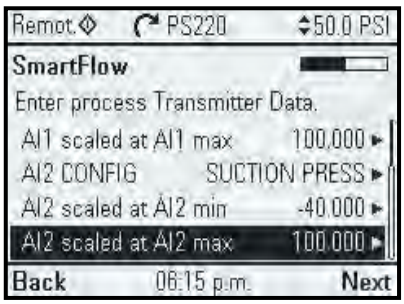






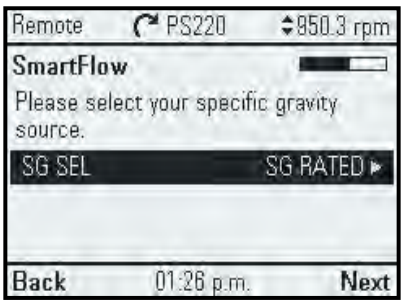






1. Scale AI2 Min
2. Scale AI2 Max

Refer to Analog Input Configuration if necessary.



1. Next

Refer to Specific Gravity

2.3 SmartFlow Tune Wizard

Please refer to the Features & Functions section in this manual for a detailed explanation of this functionality. This Wizard will show the step-by-step instructions to configure this functionality for use.

To access this Wizard, from the Home Screen follow the path: Menu>PS220 Configuration>Smartflow> Tune Smartflow

The Screen Shots that follow will show you step by step as you progress, from start to finish, how to configure this functionality.

2. Execute the Smartflow Tune

The Tune Function requires the pump to be run on its own using a predefined algorithm.

Once the tune function is initiated the drive will start and ramp up the motor and stop briefly to at 33%, 60% and 100% of the motor nameplate speed. It will automatically stop when it has completed.

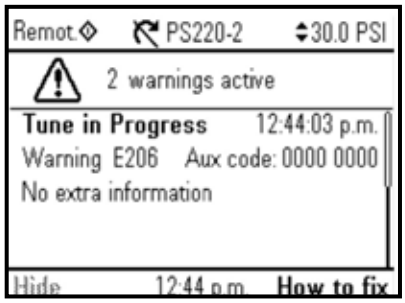
Notes:
1. It is recommended to set 74.01 to keypad prior to running the tune. Once completed please set this parameter back to the original setting.
2. Motor HP's above 50 HP (37KW) will not run above 60% speed.
3. The tune function will automatically fault if it does not complete in 35 seconds.
4. Pumps with motors 15 HP or less should be run for 30 minutes prior to running the tune function.
5. Acceleration rates for PID Tuning should remain at default until after running the Smartflow Tune
6. If the tune function cannot be performed the algorithm will use the affinity laws. Selecting "No" automatically uses the affinity laws in the calculations.
7. Do not run a SmartFlow Tune on any pump in a Multipump system. You will need to disable this on the PS220 connected to the pump to be tuned and re-enable again when completed. Parameter 81.01 should be set to "DISABLED" if it was set to SYNCHRONOUS using the PS220 Multipump Wizard previously.
8. Do not try to run a Smartflow Tune on a running pump.
9. Smart Control must be off prior to the tune function.
10. All information inputted with the wizard MUST be on water with SG of 1.0 and must be tuned with water like fluid properties. If tuning on "Non-Water-Like" liquid several corrections will be needed. Please refer to the Tuning with Non Water section in the index for the proper procedure.

Prior to executing this function:

1. All Suction and Discharge piping should be secure and ready for Pump startup.
2. Pump and motor aligned and coupled with coupling guard intact.
3. Suction line needs to be completely flooded and all air vented completely from the pump through to the discharge side.
4. Discharge valve or isolation valve and any bypass piping need to be completely closed.
5. For seal-less pumps having liquid lubricated bearings consult with the manufacturer verify if the pump can be run for 35 seconds against a closed discharge valve with the liquid that is to be pumped at the speeds noted below.

Answer the questions and follow the instructions on the screens:

This screen shot shows the end of a completed successful Smartflow Tune. There will be 2 active warnings shown and then this screen will disappear and you will prompted to continue.



DANGER

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

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 ABB ACS880 Hardware Manual, and the PumpSmart PS220 Configuration Manual prior to starting.

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3. Process Control Wizard

This section will configure the PumpSmart PS220 to be used in single pump mode with the Process Control PID functionality. Scaled feedback will be required from wired analog transmitter(s)/sensors(s) connected the appropriate input(s). There are selections that are "Sensorless" which will not require a physical wired transmitter/sensor.

Please refer to the Features & Functions section in this manual for a detailed explanation of this functionality. This Wizard will show the step-by-step instructions to configure this functionality for use. This functionality can be configured with the PumpSmart PS220 Configuration Wizard. To access this Wizard, from the Home Screen follow the path: Menu>PS220 Configuration>Process Control>

The individual steps that will be performed are:
1. Configure the Process Control Mode
2. Configure the Sleep Mode
3. Configure the PID Tuning settings

The Screen Shots that follow will show you step by step, from start to finish as you progress, how to configure this functionality.

1. Configure the Process Control Mode.
The individual steps that will be performed are:

1. Configure the Operating Mode
2. Configure the Unit Selection
3. Configure the Transmitter Location
4. Configure the Transmitter Information Detail
5. Configure the Setpoint Limits
6. Configure the Setpoint Source
7. Configure the use of a Dual Setpoint (Optional)

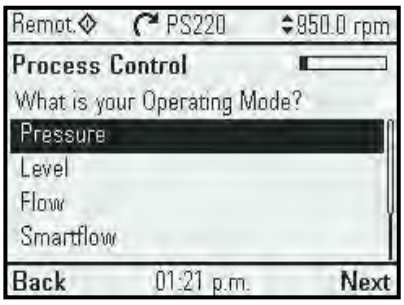
1. Configure the Process Control Operating Mode

The PumpSmart PS220 will need to be configured to operate in a specific Process Control mode.

Your choices are:

Pressure:

PumpSmart will maintain constant pressure to a setpoint.



Level:

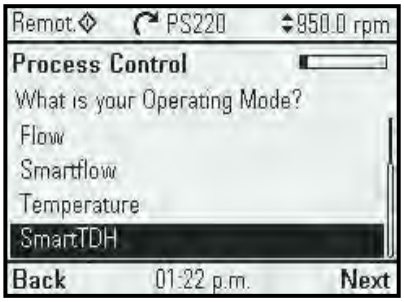
PumpSmart will maintain a defined level to a setpoint.

Flow:

PumpSmart will maintain a constant flow to a setpoint.

SmartFlow:

Pumpsmart will maintain a constant flow using the Smartflow internal flow calculation to a setpoint. No transmitter is required.



Temperature:

PumpSmart will maintain a constant temperature of a process set temperature.

Smart TDH:

PumpSmart will maintain a constant TDH using the internal TDH calculation to a setpoint. It will require a stable suction pressure. No transmitter is required.

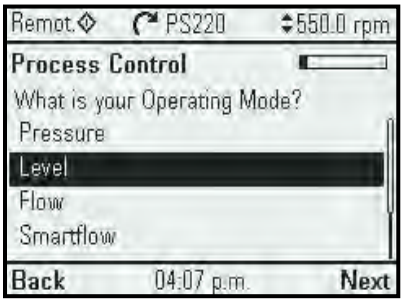
2. Configure the Unit Selection

The configuration of the PumpSmart PS220's unit selection will determine the labeling used to control the pump, the setpoint, and the actual feedback from the transmitter. Following are the available units based on your selection in 1 above. (The defaults shown are for English)

Pressure: Smart TDH

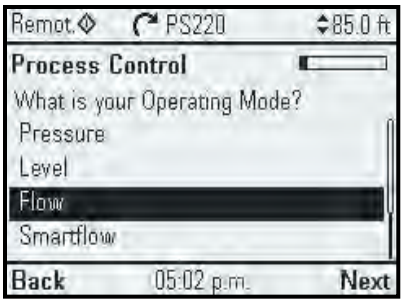
PSI (DEFAULT)
M- Meters
BAR
FT–FEET
MPa – Mega Pascals

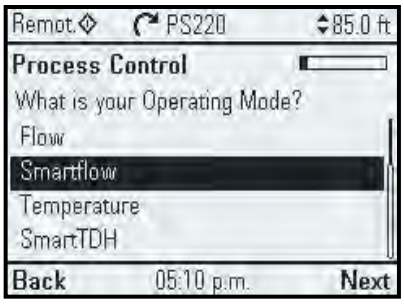
Level

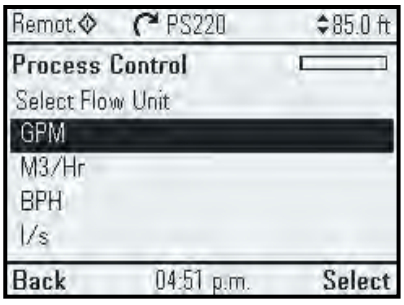


Ft – Feet (DEFAULT)
M – Meters In – Inches
Cm – Centimeters

Flow: Smartflow

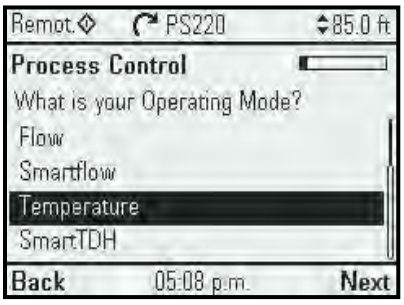


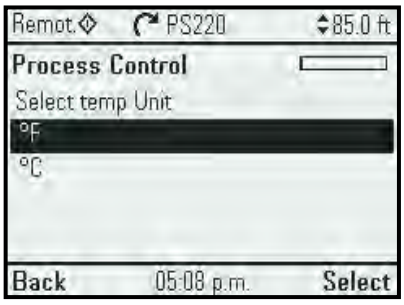




PM – Gallons per Minute (DEFAULT)
M³/hr. – Cubic meters per hour
BPH – Barrels Per Hour
L/s – Liters per second

Temperature

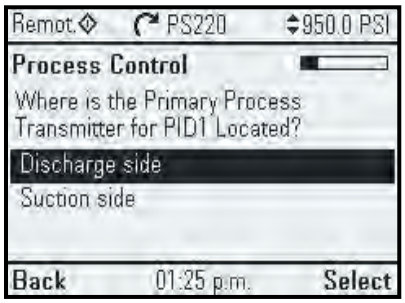




°F – Degrees Fahrenheit (DEFAULT)
°C – Degrees Celsius

3. Configure the Transmitter Location

The configuration of transmitter location on the PumpSmart SP220 identifies whether the transmitter is on the suction side of the piping system or on the discharge.



1. "ARROW UP/DOWN" to change
2. "Select"

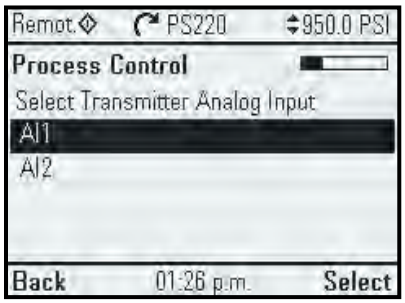
Note:
When choosing suction side, the software will automatically invert the actual signal. (A rising value will increase the speed of the pump to maintain the process setpoint). Check to be sure that the transmitter being used does not do this as standard.

Refer to the "Regulation Mode" in this manual for more information.

4. Configure the Transmitter Information Detail:

4.1. Configure the physical ID of the AI used. The location that the transmitter has been wired to.

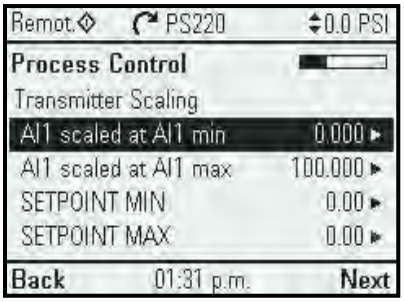
See notes below



1. "ARROW UP/DOWN" to change
2. "Select"

Notes:
1. Refer to the Analog Input section in the Index for more information on these configuration steps.
2. When Selecting the Analog Input make sure that it is connected to the correct input. Refer to the wiring diagrams in this manual.
3. The Analog Input physically used is either AI1 or AI2 unless an extension card has been installed.

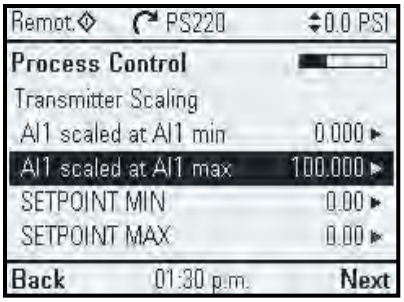
4.2. Configure the minimum scaled value of the AI's transmitters signal. AI1 (2).



1. "ARROW RIGHT" to change
2. "ARROWS" to change value
3. "Save"
4. "ARROW DOWN"

"AI1 (2) scaled at AI1 (2) min" refers to the transmitters value that corresponds to the minimum of the signal or the 4mA scaled value. The default is 0.

4.3. Configure the minimum scaled value of the AI's transmitters signal. AI1 (2).



1. "ARROW RIGHT" to change
2. "ARROWS" to change value
3. "Save"
4. "ARROW DOWN"

"AI1 (2) scaled at AI (2) max" refers to the transmitters value that corresponds to the maximum of the signal or the 20mA scaled value. The default value is 100.

Notes:
1. If the transmitter provided requires DC Voltage, please refer to the Analog Input section in this manual, for proper parameter settings of the drives analog input. A Jumper connection on the hardware will need to be moved. (J1, or J2). The defaults are for current, both in the upper most connections. See the picture below:

2. Differential pressure flowmeters [e.g., orifice plate, venturi, etc.] do not produce signals that are linear with flowrate. The PumpSmart PS220 cannot accommodate these types of flowmeters.

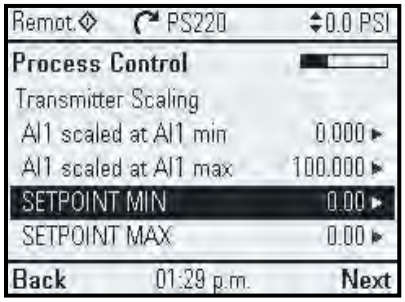
3. Refer to the transmitter manufacturer's documentation for the proper wiring instruction and to determine the correct scaled values. This information may also be printed on the device itself.

4. The software automatically defines the selected analog input to “PROC TRANS 1” as the primary process transmitter for the system.

5. Configure the Setpoint limits.
The setpoint limits, SETPOINT MIN and SETPOINT MAX, are the values, below and above, that the system cannot be operated at. These can be different from the scaled values configured for use. These limits can prevent incorrect low and high setpoints from being used by the system.

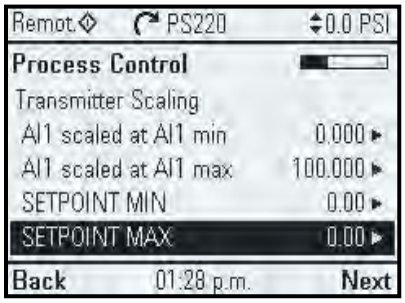
If the process variable chosen is SmartFlow or SmartTDH, then only SETPOINT MIN and SETPOINT MAX are shown and need to be defined. SETPOINT MIN will typically be zero while SETPOINT MAX should be set at a value equal to the maximum flow or TDH of the pump. Be sure that you complete the SmartFlow wizard prior to running your process or the feedback will be incorrect.

5.1. Configure the Setpoint Min



1. “ARROW RIGHT” to change
2. “ARROWS” to change value
3. “Save”
4. “ARROW DOWN”

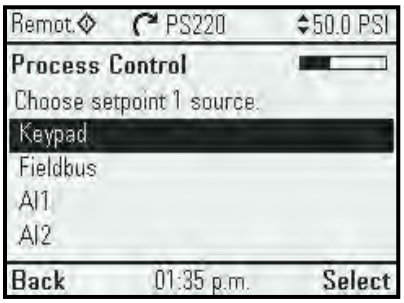
5.2. Configure the Setpoint Max:



1. “ARROW RIGHT” to change
2. “ARROWS” to change value
3. “Save”
4. “Next”

6. Configure the Setpoint Source

Detailed Information on how configure the Setpoint Source can be found in the Appendix. Please refer to Reference Function in this manual for more information.



1. "ARROW UP/DOWN" to change
2. "Select"

7. Configure the use of a Dual Setpoint (Optional)

This optional selection will allow you to configure the PumpSmart PS220 to toggle between 2 separate setpoint references.

Refer to the "Setpoint, Dual" section in this manual for more information. Configuring this option is not depicted here.

3.2. Sleep Configuration Wizard

Sleep is a function that that can be configured on the PS220 that will allow the pump to automatically stop pumping while still completely satisfying the process control function assigned to it. This onboard logic will prevent pumping at "Deadhead" or below minimum flow of the pump. It will automatically restart to maintain the pumping systems setpoint. Please refer to the Features & Functions section in this manual for a detailed explanation of this functionality. This Wizard will show the step-by-step instructions to configure this functionality for use. This functionality can be configured with the PumpSmart PS220 Configuration Wizard. To access this Wizard, from the Home Screen follow the path: Menu>PS220 Configuration>Process Control> Sleep

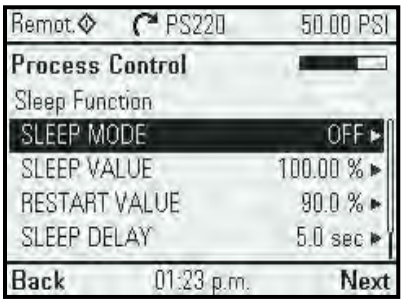
The individual steps that will be performed are:
1. Configure the Sleep Mode
2. Configure the Sleep Value
3. Configure the Restart Value
4. Configure the Sleep Delay
5. Configure the Restart Delay

The Screen Shots that follow will show you step by step, from start to finish as you progress, how to configure this functionality.

1. Configure the sleep Mode.

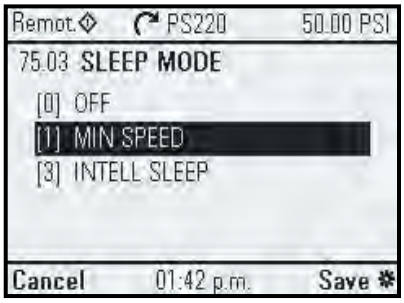
The choices are:

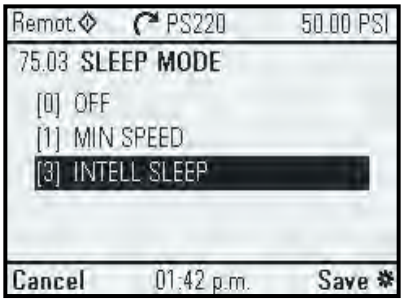
1. Off. Disable the Sleep function.

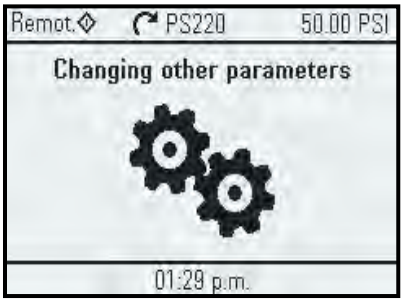


1. "ARROW RIGHT" to change
2. "ARROWS UP/DOWN" to change value
3. "Save"

2. Min Speed is the default setting. When set properly the drive will sleep as described above. With this choice the pump will sleep when the 3 values of "Sleep Value", "Minimum Speed", and the "Sleep Delay" have all been achieved. A Dead Head test is strongly recommended to be performed to correctly set the minimum speed. Refer to Dead Head in this manual.





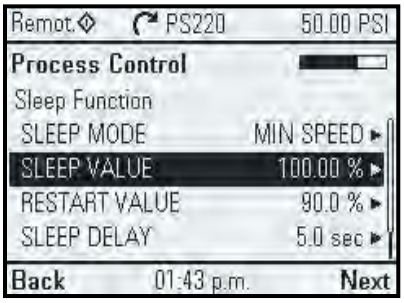


Note: If using "Minimum Speed" for use in the "Alarm & Control Pump Protection Response" Min Speed Sleep is not an available choice. See "Intelligent Sleep"

Additional Wizards will need to be run when configuring the Intelligent Sleep selection to function correctly:

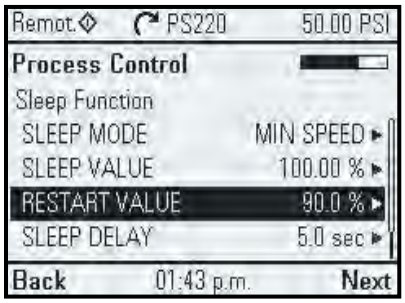
1. SmartFlow Wizard if being used for this value for flow.
2. Pump & VFD Protection Wizard, if an external flowmeter is used that is not the primary process control transmitter selected previously.

2. Configure the Sleep Value



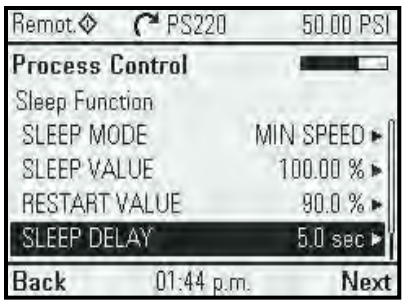
1. "ARROW RIGHT" to change
2. "ARROWS" to change value
3. "Save"
4. "ARROW DOWN"

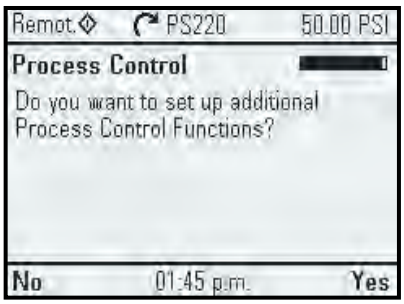
3. Configure the Restart Value



1. “ARROW RIGHT” to change
2. “ARROWS” to change value
3. “Save”
4. “ARROW DOWN”

4. Configure the Sleep Delay





1. “ARROW RIGHT” to change
2. “ARROWS” to change value
3. “Save”
4. “Next”

3.3 PROCESS TUNE WIZARD (PI Tuning)

The PumpSmart PS220's PID tuning will allow you to fine tune the reaction of the pumping system to the process control setpoint. Depending on the Process control mode selected in the "Operating Mode", defaults settings have been applied to simplify this fine tuning if needed.

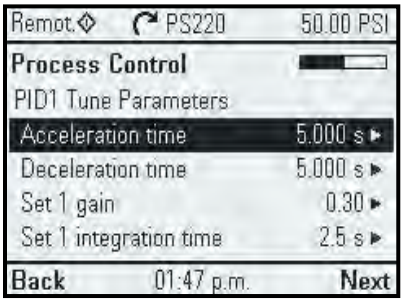
Please refer to the Tuning section in this manual for a detailed explanation of this functionality. This Wizard will show the step-by-step instructions to configure this functionality for use. To access this Wizard form the Home View follow the path: Menu>PS220 Configuration>Process Control> Process Tune

The individual steps that will be performed are:
1. Configure the Accel Time
2. Configure the Decel Time
3. Configure the Proportional Gain
4. Configure the Integral Time

The Screen Shots that follow will show you step by step, from start to finish as you progress, how to configure this functionality.

1. Configure the Accel Time.

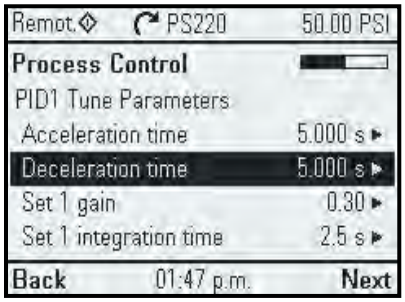
The default for this setting is 5 seconds. It can be adjusted as necessary. Range is from 0-1800 seconds.



1. "ARROW RIGHT" to change
2. "ARROWS" to change value
3. "Save"
4. "ARROW DOWN"

2. Configure the Decel Time.

The default for this setting is 5 seconds. It can be adjusted as necessary. Range is from 0-1800 seconds.

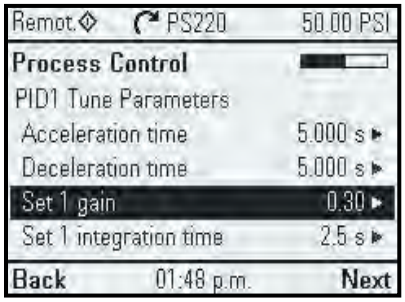


1. "ARROW RIGHT" to change
2. "ARROWS" to change value
3. "Save"
4. "ARROW DOWN"

NOTE: Both the accel and decel times should be adjusted to the same values when any changes are being made for the tuning to be most effective.

3. Configure the Proportional Gain.

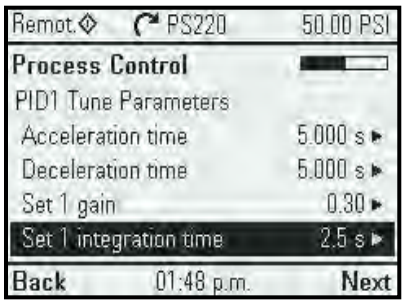
The default for this setting is 1.3. The range is from .1 to 100. The lowest increment is .1.



1. "ARROW RIGHT" to change
2. "ARROWS" to change value
3. "Save"
4. "ARROW DOWN"

4. Configure the Integral Time.

The default for this setting is .30. The range is 0 to 32767.



1. "ARROW RIGHT" to change
2. "ARROWS" to change value
3. "Save"
4. "Next"

4. Pump & VFD Protection Wizard

The PS220 Pump & VFD Protection functionality can be configured to fully identify, notify, control, and prevent a pump in a system that may operate in an underload, overload conditions, and all the adverse conditions of dry-run, dead-head, minimum flow, runout, and cavitation. It can also provide the pumping system protection to ensure that indirect damage from conditions such as over pressure, water hammer, and liquid temperature rise will not occur. The onboard logic can also monitor external devices that are an integral part of the pumping system to add an additional level of protection as well.

Since the core functionality of the PumpSmart PS220 is that it is a Variable Frequency Drive (VFD), it also provides the ability to identify and react to the most common electrical system upsets such as Undervoltage, Overvoltage, Overcurrent, Stall, Underload and Overtemp.

Please refer to the Features & Functions section in this manual for a more detailed explanation of all this functionality. This Wizard will show the step-by-step instructions to configure this functionality for use.
This Wizard is made up of 5 individual Wizards for distinctive functional protections.

They are:
1. Pump Protection. There is a choice for:
   A. Basic
   B. Advanced.
2. Secondary Protection
3. Condition Monitoring. There is a selection at the end of this for:
   A. Flow Bypass.
4. VFD Protection.
5. Protection Options.

Each of these Pump Protection functions can be configured with the PumpSmart PS220 Configuration Wizard. To access this Wizard, from the Home Screen follow the path: Menu>PS220 Configuration>Pump & VFD Protection> Scroll down to each Wizard as required.

The Screen Shots that follow for each Wizard will show you step by step, from start to finish as you progress, how to configure each of these individual choices for Protection functionality.

Pump Protection Wizard

4.1 Basic Pump Protection.

The Basic Pump Protection functionality uses the Process Control feedback to determine when upset conditions may be occurring in the system. Depending on the Process Control Mode, it is "Sensorless".

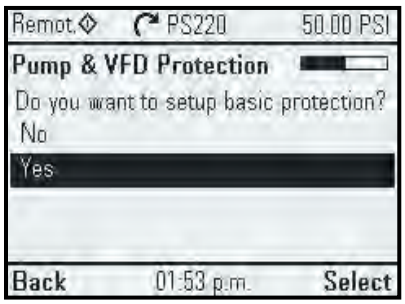
4.2 Advanced Pump Protection.

The Advanced Pump Protection functionality uses the PumpSmart PS220's feedback from SmartFlow to determine when upset conditions may be occurring in the system. This protection is "Sensorless". A flow meter can also be used for this protection.

NOTE:
The Basic Pump Protection choice and the Advanced Pump Protection choice cannot both be used together.

4.1 Configure Basic Pump Protection
OR
4.2 Configure Advanced Pump Protection

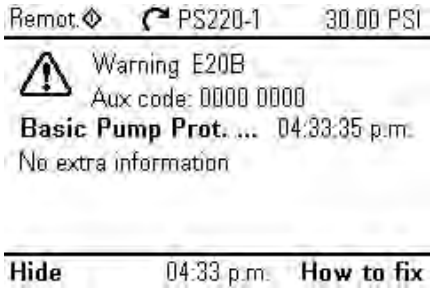
4.1 Basic Pump Protection Wizard

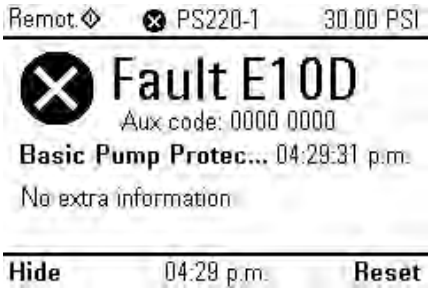


The Basic Pump Protection functionality's purpose is to identify and react to pumping system conditions when three events occur while in the process control mode (any choice of control).
1. The pump is running at a predetermined percentage of maximum speed.
2. The process controls operating point is a predetermined percentage below 100%.
3. A predetermined proof time has expired.

This event could be the result of several upset conditions both internal and external of the pump. The PumpSmart PS220 cannot determine what the cause of the event is but it will provide the desired notification and response if the event does occur.

Notes:
1. The PumpSmart PS220 keypad will display an alarm or fault message "Basic Pump Prot. Alarm" when this event occurs.





2. Basic Pump Protection is not available in Basic Speed Control.

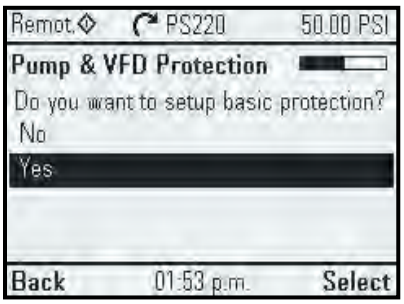
This functionality can be configured with the PumpSmart PS220 Configuration Wizard.
To access this Wizard, from the Home Screen follow the path: Menu>PS220 Configuration>Pump & VFD Protection>Pump Protection

The individual steps that will be performed are:

1. Enable the Basic Pump Protection function.
2. Configure the Response.
3. Configure the Limit.
4. Exit Basic Pump Protection Wizard

NOTE:
Some steps will require you to use the:
1. "ARROW RIGHT" button to change the value
2. "ARROWS" to configure the value
3. "Save" button to continue
Once that step is completed, use the "ARROW DOWN" button to go to the next line on the page. Selecting "Next" at the bottom of each page will bring you to the next page requiring configuration.

1. Configure enabling of the Basic Pump Protection.



1. "Select Yes"

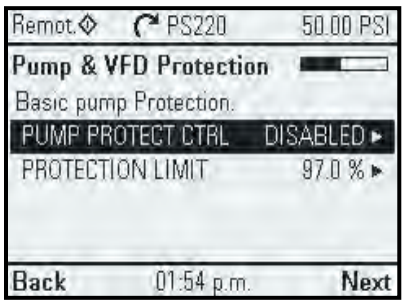
2. Configure the Response

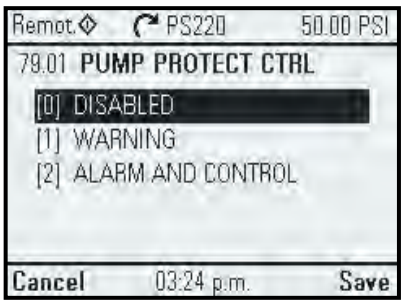
1. Disabled:
The PumpSmart PS220 will not respond. The pump will continue to run at the maximum allowed speed and while not achieving the setpoint requirement. This is the Default.

2. WARNING:
The PumpSmart PS220 will issue a warning message of "Basic Pump Protection". The pump will continue to run at the maximum allowed speed while not achieving the setpoint requirement.

3. ALARM AND CONTROL:
The PumpSmart PS220 will either:
A. Issue a warning message, and either run at minimum speed or stop. It can be configured to automatically re-start after a delay period and then run to maintain the process setpoint. It can be configured to follow this routine a set number of times before a hard Fault is issued. The Fault will have to be reset, and manually restarted. Refer to the "Fault Tracing" section for further information.

B. A hard Fault is issued, and it will stop. The fault message will be displayed, and it will have to be reset, and manually restarted. Refer to the "Fault Tracing" section for further information.

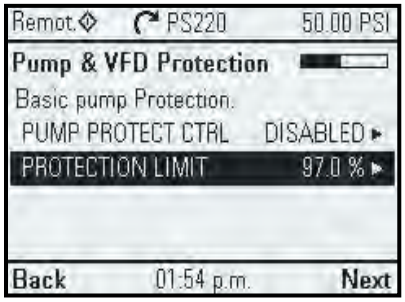




1. "ARROW RIGHT" to change
2. "ARROW UP/DOWN" to change value
3. "Save"
4. "ARROW DOWN"

3. Configure the Protection Limit.

The Pump Protection limit is the percentage value difference between the operating setpoint, and the actual setpoint, at which the Basic Pump Protection Function becomes active. The default value is 97%.



1. "ARROW RIGHT" to change
2. "ARROWS" to change value
3. "Save"
4. "Next"

Example:
In process Control Mode your system setpoint is 100. 97% of this value is 97.
The Protection Limit will become active when the actual value reading of the process is 97 or below.

4. Continue Basic Pump Protection

1. “Select No”

5. Continue to 4.5 “Protection Options” on page 110.

4.2 Advanced Pump Protection Wizard

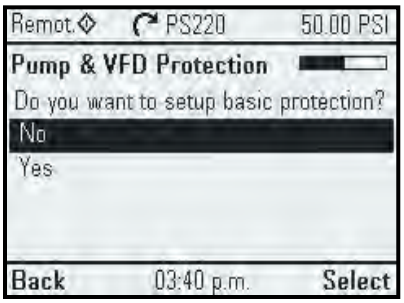
The Advanced Pump Protection functionality uses the fully array of the PumpSmart PS220’s feedback from SmartFlow and Smart TDH in identifying upset conditions that may occur in the system.
This configuration will use the values of Dry Run, Minimum Flow and Runout Flow, along with the responses you establish, to define the systems reaction to these events.
Please refer to the Features & Functions section in this manual for a detailed explanation of this functionality. This Wizard will show the step-by-step instructions to configure this functionality for use.

This functionality can be configured with the PumpSmart PS220 Configuration Wizard. To access this Wizard from the Home Screen, follow the path: Menu>PS220 Configuration>Pump & VFD Protection>Pump Protection>No> Follow the prompts

The description, along with the screenshots below, will show the steps you will take from start to finish to configure this functionality.

The individual steps that will be performed are:
1. Configure the choice for Advanced Pump Protection.
2. Configure the Flow feedback source.
3. Configure the Response to Minimum Flow.
4. Configure the Minimum Flow Value.
5. Configure the Dry Run Response.
6. Configure the Runout Flow Response.
7. Configure the Runout Flow Value.

1. Configure the choice for Advanced Pump Protection.



1. “Select Yes”

2. Configure the flow feedback source.

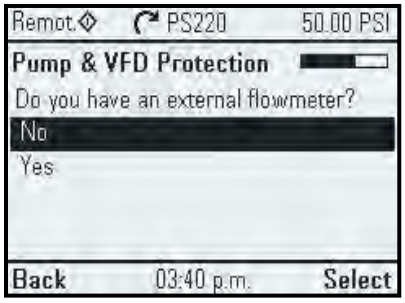
There are two choices for this configuration:

A. No (Default) this will utilize the values from Smartflow.

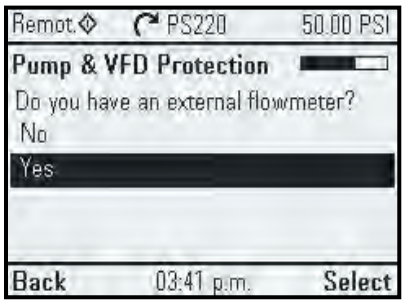
B. Yes. This choice requires an external flowmeter. If it has not already been configured this Wizard will continue and guide you through the steps in adding it.

NOTE:

THIS CHOICE CANNOT BE USED FOR PUMP PROTECTION FOR INDIVIDUAL PUMPS IN MUTIPUMP CONTROL.



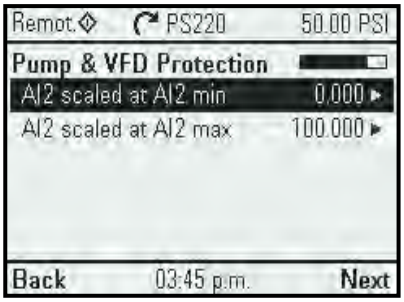
For Choice 2A: "No"



"Select"

"Select"

For Choice 2B: "Yes"



For 2B: If "No"

NOTES:

1. If you are unsure how to configure the flow meter as shown with the screen shots above, please refer to the section on Analog Inputs in this manual if necessary.

2. An unused AI will need to be used for this choice to function correctly. Please check the settings of the Analog Inputs in use by going to: Menu>PARAMATERS> Complete List>Scroll down to Group 76>Select and View 76.01&02. If available, they will show "NOT SELECTED". You may have to add an Extension Card to use an additional input. (Not provided as standard).

3. Configure the Response to Minimum Flow.

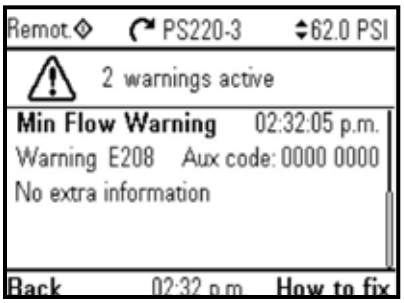
The choices are:

1. Disabled (Default)

The PumpSmart PS220 will continue to run. There will not be any indication of this event.

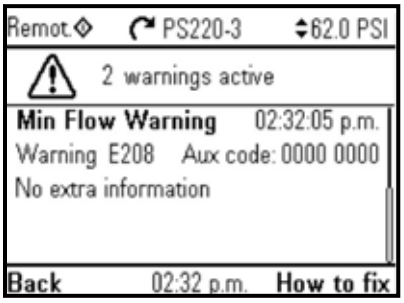
2. Warning.

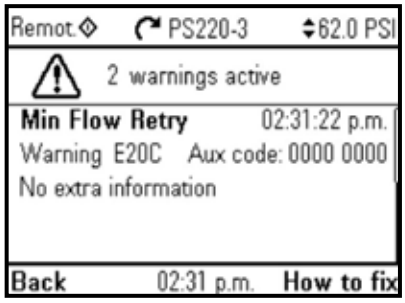
The PumpSmart PS220 will continue to run. The warning message "Min Flow Warning" will display. The event will be stored in the Event Log. It will continue to indicate the warning until the flow increases to a value above minimum flow.

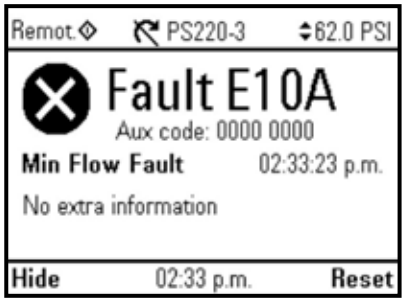


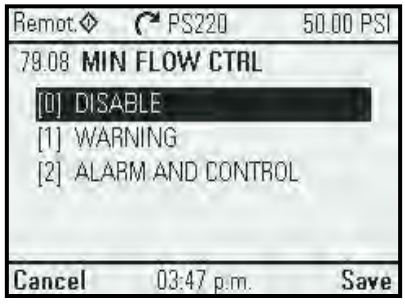
3. Alarm & Control

The PumpSmart PS220 will indicate that the pump is running at or below minimum with a message "Min Flow Warning", after the response delay time has expired. The event will be stored in the Event Log. The PS220 will then respond based on the Protections Options. If there are "Error Resets allowed, the drive will respond with a Min Flow Retry Message. If a hard fault occurs it will display the message "Min Flow Fault". The fault will have to be reset, and the drive issued a start command again. Please refer to the section "Fault Tracing" in this manual.



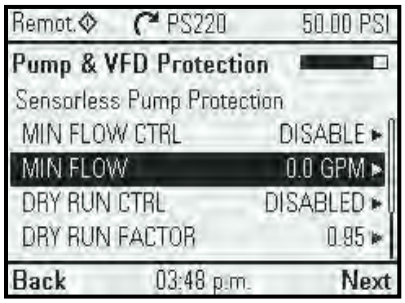






1. "ARROW RIGHT" to change
2. "ARROW UP/DOWN" to change
3. "Save"
4. "ARROW DOWN"

4. Configure the Minimum Flow Value



1. “ARROW RIGHT” to change
2. “ARROWS” to change value
3. “Save”
4. “ARROW DOWN”

5. Configure the Response to Dry Run.

The choices are:

1. Disabled (Default)

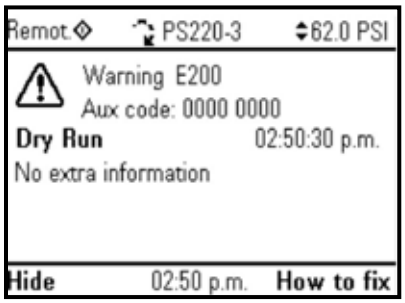
The PumpSmart PS220 will continue to run. There will not be any indication of this event.

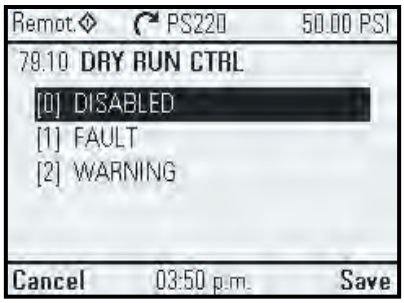
2. Fault.

The PumpSmart PS220 will fault off with the message “Dry Run Fault” after the Response Delay time has expired. It will be stored in the event log. This fault is not an Auto-resettable fault. The fault will have to be reset, and the drive issued a start command again. Please refer to the section “Fault Tracing” in this manual.

3. Warning.

The PumpSmart PS220 will continue to run and will indicate a message “Dry Run Warning” after the Response Delay time has expired. It will be stored in the event log. No other action will be taken.

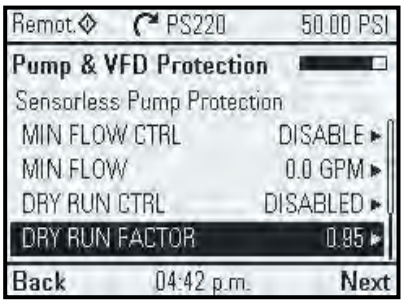




1. "ARROW RIGHT" to change
2. "ARROW UP/DOWN" to change
3. "Save"
4. "ARROW DOWN"

Configure the Dry Run factor (Not a necessary step).

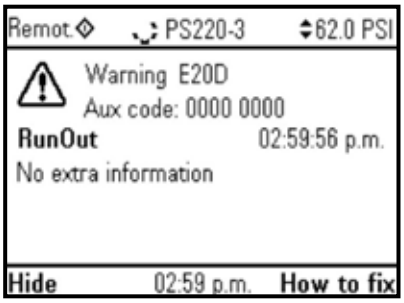
The Dry Run factor is for "fine tuning" the Dry Run fault feature. It should only be adjusted during initial PS220 commissioning. Normally this parameter requires no adjustment but is available should it be required. If it is adjusted, it should only be increased at 1/100th at a time.



6. Configure Runout Flow Response.

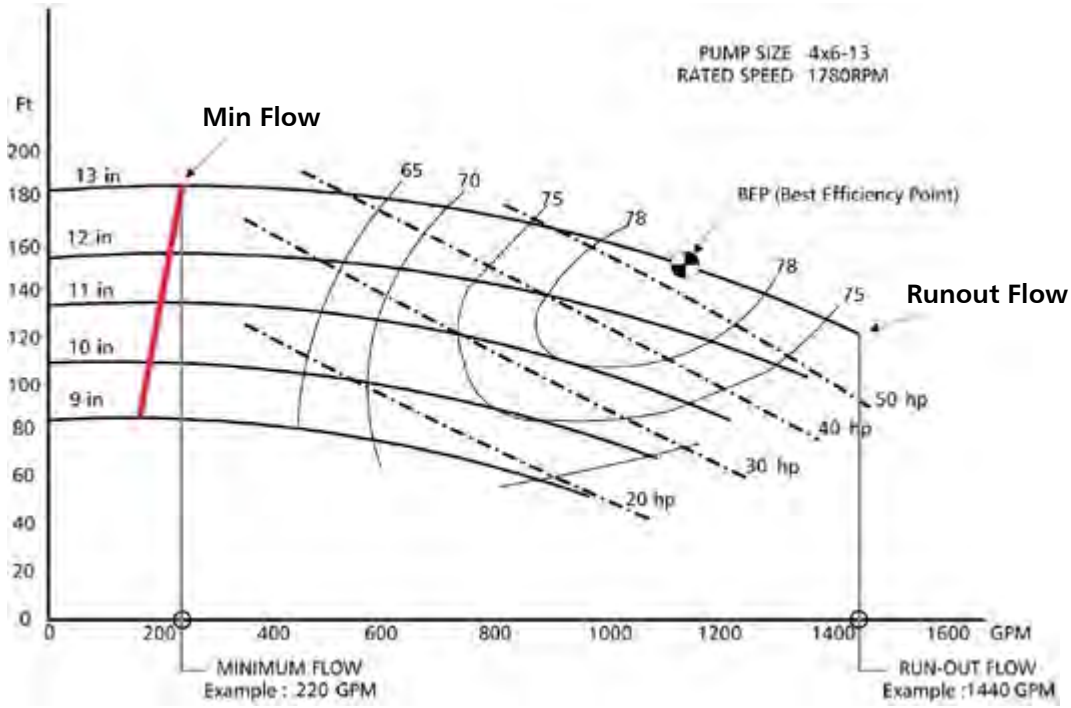
When a pump produces flow well beyond the Best Efficiency Flow rate that it was designed for it is commonly referred to as Runout. The NPSHA (Net Positive Suction Head Available) is usually less than the NPSHR (Net Positive Suction Head Required) at this operating condition which can lead to severe damage to pump internals and the suction piping system. A conservative estimate for a runout condition to occur is at 110-125% of the Best Efficiency Point Flow [BEP Flow].

The PumpSmart PS220's only available optional response is to provide a warning. The PumpSmart PS220 will continue to run. The warning message "RunOut" will display. The event will be stored in the Event Log. It will continue to indicate the warning until the flow decreases to a value below RunOut flow.

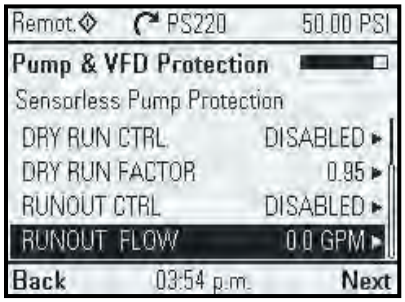


1. “ARROW RIGHT” to change
2. “ARROW UP/DOWN” to change
3. “Save”
4. “Next”

The following image illustrates both Minimum Flow and Runout Flow on a pump performance curve.



7. Configure the Runout Flow Value.



1. “ARROW RIGHT” to change
2. “ARROW UP/DOWN” to change
3. “Save”
4. “Next”

8. Continue to 4.5 “Protection Options” on page 110.

4.3. Secondary Protection Wizard

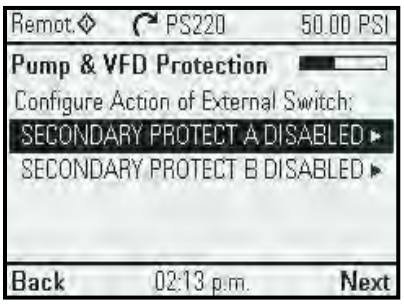
Secondary Protection uses onboard Digital Input switch connections from any external device to provide a type of permissive, or inter-lock capability to not allow the PS220 to run the pump. Examples of these are flow, pressure, level switches, or many types of "Dry-Contacts" out from PLC type devices.

Please refer to the Features & Functions section in this manual for a detailed explanation of this functionality. This Wizard will show the step-by-step instructions to configure this functionality for use.

This functionality can be configured with the PumpSmart PS220 Configuration Wizard. To access this Wizard from the Home Screen, follow the path: Menu>PS220 Configuration>Pump & VFD Protection>Secondary Protection>

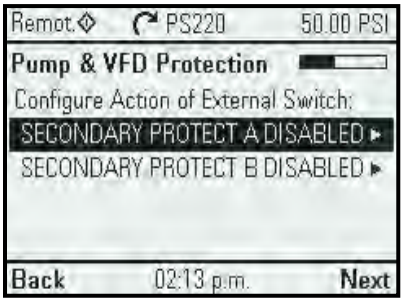
The individual steps that will be performed are:
1. Configure the use Secondary of Protection A or B.
2. Configure the Protection Response.
3. Configure the Digital Input to be used.
4. Exit the Wizard.

1. Configure the use of Secondary Protection A or B.

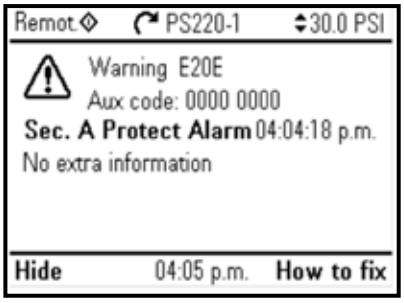


1. "Arrow Right" (For using A)
2. "Arrow Up/Down" to Define
3. "Save"
4. "Next"

2. Configure the Protection Response.



1. "Arrow Up/Down" to Define
2. "Save"
3. "Next"



NOTE: YOU MAY SEE THIS ALARM MESSAGE AS SOON AS YOU CONFIGURE THE RESPONSE. SELECT "HIDE" AND CONTINUE.

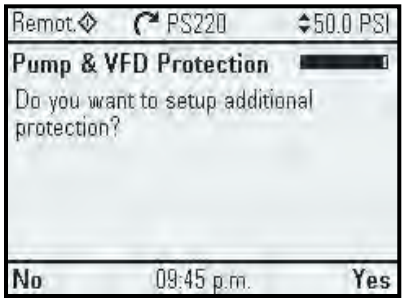
3. Configure the Digital Input to be used.

1. “Arrow Up/Down” to Define
2. “Select”
3. “Select”

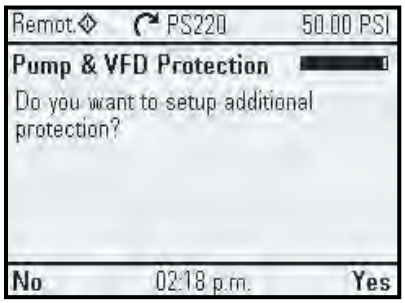
Notes:
1. It is recommended to use DI4 for Secondary Protection A and DI5 for Secondary Protection B

2. An unused Digital Input (DI) will need to be configured for either of these 2 choices to function. Please check the settings of the Digital Inputs currently in use by going to: Menu>Parameters> Complete List>Scroll down to Group 76>Select and View 76.09 through 76.14. If available for configuration, “NOT SELECTED” will be shown. An Extension Card will need to be added and configured if they are all in use.

To Configure Secondary Protection B, follow the same steps as noted above.



4. Exit the Wizard “N0” Or “Yes” to Continue to 4.5 “Protection Options” on page 110.



4.4 Condition Monitoring Wizard

The PumpSmart PS220 can monitor two separate channels of information. This information can be from any of its analog transmitters connected or from the onboard VFD and PUMP ACTUAL signals selected from specific parameter Groups. Once the source(s) have been identified you will have the ability to set both a Warning Level and Alarm level on the High AND the Low Values. You can then set the type of response properly suited for the pumping system.
Please refer to the Features & Functions section in this manual for a detailed explanation of this functionality. This Wizard will show the step-by-step instructions to configure this functionality for use.

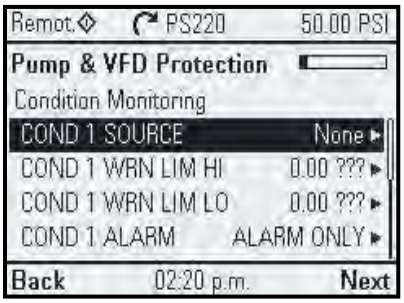
This functionality can be configured with the PumpSmart PS220 Configuration Wizard. To access this Wizard from the Home Screen, follow the path: Menu>PS220 Configuration>Pump & VFD Protection>Condition Monitoring

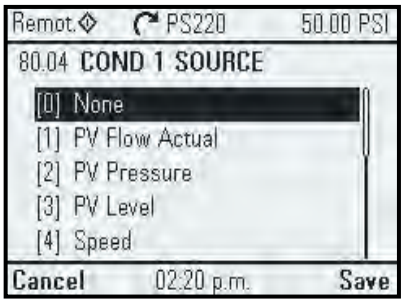
The individual steps that will be performed are:
1. Configure the Condition 1 Source.
2. Configure the Condition 1 Warning Limits High and/or Low Values.
3. Configure the Condition 1 Warning Alarm High and/or Low Values.
4. Configure the Condition 1 Response.
5. Configure the Condition 1 Response Delay time.
6. Configure the Min Speed Stop Delay time.
7. Configure the Hysteresis Value
8. Exit the Wizard

The Screen Shots that follow will show you step by step, from start to finish, how to configure this functionality.

1. Configure the Condition 1 Source.

Note: The units will display on the remaining screens when you select the source.

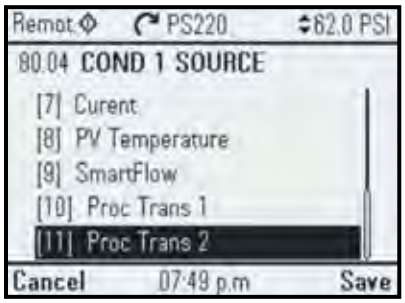




1. “Arrow Right”
2. “Arrow Up/Down” to Define”
3. “Save”
4. “Arrow Down”

NOTE:

1. When Selecting Proc. Trans 1, the Wizard will ask you to confirm all of the settings for its use. You will need to:
    1. Confirm the AI it is wired to.
    2. Confirm the Min. scaling, Max. Scaling, and the units
2. When Selecting Proc. Trans 2, (if it has not already been configured previously) the Wizard will ask you to:

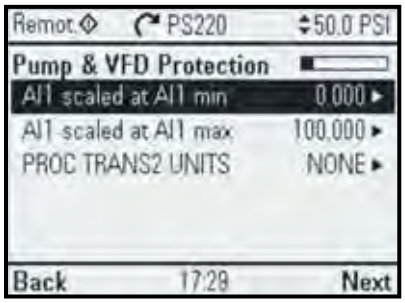


"Save"

1. Configure the AI it is wired to.

1. "Arrow Up/Down" to select.
2. "Select"

2. Configure the AI Min. scaling.

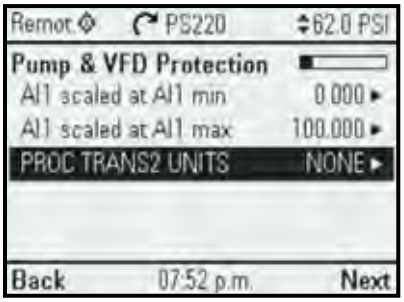


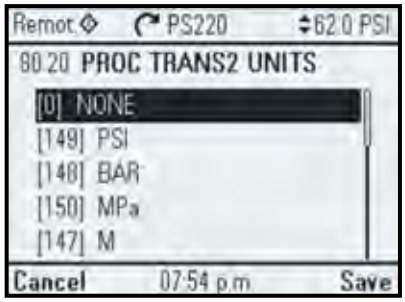
1. "Arrow Right"
2. "Arrow Up/Down" to change
3. "Save"
4. "Arrow Down"

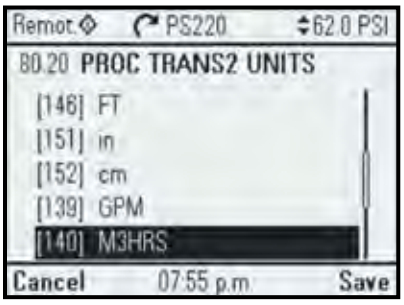
3. Configure the AI Max. Scaling.

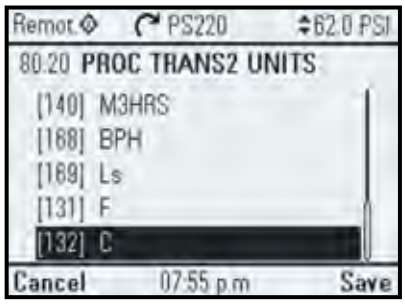
1. "Arrow Right"
2. "Arrow Up/Down" to change
3. "Save"
4. "Arrow Down"

4. Configure the units for the Process Transmitter 2.



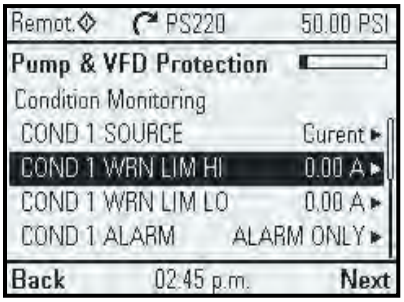


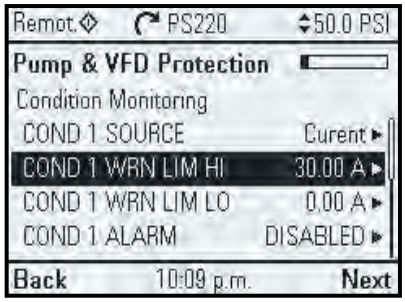


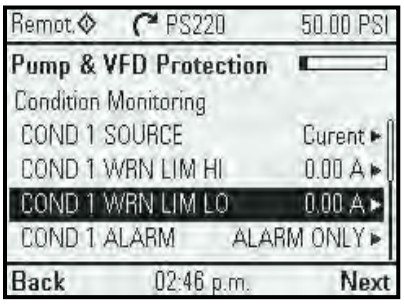


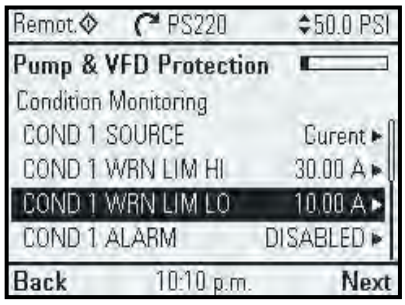
1. “Arrow Right”
2. “Arrow Up/Down” to change
3. “Save”
4. “Arrow Down”

2. Configure the Condition 1 Warning Limits High (and/or Low) Value: (If necessary)





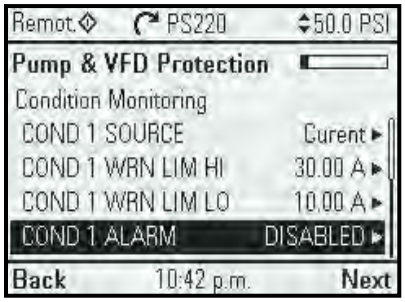


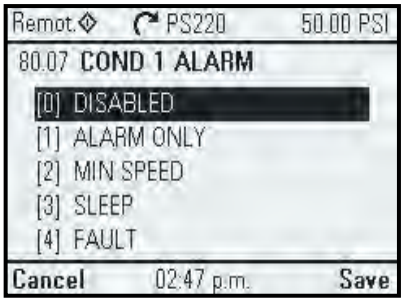


1. “Arrow Right”
2. “Arrows to Define”
3. “Save”
4. “Arrow Down”

Repeat steps 1- 4 again (If necessary)

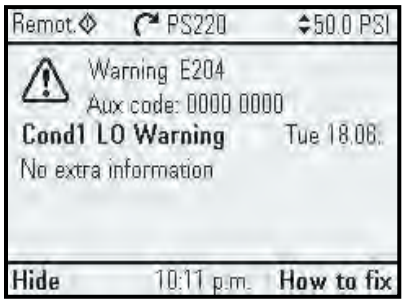
3. Configure the Condition 1 Response.





1. "Arrow Right" to change
2. "Arrows UP/DOWN" to Define
3. "Save"
4. "Arrow Down"

Once you configure the response you may receive this message. Select "Hide" and continue.

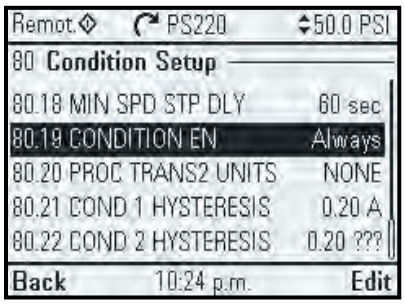


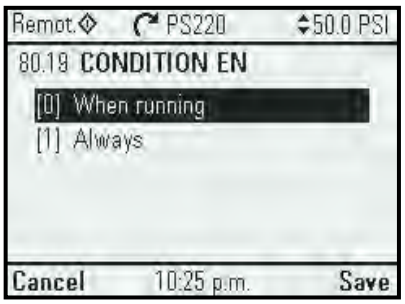
You may have to change the configuration of Parameter 80.19 to allow the Response to the Monitoring of the values when the PumpSmart PS220 is either; "When Running", or "Always". The default is "Always"

This change will need to be done manually by accessing that specific parameter directly.

From the Home Screen follow the path: Menu>Parameters>Complete List>Arrow Down to GROUP 80>80.19> Edit>Save

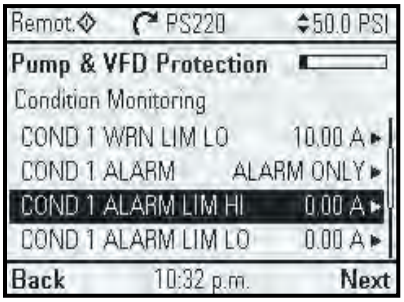
See the screen shots below:

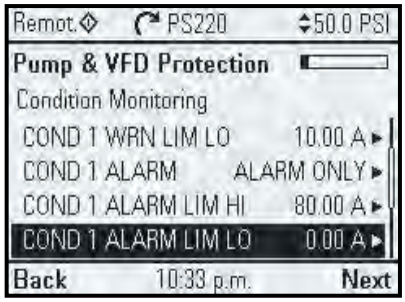




1. "Arrow Right" to change
2. "Arrows UP/DOWN" to Define
3. "Save"
4. "Back" – 3 times

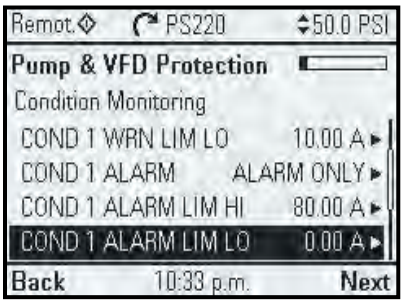
4. Configure the Condition 1 Alarm Limits High (and/or Low) Value (If Necessary)

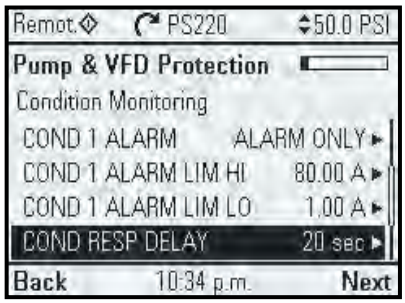




1. "Arrow Right" to change
2. "Arrow Up/Down" to define
3. "Save"
4. "Arrow Down"

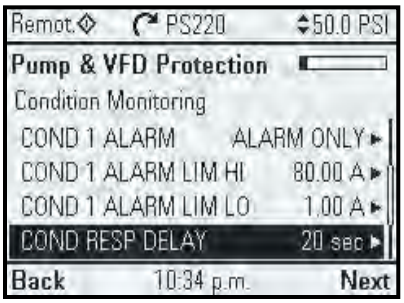
Repeat steps 1- 4 again (If necessary)





5. Configure the Condition 1 Response Delay time.

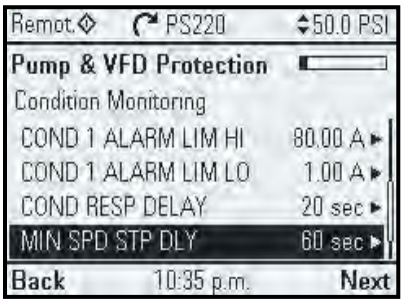
The Default is 20 Seconds. The range is 0- 3600 seconds.



1. "Arrow Right" to change
2. "Arrows UP/DOWN" to Define
3. "Save"
4. "Arrow Down"

6. Configure the Min Speed Stop Delay time.

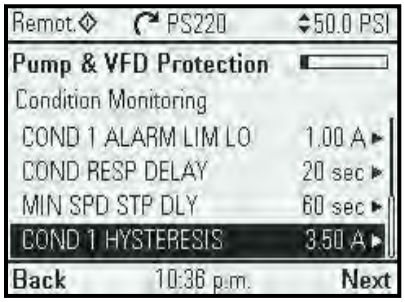
When the monitored condition triggers a Warning or Alarm, the PumpSmart PS220 can be configured to run at its minimum speed for a timed duration. If the condition that triggered the warning has not cleared during this time, the drive will fault off and stop. This is not a re-settable fault. The fault will have to be reset, and the drive issued a start command again. Please refer to the section "Fault Tracing" in this manual. The Default is 0, which disables this function. The range is (0- 3600 seconds)



1. "Arrow Right"
2. "Arrows to Define"
3. "Save"
4. "Arrow Down"

7. Configure the Hysteresis Value.

The Default is .20 of the units chosen for the condition. The range is 0-9999.

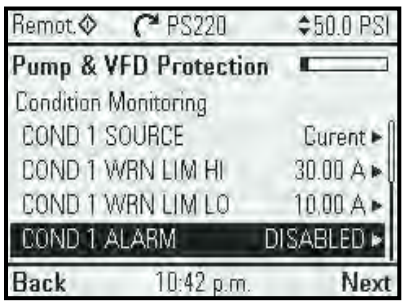


1. "Arrow Right"
2. "Arrows to Define"
3. "Save"
4. "Next"

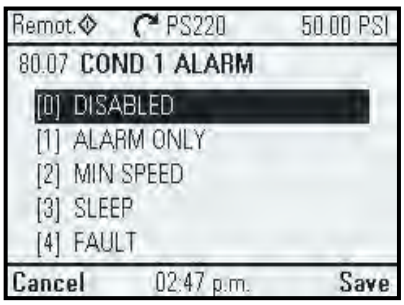
To Configure a Second Condition:

Notes:
For the configuration of the Second Condition only these steps would need to be followed.
1. Configure the Condition 2 Source.
2. Configure the Condition 2 Warning Limits High and/or Low Values.
3. Configure the Condition 2 Warning Alarm High and/or Low Values.
4. Configure the Condition 2 Response.
5. Configure the Condition 2 Hysteresis Value

8. Exit the Wizard



"No"



"No"

1. "Arrow Right" to change
2. "Arrows UP/DOWN" to Define
3. "Save"
4. "Arrow Down"

Continue to 4.5 "Protection Options Wizard" on page 110.

4.4.1 Flow Bypass Recirculation Wizard

Flow Bypass Recirculation.
The PS220's Flow Bypass Recirculation function will allow an individual pumps flow to be monitored and can control the opening and closing of a minimum flow bypass valve that may be required in the pumping system. An available Relay Out can be used with this function to send the electrical signal to operate the valves solenoid, or to trigger the external device to accomplish this.
This functionality requires the use of the Pumps Minimum Flow value. This requires either SmartFlow, or an external flow meter, and Pump Protection to be configured in advance.

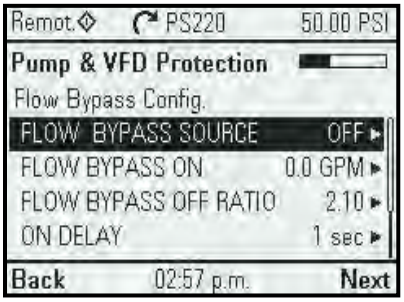
This Wizard will show the step-by-step instructions to configure this functionality for use. This functionality can be configured with the PumpSmart PS220 Configuration Wizard.

To access this Wizard from the Home Screen, follow the path: Menu>PS220 Configuration>Pump & VFD Protection>Condition Monitoring>Next>No>Yes

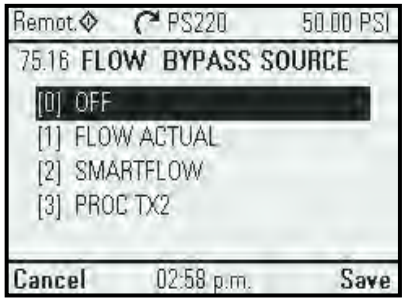
The individual steps that will be performed are:
1. Configure the use of the Flow Bypass Recirculation function.
2. Configure the FLOW BYPASS source.
3. Configure the FLOW BYPASS On flow rate
4. Configure the FLOW BYPASS OFF RATIO
5. Configure the ON DELAY time
6. Configure the OFF DELAY time
7. Configure the FLOW RELAY START DELAY time
8. Exit the Wizard

The Screen Shots that follow will show you step by step, from start to finish, how to configure this functionality.

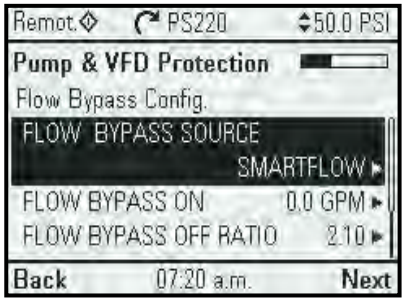
2. Configure the FLOW BYPASS SOURCE.



1. "ARROW RIGHT" To change



1. "ARROWS UP/DOWN" to select
2. "SAVE" to continue



1. "ARROW DOWN"

4.5 VFD Protection Wizard

The PumpSmart PS220 can be configured to protect itself from common electrical upset conditions, and to protect the motor from common electrical faults. By default, most all the selections are set to Fault.

Please refer to the Features & Functions section in this manual for a detailed explanation of this functionality. This Wizard will show the step-by-step instructions to configure this functionality for use. This functionality can be configured with the PumpSmart PS220 Configuration Wizard. To access this Wizard from the Home Screen, follow the path:
Menu>PS220 Configuration>Pump & VFD Protection>VFD Protection>

The Screen Shots that follow will show you step by step, from start to finish, how to configure this functionality.

The individual steps that will be performed are:
1. Access the VFD Protection Wizard
2. Configure the Maximum current
3. Configure the Overvoltage control
4. Configure the Undervoltage control
5. Configure the Auto reset selection
6. Configure the Number of trials
7. Configure the Total Trials time
8. Configure the Delay time
9. Exit Wizard

1. Access the VFD Protection Wizard.

1. “Select”

2. Configure Maximum current:

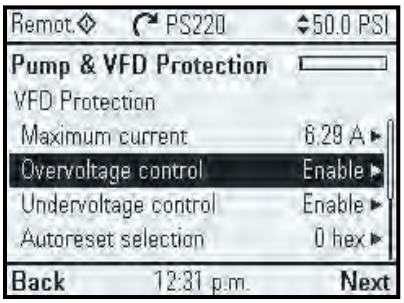
1. "ARROW RIGHT" To change
2. "ARROWS UP/DOWN" to change
3. "Save"
4. "ARROW DOWN"

⚠ CAUTION

This value should only be changed after consulting with an ITT Monitoring and Control Application Engineer, or ITT Commissioning Engineer.

3. Configure the Overvoltage control:

The default is set to ON



1. "ARROW RIGHT" To change
2. "ARROWS UP/DOWN" to change
3. "Save"
4. "ARROW DOWN"

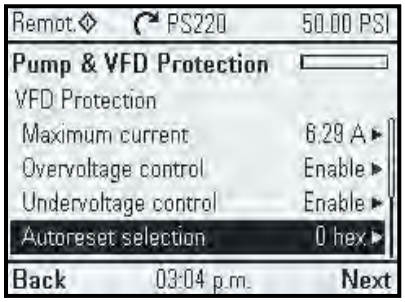
4. Configure the Undervoltage control.

The default is ON

1. "ARROW RIGHT" To change
2. "ARROWS UP/DOWN" to change
3. "Save"
4. "ARROW DOWN"

5. Configure the Autoreset selection:

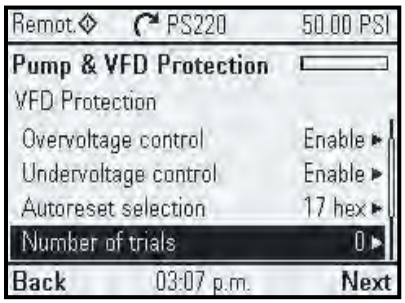
The default for all each is Disabled. (Bit in BOLD is set to 0 = Disabled)



1. “ARROW RIGHT” To change
2. “ARROWS” right to change Bit value
3. “ARROW DOWN” to next Bit (repeat step 2)
3. “SAVE” to continue
4. “NEXT”

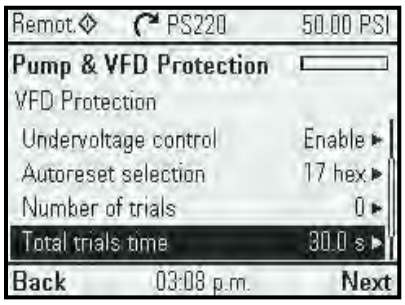
6. Configure the Number of trials.

The default is 0



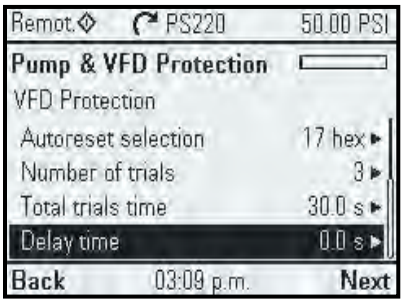
1. “ARROW RIGHT” To change
2. “ARROWS UP/DOWN” to change
3. “Save”
4. “ARROW DOWN”

7. Configure Total trials time:



1. “ARROW RIGHT” To change
2. “ARROWS UP/DOWN” to change
3. “Save”
4. “ARROW DOWN”

8. Configure the Delay time:



1. "ARROW RIGHT" To change
2. "ARROWS UP/DOWN" to change value
3. "Save"
4. "NEXT"

Note:
If the "Number of trials" and the "Delay time" exceeds the "Total trials time" the PS220 will not be able to reset automatically. The fault will need to be reset manually.

9. Exit Wizard

1. Select "No"

4.6 Protection Options Configuration Wizard

Please refer to the Features & Functions section in this manual for a detailed explanation of this functionality. This Wizard will show the step by step instructions to configure this functionality for use.

This functionality can be configured with the PumpSmart PS220 Configuration Wizard. To access this Wizard from the Home Screen, follow the path: Menu>PS220 Configuration>Pump & VFD Protection>Protection Options>

The Screen Shots that follow will show you step by step, from start to finish, how to configure this functionality

The individual steps that will be performed are:
1. Configure the Protection Delay
2. Configure Speed Override Pump Protection
3. Configure the Pump Fault Reset
4. Configure the Pump Fault Reset Delay
5. Configure the Config Speed Min Setting
6. Configure the Stp Delay Min Spd
7. Exit Wizard

NOTE:
Choices 1-5 will apply to all of the Pump Protection Functions except where noted. They will not be applicable to any VFD or Motor protection. The VFD Protection Options are covered in the section "VFD Auto-Reset".

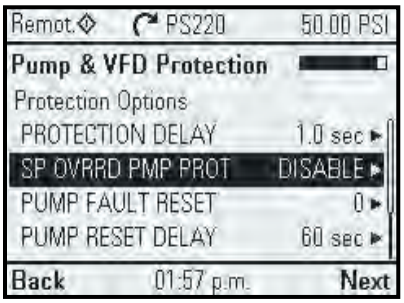
1. Configure the Protection Delay:

The PumpSmart PS220 can be configured to delay the reaction time that The PS220 will wait until activating the control of any of the protection features.
Notes:
1. The default is 0 which deactivates the function. The Maximum setting is 200 seconds, and the Minimum is 1 second.

1. "ARROW RIGHT" To change
2. "ARROWS" to change
3. "Save"
4. "ARROW DOWN"

2. Configure the Speed Override Pump Protection setting.

The PumpSmart PS220 can be configured to allow all of the Pump Protection configured to be active when the Speed Override function is also active. The Default value is "Disabled"



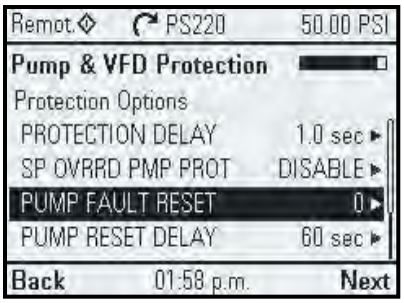
1. "ARROW RIGHT" To change
2. "ARROW UP/DOWN" to change
3. "Save"
4. "ARROW DOWN"

3. Configure the Pump Fault Reset:

The PumpSmart PS220 can be configured to "Auto-Reset" up to a set number of times when the "Alarm & Control" choice has been configured for the "Protection Response". The Default value is 0, which deactivates the function. The range is (0-19).

Notes:

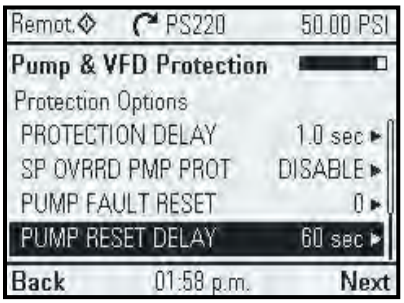
1. This function is not available for the Secondary Protection A or B functionality.
2. The PS220 will automatically end the retry attempts and end any further attempts when the system runs for more than 5 minutes, continuously, without the event(s) re-occurring.



1. "ARROW RIGHT" To change
2. "ARROWS" to change
3. "Save"
4. "ARROW DOWN"

4. Configure the Pump Fault Reset Delay

The Pump Fault Reset Delay can be configured to delay the time that The PS220 will wait until Auto-Re-starting after a Pump Protection "Alarm and Control" action has been taken. The default is 60 seconds. The range is 0 - 3600 seconds.

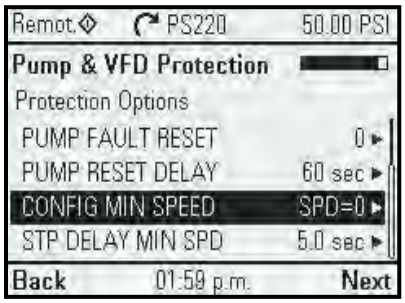


1. "ARROW RIGHT" To change
2. "ARROWS" to change
3. "Save"
4. "ARROW DOWN"

5. Configure the Config Speed Min setting.

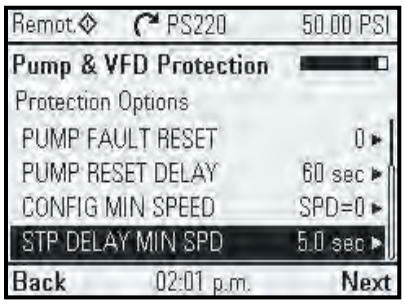
The PumpSmart PS220 can be configured to run to a "Config Speed Min" speed choice when "Alarm and Control" has been configured as the Response for the Pump Protection selection. The choices are:
1. The Minimum Speed set in Parameter 30.11. (SPD=MIN)
2. ZERO (0) RPM or to stop. (Speed =0)

Notes:
1. This choice cannot be selected for individual Responses. This is applied "globally" when selected.
2. This selection should not be used if "Min-Speed" is selected for the PID sleep function in process control. The sleep function will need to be changed to "INTELL SLEEP"



1. "ARROW RIGHT" To change
2. "ARROW UP/DOWN" to change
3. "Save"
4. "ARROW DOWN"

6. Configure the Stop Delay Min Speed.



1. "ARROW RIGHT" To change
2. "ARROWS" to change
3. "Save"
4. "ARROW DOWN"

7. Exit the Wizard

5. Multipump Wizard

The PumpSmart PS220's Multipump Functionality allows for the seamless automatic control of up to 6 pumps in a pumping system. Typically the pumps would be piped in parallel with each other. The staging and de-staging of each pump based on increases and decreases in demand has been pre-configured, as well as automatic lead-lag switching, and the automatic bypassing of a Pump/Drive combination that may experience faults of any kind. The system would need to have a Process Transmitter either wired directly to each PS220, or in series with each unit. A system setpoint would need to be established which will automatically be shared to all of the PS220 drives. Lastly a starting method would need to be established, and that command would need to be sent and received to each drive.

The Multipump Functionality will work with every Process Control Mode as configured with the Process Control Wizard and will be complimented with most all of the full suite of Functionality that is shown in this manual. For more detailed information on all Features and Functions of the MultiPump Functionality please refer to the sections that follow in this manual.

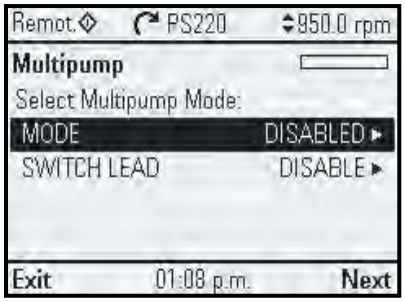
This Wizard will show the step-by-step instructions to configure this functionality for use. This functionality can be configured with the PumpSmart PS220 Configuration Wizard.
To access this Wizard from the Home Screen, follow the path: Menu>PS220 Configuration>Multipump

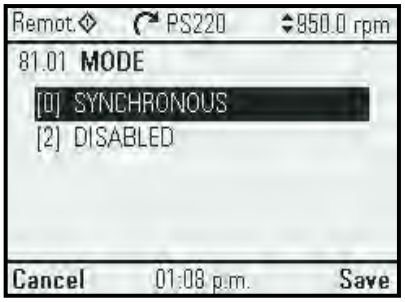
The individual steps that will be performed are:
1. Configure the Multipump Mode
2. Configure the Pump Address(s)
3. Configure the Lead/Lag Switch Hours
4. Configure the Value Increase and Decrease Values
5. Configure the Stage and Destage Method
6. Configure the Stage Proof Time
7. Configure the De-Stage Proof Time
8. Configure the Min Pumps On
9. Configure the Max Pumps On
10. Configure Stage/De-Stage Values for Pumps 2, 3 etc.
11. Exit the Wizard

The Screen Shots that follow will show you step by step as you progress, from start to finish as you progress, how to configure this functionality

NOTE: When Configuring Multiple Pumps to be used in your system you will need to follow these steps on each PS220 installed. All of the settings will be identical except for step 2 below.

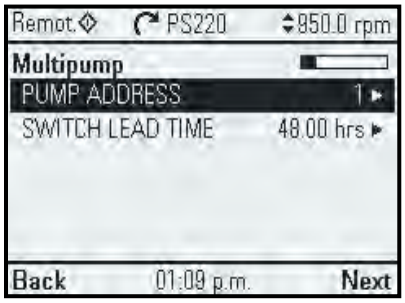
1. Configure the Multipump Mode.

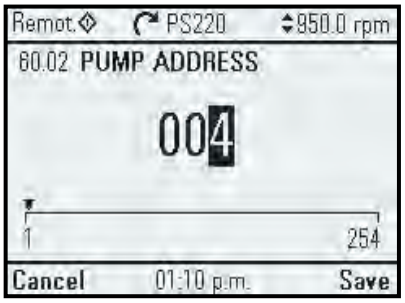




1. "ARROW RIGHT" To change
2. "ARROW UP/DOWN" to change
3. "Save"
4. "NEXT"

2. Configure the Pump Address(S).





1. "ARROW RIGHT" To change
2. "ARROWS" to change value
3. "Save"
4. "ARROW DOWN"

NOTES:
1. This Pump address MUST be entered in same fashion as the PS220's are wired with the D2D connections. Refer to the wiring diagrams in this manual. They must be wired in the 1-2-3-4-5-6 ring configuration.

3. Configure the Lead/Lag Switch Hours.

1. "ARROW RIGHT" To change
2. "ARROWS" to change value
3. "Save"
4. "Next"

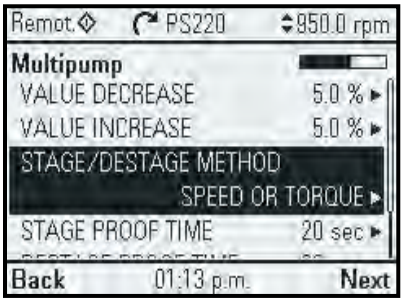
4. Configure the Value Increase and Decrease Values:

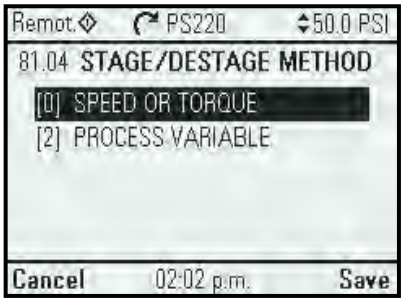
The defaults are 5%

1. "ARROW RIGHT" To change
2. "ARROWS" to change value
3. "Save"
4. "ARROW DOWN"

5. Configure the Stage and Destage Method

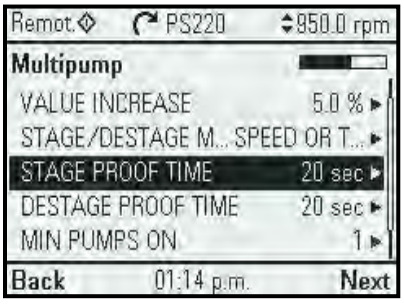
The default value is SPEED or TORQUE





6. Configure the STAGE PROOF TIME:

The default is 20 Seconds

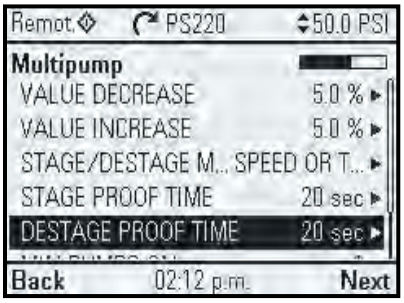


1. "ARROW RIGHT" To change
2. "ARROWS" to change value
3. "Save"
4. "ARROW DOWN"

1. "ARROW RIGHT" To change
2. "ARROWS" to change value
3. "Save"
4. "ARROW DOWN"

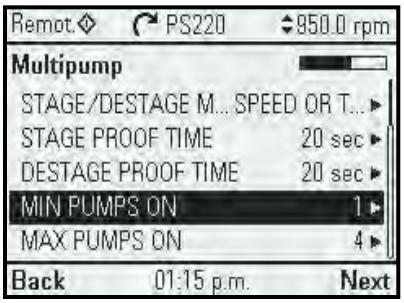
7. Configure the DESTAGE PROOF TIME

The default value is 20 seconds.



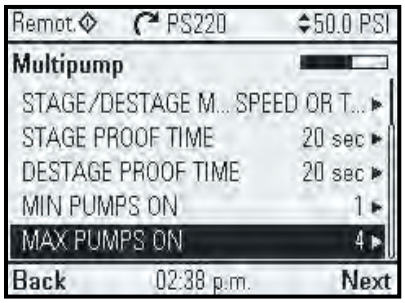
1. "ARROW RIGHT" To change
2. "ARROWS" to change value
3. "Save"
4. "ARROW DOWN"

8. Configure the MIN PUMPS ON



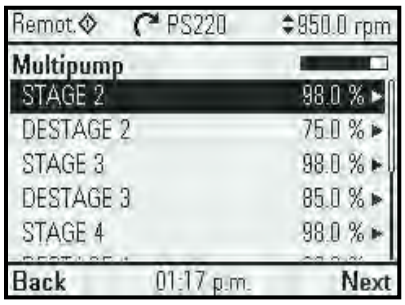
1. "ARROW RIGHT" To change
2. "ARROWS" to change value
3. "Save"
4. "ARROW DOWN"

9. Configure MAX PUMPS ON:



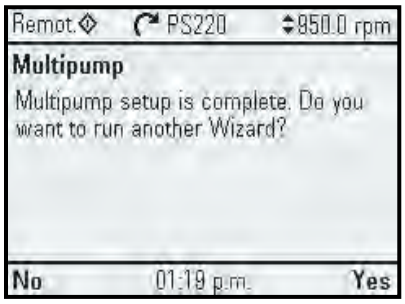
1. "ARROW RIGHT" To change
2. "ARROWS" to change value
3. "Save"
4. "NEXT"

10. Configure the Stage/De-Stage Values for Pumps 2, 3 etc.



1. "ARROW RIGHT" To change
2. "ARROWS" to change value
3. "Save"
4. "ARROW DOWN"
5. Repeat steps 1-3 for the remaining pumps in your system (6 Maximum).
6. "Next"

11. Exit the Wizard

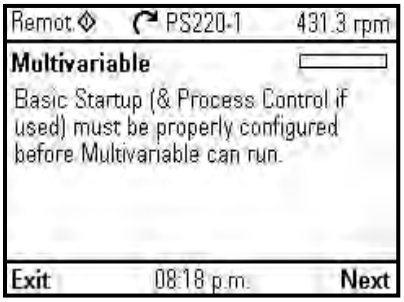


NOTE:
Once you have completed the Multipump Configuration Wizard you MUST send a setpoint reference change from the source selected in Basic Startup, from each drives setpoint source to each drive. This will ensure that the reference changes on each drive's keypad display. This will confirm that the PS220's are communicating with each other properly. It should take 3-4 seconds for this change to visibly register across all the individual drive's keypads, when using keypad as the reference, you should see the Double Arrows (Up/Down) flash during this time and the value should change after this flash.

6. Multivariable Control Wizard

The PumpSmart PS220's Multivariable Control function will allow the Primary Process Controls Setpoint to be varied, and or offset, with a second process transmitters signal.

Note:
1. This is only available for Single Pump Applications.
2. This message will be displayed if you have not run the Basic Startup and Process Control Wizards prior to configuring Multivariable Control.



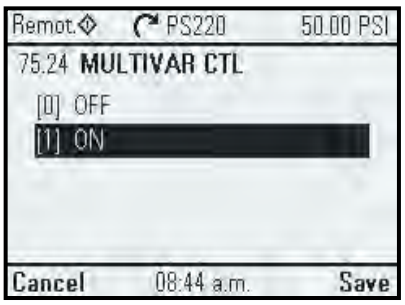
Please refer to the Features & Functions section in this manual for a detailed explanation of this functionality. This Wizard will show the step-by-step instructions to configure this functionality for use. This functionality will require a transmitter and an additional available Analog Input. This wizard will completely configure this as you proceed. This functionality can be configured with the PumpSmart PS220 Configuration Wizard. To access this Wizard from the Home Screen, follow the path: Menu>PS220 Configuration>Multivariable>

The individual steps that will be performed are:
1. Enable the Multivariable Control Functionality
2. Configure the source for the Secondary process transmitter
3. Configure the Scale of the Secondary process transmitter
4. Configure the Limits of Operation
5. Exit the Wizard

The Screen Shots that follow will show you step by step, from start to finish, how to configure this functionality.

1. Enable the Multivariable Control Functionality

1. "ARROW RIGHT"



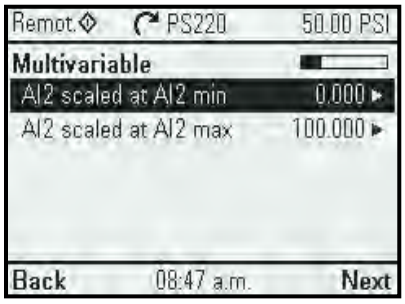
1. "ARROW UP/DOWN"
2. "Save"

1. "Next"

2. Configure the source for the Secondary process transmitter

1. "ARROW RIGHT" To change
2. "ARROW UP/DOWN" to change value
3. "Select"

3. Configure the Min and Max Scale of the Secondary Process Transmitter.

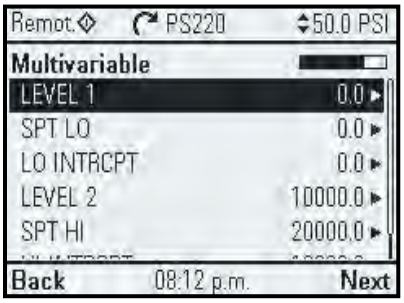


1. "ARROW RIGHT" To change
2. "ARROWS" to change value
3. "Save"
4. "ARROW DOWN"
5. Repeat steps 1-3 for AI Max scale
6. "Next"

4. Configure the Limits of Operation

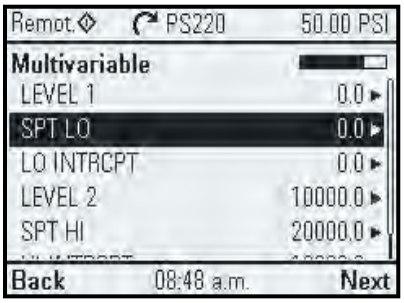
The limits of operation define the full interaction between the Analog Input you have selected in the previous step with the Primary Reference. Please refer to the example at the end of this section for assistance with the individual limit steps. There are 6 individual steps that will need to be configured listed as A through F. They are:

A. Configure the Level 1



1. "ARROW RIGHT" To change
2. "ARROWS" to change value
3. "Save"
4. "ARROW DOWN"

B. Configure the SPT LO

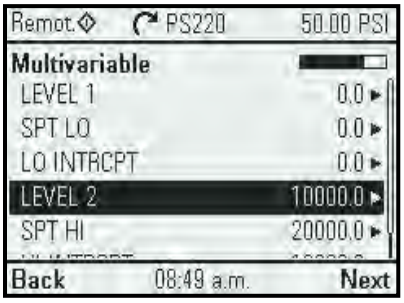


1. "ARROW RIGHT" To change
2. "ARROWS" to change value
3. "Save"
4. "ARROW DOWN"

C. Configure the LO INTRCPT

1. "ARROW RIGHT" To change
2. "ARROWS" to change value
3. "Save"
4. "ARROW DOWN"

D. Configure the LEVEL 2



1. "ARROW RIGHT" To change
2. "ARROWS" to change value
3. "Save"
4. "ARROW DOWN"

E. Configure the SPT HI

1. "ARROW RIGHT" To change
2. "ARROWS" to change value
3. "Save"
4. "ARROW DOWN"

F. Configure the Hi INTRCPT

1. "ARROW RIGHT" To change
2. "ARROWS" to change value
3. "Save"
4. "Next"

5. Exit the Wizard

Below is the example that is also shown in the Functions and Features to assist you.

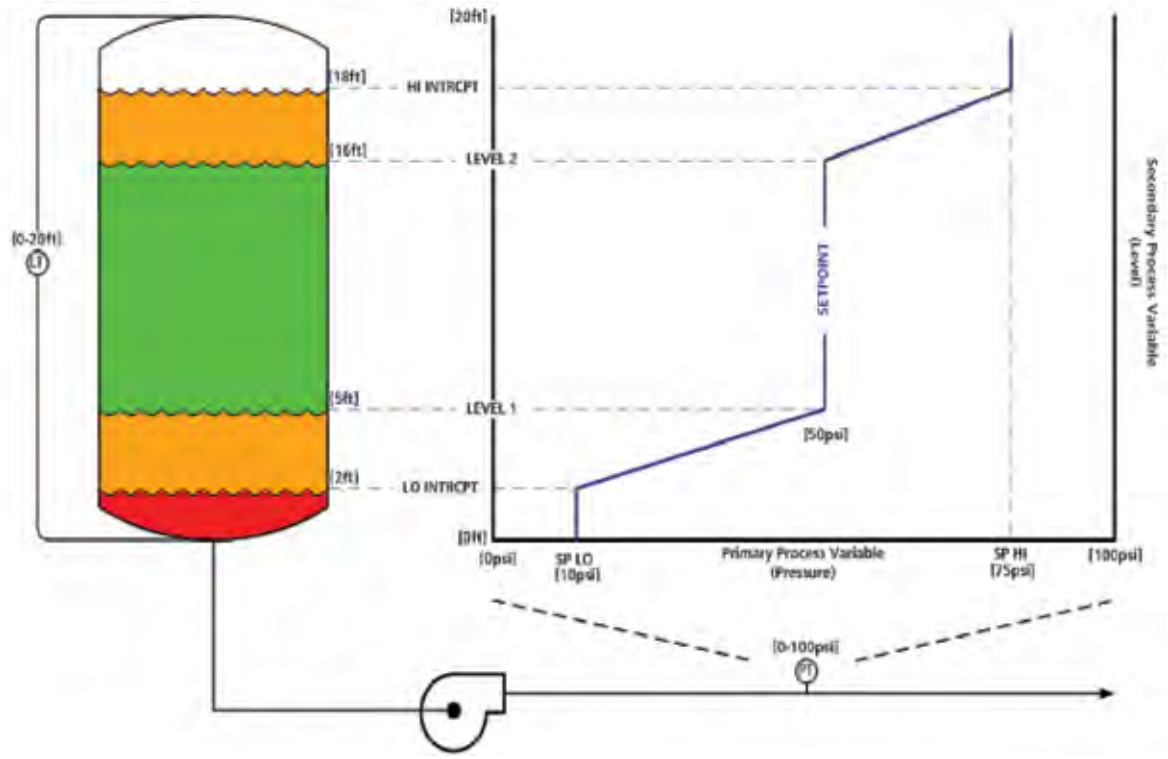
Note:
This is only available for Single Pump Applications.

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. The Basic Pump Protection on the PS220 would limit the speed of the pump or shut it off. Using the Multivariable Control feature would allow for pumping to continue, but at a reduced and allowable rate to prevent any harm to the pump, or the pumping system.

A suction pressure transmitter would need to be added and wired into an unused Analog Input (AI2 in this example). AI1 has already been configured for the primary control of the pump. The AI2 signal would then be configured such that when the suction pressure is sufficient, the PumpSmart unit would run to its current reference. When the suction pressure dropped below a certain value it would start to change/offset the setpoint based on the new scaling. In this case it would begin to lower the set point.

When configuring the Multivariable Control function, it is helpful to plot how you will want your set-point to behave in relation to the seconds analog inputs signal.

We suggest using diagrams like the one shown below:



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

Note:
To Disable this Functionality, you MUST re-run the Basic Startup and the Process Control Wizards.

7. Water Functions Wizard

The PS220 Water Functions will provide the functionality to alleviate common problems associated with pumping systems in the Municipal and Industrial marketplace. Many of the uses for these can l be found in the Waste Treatment, Water Treatment, and Water Distribution areas of these facilities.
The functions are as follows:

1. Pump Cleaning.
2. Pump Snoring.
3. Pipe Cleaning.
4. Pipe Filling.

Each of these functions has an individual PS220 Wizard to assist you with configuring the functionality.

7.1 Pump Cleaning Sequence (PCS) Wizard

The main function of the pump cleaning sequence (PCS) is to automatically detect and remove substances that may have become lodged in the pump or an inlet vane of the pump impeller. The PS220 can detect this during operation by monitoring the actual motor torque value (1.10 MOTOR TORQUE). This vale is then compared to a higher reference threshold value (83.03 TORQUE REQ). When the actual value exceeds the reference threshold value for a certain time period (83.04 TON REQ), the pump cleaning sequence will be executed. The pump cleaning sequence can also be executed at a preset time, every day, to serve as a preventive measure and a complement to the automatic detection and removal of debris that can become lodged in pump components on clog prone pumping 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:
1. 83.01 EXE P CLEAN SEQ
2. 83.02 REQ P CLEAN SEQ.

The PCS can be executed based on these choices:

1. Automatically at the detection of clog.
2. Automatically at specified time of every day.
3. Manually 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 Principles of the Pump Cleaning Sequence

Starting the PCS

The PumpSmart PS220 must be in Remote control, show a "Start Received" command, and running a pump.

Notes

1. The PCS cannot be run in "Local" control.
2. The request and execution of the PCS is blocked for 3 seconds after a start command, and after a completed PCS, to prevent increased starting torque levels from motor starts from triggering a false request for the PCS to execute automatically.
3. A "Complete Sequence" is defined by the number of cycles allowed to run. A full cycle is:
    1. The PS220 coming to a complete stopping after initiating the PCS.
    2. The PS220 running in the reverse direction until stopped during the PCS
    3. The PS220 running in the forward direction until stopped by the PCS.

Stopping/Interrupting the PCS

There are two methods that can stop the execution of the PCS:

1. Issuing a Stop signal.
2. Opening Digital Input 3 (DI3), if it was used to start the PCS.

Note:

When either of these choices is used to stop the PCS the PumpSmart PS220 will need to be restarted. It will not restart on its own.

Disabling the PCS

To completely disable this function, you will need to configure the settings of parameter 83.01 EXE P CLEAN SEQ to "NOT SELECTED", and 83.02 to "NOT SELECTED".

PCS in Multipump Applications

In Multipump Synchronous control, only one pump shall be permitted to execute the PCS at a time. The other pump(s) shall be held in queue until they individually become available to execute their PCS routines.

PCS Parameter Configuration Settings:

The following parameter settings are used to configure the Pump Cleaning Sequence.

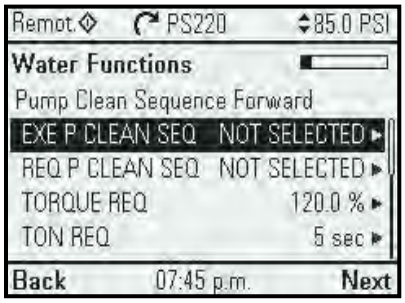
Note:

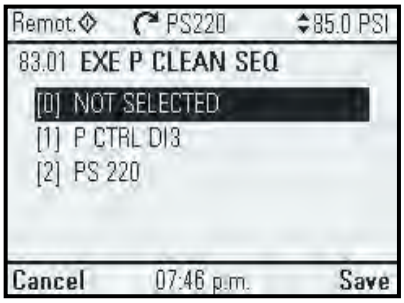
Setting parameter 83.02 is set to TORQ or TORQ OR RUN TIME, will require a "Torque Test" to be performed to ensure that the setting for parameter 83.03 TORQUE REQ is suited for the application.

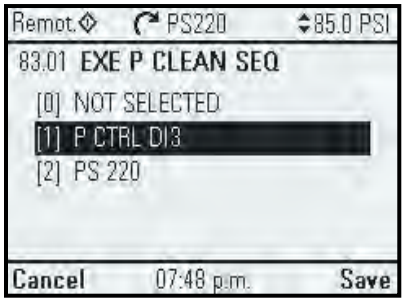
The test can be done as follows:

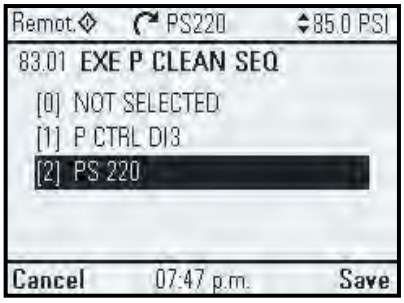
1. Switch to "LOCAL" Keypad Control.
2. Start the Pump by pressing the Green Start Button.
3. Set the Speed Reference to Max Speed and let the pump run to full speed. Check and validate that the pump is pumping with a "normal level" in the sump, or the suction side tank and it is maintaining a stable flow.
4. View/Record the value of Parameter 1 .10 MOTOR TORQUE in %. Multiply this value by 1.2. The factor 1.2 corresponds to the expected increased torque that can be expected when a clog may occur. Use this calculated value when you configure parameter 83.03 TORQUE REQ.
5. Stop the PS220 with the Red Stop Button.
6. Switch back to REMOTE control.

1. Configure how the Pump Cleaning Sequence executes. (Manual or Automatic)



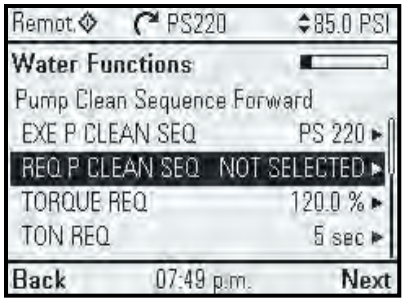


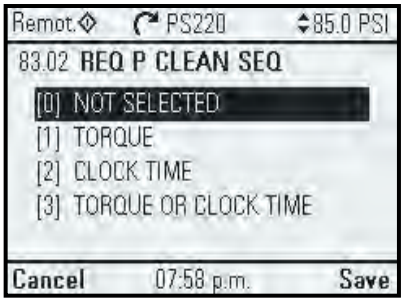




1. "ARROW RIGHT" To change
2. "ARROW UP/DOWN" to change value
3. "Save"
4. "ARROW DOWN"

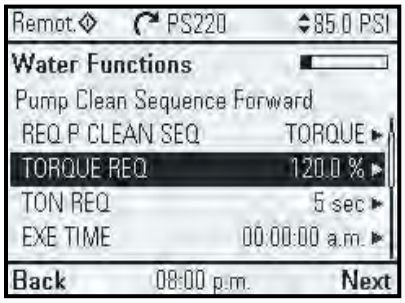
2. Configure what triggers the Execution of the Pump Cleaning Sequence when PS220 is configure for step 1. (Automatic operation)





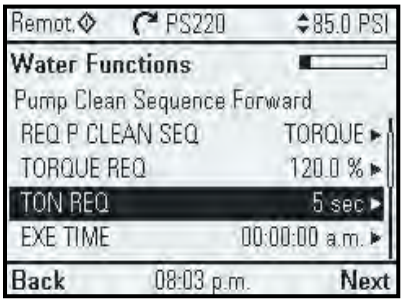
1. "ARROW RIGHT" To change
2. "ARROW UP/DOWN" to change value
3. "Save"
4. "ARROW DOWN"

3. Configure the Torque Request Value above normal Torque for executing the PCS.



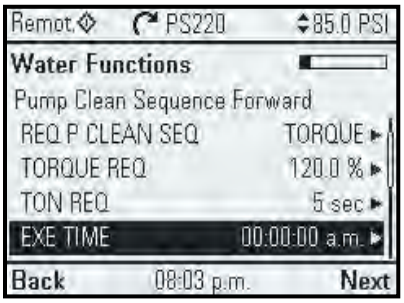
1. "ARROW RIGHT" To change
2. "ARROWS" to change value
3. "Save"
4. "ARROW DOWN"

4. Configure the proof time before executing the PCS once the request torque threshold is met.



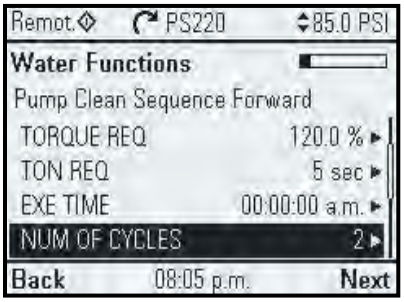
1. “ARROW RIGHT” To change
2. “ARROWS” to change value
3. “Save”
4. “ARROW DOWN”

5. Configure the time of the day to execute the PCS.



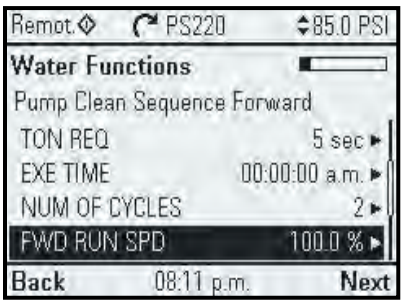
1. “ARROW RIGHT” To change
2. “ARROWS” to change value
3. “Save”
4. “ARROW DOWN”

6. Configure the maximum number of cycles the PCS can execute.



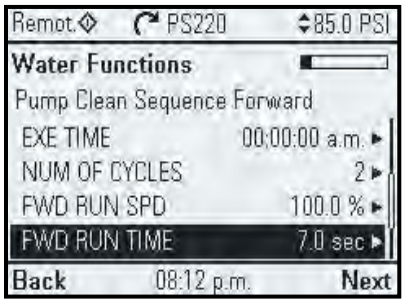
1. “ARROW RIGHT” To change
2. “ARROWSUP/DOWN” to change value
3. “Save”
4. “ARROW DOWN”

7. Configure the forward running speed during the PCS.



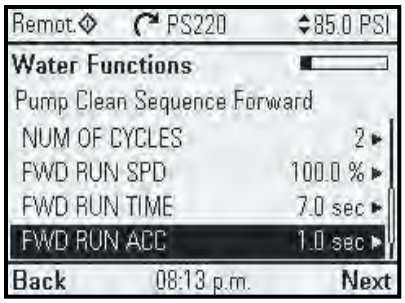
1. “ARROW RIGHT” To change
2. “ARROWS” to change value
3. “Save”
4. “ARROW DOWN”

8. Configure the forward speed run time during the PCS.



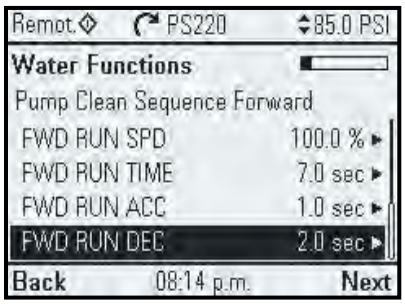
1. “ARROW RIGHT” To change
2. “ARROWS” to change value
3. “Save”
4. “ARROW DOWN”

9. Configure the forward run acceleration rate during the PCS.



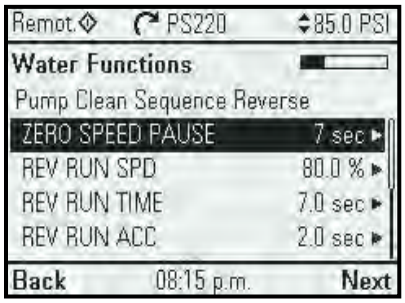
1. “ARROW RIGHT” To change
2. “ARROWS” to change value
3. “Save”
4. “ARROW DOWN”

10. Configure the forward run deceleration rate during the PCS.



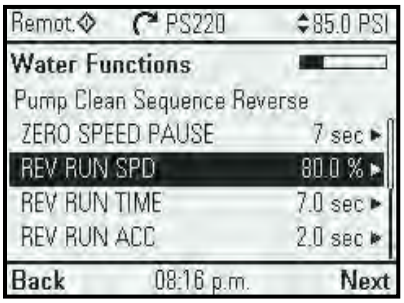
1. “ARROW RIGHT” To change
2. “ARROWS” to change value
3. “Save”
4. “ARROW DOWN”

11. Configure the time pause before reverse rotation begins during the PCS.



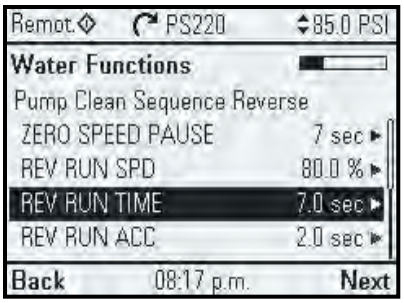
1. “ARROW RIGHT” To change
2. “ARROWS” to change value
3. “Save”
4. “ARROW DOWN”

12. Configure the reverse run speed during the PCS.



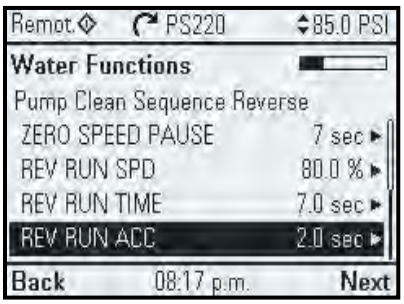
1. "ARROW RIGHT" To change
2. "ARROWS" to change value
3. "Save"
4. "ARROW DOWN"

13. Configure the reverse run time during the PCS.



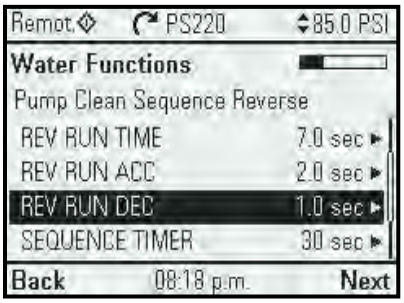
1. "ARROW RIGHT" To change
2. "ARROWS" to change value
3. "Save"
4. "ARROW DOWN"

14. Configure the Reverse Run Acceleration rate during the PCS.



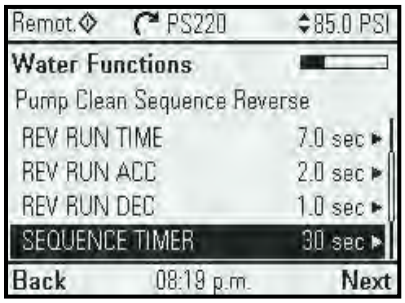
1. "ARROW RIGHT" To change
2. "ARROWS" to change value
3. "Save"
4. "ARROW DOWN"

15. Configure the Reverse Run Deceleration rate during the PCS.



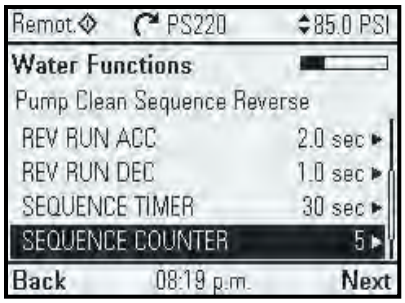
1. "ARROW RIGHT" To change
2. "ARROWS" to change value
3. "Save"
4. "ARROW DOWN"

16. Configure the maximum time the PCS is allowed to complete a full sequence.



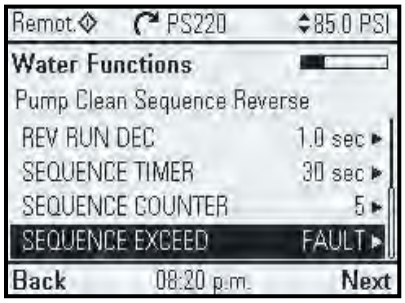
1. “ARROW RIGHT” To change
2. “ARROWS” to change value
3. “Save”
4. “ARROW DOWN”

17. Configure the maximum number of complete sequences the PCS is allowed to run.



1. “ARROW RIGHT” To change
2. “ARROWS” to change value
3. “Save”
4. “ARROW DOWN”

18. Configure the Sequence Exceeded Reaction when the PCS does not reduce the torque to acceptable levels.



1. “ARROW RIGHT” To change
2. “ARROWS” to change value
3. “Save”
4. “ARROW DOWN”

19. Exit the Wizard

7.2 Snore Function Wizard

The PumpSmart PS220's Snore functionality primary use is to remove oil, grease, and other floating debris from the surface of the liquid in a vessel. This eliminates the need to schedule the vessel to have the level "pumped down" and to have the sump cleaned manually. Typically, this function is used with Level Control applications when emptying sump systems or tanks.

When the Snore Function is initiated all PS220 functional control is disabled. It is automatically enabled once the function terminates.
When the Snore Function is active the message "Pump Snoring" will be displayed on the Keypad and will be captured and stored in the event log.

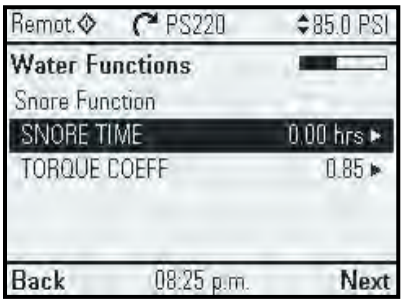
Please refer to the Snore section in this manual for a more detailed explanation of this functionality. This Wizard will show the step-by-step instructions to configure this functionality for use. This functionality can be configured with the PumpSmart PS220 Configuration Wizard. To access this Wizard, from the Home View follow the path: Menu>PS220 Configuration>Water Functions>Snore Function

The individual steps that will be performed are:
1. Configure the Snore Time which enables the function.
2. Configure the Snore Torque Coefficient
3. Exit the Wizard

The Screen Shots that follow will show you step by step, how to configure this functionality.

1. Configure enabling of the Snore Function.

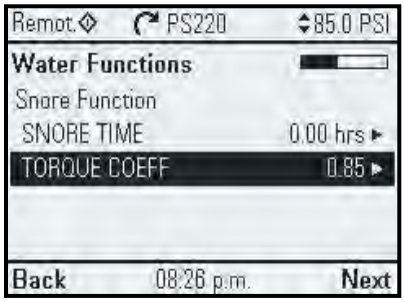
The Snore Time is the accumulated timeframe that the PS220 will use to execute the Snore function.
The range is 0 to 10,000 hours. The default shown disables the function.



1. "ARROW RIGHT" To change
2. "ARROWS" to change value
3. "Save"
4. "ARROW DOWN"

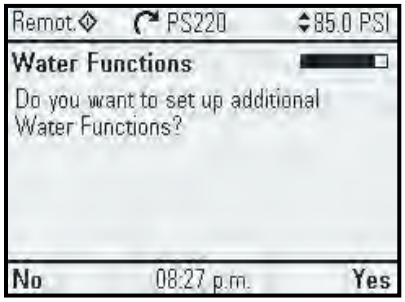
2. Configure the Snore Torque Coefficient

This value is used to terminate the Snore function. The Default value is 85% or .85.



1. “ARROW RIGHT” To change
2. “ARROWS” to change value
3. “Save”
4. “Next”

3. Exit the Wizard



7.3 PIPE CLEANING FUNCTION WIZARD

The PS220's Pipe Cleaning function will allow for a high flow flushing of the discharge piping system. This will reduce sedimentation that may have accumulated in the piping and he overall wear on the piping system over time. The PS220 can be configured to execute the pipe clean sequence on every start, or strictly based on actual accumulated pump/motor running hours. The pump will be run at full speed when this function is executed.

When the Pipe Cleaning function is initiated, all PS220 functional control is disabled except for Pump Protection. It is automatically enabled once the function completes.

When the Pipe Cleaning function is active the message "Pipe Clean Running" will be displayed on the Keypad and will be captured and stored in the event log.

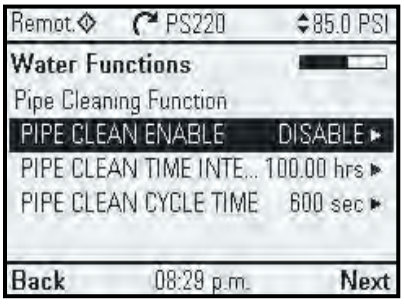
Please refer to the Pipe Cleaning section in this manual for a more detailed explanation of this functionality. This Wizard will show the step-by-step instructions to configure the Pipe Clean Function for use. This functionality can be configured with the PumpSmart PS220 Configuration Wizard. To access this Wizard from the Home View, follow the path: Menu>PS220 Configuration>Water Function>Pipe Cleaning Function>I

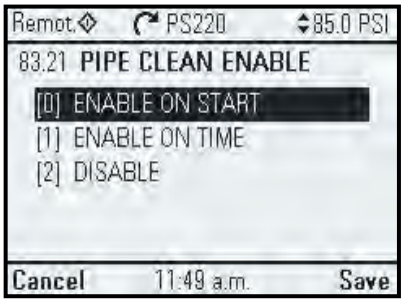
The individual steps that will be performed are:
1. Configure the method to enable Pipe Cleaning function.
2. Configure the Pipe Clean Time interval,
3. Configure the Pipe Clean Cycle Time.
4. Exit the Wizard

The Screen Shots that follow will show you step by step, how to configure this functionality.

1. Configure the method to enable Pipe Cleaning function.

The two selection choices are:
1. At every Start command
2. Based on an accumulated run time interval.

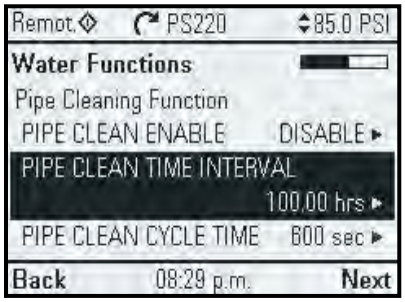




1. "ARROW RIGHT" To change
2. "ARROW UP/DOWN" to change value
3. "Save"
4. "ARROW DOWN"

2. Configure the Pipe Clean Time interval.

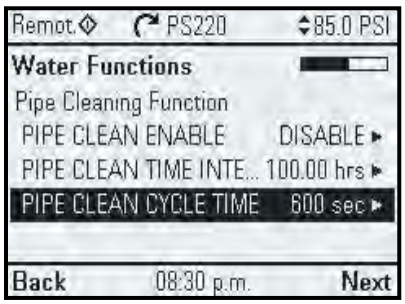
This is the time interval used for step 1B. The default is 100 Hours.



1. "ARROW RIGHT" To change
2. "ARROWS" to change value
3. "Save"
4. "ARROW DOWN"

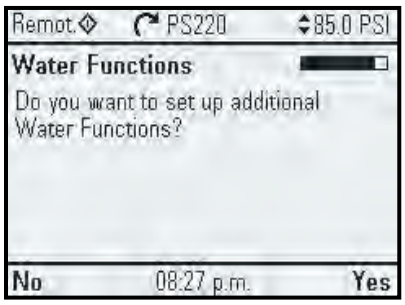
3. Configure the Pipe Clean Cycle Time.

This is the total time that the Cleaning Cycle will run. The default is 600 Seconds (10 Minutes).



1. "ARROW RIGHT" To change
2. "ARROWS" to change value
3. "Save"
4. "Next"

4. Exit the Wizard



Select "NO"

7.4 Pipe Fill Wizard

The PS220's Pipe Fill function allows for the gradual filling of the discharge piping system when the pumping system is initially started. This will dramatically reduce the impact of any "water hammer" and prevent a "run- out" flow condition as the system gradually fills. The pump will run to a pre-configured speed and for a set duration.
When using the PS220's Process Control Functionality, this function can be configured to bypass the time allowed to run. The PS220 will monitor a process control value, compare it to a preset value, and then end the Fill Function. Process control will begin automatically at this time.

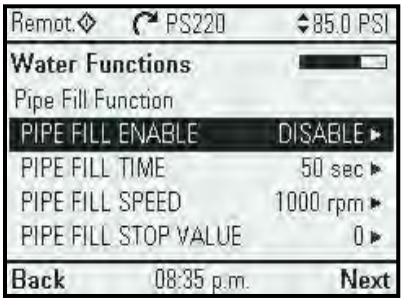
When the Fill Function is active the message "Pipe Fill Running" will be displayed on the Keypad and will be captured and stored in the event log.
When the Pipe Fill function is initiated, all PS220 functional control is disabled. It is automatically enabled once the function completes.

Please refer to the Pipe Fill section in this manual for a more detailed explanation of this functionality. This Wizard will show the step-by-step instructions to configure this functionality for use. This functionality can be configured with the PumpSmart PS220 Configuration Wizard. To access this Wizard, from the Home View follow the path: Menu>PS220 Configuration>Water Functions>Pipe Fill

The individual steps that will be performed are:
1. Configure enabling of the Pipe Fill function
2. Configure the Pipe Fill Time
3. Configure the Pipe Fill Speed
4. Configure the Pipe Fill Stop Value
5. Exit the Wizard

The Screen Shots that follow will show you step by step, how to configure this functionality.

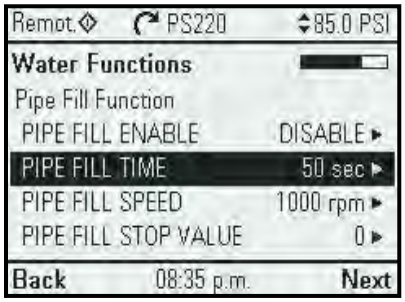
1. Configure enabling of the Pipe Fill function



1. "ARROW RIGHT" To change
2. "ARROWS" to change value
3. "Save"
4. "ARROW DOWN"

2. Configure the Pipe Fill Time

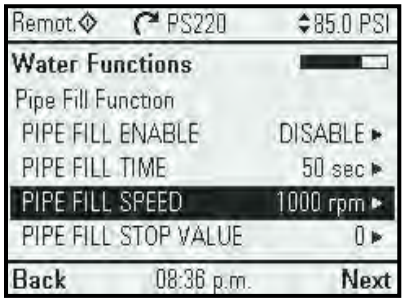
The fill time is the time frame that the PS220 will run the Pipe Fill function. The default value is 50 Seconds.



1. "ARROW RIGHT" To change
2. "ARROWS" to change value
3. "Save"
4. "ARROW DOWN"

3. Configure the Pipe Fill Speed

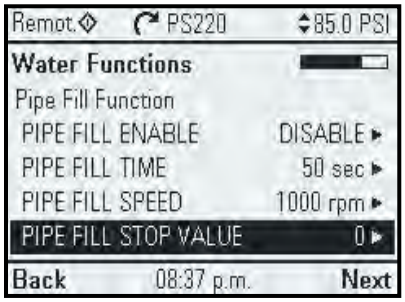
The fill speed is the RPM value that the PS220 will ramp up to and remain at while the function is executing. The default value is 1000 RPM



1. "ARROW RIGHT" To change
2. "ARROWS" to change value
3. "Save"
4. "ARROW DOWN"

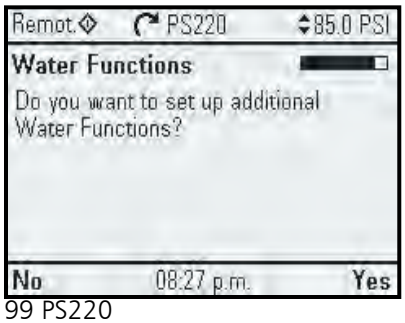
4. Configure the Pipe Fill Stop Value

This value is used to end the Fill Function prior to the time in step 3. Applicable only when using Process Control. There are no units displayed. The units are as configured with the Process Control Wizard.



1. "ARROW RIGHT" To change
2. "ARROWS" to change value
3. "Save"
4. "Next"

5. Exit the Wizard



Select "NO"

8. I/O Configuration Wizard

The PumpSmart PS220 utilizes 3 types of electric connections that can be individually configured for use. This Wizard will guide you through configuring these connections

The connection types are:
1. 1. Analog Inputs.
   2. Analog Outputs.
2. Digital Inputs/Outputs.
3. Relays.

Refer the index in this manual for a more detailed description on these types of connections.
This wizard will guide you, step by step as you progress, how to configure each of these for use

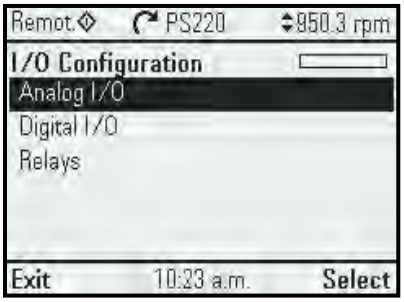
NOTES:
1. When configuring a particular function with the PumpSmart PS220 Configuration Wizards that will require the use of an Analog Input and/or a Digital Input, the Wizard in use will assist the configuration for proper use as you progress. There are times when you will be reminded to manually configure a connection, or to validate a connection.

2. This Wizard should be used only after Basic Startup, Process Control, and Pump Protection is completed first.

3. This Wizard will guide you through the configuration of each one of these types of connections.

4. If an extension module is required it must be installed in Slot 3 only.

This functionality can be configured with the PumpSmart PS220 Configuration Wizard.
To access this Wizard, from the Home Screen follow the path:
Menu>PS220 Configuration>I/O Configuration>No>See Below
>Yes (if you are configuring the FIO-11optional extension module)



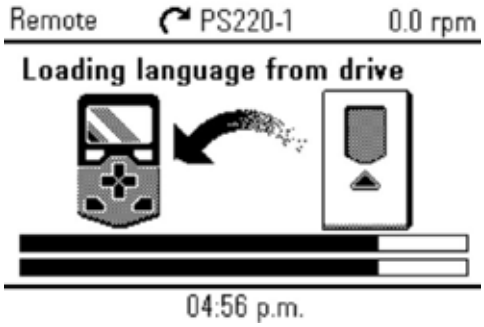
The Screen Shots that follow will show you step by step as you progress, from start to finish as you progress, how to configure this functionality.

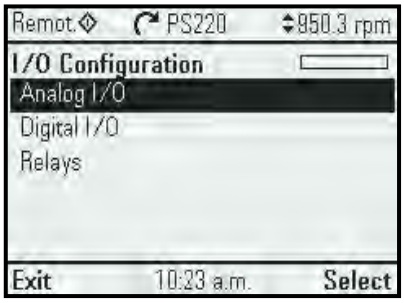
8.1.1 Analog Input Configuration Wizard.

To configure an Analog Input or Output, from the Home Screen follow the path: Menu>PS220 Configuration>I/O Configuration>No)>Analog I/O.

1. "No"
2. "Select"

OR "Yes" if you are configuring the FIO-11optional Extension Module for the first time. If the Extension model is included, then wait until it loads software. This message and the loading of the software will only occur during the initial configuration of the addition of the extension module.





1. "Select"

The steps that you will perform for each Analog Input:

1. Choose the AI that you wish to configure.
2. Configure the Function/name for the Input.
3. Configure the sourcing units input value for the AI mA or Vdc.
4. Configure the Value in mA/Vdc for the Min value.
5. Configure the Value in mA/Vdc for the max value.
6. Configure the Scaled Min value for the AI.
7. Configure the Scaled Max value for the AI.
8. Exit Wizard

1. Configure AI 1(if used).

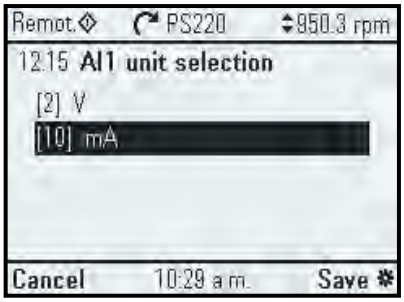
1. “Arrow Down 1 time” (Bypass the line for AI tune)

2. Configure the Function/Name for AI1 Config.

1. “ARROW RIGHT” To change
2. “ARROW UP/DOWN” to select
3. “SAVE”
4. “ARROW DOWN”

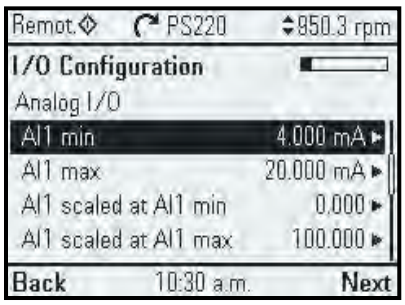
3. Configure the Inputs unit sourcing method.

mA is the default Choices are mA or vDC



1. “ARROW RIGHT” To change
2. “ARROW UP/DOWN” to select
3. “SAVE”
4. “ARROW DOWN”

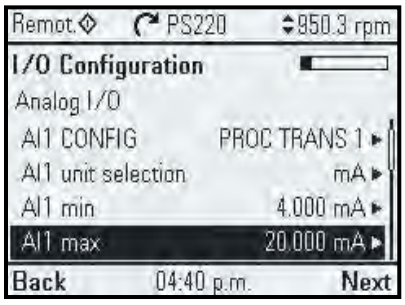
4. Configure the value in mA for the Min value. The default is 4mA



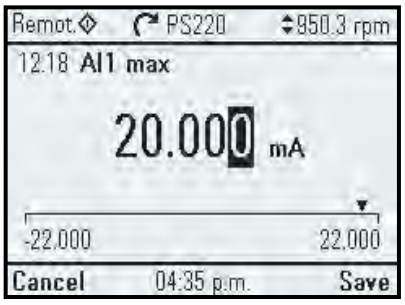
1. “ARROW RIGHT” To change

1. “ARROWS” to change
2. “SAVE”
3. “ARROW DOWN”

5. Configure the value in mA for the Max value. The default is 20mA.



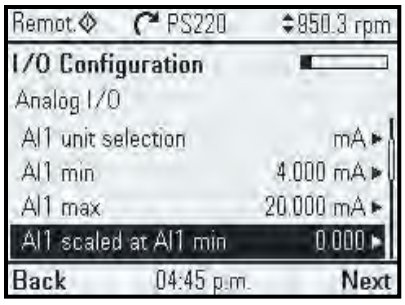
1. “ARROW RIGHT” To change



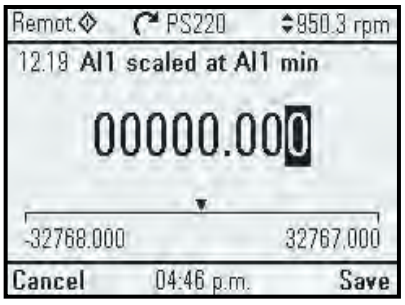
1. “ARROWS” to change
2. “SAVE”
3. “ARROW DOWN”

6. Configure the Scaled Min value for the AI.

This refers to the value that corresponds to the minimum of the signal for the 4mA scaled value. This is defaulted to 0.



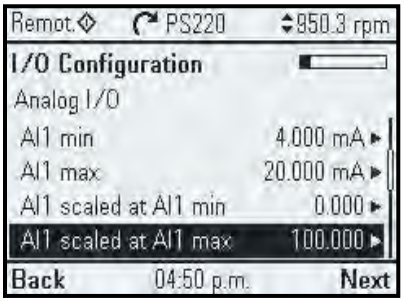
1. “ARROW RIGHT” To change



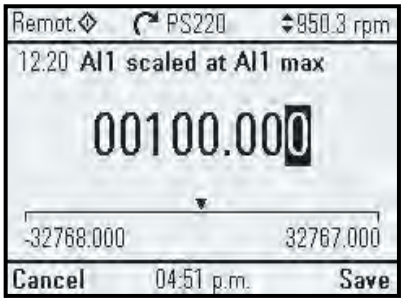
1. “ARROWS” to change
2. “SAVE”
3. “ARROW DOWN”

7. Configure the Scaled Max value for the AI.

This refers to the value that corresponds to the maximum of the signal for the 20mA scaled value. This is defaulted to 100.



1. "ARROW RIGHT" To change

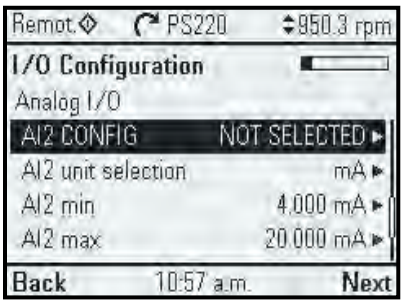


1. "ARROWS" to change
2. "SAVE"
3. "ARROW DOWN"

NOTE:

1. The configuration of AI2 would start as shown below:

Follow the steps 1-7 above that were used for AI1.



8. Exit Wizard

1. "Next" twice
2. "No"

8.1.2 Analog Output Configuration Wizard.

To configure an Analog output from the Home Screen follow the path: Menu>PS220 Configuration>I/O Configuration>-No (or Yes if you are configuring the FIO-11optional Extension Module for the first time)>Analog I/O>Select>Next

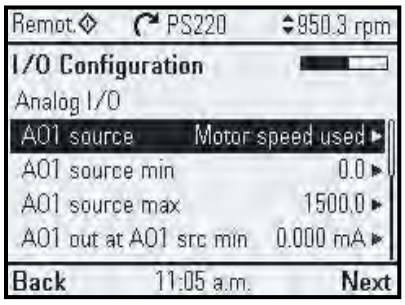
The steps that you will perform for each Analog Input:

1. Choose the AO by numbers Source.
2. Configure the Scaled Min value for the AO.
3. Configure the Scaled Max value for the AO.
4. Configure the Min value in MA for the Min value.
5. Configure the Max Value in MA for the max value.
6. Exit the Wizard.

The Screen Shots that follow will show you step by step as you progress, from start to finish as you progress, how to configure this functionality.

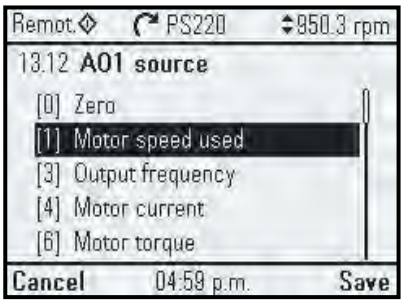
1. Choose the AO by numbers Source.

AO1



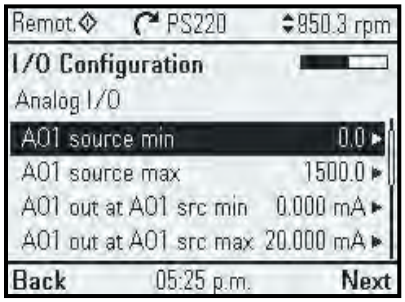
AO2

CHOICES



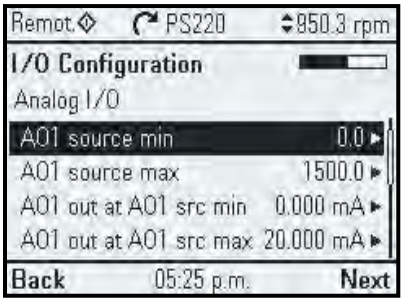
1. "ARROW RIGHT" To change
2. "ARROW UP/DOWN" to select
3. "SAVE"
4. "ARROW DOWN"

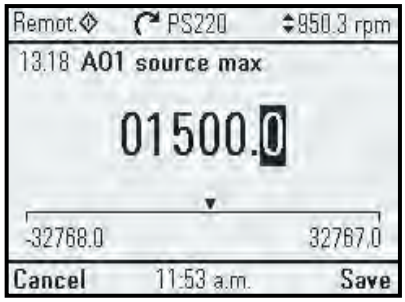
2. Configure the Scaled Min value for the AO.



1. "ARROW RIGHT" To change
2. "ARROW UP/DOWN" to select
3. "SAVE"
4. "ARROW DOWN"

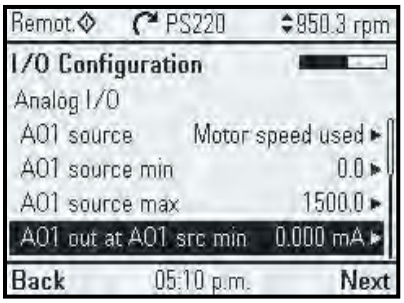
3. Configure the Scaled Max value for the AO.





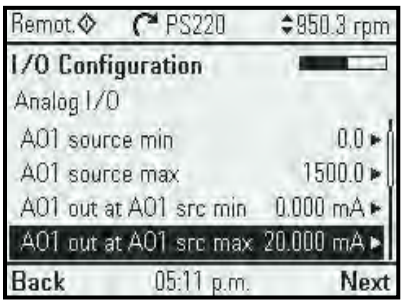
1. "ARROW RIGHT" To change
2. "ARROW UP/DOWN" to select
3. "SAVE"
4. "ARROW DOWN"

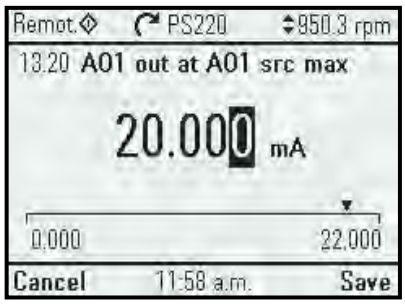
4. Configure the Min Value in mA for the AO Min value.



1. "ARROW RIGHT" To change
2. "ARROW UP/DOWN" to select
3. "SAVE"
4. "ARROW DOWN"

5. Configure the Max Value in mA for the AO Max value.





1. "ARROW RIGHT" To change
2. "ARROW UP/DOWN" to select
3. "SAVE"
4. "ARROW DOWN"

NOTE:
1. To configure AO2 "ARROW DOWN"
2. Follow the steps 1-5 above that were used for AO1.

6. Exit Wizard

1. "Next"
2. "No"

8.2. Digital Inputs Configuration Wizard

The PumpSmart PS220 comes standard with 6 Digital inputs. There are 2 additional that may be configured for use as well. These inputs are sourced internally from the PS220 with 24V. This Wizard will guide you through configuring these connections.

NOTES:
1. When configuring a particular function with the PumpSmart PS220 Configuration Wizards that will require the use of a Digital Input, the Wizard in use will assist the configuration for proper use as you progress. There are times when you will be reminded to manually configure a connection, or to validate a connection.

2. This Wizard should be used only after Basic Setup, Process Control, and Pump Protection is completed first.

3. This PS220 Configuration Wizard CANNOT be used to change or modify the methods of starting and stopping, or to change or modify any of the Estop or Safe Torque Off functionality that is already in use on the PumpSmart PS220.

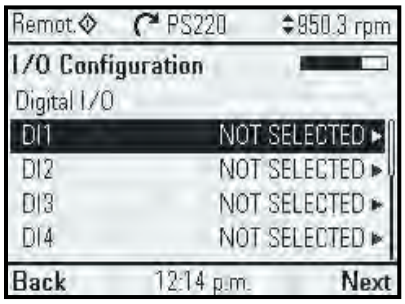
To access this Wizard, from the Home Screen follow the path: Menu>PS220 Configuration>I/O Configuration>No> (OR Yes if you are configuring the FIO-11optional Extension Module for the first time)> Digital I/O > "Select"

The steps that you will perform:
1. Configure the Digital Input Number
2. Configure the Digital Input Function
3. Exit the Wizard

The Screen Shots that follow will show you step by step as you progress, from start to finish as you progress, how to configure this functionality.

1. Configure the Digital Input by Number.

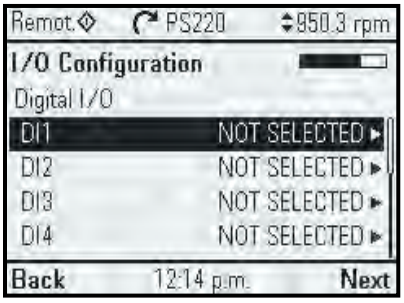
There are 6 digital inputs that can be selected.
NOTE: You may only select an input that shows a status of "NOT SELECTED" if already configured it will show "IN USE"

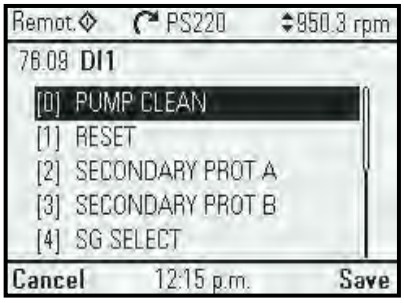


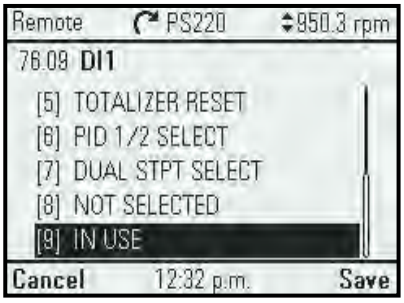
1. "ARROW UP/DOWN" to select DI*
1. "ARROW RIGHT" To change
2. "ARROW UP/DOWN" to select
3. "SAVE"
4. "ARROW UP/DOWN" (for further selections)

2. Configure the Digital Inputs Function.

There are 8 choices for the Function that this digital Input will be used for. They are all shown on the 3 screens below.







1. "ARROW UP/DOWN" to select
2. "ARROW RIGHT" to change
3. "Save"
4. Repeat steps 1- 3 for additional inputs -OR- "Next"

3. Exit Wizard

1. "Next"
2. "No"

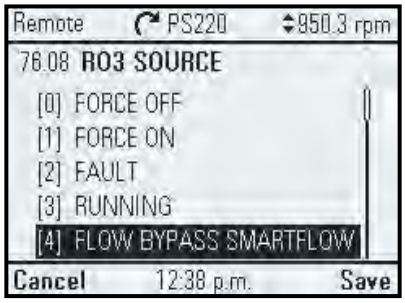
8.3 Relay Configuration Wizard

The PumpSmart PS220 has 3 Form C "Dry Contact" relays on board as standard. They are fully configurable for different pumping system and electrical system operating conditions, to include warnings, and for fault conditions. Relays will revert to their original states once any warnings, faults, or the operating conditions that triggered them are reset or cleared. Each can be forced on, off, and inverted. By default, Relay 1 is configured for Ready, Relay 2 is configured for Running, and Relay 3 is configured for Fault. Additional relays can be added with the use of optional plug-in extension modules available from ITT.

Note:
To access this Wizard from the Home Screen, follow the path: Menu>PS220 Configuration>I/O Configuration>No> (OR Yes, if you are configuring the FIO-11optional Extension Module for the first time)>Relays >Select
The steps that you will perform:

1. Configure the Assignment for the Relay by Number.
2. Exit the Wizard

The Screen Shots that follow will show you step by step as you progress, from start to finish as you progress, how to configure this functionality.



1. "ARROW UP/DOWN" to change
2. "SAVE" to continue
3. Repeat steps 1-2 for additional relays that need configuration.

2. Exit Wizard

1. "Next" to end.

NOTE:
For "Other" contact your ITT Monitoring & Control Application Engineer or Commissioning Engineer.

9. Restoring Factory Defaults Wizard

The PumpSmart PS220 can be completely reset back to the original factory defaults. This will erase all the current settings that may have become corrupt, or you may be experiencing trouble during the normal operation of the system. This function can also be used when you relocate and re-connect the PumpSmart to a different piece of equipment.

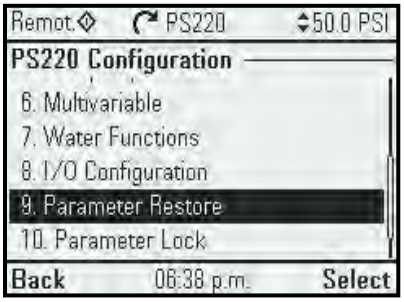
Please use the PumpSmart PS220 Wizard to accomplish this.

From the home screen follow the path:
Menu>PS220 Configuration>Parameter Restore>

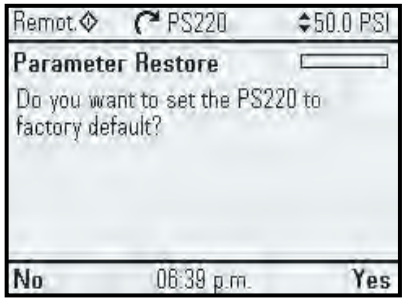
The steps that you will perform:
1. Perform a Parameter Restore
2. Exit the Wizard
3. Clear all Parameters
4. Restore the PS220 Defaults
5. Reconfigure the PS220

The Screen Shots that follow will show you step by step as you progress, from start to finish as you progress, how to configure this functionality

1. Perform a Parameter Restore.



"Select"

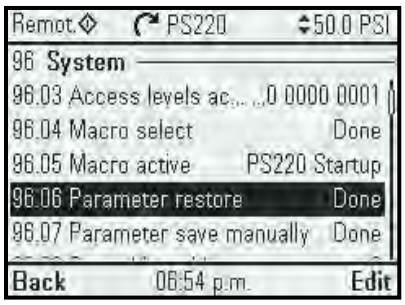


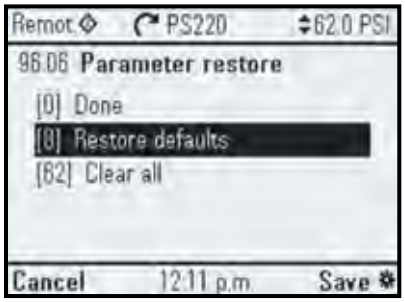
"Yes"

2. Exit Wizard

3. Clear all Parameters.

From the Home Screen follow the path: MENU>Parameters>Complete List> ARROW UP to “96 System”>Select>





1. “Arrow Down” to 96.06
2. “Edit”
3. “Arrow Down” to “Clear All”
4. “Save”
5. Wait
6. “Edit”
7. Arrow Up” to “Restore defaults”
8. “Save”
9. Wait until home screen returns
10. Power cycle the PS220
11. Wait 1 Minute to restore Power.
12. Reconfigure the PS220

10. Parameter Lock Wizard

Not Used.

11. Miscellaneous Wizard

This Wizard will configure the PumpSmart PS220 functionality for:

1. Speed Override.
2. Torque Control (SmartControl).
3. Advanced Pressure Control (System Curve Compensation).

11.1 Speed Override Wizard

Please refer to the Features & Functions section in this manual for a detailed explanation of this functionality. This Wizard will show the step-by-step instructions to configure this functionality for use. To access this Wizard from the Home Screen follow the path: Menu>PS220 Configuration>Miscellaneous Setup>Speed Override.

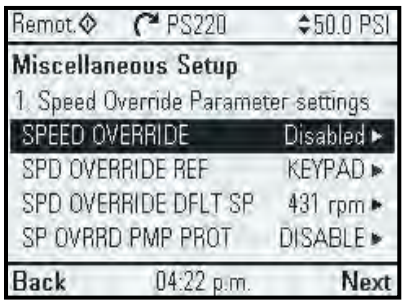
The steps that you will perform:

1. Configure the method to activate the Speed Override function
2. Configure the Speed Override Reference source
3. Configure the Speed Override Default speed
4. Configure the setting for Pump Protection when this function is activated.
5. Exit the Wizard

The Screen Shots that follow will show you step by step as you progress, from start to finish as you progress, how to configure this functionality

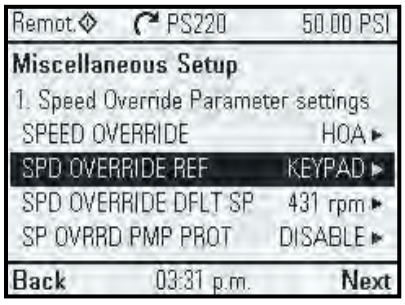
1. Configure the method to activate the Speed Override function.

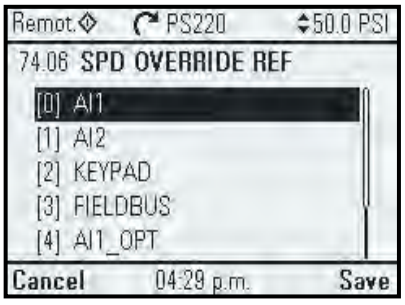
There are 8 choices for the Function that this digital Input will be used for. They are all shown on the 3 screens below.



1. "ARROW RIGHT" To change
2. "ARROW UP/DOWN" to change value
3. "Save"
4. "ARROW DOWN"

2. Configure the Speed Override Ref source.

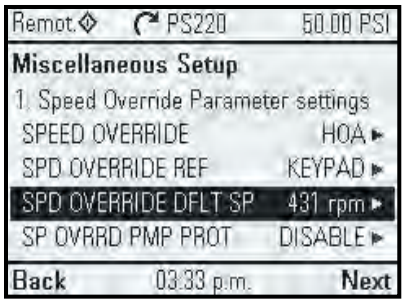




1. "ARROW RIGHT" To change
2. "ARROW UP/DOWN" to change value
3. "Save"
4. "ARROW DOWN"

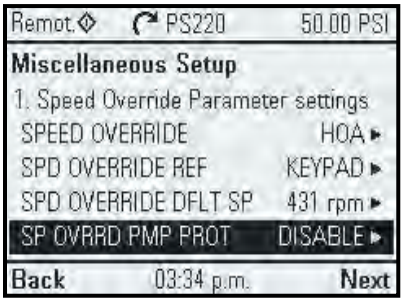
3. Configure the Speed Override Default speed.

The Default is 25% of Motor Nameplate speed.



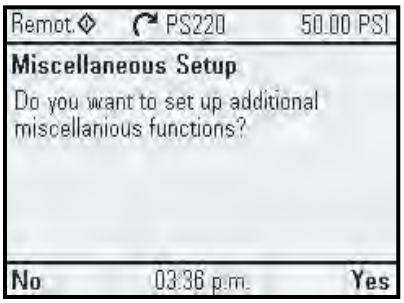
1. "ARROW RIGHT" To change
2. "ARROWS" to change value
3. "Save"
4. "ARROW DOWN"

4. Configure the setting for Pump Protection when Speed Override is activated.



1. “ARROW RIGHT” to change
2. “ARROW UP/DOWN” to change value
3. “Save”
4. “Next”

5. Exit the Wizard.



1. Select “Yes” or “No”

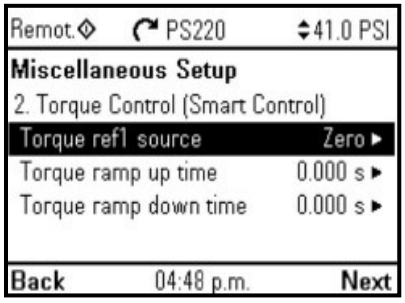
11.2 Torque Control (Smart Control) Wizard

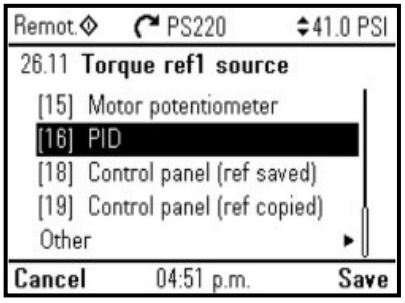
The PumpSmart PS220 has the functional capability to use the pumps torque rather than the pump speed in its PID Process Control Functionality. This allows for a significant improvement in the stable output of pump flow to maintain the process systems requirement. This is called SmartControl. Please refer to the SmartControl section in this manual for a detailed explanation of this functionality. This Wizard will show the step-by-step instructions to configure this functionality for use. To access this Wizard from the Home Screen follow the path: Menu>PS220Configuration>Miscellaneous Setup>Torque Control (SmartControl) >

The steps that you will perform:
1. Configure the Torque Reference to PID.
2. Configure the Torque Ramp up and Ramp down times
3. Turn on Torque Control.
4. Configure the Max Torque value to be used.
5. Exit the Wizard

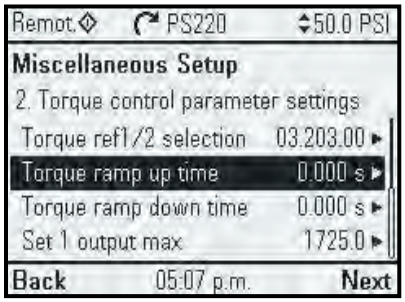
The Screen Shots that follow will show you step by step as you progress, from start to finish as you progress, how to configure this functionality.

1. Configure the Torque ref1 source to PID



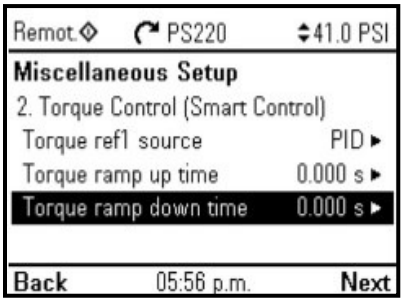


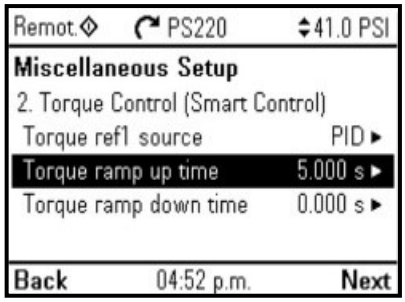
1. "ARROW RIGHT" To change
2. "ARROW UP/DOWN" to change value to PID
3. "Save"
4. "ARROW DOWN"



1. "ARROW RIGHT" To change
2. "ARROW UP/DOWN" to PID
3. "Save"
4. "ARROW DOWN" 2 times

2. Configure the Torque Ramp up and Ramp down times to 5 Seconds.

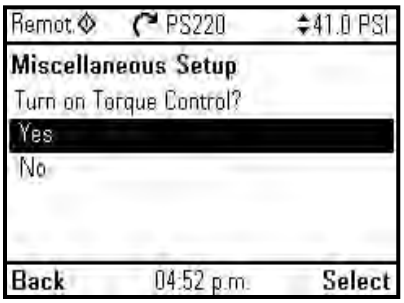




For Ramp up:
1. "ARROW RIGHT" To change
2. "ARROWS" to change value to 5 seconds
3. "Save"
4. "ARROW DOWN"

For Ramp down: Repeat steps 1-4
1. Select "Next"

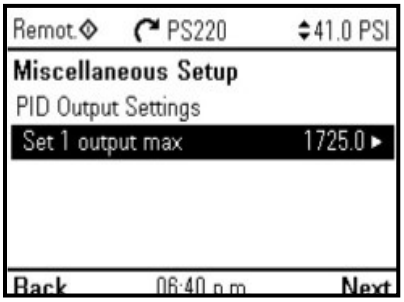
3. Turn On Torque Control.

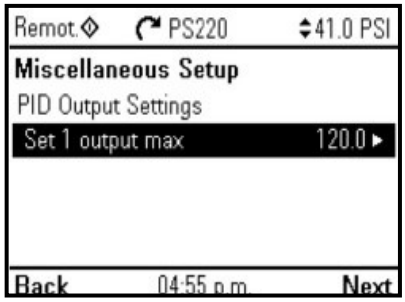


1. "ARROW UP/DOWN" to YES
2. "Select"

4. Configure PID output setting.

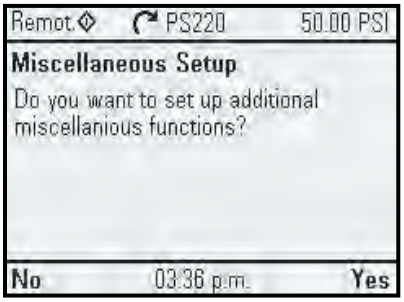
The value shown will be the Motor's slip speed.





1. "ARROW RIGHT" to change
2. "ARROWS" to change the value to no more than 120.
3. "Save"
4. "Next"

5. Exit the Wizard.



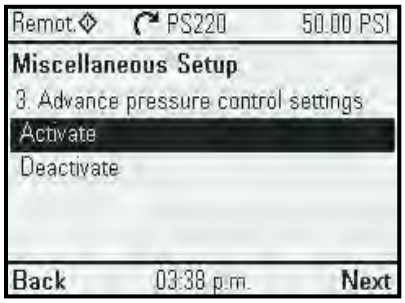
11.3. Advanced Pressure Control Wizard

Please refer to the Functions and Features section in this manual for a detailed explanation of this functionality. This Wizard will show the step-by-step instructions to configure this functionality for use. To access this Wizard, from the Home Screen follow the path: Menu>PS220 Configuration>Miscellaneous Setup>Advanced Pressure Control

The steps that you will perform:
1. Activate the functionality
2. Configure the speed when the function will become active
3. Configure the Percentage increase.
4. Exit the Wizard

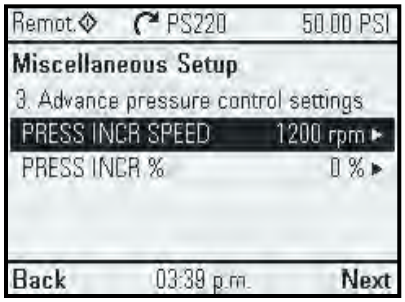
The Screen Shots that follow will show you step by step as you progress, from start to finish as you progress, how to configure this functionality

1. Activate the functionality



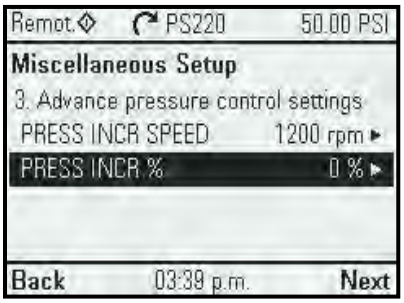
1. "ARROW UP/DOWN" To Activate.
2. "Next"

2. Configure the speed when the function will become active



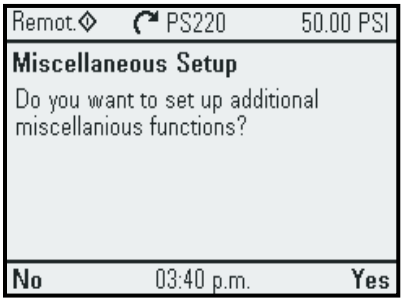
1. "ARROW RIGHT" to change
2. "ARROWS" to change
3. "SAVE" to continue.
4. "ARROW DOWN"

3. Configure the Percentage Pressure Setpoint increase.



1. “ARROW RIGHT” To change
2. “ARROWS” to change
3. “SAVE” to continue.
4. “Next”

4. Exit the Wizard



Functions and Features

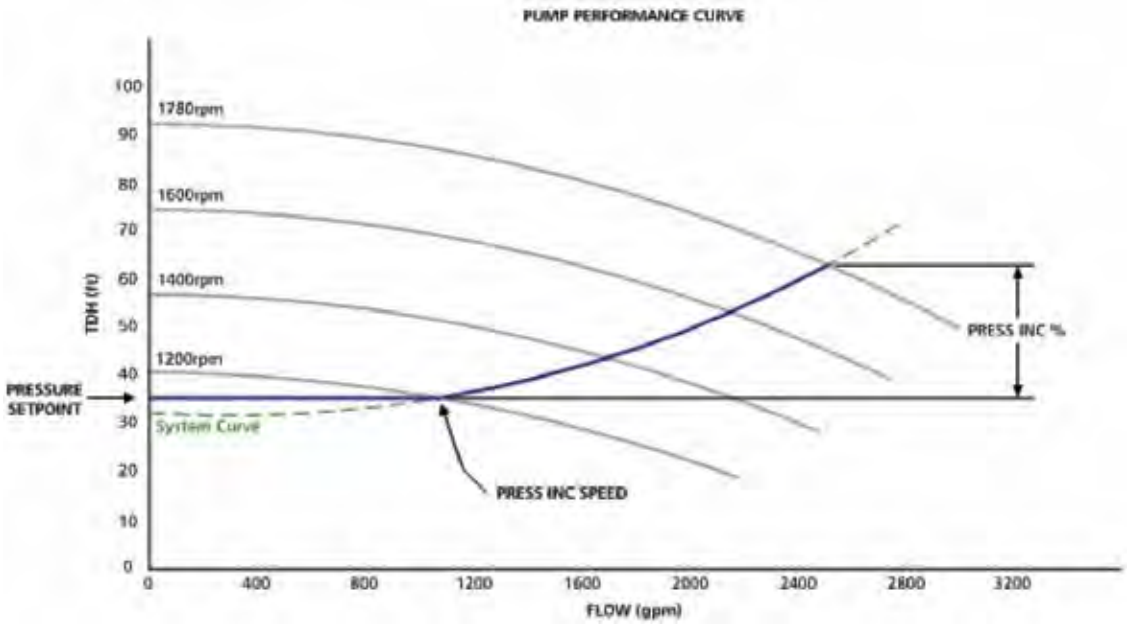
This section provides a detailed explanation off all the functionality provided on the PumpSmart PS220 as well as descriptions of common terms used with the functions. Each will provide a list with descriptions of all parameters used for the individual function to operate.

Advanced Pressure Control (System Curve Compensation)

The PumpSmart PS220 can be configured to automatically increase the systems operating pressure setpoint when an increase in the demand for more flow is required. This feature compensates for additional frictional losses associated with the higher flows and will set the new systems operating setpoint to a higher system matched value automatically. This new value is the difference between the original setpoint and the setpoint that could be achieved in the system at the pumps maximum speed. This is called PRESS INC %. The primary pressure setpoint will be maintained until the pump speed continues to increase to preset speed value. This Speed Value is "PRESS INCR SPEED". When the demand increases, the pump speed will gradually increase to this value, and once this speed is reached, the PS220 will raise the setpoint to the new systems compensated higher value based on the maximum speed of the pump.

The rate of increasing pressure is determined by the PRESS INC % which is the increase in the pressure setpoint at maximum speed (parameter 30.12).
The Formula for this is: (Pressure Increase Max)/ (Pressure Setpoint)=Press Inc %

Note: This is only available in single pump operation.



EXAMPLE - If the setpoint of this system is 15psi [34.65ft @ 1.0 SG] and the system resistance increases 10psig at the maximum flow rate, or roughly 67% of the set-point (10/15=.67), parameter 75.23 would be set as 67%.

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

ALARM AND CONTROL

An integral part of the core functionality of the PS220 is the ability for it to identify pumping system problems, provide a notification, determine the possible causes, and to allow the customer to predefine and implement corrective action measures automatically. The Alarm and Control Function allows for the predefining of these corrective actions. The actions listed below are also an integral part of the Pump Protections Wizards.

For Basic Pump Protection:
The PumpSmart PS220 will either:
A. Issue a warning message signifying the event9s), and either run at minimum speed or stop. It can be configured to automatically re-start after a delay period and then run again to try to maintain the process setpoint. It can be configured to follow this routine a set number of times before a hard Fault is issued. The Fault will have to be reset, and manually restarted.

B. A hard Fault is issued, and it will stop. The fault message will be displayed, and it will have to be reset, and manually restarted.

For Minimum Flow Protection:
The PumpSmart PS220 will indicate that the pump is running at or below minimum flow with a message "Min Flow Warning". After the response delay time has expired. The event will be stored in the Event Log. The PS220 will then respond based on the Protections Options. If and when a hard fault occurs it will display the message "Min Flow Fault". The PS220 will have to be reset and manually restarted. Please refer to the sections "Protection Options" and "Fault Tracing" in this manual.

For Secondary Protection:
The PumpSmart PS220 will indicate a "Secondary Protect A, (B)" warning message, after the response delay time has expired. The event will be stored in the Event Log. The PS220 will then respond based on the Protections Options.

With every occurrence, the event(s) are automatically logged in the PS220's Event Log, which are Date and Time stamped for historical analysis.

Analog Inputs

The PumpSmart PS220 has two configurable analog inputs as standard. By default, both inputs are current sourced and set to a scaled value of 4 to 20 mA. Each can be independently changed to a 0 to 10VDCvoltage sourced input by changing a jumper position on the control board. See the Pic below:

The jumpers by default are in the 2 top positions on both inputs.

Each input can also be undependably filtered, inverted, and scaled. The number of analog inputs can be increased to five by installing an optional FIO-11 I/O extension card in slot 3 on the control board.
When using many of the PS220 Configuration wizards, the inputs that you need will automatically be configured. If you need to incorporate additional inputs that have not yet been configured to complete your configuration, you can use the PS220 configuration Wizard.
To add the FIO-11 I/O extension card from the home view follow the path:
Menu>PS220 Configuration> I/O Configuration>Yes > Wait for the software to load.

When configuring an Analog Input, you will need the information listed in the tables below:
Table 1. Identity's what the Individual Analog Input will be used for, or its Name configuration.

These choices are listed in the table below. For both IA1 and AI2:

Parameter	Name	Value/Range	NOTES
76.01 or 76.02	AI1 CONFIG or AI2 CONFIG	PROC TRANS 2	Used for the Multivariable control functionality.
		PROC TRANS 1	Used as the primary process transmitter for Control Mode.
		EXT SETPOINT1	Used for the Primary External Setpoint
		EXT SETPOINT2	Used for a Secondary External Setpoint for the Dual Setpoints functionality.
		FLOWMETER	Used when Flow is used for the Control Mode or for use with Smartflow Pump Protection
		DISCH PRESSURE	Used with Advanced SmartFlow.
		SUCTION PRESS	Used with Advanced SmartFlow
		DIFF PRESS	Used with Advanced SmartFlow
		TEMPERATURE	Used when Temperature is the primary Control Mode or when a temperature transmitter is required for Specific Gravity correction with Smartflow.
		VISC/SG VALUE	Used when a correction is required for Specific Gravity with Smartflow.
		SPD OVRRD	Used for the external reference for the Speed Override functionality.
		LEVEL	Used when Level is the primary process transmitter for Control Mode.
		FLOW REF	Used for the Primary External Setpoint for the Flow Control Mode
		PRESSURE REF	Used for the Primary External Setpoint for the Pressure Control Mode
		TEMPERATURE REF	Used for the Primary External Setpoint for the Temperature Control Mode

Table 2. Identity's what the Individual Analog Inputs electrical attributes are.
These choices are listed in the table below. For both IA1 and AI2:

GROUP 12	ANALOG INPUTS	DESCRIPTION
12.15	AI1 UNIT SELECTION	Selects the electrical unit for readings. Note: This setting must match the corresponding hardware setting on the drive control unit. See Basic Wiring drawing in appendix A4. (mA or V)
12.17	AI1 MIN	Defines the minimum value for analog input AI1. (0-22mA or 0-10V)
12.18	AI1 MAX	Defines the maximum value for analog input AI1. (0-22mA or 0-10V)
12.19	AI1 SCALED AT AI1 MIN	Defines the real internal value that corresponds to the minimum analog input AI1 value defined by parameter 12.17 AI1 min. The range is -32767.000 - 32767.000.
12.20	AI1 SCALED AT AI1 MAX	Defines the real internal value that corresponds to the maximum analog input AI1 value defined by parameter 12.18 AI1 max. The range is -32767.000 - 32767.000
12.25	AI2 UNIT SELECTION	Selects the electrical unit for readings. This setting must match the corresponding hardware setting on the drive control unit.
12.27	AI2 MIN	Defines the minimum value for analog input AI2.(0-22mA or 0-10V)
12.28	AI2 MAX	Defines the maximum value for analog input AI2. (0-22mA or 0-10V)
12.29	AI2 SCALED AT AI2 MIN	Defines the real value that corresponds to the minimum analog input AI2 value defined by parameter 12.27 AI2 min. The range is -32767.000 - 32767.000
12.30	AI2 SCALED AT AI2 MAX	Defines the real value that corresponds to the maximum analog input AI2 value defined by parameter 12.28 AI2 max. The range is -32767.000 - 32767.000

NOTE: To change from Current sourced to Voltage sourced on the individual inputs change the Jumpers as follows: J1 for AI1 and J2 for AI2. See the Pic below:

Analog Outputs

The PumpSmart PS220 has two configurable analog outputs as standard. By default, both outputs are current sourced and set to a value of 0 to 20 mA. These outputs can be configured to any Signal in the Group 1 parameters. There is also a configurable choice for "Other" to define custom outputs if so required. Each choice will need to have a pre-defined scale, Minimum and Maximum associated with it.
See the table below for Parameters Configuration
Notes:
1. The number of analog outputs can be increased to three by installing FIO-11 or FAIO-01 I/O extension card in slot 3 on the control board.
2. The default choices for both outputs are listed in the table below. You can use this configuration Wizard to change them as needed to complete your configuration.
3. The Wizard will allow you to add the FIO-11 I/O extension card.
To add the FIO-11 or FAIO-01 I/O extension card (Must be in Slot#3) from the home view follow the path Menu>PS220 Configuration> I/O Configuration>Yes>Wait for the software to load.

Parameter	Name	Value/Range	Note
13.12	AO1 SOURCE	MOTOR SPEED [default]	Source selection parameters (pointers) are used to configure a signal for analog output. See explanation above.
13.17	AO1 SOURCE MIN	-32767 to +32767 0 is the default	Defines the real minimum value of the signal AO1 source that corresponds to 0/4mA.
13.18	AO1 SOURCE MAX	-32767 to +32767 1500 is the default	Defines the real maximum value of the signal AO1 source that corresponds to 20mA.
13.19	AO1 OUT at AO1 Source Min	0.00 to 22.00 mA 0mA [default]	Defines desired lower limit of Analog out signal in mA.
13.20	AO1 OUT at AO1 Source Max	0.00 to 22.00 mA 20mA [default]	Defines desired upper limit of Analog out signal in mA.
13.22	AO2 SOURCE	MOTOR CURRENT [default]	Source selection parameters (pointers) are used to configure a signal for analog output. See explanation above.
13.27	AO2 SOURCE MIN	-32767 to +32767 0 is the default	Defines the scaled real minimum value of the signal AO2 source that corresponds to lowest mA value.
13.28	AO2 SOURCE MAX	-32767 to +32767 100 is the default	Defines the scaled real maximum value of the signal AO2 source that corresponds to highest mA. value
13.29	AO2 OUT at AO2 Source Min	0.00 to 22.00 mA 0mA is the default.	Defines desired lower limit of Analog out signal in mA.
13.30	AO2 OUT at AO2 Source Max	0.00 to 22.00 mA 0mA is the default	Defines desired upper limit of Analog out signal in mA.

Example of an "Other" choice for Analog Output:

To send the SMARTFLOW value out using Analog Output 1 (AO1) for a Flow range of 0-10000 GPM the following parameters would be configured to:
Parameter 13.12: to SMARTFLOW.
Select other and then scroll to 1.217. Select
Configure Parameter 13.17 to 0
Configure Parameter 13.18: to 10000

Notes:
1. The default value for both AO1 and AO2 Parameters 13.19 and 13.29 is 0 mA
2 The scaling on the receiving side needs to be identical to what is configured on the PumpSmart PS220
3. Refer to the wiring diagrams in the back of this manual for details on these connections.

Auto Restart

The PS220 can be configured to automatically restart on conditions such as Power Failure, VFD faults, and Pump Protection faults. It can be set to reset a fault(s) up to a limited number of sequential attempts. If after these attempts the Fault condition did not clear or could not be reset the drive will produce a "Hard" Fault and will have to be manually reset. See the Section on Fault Tracing in this Manual for further information on how to restart the drive after these events.

⚠ WARNING

By enabling 74.02 AUTO RESTART, 31.14 AUTO RESET TRIALS or 79.05 PUMP FAULT 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 Auto-Restart

The PS220 can be configured to start automatically following a power failure by configuring the following parameters:

Parameter	Name	Value/Range	Note
74.02	AUTO RESTART	ON OFF [default]	Must be set to ON.
21.18	AUTO RESART TIME	0 Seconds 5 Seconds(default)	Must be set to "0" seconds

NOTE:
Auto-Restart will not function with the "Keypad", or any "Fieldbus" combination is configured for parameter 74.01, or when in "Local" Control Mode.

Auto Reset Pump Protection

The PS220 can be configured to automatically reset a pre-defined pump related fault. If this condition occurs, the pump will ether go to its minimum speed, or fully stop for a limited duration. After this time frame it will automatically re-start. If the condition has cleared the pump will resume normal operation. If the condition remains the PS220 will continue to run this protection routine until the number of configured attempts has expired. After these attempts, the PS220 will issue a Fault and stop. The fault will need to be reset and restarted. See the Section on Fault Tracing in this Manual for further information on how to restart the drive after these events.

Please refer to the Pump and VFD Wizard for more specific detail on how to set these parameters with your pumping system:

To access this Wizard from the home view, follow the path:
Menu>PS220 Configuration> Pump &VFD Protection>Protection Options>

Following are the Parameters typically used for the Pump Protection Auto-Reset functionality to work properly:

79.01	Basic Pump Protect Control	Disabled (default) Alarm Alarm & Control	Needs to be set to Alarm and Control to allow auto-resetting.
79.05	PUMP FAULT RESET	1-19 0 [default]	Indicates number of automatic fault resets. Selection range is 0 – 19. Needs to be greater than 0 to allow auto-resetting.
79.06	PUMP RESET DELAY	0-3600 seconds 60 [default]	Defines the time that the PS220 will wait after an alarm and control condition before attempting an error reset. Setting Range = 0-3600 sec.
79.08	Min Flow Control	Disabled (default) Alarm Alarm & Control	Defines how the drive will react when a Min Flow condition occurs. Alarm and Control will operate according to 79.16
79.14 & 15	Secondary Protect Control (A & B)	Disabled (default) Alarm Alarm & Control	Defines how the drive will react when a Sec Protect A or B condition occurs. Alarm and Control will operate according to 79.16.
79.16	Config Speed Min	SPD=MINSPD 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 stopping completely.

Auto Reset (VFD)

The PumpSmart PS220 can be configured to automatically reset specific VFD related faults. The drive will follow a routine of faulting, waiting, and automatically resetting up to five time within a pre-determined amount of time. After this time if the condition(s) still exists the PumpSmart PS220 drive will issue a "Hard" fault and will have to be manually restarted. Please refer to the Pump and VFD Protection Wizard for more specific detail on how to set these parameters with your pumping system. To access this wizard from the home view, follow the path: Menu>PS220 Configuration> Pump &VFD Protection>VFD Protection

Parameter	Name	Value/Range	Note
31.12	AUTO RESET SELECTION	BIT 0 – OVERCURRENT BIT 1 – OVERVOLTAGE BIT 2 – UNDERVOLTAGE BIT 3 – AI SUPERVISION BIT 4 – SUPPLY UNIT 0000 [default]	Selects faults that are automatically reset. The parameter is a 16-bit word with each bit corresponding to a fault type. Whenever a bit is set to 1, the corresponding fault is Automatically reset.
31.14	NUMBER OF TRIALS	0 – 5 0 [default]	Defines the number of automatic resets allowed. A setting of zero disables this function.
31.15	TOTAL TRIAL TIME	1 – 600 sec 180 [default]	Defines the allowable time period for counting and resetting a fault. This parameter limits the number resets in Parameter 31.14 which can occur within this time period.
31.16	DELAY TIME	0 – 120 sec 0 sec [default]	Defines the time that the PS220 will wait before at-tempting an autoreset of the VFD FAULTS selected in 31.12

Condition Monitoring

The PumpSmart PS220 can monitor two separate channels of information. This information can be from any of its analog transmitters connected or from the onboard VFD and PUMP ACTUAL signals selected from specific parameter Groups. Once the source(s) have been identified you will have the ability to set both a Warning Level and Alarm level on the High AND the Low Values. You can then set the type of response properly suited for the pumping system.

This functionality can be configured with the PumpSmart PS220 Configuration Wizard. To access this Wizard from the Home Screen, follow the path: Menu>PS220 Configuration>Pump & VFD Protection>Condition Monitoring

The individual steps that will be performed are:
1. Configure the Condition 1or 2 Source.
Note: The units will display on the remaining screens as defined by the source once configured.

2. Configure the Condition 1 or 2 Warning Limits High and/or Low Values.
This is the PS220's first level of condition monitoring is the Condition 1or 2 Warning. This is available for a high and a low value and are independent of each other. Setting any value other than zero will activate this warning.

3. Configure the Condition 1 or 2 Alarm High and/or Low Values.
The PS220's second level of condition monitoring is the Condition 1or 2 Alarm. This is available for a high and a low value and are independent of each other. Setting any value other than zero will activate this warning.

4. Configure the Condition 1 or 2 Response.
Alarms can be configured as follows:
1. Alarm and notify. The system will continue to run.

2. Alarm, Notify, and run at a Min Speed
The PS220 will run at the Min Speed until a time value expires. After this time, if the condition still exists, it will Fault off.

3. Alarm, Notify and Sleep. It will "Sleep" and then "Wake" based on setting of the Hysteresis window.

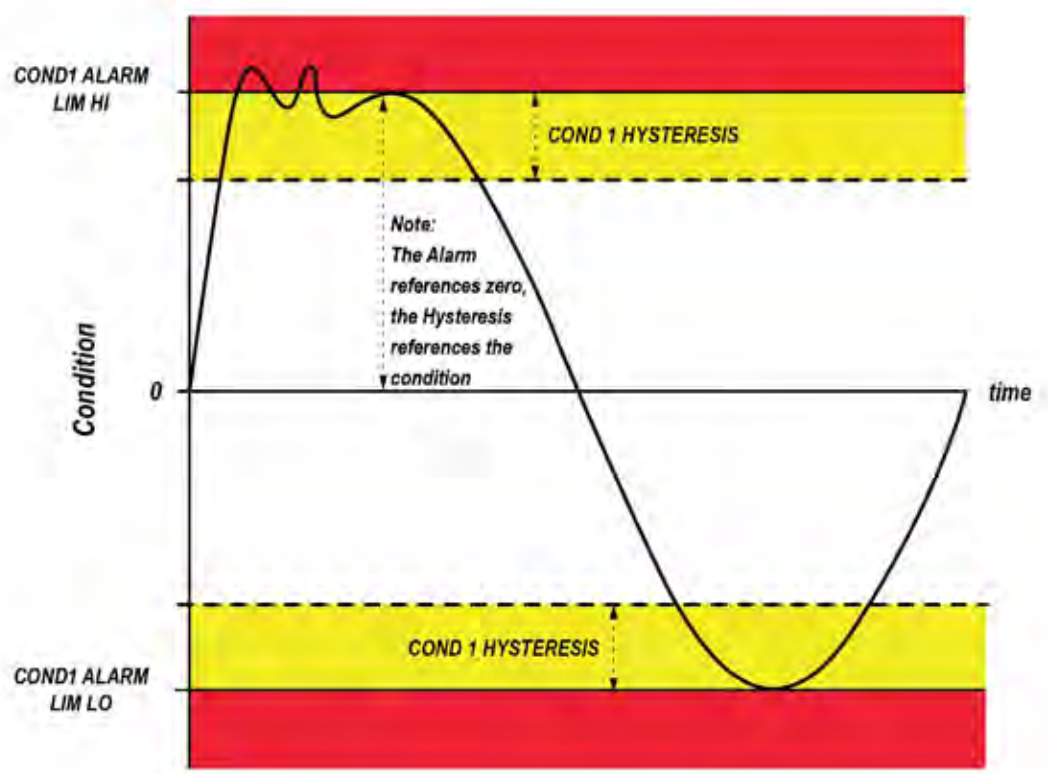
4. Alarm, Notify, Hard Fault OFF (Stop).

When the PS220 Faults off it will need to be reset. Condition Monitoring alarms are not auto resettable. See Fault Tracing/Fault Reset on how to reset the fault.

5. Configure the Condition 1 or 2 Response Delay time.
The Default is 20 Seconds. The range is 0- 3600 seconds.

6. Configure the Min Speed Stop Delay time.
The Default is 60 Seconds. The range is 0- 3600 seconds.

7. Configure the Hysteresis Value
Hysteresis is the monitored difference (window) between the warning and alarm values, and the actual values used to deactivate a Condition event. It prevents a condition from continuously activating and deactivating when the monitored value fluctuates above and below the High or Low limits.
The default is .20 of the units selected for the source. The range is .20 to 9999.00.



You may have to change the configuration of Parameter 80.19 to allow Monitoring of the values when the PumpSmart PS220 is either Running or Always. The default is ALWAYS.

This change will need to be done manually by accessing that specific parameter directly:

From the HOME SCREEN follow the path: Menu>Parameters>Complete List>Arrow Down to GROUP 80>80.19> Edit>Save

The Parameters used in configuring the condition monitoring function are listed in the table below.

GROUP 80	CONDITION MONITORING	DESCRIPTION	
80.01	CONDITION STATUS	A 1 indicates the condition is active BIT 0: Enabled BIT 1: Cond1 High Alarm BIT 2: Cond1 High Warning BIT 3: Cond1 Low Warning BIT 4: Cond1 Low Alarm BIT 5: Cond2 High Alarm BIT 6: Cond2 High Warning BIT 7: Cond2 Low Warning BIT 8: Cond 2 Low Alarm BIT 13: Sleep Active BIT 14: Min Speed Active	
80.04	COND 1 SOURCE	None [Default] Flow Actual Pressure Actual Level Actual Speed Torque Power Current Temperature Actual SmartFlow PROC TRANS 1 PROC TRANS 2	Select the source of the signal to be monitored. The source can either be from an external transmitter wired to an available analog input or it can be an internal signal as selected by the parameter number.
80.05	COND 1 WRN LIM HI	-10000 to +10000 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 Inactive if set to 0.
80.06	COND 1 WRN LIM LO	-10000 to +10000 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. Inactive if set to 0.
80.07	COND 1 ALARM	DISABLED [default]	Protection is inactive.
		ALARM ONLY	Selecting ALARM ONLY will issue a Keypad message showing that an ALRM LIM HI or ALRM LIM LO condition is detected. No further action is taken.
		MIN SPD	Selecting MIN SPD will issue a Keypad message showing that an ALRM LIM HI or ALRM LIM LO condition is detected and will drop to MIN SPEED. If the alarm does not reset itself after the MIN SPD STP DLY the PS220 will fault.
		SLEEP	The PS220 will shut down and go into a sleep mode if an ALRM LIM HI or ALRM LIM LO condition is detected. It will "wake up" according to the value in 80.22.
		FAULT	The PS220 faults if an ALRM LIM HI or ALRM LIM LO condition is detected. A Keypad notice is issued
80.08	COND 1 ALRM LIM HI	-10000 to +10000 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 80.16). Inactive if set to 0.
80.09	COND 1 ALRM LIM LO	-10000 to +10000 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 80.16). Inactive if set to 0.
80.10	COND 2 SOURCE	None [Default] Flow Actual Pressure Actual Level Actual Speed Torque Power Current Temperature Actual SmartFlow PROC TRANS 1 PROC TRANS 2	Select the source of the signal to be monitored. The source can either be from an external transmitter wired to an available analog input or it can be an internal signal as selected by the parameter number.
80.11	COND 2 WRN LIM HI	-10000 to +10000 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 80.16). Inactive if set to 0.

80.12	COND 2 WRN LIM LO	-10000 to +10000 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 80.16). Inactive if set to 0.
80.13	COND 2 ALARM	DISABLED [default]	Protection is inactive.
		ALARM ONLY	Selecting ALARM ONLY will issue a Keypad message showing that an ALRM LIM HI or ALRM LIM LO condition is detected. No further action is taken.
		MIN SPD	Selecting MIN SPD will issue a Keypad message showing that an ALRM LIM HI or ALRM LIM LO condition is detected and will drop to MIN SPEED. If the alarm does not reset itself after the MIN SPD STP DLY the PS220 will fault.
		SLEEP	The PS220 will shut down and go into a sleep mode if an ALRM LIM HI or ALRM LIM LO condition is detected. It will "wake up" according to the value in 80.22.
		FAULT	The PS220 faults if an ALRM LIM HI or ALRM LIM LO condition is detected. A Keypad notice is issued.
80.14	COND 2 ALRM LIM HI	-10000 to +10000 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. Inactive if set to 0.
80.15	COND 2 ALRM LIM LO	-10000 to +10000 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. Inactive if set to 0.
80.16	COND RESP DELAY	0-3600 sec 20 sec [default]	The delay period prior to activation of a COND 1 or COND 2 WRN OR ALRM
80.17	PROC TRANS 1 UNITS	None [default]	Select from the available 13 options: PSI, BAR, MPa, M, FT, in, cm, GPM, M3HRS, BPH, Ls, F, C.
80.18	MIN SPD STP DLY	0-3600 sec 60 sec [default]	The time which the PS220 will operate at min speed during an alarm condition if it does not reset. If the time expires the PS220 will fault
80.19	CONDITION ENABLE	When running Always [Default]	Allows selection of when condition monitoring warnings and alarms will be triggered.
80.20	PROC TRANS 2 UNITS	None [default]	Select from the available 13 options: PSI, BAR, MPa, M, FT, in, cm, GPM, M3HRS, BPH, Ls, F, C.
80.21	COND 1 HYSTERESIS	-10000 to +10000 .20 [default]	The monitored difference (window) between the warning and alarm values, and the actual values used to activate or deactivate the Condition 1 event. It prevents a condition from continuously activating and deactivating when the monitored value fluctuates above and below the High or Low limits
80.22	COND 2 HYSTERESIS	-10000 to +10000 .20 [default]	The monitored difference (window) between the warning and alarm values, and the actual values used to activate or deactivate the Condition 2 event. It prevents a condition from continuously activating and deactivating when the monitored value fluctuates above and below the High or Low limits

⚠ CAUTION

Parameter 80.19 is a setting that allows the monitoring of the Condition Values to be always on or only on when the Pump is physically running (Rotating).

Control Modes. (Process PID Control)

The PumpSmart PS220 use can be configured to operate in a specific control mode using internal PID control functionality. This will allow a pumping system to maintain a stable rate of control to a defined setpoint, or reference. Based on the feedback supplied from wired or "Sensorless" transmitters, it will react immediately to any changes that may occur on both the suction and discharge side of the pump, automatically stabilizing the system.
Only a few steps are required to enable this control.
This control can only be enabled through the use of the PS220 Configuration Wizard. Basic Startup must be configured prior to enabling and fully configuring the Control Mode.

There are 4 steps to full configure the Control Mode. They are:
1. Configure the Control Mode.
2. Configure the Control Modes unit of measure.
3. Configure the Regulation Mode of the Transmitter to be used.
4. Configure all of the Transmitters detail.
5. Configure the scaling of the Setpoint.
6. Configure the source for the Setpoint

1. Configure the Control Mode
The PumpSmart PS220 can be configured to operate in the following Process Control Modes.

1. Pressure.
The PumpSmart PS220 will maintain constant pressure regulated to a setpoint. A pressure transmitter will need to be connected and configured for use.

2. Flow.
The PumpSmart PS220 will maintain constant flow rate regulated to a setpoint. A flow transmitter will need to be connected and configured for use.

3. SmartFlow.
The PumpSmart PS220 will maintain constant flow regulated to a setpoint. A flow transmitter will not be required. Feedback will be transmitted internally using the SmartFlow functionality to determine actual flow. Smartflow configuration will required.

4. Level.
The PumpSmart PS220 will maintain constant level regulated to a setpoint. A level, (or pressure that can be converted to level), transmitter will need to be connected and configured for use.

5. Temperature.
The PumpSmart PS220 will maintain constant temperature of the process fluid regulated to a setpoint. A temperature transmitter will need to be connected and configured for use.

6. Smart TDH.
The PumpSmart PS220 will maintain a constant Total Dynamic Head (TDH) using internal TDH calculations to a setpoint. A TDH transmitter will need to be connected and configured for use. It will not require the use of a suctions side transmitter if the suction pressure is relatively stable. If the suction pressure does vary this control mode will require both a suction and discharge transmitter to be connected, and fully configured for use. It will also require the configuration of the Advanced SmartFlow Functionality.

2. Configure the Control Modes Unit of Measure.
The configuration of the PumpSmart PS220's unit selection will determine the labeling used to control the pump, the set-point, and the actual feedback from the transmitter. Following are the available units based on your selection in 1 above.

Control Mode	Units available for selection
Pressure Smart TDH	PSI (DEFAULT)
	FT – FEET
	MPa – Mega Pascals
	M - Meters
	BAR
Level Pressure (#) # = can be converted to level	Ft – Feet (DEFAULT)
	In – Inches
	M – Meters
	Cm – Centimeters
Flow SmartFlow	GPM – Gallons per Minute (DEFAULT)
	M^3/hr. – Cubic meters per hour
	BPH – Barrels Per Hour
	L/s – Liters per second
Temperature	°F – Degrees Fahrenheit (DEFAULT)
	°C – Degrees Celsius

3. Configure the Regulation Mode of the Transmitter to be used.
The configuration of transmitter location on the PumpSmart SP220 identifies whether the transmitter is on the suction side of the piping system or on the discharge.

Note:
When choosing suction side, the software will automatically invert the actual signal. (A rising value will increase the speed of the pump to maintain the process setpoint). Check to be sure that the transmitter being used does not do this as standard.

Refer to the "Regulation Mode" in this manual for more information.

4. Configure all of the Transmitters Detail

Configure the physical identity of the Analog Input's transmitter, or AI#, used for the Control Mode
NOTES
1. # = The identification of the Analog Inputs physical wired connection. 1, 2 etc.
2. When Selecting the Analog Input make sure that it is connected to the correct input
3. For More detailed information on Analog Input configuration please refer to Analog Inputs I this manual.

Configure the minimum scaled value of the AI# transmitters signal.

"AI# scaled at AI# min" refers to the transmitter value that corresponds to the minimum of the signal or the 4mA scaled value. This is defaulted to 0.

Configure the maximum scaled value of the AI# transmitters signal.

"AI# scaled at AI# max" refers to the transmitter value that corresponds to the maximum of the signal or the 20mA scaled value. The default value is 100.

NOTES
1. If the transmitter provided requires DC Voltage, please refer to the Analog Input section in this manual, for proper parameter settings of the drives analog input. A Jumper connection on the hardware will need to be moved. (J1, or J2)

2. Differential pressure flowmeters [e.g. orifice plate, venturi, etc.] do not produce signals that are linear with flowrate. The PumpSmart PS220 cannot accommodate these types of flowmeters.

3. Refer to the transmitter manufacturer's documentation for the proper wiring instructions, and to determine the correct scaled values needed for configuration. This information may be printed on the device's nameplate.

4. The software automatically defines the selected analog input to "PROC TRANS 1" as the primary process transmitter for the system.

5. Configure the scaling of the Setpoint.
The setpoint limits, SETPOINT MIN and SETPOINT MAX, are the values, below and above, that the system cannot be operated at. These can be different from the scaled values
configured for use.

If the process variable chosen is SmartFlow, then only SETPOINT MIN and SETPOINT MAX are shown and need to be defined. SETPOINT MIN will typically not be zero while SETPOINT MAX should be set at a value equal to the maximum flow of the pump. Be sure that you complete the SmartFlow Wizard prior to running your process or the feedback will be incorrect.
Detailed Information on how configure the Setpoint Limits can be found in this manual. Please refer to "Setpoints"

6. Configure the Source of the Setpoint.
The source can be selected from the PS220's Keypad, an Analog Input, or a Fieldbus Control command.
Detailed Information on how configure the Setpoint Source can be found in this manual. Please refer to "Setpoints"

Critical Speed Windows

The PumpSmart PS220 can be configured to bypass operating speed windows to avoid resonance frequencies that may be encountered when running a pumping system. Refer to the pump manufacturer to determine if the pump being controlled has a critical speed within the defined operating speed range (between 30.11 MIN SPEED and 30.12 MAX SPEED).

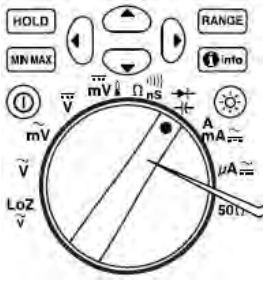
Parameter	Name	Value/Range	Note(s)
22.51	CRITICAL SPEED FUNC	0-1 0-Disables [default]	0000 will display as default Bit 0 will need to be changed to a 1 to Enable
22.52	CRITICAL SPEED 1 LOW	-30000 to +30000 0 [default]	Refer to the pump manufacturer for critical speeds or determine these speeds during commissioning of the system.
22.53	CRITICAL SPEED 1 HIGH	-30000 to +30000 0 [default]]	
22.54	CRITICAL SPEED 2 LOW	-30000 to +30000 0 [default]	
22.55	CRITICAL SPEED 2 HIGH	-30000 to +30000 0 [default]	
22.56	CRITICAL SPEED 3 LOW	-30000 to +30000 0 [default]	
22.57	CRITICAL SPEED 3 HIGH	-30000 to +30000 0 [default]	

NOTE: This function will not allow the operating speed to be maintained within the bands selected and should not be used with any PS220 PROCESS CONTROL MODES.

Diode Test

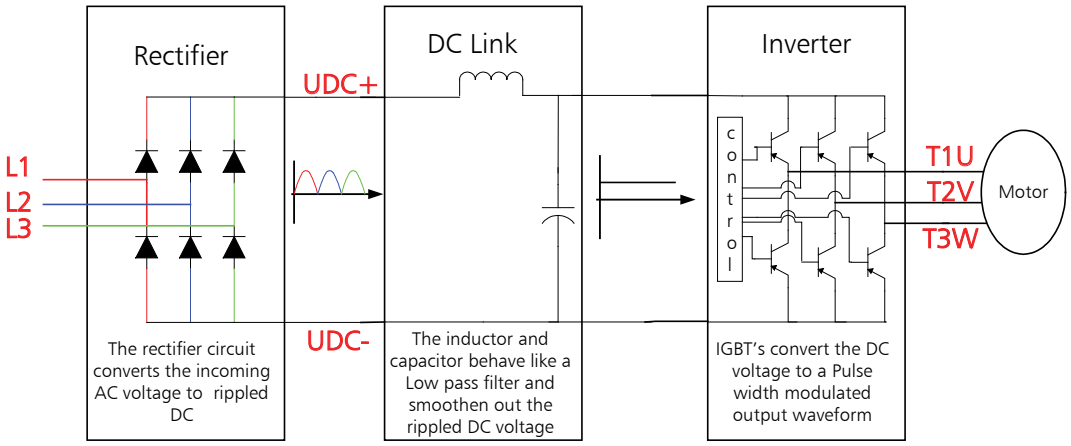
A Diode test may need to be performed when drive faults occurred. Typically these are a result of incoming power problems, or they may be the result of a fault Input Bridge. This procedure will show how measure and document readings necessary to determine a remedy.

1. Take readings of the VFD input diode bridge.
   - Make sure the mains power supply (460 VAC) is OFF.
   - Set the Digital MultiMeter Meter to be in the diode mode



   - Place one of the leads on the UDC+ terminal and the second one on one of the input phases (L1, L2, and L3) per the table below. Document the readings in the table below.
   - Repeat the test for the other two input phases and note the reading.
   - Switch the DMM leads now and repeat the test. Document the readings in the table below.
   - Typical readings will show values. Any reading that shows "OL" will be problematic.

	Input L1	Input L2	Input L3
Red Probe on UDC+ terminal and black probe on the Input terminal			
Black Probe on UDC+ terminal and red probe on the Input terminals			
Red Probe on UDC- terminal and black probe on the Input terminal			
Black Probe on UDC- terminal and red probe on the Input terminals			



Notes:
The above test is used to verify if the input rectifier bridge on the drive is faulty.

Possible causes of failure:
- High input voltage spikes or surges can cause damage to input bridge.
- A Short Circuit on the output could cause damage the output bridge.

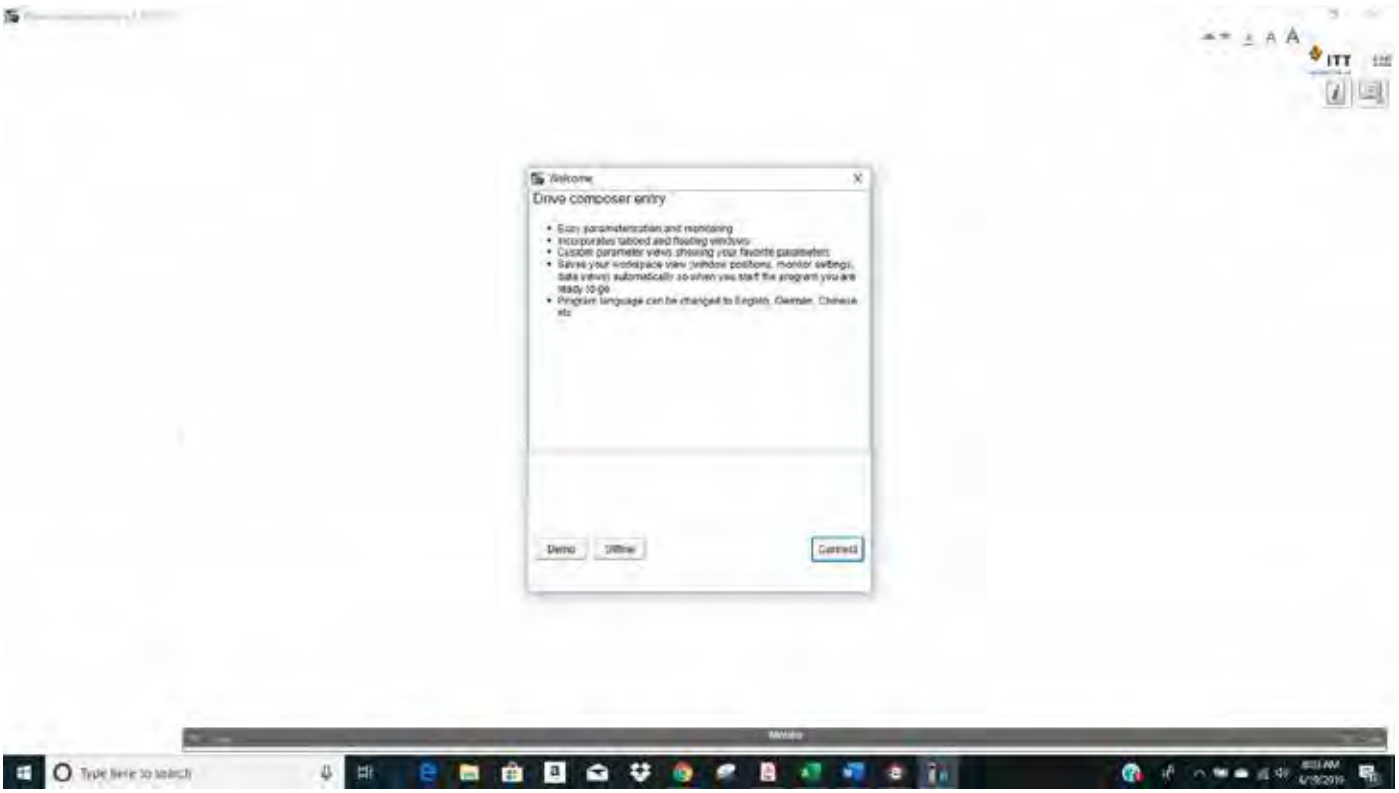
Drive Composer

Drive Composer is a free Windows based computer Tool that will allow you connect to the ITT PS220 PumpSmart through a connection on the Keypad that will all you to perform many tasks. The link to download this may be found using this link: https://www.ittproservices.com/ittgp/medialibrary/ITTPROServices/website/Literature/Technical%20Data/ITT-Drive-composer-entry-1-12-1200-setup-(1).zip

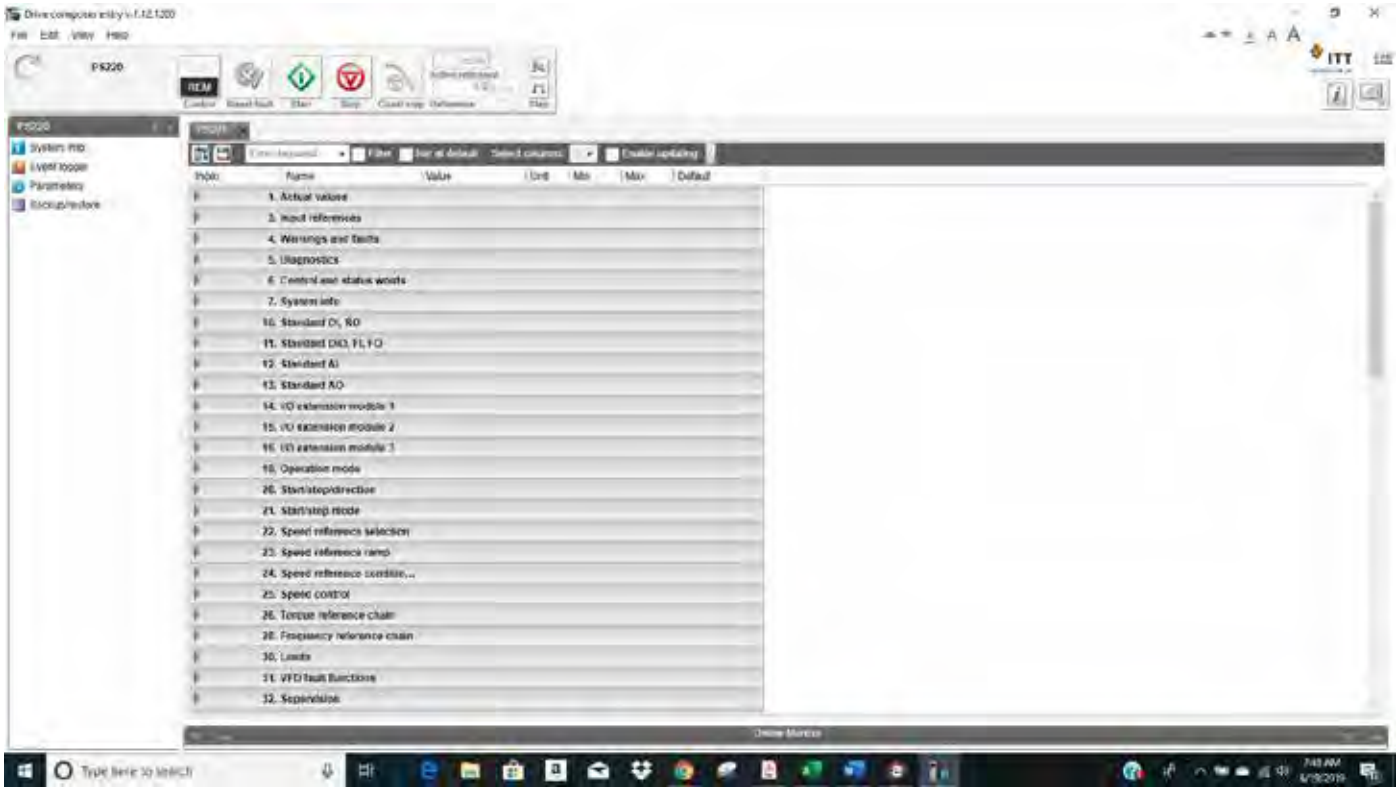
The link to download the latest version of the user manual may be found using this link: https://library.e.abb.com/public/bdc3281361014df8a4e25d92241b88aa/EN_DriveCompPC_tool_UM_S_A4.pdf

The following is a procedure to allow you to connect to the PS220 to be able to save the parameter settings in PDF format.

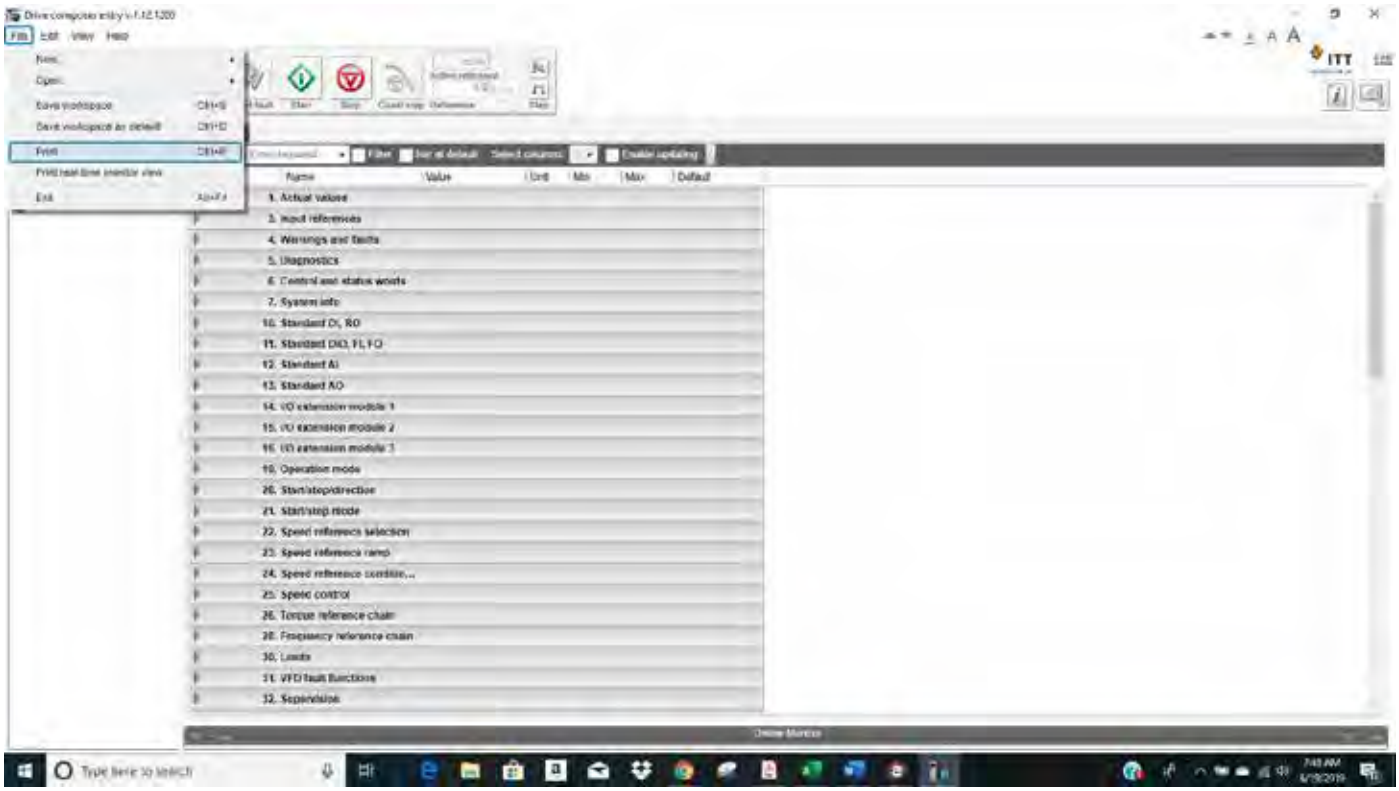
Once you launch the "Drive Composer Entry" application program, this is the first screen that will populate. Click on "Connect".



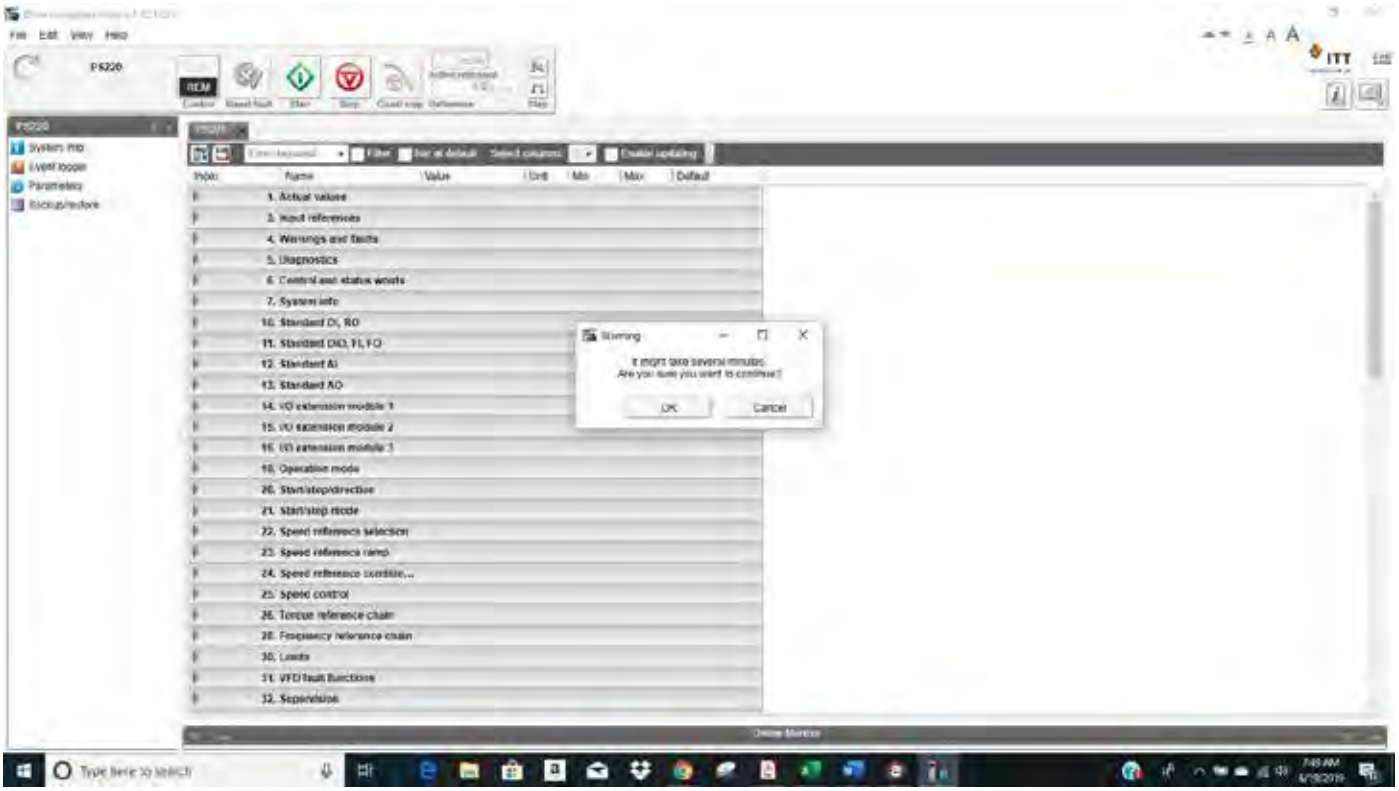
The next screen will automatically populate to show this:



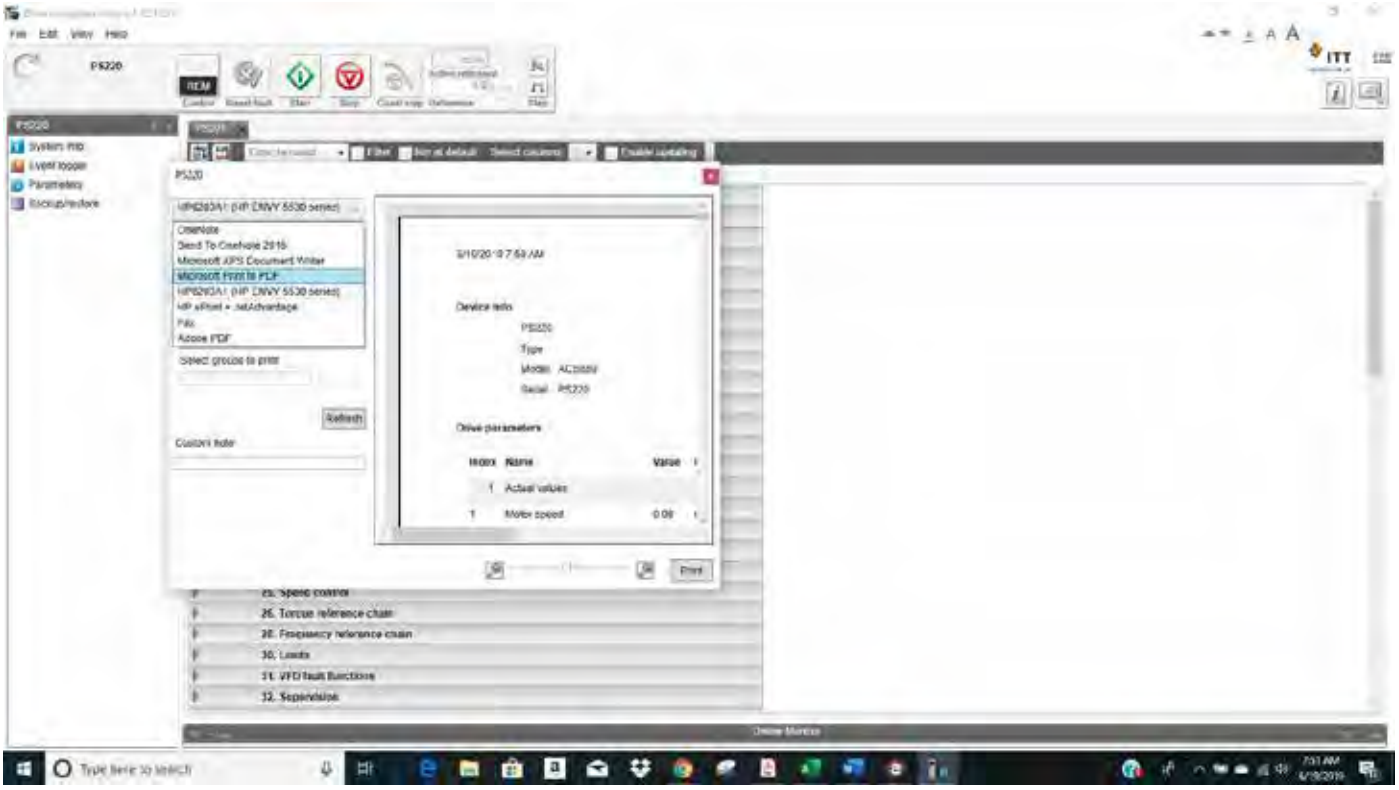
Select “File”, then “Print”:



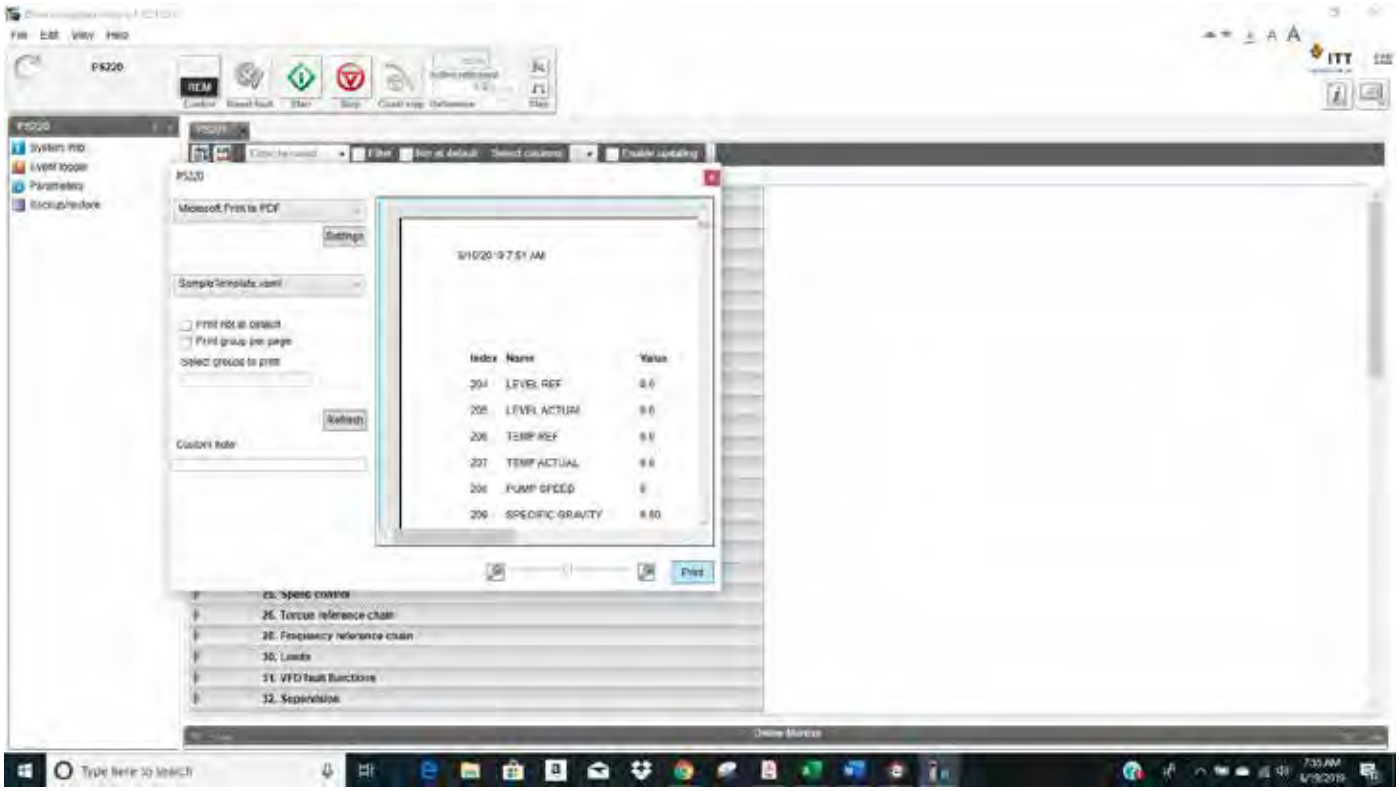
Select "OK" then wait:



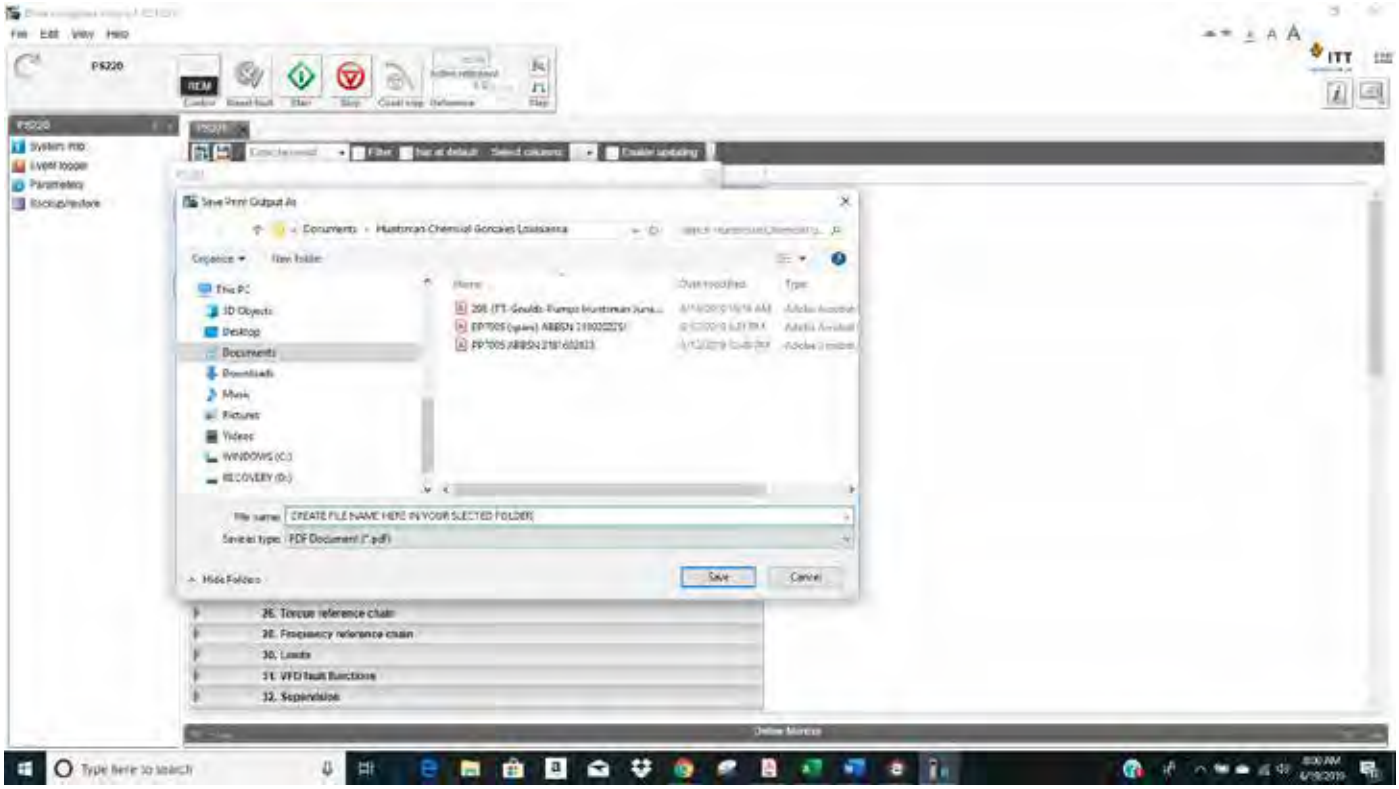
Change how you want them to print. Below is shown changing from the default printer to Microsoft Print to PDF:



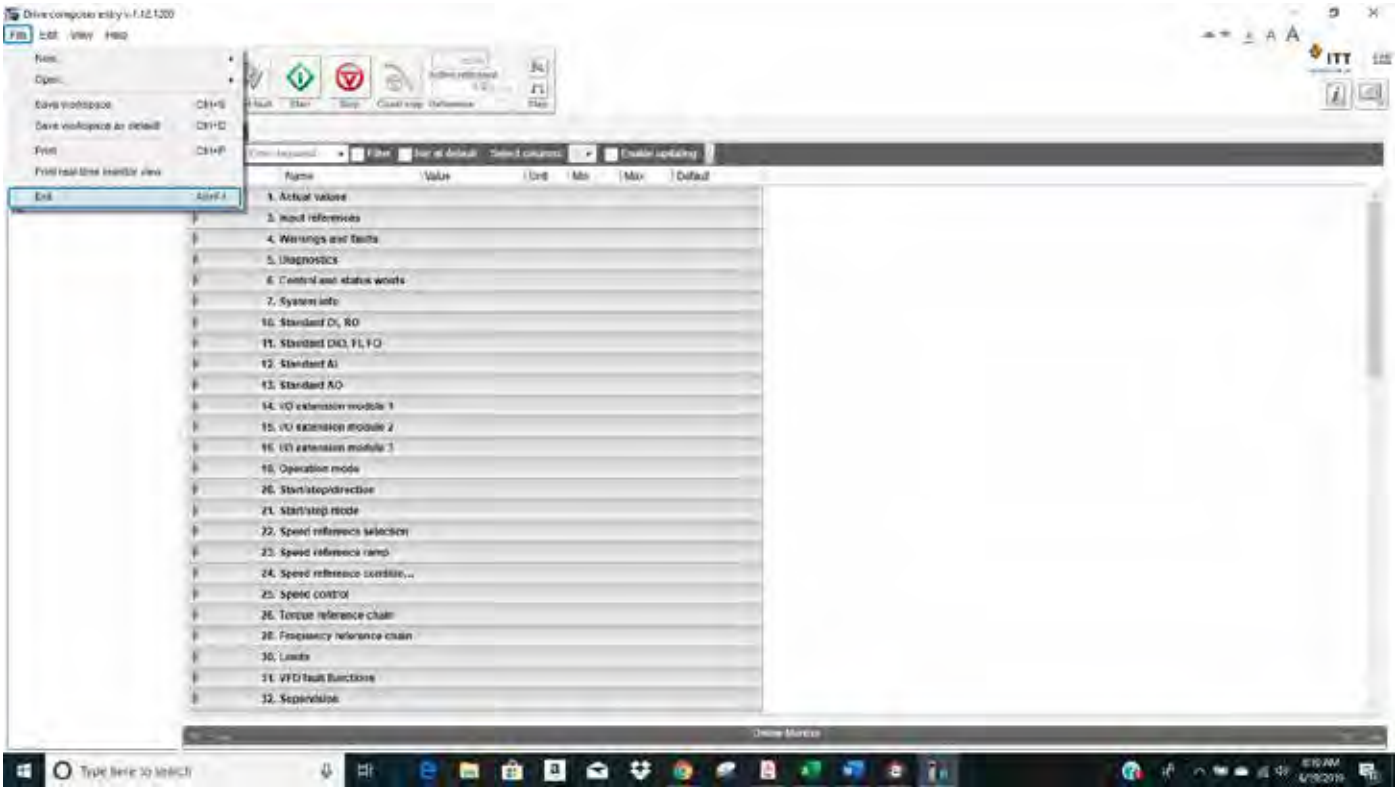
Select “Print”



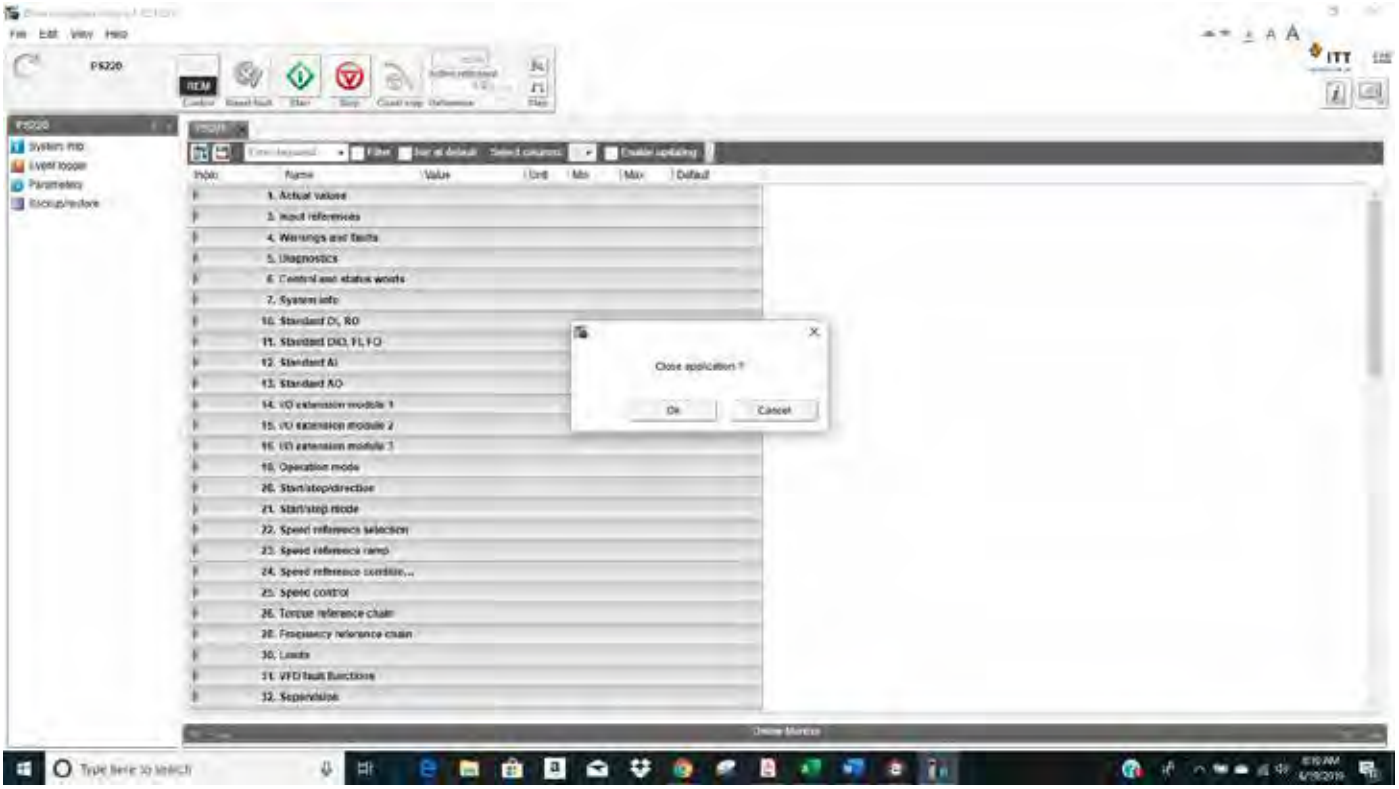
Select the location where you want to save it to, (Folder, Desktop etc.), and then create the file name. Select “Save”.



To close the application, Select “File”, then “Exit”



Select “OK”



Dead Head

Dead Heading is a term used to define when a pump is running at "A Zero Flow Rate" AND producing pressure in the discharge piping. When this occurs, the pump is also generating work in Horsepower. Depending on the HP of the pump this pressure generated can be a large value. The HP generated for all centrifugal Pumps follow the Affinity Laws. The Pressure generated will be directly proportional to the square of the running speed, and HP will be to the cube of the speed.
This can be the result of:
1. A pump that is "undersized" that cannot generate enough pressure to move fluid to the end point in the discharge.
2. A discharge valve that has been closed inadvertently or has failed in the closed position.
3. A blockage or Clog in the discharge line preventing any flow from exiting the discharge end of the piping.

When using the PumpSmart PS220's PID Pressure or Smart THD Control Logic this can be completely avoided by performing the "Dead Head Test"
This test will require the wired pressure sensor (Pressure PID)/gauge (SmartTDH) on this discharge end of the piping that is placed down-stream of a check valve and a discharge valve that will completely prevent any flow into the piping system. That valve will need to be able to be completely closed with no path for any re-circulation back to the suction. The suction line will also need to be completely open and flooded with all air vented out of the pump. When all of these conditions are met, you will need to do the following.

NOTE: All Configuration should be completed prior to this step EXCEPT for pump protection.

1. Open the Suction Valve.
2. Vent all air out of the discharge side and what may be inside the pump.
3. Open the Discharge Valve 100%
4. On the PS220 Set Parameter 30.11 (Min Speed) to no less than 25% of the nameplate speed of the motor.
5. Enter the setpoint that you will be using that run the system.
6. Issue a start command. The PS220 will then run at a speed to maintain the setpoint for your system.
7. Slowly close the discharge valve until its 100% closed.
8. Document the speed the PS220 runs at when the valve is 100% closed.
9. Issue a STOP command.
10. Set Min Speed in 30.11 to at least 100 RPM above the value from Step 8.
11. Open the discharge valve 100%

If "Min Speed Sleep" has been configured using The Process Control Wizard. This system is now configured correctly so that it will never "Dead Head"

12. Finish any remaining Configuration as required.

To perform this Test on non-Pressure controlled and Speed Controlled pumping systems follow the following procedure:

1. Open the Suction Valve.
2. Vent all air out of the discharge side and any that may be inside the pump.
3. Open the Discharge Valve 100%
4. On the PS220 Set Parameter 30.11 (Min Speed) to 25% of the nameplate speed of the motor.
5. Set the drive to run in local control using the LC/REM button.

6. Issue a start command by pressing the Green tart button. The PS220 will then run at its minimum speed. The speed should be low enough to prevent liquid form coming out of the farthest point away, or longest run, ay and at the highest elevation point in the discharge piping.
7. Slowly increase the speed so that liquid eventually flows out of the point in the piping you are monitoring in step 6.
8. Document the speed the PS220 runs at when the liquid begins to flow.
9. Issue a STOP command.
10. Set Min Speed in 30.11 to at least 100 RPM above the value from Step 8.
11. Place the drive back in Remote Control.
12. Finish any remaining Configuration as required. Pump Protection is highly recommended.

Digital Inputs

The PumpSmart PS220 has 6 configurable Digital Inputs as standard. Each of these are normally closed and commonly sourced with an internal 24VDC supply. They can be inverted and forced on and off as required. There are 2 additional inputs that can be assigned as either an input or an output relay. By default, all show "Not Selected". There is additional input that is primarily used for E-stop functionality. It is labeled as the DIIL.
The preferred uses for these Inputs are as follow:

DI1 Auto Start/Stop
DI2 Hand or Speed Override
DI3 Dual Setpoints
DI4 Secondary Protection A
DI5 Secondary Protection B
DI6 Fault Reset

GROUP 76	ANALOG I/O CONFIG	DESCRIPTION
76.09	DI1	Selects the Digital input 1 function
76.10	DI2	Selects the Digital input 2 function
76.11	DI3	Selects the Digital input 3 function
76.12	DI4	Selects the Digital input 4 function
76.13	DI5	Selects the Digital input 5 function
76.14	DI6	Selects the Digital input 6 function
76.15	DIO1	Selects whether DIO1 is used as a digital output or input, or a frequency input.
76.16	DIO2	Selects whether DIO2 is used as a digital output or input, or a frequency input.

Caution must be taken when configuring them manually. It is possible to configure the same Digital Input for more than one function.

A digital input that displays the status of "IN USE" cannot be changed manually with the I/O Wizard. Only inputs which display the status of "NOT SELECTED" can be configured with the I/O Wizard.
To manually configure an input, from the Home View follow the path: Menu>PS220 Configuration
I/O Configuration>No>Digital I/O (or Yes if you are configuring the FIO-11optional Extension Module for the first time)> Digital I/O

NOTE: The PS220 Configuration Wizard is recommended to be re-run to change or modify the methods of starting and stopping.

The steps that you will perform:
1. Configure the Digital Input to be used by Number.
There are 6 digital inputs that can be selected.
NOTE: You may only select an input that shows a status of "NOT SELECTED"
2, Configure the Digital Inputs Function.
There are 8 choices for the Function that this digital Input will be used for.
Note: The description "IN USE" will display if that Input is already configured. It cannot be changed with this Wizard.

Energy Savings Calculator

The PumpSmart PS220 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 84.03
Enter the average nominal power rating of the comparable fixed speed pump into parameter 84.04.
This can be determined from the fixed speed pump performance curve at the rated condition of the pump. Do not enter the Nameplate HP of the motor.

One of the benefits of using PumpSmart is its ability to have the pump "SLEEP" when demand is not present. Parameter 84.05 SAVINGS OPTION 2 allows these savings to be computed while the pump is "Sleeping". SAVINGS OPTION 1 only computes the energy savings while the pump is running.

The parameters used for this function are in the table below:

Parameter	Name	Value/Range	Note(s)
84.03	$/kWh	0-1.00 0 [default]	Example: If the utility cost per energy unit is $0.06 per kWh then a value of 0.06 would be entered.
84.04	BASELINE POWER	0-1000 Hp 0 [default]	Enter the average nominal power of the comparable fixed speed pump.
84.05	ENERGY SAVE METHOD	SAVINGS OP 1 [default] SAVINGS OP 2	Defines if the savings should be tracked only when the pump is running (OP1) or also during "Sleep Mode" (OP2).
84.06	ENERGY SAVE RESET	DISABLED [default] RESET	Allows resetting the savings to zero.
84.07	KWH AT RESET	0-5000 0 [default]	
84.08	OP HRS AT RESET	Read Only Parameter	Operating hours since last reset.

Note – For languages other than English (US) 84.04 BASELINE POWER is entered in KW and 84.03 is Euro/KW.

Fault Functions (VFD)

The PumpSmart PS220 can be configured for various motor and variable speed drive hardware and electrical faults. By default, most all of these are set to Fault. See the VFD Auto-Reset section for details on, if and how, these may be able to be reset automatically.

⚠ WARNING

It is not recommended to change any of these from Fault to No Action or Warning. Serious Injury or Death May occur.

Parameter	Name	Value/Range	Note(s)
31.19	MOTOR PHASE LOSS	NO ACTION FAULT [default]	Selects how the PS220 reacts when a Motor Phase loss is detected. IN SCALR MODE THIS NEEDS TO BE CHAGNED TO NO ACTION
31.20	EARTH FAULT	NO ACTION WARNING FAULT [default]	Selects how the drive reacts when an earth fault or current unbalance is detected in the motor or the motor cable.
31.21	SUPPLY PHASE LOSS	NO ACTION FAULT [default]	Selects how the drive reacts when a supply phase loss is detected.
31.23	WIRING OR EARTH FAULT	No Action FAULT[default]	Selects how the drive reacts to incorrect input power and motor cable connection.
31.24	STALL FUNCTION	NO ACTION WARNING FAULT[default]	Selects how the drive reacts to a motor stall condition. Stall protection is activated if • The drive exceeds the stall current limit (31.25 Stall current limit), AND • the motor speed is below the level set by parameter 31.26 Stall speed limit, AND • the conditions above have been true longer than the time set by parameter 31.28 Stall time.
31.25	STALL CURRENT LIMIT	0-1600% 200% [default]	
31.26	STALL SPEED LIMIT	0-10000 rpm 150 rpm [default]	
31.28	STALL TIME	0-3600 sec 20s [default]	
31.35	MAIN FAN FLT FUCN	NO ACTION WARNING FAULT[default]	Selects how the drive reacts when a main cooling fan fault is detected.
31.36	AUX FAN FLT BYP	Off Temp Bypass	Temporarily suppresses auxiliary fan faults. NEMA12 / IP55 wall mount drives have an auxiliary fan built into the front cover as standard. If the fan is sticking or disconnected, the control program first generates a warning, then a fault. If it is necessary to operate the drive without the front cover (for example, during commissioning), this parameter can be activated to temporarily suppress the fault. Notes: • The parameter must be activated within 2 minutes of control unit reboot (either by cycling the power or by parameter 96.08). • The parameter only suppresses the fault, not the warning. • The parameter will be in effect until the auxiliary fan is reconnected and detected, or until the next control unit reboot.
31.42	OVERCURRENT FLT LIM	0-30000A DEFAULT IS 0	Sets a custom motor current fault limit. The drive automatically sets an internal motor current limit according to the drive hardware. The internal limit is appropriate in most cases, but this parameter can be used to set a lower current limit, for example, to protect against pump run out conditions. With this parameter at 0.0 A, only the internal limit is in force.

Fieldbus Control

Embedded Fieldbus Interface

The embedded fieldbus interface functionality is dedicated to the PS220's Multipump functionality and cannot be used for communication with an external control system. Modbus RTU communication is available by using the FSCA -01 fieldbus adapter.

There are many forms of Serial Communications Protocols that can be used with the PS220. Each of these are listed below. Each of these will require an Adapter Module to be mounted and then configured for proper use. Please refer to the ABB IOM manual that is supplied with each of these Modules for detailed information on their operation and use.

The Fieldbus Communications Protocols available with the PumpSmart PS220 are:
Control Net
Device Net
Ethernet/IP
Modbus RTU
Modbus TCP
Profibus DP
ProfiNet IO

The Information below can be used to further understand what is required to communicate with the PS220 using Fieldbus Control.

Modbus Register	Direction In to the PS220	Pointer in drive	Customer Setting
40001	->	**Control Word - Fixed PS220 Par 6.03**	**Control Word - Fixed**
40002	->	**FBA REF1 - Fixed PS220 Par 40.16**	**FBA REF1 - Fixed**
40003	->	**FBA REF2 - Fixed PS220 Par 40.17**	**FBA REF2 – Fixed (NOT USED AT THIS POINT)**
40004	->	OUT1 (53.01)	User Defined
40005	->	OUT2 (53.02)	User Defined
40006	->	OUT3 (53.03)	User Defined
40007	->	OUT4 (53.04)	User Defined
40008	->	OUT5 (53.05)	User Defined
40009	->	OUT6 (53.06)	User Defined
40010	->	OUT7 (53.07)	User Defined
40011	->	OUT8 (53.08)	User Defined
40012	->	OUT9 (53.09)	User Defined
40013	->	OUT10 (53.10)	User Defined
40014	->	OUT11 (53.11)	User Defined
40015	->	OUT12 (53.12)	User Defined

Modbus Register	Direction: Out from the PS220	Pointer in drive/PS220 PARAMATER	Customer Setting
40051	<-	Status Word PS220 word 6.11	Status Word FIXED
40052`	<-	FBA ACT1 PS220 Word 40.01	FBA ACT1 Fixed
40053	<-	FBA ACT2 PS220 Word TBD	FBA ACT2 Fixed
40054	<-	IN1 (52.01)	Example: 6.11(16) Main Status Word
40055	<-	IN2 (52.02)	Example: 1.07(16) Motor Current
40056	<-	IN3 (52.03)	Example: 1.14(16) Output Power HP
40057	<-	IN4 (52.04)	Example: 1.212(16) Setpoint 1
40058	<-	IN5 (52.05)	Example: 1.217((16) Smartflow
40059	<-	IN6 (52.06)	Example: 1.224(16) Runtime
40060	<-	IN7 (52.07)	Example: 1.31(16) Amb. Temp
40061	<-	IN8 (52.08)	Example: 60.03(16) M/F Mode
40062	<-	IN9 (52.09)	Example: 6.200(16) Pump Status
40063	<-	IN10 (52.10)	Example: 12.12(16) AI1 scaled value
40064	<-	IN11 (52.11)	User Defined
40065	<-	IN12 (52.12)	User Defined

Please refer to the ITT PS220 Fieldbus Configuration Guides.

PS220 Pump status "WORD 6.200" Bit Breakdown

Remote	Bit 0
M/F Ready	Bit 1
Running	Bit 2
Fault	Bit 3
M/F Switch request	Bit 4
Setpoint Changed	Bit 5
Drive Lock	Bit 6
Sleep	Bit 7
Start Issued	Bit 8
Speed Override	Bit 9
Switch to Follower	Bit 10
Switch to Master	Bit 11
Start Delay	Bit 12
Multipump Alarm	Bit 13
Water Enable	Bit 14
Follower Switch over	Bit 15

PS220 Alarm Word 1 "WORD 6.203" Bit Breakdown

Basic Pump Protect Warning	Bit 0
Sleep Warning	Bit 1
Dry Run Warning	Bit 2
Min Flow Warning	Bit 3
Runout Flow Warning	Bit 4
Tuning Warning	Bit 5
VFD Warning	Bit 6
Cond1 Warning	Bit 7
Cond1 Alarm/Fault	Bit 8
Cond2 Warning	Bit 9
Cond2 Alarm/Fault	Bit 10
Speed Override	Bit 11
TX/AI Warning	Bit 12
Secondary Protect A Warning	Bit 13
Secondary Protect B Warning	Bit 14
Not Used	Bit 15

PS220 Alarm Word 2 "WORD 6.204" Bit Breakdown

Basic Pump Protect Fault	Bit 0
PID Low Demand Warning	Bit 1
Dry Run Fault	Bit 2
Min Flow Fault	Bit 3
Pump Clogged Fault	Bit 4 (Only happens during pump clean)
Tuning Fault	Bit 5 (SmartFlow Tune failure)
VFD Fault	Bit 6
Multipump Comm	Bit 7 (Comm Loss)
Not USED	Bit 8
Not USED	Bit 9
Start Delay	Bit 10
Not USED	Bits 11-15

HEX	0 (0,0,0,0) to F (1,1,1,1)				0 (0,0,0,0) to F (1,1,1,1)				0 (0,0,0,0) to F (1,1,1,1)				0 (0,0,0,0) to F (1,1,1,1)				
DEC VALUE	**32768**	**16385**	**8192**	**4096**	**2048**	**1024**	**512**	**256**	**128**	**64**	**32**	**16**	**8**	**4**	**2**	**1**	
BITS	**15**	**14**	**13**	**12**	**11**	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**	
	User bit 4	**User bit 3**	**User bit 1**	**User bit 0**	**Ext ctrl loc**	**Remote cmd**	**Inching 2**	**Speed Override**	**Reset**	**Ramp in zero**	**Ramp hold**	**Ramp out zero**	**Run**	**Off3 control**	**Off2 control**	**Off 1 control**	
Stop																	
Bits On					0	1	0	0	0	1	1	1	1	1	1	0	
1150 Dec					0	1024	0	0	0	64	32	16	8	4	2	0	**1150**
47E Hex					4 (0,1,0,0)				7 (0,1,1,1)				E (1,1,1,0)				**47E**
Stop (alternate)																	
Bits On					0	1	0	0	0	1	1	1	0	1	1	1	
1143 Dec					0	1024	0	0	0	64	32	16	0	4	2	1	**1143**
477 Hex					4 (0,1,0,0)				7 (0,1,1,1)				7 (0,1,1,1)				**477**
Start																	
Bits On					0	1	0	0	0	1	1	1	1	1	1	1	
1151 Dec					0	1024	0	0	0	64	32	16	8	4	2	1	**1151**
47F Hex					4 (0,1,0,0)				7 (0,1,1,1)				F (1,1,1,1)				**47F**
Fault Reset																	
Bits On					0	1	0	0	1	1	1	1	1	1	1	0	
1278 Dec					0	1024	0	0	128	64	32	16	8	4	2	0	**1278**
4FE Hex					4 (0,1,0,0)				F (1,1,1,1)				E (1,1,1,0)				**4FE**
Speed Override																	
Bits On					0	1	0	1	0	0	0	0	1	1	1	1	
1295 Dec					0	1024	0	256	0	0	0	0	8	4	2	1	**1295**
50F Hex					5 (0,1,0,1)				0 (0,0,0,0)				F (1,1,1,1)				**50F**

Flow Totalizer

The PS220's Totalizer function can be used in a "Batch Operation" when a defined total flow volume is required to be pumped. When the Batch is completed the PS220 with stop the pump. Prior to a new start command, the value from the previous total must be reset. This can be done manually via parameter 84.02, or with a Digital Input configured for "TOTALIZER RESET".

Notes

1. The Flow Totalizer function will not operate in Multi-Pump mode.
2. A Flow source is required to be configured to utilize the totalizer function.
3. The total pumped volume will update every 5 seconds and only will display whole numbers.

The table below lists all of the Parameters used in this function:

Parameter	Name	Value/Range	Note(s)
84.01	TOTL SYS VOL STPT	0.0 – 999999.0 The Default is 0	Set the total volume of the batch that needs to be pumped. Units are based on unit selection in SMARTFLOW setup wizard
84.02	TOTAL VOLUME RESET	DISABLED [default] ENABLE	Resets the total pumped volume displayed in parameter 1.228. The PS220 cannot be restarted once the system volume is achieved until the reset is completed.
1.228	TOTAL PMP VOLUME	READ ONLY	Displays the total pumped volume in the units selected with either the SmartFlow Configuration Wizard, or with the Process Control Configuration Wizard.

Local Lock

The PumpSmart PS220 has the capability of "locking" the Local/Remote buttons function. Once activated a user cannot switch the drive from Remote to Local. To activate, access Parameter 19.17. "Yes" activates the "Local Lock" Function. It is "Unlocked "by default with the choice of "No".

Language

English American is the default language. On the PumpSmart PS220. Units of power are in HP. English (UK) notation refers to British English, with units of power in kW.
The language selection between English (US) and English (UK) is configured in the Basic Startup Wizard upon first powering up of the drive. Once a selection is made, the language selection option does not reappear in the basic startup wizard. It can be changed with Parameter 96.01

Local Control (Speed Control)

When in LOCAL control mode the PS220 will only operate in the manual speed control mode using all functions on the PS220 keypad. This includes controlling both the start/stop function and the reference speed setting. Local control bypasses all PumpSmart PS220 control logic and functions except for ALL VFD PROTECTION which will remain intact. Refer to Keypad use for operation on how to switch from LOCAL to REMOTE control.

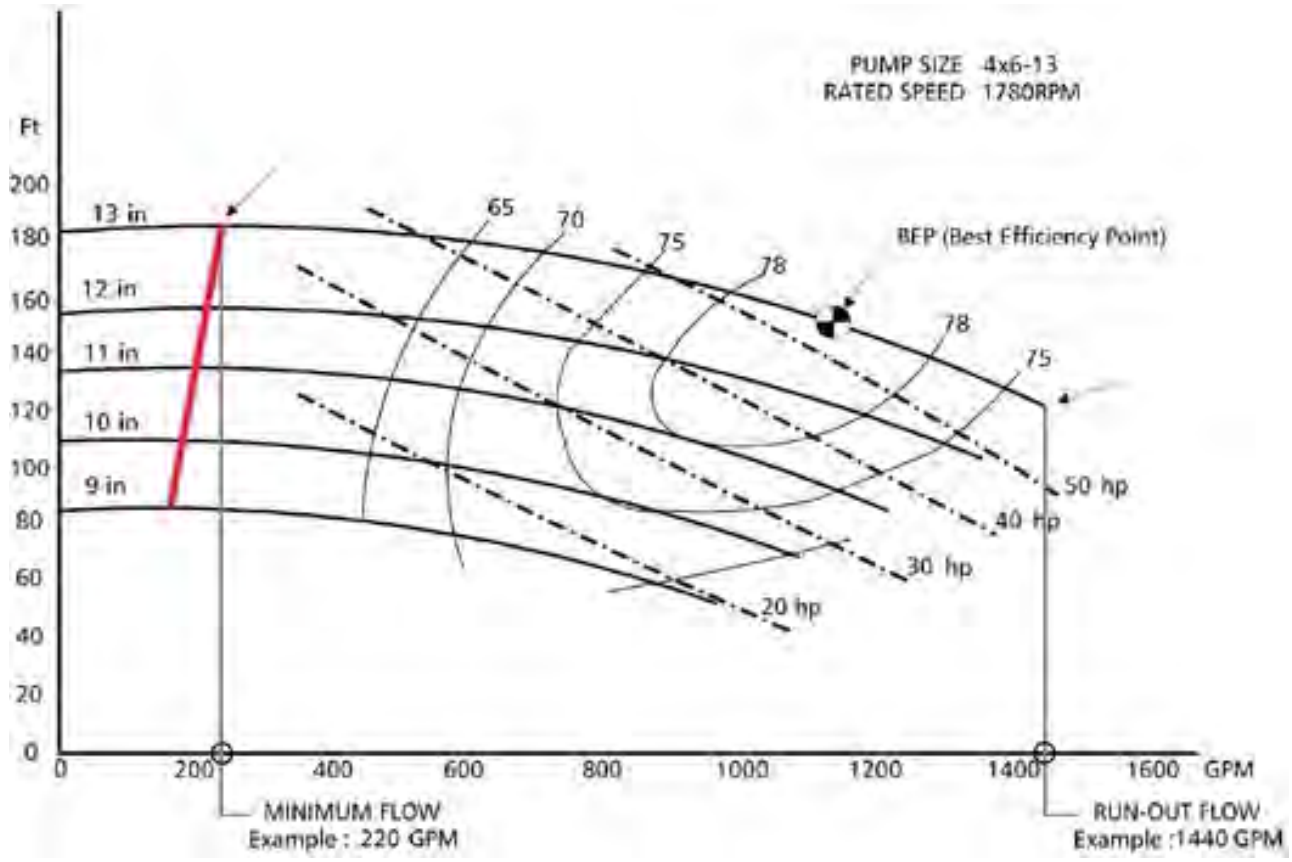
Locking

The PS220 does not have the capability of locking or passcode/password protecting the configured settings. It is always "open" by default and cannot be changed.

Minimum Flow Control

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. A pumps 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. As a general rule, at full speed, it is approximately 15-20% of the Best Efficiency Point Flow (BEP Flow). When pumping liquids with Vapor Pressures that are close to "boiling at ambient temperature" a greater thermal minimum flow will need to be used. The PumpSmart PS220 functionality can automatically adjust using the Advanced Smartflow feature.

Typical Performance Curve Depicting Minimum Flow



The PumpSmart PS220 can identify when a Minimum flow event is occurring and provide several responses as noted below:

When configuring the use of the Minimum Flow Control you will need to select a Response and define the actual Minimum flow value.
The choices are:

A. Disabled (Default)
The PumpSmart PS220 will continue to run. There will not be any indication of this event.

B. Alarm (Warning).
The PumpSmart PS220 will continue to run. The warning message "Min Flow Warning" will display. The event will be stored in the Event Log. It will continue to indicate the warning until the flow increases to a value above minimum flow.

C. Alarm & Control
The PumpSmart PS220 will indicate that the pump is running at or below minimum with a message "Min Flow Warning". After the response delay time has expired. The event will be stored in the Event Log. The PS220 will then respond based on the configured Protections Options. When a Hard Fault occurs, it will display the message "Min Flow Fault". It will have to be reset and manually restarted.
Please refer to the section "Fault Tracing" and "Protection Options" in this manual for more information on these topics.

This functionality can be configured with the PumpSmart PS220 Configuration Wizard.

To access this Wizard from the Home Screen, follow the path: MENU>PS220 Configuration>Pump & VFD Protection>Pump Protection>No>Yes or No> Follow the prompts

Minimum Flow Bypass Recirculation

The PS220's Flow Bypass Recirculation function will allow for a triggered event that can be used to control the opening and closing of a minimum flow bypass valve that may be required in a pumping system. An available Relay Out can be used with this function to send the signals to external devices when required to operate.
This functionality uses the Minimum Flow value sensed from either SmartFlow or from an external flow meter.
The Table below lists the parameters that are used in this configuration.

Parameter	Name	Setting	Notes
75.15	Flow Bypass Source	Off(Default) Flow Actual Smartflow Process TX2	Defines the flow signal for the Bypass function
75.17	Flow Bypass on Flow Value	0 (Default) (0-100000)	The set flowrate value used to trigger the function to operate. Units are as selected with the flow signal
75.18	Flow Bypass Off Ratio	2.1 (Default) (0-5)	Defined as a percentage of the "Bypass On flow value" when to close.
75.19	On Delay	1 Default (0-1800 Seconds)	Time for the logic to turn on the relay
75.20	Off Delay	1 Default (0-1800 Seconds)	Time for the logic to turn off the relay
75.21	Relay Start Delay	15 (Default) (0-200 Seconds)	Time for the Logic to activate the "Flow Bypass Open" Warning Message to Open the Bypass and to energize the selected relay. The relay will turn and off based on the time settings of 75.19 and 75.20

Notes
1. A warning Message will Flash "Bypass Valve Open" when the relay energizes and continue to flash until it closes.

2. The Value of 75.17 "Flow Bypass On, Flow Value" can be a different value than what is already defined in Parameter 79.09 for MIN FLOW. 75.17 will be internally corrected proportionally to the change in speed with the Pump Affinity Laws (Q1/Q2 = N1/N2 where Q = Flow and N = Speed).

This function can be configured with the PS220 Configuration wizards.
To access the Flow Bypass Recirculation Wizard from the Home View, follow the path: Menu>PS220 Configuration>PUMP & VFD PROTECTION >Condition Monitoring>Next>Next>

1. Configure the use of the function by choosing, yes
2. Select the FLOW BYPASS SOURCE:
3. Define the FLOW BYPASS ON Flow rate:
Remember this can be a different value than what is already defined in Parameter 79.09 for MIN FLOW
4. Set the FLOW BYPASS OFF RATIO
5. Set the ON DELAY: Defines the time duration for the Flow Bypass to activate the relay after the minimum flow value has been reached after the duration of FLOW RELAY START DELAY expires.

6, Set the OFF DELAY: Defines the time duration for the Flow Bypass to deactivate the relay after the product of FLOW BYPASS ON x FLOW BYPASS OFF
RATIO is reached.

5. Set the FLOW RELAY START DELAY:

Motor Setup/Configuration

The PumpSmart PS220's default mode of operation utilizes the Electric Motor connected and will run the Pump using the Basic Speed Control Functionality. The Basic Startup will configure the PumpSmart PS220 with the language you select, allow you to define the motor characteristics, execute a Motor ID, and verify correct motor rotation. You will then select the start/stop method, the operating speed range, and the method used to send the speed set point reference for the system to work.

This procedure provides a baseline for all the PumpSmart functionality to properly perform. The PumpSmart PS220 will not operate unless the Electric Motor connected is configured with all necessary information required. It must be performed prior to any other functions and or features can be configured.

This functionality can only be configured with the PumpSmart PS220 Configuration Wizard.

To access this Wizard, from the Home Screen follow the path: Menu>PS220 Configuration>Basic Startup>Edit Motor Parameters>

The steps that you will perform are as follows:

1. Configure the Motor Information
2. Perform the Motor ID Run
3. Perform a Motor Jog for Direction

1. Configure the Motor Information

All this information can usually be found on the Motor Nameplate that should be physically attached to the Motor. If the Nameplate is not available, you cannot proceed to any of the next steps.

1. Configure the Supply voltage On a new PS220 the supply voltage will show "Not Given". Select from the ranges shown.
2. Configure the Motor Full Load Amps or Current (FLA)
3. Configure the Motor Voltage
4. Configure the Motor frequency This will either be 50 or 60Hz.
5. Configure the Motor full load RPM. This number will not be 3600, 1800, (at 60 Hz), it will need to be the "Slip Speed" or "Synchronous speed" of the motor.
6. Configure the Motor nominal power

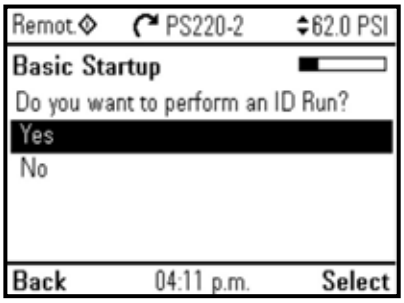
2. Perform a Motor ID RUN

The PumpSmart PS220 drive uses specific motor details to create a mathematical model. This model enables more accurate motor control and is created using the motor data you have just entered. The PS220 will be magnetizing the motor from 20 to 60 seconds at zero speed. This is called a Standstill ID run as the motor will not turn. It is also called a MAG ID, or ID Run. Once all the motor data has been entered, you will
be prompted as follows:

⚠ WARNING

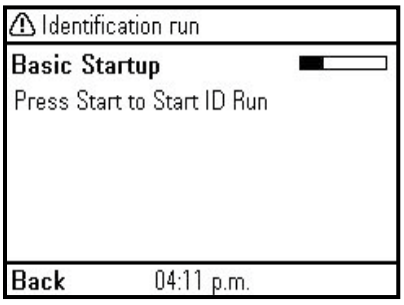
The following procedure, while not spinning the motor, will energize the motor. All safety precautions must be followed before initiating the Motor ID run. Failure to do so could result in serious injury or death.

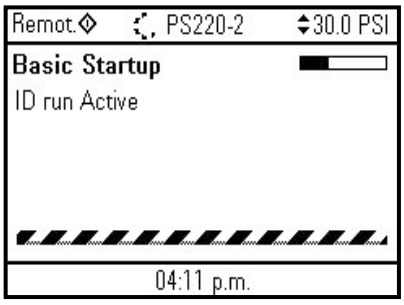
1. Request to perform a Motor ID Run.



1. "Select Yes"

2. Run the ID.





1. Push the "Green Start Button"
2. Wait

Note – Although the motor may not appear to respond to the start command. There may be an audible high-pitched sound coming from the motor which is normal.

Note – If the motor is repaired or replaced in the future, a Motor Identification run must be performed again to maintain the accuracy of the PumpSmart drive.

Safe Torque Off

The PS220 will not run the motor unless the Safe Torque Off (STO) is closed. The Safe Torque Off inputs are typically used for the external E-Stop circuit. If the E-Stop is active (STO open) the keypad will display:

The PS220 drive will come from the factory with jumpers installed between the STO Output and Inputs 1 and 2. If an E-Stop push button is installed in the STO circuit be sure the E-Stop is not activated.

DIIL Permissive

The PS220 will not run the motor unless the Permissive input [DIIL] is closed (24Vdc). This includes performing the Motor ID Run. If not closed a warning message will appear on the keypad display:

⚠ Run enable missing

The PS220 drive will come from the factory with a jumper between the DIIL input and 24Vdc. See Appendix A-4, Instrument Wiring, for details on wiring this switch.

3. Perform a Motor Jog for Direction

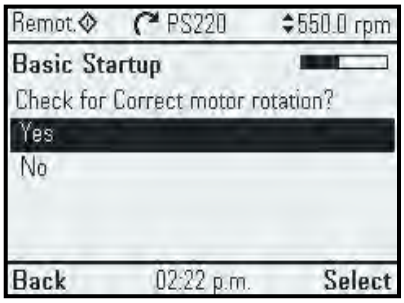
Jogging the pump motor for correct rotation can be accomplished through the Motor Jog function. The PumpSmart PS220 will rotate at 60 RPM and continue to do so until the rotation is confirmed to be correct (or incorrect). If incorrect the drive will prompt you to correct the rotation and then ask you to start it again to then confirm that rotation is correct. It will always only operate at 60RPM.

Note. There is no need to change any wiring on the (motor) load side of the PS220 to correct the rotation. It is all done by an internal PumpSmart PS220 setting.

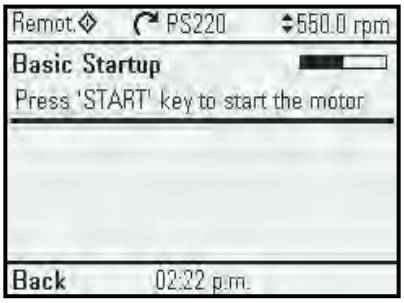
⚠ DANGER

Never work on the PumpSmart PS220, 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 may result in serious injury or death.

The Screen Shots below follow the sequence when the initial rotation is incorrect.
If it is correct the only screens 1, 2, 3, and 8 will apply.



1



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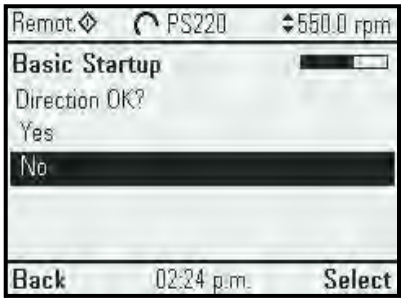
3



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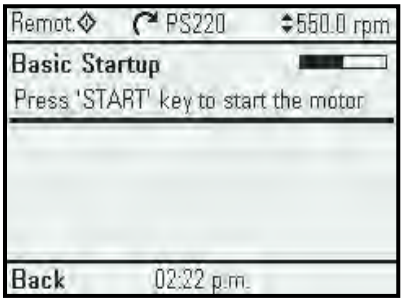


6

7

8

Motor Jog-Rotation Re-checking

Checking the motor for correct rotation can be done initially by using the Basic Startup Wizard. The motor will run at 60RPM until the operator confirms the correct rotation. Once initial configuration is fully complete this cannot be repeated using the Basic Startup Wizard.

ALL SAFEY PRECAUTIONS SHOULD BE TAKEN AND FOLLOWED AS NOTED IN THE BASIC STARTUP SECTION PRIOR TO PERFORMING THIS FUNCTION AGAIN

To recheck the rotation, you will need to follow the steps outlined below:

This procedure is for a Pump that CANNOT be run in REVERSE

1. Place the drive in Local Control if it is in remote.
2. Set parameters 30.11 and 30.12 to 60 RPM. Please remember or document what they were set to originally.
3. Press the Green Start button and watch for rotation.
4. Press the Red Stop button.
   If the rotation is NOT correct go to step5, otherwise go to step 6.
5. Go to parameter 99.16 and change the setting to reverse phase V and W
   The 2 choices are (0) UVW and (1) UWV. Repeat steps 3 and 4.
6. Set parameters 30.11 and 30.12 back to original settings.
7. Place the drive back to the original control mode of Remote if necessary.

This procedure is for a Pump that CAN be run in REVERSE

1. Place the drive in Local Control if it is in remote. (Manual speed control)
2. Press the Green Start button and watch for rotation. The speed reference may be adjusted if necessary.
3. Press the Red Stop button. If the rotation is NOT correct go to step 4, otherwise go to step 5.
4. Go to parameter 99.16 and change the setting to reverse phase V and W The 2 choices are (0) UVW and (1) UWV
   Repeat steps 2 and 3.
5. Place the drive back to the original control mode of Remote if necessary

Motor Thermal Protection

The PS220 features two separate motor temperature monitoring functions. The default method of protection is a motor temperature thermal model created by the PS220. Upon power up, the PS220 model uses the value set internally as the ambient temperature to calculate the temperature of the motor. The thermal model can be user adjusted if required. You can view the Motor Temperature in Parameter 35.01.

If you wish to change the Motor Temperature Measuring method or how the protection is configured, please Contact your ITT PumpSmart Application Engineer, or Commissioning Engineer.

Multipump

PumpSmart Multipump Control Theory Overview.

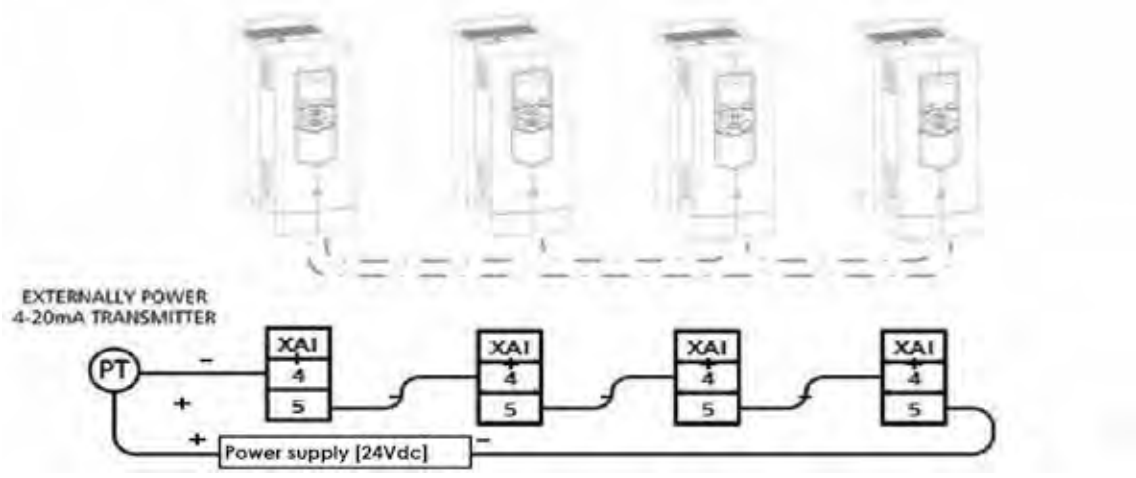
The PumpSmart PS220's Multipump Functionality allows for the seamless automatic control of up to 6 pumps in a pumping system. Typically the pumps would be piped in parallel with each other. The staging and de-staging of each pump based on increases and decreases in demand has been pre-configured, as well as automatic lead-lag switching, and the automatic bypassing of a Pump/Drive combination that may experience faults of any kind. The system would need to have a Process Transmitter either wired directly to each PS220, or in series with each unit. A system setpoint would need to be established which will automatically be shared to all of the PS220 drives. Lastly a starting method would need to be established, and that command would need to be sent and received to each drive.

The Multipump Functionality will work with every Process Control Mode as configured with the Process Control Wizard and will be complimented with most all of the full suite of Functionality that is shown in this manual. For more detailed information on all functions and features of the MultiPump Functionality please refer to the sections that follow in this manual.

Process Transmitter Connections.

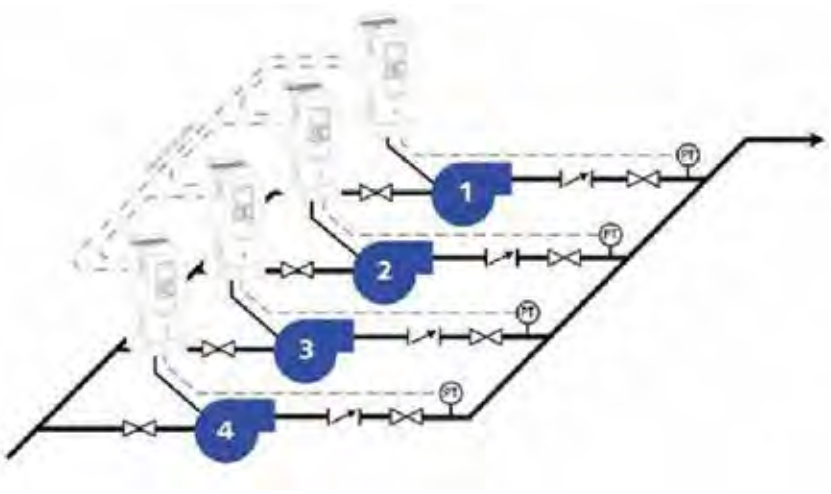
There are two methods to allow the physical process transmitter(s) with using the PID control Modes on the PS220 PumpSmart to function properly.

1. A single transmitter wired "in-series" to all drives. Refer to External 24VDC connections below and the wiring diagram example.



Note – If degradation in signal quality is experienced on any of the drives, complete the circuit on a smaller loop and wire an analog output of one drive that is directly receiving the process feedback into the Analog input of the next drive.

2. A transmitter connected to each drive. (Recommended)



Note – This method Cannot be used on with Flow control.

Notes:
1. Analog Supervision is highly recommended and will require configuration. Refer to Analog input supervision in this manual.
2. The Multipump functionality uses only the running master's Process Transmitter's feedback signal(s).When the lead is switched or if the Master's/(Lead's) Pump/Motor/Drive combination were to fault, the software automatically switches to use all of the connections on the Pump/Motor/Drive combination that it switched the Master/(Lead) to. This will include the Primary Process Transmitter and any transmitters used for functionality, including pump protection.

Minimum and Maximum number of pumps.

The PumpSmart PS220 can be set up to operate a minimum number of pumps and also to limit the maximum number of pumps when required.
The Maximum number of pumps is 6, the Minimum number of pumps is 1.

Example 1:
A Duplex Multipump system where you only run 1 pump. The second Pump is installed as a Back-up or spare. Min Pumps and Max Pumps would be configured to 1.
Each PS220 will need to be given a start command. If the first pump faulted offline, the 2nd pump would automatically start.

Example 2:
A Quadplex system that always requires 2 pumps to run constantly, but at times the 3rd and or 4th pump are needed due to process system demand increases. Min Pumps would be configured to 2 and Max Pumps would be configured to 4. The first 2 pumps would continuously run after they staged on successfully, but the first 2 pumps to stage will never destage. Only the 2 remaining available pumps would stage and de-stage as necessary. The only way to stop them is to take away the start command.

Staging Pumps

Basic Theory of Staging.

The PS220 PumpSmart Multipump staging logic works based on 4 criteria:

1. A Pump is available with a Start Command Issued
2. The Process's differential value between the setpoint and actual value.
3. Pump Speed
4. Stage Proof Time.

Once the Master Pump is running, the Multipump Control will stage the first Follower pump when:

1. The system differential value drops to the value of "Value Decrease".
2. The Master pumps running speed reaches its" Stage Speed".
3. The "Stage Proof Time" has expired.

NOTE: All 3 of these have to be valid during the proof period. If either item 1, or item 2 changes to below the thresholds during the proof time the proof time resets and start again until all 3 are again true.

The next available Follower in sequence with a start command will then stage on. The follower PS220 will ramp up, with the Master controlling both, then will synchronize so that both will be running at identical speeds. Any remaining pumps in the system that are available and have Start Commands will behave in the same fashion as the system demand continues to increase. The Value configured for Max Pumps will determine how many lag pumps can stage in the system when required.

The PS220 that receives the start command first in this ring format will automatically become the master.

Notes:

1. Staging values for up to 6 pumps are set to default values in the PS220 Multipump Functionality. For both Speed and Torque, they are set to 98% of Max Speed, Parameter 30.12.
2. If you are using Torque/Smart Control in lieu of Speed (Parameter 81.04) All of the stage values need to be adjusted to no more than 65%.
3. If you are using Process Variable you should "draw out", and well define these stage values for all pumps. The default values WILL NOT WORK PROPERRLY
4. If any Follower/Lag faults off, that pump will immediately stop, and the system will start the next available lag.
5. If the Master/Lead faults the Master will be transferred to the running first running lag and will synchronize the system.

Stage Proof Time

There is a default value set in the PS220 Multipump Functionality for "Stage Proof Time". It is 20 Seconds.

Note:

For High Pressure controlled system it is recommend shortening this to no more than 3-5 seconds. A significant drop in pressure may occur when the second pump stages as the system balances.

Staging Pumps

Basic Theory of Destaging.

The PS220 PumpSmart Multipump de-staging logic works based on 4 criteria:

1. Follower/Lag Pump is running
2. The Process's differential value between the setpoint and actual value.
3. Pump Speeds
4. De-Stage Proof Time.

Once a Follower is running, the Multipump Control will de-stage the last Follower when:

1. The system differential increases to the value of Pressure Setpoint Actual.

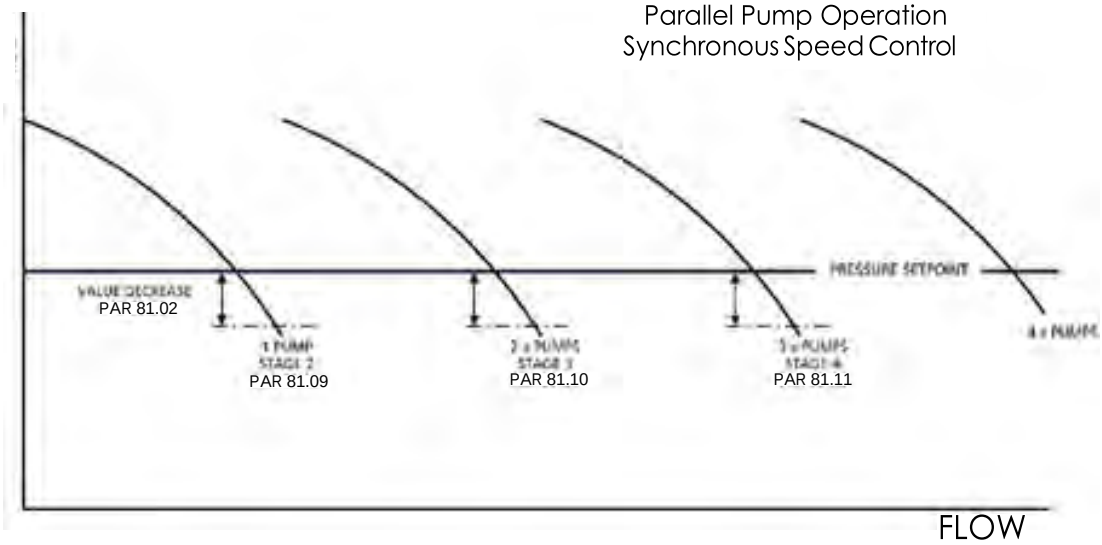
2. The Master pump and any running Follower have reduced in speed to the "De-Stage Speed" (based on quantity of pumps running, Destage 3, 2 etc.)

3. De-stage Proof Time has expired.

NOTE: All 3 of these have to be valid during the proof period. If either item 1, or item 2 changes to below the thresholds noted during the proof time the proof time resets and starts again until all 3 are again true.

The last Follower in the sequence will then de-stage off. The follower PS220 will ramp down, with the Master controlling both, then will synchronize so that both will be running at identical speeds. Any remaining pumps in the system that have been stage on will behave in the same fashion as the system demand continues to decrease. The Value configured for Max Pumps will determine how many lag pumps can de-stage in the system when required.

Pumps will de-stage in a 6-5-4-3-2-1 ring fashion unless a pump was offline and brought into the staging sequence "Out of the ring order".



There is a default value set in the PS220 Multipump Functionality for De-Stage Proof Time. It is 20 Seconds.

Notes:

1. De-Staging values for up to 6 pumps are set to default values in the PS220 Multipump Functionality.

For both Speed and Torque, these values are set to % of "Max Speed" (Parameter30.12). Recommendations for these values are as follows:

Name	Value	Notes
Destage 2	75%	Adjust based on Static Head
Destage 3	85%	Adjust 5% Higher than Destage 2
Destage 4	92%	Adjust 3% Higher than Destage 3
Destage 5	94%	Adjust 3% Higher than Destage 4
Destage 6	96%	96% should not be exceeded.

2. If you are using Torque/Smart Control in lieu of Speed PS220 Miscellaneous Wizard choice 2, the recommended values for Destaging are as follows:

Name	Value	Notes
Destage 2	60%	Test all values. These are system dependent
Destage 3	70%	Test all values. These are system dependent
Destage 4	80%	Test all values. These are system dependent
Destage 5	86%	Test all values. These are system dependent
Destage 6	90%	Test all values. These are system dependent

3. If you are using Process Variable as your stage and destage value you should "draw out" and well define these De-stage values for all pumps. The default values WILL NOT WORK PROPERRLY

Lead-Lag Switching Definitions:

1. D2D Master: The PS220's designation for the Lead pump. This can be referred to as the Lead Pump.

2. D2D Follower: The PS220's designation for the Follower Pump. This can be referred to as the Lag Pump.

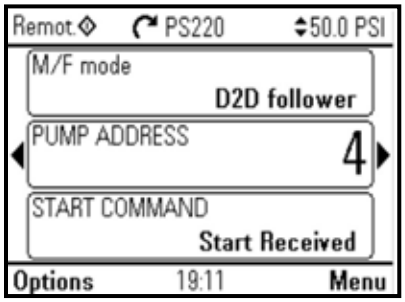
3. Pump Address:
This is the Physical Addresses of each of the drives connected together using the D2D connections on the drive. Parameter 60.02. All PumpSmart PS220's must have their individual D2D connections wired together sequentially, or the system will not work correctly. See the Diagrams in the back of the manual. The Jumper Switches (J3) must also be terminated as shown in this diagram as well to match how the connections were wired. When the system is functioning The Master-Follower (Lead -Lag) designations are completely independent of the PS220's assigned address values.

Basic Theory of Lead Lag Switching

Alternation of the D2DMaster (Lead) to a D2D Follower (Lag) functionality on the PumpSmart PS220 in the Multi-pump control mode is accomplished in one the following ways:

1. Individual accrued pump runtime.
The PumpSmart PS220 has an internal counter that accrues individual run-time when running in Multipump mode. The running Master will transfer its status to the next "Available Follower" based on a time window configured with parameter 81.31, "SWITCH LEAD TIME". The default setting is 48 hours. This is not true clock hours. It is accrued time of actually running. In theory, the next "Follower" in the sequence of Pump Addresses 1-2-3-4, etc. should be the pump that the lead status would be switched to. The PS220 has additional logic that will equally balance the runtime of all D2D Follower (Lag) pumps. As such the "Available" D2D Follower pump with lowest accrued run time will become the next D2D Master.
Parameter 81.41 "FOLLOWER SWITCH FACTOR" can be used to balance lags pumps with significantly "unequal" run times.
The runtime for each of the Pumps under control of the Multipump Functionality can have its runtime hours reset by manually with the use of Parameter 81.23. Changing the setting to "On" automatically resets the hours to zero and changes the setting back to "Off".

Notes:
1. "Available" is defined as any "Follower" Pump in sequence with a "Start Received" status. This status is visible in parameter 1.233 and is displayed on one of the MultiPump home screens. See below:



2. The next pump in sequence may not be the next one to be switched to. The Multipump internal counter works independently from the drives operating hours displayed in parameter 1.224 until the software sees that all of the run times have equaled out.

2. Fault or Stop

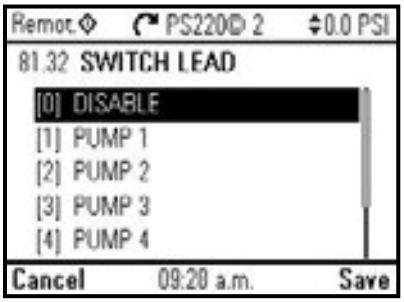
When the running D2D Master(Lead) is stopped manually or faults offline, the transfer of the D2D Master status will immediately switch to the next "Available" D2D Follower (Lag pump). It will always follow the sequence ring of 1-2-3-4-5-6 and not follow the accrued hours run time.

3. Sleep Cycles

Based on the number of times the D2D Master (Lead) drive has completed the "Sleep" function. This would need to be configured with the Wizard or with Parameter 81.36, "SWITCH LEAD SLP COUNT". The transfer of the D2D Master (Lead) status to the next "Available" D2D Follower (Lag pump) with lowest run time when the switch needs to occur. See Notes 1& 2 above.

4. Manual Switch

On the Running D2D Master (Lead) drive you can access Parameter 81.32 and switch the Master Status to any "Available" pump. If not "Available" the switch selection will not function. See the Screen shot below:



The Following table identifies the parameters used in Lead Lag Switching:

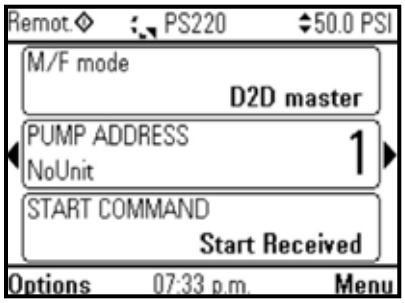
81.23	MULTIPUMP RUNTIME RESET	Selecting Reset clears the operating hours accumulated on this drive only when running in MultiPump operation.
81.31	SWITCH LEAD TIME	Defines the elapsed actual motor runtime time the D2D Master (Lead) will run before switching to the next available D2D Follower (lag) in the system. 0.00 hours disables the function, including alternating when a fault may occur. For the equivalent of disabling the alternating function and allowing for alternation during a fault, set the value to 99999.00 Setting range is .01 to 99999.00 hours. Maximum hours =11.5 years.
81.32	SWITCH LEAD	Allows for the manual switching of the D2D Master (Lead) via this parameter. Selections are: Disabled (default), pump 1, pump 2, pump 3, pump 4, pump 5 and pump 6. This parameter returns to disabled after a selection is made. Manual switch shall function only through the D2D Master using the D2D Master's keypad, or PC tool.
81.36	SWITCH LEAD SLP COUNT	Defines the elapsed number of times the D2D Master (Lead) pump goes into sleep mode. After this count the DS2D Master (Lead) will be automatically transferred to the next available D2D Follower (Lag) in the sequence. Any value greater than 0 automatically sets parameter 81.31 to 0 disabling switching based on hours.
81.41	Follower Switch Factor	This allows for the automatic balancing of D2D Follower (lag) pumps if used on a system with significantly unequal run times. It will use this number as a multiplier of the switch hours to offset the unequal time differences to eventually equal them out over time. The default is 0
1.238	MULTIPUMP RUNTIME	Provides the length of time this drive pump has run in Multipump. Does not include sleeping. 0 – 65535.Hours and is viewable only

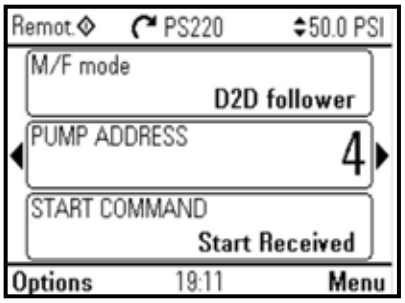
Multipump Home Screens

The following screen shots document the detail of parameters that have been pre-configured to display on the keypad display when running the PS220 Multipump Control Function.

M/F mode:

The information displayed will either be “D2D master” or “D2D” follower. It will display “D2D master” as soon as it has been given the start command and is running. It will never show “D2D Follower” if a current master is running.





PUMP ADDRESS:

This is the physical address configured of the PS220 hardware. This will never change when pumps start and stop.

To be able to determine what pump should start next if the D2D master is running, “In Theory” if this ID is the one that is running, and it is a D2D Master the next addressed Drive that is “Available” should run next. The switching logic can override this if the run time on the lags are not equal (3 or more pump system)

START COMMAND:

This information will either show “Start Received” or “Start Not Received”.

None of the pumps will start unless they have received a Start command. A drive that has been issued a start command may not be running as the Multipump logic determines when it is needed to run.

Multipump Menu Tree

Below is the chronologic list of steps that the PumpSmart PS220 Multi-pump Wizard follow during the configuration of the system.
The Section in the Wizards has each and every screen shot shown for easy step by step instructions.

This functionality can be configured with the PumpSmart PS220 Configuration Wizard. To access this Wizard from the Home Screen, follow the path: Menu>PS220 Configuration>Multipump>

NOTE: When Configuring Multiple Pumps to be used in your system you will need to follow these steps on each PS220 installed. However, all of the settings will be identical except for step 2 below.

1. Configure the Multipump Mode
   "Synchronous" enables the Multipump Functionality.
2. Configure the Pump Address (1-6)

NOTES:
1. This Pump address MUST entered in same fashion as the PS220's are wired with the D2D connections. Refer to the wiring diagrams in this manual. They must be wired in the 1-2-3-4-5-6 ring configuration.
2. Configuring the remaining Pumps will only require this number to be changed to 2, 3, 4, 5 or 6.

3. Configure the Lead/Lag Switch Hours
   The default value is 48 Hours

4. Configure the Value Increase and Decrease Values:
   The default values are 5%

5. Configure the Stage and Destage Method
   The default value is SPEED/Torque. The options is for Process Value, typically used for Level Control applications. The Torque selection will require the Miscellaneous Wizard to be run for Torque control

6. Configure the STAGE PROOF TIME:
   The default value is 20 seconds.

7. Configure the DESTAGE PROOF TIME
   The default value is 20 seconds.

8. Configure the MIN PUMPS ON
The default is 1

9. Configure MAX PUMPS ON
The default value is 4.

10. Configure the Stage/De-Stage Values for Pumps 2, 3 etc.
The default values are as shown. Validate all during commissioning.

Parameter	Description	Default Setting
81.09	Stage 2 Value	98%
81.10	Stage 3 Value	98%
81.11	Stage 4 Value	98%
81.17	Stage 5 Value	98%
81.18	Stage 6 Value	98%
81.13	De-Stage 2 Value	75%
81.14	De-Stage 3 Value	85%
81.15	De-Stage 4 Value	92%
81.21	De-Stage 5 Value	94%
81.22	De-Stage 6 Value	98%

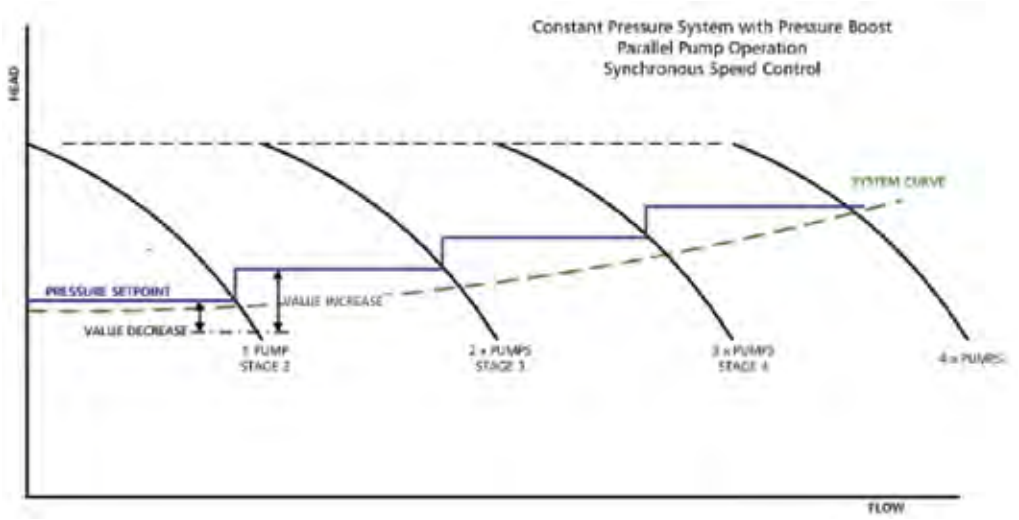
11. Exit the Wizard and repeat for the remaining Pumps.

12. Follow instruction below:

Once you have completed the Multipump Configuration Wizard you MUST send a setpoint reference change from the source selected in Basic Startup, from and to each and every drive. This will ensure that the reference changes on each drive's keypad display. It confirms that the PS220's are communicating with each other. It should take 3-4 seconds for this change to visibly register across all of the individual drive's keypads.

Pressure Boost

In a constant pressure system often times the systems design 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. This means that typically in a multi-pump system, excess pressure may be wasted when more than 2 or more pumps are designed to run to satisfy system pressure requirements when only 1 may need to run to satisfy lower demand and at a reduced speed. See the Diagram Below:



The PumpSmart PS220 can optimize a constant pressure multi-pump system by adding a "boost pressure" to the pressure setpoint as pumps are staged on and subtracting it as pumps are staged off in these types of systems. As each lag pump is brought online, indicating an increase in flow, PumpSmart will automatically increase the pressure setpoint as set by parameters 81.02 "VALUE DECREASE" and 81.03 "VALUE INCREASE".

The amount of pressure increase to the setpoint is determined by the following formula:
(1 + VALUE INCREASE – VALUE DECREASE)

EXAMPLE: In a 4-pump system the set-point is 100psi:
The VALUE INCREASE is 10%
The VALUE DECREASE is 5%.

Based on the formula the set-point increase equals = 1+0.10-0.05 = 1.05
When 2 pumps are running the pressure set-point = 100 psi x 1.05 = 105 psi.
When 3 pumps are running the pressure set-point = 105 psi x 1.05 = 110.25 psi.
When 4 pumps are running the pressure set-point = 110.25 psi x 1.05 = 115.76 psi.

Parameter	Name	Value/Range	Notes
81.02	VALUE DECREASE	0-100% 5% [default]	Defines the percentage difference decrease between the system set point versus the actual value to initiate staging of an available lag pump. Setting range = 0.0 – 100.0% of set point.
81.03	VALUE INCREASE	0-100% Defaults to same value as 81.02 VALUE DECREASE	Defines the increase in the systems set point desired when lag pumps start. This value is cumulative for each additional lag pump that stages on. This is used to compensate for higher friction losses form increased flow rate in systems that need to be overcome as additional pumps add more flow into the system. The formula used is Set point Increase = Value Decrease - Value Increase Setting range = 0.0 – 100.0% of set point. The default setting for is equal to the value set in 81.02. (No increase in setpoint as additional pumps stage on) The setpoint will decrease at the same rate as pumps destage.

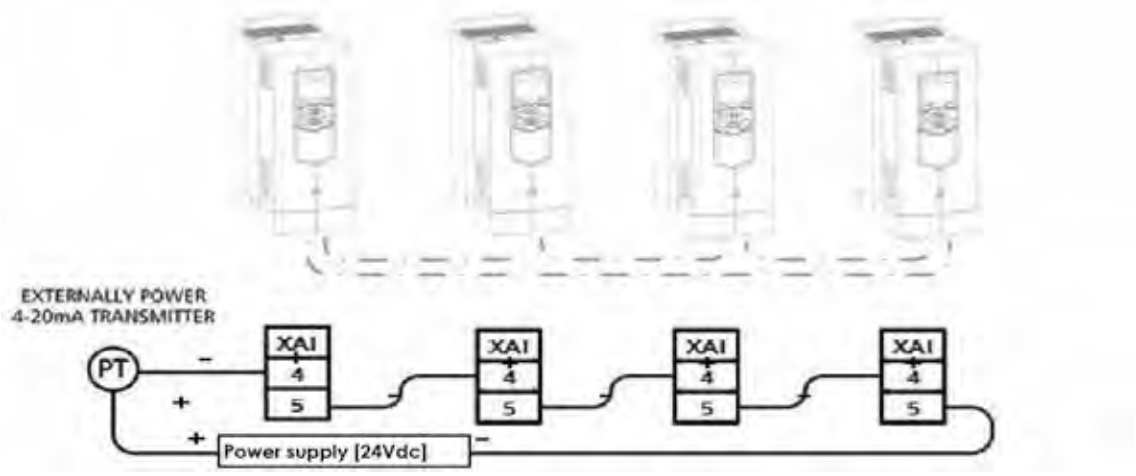
External 24V DC Power Sourcing

1. Control Board. There is NO NEED to use a remote power source to power the PS220 PumpSmart Drives control power circuit boards. It should be used only if the keypad needs to remain active if the drive were to lose Mains Supply Power.

The control 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 95.04 "CTRL BOARD SUPPLY" must be set to "EXTERNAL 24VDC" to avoid warnings displayed when the main supply power is disconnected.

Parameter	Name	Value/Range	Notes
95.04	CTRL BOARD SUPPLY	INTERNAL 24VDC [default] EXTERNAL 24VDC	By selecting EXTERNAL 24 the PS220 is instructed that the control board is being externally powered.

2. It is recommended that if one process transmitter has been provided, and it is going to be shared among all of the PS220's in a Multipump system that the power to it be from an external source. By externally powering the power to that transmitter's circuit, it will remain powered if any of the PS220's, the Pumps, or the Motors need to be serviced, locked out, and taken out of service.



The table below lists all of the Parameters used in this function:

GROUP 60	MULTIPUMP COMMUICATION SETUP	DESCRIPTION
60.02	PUMP ADDRESS	Selects the node address of the drive for Multipump D2D Master and D2D Follower communication. No two nodes may have the same address. Range is 1 – 6.
GROUP 81	MULTIPUMP	DESCRIPTION
81.01	MODE	Selects how multiple PS220 units operate together in parallel to satisfy the set-point. Multipump control is disabled. (Default) Synchronous Speed. Lag pumps start as needed and all pumps regulate to the set-point at the same speed or torque.
81.02	VALUE DECREASE	Defines the percentage difference decrease between the system set point versus the actual value to initiate staging of an available lag pump. Setting range = 0.0 – 100.0% of set point.
81.03	VALUE INCREASE	Defines the increase in the systems set point desired when lag pumps start. This value is cumulative for each additional lag pump that stages on. This is used to compensate for higher friction losses form increased flow rate in systems that need to be overcome as additional pumps add more flow into the system. The formula used is Set point Increase = Value Decrease - Value Increase Setting range = 0.0 – 100.0% of set point. The default setting for is equal to the value set in 81.02. (No increase in setpoint as additional pumps stage on) The setpoint will decrease at the same rate as pumps destage.
81.04	STAGE/DESTAGE METHOD	Selects the method of staging or de-staging pumps in the MultiPump system. Pumps stage and de-stage based on speed or Torque. Default) Pumps stage and de-stage based on the process variable values.
81.09	STAGE 2	Selects the control value at which lag pump 1 should be turned on. Setting range = 0.0 – 100.0% of MAXIMUM SPEED/Torque or the actual Process variable.
81.10	STAGE 3	Selects the control value at which lag pump 2 should be turned on. Setting range = 0.0 – 100.0% of MAXIMUM SPEED/Torque or the actual Process variable.
81.11	STAGE 4	Selects the control value at which lag pump 3 should be turned on. Setting range = 0.0 – 100.0% of MAXIMUM SPEED/Torque or the actual Process variable.
81.13	DESTAGE 2	Selects the control value at which lag pump 1 should be turned off. Setting range = 0.0 – 100.0% of MAXIMUM SPEED/Torque or the actual Process variable.
81.14	DESTAGE 3	Selects the control value at which lag pump 2 should be turned off. Setting range = 0.0 – 100.0% of MAXIMUM SPEED/Torque or the actual Process variable.
81.15	DESTAGE 4	Selects the control value at which lag pump 3 should be turned off. Setting range = 0.0 – 100.0% of MAXIMUM SPEED/Torque or the actual Process variable.
81.17	STAGE 5	Selects the control value at which lag pump 5 should be turned on. Setting range = 0.0 – 100.0% of MAXIMUM SPEED/Torque or the actual Process variable.
81.18	STAGE 6	Selects the control value at which lag pump 6 should be turned on. Setting range = 0.0 – 100.0% of MAXIMUM SPEED/Torque or the actual Process variable.
81.21	DESTAGE 5	Selects the control value at which lag pump 4 should be turned off. Setting range = 0.0 – 100.0% of MAXIMUM SPEED/Torque or the actual Process variable.
81.22	DESTAGE 6	Selects the control value at which lag pump 6 should be turned off. Setting range = 0.0 – 100.0% of MAXIMUM SPEED/Torque or the actual Process variable.
81.23	MULTIPUMP RUNTIME RESET	Selecting Reset clears the operating hours accumulated on this drive only when running in MultiPump operation.
81.31	SWITCH LEAD TIME	Defines the elapsed actual motor runtime time the D2D Master (Lead) will run before switching to the next available D2D Follower (lag) in the system. 0.00 hours disables the function, including alternating when a fault may occur. For the equivalent of disabling the alternating function and allowing for alternation during a fault, set the value to 99999.00 Setting range is .01 to 99999.00 hours. Maximum hours =11.5 years.
81.32	SWITCH LEAD	Allows for the manual switching of the D2D Master (Lead) via this parameter. Selections are: Disabled (default), pump 1, pump 2, pump 3, pump 4, pump 5 and pump 6. This parameter returns to disabled after a selection is made. Manual switch shall function only through the D2D Master using the D2D Master's keypad, or PC tool.
81.33	MAX PUMPS ON	Defines the maximum number of pumps that can stage on, and then continue to run as required.
81.34	MIN PUMPS ON	Defines minimum number of pumps that can run at any one time or when de-staging has been completed. De-staging is ignored on any pump less than this number.
81.36	SWITCH LEAD SLP COUNT	Defines the elapsed number of times the D2D Master (Lead) pump goes into sleep mode. After this count the D2D Master (Lead) will be automatically transferred to the next available D2D Follower (Lag) in the sequence. Any value greater than 0 automatically sets parameter 81.31 to 0 disabling switching based on hours.
81.38	DESTAGE PROOF TIME	Elapsed time required before the de-staging of a lag pump will occur. De- stage value and the reference value must both be met during this timeframe. Setting range 0-900 seconds. Default is 20 seconds.
81.39	STAGE PROOF TIME	Elapsed time required for the staging of a lag pump will occur. The stage value and the value decrease value must both be met during this timeframe. Setting range 0-900 seconds. Default is 20 seconds
81.41	Follower Switch Factor	This allows for the automatic balancing of D2D Follower (lag) pumps if used on a system with significantly unequal run times. It will use this number as a multiplier of the switch hours to offset the unequal time differences to eventually equal them out over time. The default is 0

Multivariable Control

The PumpSmart PS220 Multivariable Control function will allow the Primary Process Controls Set-point to be varied, and or offset, with a second process transmitter signal.

This functionality can be configured with the PumpSmart PS220 Configuration Wizard.
To access this Wizard from the Home Screen, follow the path:
Menu>PS220 Configuration>Multivariable>

The individual steps that will be performed are:
1. Enable the Multivariable Control Functionality
Basic startup must be performed prior to configuring this function. When running this Wizard, a message will prompt you to do this if you have not already.

2. Configure the source for the Secondary process transmitter
The Secondary Process Transmitter is the device that will measure the conditions that affect how the PS220 will adjust the active setpoint (reference). Your choices are from any unused Analog Input, AI1, AI2, etc. This selection requires that it has not already been used in other functionality. When selecting this Analog, it will be automatically identified as “Proc Trans 2” in the configuration settings

To be sure if it has not been configured for use previously. Check the Analog Input Settings in Group76. To access this from the Home View follow the path: Menu>Parameters>Complete List>Scroll down to Group 76 AI/AO Config>

3. Configure the Scale of the Secondary Process Transmitter
The Minimum and Maximum values of the “Electrical Values” will be established. These are in mA or VDC. Refer to the section on Analog Inputs for more detailed information.

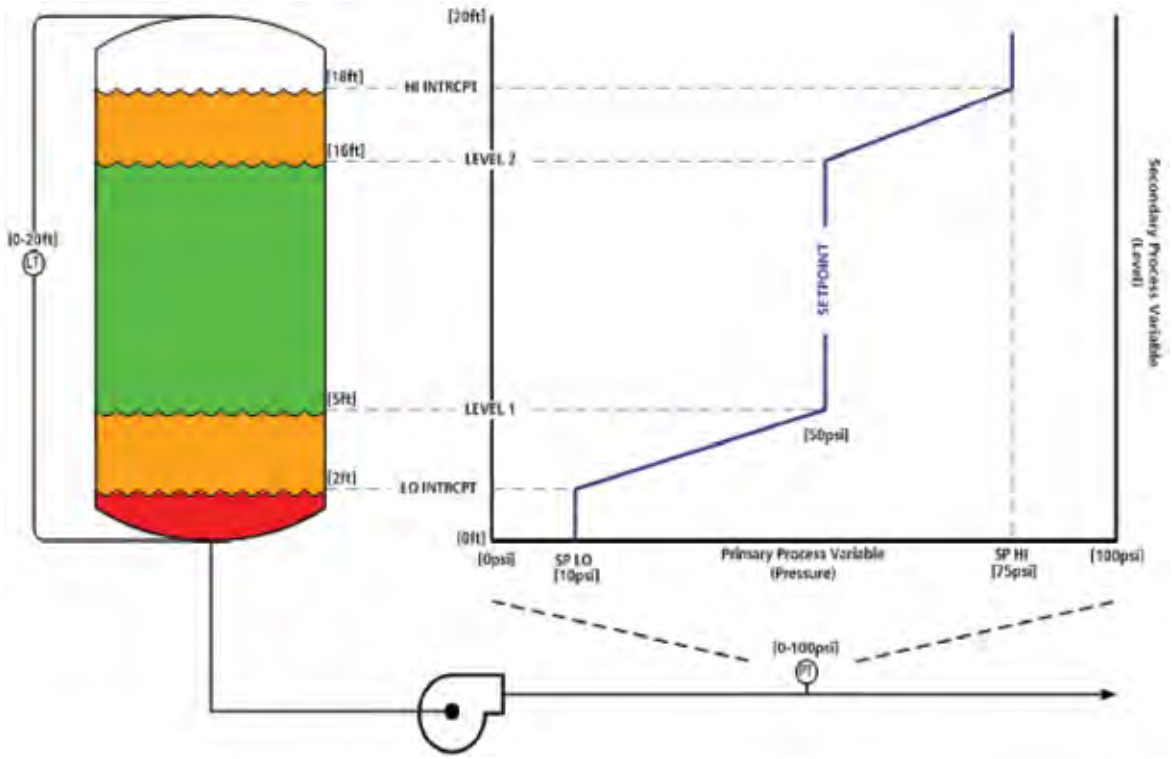
4. Configure the Limits of Operation
The limits of operation define the full interaction between the Analog Input you have selected in the previous step with the Primary Setpoint (Reference). Please refer to the example at the end of this section for assistance with the individual limit steps.
A. Configure the Level 1
B. Configure the SPT LO
C. Configure the LO INTRCPT
D. Configure the LEVEL 2
E. Configure the SPT HI
F. Configure the Hi INTRCPT

When configuring the Multivariable Control function, it is helpful to plot how you will want your set-point to behave in relation to the second analog inputs signal. This should assist you with understanding this functionality and how to correctly configure the use of it. We suggest using diagrams like the one shown below:

Note:
This is only available for Single Pump Applications.

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. The Basic Pump Protection on the PS220 would limit the speed of the pump or shut it off. Using the Multivariable Control feature would allow for pumping to continue, but at a reduced and allowable rate to prevent any harm to the pump, or the pumping system.

A suction pressure transmitter would need to be added and wired into any unused Analog Input (AI2 in this example). AI1 has already been configured for the primary control of the pump. The AI2 signal would then be configured such that when the suction pressure is sufficient, the PS220 would be controlled to the setpoint (reference) value chosen. When the suction pressure dropped below a certain value it would start to change/offset the setpoint reference) based on the new scaling. In this case it would begin to lower the set point.



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

Note:
To disable this functionality, you MUST re-run the Basic Startup and Process Control Wizards.

The table below lists all of the Parameters used in this function:

Parameter	Name	Value/Range	Notes
75.24	MULTIVAR CTL	OFF [default] ON	Set to "ON" to enable the Multivariable functionality
75.25	MULTIVAR REF SOURCE	Analog Input 1 Analog Input 2	This parameter defines the source used in the Multivariable control function. Choices are from any available Analog Input. The selected Input will need to be fully configured as "Proc Trans 2"
75.26	LEVEL 1	Range: 0-9999 0 [default]	This is the first level in which the Multivariable control function will scale the set-point as it is defined by the LO INTRCPT value and SP LO value. LEVEL 1 is defined in units of the secondary process variable.
75.27	SP LO	Range: ±20000 0 [default]	This is the lower limit set-point as related to LO INTRCPT. SP LO is defined in units of the primary process variable or RPM when in speed control.
75.28	LO INTRCPT	Range: 0-9999 0 [default]	This is the lower limit level in which the Multivariable function will scale the set-point as defined by the SP LO value. LO INTRCPT is defined in units of the secondary process variable.
75.29	LEVEL 2	Range: 0-9999 100 [default]	This is the upper level in which the Multivariable control function will scale the set-point as it is defined by the HI INTRCPT value and SP HI value. LEVEL 2 is defined in units of the secondary process variable.
75.30	SP HI	Range: ±20000 0 [default]	This is the upper limit set-point as related to HI INTRCPT. SP HI is defined in units of the primary process variable or RPM when in speed control.
75.31	HI INTRCPT	Range: 0-9999 0 [default]	This is the upper limit level in which the Multivariable function will scale the set-point as defined by the SP HI value. HI INTRCPT is defined in units of the secondary process variable.

Parameter Backup/Restoring

The PS220 has the ability to save all of the parameter settings configured to run the pump within the Keypads on board memory. This is called a Backup. This backup will also allow the ability to restore all parameter settings if the need arises. Two pump configuration backup files can be created using this function. This may allow you to reconfigure the drive to operate separate configurations for the same pump in service.

The Backup Functionality also can create an "Automatic backup". This is created two hours after any parameter changes, or if a backup was not created manually. After 24 hours the "Automatic Backup Function" completes a compare function, which compares the existing backup to how the PS220 is currently configured, and again will automatically create a new backup overwriting the previous one. When viewing the backup files, there will be "Folded Page Icon" with the letter "A" shown on the top left corner signifying that this was Automatically created. See the Screen shot below:

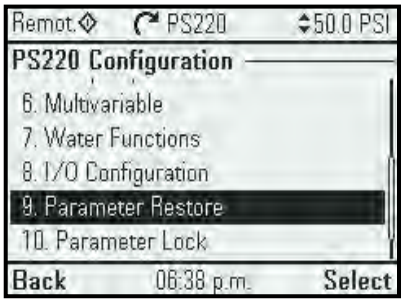
To create a parameter Backup, follow these steps:

1. From the Home Screen: Menu> Backups>
2. Select create backup. If there is not a free backup slot in the control panel, skip to step 3.
3. Use the arrow key's (right or down) to select one of the existing backup files, and press Replace.
4. Wait until the backup is completed. An animation is shown on the control panel during the backup process. The control panel automatically returns to the Backups menu.

Note: If the backup process is canceled or interrupted, the previously saved backup file will not be deleted or damaged.

To Restore a PS220 Configuration from a parameter Backup follow these steps:

1. Switch the Control Panel to "Local" Control
2. From the Home Screen Select Menu>Backups>use the Arrow keys to select the backup file you want to restore from.
3. Arrow Down to "Restore All Parameters"
4. Push "Select"
5. Wait until the restore is completed. An animation is shown on the control panel during the restoring process. The control panel automatically returns to the Backups menu when completed.
6. Switch Control Panel Back to Remote Mode.



Priming Delay

This feature is designed to allow Self-Priming pumps sufficient time to prime. The PumpSmart PS220 will run at full speed for a preset time period. During the time frame configured all of the PumpSmart logic becomes inactive. Once the priming time has elapsed all logic will then become active. A warning message "Priming" will be displayed and acknowledged by the PS220.

Note:
In Multipump control when the system is started for the first time, as each PS220 receives a start command, each will run the Priming function, and then will operate as required in Multipump Mode. If a pump is taken offline for any reason once it is issued another start command, it will also run the Priming function and then will operate as required in Multipump Mode.

Parameter	Name	Value/Range	Notes
75.02	PRIMING DELAY	0-6000 Seconds 0 [default]	This delay is active on every pump start, including Multipump. During this time frame all of the control logic is completely disabled.

Protection Options

The Protection Options are settings which can be applied to many of the Pump Protection Functions that are available on the PS220. They are an Integral part of the Alarm and Control functionality. There are 6 individual steps at the end of each Protection Wizard that should be completed to ensure the Protection is suited for the pumping application.

The individual steps that will be performed are:
1. Configure the Protection Delay
2. Configure Speed Override Pump Protection
3. Configure the Pump Fault Reset Delay
4. Configure the Config Speed Min Setting
5. Configure the Stop Delay at Min Speed
6. Configure the Pump Fault Reset

NOTE:
Choices 1-5 will apply to all of the Pump Protection Functions except where noted. They will not be applicable to any VFD or Motor protection. The VFD Protection Options are covered in the section "VFD Auto-Reset".
This functionality can be configured with the PumpSmart PS220 Configuration Wizard. To access this Wizard from the Home Screen, follow the path: Menu>PS220 Configuration>Pump & VFD Protection>Pump Protection>No> Follow the prompts

1. Configure the Protection Delay:
The PumpSmart PS220 can be configured to delay the reaction time that The PS220 will wait until activating the control of any of the protection features.
Notes:
1. The default is 1 which activates the function. The Maximum setting is 200 seconds. 0 will deactivate any protection associated with this delay

2. Configure the Speed Override Pump Protection setting.
The PumpSmart PS220 can be configured to allow all the Pump Protection configured to be active when the Speed Override function is also active. The Default value is "Disabled"

3. Configure the Pump Fault Auto Reset:
The PumpSmart PS220 can be configured to "Auto-Reset" up to a set number of times when the "Alarm & Control" choice has been configured for the "Protection Response" for any Pump Protection function.

Notes:
1. The Default value is 0, which deactivate the function. The range is from 0-19.
2. The PS220 will automatically end the retry attempts and end any further attempts when the system runs for more than 5 minutes continuously, without the event(s) re-occurring.
3. This function is not available for the Secondary Protection A or B functionality, or for Dry Run.

4. Configure the Pump Fault Reset Delay
The Pump Fault Reset Delay can be configured to delay the time that The PS220 will wait until Auto-Restarting after a Pump Protection "Alarm and Control" action has been taken.

Notes:
1. The default is 60 seconds. The range is 0 - 3600 seconds.

5. Configure the Config Speed Min setting.
The PumpSmart PS220 can be configured to run at either minimum speed or stop when "Alarm and Control" has been configured as the Response for the Pump Protection selection. The choices are:
1. The Minimum Speed set in Parameter 30.11. (SPD=MIN)
2. ZERO (0) RPM or to stop. (Speed =0)

Notes:
1. This choice cannot be selected for individual Responses. This is applied "globally" when selected.

2. The selection "Zero" should not be used if "Min-Speed" is selected for the PID sleep function in Process Control. The sleep function will need to be changed to "INTELL SLEEP". Refer to the Sleep function in this manual.

6. Configure the Stop Delay Min Speed.
When an upset condition triggers a Pump Protection Warning, the PumpSmart PS220 can be configured to run at its minimum speed for a timed duration. If the condition that triggered the warning has not cleared during this time, the drive will either try to reset and run again, based on the number of error resets from step 4, or fault off and stop. This is not a re-settable fault. The fault will have to be reset, and the drive issued a start command again. Please refer to the section "Fault Tracing" in this manual.

Pump Protection

The PS220 Pump Protection functionality can be configured to fully identify, notify, control, and prevent a pump in a system that may operate in an underload, or overload conditions, and all the adverse conditions of dry-run, dead-head, minimum flow, runout, and cavitation. It can also provide the pumping system protection to ensure that indirect damage from conditions such as over pressure, water hammer, and liquid temperature rise will not occur. The onboard logic can also monitor external devices that are an integral part of the pumping system to add an additional level of protection as well.

The PS220 offers 2 forms of this protection. They are:

1. Basic Pump Protection.
The Basic Pump Protection functionality uses the Process Control feedback to determine when upset conditions may be occurring in the system. Depending on the Process Control Mode, it is "Sensorless".

2. Advanced Pump Protection.
The Advanced Pump Protection functionality uses the PumpSmart PS220's feedback from SmartFlow to determine when upset conditions may be occurring in the system. This protection is "Sensorless". A flow meter can also be used for this protection

NOTE:
The Basic Pump Protection choice and the Advanced Pump Protection choice cannot both be used together.

1. Configure Basic Pump Protection

OR

1. Configure Advanced Pump Protection
   A. Configure flowmeter [OPTIONAL]
   B. Configure Minimum Flow Control
   C. Configure Dry Run Control
   D. Configure Runout Control

Basic Pump Protection.

The Basic Pump Protection functionality's purpose is to identify and react to pumping system conditions when three events occur while in the process control mode (any choice of control).

1. The pump is running at a predetermined percentage of maximum speed.
2. The process controls operating point is a predetermined percentage below 100%.
3. A predetermined proof time has expired.

This event could be the result of several upset conditions both internal and external of the pump. The PumpSmart PS220 cannot determine what the cause of the event is but it will provide the desired notification and response if the event does occur.

Notes

1. The PumpSmart PS220 keypad will display an alarm or fault message "Basic Pump Prot. Alarm" when this event occurs.
2. Basic Pump Protection is not available in Basic Speed Control or in Local control.

This functionality can be configured with the PumpSmart PS220 Configuration Wizard. To access this Wizard, from the Home Screen follow the path:
Menu>PS220 Configuration>Pump & VFD Protection>Pump Protection>Yes> Follow the prompts

The individual steps that will be performed are:

1. Configure enabling of the Basic Pump Protection.
2. Configure the Response

1. Disabled:
   The PumpSmart PS220 will not respond. The pump will continue to run at the maximum allowed speed and while not achieving the setpoint requirement. This is the Default.

2. WARNING:
   The PumpSmart PS220 will issue a warning message of "Basic Pump Protection". The pump will continue to run at the maximum allowed speed while not achieving the setpoint requirement.

3. ALARM AND/OR CONTROL:
The PumpSmart PS220 will either:

A. Issue a warning message, and either run at minimum speed or stop. It can be configured to automatically re-start after a delay period and then run to maintain the process setpoint. It can be configured to follow this routine a set number of times before a hard Fault is issued. The Fault will have to be reset, and manually restarted. Refer to the "Fault Tracing" section for further information.

B. A hard Fault is issued, and it will stop. The fault message will be displayed, and it will have to be reset, and manually restarted. Refer to the "Fault Tracing" section for further information.

3. Configure the Protection Limit.
   The Pump Protection limit is the percentage value difference between the operating setpoint, and the actual setpoint, at which the Basic Pump Protection Function becomes active. The default value is 97%.

Example:
In process Control Mode your system setpoint is 100. 97% of this vale is 97. The Protection Limit will become active when the actual value reading of the process is 97 or below.

This event could be the result of a number of upset conditions both internal and external of the pump. The PumpSmart PS220 cannot determine what the cause of the event is but it will provide the desired notification and response if the event does occur.

2. Advanced Pump Protection.
The Advanced Pump Protection functionality uses the full array of the PumpSmart PS220's feedback from SmartFlow and Smart TDH in identifying upset conditions that may occur in the system.
This configuration will use these values of Dry Run, Minimum Flow and Runout Flow, along with the responses you establish, to define the systems reaction to these events. This protection is considered to be "Sensorless". A flow meter can also be used for this protection with the exception of Dry Run.

NOTE:
1. The Basic Pump Protection choice and the Advanced Pump Protection choice cannot both be used together.

2. The Keypad will show the specific warning and alarm message signifying when they occur. The list of events will be as follows:

This functionality can be configured with the PumpSmart PS220 Configuration Wizard. To access this Wizard from the Home Screen, follow the path: Menu>PS220 Configuration>Pump & VFD Protection>Pump Protection>Yes> Follow the prompts

Advanced Pump Protection.
To configure the Advanced Pump Protection the individual steps that will be performed are:
1. Configure the choice for Advanced Pump Protection.
2. Configure the use of an external flow meter as the flow feedback source.
There are two choices for this configuration:
A. No (Default). Utilizes the Smartflow functionality to determine flow values.
B. Yes. This choice requires an external flowmeter. If a Flowmeter was not configured when the Process Control Wizard was completed it will need to be added and configured. This Wizard will continue and guide you through the steps in adding and fully configuring it for use.

Notes:
1. This choice cannot be used for Pump Protection on an individual pump in Multipump Control.
2. If you are unsure how to configure the external Flowmeter, please refer to the Analog Input configuration section in this manual.

2. An unused Analog Input will need to be used for this choice to function correctly. Please check the settings of the Analog Inputs in use by going to: Menu>PARAMATERS> Complete List>Scroll down to Group 76>Select and view 76.01&02. If available "NOT SELECTED" will be displayed. You may have to add an Extension Card to use an additional input.

3. Configure the Response to Minimum Flow.
There are three choices for this response:

A. Disabled (Default)
The PumpSmart PS220 will continue to run. There will not be any indication of this event.

B. Warning.
The PumpSmart PS220 will continue to run. The warning message "Min Flow Warning" will display. The event will be stored in the Event Log. It will continue to indicate the warning until the flow increases to a value above minimum flow.

C. Alarm & Control
The PumpSmart PS220 will indicate that the pump is running at or below minimum flow with a message "Min Flow Warning". After the response delay time has expired. The event will be stored in the Event Log. The PS220 will then respond based on the Protections Options. If and when a hard fault occurs it will display the message "Min Flow Fault". The PS220 will have to be reset and manually restarted. Please refer to the sections "Protection Options" and "Fault Tracing" in this manual.
4. Configure the Minimum Flow Value
This value should be the minimum flow value as recommend by the Pump Manufacturer. It should be at the rated speed full speed of the pump. There is a graphic below which depicts this value on a performance curve.
For more detailed information on Minimum Flow please refer to the section on Minimum Flow in this manual.

5. Configure the Response to Dry Run.
For more detailed information on Dry Run please refer to the sections of "Dry Run" and "Dead Head" in this manual.
The choices are:

1. Disabled (Default)
The PumpSmart PS220 will continue to run. There will not be any indication of this event.

2. Fault.
The information entered with the Smartflow configuration Wizard will automatically determine the value used for this protection's response. The PumpSmart PS220 will fault off with the message "Dry Run Fault" when conditions are satisfied based on the configuration of the "Protection Options". The event will be stored in the event log. This fault is not an Auto-resettable fault. The PS220 will have to be reset, and manually restarted. Please refer to the "Protection Options" and "Fault Tracing" sections in this manual.

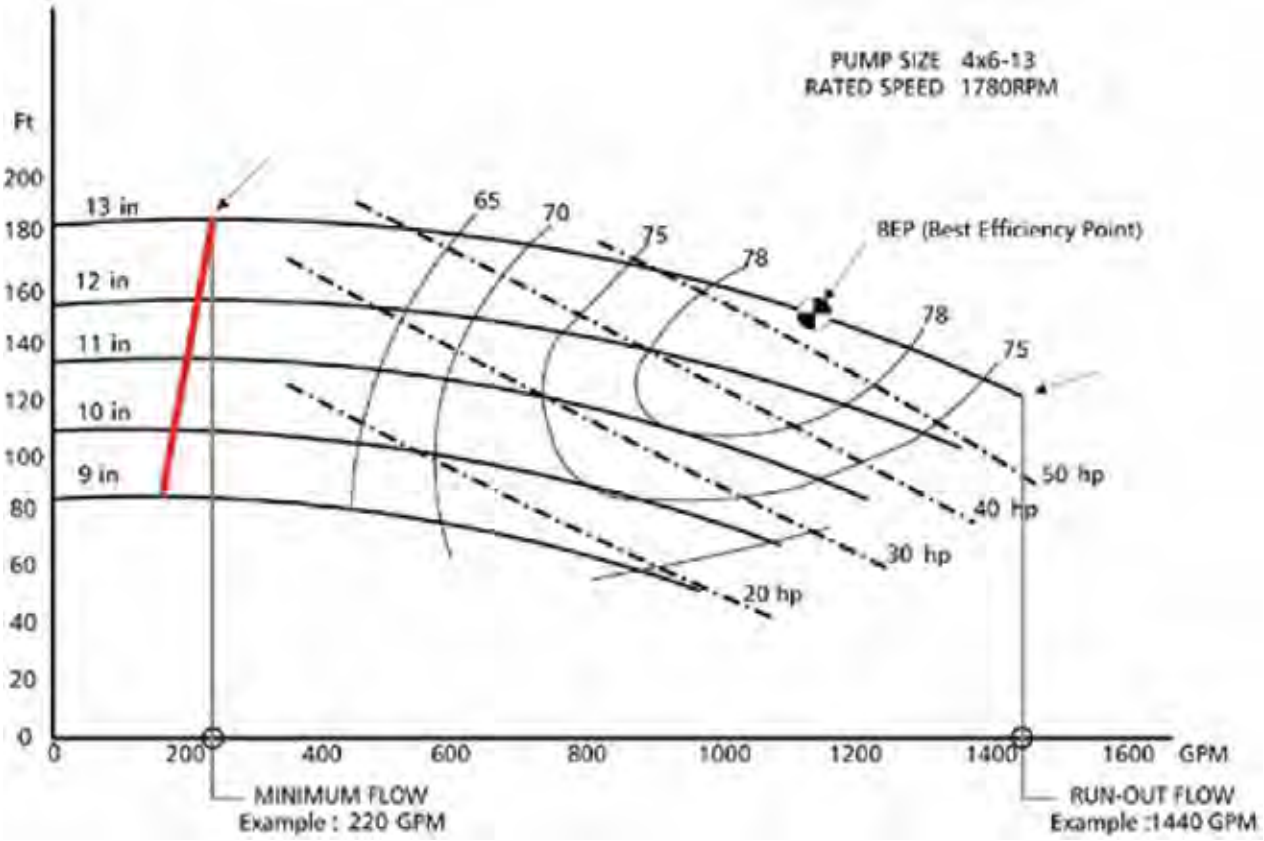
3. Warning
The PumpSmart PS220 will respond with the message "Dry Run Warning" when conditions are satisfied based on the configuration of the "Protection Options". The event will be stored in the event log. This warning message will clear when operating conditions return to normal. No further action will be taken.

Dry Run factor Adjustment (Not a step)
The Dry Run factor is for "fine tuning" the Dry Run fault feature. It should only be adjusted during initial commissioning to test the Dry Run Response function. Normally this parameter requires no adjustment. When adjustment may be required this value should only be changed in increments of 1/100th at a time.

6. Configure Runout Flow Response
When a pump produces flow well beyond the Best Efficiency Flow rate that it was designed for it is referred to as Runout. The NPSHa (Net Positive Suction Head Available) is usually less than the NPSHr (Net Positive Suction Head Required) at this operating condition which can lead to severe damage to pump internals and the suction piping system. A conservative estimate for a runout condition to occur is at 110-125% of the Best Efficiency Point Flow [BEP Flow].

The PumpSmart PS220's only response when using the Advanced Protection is to provide a warning.

This graphic depicts both the Minimum Flow and Runout Flow on a pump performance curve.



7. Configure the Runout Flow Value

This value should be the maximum flow value as recommend by the Pump Manufacturer. It should be at the rated full speed of the pump. The graphic above depicts this value on a pump performance curve. It is typically the flow value directly below and to the right of the last line of efficiency, for the rated diameter of the pump. It is approximately 10 to 25% greater the BEP Best Efficiency Point (BEP) flow.

The table below lists all of the parameters used with the Basic and Advanced Pump Protection functionality.

Group 79	PUMP PROTECTION	DESCRIPTION
79.01	PUMP PROTECT CTRL	The PS220's reaction to a Basic Pump Protection Event.
	DISABLED [DEFAULT]	Protection is disabled
	WARNING	The PumpSmart PS220 will issue a warning message of "Basic Pump Protection". The pump will continue to run at the maximum allowed speed while not achieving the setpoint requirement.
	ALARM AND CONTROL	The PumpSmart PS220 will either : A. Issue a warning message, and either run at minimum speed or stop. It can be configured to automatically re-start after a delay period and then run to maintain the process setpoint. It can be configured to follow this routine a set number of times before a hard Fault is issued. The Fault will have to be reset, and manually restarted. B. A hard Fault is issued, and it will stop. The fault message will be displayed, and it will have to be reset, and manually restarted.
79.02	PROTECTION LIMIT	The Pump Protection limit is the percentage value difference between the operating setpoint, and the actual setpoint, at which the Basic Pump Protection Function becomes active. The default value is 97%. Setting range: 0.0 – 100.0% of setpoint.
79.03	PROTECTION DELAY	This is the protection delay period prior to activation of Pump Protection. Setting range: 0– 200 sec. Default is 0
79.04	SP OVRRD PMP PROT	Selects if Pump protection warning and faults are enabled when the Speed Override function is activated.
	DISABLED [DEFAULT]	Protection is inactive.
	ENABLED	Protection is active
79.05	PUMP FAULT RESET	Determines the number of automatic fault resets or retries allowed before a fault condition will become active. Selection range is 0 – 19. The Default is 0. A "0" also deactivates this function. The counter resets if a stop command is issued or the condition has passed and the PS220 runs without further incident for 5 minutes. Not Applicable for DRY RUN.
79.06	PUMP RESET DELAY	Defines the time that the PS220 will wait before attempting an error reset. Setting Range = 0 -3600 sec. Default is 60 Seconds
79.07	Q ACT SOURCE	Identifies the source of the flow readings used in Pump Protection
	SMARTFLOW [DEFAULT]	The PS220 will use the Smartflow calculated flow value.
	FLOW METER	The PS220 will use the flow value from an external flow meter.
79.08	MIN FLOW CTRL	The PS220's reaction to a Minimum Flow Event.
	DISABLED [DEFAULT]	Protection is disabled.
	WARNING	The PumpSmart PS220 will continue to run. The warning message "Min Flow Warning" will display. The event will be stored in the Event Log. It will continue to indicate the warning until the flow increases to a value above minimum flow.
	ALARM AND CONTROL	The PumpSmart PS220 will indicate that the pump is running at or below minimum flow with a message "Min Flow Warning". After the response delay time has expired. The event will be stored in the Event Log. The PS220 will then respond based on the Protections Options. If and when a hard fault occurs it will display the message "Min Flow Fault". The PS220 will have to be reset and manually restarted.
79.09	MIN FLOW	Defines the safe minimum flow of the pump at pump rated speed.
79.10	DRY RUN CTRL	The PS220's reaction to a Dry Run Event. The information entered with the Smartflow Configuration Wizard will automatically determine the value used for this protection's response
	DISABLED [DEFAULT]	Protection is disabled.
	FAULT	The PumpSmart PS220 will fault off with the message "Dry Run Fault" when conditions are satisfied based on the configuration of the "Protection Options". The event will be stored in the event log. This fault is not an Auto-resettable fault. The PS220 will have to be reset, and manually restarted.
	WARNING	The PumpSmart PS220 will respond with the message "Dry Run Warning" when conditions are satisfied based on the configuration of the "Protection Options". The event will be stored in the event log. This warning message will clear when operating conditions return to normal. No further action will be taken.
79.11	DRY RUN FACTOR	The Dry Run factor is for "fine tuning" the Dry Run fault feature. It should only be adjusted during initial commissioning to test the Dry Run Response function. Normally this parameter requires no adjustment. When adjustment may be required this value should only be changed in increments of 1/100th at a time. Range is 0 – 2.00. Default is .95.
79.12	RUNOUT CTRL	The PS220's reaction to a Runout Event.
	DISABLED [DEFAULT]	Protection is disabled.
	WARNING	The PumpSmart PS220's only response is to provide a warning.
79.13	RUNOUT FLOW	Defines the Runout flow of the pump at pump rated speed.

Positive Displacement Pump Protection (PD and PC Pumps)

Positive displacement and progressive cavity type pumps are significantly different from centrifugal pumps in that they maintain a constant torque load. The torque for this type of pump is a consistent value throughout all operating speeds. Typically the fluids pumped are used for lubrication of internal components. If these pumps are "run dry", the lack of lubricity will lead to a significant increase in torque required to run. Pump Protection for these types of pumps can easily be accomplished with the PS220 Condition Monitoring Function by monitoring the normal operating torque for a sudden increase in this value.

NOTE - When operating a constant torque load the drive must be rated for the motors nameplate amp draw. This may require upsizing the PS220 to a larger HP size from that of the motor that will be used.
(150% overload capability required).

⚠ WARNING

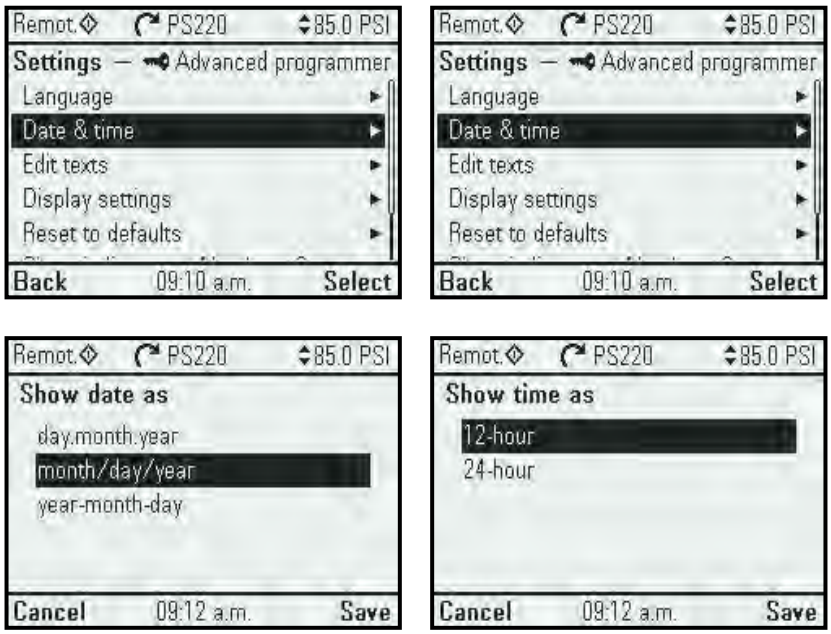
This functionality is designed to complement the existing pressure relieving safety devices that should be integral to the pumps. This form of protection is not intended to substitute the pump manufacture's recommended pressure relief protection. Failure to follow these instructions may result in physical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

Please refer to the Condition Monitoring Function in this manual for more information on how to use this functionality.

NOTE:
To determine the proper torque warning and alarm limits, consult the pump manufacture for their recommended guidelines.

Real Time Clock

The PS220 has a built-in Real-time clock on Board. There are many ways that you can set and display this information.



The time and date display settings determine how the time stamps are formatted to view on screen and in the event logs. The clock is powered by a battery on the backside of the panel underneath the battery cover. At an ambient temperature of 77 °F, the change interval of the real-time clock battery is approximately 10 years. Battery type used is CR2032.

To configure the real time clock settings from the Home View, follow the path: Menu>SETTINGS>DATE & TIME

Reference/Setpoint Source

The Reference or the Setpoint that PumpSmart PS220 will be maintaining will need to be configured. The keypad included is the default choice. An external source can be used that may require wiring with proper scaling values (minimum and maximum). The PS220 also has the capability to establish limits of the overall scaling to prevent operations below and above thresholds for any particular system when using Process Control. The configuration Wizards that are part of the Basic Startup and Process Control will guide you through this configuration.

This functional setting can only be configured using the PS220 Configuration Wizards. To access this form the Home View, follow the paths:

For Speed Control: MENU>PS220 Configuration>BASIC Startup>

For Process Control: MENU>PS220 Configuration> Process Control> (Push select or next 5 times)

The steps you will need to go through will be as follows.

Configuring the setpoint source. The choices are:
1. Keypad (Default)
2. Analog Input (AI1, AI2)
3. Fieldbus Control

1. Keypad:
This is the default setting when configuring the drive for the first time.

2. Analog Input:
An analog signal can be sent into the drive, from a PLC, DCS or another form of controller.
The signal will need to be wired into any unused analog input AI1, or AI2.

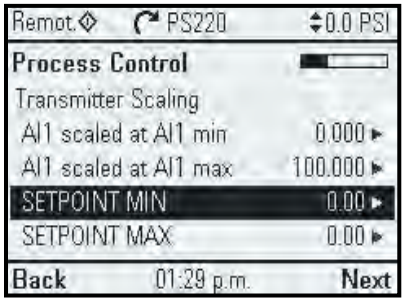
NOTES:
For all Analog Inputs to be used:
1. "AI# scaled at AI min" refers to the speed value that corresponds to the minimum of the signal or the 4mA scaled value. This is defaulted to 0 RPM.

2. "AI# scaled at AI1 max" refers to the speed value that corresponds to the maximum of the signal or the 20mA scaled value. This is typically the motor nameplate speed or slip speed.

(# = refers to the choice of the physical number of the AI used)

NOTE: If your input wired signal provided is DC Voltage, please refer to the options and features section for proper parameter settings of the drive. A Jumper connection on the hardware will need to be moved. (J1, or J2) This is shown in the wiring diagrams.

Configuring the setpoint for Process Control in any mode will require two additional settings after the configuration of the transmitter. These will scale the setpoint separately from that of the transmitter. This scale will provide the limits on how low, or high, a setpoint can be, to prevent operation at values that could be detrimental to the pumping systems.



To get to this screen directly to change the setpoint min and max:
MENU>PS220 Configuration> Process Control> (Push select or next 5 times)

The parameters used to adjust these manually are as shown below:

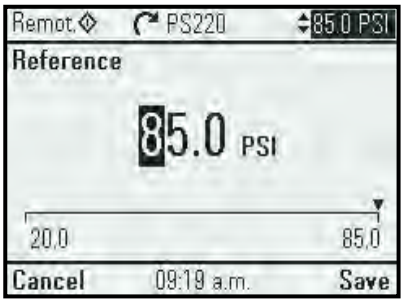
75.09	SETPOINT MIN	Defines the Minimum Process Control Setpoint. Any value below this will not be used in the PID control.
75.10	SETPOINT MAX	Defines the Maximum Process Control Setpoint. Any value above this will not be used in the PID control.

NOTE:
If you forget to set, or send a reference to the PumpSmart PS220, it will run at the minimum speed that had been configured in parameter 30.11. A warning message will not display if the reference is 0. In Process control mode it may run to maintain the reference but will not speed up higher than this value.

Setting/Adjusting the Reference:

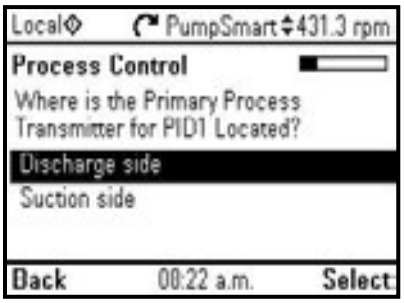
The reference can only be set and adjusted by the choice you have selected during configuration.
If you chose the Keypad (default) you can use the Keypad for entry of the running speed. You can edit it on the Home Screen whenever you see the symbol to the left to the reference. On the Home Screen the up and down arrow keys of the keypad will directly adjust your speed reference as viewed in the upper right corner of the display.

By accessing it from the Home Screen using the path: Option> Reference> Select it may be adjusted quicker than holding down the arrow keys. See the Screens below



Regulation Mode

The transmitter location identifies whether the transmitter is on the suction side of the pump, or on the discharge.



Note:
When choosing suction side, the software will automatically invert the actual signal.
A rising value will increase the speed of the pump to maintain the process setpoint, typically used in level control application is sumps below grade. Check to be sure that the transmitter being used does not do this as standard.

The regulation mode is automatically configured using in the PROCESS CONTROL wizard. 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.

If this parameter has been configured incorrectly typically the drive will not run after a start command is issued, or show "PID Sleep. To correct this, you will need to change the setting of the parameter noted below to the opposite from what it currently may be configured to.

Parameter	Name	Value/Range	Notes
40.31	REGULATION MODE (PID1 Deviation inversion)	0=NORMAL [default] 1=INVERSE	Inverse is normally used for control of suction side systems.

Relay Outputs

The PumpSmart PS220 has 3 Form C "Dry Contact" relays on board as standard. They are fully assignable to operating and fault conditions. Relays will revert to original states once warnings, faults and the operating conditions are reset or cleared. Each can be forced on, off, and inverted. By default, Relay 1 is configured for Ready, Relay 2 is configured for Running, and Relay 3 is configured for Fault. If they are not used, they will show "Force Off" in their configuration status. Additional relays can be added with an extension module.

The relay outputs should be configured using the PS220 Configuration Wizard. To get to the wizard from the home view follow the path:
Menu>PS220 Configuration>I/O Configuration>No>Relays>

Relay Output Technical Information.
Switching Capacity is 30 VDC/250VAC with max of 2 Amps.

Refer to the PS220 Wiring Diagram for detailed information on connections required.

Parameter	Name	Value/Range	Notes
76.06 76.07 76.08	RELAY R01 SOURCE RELAY R02 SOURCE RELAY R03 SOURCE	24 Individual Choices	Default for RO1 (default READY) Default for RO2 (default RUNNING) Default for RO3 (default FAULT)
		FORCE OFF	Force the relay to the off state
		FORCE ON	Force the relay to the on state
		INVERTED FAULT	A general VFD or PUMP related fault has occurred. Normally Open
		FAULT	A general VFD or PUMP related fault has occurred.
		RUNNING	VFD is running the motor. Will remain on until stop at end of deceleration ramp.
		FLOW BYP SMRT FLW	Minimum flow bypass valve control triggers the relay to open the valve when using SmartFlow
		PIPE CLEAN	A pipe cleaning sequence is being executed. The relay remains energized until the completion of the cleaning sequence.
		COND1 HI ALARM	Condition 1 HI Alarm is active
		COND2 HI ALARM	Condition 2 HI Alarm is active
		FLOW BYP EXT FLW	Minimum flow bypass valve control triggers the relay to open the valve when using an external flow meter.
		PUMP FLTS/WRNGS	A general pump related warning or fault has occurred
		READY	Drive is ready to run (no faults or warnings)
		SECOND PROTECT A	Secondary Protect A activation
		SECOND PROTECT B	Secondary Protect B activation
		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 PROTECT	Pump protection activation
		MULTI VAR ACTIVE	Multivariable control is active
		SPEED OVERIDE	Speed override is active
		COND1 LOW ALARM	Condition 1 LOW Alarm is active
		COND2 LOW ALARM	Condition 2 LOW Alarm is active
		START DELAY ACTIVE	Drive is under a start delay (74.04
		REMOTE	Remote/Local in in Remote mode
		OTHER	Selecting other will allow relay to change state based on a specific Parameter or setting.

Restoring Factory Defaults

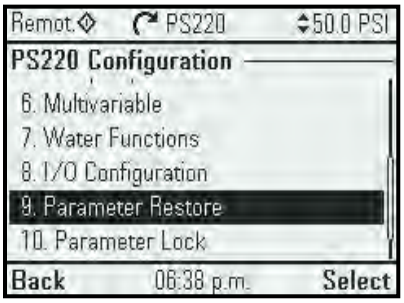
The PumpSmart PS220 can be completely reset back to the original factory defaults. This will erase all the current settings that may have become corrupt, or you may be experiencing trouble during the normal operation of the system. This function can also be used when you relocate and re-connect the PumpSmart to a different piece of equipment.

Please use the PumpsmartPS220 Wizard to accomplish this.

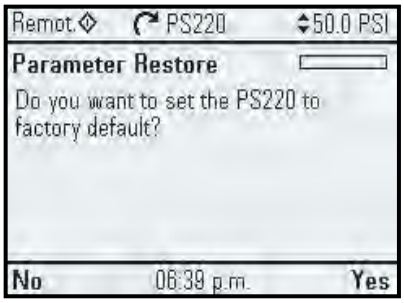
From the home screen follow the path:
Menu>PS220 Configuration>Parameter Restore>"SELECT YES"

The steps that you will perform:
1. Perform a Parameter Restore
2. Exit the Wizard
3. Clear all Parameters
4. Restore the PS220 Defaults
5. Reconfigure the PS220

1. Perform a Parameter Restore



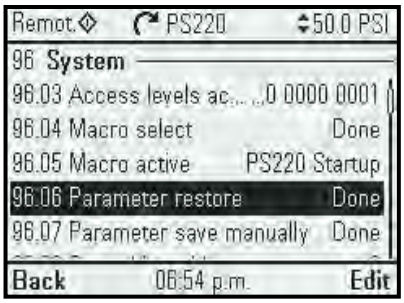
"Select"

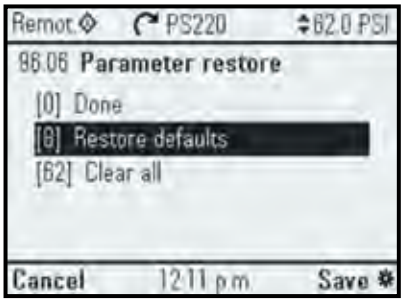


"Yes"

2. Exit the Wizard

3. Clear all Parameters
From the Home Screen follow the path: MENU>Parameters>Complete List> ARROW UP to "96 System">Select>





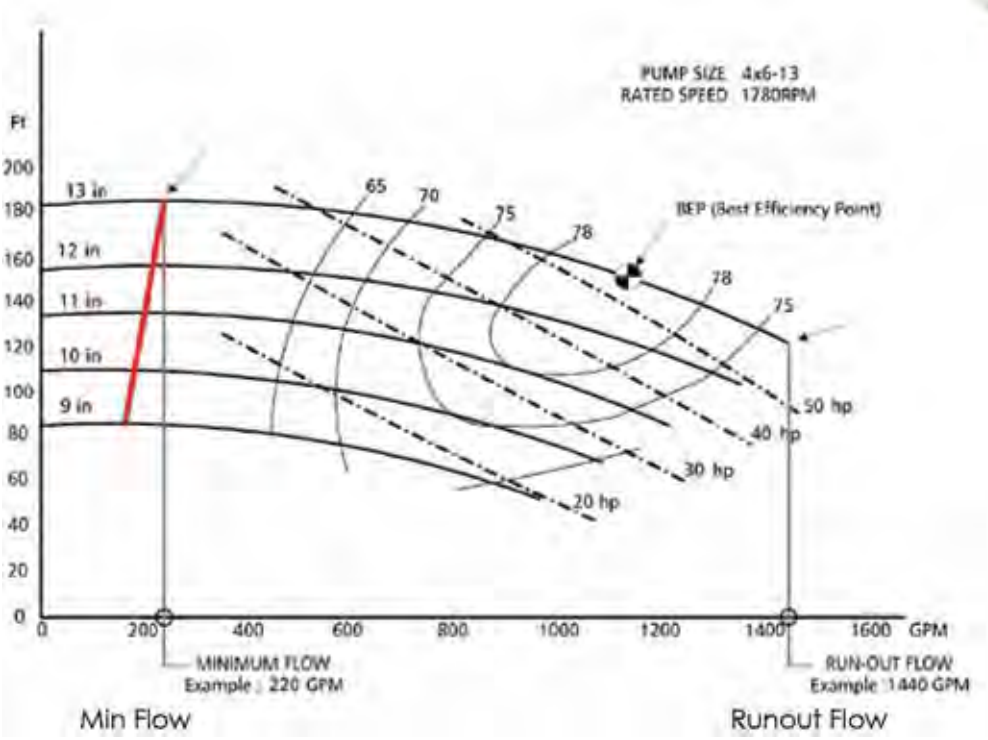
1. “Arrow Down” to 96.06
2. “Edit”
3. “Arrow Down” to “Clear All”
4. “Save”
5. Wait
6. “Edit”
7. Arrow Up to “Restore defaults”
8. “Save”
9. Wait until home screen returns
10. Power cycle the PS220
11. Wait 1 Minute to restore Power.
12. Reconfigure the PS220

Runout/Runout Control

When a pump produces flow well beyond the Best Efficiency Flow rate that it was designed for it is referred to as Runout. The NPSHa (Net Positive Suction Head Available) is usually less than the NPSHr (Net Positive Suction Head Required) at this operating condition which can lead to severe damage to pump internals and the suction piping system. A conservative estimate for a runout condition to occur is at 110-125% of the Best Efficiency Point Flow [BEP Flow].

The PumpSmart PS220's only response when using the Advanced Protection is to provide a warning.

The graphic depicts both Minimum Flow and Runout Flow on a typical pump performance curve.



The Runout Control Function can be configured with the PumpSmart PS220 Configuration Wizard.

To access this Wizard from the Home Screen, follow the path: Menu>PS220 Configuration>Pump & VFD Protection>Pump Protection>No> Yes or No>Scroll down to Runout Ctrl>

Safe Torque Off Detection

The PS220 is equipped with two on board Safe Torque off inputs that are located on the control board. Alternatively, the optional module FSO-12 or FSO-21 can be used if added protection is desired or if local electrical standards require an external module.

You can also implement the motor thermal protection circuit with or without an FSO safety functions module. The FSO safety functions module (FSO-12 or FSO-21) is an optional device used with the PS220 drives to implement safety functions. When installed, it reserves the standard STO connection of the drive. In this case, the FSO module activates the STO function of the drive (opens the drive STO circuit) either immediately or after a deceleration ramp.

The drive monitors the status of the Safe torque off input, and parameter 31.22 selects which indications are given when the signals are lost. The parameter does not affect the operation of the Safe torque off function itself. For more information on the Safe torque off function, see the basic wiring diagram in appendix A-4 or refer to the ABB ACS880 Hardware manual.

Parameter	Name	Value/Range	Notes
31.22	STO Indication	Fault / Fault [default] Fault / Warning Fault / Event Warning / Warning Event / Event No Indication	Selects which indications are given when one or both Safe torque off (STO) signals are switched off or lost. The indications also depend on whether the drive is running or stopped when this occurs.

Note:

1. You cannot connect the temperature sensor directly to the FSO module. You must use an ATEX-compliant protection relay in between.
2. Jumpers are installed at the factory between OUT1 and In1 and OUT1 and In2. If using the safe torque –off, remove the jumpers and replace with appropriate contact blocks or safe torque – off switch.
3. Both inputs must be closed for drive to run the motor. See the Pic below:

Scalar Test/Control

Scalar Test/Control

Scalar control is a motor control method that does not rely on motor feedback when the standard ABB ACS880 drive is running. This control mode can only be used as a method to diagnose electrical faults associated with the "Load-Side" or the motor connections of the drive. The PS220 may not function properly using this Motor Control Mode.

The "Scalar Test" will need to be performed in order to determine:

1. There may be a faulty component in the base ABB ACS880 Variable Frequency Drive (VFD).
2. There is an electrical problem with either the Motor connection or the Motor itself.

Typical examples of these faults will be:

1. Overcurrent
2. Motor Phase
3. Short Circuit
4. Earth Leakage
5. IGBT Overload

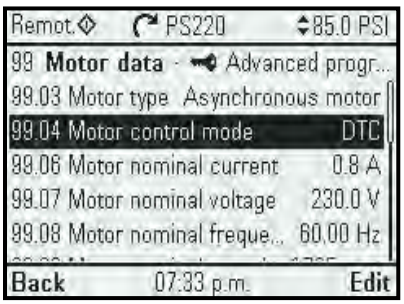
The Scalar Test will require the following steps to be performed.

1. Power down the drive.
2. Disconnect all of the Motor leads and the ground from the PS220.
3. Power up the drive.

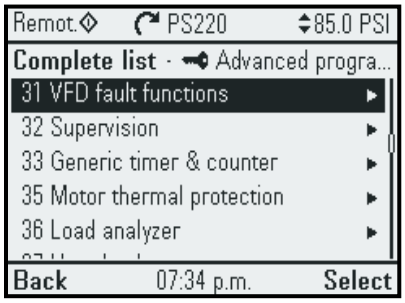
When the power is restored, and the display shows the Home View:

1. Access Parameter Group 99.

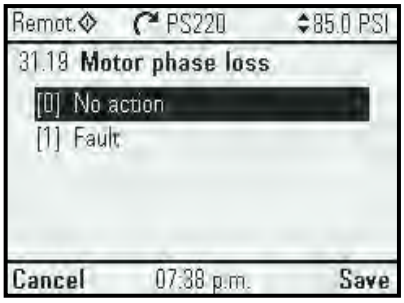
2. Configure Parameter 99.04 to Scalar.



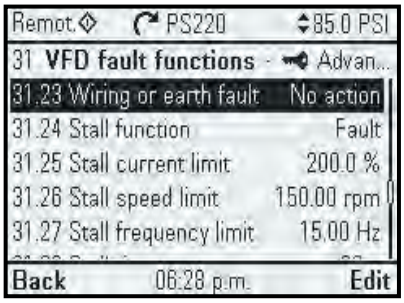
3. Access Parameter Group 31, VFD Fault Functions.



4. Configure Parameter 31.19 "Motor Phase Loss" to "No action".



5. Configure Parameter 31.23 "Wiring or earth fault" to "No action"



6. Return to the Home View.
7. Switch to "Local" control.
   Please refer to the "Local/Control" section in the manual if you may need more information on this topic.
8. Press the Green "Start"
9. Set the reference speed to Full Speed"
10. Let the drive run for an "extended" period of time.

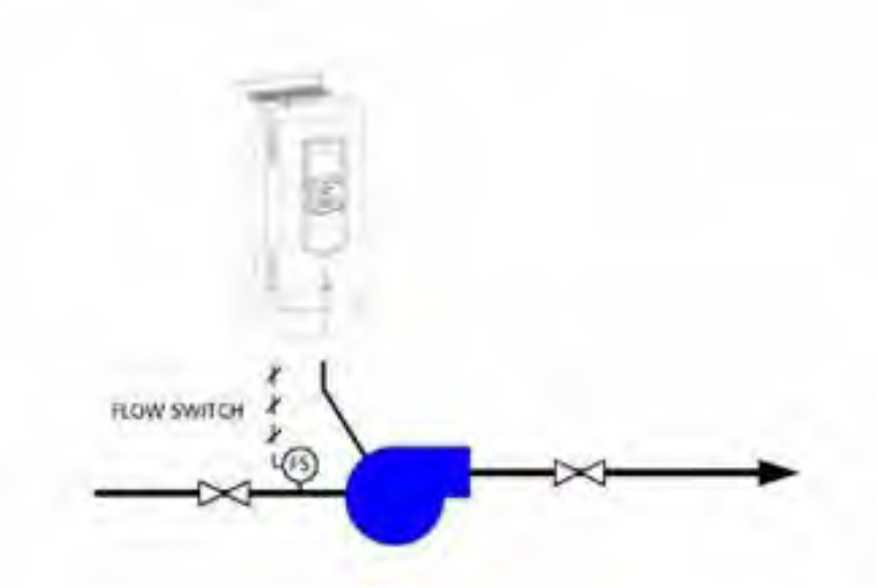
Observations expected:

1. Should the drive fault off with the same message or messages as prior to running this test, the most likely problem is with the internal components of the drive. Contact your local ITT Gould's Pumps Sales Engineer for further assistance.
2. Should the drive run to the speed commanded with no faults or warning messages. The problem is either with the Motor or the Motor connections or both. Contact an Electrician.
   Perform a "Megger Test" on the motor and/or a continuity test on the motor leads. The Meter used should have the capability of stressing the winding with 1600Volts.

When the Test is completed, reconfigure the settings changed in steps 2, 4 and 5 to the original values of Scalar, Fault, and Fault respectively and return the drive to Remote control.

Secondary Protection

Secondary Protection uses the PumpSmart PS220's onboard Digital Input connections. There are two that are available to be used with this function. Externally connected devices, such as flow, pressure, and level switches, and "Dry-Contact" outputs devices such as a PLC and DCS can be configured for use with this protection. They can be used as type of a permissive or "Go-No Go" providing inter-lock capabilities with the pumping system.



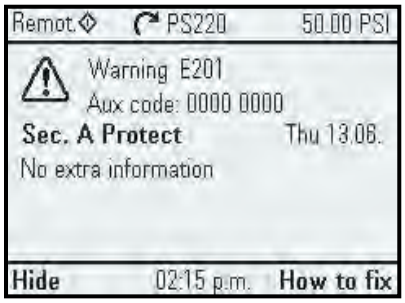
This functionality can be configured with the PumpSmart PS220 Configuration Wizard. To access this Wizard from the Home Screen, follow the path: Menu>PS220 Configuration>Pump & VFD Protection>Secondary Protection>

The individual steps that will be performed are:
1. Configure the use of Secondary Protection A or B or both.
2. Configure the Protection Response. See the table below for
.
The selection choices are:
1. Disabled
Protection is disabled

2. Alarm
The PS220 generates a warning only "Secondary Protect A". No further action is taken.

3. Alarm and Control
The PumpSmart PS220 will indicate a "Secondary Protect A" warning message, after the response delay time has expired. The event will be stored in the Event Log. The PS220 will then respond based on the Protections Options.

NOTE:
This message may appear as you configure this function with the Wizard. Select "Hide" and continue. This message is the result of the Digital Input is showing "Open". It may be wired incorrectly, or the device is in an "Open-state". This is quite normal. Select "Hide" to continue.



3. Configure the Digital Input to be used.
Notes:
Digital Input 4 (DI4) is the recommended selection for Secondary Protection A
Digital Input 5 (DI5) is the recommended selection for Secondary Protection B

Please refer to the "Protection Options" in this manual for the details of the responses available with Secondary protection

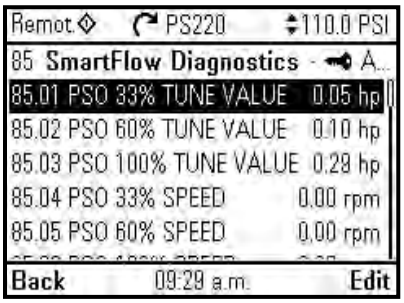
Any unused Digital Input (DI) can be configured for use with this function. Please check the settings of the Digital Inputs currently in use by going to: Menu>Parameters> Complete List>Scroll down to Group 76> Select and View 76.09 through 76.14. If available "NOT SELECTED" will be displayed. An Extension Card will need to be added and configured if they are all in use.

The Table below list all of the Parameters used with the Secondary Protection Wizard functionality. Parameters may be manually configured if required for a particular application.

GROUP 76	ANALOG I/O CONFIG	DESCRIPTION
76.09	DI1	Selects the Digital input 1 function
76.10	DI2	Selects the Digital input 2 function
76.11	DI3	Selects the Digital input 3 function
76.12	DI4	Selects the Digital input 4 function
76.13	DI5	Selects the Digital input 5 function
76.14	DI6	Selects the Digital input 6 function
76.15	DIO1	Selects whether DIO1 is used as a digital output or input, or a frequency input.
76.16	DIO2	Selects whether DIO2 is used as a digital output or input, or a frequency input.
79.14	SECONDARY PROTECT A	Loss of the Digital Input configured for this Function.
	DISABLED [DEFAULT]	Protection is disabled
	ALARM	The PS220 generates a warning only "Secondary Protect A". No further action is taken.
	ALARM AND CONTROL	The PumpSmart PS220 will indicate a "Secondary Protect A" warning message, after the response delay time has expired. The event will be stored in the Event Log. The PS220 will then respond based on the Protections Options
79.15	SECONDARY PROTECT B	Loss of the Digital Input configured for this Function.
	DISABLED [DEFAULT]	Protection is disabled
	ALARM	The PS220 generates a warning only "Secondary Protect B". No further action is taken.
	ALARM AND CONTROL	The PumpSmart PS220 will indicate a "Secondary Protect B" warning message, after the response delay time has expired. The event will be stored in the Event Log. The PS220 will then respond based on the Protections Options.

Shutoff Power

The PS220 has the ability to automatically calculate the power at "Shutoff" for the pump that will be used. This value is captured when the Smartflow Tuning Function is executed. This value is stored in Parameter 85.03 PSO 100%. To view this value from the Home View, follow the path: Menu>Parameters>Complete List> Scroll Down to Group 85> See the screen shot below:



This value should be used during Smartflow Configuration. Most performance curves do not have an accurate value for the data needed for Parameter 77.06 SO POWER. Once the first tune is completed, access 85.03 and then use this number and enter this value in place of the existing one previously entered in 77.06. Execute another Smartflow Tune. This will substantially improve the accuracy of the Smartflow values displayed when the pump is running.

Signal Supervision Process Sensor Failure

If any Analog Transmitter connected to the PS220 fails, the unit can be configured to react based on the settings available. The default for this option is "No-Action".
The available choices are as follows:

1. NO ACTION – The PS220 will continue to run. Based on how the signal has failed it will either stop or go to full speed.

2. FAULT - The PS220 will fault and stop. This fault can be automatically reset. Refer to section on Automatic Reset -VFD Faults & Process Sensor Fault.

3. WARNING – The PS220 will issue a warning message and continue to run. Based on how the signal has failed it will either stop or go to full speed.

4. LAST SPEED – The PS220 will issue a warning message and continue to run at the last speed it was running when the sensor failed.

5. SPEED REF SAFE – The PS220 will issue warning and run at the speed defined by parameter 22.41 "Speed ref safe". "Speed Ref Safe" by Default is 0.

You can further define the failure values (above and below the default values) for these reactions to occur and how you want to drive to react to the failure mode of low, high or both. These reactions can be independent for each AI used for individual sensors attached. See the Parameter Groups 12 and 32 below for recommended settings.

Selecting the choice of "NO Action" may result in running a pump up to full speed. If using the Multipump functionality it may run all of the additional pumps that have start commands initiated to try to regulate to the process setpoint.

<table>
<tr><th>Parameter</th><th>Name</th><th>Value/Range</th><th>Notes</th></tr>
<tr><td>12.03</td><td>ANALOG INPUT SUPERVSION FUNCTION</td><td>NO ACTION [default]
FAULT
WARNING
LAST SPEED
SPEED REF SAFE</td><td>Defines action taken upon failure of an analog input. Failure messages indicate which input channel has failed.
RECOMMENDATION IS FAULT</td></tr>
<tr><td>12.04</td><td>AI SUPERVISION SELECTION</td><td><table><tr><th>Bit</th><th>Fault trigger</th><th>default</th><th>Setting</th></tr><tr><td>0</td><td>AI1<MIN LIMIT</td><td>0</td><td>**</td></tr><tr><td>1</td><td>AI1>MAX LIMIT</td><td>0</td><td>**</td></tr><tr><td>2</td><td>AI2<MIN LIMIT</td><td>0</td><td>**</td></tr><tr><td>3</td><td>AI2>MAX LIMIT</td><td>0</td><td>**</td></tr></table></td><td>Each corresponding bit allows selection of minimum and maximum limit supervision. User may enable/disable each of the limit types.

** = RECOMMENDATION IS FOR ALL BITS TO BE CONFIGRED HIGH (1 vs 0) FOR ANY AI CONNECTED</td></tr>
</table>

Parameter	Name	Value/Range	Notes
32.05	Supervision 1 Function	Both	Monitors both the Lower and Upper limits of the Analog Signal selected
32.06	Supervision 1 Action	Fault	Faults the PS220 when either signal reaches the thresholds noted in 32.09 and 32.10
32.07	Supervision 1 Signal	AI1 (If Used)	The AI used
32.09	Supervision 1 Low value	3.8	Any value below this threshold will trigger supervision
32.10	Supervision 1 High value	20.2	Any value above this threshold will trigger supervision
32.15	Supervision 2 Function	Both	Monitors both the Lower and Upper limits of the Analog Signal selected
32.16	Supervision 2 Action	Fault	Faults the PS220 when either signal reaches the thresholds noted in 32.09 and 32.10
32.17	Supervision 2 Signal	AI2 If Used)	The AI used
32.19	Supervision 2 Low value	3.8	Any value below this threshold will trigger supervision
32.20	Supervision 2 High value	20.2	Any value above this threshold will trigger supervision

Setpoints - Dual

The PumpSmart PS220 can be configured to use two separate and distinct setpoints, or references. The Set-point methods or references can be configured in the same fashion that are described in the Reference section.

For Process PID Control:

This functionality is the last step in the Process Control Wizard. The PS220 will require a selection to be configured to toggle between the two setpoints.
The choices are:
1. Digital Input 3. See note 3 below.

2. A Fieldbus command. See note 3 below.
   This can only be selected if Fieldbus is the Primary setpoint source. .

To access this Wizard from the Home View, follow the path:
Menu>PS220 Configuration>Process Control>Process Control Mode> (SEE NOTE BELOW) NOTE: Please remember your selections when proceeding though this wizard to configure the dual setpoint functionality!

Next>Select>Select>Select>Next>Select>Yes>

The steps that you will follow are:
1. Configure the source for setpoint 2.
2. Configure the method to activate Setpoint 2.
3. Configure DI3 with the I/O Wizard. This is only required if DI3 is not selected in step 2.

Note:
1. Dual Set-points configuration for Speed Control cannot be done with the PS220 Configuration wizard. This functionality will need to be configure manually. Follow the procedure as noted below.
2. Dual Set-points for use with the MultiPump Functionality will require the Digital Input used to be wired "In-Series" with all of the drives.
3. The source for both setpoint 1 and 2 must be the same. Selecting Keypad for Setpoint 1 and an Analog Input or Fieldbus for Setpoint 2 is not an available option.
4. This functionality cannot be used with a Start/Stop selection that requires the use of DI3. Example: HOA DI1, 2 - DI5.

For Speed Control:

This procedure configures the PS220 keypad to set the speed reference for Setpoint 1 and for Setpoint 2. The steps required as follows:

1. Configure the PS220 for Basic Startup and end with Basic Drive Setup. From the Home screen view, follow the path: Menu>PS220 Configuration>Basic Startup>Basic Drive Setup>

2. Exit the assistants and go to group 22 (Speed reference selection): Follow the path: Menu>Parameters>Complete List> Arrow down to Group 22>Select> Arrow down to: 22.11.

3. Configure 22.11 (speed Ref1 source) to "03.51- IEC Panel Reference"
    1. "Edit",
    2. "Arrow Down" to "Other"
    3. "Arrow Down" to 03 Input references
    3. Select"
    4. "Arrow Down "to 3.51 IEC panel reference.
    5. Save""
    6. "Arrow Down"

4. Configure 22.12(Speed Ref2 source) to "3.01 Panel Reference"
    1. "Edit",
    2. "Arrow Down" to "Other"
    3. "Arrow Down" to 03 Input references
    3. Select"
    4. "Arrow Down "to 3.51 IEC panel reference.
    5. Save""
    6. "Arrow Down" 2 times.

5. Configure 22.14 to "DI3" or any other available Digital input.
    1. "Arrow Up to the DI to be used"
    2. "Save"
    3. "Back" 3 times.

6. Configure the Digital Input selected in step 5 with the PS220 Configuration Wizard. This will be choice (7) when using the PS220 I/O Configuration Wizard.

7. Set min and max speed in group 30, if this has not been done previously, and then Start the PS220. Cycling the Digital Input for the first time will have it run at Min speed until the reference is changed and saved. The PS220 will then remember the 2 setpoints when cycling the Digital Input.

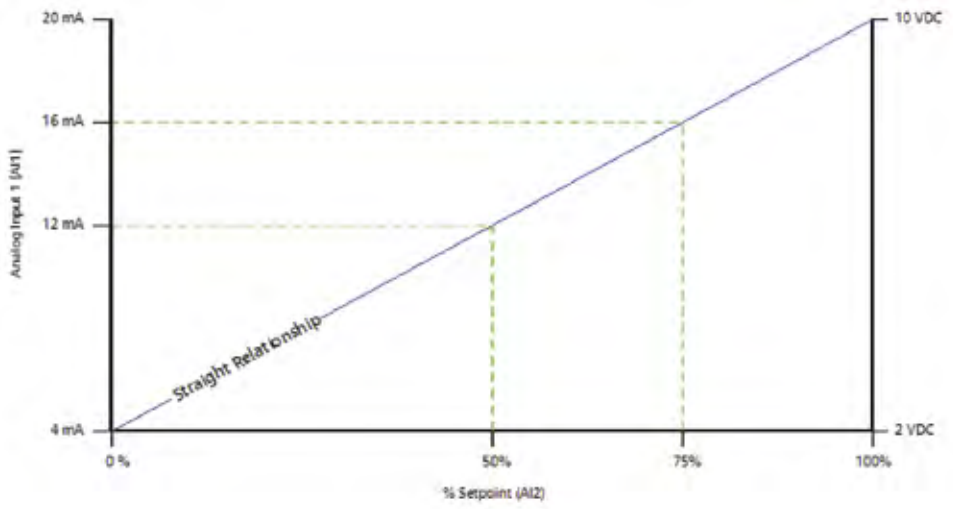
2. There is a separate/different configuration procedure for using any Analog input for Reference 2

The table below shows that Digital Input 3 is defaulted to be used for the Dual Setpoint Function

Parameter	Name	Value/Range	Notes
76.11	DI3	DUAL STPT SEL	This is the Default setting for this parameter. This selection will use setup digital input DI3 to toggle between set-point 1 and set-point 2. DI3 low is Setpoint 1; DI3 High is Setpoint2. Any available DI can be used for this function. DI3 is the default. For Multipump this MUST BE WRIED IN SERIES between all drives.

EXAMPLE: Process Control PID with the primary 4- 20 mA Transmitter wired to AI1 with the primary set point, which can be varied wired to AI2. Either Analog Input can be either Current or voltage.

Parameter	Name	Value/Range	Notes
76.01	AI1 CONFIG	Proc Trans 1	control
76.02	AI2 CONFIG	*EXT T Setpoint*	AI2 used for EXT 1 Setpoint (It can be varied)



Note: The effect is a straight relationship with the maximum set-point value corresponds to the maximum signal [i.e. 20 mA or 10 VDC] while the minimum set-point value corresponds to the minimum signal [0/4mA or 0/2 VDC].

Sleep

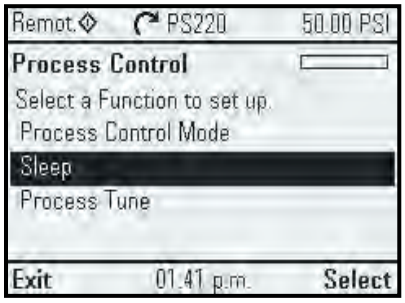
Sleep is a function that that can be configured on the PS220 that will allow the pump to automatically stop pumping while still completely satisfying the process control function assigned to it. This onboard logic will prevent pumping at "Deadhead" or below minimum flow of the pump. It will automatically restart to maintain the pumping systems setpoint.

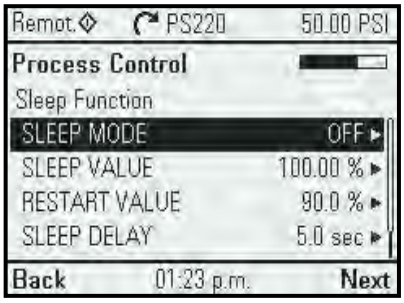
The choices available for this function are:

1. Off
2. Min Speed (default)
3. Intelligent Sleep

The Sleep function can be configured with the PS220 Configuration Wizard. From the Home View follow the path: Menu>PS220 Configuration>Process Control >Sleep>

1. When choosing off, the Sleep function is disabled. When the demand in the system decreases, the pump will continue to run down to the minimum speed set in parameter 30.11. A "Dead Head" test is strongly recommended to be performed to correctly set the minimum speed. Refer to the section for "Dead Head" in this manual.

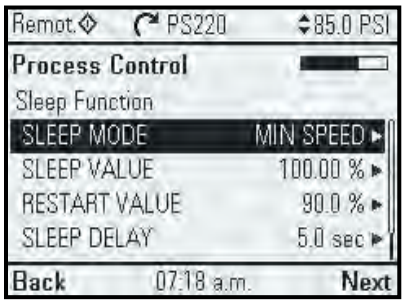


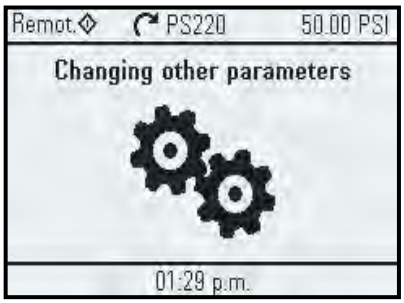


2. Min Speed is the default setting. When set properly the drive will sleep as described above. With this choice the pump will Sleep when the 3 values of "Sleep Value", "Minimum Speed", and the "Sleep Delay" have all been achieved. A Dead Head test is strongly recommended to be performed to correctly set the minimum speed. Min Speed Sleep is not recommended for Level Control applications.

Note

When using "Minimum Speed" in the "Alarm & Control Pump Protection Response" the Minimum Sleep is not a functional choice. "Intelligent Sleep" will need to be configured.

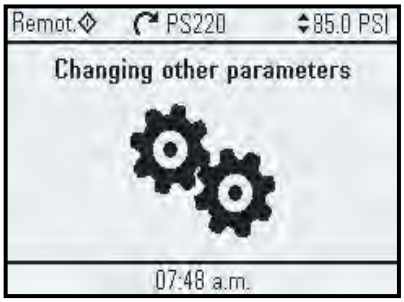




When selecting Min Speed, the "Meshing Gears" animation will be displayed.

3. Intelligent Sleep. This selection will utilize the pumps minimum flow value from an external flow meter, or from SmartFlow. With this choice the pump will Sleep when the values of "Sleep Value", "Minimum Flow", and the "Sleep Delay" have all been achieved. The PS220 will use internal logic to correctly determine the minimum flow as speeds change.

When selecting Intelligent Sleep, the "Meshing Gears" animation will also be displayed.



Additional Wizards noted below may need to be run when configuring the Intelligent Sleep selection to function correctly.

1. SmartFlow Wizard if being used for this value for flow.
2. Pump & VFD Protection Wizards if an external flowmeter is used that is not the primary process control transmitter selected previously.

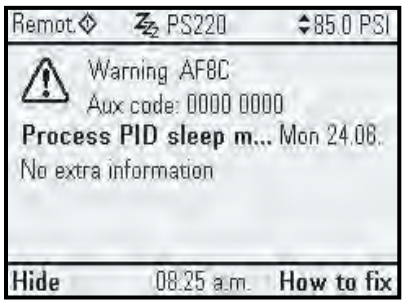
The Sleep Function will require that the following parameters to be configured:
1. Sleep Value
100% is the default value. This is the actual value as a percentage of the process setpoint that the system will need to read before the sleeping logic will work. It can be adjusted.

2. Restart Value
90% is the default value. This is drop in actual value of the process, as a percentage of the process set-point, that the system will need to read before it can "Wake-Up" and pump again. It can be adjusted.

4. Sleep Delay
5 Seconds is the default value. This is the time value that the system will need to wait before it will go to sleep after the "Sleep Value" and either "Min Flow" or "Min Speed" have been achieved. It can be adjusted.

5. Restart Delay
10 Seconds is the default value. This is the time value that the system will need to wait before it will "Wake -Up" after the "Restart Value" has been achieved. It can be adjusted.

When all the condition are met for the "Sleep" function to activate the following message will display:



NOTE:
The MultiPump control functions will only allow the Master to Sleep.

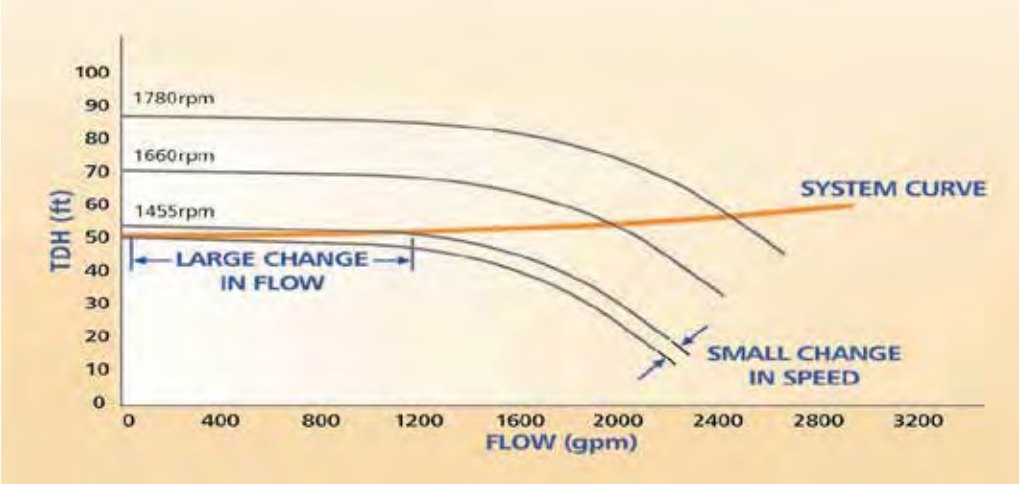
The table below lists all of the Parameters used in this function:

GROUP 75	PROCESS CONTROL	DESCRIPTION
75.02	PRIMING DELAY	The time that the drive will run at full speed to prime. All functionality except for VFD protection is disabled during this time. The range is 0 – 6000 sec
75.03	SLEEP MODE	Defines the selections for SLEEP MODE.
	DISABLED	Function is disabled.
	MIN SPEED	Pump will enter sleep mode when the both the minimum speed and the process variable is achieved. This is the default.
	INTELL SLEEP	Pump will enter sleep mode when the both the minimum flow and the process variable is achieved. The PS220 will determine the correct value proportionally based on operating speeds.
75.05	SLEEP VALUE	The percentage of the process value achieved while the PS220 runs at the minimum speed setting before entering the sleep mode. Default is 100%. Range is 0-200 Applies to 75.03 = Min Speed. The percentage of the process value achieved while the PS220 runs at the minimum flow setting before entering the sleep mode. Default is 100% of minimum flow value. Range is 0-200 Applies to 75.03 = INTELL SLEEP.
75.06`	RESTART VALUE	The percentage value of the process variable that is allowed before the drive will resume operation and restart from the sleep mode. Wake-up level in % of setpoint value = Range is 0 – 500%. The default is 10%.
75.07	SLEEP DELAY	The time delay before the Ps220 will enter the sleep mode. Range 0-1800 sec. Default is 5 seconds.
75.08	RESTART DELAY	Time delay for the PS220 to resume operation and restart from the sleep mode. Range = 0 –1800 sec. Default = 10 second

Be aware that a drive that is in sleep mode is receiving the START signal. Switching the drive to Local mode while it is asleep will immediately start the driven equipment, as sleep is not active in Local.

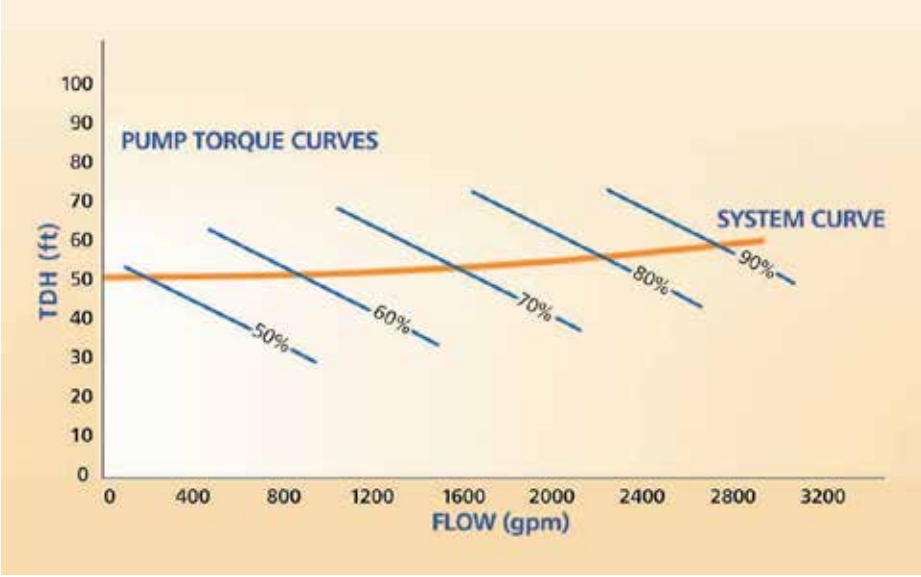
SMARTCONTROL - Torque Based Pump Control

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 fixed speed motor control, as well as a standard variable speed-controlled motor very difficult. The PumpSmart PS220 is able to increase and decrease pump flow by changing the pump torque rather than the pump speed in its PID Process Control Functionality. Controlling to pump torque can change a relatively flat pump performance curve into a steep, easy to control pump performance curve. This is Smart Control.



SMARTCONTROL

By regulating to pump torque values in lieu of speed with a traditional PID controlled system, the PumpSmart PS220's PID control will control pump flow precisely eliminating any oscillations or "hunting".
The use of this functionality allows for the PumpSmart PS220 to be used with any system that traditionally could not be controlled with a "Flat Pump Curve" & "Flat System Curve". This result of using torque is depicted in the graphic below.



The graphic above depicts how using torque changes the slope of the interaction between the Pump curve and the System curve. This allows for the precise control mentioned above.

The Smart Control functionality can only be configured with the PS220 Configuration Wizard. To access this Wizard from the Home View, follow the path: Menu>PS220 Configuration>Miscellaneous>Smart Control Parameter Settings

The steps that you will follow to configure this functionality are as follows:

1. Configure the use of Torque (SmartControl) for PID Process Control for
Both "EXT2 control mode" and "EXT1 CONTROL MODE". They both need to be configured to (3) Torque.

2. Configure the Torque Ramp up and Ramp down times.
This is the time the PS220 will use to start regulating using the PID control. 5 seconds is recommended. Both the Ramp up and Down should be set to the same value.

3. Configure the Max Torque Value.
The value shown will be the Maximum Speed of the Motor.
The value for Torque will need to be in Percent (%). This the Maximum Torque Value that the PS220 will regulate to in PID control.
It should not be set any lower than 150%.

4. Exit the Wizard.

5. Access the PS220 MultiPump Control Wizard.
NOTE: This step is not required for single Pump Smart Control.

Configure the Stage and De-stage values to the values as shown in the table below. Only configure the values for the total number of pumps in use in the pumping system.

Parameter	Description	Recommended Setting	Notes
81.09	Stage 2 Value	75%	Validate during commissioning
81.10	Stage 3 Value	75%	Validate during commissioning
81.11	Stage 4 Value	75%	Validate during commissioning
81.17	Stage 5 Value	75%	Validate during commissioning
81.18	Stage 6 Value	75%	Validate during commissioning
81.13	De-Stage 2 Value	65%	Validate during commissioning
81.14	De-Stage 3 Value	70%	Validate during commissioning
81.15	De-Stage 4 Value	75%	Validate during commissioning
81.21	De-Stage 5 Value	80%	Validate during commissioning
81.22	De-Stage 6 Value	85%	Validate during commissioning

TO "TURN OFF" Smart Control, reverting to Speed PID Control, you will follow the identical steps noted above and configure the settings as follows:

1. Configure the use of Speed for PID Process Control
Configure both "EXT2 control mode" AND "EXT1 CONTROL MODE" to SPEED.

2. Configure the Speed Ramp up and Ramp down times.
Configure both values to 0 Seconds.

3. Configure the Max Speed Value.
Configure the Max Speed value to the Motor Slip Speed used in Basic startup. You may view this in Parameter 99.09 to ensure that the correct value will be used.
4. Exit the Wizard

5. Access the PS220 MultiPump Control Wizard.
Re-Configure the Stage and De-stage values to the values as shown in the table below. Only configure the values for the total number of pumps in use in the pumping system.

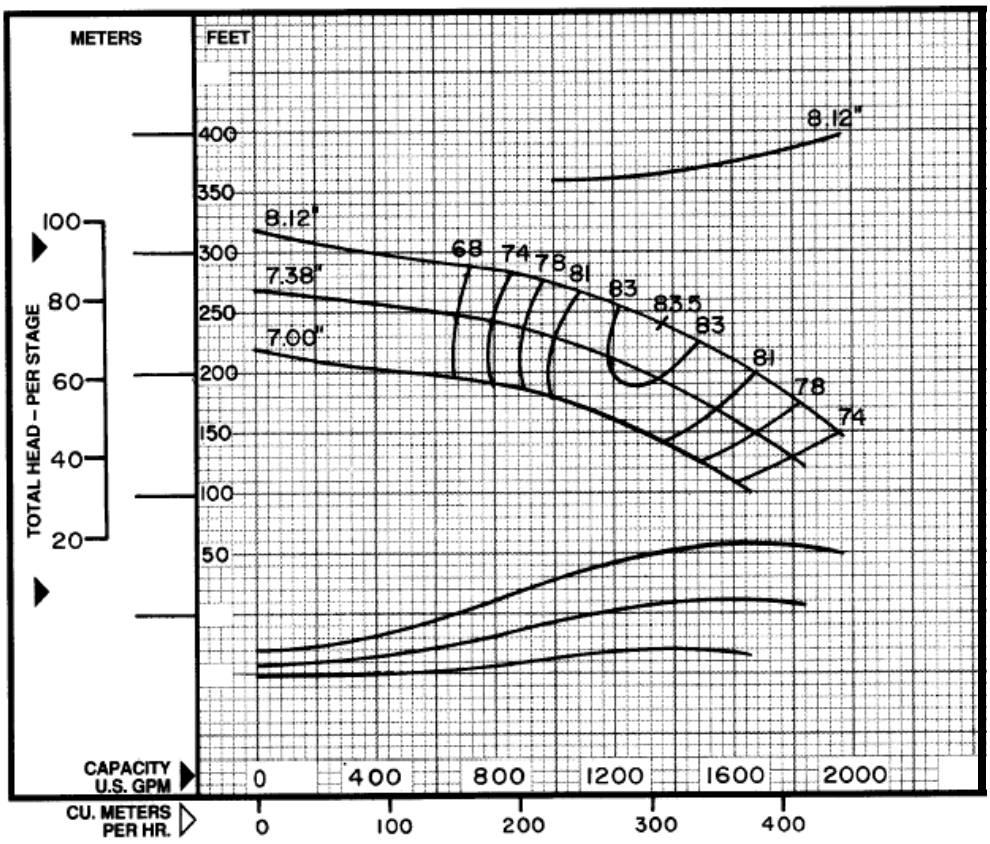
Parameter	Description	Recommended Setting	Notes
81.09	Stage 2 Value	98%	Default setting
81.10	Stage 3 Value	98%	Default setting
81.11	Stage 4 Value	98%	Default setting
81.17	Stage 5 Value	98%	Default setting
81.18	Stage 6 Value	98%	Default setting
81.13	De-Stage 2 Value	75%	Validate during commissioning
81.14	De-Stage 3 Value	80%	Validate during commissioning
81.15	De-Stage 4 Value	85%	Validate during commissioning
81.21	De-Stage 5 Value	90%	Validate during commissioning
81.22	De-Stage 6 Value	92%	Validate during commissioning

Smartflow

Basic SmartFlow

The PumpSmart PS220 utilizes a complex algorithm that will calculate the actual flow of the pump. External sensors are not required with Basic SmartFlow. Any manufacturers pump will work with Smartflow.
Basic SmartFlow is designed for low to medium specific speed pumps, under 3000NS. A pump with a specific speed under 3000 will have the following characteristics.

1. Power rises as flow increases with no “dips or bumps” in the power curve.
2. The power value at shut off is at least 20% less than the power at BEP (Best Efficiency Point).



1. To Configure Basic SmartFlow the following steps will be performed:

1. Configure the Flow Unit

The SmartFlow unit selection identifies what units SmartFlow will display in. It also will be used for providing the necessary Pump Protection and input to other internal functions when required.

Note:

The SmartFlow unit can be set independently from units that may have already been used for the language selected at first startup.

2. Configure the Pump Specific Properties

1. Configure the Pump Type

The choices are:

SS Centrifugal – Single Suction Centrifugal
DS Centrifugal – Double Suction Centrifugal
Mag Drive – Magnetically Driven Pump

Metal or Nonmetallic

Magnetically driven pumps with metallic containment shell select Mag Drive. For non-metallic shells select SS Centrifugal as the Pump Type.

PD Pump – Positive Displacement (Gear Pump)

2. Configure the BEP FLOW value.

This is the Best Efficiency Flow value form the pump curve.

3. Configure the PUMP RATED SPEED value.

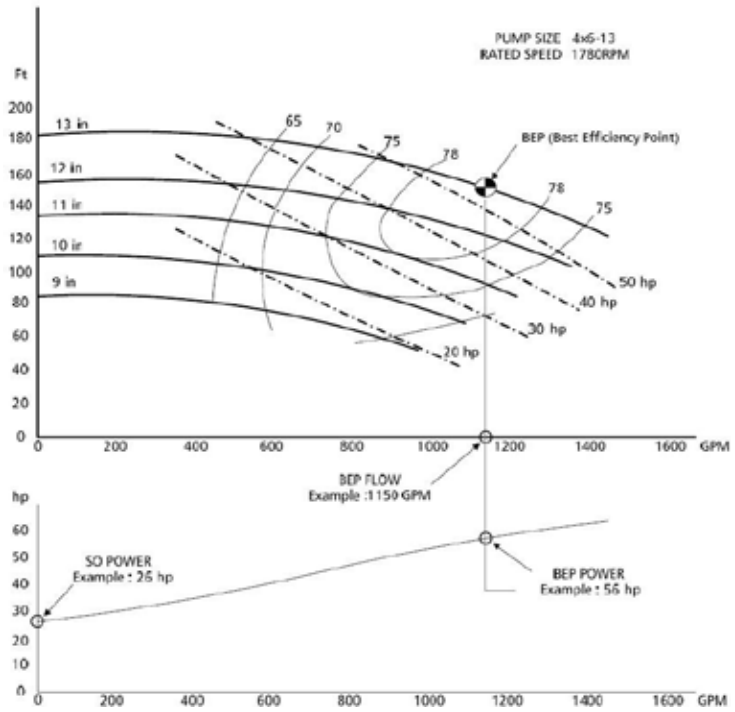
4. Configure the BEP POWER value.

This is the Best Efficiency Power value from the pump curve at the rated diameter of the impeller.

5. Configure the SO POWER value.

This is the Shutoff Power value from the pump curve at the rated diameter of the impeller. When running the Tune function this value can be viewed and updated for better accuracy.

The information required for the configuration steps above can be found on a Manufacturers Pump Performance Curve. See the chart below as an example of a typical Pump Performance Curve.



3. Configure Fluid Specific Gravity
Please refer to Specific Gravity section in this manual for the detailed information required to complete this step.

4. Execute a Smart flow Tune
Please refer to the Smartflow Tune section in this manual for detailed information on how to execute this step.

5. Exit the Wizard

Note:
1. The RATED SPEED must be less than or equal to the setting in parameter 30.12 (Maximum Speed) or you will need to adjust this parameter to allow the tune function to work properly.
2. All values entered need to be at Specific Gravity (SG) 1.0 or water-like.

Advanced SmartFlow

For pumps that do not meet the criteria for Basic Smartflow the Advanced SmartFlow function configuration will be required. This will require added instrumentation to provide the necessary running feedback to the PumpSmart PS220 and additional pump and pumping system information. The configuration Wizard will guide you through this step by step.

Basic & Advanced SmartFlow limitations
1. Dynamically changing specific gravity values must be provided to PumpSmart. This can be done using a digital input, an analog input, or a temperature input. Please refer to the Specific Gravity section for the details on the SG correction methods available.
2. A stable Specific Gravity of +/- 5% will not require any corrections.
3. If the values from the performance curve have been corrected for a SG value other than 1.0 do not use these values. Refer to the procedure for Smartflow tune in this manual.
4. SmartFlow cannot not be used with viscous fluids that have a viscosity greater than 20 CP.

The Basic SmartFlow functionality can be configured with the PumpSmart PS220 Configuration Wizard.

To access this Wizard from the Home Screen, follow the path: Menu>PS220 Configuration>SmartFlow>

To Configure Advanced SmartFlow the following steps will be performed:

1. Configure the Flow Unit (Same as Basic)
2. Configure the Pump Specific Properties (Same as Basic)
3. Configure the Calculation Method (Specific for Advanced)
4. Configure the Pumping System Information (More Info Required)
5. Configure Transmitter(s) and Analog Input(s) (More info required)
6. Configure Fluid Specific Gravity (Same as Basic)

Notes:
1. Steps 1, 2, & 6 will not be shown as they are identical to the Basic Smartflow configuration. These steps are not shown below. Please refer to Basic Smartflow for additional detailed information or you can start with the Basic Smartflow Configuration Wizards and add these steps as you progress.
2. These additional steps are also required to configure the use of Smart TDH

1. Configure the Flow Unit (Same as Basic)
2. Configure the Pump Specific Properties (Same as Basic)
3. Configure the Calculation Method

Selections available:

1. Brake Horsepower/Total Dynamic Head (BHP/TDH)
This choice will calculate the SmartFlow flow value using a combination of the BHP and TDH. This should be used if the power curve has “dips or bumps”. See Smartflow limitations

2. Total Dynamic Head. (TDH)
Not a valid option for Advanced Smartflow

Both choices will calculate flow utilizing the differential pressure of the system. This should be used if your power curve is very flat. See Smartflow limitations.

NOTES:
1. Both choices will require either a Differential Pressure transmitter (Discharge-Suction) or separate Suction and Discharge transmitters.
2. BHP is shown on the screen below, however, it is but is NOT A VALID OPTION.

4. Configure the Pumping System additional Information.

Notes:
1. Please note the “Units of Measure” required for each step below.
2. See the figure below to locate these values depicted on a typical pump curve.

1. Configure the PATM.

This is the local barometric pressure at the location of the pump. (14.7 psi is normal)

2. Configure the BEP TDH

This is the Total Dynamic Head at the Best Efficiency Flow, at the rated speed, of the Pump.

3. Configure the SO TDH.

The pump Total Dynamic Head at the Shut Off (zero flow) condition at rated speed.

4. Configure the SUCTION DIA.

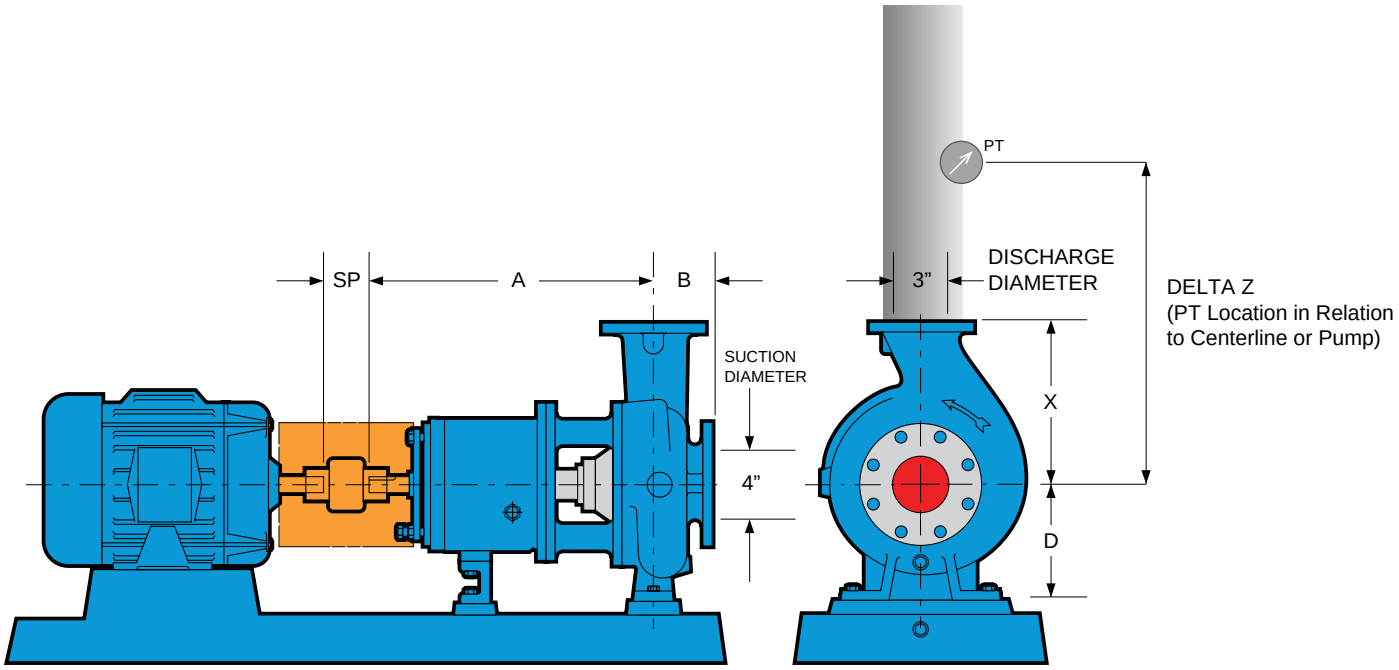
The pumps Suction Flange Diameter.

5. Configure the DISCHARGE DIA.

The pumps Discharge Flange Diameter.

6. Configure the DELTA Z.

This is the dimension of the discharge pressure gauges height above the centerline of the pumps centerline of piping.



5. Configure the Transmitter(s) and the associated Analog Inputs to be used for the TDH calculations.

A. For the Discharge Transmitter

1. Select the Analog Input that will be used.
2. Configure the Analog Input for use as Discharge pressure.

If you have already configured a discharge transmitter with the Process Control Wizard, please select "PROC TTANS 1" and skip to step B below. You will not have to reconfigure the use of this transmitter.

3. Configure the Minimum and Maximum scaled values.
4. Configure the Unit of measure for the transmitter

B. For the Suction Transmitter

1. Select the Analog Input that will be used.
2. Configure the Analog Input for use
3. Configure the transmitter will read in Gauge or Absolute pressure.
   Gauge pressure does not correct for the local Barometric pressure.
4. Configure the Minimum and Maximum scaled values

NOTE:

An unused Analog Input (AI) will need to be used for either of these 2 choices in step 5 to function correctly. Please check the settings of the Analog Inputs currently in use by going to: Menu>PARAMATERS> Complete List>Scroll down to Group 76>Select and View 76.01&02. If available "NOT SELECTED" will be displayed. You may have to add an Extension Card to use additional inputs.

6. Configure Fluid Specific Gravity (Same as Basic)

Please refer to Specific Gravity section in this manual for the detailed information required to complete this step.

7. Execute a Smart flow Tune (Same as Basic)

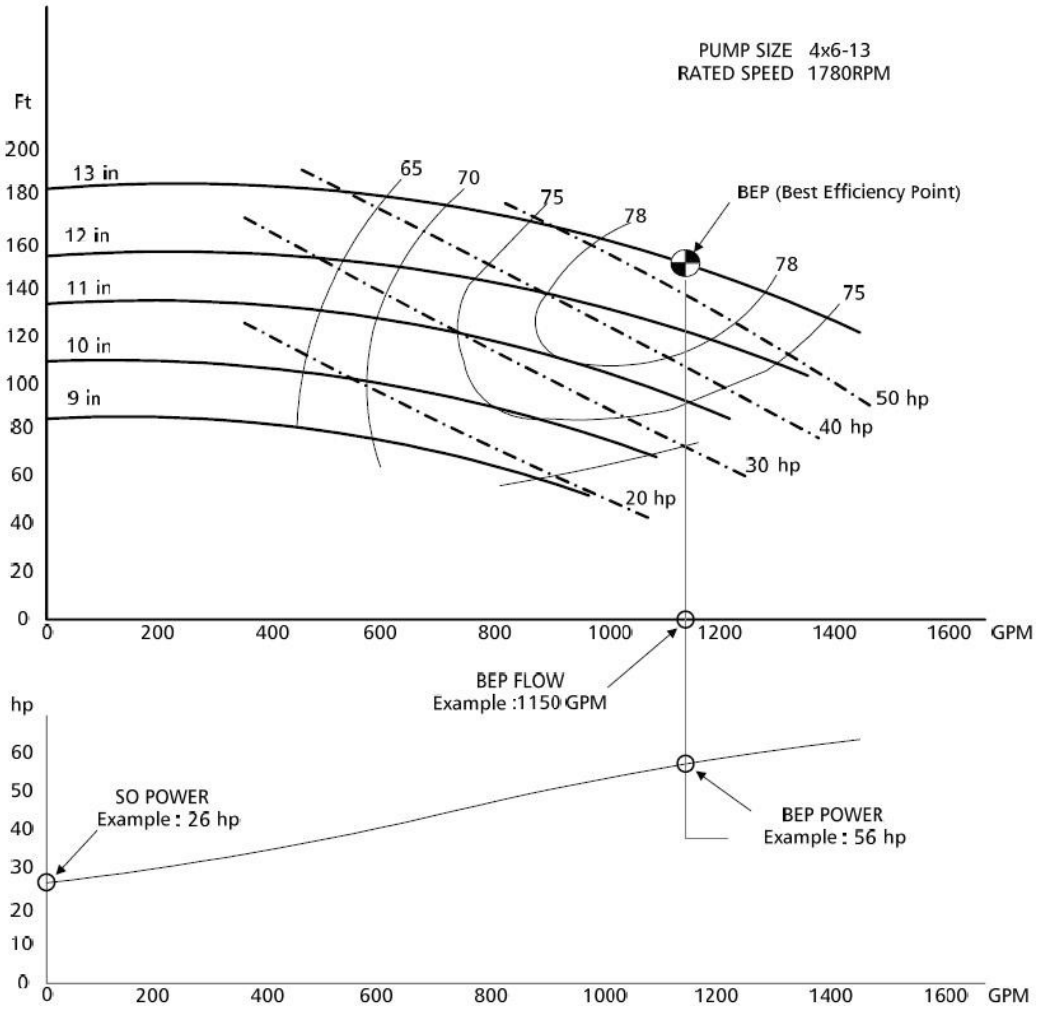
Please refer to the Smartflow Tune section in this manual for detailed information on how to execute this step.

8. Exit the Wizard

The Table below lists all of the Parameters used for both Basic and Advanced Smart Flow.
There are several parameters listed that are not used with the PS220 configuration Wizard functionality. They can be manually configured if required for a particular application. The description of these parameters are also listed in the index under Parameter Listings.

GROUP 77	SMARTFLOW	DESCRIPTION
77.01	PUMP TYPE	Defines the type of pump being used.
	DISABLED	Disables the SmartFlow function
	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
77.02	CALC METHOD	Selects the calculation method depending on the power curve shape. A suction and dis- charge transmitter or differential pressure transmitter is required for BHP/TDH and TDH
	BHP [DEFAULT]	Select BHP for a constantly rising power curve.
	BHP/TDH	Select BHP/TDH for a non-constantly rising power curve.
	TDH	Select TDH if power curve is flat.
77.03	BEP FLOW	Flow at the pump Best Efficiency Point (BEP) at rated speed. Range: 0-10,000.
77.04	PUMP RATED SPD	Speed at which pump data (QBEP, PBEP, and PSO) is entered. Range 0 – 18000 RPM Scalar mode units are Hz. Default = MAXIMUM SPEED.
77.05	BEP POWER	Power at the pump Best Efficiency Point (BEP) at rated speed. Must be at SG = 1.0. Range 0 – 3000.00.
77.06	SO POWER	Power at the pump shut-off condition (SO) at rated speed. Must be at SG = 1.0. Range: 0 – 3000.00.
77.07	BEP TDH	The pump Total Dynamic Head (TDH) at the Best Efficiency Point (BEP) at rated speed.
77.08	SO TDH	The pump Total Dynamic Head (TDH) at Shut-Off (closed valve condition) at rated speed.
77.09	SUCTION DIA	Pump nominal suction diameter. If LANGUAGE = ENGLISH (US), the units are in inches. MM for all other languages. Range 0.00 – 1000.00.
77.10	DISCHARGE DIA	Pump nominal discharge diameter. If LANGUAGE = ENGLISH (US), the units are in inches. MM for all other languages. Range 0.00 – 1000.00.
77.11	DELTA Z	The suction and discharge pressure gage height differential with respect to the Centerline of the pump. If LANGUAGE = ENGLISH (US), the units are in Ft. M for all other languages. Range 0.0 – 1000.0.
77.12	SPD RATIO	The input speed to output speed ratio. Range 0.00 – 20.00. Used for pumps with belt drives.
77.13	DP SOURCE	Identifies the configured analog input to be used for the differential pressure source.
	NOT USED [DEFAULT]	
	PROC TRANS 1	Select if using the primary process transmitter
	PROCE TRANS 2	Select if using the secondary process transmitter
	DIFFERENTIAL PRESSURE	Select if using a differential pressure transmitter.
77.14	DISC PRES SOURCE	Identifies the configured analog input to be used for the discharge pressure source.
	NOT USED [DEFAULT	
	PROC TRANS 1	Select if using the primary process transmitter
	PROCE TRANS 2	Select if using the secondary process transmitter
	DISCHARGE PRESSURE	Select if using a separate suction pressure transmitter.
77.15	SUC PRES SOURCE	Identifies the configured analog input to be used for the discharge pressure source.
	NOT USED [DEFAULT	
	PROC TRANS 1	Select if using the primary process transmitter
	PROCE TRANS 2	Select if using the secondary process transmitter
	S PRESSURE	Select if using a separate suction pressure transmitter.
77.20	CALC SO SOURCE	
	AFFINITY [DEFAULT]	Estimates power at shut-off using the affinity laws.
	TUNED VALUE	Uses the power at shut-off characteristic curve developed during the tune function.
	TUNE	A Smartflow Tune function will be required to calculate the actual SO value and to create the unique flow characteristic model used to determine Smartflow value for the pump in service.
77.22	P MAG CORR	An eddy current correction factor for magnetic drive pumps. Visible only if 77.01 TYPE = MAG DRIVE. Range: 0.00 – 100.00. If LANGUAGE = ENGLISH (US), the units are in BHP. KW for all other languages.
77.23	QACT FILTER	Defines the filter time constant for QACT. Range is 0-10 sec. Default is 1. Recommended is 5.
77.24 - 33	Various Parameters	Not used in the current Version of the software.
77.34	MECH LOSS	Mechanical loss correction factor. When losses are greater than 20%-30% of the overall pump power consumed a correction may need to be made. If LANGUAGE = ENGLISH (US), the units are in BHP. KW for all other languages. Default is 0.
GROUP 78	FLUID PROPERTIES	DESCRIPTION
78.01	PATM	The local barometric pressure.
78.02	SG SEL	Selects SG source

This is an example of a typical Pump Performance Curve.



SMARTFLOW TUNE FUNCTION

A SMARTFLOW tune function will calibrate the necessary information to compensate for mechanical losses, volumetric efficiency, casting defects, pump wear, eddy current losses, and general pump performance defects that can have an effect on the total pump efficiency that will not show up on a standard performance curve.
Once the tune function is initiated the drive will start and ramp up the motor and stop briefly to gather information at 33%, 60% and 100% of the motor nameplate speed. It will automatically stop when it has completed.

To access the SmartFlow Tune function from the home screen, follow the path: Menu> PS220 Configuration> Smartflow>Tune Smartflow

NOTE: The tune function can be run at any time.

Prior to executing the Tune function:
1. All Suction and Discharge piping should be secure and ready for Pump startup.
2. Pump and motor aligned and coupled with coupling guard intact.
3. Suction line needs to be completely flooded and all air vented from the pump.
4. Discharge valve and any bypass piping needs to be completely closed.
5. For seal-less pumps having liquid lubricated bearings consult with the manufacturer and the customer to verify if the pump can be run for 35 seconds against a closed discharge valve with the liquid that is to be pumped at the speeds noted below.

General Notes:
Notes:
1. It is recommended to set 74.01 to keypad prior to running the tune. Once completed please set this parameter back to the original setting.
2. Motor HP's above 50 HP (37KW) will not run above 60% speed.
3. The tune function will automatically fault if it does not complete in 35 seconds.
4. Pumps with motors 15 HP or less should be run for 30 minutes prior to running the tune function.
5. Acceleration rates for PID Tuning should remain at default until after running the Smartflow Tune
6. If the tune function cannot be performed the algorithm will use the affinity laws. Selecting "No" automatically uses the affinity laws in the calculations.
7. Do not run a SmartFlow Tune on any pump in a Multipump system. You will need to disable this on the PS220 connected to the pump to be Tuned and re-enable again when completed. Parameter 81.01 should be set to "DISABLED" if it was set to SYNCHRONOUS using the PS220 Multipump Wizard previously.
8. Do not try to run a Smartflow Tune on a running pump.
9. Smart Control must be off prior to the tune function.
10. All information inputted with the wizard MUST be on water with SG of 1.0 and must be tuned with water like fluid properties. If tuning on "Non-Water-Like" liquid several corrections will be needed. Please refer to the Tuning with Non Water section in the index for the proper procedure.

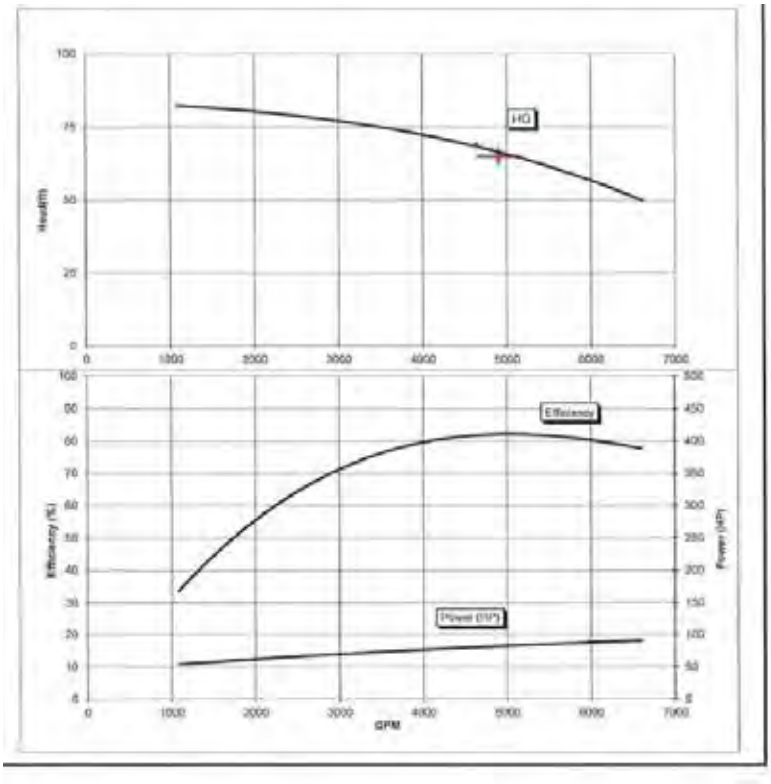
⚠ CAUTION

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

Procedure for properly configuring and performing a SMARTFLOW TUNE with liquids with SG other than water (1.0 S.G.) at a customers' facility.
This procedure should be followed for both Basic and Advanced Smartflow.

This example will use a case study from a Goulds Model 3420, pumping a light Hydrocarbon with an actual Specific Gravity (S.G.) of liquid in the pump of .85. (Lighter than water)

1. Use the BASIC Smartflow Wizard as noted is this manual by calculating inputting all the necessary information from the pump curve below for water 1.0 SG.



Using information from this test curve at 710 RPM:

Units are: GPM (viewable only)	85.27
DS Centrifugal (Model 3420)	77.01
BHP Calc Method	77.02
BEP Flow 5200 GPM	77.03
Pump Speed 710 RPM	77.04
BEP Power 69.65	77.05
SO Power (estimated at 9.5)	77.06
Q Act Filter 5 Seconds	77.23
SG Rated: 1.0 ALWAYS PRIOR TO TUNING!	78.03

VERY IMPORTANT NOTE: MAKE SURE YOU ALWAYS USE 1.0 SG PRIOR TO TUNE

2. Select “Smartflow Tune” and wait for tune to be completed. Exit the Wizard.
3. Go to Parameter Group 85, View, AND document the values populated in Parameters 85.01, 2, and 3. Note these values are values at the .85 SG of the liquid that the pump just ran the tine function with. They will need to be converted to water like, to 1.0 SG.
4. Using each of the values from step 3, divide each by the SG value of .85 and revise the values in parameters 85.01, 2, and 3 to the higher values calculated. Exit this group and go to group 77.
5. Use the newly calculated value of 85.03 and change the value of parameter 77.06 to the newly calculated value of 85.03 (PSO100%)
6. Change value of Parameter 78.03 to .85. If you have a variable SG follow the guidelines as outlined in the Manual for the Smartflow Wizard.

Note:
This example uses a Specific gravity lighter than water. If the liquid you are performing a Smartflow tune on is heavier than water, you will need to also DIVIDE the values from step 3 above and use these newer values. The water like values needed should be lighter than the values recorded during the tune.

Smart TDH (Sensorless Total Dynamic Head)

The PumpSmart PS220 can calculate the Total Dynamic Head (TDH) of a pump using information configured using the Advanced Smartflow Wizard. Individual Suction and discharge sensors or a Differential Pressure sensor are required to use this functionality. Should the pumping system maintain a relatively stable suction pressure (+-5%) the additional sensors will not be required.
Refer to the Advanced Smartflow section for more detailed information on this requirement.

Smart TDH PID Control

The PumpSmart PS220 can regulate to the TDH of a pump using the information gathered when running the Advanced Smartflow Wizard. It will require the Control Mode configured using the Process Control Wizard to be set to Smart TDH.

To access the Process Control Wizard from the Home View, follow the path:
Menu>PS220 Configuration>Process Control>Process Control Mode>SmartTDH

Specific Gravity

Specific Gravity is not always a constant value in a pumping system. It can be a different value if a pump is used on a batch application or vary widely based on the temperature of the process fluids.
SMARTFLOW, Smart TDH, and significant portions of the PumpSmart PS220 Control and Protection logic will need to use this feedback as the values change to maintain the performance and accuracy of these functions.

The Specific Gravity feature of the PS220 is that it can account for these types of changes as follows:

1. SG RATED (Fixed)

The default value for Specific Gravity [SG] is 1.0. The Smartflow Wizard will allow you to change this during configuration of SmartFlow. It may be accessed directly by going to parameter 78.03(SG Rate).
If the Specific Gravity varies by more than 5% a correction method will be necessary as the accuracy of the value of Smartflow will be decreased.

2. Specific Gravity (Variable)

1. Fluid Temperature measured with Transmitter:
When changes in the Specific Gravity are directly related to changes of the fluid's temperature, the PumpSmart PS220 can monitor a temperature transmitter, and use values to update the calculated flow continuously. An unused Analog Input will be required. To calculate the variable Specific Gravity based on temperature changes, six points of data are required.
TEMP MAX @ S.G. MAX
TEMP RATE @ S.G. RATE
TEMP MIN @ S.G. MIN.
This data can be found in most fluid handling property manuals.

NOTE:
Configuration of the Analog Transmitter used for Variable Specific Gravity will not be a step in the Smartflow Wizard. This can be configured using the I/O wizard. To access this from the Home View follow the path: Menu>PS220 Configuration>I/O Configuration>Select the Analog Input #> Please refer to the Analog Input/Output Wizard In this manual for more information.

3. Specific Gravity measured directly with a Transmitter:
Specific Gravity values that vary linearly, can be measured directly with a transmitter, using an Analog Input to use the values in the internal Smartflow calculations.

Notes:
1. Complete configuration of the Specific Gravity's Analog Transmitter will not be accomplished with the Smartflow Wizard. The Identity of the transmitter will need to be configured with the PS220 I/O Configuration Wizard. To access this from the Home View follow the path: Menu>PS220 Configuration>I/O Configuration>Select the Analog Input #> Please refer to the I/O Wizard In this manual for more information if required.

2. An unused AI will need to be used for either of these 2 choices to function correctly. Please check the settings of the Analog Inputs in use by going to: Menu>PARAMATERS> Complete List>Scroll down to Group 76>Select and View 76.01&02. If available, the status "NOT SELECTED" will be displayed. You may have to add an Extension Card to use an additional input.

4. Two Rated Specific Gravities (Dual):
A digital input can be used to toggle between two pre-defined Specific Gravity. When the Digital Input is open SG Min is used. When the Digital input closed SG Max is used. The default Digital Input for the function is DI5. Any available Digital Input can be configured for this selection.

The steps to be performed for each of these 3 selections are shown below:

1. Configure the Specific Gravity's source

A. SG RATED (Fixed)
1. Configure the Rated SG value. This value can be changed as required.

B. Specific Gravity (Variable)
1. Fluid Temperature measured with Transmitter:
1. Configure fluid TEMP Rated.
2. Configure fluid TEMP MIN.
3. Configure fluid TEMP MID.
4. Configure fluid TEMP MAX.
5. Configure fluid SG Rated.
6. Configure fluid SG MIN.
7. Configure fluid SG MID.
8. Configure fluid SG MAX.

Please note the units of Measure that are required for Temperature.
2. Specific Gravity measured directly with a Transmitter:
1. Configure the measurement source as an AI.
2. Configure the Identity of the AI to be used as a SG transmitter.
   Any available analog Input can be selected for use. (see note 2 above)
3. Configure the Minimum scaled value of the Specific Gravity.
4. Configure the Maximum scaled value of the Specific Gravity.

C. Two Rated Specific Gravities (Dual):
   1. Configure the Digital Input to be used.
      The default for use with this function is Digital Input 5. Any available Input may be used.
   2. Configure the Min Specific Gravity value
   3. Configure the Min Specific Gravity value

The table below lists all of the Parameters that may be used during the configuration of the Specific Gravity when using the Smartflow Wizard. The description of these parameters is also listed in the index under Parameter Listings.

Parameter	Name	Value/Range	NOTES
76.01	AI1 CONFIG	See the choices below	
76.02	AI2 CONFIG	PROC TRANS 2	Used with Multivariable control.
		PROC TRANS 1	The primary process transmitter. The units and transmitter scaling AI1 Max and AI1 Min must also be set.
		EXT SETPOINT1	Used when fixed or variable setpoint is sent via an external source to setpoint1
		EXT SETPOINT2	Used when fixed or variable setpoint is sent via an external source to setpoint2
		FLOWMETER	Used when a flow meter is selected for use with Advanced Pump Protection,
		DISCH PRESSURE	Used with Advanced SmartFlow. Identifies the location of the discharge pressure transmitter.
		SUCTION PRESS	Used with Advanced SmartFlow. Identifies the location of the suction pressure transmitter.
		DIFF PRESS	Used with Advanced SmartFlow. Identifies the location of the differential pressure transmitter.
		TEMPERATURE	Used when a temperature transmitter is being used for SG / VISC correction with Smartflow.
		VISC/SG VALUE	Used if setting SG or VISC directly using an analog input with SmartFlow.
		SPD OVRRD REF	Used when setting a speed override reference.
78.02	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 78.02 automatically configures DI5 in parameter 76.13 to SG SELECT.
78.03	SG RATED	1.0 [default]	Setting range is 0 – 10.0.
78.04	SG MIN	1.0 [default]	Setting range is 0 – 10.0.
78.05	SG MID	1.0 [default]	Setting range is 0 – 10.0.
78.06	SG MAX	1.0 [default]	Setting range is 0 – 10.0.
78.07	TEMP RATED	104°F English(US) 50°C All Other Languages	Temperature of pumped liquid at SG RATE. Setting range: -200 to 1000
79.08	T MIN	0°F English(US) 0°C All Other Languages	Temperature of pumped liquid at SG MIN. Setting range: -200 to 1000.
79.09	T MAX	212°F English(AM) 100°C All Other Languages	Temperature of pumped liquid at SG MAX. Setting range: -200 to 1000.
79.10	T RATE	104°F English(AM) 50°C All Other Languages	Temperature of pumped liquid at SG RATE. Setting range: -200 to 1000

Speed Control

The PS220 can be run in Basic Speed Control mode if a form of Process Control is not required. Many of the Functions and Features in this manual, specifically Pump Protection, are available in this Control Mode.

The PS220 Configuration Wizard can be used to accomplish this. Once this Wizard is completed, you will be able to run the PS220 coupled to the motor in Basic Speed control mode. To access this Wizard, from the Home Screen follow the path: Menu>PS220 Configuration>Basic Startup>Basic Drive Setup

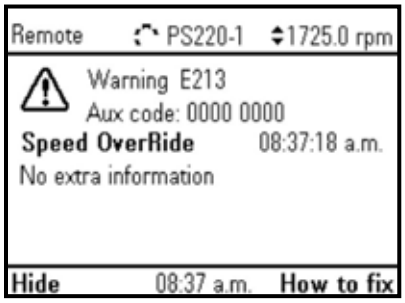
This functionality should only be configured with the PumpSmart PS220 Configuration Wizard. Refer to this manual for more information on this Wizard and the other steps that will be required.

Steps to be performed will be as follows:
1. Configure a Start and Stop source.
2. Configure the Min Speed.
3. Configure the Max Speed.
4. Confirm the operating mode for Speed Control
5. Configure a Setpoint Source
6. Exit the Wizard

Speed Override

The PumpSmart PS220 can be taken out of its primary control mode of operation and placed into complete MANUAL control. All the as configured control logic will be bypassed.

The Speed Override function can be initiated through a wide range of choices. These choices are listed in the table below:
Notes:
1. All Pump Protection Logic is functional during this time Parameter 79.04, Speed Override Pump Protection, is enabled.
2. The Message "Warning Speed Override" will appear on the display and continue to flash when this function is activated.



3. This function is very similar to "Local Control" except that Pump Protection is not available in "Local Control".

This functionality can be configured with the PumpSmart PS220 Configuration Wizard.
To access this Wizard, from the Home Screen follow the path:
Menu>PS220 Configuration>Miscellaneous>Speed Override Parameter settings.

The Table below list all the Parameters used for the Speed Override Function. The description of these parameters are also listed in the index under Parameter Listings.

Parameter	Name	Choices	Notes
74.05		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.
74.06	SPD OVERRIDE REF	Keypad (default)	The source of the Speed Override References (Default value).
		AI1 AI2 AI1 OPT AI2 OPT AI3 OPT	Defines analog input as the speed override reference. The corresponding analog input must be configured for SPD OVRRD in parameters using the I/O CONIGURATION wizard.
		Fieldbus	Speed Override reference is defined by a Fieldbus command. Refer to Fieldbus Manual for details.
79.04	SP OVRRD PMP PROT	Enabled [Default] Disabled	Enables or disables pump protection warnings and faults when speed override is activated.

Note: When selecting a Digital Input please make sure that it is unused by another configuration setting. You can view 76.11 and 76.15 to see if they are “Not Selected”

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

Start Delay

This feature is designed to delay the pump from starting once a start command has been received. When a start signal is received, the drive will delay starting by a set amount of time. A value greater than 0 activates this function. It will become active on every start.

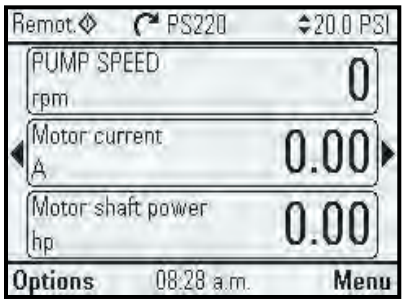
Examples:

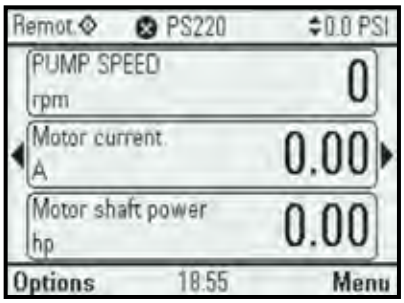
1. A generator is used for the Power Supply for Backup when a power failure occurs. Once the generator starts it take a few seconds for the power to stabilize. The PS220 may fault off during this unstable period.
2. Oil needs to circulate to the bearings of a pump before it can rotate. Once the start command is issued, a wired relay could be configured and wired to start a circulation system first. The pump would then start after this delay has expired.

Parameter	Name	Value/Range	Notes
74.04	START DELAY	0-9999 Seconds 0 [default]	This is the time in seconds the drive will delay starting the pump once a start signal is received. This will work in Local or Remote.

Starting & Stopping

Starting and Stopping the PumpSmart PS220 can be accomplished by many methods.
The default is the keypad pictured. If there is a solid green light on the keypad just above and to the left of the left arrow key, you should be ready to run the drive. If it is red there is an active fault that will need to be investigated.





1. Local Control Start/Stop

When in LOCAL control the drive will run completely in manual mode and bypass all PumpSmart PS220 settings. It will run in manual speed control and can only be started and stopped with the Red and Green Buttons. The reference running speed can only be adjusted by the arrow up and down keys, or with the Options key.
When in REMOTE control all the PS220 Functionality is active.

To verify if the drive is in LOCAL or REMOTE, check the top left-hand corner of the keypad →display. The current mode, either “Local” or “Remote” will be displayed. A diamond symbol will appear next to the word Local/Remote if the basic start command is assigned to the keypad.

ALL PS220 Features are designed to operate in REMOTE mode.

⚠ WARNING

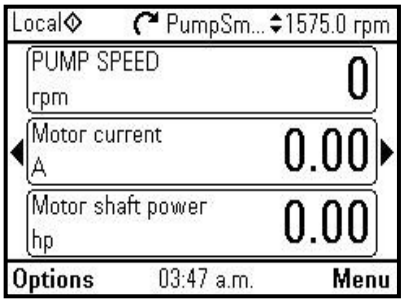
Never operate rotating equipment unless all protective coupling and shaft guards are in place. Personal injury may occur if the driven equipment is operated without coupling and shaft guards.

⚠ WARNING

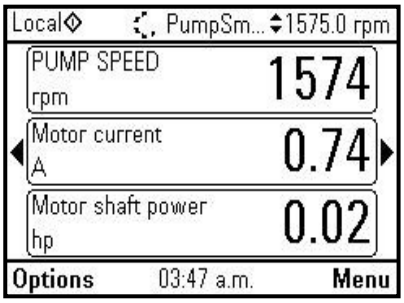
Observe all CAUTIONS and WARNINGS highlighted in the ACS880 Hardware Manual, PS220 Configuration and Operation Guide and Installation, Operation and Maintenance Guide for the applied driven equipment prior to starting.

The steps required to switch from Remote to Local mode.

1. Press “Loc/Rem” button



1. Press Green Start



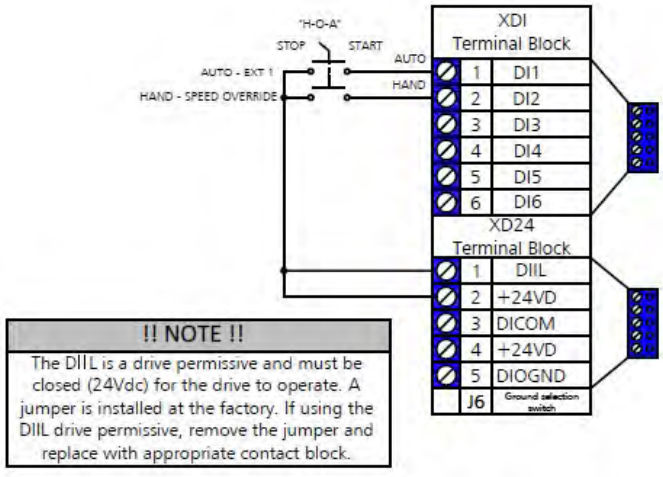
1. Wait for pump to start

2. Remote Control Start/Stop

1. H-O-A DI1, 2

This is the most common External Switch Combination used on the PS220

Refer to the diagram below.



Note: Set Start/Stop 74.01 to HOA DI1,2

Functionality:

Control from one external location.

DI1 is assigned to “Auto”.

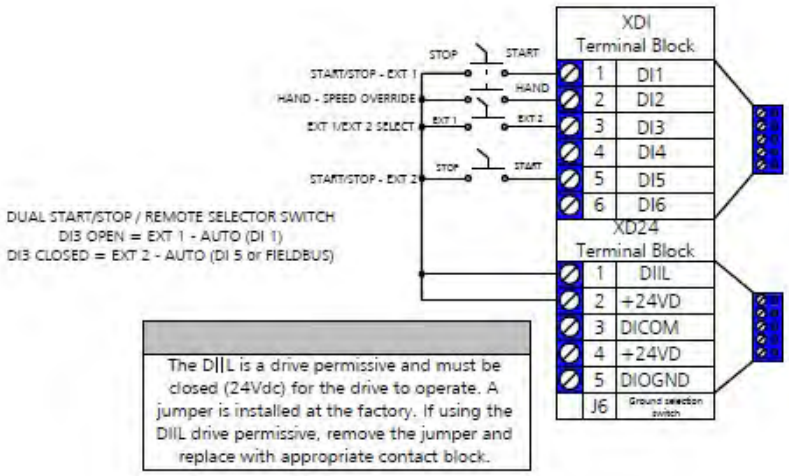
DI2 is assigned to Hand, or “Speed Override”.

All switches are normally open

2: H-O-A DI1, 2 DI5

This is a commonly requested External Switch Combination used on the PS220

Refer to the diagram below.



Note:
Set Start/Stop 74.01 to HOA DI1,2 DI5

Functionality:
"Auto Control" from two external locations.

External Location 1:
DI1 is assigned to "Auto"
External Location 2:
DI5 is assigned to "Auto".

This combination requires a pre-assigned switch using Digital Input 3 (DI3) to switch between these 2 Auto Choices. DI3 High selects Auto DI1, DI3 Low selects Auto DI5.

DI2 is assigned to Hand or "Speed Override"
All switches are normally open

The table below lists all the choices that can be configured for the start and stop method on the PS220. The Digital Inputs assignments are automatically configured when using the PS220 Basic Setup Configuration Wizard for this function.

Parameter	Name	Value/Range	Notes
74.01	START/STOP	KEYPAD [default]	Start /Stop controlled via the PS220 Keypad
		2 WIRE DI1	Control at one external location via 2-Wire switch assigned to DI1. DI1 is normally open.
		3W DI1P,2P	Control at one external location. Pulse start assigned to DI1 and pulse stop assigned to DI2. DI2 will be "normally closed"
		HOA DI1,2	Control Used for Hand-Off-Auto. DI1is assigned to Auto; DI2 is assigned to Hand (Speed Override).Both are normally open.
		HOA DI1,2 – DI5	Control at two external locations. EXT1: Hand-Off-Auto. DI1 is assigned to Auto, DI2 is assigned to Hand(Speed Over) EXT2: Auto. 2-Wire switch is assigned to DI5. This combination requires a preassigned switch (DI3) to switch between these 2 choices. All switches are normally open
		DI1P,2P- DI5	Control at two external locations. EXT1: Pulse start assigned to DI1 and pulse stop assigned to DI2. DI1 is normally open and Di2 is normally closed. EXT2: Auto is a 2-Wire start/stop switch assigned to DI5. Normally open. This requires a preassigned switch (DI3) to switch between these 2 choices.
		HOA DI1,2 –FB	Control at two external locations. EXT1: Hand-Off-Auto. DI1 is assigned to Auto, DI2 is assigned to Hand (Speed Override). EXT2: Fieldbus is the second control location. This requires a preassigned switch (DI3) to switch between these choices. All switches are Normally open
		2W DI1 – 2W DI5	Control at two external locations. EXT1: 2-Wire assigned to DI1. EXT2: 2-Wire switch at DI5. This requires a preassigned switch (DI3) to switch between these choices. All switches are "normally open"
		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. This requires a preassigned switch (DI3) to switch between these choices.Di1 and di3 are normally open. DI2 is normally closed.

Stop Method

By default, the PumpSmart PS220 will "Ramp Stop" when commanded or when a fault occurs.
The parameters listed below can this to Coast if required and are independent of each other.

Parameter	Name	Value/Range	Notes
21.03	STOP FUNCTION	RAMP STOP [default] COAST STOP	Selects how the motor will stop.
21.04	EMERG Stop Function	RAMP STOP [default] COAST STOP	Selects how the motor will stop with Fault or ESTOP.

Tuning

The PumpSmart PS220 utilizes onboard PID control when running in any Process Control Mode. The two primary controlling functions are the Proportional Gain and the Integration time. The interaction of these properly configured settings allow for the running speed of the pump to quickly stabilize when the pump is turned on, and when there are gradual or rapid changes in the systems demand.
The Tuning parameter settings that are associated by default with the Control Mode selected while using the Process Control Tune Wizard may result in an unstable response from the PS220. The Proportional Gain and the Integration Time will need to be "Fine Tuned" to alleviate this condition. Every pumping system is unique, and this is very common.

Following are a few "Rules of thumb" that can be followed as you adjust the parameters settings. You will need to access the Tune Wizard to accomplish this.

These are in order of what to adjust first. After each adjustment you should wait a few minutes for the reaction to take effect.

1. Rapid speed swings, or oscillations known as "Hunting" may be occurring. The audible "whining" of the drive as it increases/decreases in speed by a large RPM value can be heard. The Integral time will need to be increase. This should be done in increments of .5 seconds at a time.

2. When "Hunting" occurs as an "Overshoot" only, with the speed then coming down gradually, then the Proportional gain will need to be lowered. This should be done in decrements of .2 to .5.

3. When "Hunting" occurs only an "Undershoot" then the Proportional Gain should be increased. This should be done in increments of .2 to .5.

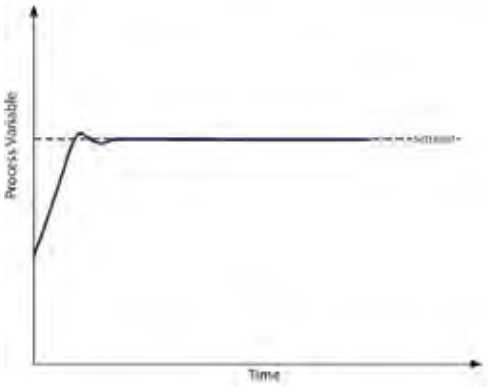
4. When there is minimal "Hunting" but still a lengthy time period before stable speed is achieved to maintain the process set-point, the Integral Time should be decreased. This should be in decrements of .5 seconds at a time.

Notes
1. For level control application the Integral Time is very dependent on the size of the pump and the volumetric size of the vessel pumping to/from. The default settings are preconfigured for large pumps with large vessels. This setting will need to be lowered significantly if the pump is undersized.
2. The changing of the values of Proportional Gain and Integral Time may require several iterations to obtain the optimum results.
3. "Start-up" conditions usually are quite different than actual process running conditions. Tuning adjustment are normally required after initial commissioning.

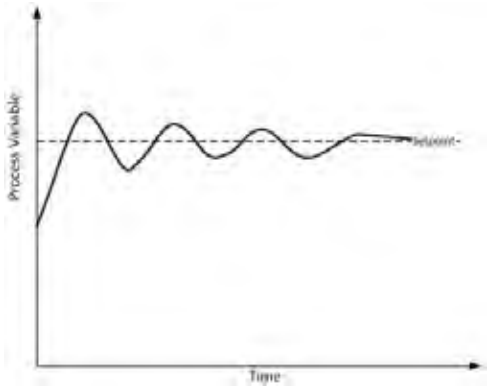
The following figures show examples of Properly and Improperly Tuned systems.

Properly Tuned System
This system has the appropriate Proportional gain and Integration Time.

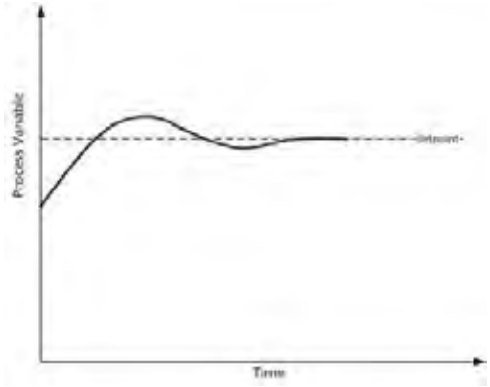
Properly tuned system. There is both a slight overshoot and undershoot. This is a depiction of the "Ideal "scenario you should expect



Improperly Tuned System. The Proportional Gain is too high, and the Integration Time is too short.



Improperly Tuned System. The Integration Time is too long.



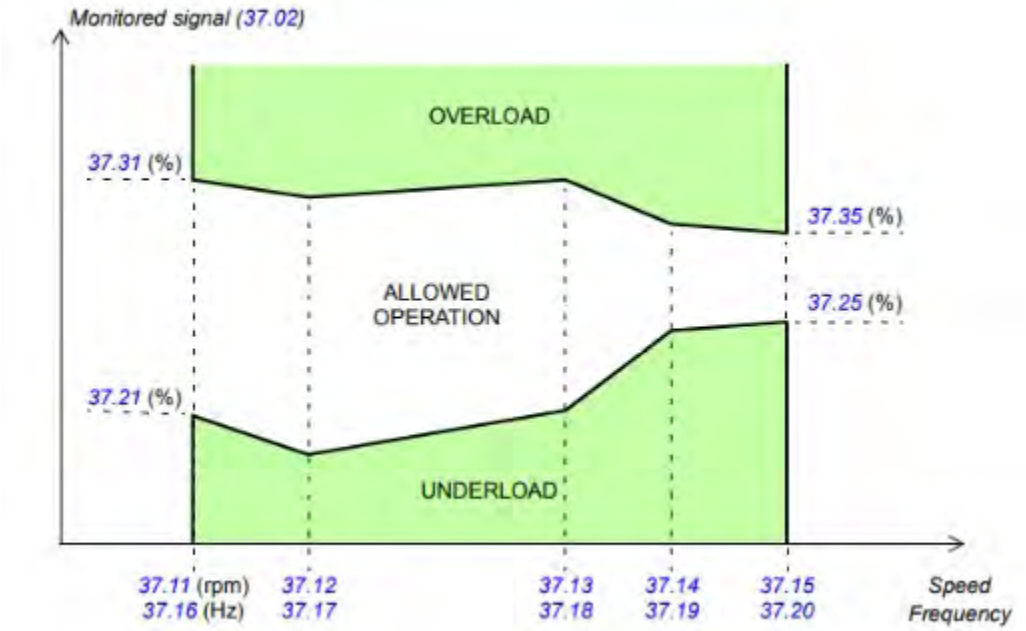
Note - Air in the system may cause a condition that looks like oscillation or hunting. Be sure all air is purged from the system before attempting tuning.

This functionality can be configured with the PumpSmart PS220 Configuration Wizard.
To access this Wizard from the Home Screen, follow the path: Menu>PS220 Configuration>Process Control>Process Tune

Underload (Freewheel)

The PumpSmart PS220 can monitor the Motor load continuously and can be configured to react when the load suddenly drops. Typically, this is a result of a de-coupling between the motor and the pump.

The Figure below depicts some of the parameters that will need to be configured for this function.



This function will need to be configured manually. To access the required parameters from the Home View, follow the path: Menu> Parameters> Complete List> Group 37>

The steps that will need to be performed are:

1. Configure the actual load to be monitored. Parameter 37.02. The recommended selection is (2) Motor Current.

2. Configure the reaction when the load drops. Parameter 37.04. The recommended selection is (2) Fault

3. Configure the 5 "x" axis motor speeds used as the intersection points with the monitored values. These are Parameters 37.11 through 37.15. Refer to the Graphic above.

NOTES
1. Parameters 37.22, 23 and 24 on not shown on the graphic and should not need to be changed.

2. The settings for Parameters 37.11 through 15 should not have to be changed for a 1780 RPM motor. They will need to be change for motors of lower or higher full load synchronous speeds (1180 RPM and 3550 RPM). The recommendations are as follows:

37.11 = 8.5% of Full Load speed
37.12 = 42% of Full Load speed
37.13 = 72% of Full Load speed
37.14 = 84% of Full Load speed
37.15 = 100% of Full load speed

3. Parameters not mentioned do not apply to this function

Parameter	Description	Default in RPM of the Motor	Recommendation	Notes
37.11	1st X Axis Intersection Point	150	See Notes	Should be 10% of Max Motor Speed
37.12	2nd X Axis Intersection Point	750	See Notes	Should be 50% of Max Motor Speed
37.13	3rd X Axis Intersection Point	1290	See Notes	Should be 72% of Max Motor Speed
37.14	4th X Axis Intersection Point	1500	See Notes	Should be 83% of Max Motor Speed
37.15	5th X Axis Intersection Point	1800	See Notes	Should be 100% of Max Motor Speed

4. Configure the time period before the drive will react when an underload condition exits. The Default is 20 Seconds. The Ranges is 0-10,000 seconds.

VFD PROTECTION

Since the core functionality of the PumpSmart PS220 is that of a Variable Frequency Drive (VFD), it also provides the ability to configure the on-board electrical parameters to provide a very high degree of Drive and Motor protection. It will identify and react to the most common electrical system upsets such as Undervoltage, Overvoltage, Overcurrent, Stall, Underload and Overtemp. Faults can be automatically re-set faults which can prevent "Nuisance Trips". The default settings for most all of the protection selections are set to Fault.

The settings that can be configured are as follows.
NOTE:
Please refer to the "Underload Control' in this manual for more information on this topic.
Please refer to the "Auto Reset Function' in this manual for more information on this topic.

1. Maximum current:
This value is predefined in the drive automatically during the setup of Basic Startup Wizard. This value should only be adjusted DOWN. An example of this would be if you installed a Pump with a non-overloading motor you could lower this value to prevent tripping. (Higher amp-draw at higher flow rates)

2. Overvoltage control:
This parameter enables the overvoltage control of the DC Bus. Fast braking of a high inertia load causes the voltage to rise to the overvoltage control limit. To prevent the DC voltage from exceeding the limit, the overvoltage controller automatically decreases the braking torque.

3. Undervoltage control:
This parameter enables the undervoltage control of the DC Bus. If the DC voltage drops due to input power cut off, the motor torque will automatically be decreased in order to keep the voltage above the lower limit. By decreasing the motor torque, inertia of the load will cause regeneration back into the drive. This mechanism acts as a power-loss ride-through function.

4. Auto reset selection: (See also Fault Auto-Reset VFD)
This parameter setting selects faults which can be automatically reset. Auto reset selection is a 16-bit word with each bit corresponding to a fault type. Whenever a bit is set to "1", the corresponding fault can be automatically reset.

5. Number of trials:
This parameter setting defines the maximum number of resets allowed to be attempted in the time specified by Total trials time. As many as 5 attempts can be made. Setting of zero disables this function.

6. Total trials time:
This parameter setting defines the allowable time period for the counting and resetting of the electrical fault conditions configured. This parameter also limits the number of resets allowed during this time period.

7. Delay time:
This parameter setting defines the time that the PS220 will wait before attempting an Autoreset of the VFD Faults selected in Autoreset selection.

The VFD Protection can be configured with the PumpSmart PS220 Configuration Wizard. To access this Wizard from the Home Screen, follow the path: Menu>PS220 Configuration>Pump & VFD Protection>VFD Protection>

The table below shows all of the parameters used for the VFD protection. Additional Motor limits and protection parameters are described in the index under the Parameter Listing for the Groups 30 and 31.

GROUP 30	LIMITS	DESCRIPTION
30.17	MAXIMUM CURRENT	Defines the maximum allowed motor current. Once this value is achieved the motor will not increase to higher in speed.
30.20	MAXIMUM TORQUE	Defines the maximum torque for the motor. Once this value is achieved motor will not increase in speed.
30.30	OVERVOLTAGE CONTROL	Enables the overvoltage control of the intermediate DC link. Fast braking of a high inertia load causes the voltage to rise to the overvoltage control limit. To prevent the DC voltage from exceeding the limit, the overvoltage controller automatically decreases the braking torque. Note: If the drive is equipped with a brake chopper and resistor, or a regenerative supply unit, the controller must be disabled.
30.31	UNDERVOTLAGE CONTROL	Enables the undervoltage control of the intermediate DC link. If the DC voltage drops due to input power cut off, the undervoltage controller will automatically decrease the motor torque in order to keep the voltage above the lower limit. By decreasing the motor torque, the inertia of the load will cause regeneration back to the drive, keeping the DC link charged and preventing an undervoltage trip until the motor coasts to a stop. This will act as a power-loss ride-through functionality in systems with high inertia, such as a centrifuge or a fan.
GROUP 31	FAULT FUNCTIONS	DESCRIPTION
31.12	AUTORESET SELECTION	Selects faults that are automatically reset. The parameter is a 16-bit word with each bit corresponding to a fault type. Whenever a bit is set to 1, the corresponding fault is automatically reset.
31.14	NUMBER OF TRIALS	Defines the maximum number of automatic resets that the drive is allowed to attempt within the time specified by 31.15 Total trials time. If the fault persists, subsequent reset attempts will be made at intervals defined by 31.16 Delay time. The faults to be automatically reset are defined by 31.12 Autoreset selection.
31.15	TOTAL TRIALS TIME	Defines a time window for automatic fault resets. The maximum number of attempts made during any period of this length is defined by 31.14 Number of trials. If the "Number of trials" and the "Delay time" exceeds the "Total trials time" the PS220 will not be able to reset automatically. The fault will need to be reset manually.
31.16	DELAY TIME	Defines the time that the drive will wait after a fault (or a previous reset attempt) before attempting an automatic reset. See parameter 31.12 Autoreset selection.

⚠ DANGER

Before you activate any part or parts of this function, proceed with extreme caution. This function resets the drive automatically and continues automatic operation after a Fault. This may result in severe equipment damage and/or physical injury and death.

Water Functions

Pump Cleaning Function (PCS)

The main function of the pump cleaning sequence (PCS) is to automatically detect and remove substances that may have become lodged in the pump or an inlet vane of the pump impeller. The PS220 can detect this during operation by monitoring the actual motor torque value (1.10 MOTOR TORQUE). This vale is then compared to a higher reference threshold value (83.03 TORQUE REQ). When the actual value exceeds the reference threshold value for a certain time period (83.04 TON REQ), the pump cleaning sequence will be executed. The pump cleaning sequence can also be executed at a preset time, every day, to serve as a preventive measure and a complement to the automatic detection and removal of debris that can become lodged in pump components on clog prone pumping applications.

The PCS is controlled in a way that is referred to as “request” and “execute”. This control is defined by the settings of parameters:

1. 83.01 EXE P CLEAN SEQ
2. 83.02 REQ P CLEAN SEQ.

The PCS can be executed based on these choices:

1. Automatically at the detection of clog.
2. Automatically at specified time of every day.
3. Manually 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 Principles of the Pump Cleaning Sequence

Starting the PCS

The PumpSmart PS220 must be in Remote control, show a "Start Received "command, and running a pump.

When the Pump Cleaning function is initiated, all PS220 functional control is disabled. It is automatically enabled once the function completes.

Notes

1. The PCS cannot be run in "Local" control.
2. The request and execution of the PCS is blocked for 3 seconds after a start command, and after a completed PCS, to prevent increased starting torque levels from motor starts from triggering a false request for the PCS to execute automatically.

Stopping/Interrupting the PCS

There are two methods that can stop the execution of the PCS:

1. Issuing a Stop signal.
2. Opening Digital Input 3 (DI3), if it was used to start the PCS.

Note:

When either of these choices is used to stop the PCS the PumpSmart PS220 will need to be restarted. It will not restart on its own.

Disabling the PCS

To completely disable this function, you will need to configure the setting of parameter 83.01 EXE P CLEAN SEQ to "NOT SELECTED", and 83.02 to NOT SELECTED.

PCS in Multipump Applications

In Multipump Synchronous control, only one pump shall be permitted to execute the PCS at a time. The other pump(s) shall be held in queue until they individually become available to execute their PCS routines.

Note:

Setting parameter 83.02 is set to TORQ or TORQ OR RUN TIME, will require a "Torque Test" to be performed to ensure that the setting for parameter 83.03 TORQUE REQ is suited for the application. This test may also be required for the Pump Snore functionality.

The test can be done as follows:
1. Switch to "LOCAL" Keypad Control.
2. Start the Pump by pressing the Green Start Button.
3. Set the Speed Reference to Max Speed and let the pump run to full speed. Check and validate that the pump is pumping with a "normal level" in the sump, or the suction side tank and it is maintaining a stable flow.
4. View/Record the value of Parameter 1 .10 MOTOR TORQUE in %. Multiply this value by 1.2. The factor 1.2 corresponds to the expected increased torque that can be expected when a clog may occur. Use this calculated value when you configure parameter 83.03 TORQUE REQ.
5. Stop the PS220 with the Red Stop Button.
6. Switch back to REMOTE control.

The following steps will be followed to configure the Pump Cleaning Sequence. Refer to the description of each parameter listed below for the functional description of each parameter.

1. Configure how the Pump Cleaning Sequence executes, Manually or Automatically
2. Configure what triggers the Execution of the Pump Cleaning Sequence when PS220 is configure for step 1. (Automatic operation)
3. Configure the Torque Request Value above normal Torque for executing the PCS.
4. Configure the proof time before executing the PCS once the request torque threshold is met.
5. Configure the time of the day to execute the PCS.
6. Configure the maximum number of cycles the PCS can execute.
7. Configure the forward running speed during the PCS.
8. Configure the forward speed run time during the PCS.
9. Configure the forward run acceleration rate during the PCS.
10. Configure the forward run deceleration rate during the PCS.
11. Configure the time pause before reverse rotation begins during the PCS.
12. Configure the reverse run speed during the PCS.
13. Configure the reverse run time during the PCS.
14. Configure the Reverse Run Acceleration rate during the PCS.
15. Configure the Reverse Run Deceleration rate during the PCS.
16. Configure the maximum time the PCS is allowed to complete a full sequence.
17. Configure the maximum number of complete sequences the PCS is allowed to run.
18. Configure the Sequence Exceeded Reaction when the PCS does not reduce the torque to acceptable levels.

The table below lists all of the Parameters used in this function.

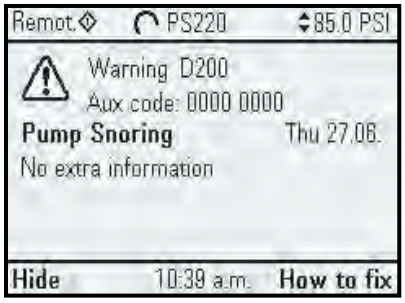
Parameter	Name	Value/Range	Notes
83.01	EXE P CLEAN SEQ		Defines how the cleaning sequence is executed.
		NOT SEL (DEFAULT)	The pump cleaning sequence is disabled.
		P CTRL DI3	The pump cleaning system is executed using DI3.
		PS220	The pump cleaning system is executed by the PS220 automatically.
83.02	REQ P CLEAN SEQ	Applicable only when 83.01 is set to PS220.	Defines what triggers the request of the pump cleaning sequence.
		NOT SEL (DEFAULT)	Disable the Automatic execution of the PCS
		TORQ	The request is triggered when 1.10 MOTOR TORQUE exceeds the value set in 83.03 TORQ REQ for the 83.04 TON REQ.
		Time of Day	This request is triggered when the time of day is reached,
		TORQ OR TIME of Day	This request is triggered by either motor torque or run time.
83.03	TORQUE REQ	0.0-200.0% 120% [default]	Defines the motor torque threshold value in % above nominal motor torque to trigger the execution of the pump cleaning sequence.
83.04	TON REQ	0-100 Seconds 5s [default]	Time period before the pump cleaning sequence can be triggered once the threshold torque is reached,
83.05	RUN TIME REQ	24-hour clock time in Hours, Minutes, and seconds.	Defines the time of the day at which the pump cleaning sequence executes automatically.
83.06	NUM OF CYCLES	1-10 2 [default]	Defines the number of cycles the pump cleaning sequence can execute.
83.07	FWD RUN SPD	0.0-100.0% 100% [default]	Defines the forward running speed in % of parameter 30.12, MAXIMUM SPEED.
83.08	FWD RUN TIME	0.0-100.0 Seconds 7s [default]	Defines the forward running time of the pump cleaning sequence.
83.09	FWD RUN ACC	0.0-100.0 Seconds 1s [default]	Defines the forward acceleration rate during the execution of the cleaning cycle.
83.10	FWD RUN DEC	0.0-100.0 Seconds 2s [default]	Defines the forward deceleration rate during the execution of the cleaning cycle.
83.11	ZERO SPEED PAUSE	0.0-100.0 Seconds 7s [default]	Defines the pause time during the pump cleaning sequence that the pump does not run when switching from forward to reverse rotation.

Parameter	Name	Value/Range	Notes
83.01	EXE P CLEAN SEQ		Defines how the cleaning sequence is executed.
		NOT SEL (DEFAULT)	The pump cleaning sequence is disabled.
		P CTRL DI3	The pump cleaning system is executed using DI3.
		PS220	The pump cleaning system is executed by the PS220 automatically.
83.02	REQ P CLEAN SEQ	Applicable only when 83.01 is set to PS220.	Defines what triggers the request of the pump cleaning sequence.
		NOT SEL (DEFAULT)	Disable the Automatic execution of the PCS
		TORQ	The request is triggered when 1.10 MOTOR TORQUE exceeds the value set in 83.03 TORQ REQ for the 83.04 TON REQ.
		Time of Day	This request is triggered when the time of day is reached,
		TORQ OR TIME of Day	This request is triggered by either motor torque or run time.
83.12	REV RUN SPD	0.0-100.0% 80% [default]	Defines the reverse running speed in % of parameter 30.12, MAXIMUM SPEED.
83.13	REV RUN TIME	0.0-100.0 Seconds 7s [default]	Defines the reverse running time of the pump cleaning sequence.
83.14	REV RUN ACC	0.0-100.0 Seconds 2s [default]	Defines the forward acceleration rate during the execution of the cleaning cycle
83.15	REV RUN DEC	0.0-100.0 Seconds 01s [default]	Defines the reverse deceleration rate during the pump cleaning sequence.
83.16	SEQUENCE TIMER	0-100 Seconds 30s [default]	.
83.17	SEQUENCE COUNTER	0-10 5 [default]	The number of times the PCS will run sequentially when executed.
83.18	SEQUENCE EXCEED		Action and message displayed when the number of sequences in 83.17 has been completed and the torque value monitored is still at or above the value in 83.03. The 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 rese. The Keypad displays a PUMP CLOGGED fault message.

Snore Function

The PumpSmart PS220's Snore functionality primary use is to remove oil, grease, and other floating debris from the surface of the liquid in a vessel. This eliminates the need to schedule the vessel to have the level "pumped down" and to have the sump cleaned manually. Typically, this function is used with Level Control applications when emptying sump systems or tanks.

When the Snore Function is initiated all PS220 functional control is disabled. It is automatically enabled once the function terminates.



When the Snore Function is active the message "Pump Snoring" will be displayed on the Keypad and will be captured and stored in the event log.

This functionality can be configured with the PumpSmart PS220 Configuration Wizard.
To access this Wizard, from the Home View follow the path:
Menu>PS220 Configuration>Water Functions>Snore Function

The individual steps that will be required to configure this functionality are:
1. Configure the Snore Time which enables the function.
2. Configure the Snore Torque Coefficient

1. Configure enabling of the Snore Function.
The Snore Time is the frame that the PS220 will use to execute the Snore function. The range is 0 to 10,000 hours. The default shown disables the function.

2. Configure the Snore Torque Coefficient
This value is used to terminate the Snore function. The Default value is 85% or .85. This is the value of torque as compared to "normal" torque when the pump is running. Refer to the "Torque Test" for more information on how to determine what normal running torque is.

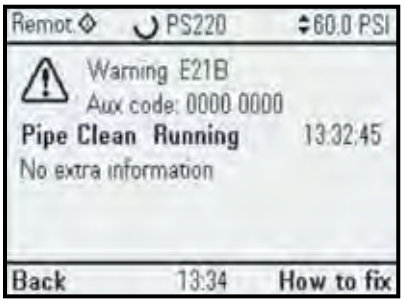
The table below lists all of the Parameters used in this function.

Parameter	Name	Value/Range	Notes
83.19	SNORE TIME	0-10000 hrs. 0 hrs. [default]	Defines the elapsed time before the Snore function is activated. Range: 0 – 10,000 hrs. Default is zero hrs which disables this function.
83.20	TORQUE COEFF	0.0 – 1.00 0.85 [default]	Defines the torque coefficient setting needed to terminate the snore function. This is expressed as a percentage of the normal running torque. Range: 0.00 – 1.00.

Pipe Cleaning Function

The PS220's Pipe Cleaning function will allow for a high flow flushing of the discharge piping system. This will reduce sedimentation that may have accumulated in the piping and he overall wear on the piping system over time. The PS220 can be configured to execute the pipe clean sequence on every start, or strictly based on actual accumulated pump/motor running hours. The pump will be run at full speed when this function is executed.

When the Pipe Cleaning function is initiated, all PS220 functional control is disabled. It is automatically enabled once the function completes.



When the Pipe Cleaning function is active the message "Pipe Clean Running" will be displayed on the Keypad and will be captured and stored in the event log.

This functionality can be configured with the PumpSmart PS220 Configuration Wizard. To access this Wizard from the Home View, follow the path: Menu>PS220 Configuration>Water Function>Pipe Clean>I

The individual steps that will be performed are:
1. Configure the method to enable Pipe Cleaning function.
2. Configure the Pipe Clean Time interval,
3. Configure the Pipe Clean Cycle Time.
4. Exit the Wizard

1. Configure the method to enable the Pipe Cleaning function.
    The two selection choices are
    1. At every Start command
    2. Based on run time interval.

2. Configure the Pipe Clean Time interval.
    This is the time interval used for step 1B. The default is 100 Hours.

3. Configure the Pipe Clean Cycle Time.
    This is the total time that the Cleaning Cycle will run. The default is 600 Seconds (10 Minutes).

4. Exit the Wizard

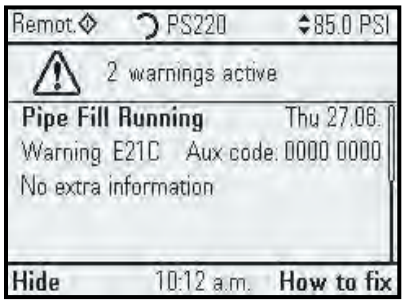
The table below lists all of the Parameters used in this function.

Parameter	Name	Value/Range	Notes
83.21	ENABLE ON START	DISABLE [default] ENABLE ON START ENABLE ON TIME	Defines if the pipe cleaning function is executed on every start or time.
83.22	PIPE CLEAN TIME INTVL	0 – 10000 hrs. 100 hrs. [default]	Time interval between each pipe cleaning cycle if 83.21 is set to ENABLE ON TIME.
83.23	PIPE CLEAN CYCLE TIME	0-1800 Seconds 600 [default]	Defines how long the pipe cleaning sequence will run.

Pipe Fill Function

The PS220's Pipe Fill function allows for the gradual filling of the discharge piping system when the pumping system is initially started. This will dramatically reduce the impact of any "water hammer" and prevent a "run- out" flow condition as the system gradually fills. The pump will run to a pre-configured speed and for a set duration.

When using the PS220's Process Control Functionality, this function can be configured to bypass the time allowed to run. The PS220 will monitor a process control value, compare it to a preset value, and then end the Fill Function. Process control will begin automatically at this time.



When the Fill Function is active the message "Pipe Fill Running" will be displayed on the Keypad and will be captured and stored in the event log.

When the Pipe Fill function is initiated, all PS220 functional control is disabled. It is automatically enabled once the function completes.

This functionality can be configured with the PumpSmart PS220 Configuration Wizard. To access this Wizard from the Home View, follow the path: Menu>PS220 Configuration>Water Functions>Pipe Fill Function>I

The individual steps that will be performed when using the Wizard are:

1. Configure enabling of the Pipe Fill function
When enabled, this function will execute at every start command. It cannot be turned off once initiated.

2. Configure the Pipe Fill Time
The fill time is the time frame that the PS220 will run the Pipe Fill function. All PS220 functional control is disabled during this time frame. The default value is 50 seconds. The range is 0-65,000 seconds.

3. Configure the Pipe Fill Speed
The fill speed is the RPM value that the PS220 will ramp up to and remain at while the function is executing. The default value is 1000 RPM

NOTES
1. The ramp up speed is set with the Process Control Tune wizard when using any Process Control Mode.
2. When using Basic Speed Control, the ramp up speed is defaulted to 5 seconds. It can be configured manually by accessing Parameter 23.12 "Acceleration Time"
3. Changing the ramp up time may have an adverse effect on the control mode when the Pipe Fill function is non-functional.

4. Configure the Pipe Fill Stop Value
When using any Process Control Mode this value will be continuously monitored during the execution of the Pipe Fill function. When this value is achieved the Pipe Fill function will terminate and automatically begin to control the process as configured.

Example:

The Process control mode is Pressure control, Discharge side. The Process Control Setpoint is 60 PSI. There is a pressure transmitter a significant distance from where the pump is physically located. The piping is completely empty when the system is started. The actual pressure measured and displayed is 0PSI. The Pipe Fill Stop Value is 70PSI, the Fill Time is 180 seconds, and the Fill Speed is 1750 RPM.
The PS220 is started, ramps up 1750 RPM. Internally a timer start to count down. After two minutes the pressure slowly increase in the discharge line and measures 70PSI. The Fill function immediately stops and the PS220 begins to control the system to the 60PSI setpoint. IN this example it terminated 1 minute before the fill time configured.

The table below lists all of the Parameters used in this function.

Parameter	Name	Value/Range	Notes
83.24	PIPE FILL ENABLE	DISABLE (default) ENABLE DI6(Not Functional)	This parameter enables the pipe fill function when the drive is started.
83.25	PIPE FILL TIME	0 – 65000 sec. 50 sec. (default0]	Maximum total time that the pipe fill function will execute. It will stop prior if a value is entered in 83.27 for Process PID control.
83.26	PIPE FILL SPEED	0-20000 Seconds 1000 [default]	Defines the speed the drive will run at when the pipe fill function is being executed.
83.27	Pipe Fill Stop Value	Default is 0	Defines the actual value used in the primary PID control mode to stop the pipe fill function. When this value is achieved the PS220 will resume normal pump control. The units are not shown but are the same as defined in the PID control mode.

5. Exit the Wizard

Keypad Use

Installation

Attach the control panel directly to the drive or use a separate mounting kit (cabinet door mounting).

To attach the control panel:

1. Place its bottom end into the bottom of the slot in the drive (A),
2. Pivot the control panel and push the upper part (B) until you hear a click.

To detach the control panel:

1. Release the control panel by pressing the clip (B),
2. Pull the upper end of the control panel out of the slot in the drive.

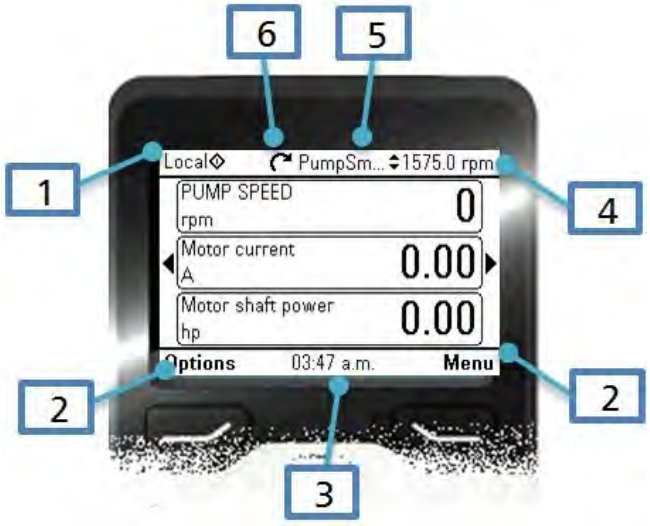
Keypad Basics

1	Left Soft Key 	Usually used for exiting and canceling. Its function in a given situation is shown by the Softkey selection in the bottom left corner of the display. Holding down the key exits each view in turn until you are back in the Home view.
2	Status LED	Green, continuous: The drive is functioning normally. Green, flickering: Data is transferred between the PC tool and drive through the USB connection of the control panel. Green, blinking: There is an active warning in the drive. Red, continuous: There is an active fault in the drive. Blue, blinking: Bluetooth interface is enabled. It is in discoverable mode and ready for pairing. Blue, flickering: Data is transfered through the Bluetooth interface of the control panel.
3	Stop	Used to stop the drive in LOCAL mode. To use in REMOTE mode set parameter 74.01 to KEYPAD
4	USB Connector	The USB connector is used for connecting the control panel to a PC. When connected, the control panel acts as an USB adapter for data transfer between the PC tool and the drive.
5	Local / Remote	The location key (Loc/Rem) is used to switch the control between the control panel (Local) and remote connections (Remote). When switching from Remote to Local while the drive is running, the drive keeps running at the same speed. When switching from Local to Remote, the status of the remote location is adopted.
6	Start	Used to start the drive in LOCAL mode. To use in REMOTE mode set parameter 74.01 to KEYPAD
7	Arrow Keys	The up and down arrow keys are used to highlight selections in menus and selection lists, to scroll up and down on text pages, and to adjust values when, for example, setting the time, entering a passcode or changing a parameter value. The left and right arrow keys are used to move the cursor left and right in parameter editing and to move forward and backward in assistants
8	Help	The help key (?) opens a help page for certain drive functions and faults.
9	Right Soft Key 	The right softkey is usually used for selecting, accepting and confirming. The function of the right softkey in a given situation is shown by the softkey selection in the bottom right corner of the display.

Display

1	Control Location	• Local – The drive is in local (speed) control and controlled from the keypad. • Remote – the drive is in remote control and start / stop is based on parameter 74.01. • No Text – The drive is in local control but controlled from another Device.
2	Softkey selection	Displays the function of the softkey.
3	Clock	Displays the current time. Can be changed through the settings menu.
4	Reference value	The reference value when in Local (RPM) or when in Process Control Mode. The displayed units are as configured.
5	Drive Name	If a name has been given, it is displayed at the top pane. By default, it is PS220. You can change the name in the Settings menu.
6	Status icon	Indicates the status of the drive and the motor. The direction of the arrow indicates forward (clockwise) or reverse (counter-clockwise) rotation.

Status Icon	Animation	Drive Status
	-	Stopped
	-	Stopped, start inhibited
	Blinking	Stopped, start command given but start inhibited
	Blinking	Faulted
	Blinking	Running, at reference, but the reference value is 0
	Rotating	Running, not at reference
	Rotating	Running, at reference



Key Shortcuts

The table below lists key shortcuts and combinations. Simultaneous key presses are indicated by the plus sign (+).

Shortcut	Available in	Effect
	any view	Save a screenshot. Up to fifteen images can be stored in the control panel memory. To download images, connect a PC to the keypad using a mini USB cable.
	any view	Adjust backlight brightness.
	any view	Adjust display contrast.
or	Home view	Adjust reference.

Home View

The main view of the control panel is called the Home view. In the Home view, you can view the current status of both Pump and VFD values. The PumpSmart PS220 Home View has 4 pages of 3 predefined lines of signal status as standard. Each are customizable, and fully editable. The Home View configuration is saved to the drive whenever you change it. The maximum total number of signals displayed is 21, depending on the view selected for each signal. In the example below, three Home view pages are used, showing different display formats allowing only 1 per page.

The PS220 has 4 default home views. Press the Right and Left Arrows keys to scroll through the pages for each. You can return to the Home View from any view by holding down the left softkey.

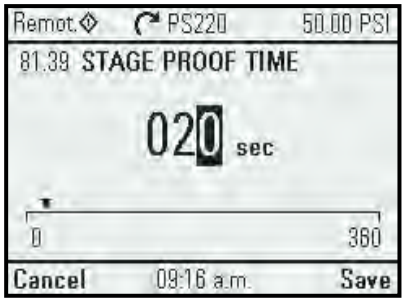
Help

When pressing the “Question Mark Button” it will open a help page. The page may describe how to resolve a message displayed or provide information on a particular setting. It also may not provide any information.

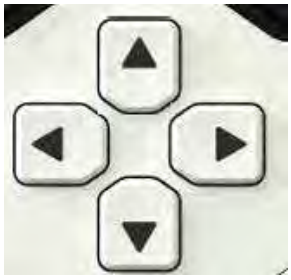
Parameter Access

In the Parameters menu, you can access, view and edit parameters.
In each sub-menu, you can edit a parameter by highlighting it and pressing "Edit".

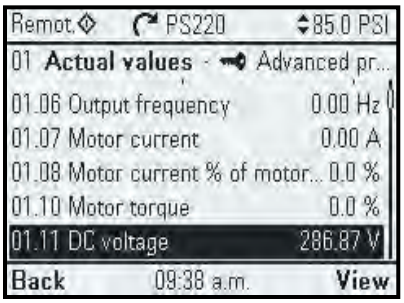
Complete list
In the Complete list sub-menu, all parameter groups are listed in numerical order. If you select a parameter group, all parameters in that group are listed. Parameter numbers are always displayed in this sub-menu.



For every bottom on the bottom of the screen will be the minimum and maximum scaled values that are allowed to be selected. The "ARROW" keys allow you to move in all 4 directions for to edit values easily.



There are distinct parameters that may be "read-only" and can only be viewed by pressing "View". The values shown cannot be modified.



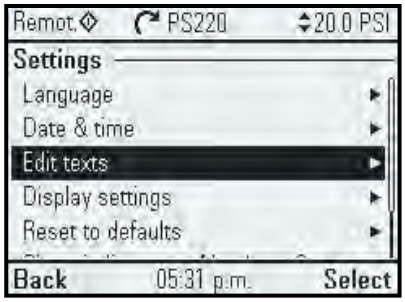
Favorites

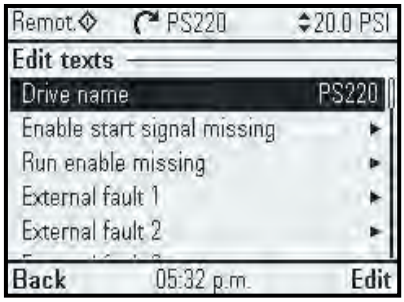
In the Favorites sub-menu, only user-selected parameters are listed. The order is determined by the parameter number.

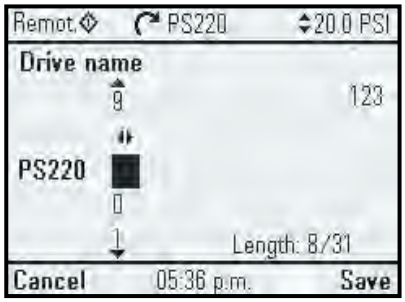
Modified

In the Modified sub-menu, only the parameters whose values differ from the defaults are listed. The order is determined by the parameter number.

To Change the PS220 name that displays on the top-center of the keypad display.
Menu>Settings>Select>Arrow Down or Up to Edit Texts>Select > Arrow Up or Down to Drive name> Edit>







1. Moving the Arrows Left & Right allow you to edit the existing name.
2. Using the Up Arrow allow you to open the top right box where you can choose the type of information to change or add. The four choices are;

1. Lower case letters.
2. Upper case letters.
3. Numbers
4. Symbols.

You can view and download the complete user manual for the Keypad use and Functions for the PS220 by accessing this link: https://library.e.abb.com/public/84155b51c04a401581c9bab076292054/EN_AssistantPanel_UM_E_A4.pdf

PS220 FAULT TRACING

The section lists most all of the PumpSmart PS220 Fault and Warning messages that may occur and display. It will describe in detail:

1. How to access the list of all current and historical events on the PS220 unit.
2. Describe in User Friendly Terms what the event was/is.
3. Describe in User Friendly terms the list of possible causes of each event.
4. Describe in User Friendly Terms the list of corrective action(s) that may be necessary to correct the event from re-occurring if started again.
5. Describe to how Reset each event to run the PS220 successfully again.

Warnings:
Warnings messages displayed when the PS220 is in operation are common. The PS220 PumpSmart will not stop, and it will not have to be reset, unless configured to do so with the "Protection Options". The Warning Message can be hidden by pressing the HIDE key. There will be a green LED flashing on the keypad signifying that there is as active warning. The Warning and message will reappear in one minute if running conditions remain unchanged. If the condition which caused the warning is resolved the warning will turn off on its own. The event(s) will always be logged in the event log.

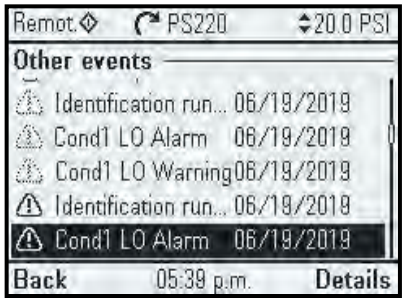
Faults:
Faults and the messages displayed are not common but do and will occur. They will stop the PS220 PumpSmart drive and prevent it from being able to be restarted and run again. As described in this manual, certain faults are internally re-set. Those faults, at this point, should have gone past the point of auto-re-setting and are now "Hard Faults". Corrective action in all cases is now required.

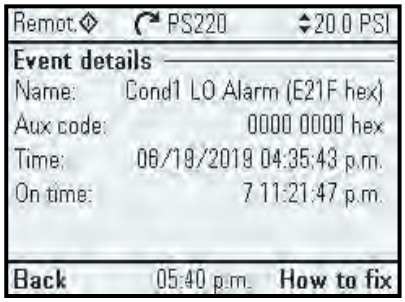
Warning and Fault messages are presented in tables below and include information on the cause and remedy for each case. Most Warning and Fault conditions can be identified and cured with this information. If not, contact your authorized ITT Gould's Pumps Monitoring and Controls Service Representative or your commissioning Engineer.
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 may increase downtime and any repair expense.

Fault History
The Fault history can be viewed in the Event log. When a Fault is detected, it is stored in the Event Logs history.

To access the Event Log from the Home View follow the Path:
Menu>Event log>Select

The last 32 fault and warnings are stored in the drives event logs. They are date and time stamped so they can be used for analysis. Details of each event can be reviewed by pressing the key below the word "Details"





There are multiple ways to reset or clear an active fault:

1. If the fault is still active it can be reset by hitting the key below the word "reset."
2. A wired digital input can be cycled (low to high). Any available Digital input can be set up using the I/O Configuration wizard.
3. Fieldbus control can be used. The proper configuration settings will have to be setup and communicated to the drive. If using Fieldbus Start/stop a fault cannot be reset via the keypad or with a digital input. It must be reset with a Fiel bus command. Please refer to the Fieldbus Quick start guide for more information.
4. The event log can be used to view fault(s) that need to be reset and reset them there.
5. Using an approved PC based tool (ABB Drive Composer) connected to the drives input.
6. A Bluetooth device that can run the ABB DRIVETUNE App
5. All Power can be cycled off to the drive, then wait until the keypad goes dark, and then apply all power on again.

Note: Depending on how you may have set up Pump and VFD Protection with the Pump & VFD Protection Wizard there may be active faults that are in the process of automatically resetting themselves. Please wait until the duration that was configured has expired before trying to reset and restart the PumpSmart PS220 again.
It will need to be restarted in the same fashion as it was prior to any event(s) that may have caused the fault to occur.

All PS220 Pump and System Warning Messages

Each message on the keypad displays the warning name as well as and unique code on the Keypad and store the event in the Event Log.

CODE (HEX)	WARNING	CAUSE	WHAT TO DO
D200	PUMP SNORING Warning Only	Pump Snoring sequence is being executed	• No action required.
E200	See E106 Below DRY RUN Warning Only	The pump is operating in a dry running condition (loss of suction).	• Check discharge line for blockages. • Check valve not opened due to excessive back pressure. • Check setting of parameter 79.09 for the correct value • If using a flow meter check flow meter outputs and calibration • Check Smartflow settings • Re-tune SmartFlow. • Check pump for wear. • Open the suction valve. • Check suction line for blockages. • The Foot valve not opening on suction lift applications. • Pump is not primed. • Pump is air locked, purge air from system. • Check for excessive amount of entrained air in suction system • Transmitter may have failed showing a "Low Value" • Check discharge piping static height compared to TDH output of the pump.
E201	SECONDARY A PROTECT ALARM Warning Only	Loss of the signal from the Digital Input configured for Secondary Protection.	• Instrumentation wired to the Digital Input (pressure switch, level switch, flow switch, temperature switch, etc.) may have failed. • Check the XD24 24V Digital input power source for correct voltage. Note: Other functions may have been configured to use this Input.
E202	SECONDARY B PROTECT ALARM Warning Only	Loss of the signal from the Digital Input configured for Secondary Protection.	• Instrumentation wired to the Digital Input (pressure switch, level switch, flow switch, temperature switch, etc.) may have failed. • Check the XD24 24V Digital input power source for correct voltage. Note: Other functions may have been configured to use this Input.
E203	CONDITION1 HI WARNING Warning Only	The signal level for Condition 1 exceeded the 80.05 COND 1 WRN LIM HI.	• Investigate cause of condition • Check parameter settings of 80.05 COND 1 WRN LIM HI for correct value.
E204	CONDITION 1 LO WARNING Warning Only	The signal level for Condition 1 has fallen below the 80.06 COND 1 WRN LIM LO.	• Investigate cause of condition • Check parameter setting of 80.06 COND 1 WRN LIM LOI for correct value.

E205	PUMP PROTECT Warning Only	The actual process value is lower than protection limit	• Open the suction valve. • Check suction line for blockages. • The Foot valve not opening on suction lift applications. • Pump is not primed. • Pump is air locked, purge air from system. • Check discharge piping for breaks or excessive leaks. • Check for excessive amount of entrained air in suction system • Transmitter may have failed showing a "Low Value" • Check for additional discharge line branches that may have been added to piping. Check discharge piping static height compared to TDH output of the pump.
E206	TUNE IN PROGRESS Warning Only	A SmartFlow tune is being executed	•Warning message only. It will either complete or show failed in less than 35 seconds.
E207	TUNE COMPLETE Warning Only	A SmartFlow tune is success-fully completed.	• Warning message only No action necessary.
E208	MIN FLOW WARNING	The pump is operating at or below the minimum flow configured.	• Check discharge line for blockages. • Check valve not opened due to excessive back pressure. • Check setting of parameter 79.09 for the correct value • If using a flow meter check flow meter outputs and calibration • Check Smartflow settings • Re-tune SmartFlow. • Check pump for wear. • Open the suction valve. • Check suction line for blockages. • The Foot valve not opening on suction lift applications. • Pump is not primed. • Pump is air locked, purge air from system. • Check for excessive amount of entrained air in suction system • Transmitter may have failed showing a "Low Value" • Check discharge piping static height compared to TDH output of the pump.
E209	PIPE FILL ERROR	Unable to complete a Pipe fill sequence.	• Verify parameters 83.25 and 83.26 • Verify that the PS220 is not current limited and is able to reach speed set up in 83.26 • Verify that another warning or fault is not active. This can be seen in the event log.
E20B	BASIC PUMP PROT RETRY	The Alarm and Control Function is active for Basic Pump Protection.	• No action required
E20C	MIN FLOW RETRY Warning Only	The Alarm and Control Function is active for Minimum Flow Pump Protection.	•No action required
CODE (HEX)	WARNING	CAUSE	WHAT TO DO
E20D	RUNOUT Warning Only	The pump is operating at a flow rate above the value set in 79.13	• Check for additional larger discharge line branches that may have been added or opened to piping. • Check for a break in the discharge piping • Slowly close discharge valve or restrict discharge output • Check setting of parameter 79.13 • Re-tune Smart flow if using this value for Runout. • If using a flow meter check the electrical value of the output from the flow meter and its calibration. • Check for excessive power draw.
E20E	SECONDARY A PROTECT ALARM Warning Only	Loss of the signal from the Digital Input configured for Secondary Protection.	• Instrumentation wired to the Digital Input (pressure switch, level switch, flow switch, temperature switch, etc.) may have failed. • Check the XD24 24V Digital input power source for correct voltage. Note: Other functions may have been configured to use this Input.
E20F	SECONDARY B PROTECT ALARM Warning Only	Loss of the signal from the Digital Input configured for Secondary Protection.	• Instrumentation wired to the Digital Input (pressure switch, level switch, flow switch, temperature switch, etc.) may have failed. • Check the XD24 24V Digital input power source for correct voltage. Note: Other functions may have been configured to use this Input.
E210	BASIC PUMP PROTECT ALARM Warning Only	The actual process value is lower than protection limit	• Open the suction valve. • Check suction line for blockages. • The Foot valve not opening on suction lift applications. • Pump is not primed. • Pump is air locked, purge air from system. • Check discharge piping for breaks or excessive leaks. • Check for excessive amount of entrained air in suction system • Transmitter may have failed showing a "Low Value" • Check for additional discharge line branches that may

			have been added to piping. • Check discharge piping static height compared to TDH output of the pump.
E211	CONDITION 2 LO WARNING Warning Only	The signal level for Condition 2 fallen below the 80. 12 COND 2 WRN LIM LO.	• Investigate cause of condition • Check parameter settings of 80.12
E212	PIPE CLEAN TIME OUT Warning Only	Unable to complete the pipe clean sequence.	• Check parameter settings of 83.22 and 83.23 • Verify that the PS220 is not current limited and is able to reach maximum speed set up in 30.12 • Verify that another warning or fault is not active. This can be seen in the event log.
E213	SPEED OVERRIDE Warning Only	The PS220 Speed Override function is active	• The Speed Override function is running. Waring message only. Check that Speed Override Pump protection is active (79.04) if required to protect the pump.
E214	CONDITION 2 HI WARNING Warning Only	The signal level for Condition 1 has exceeded the 80.11 COND 2 WRN LIM HI.	• Investigate cause of condition • Check parameter settings of 80.06
E215	PUMP CLEANING RUNNING Warning Only	Pump clean sequence is being executed	• Check parameter 83.01 and 83.02 to verify that the cleaning sequence is executing asintended.
E216	PUMP CLEANING (RT) RUNNING Warning Only	The Pump Cleaning sequence has re-executed. It did not unclog in the previous try.	• PS220 try will continue to run the sequence until the pump is unclogged. If the number of cycles set up in 83.06 has exceeded and the pump is still clogged, the PS220 will respond based on parameter 83.18.
E217	PUMP CLEANING WARNING	Pump clean sequence is being executed	• Check parameter 83.01 and 83.02 to verify that the cleaning sequence is executing asintended.
E218	PIPE CLEANING (RT) RUNNING Warning Only	The Pipe Clean Sequence has initiated an automatic retry.	Warning message only. No action is necessary. Issue a stop command to end the Pump Cleaning Sequence completely.
E219	TOTAL SYSTEM FLOW COMPLETED Warning Only	The pump has completed pumping the total volume set in parameter 84.01.	• The flow totalizing function is setup by parameters 84.01and 84.02. • Verify that the pumped volumes are based on the above settings (within the stated Ps220's published accuracy limits)
E220	COND 2 HI ALARM Warning only	The signal level for Condition 2 has exceeded the 80.14 COND 2 ALAMR LIM HI.	• Investigate cause of condition • Check parameter settings of 80.13 and 80.14
E221	CONDITION SLEEP Warning Only	A Condition 1 or Condition 2 value exceeded the alarm limits, and the Condition Sleep Function is active.	• Investigate cause of condition • Check parameter settings of 80.0,7 80.08,80.09, 80.13, 80.14 and 80.15
E222	COND 2 LO ALARM Warning Only	The signal level for Condition 2 has fallen below 80.15 COND 1 ALAMRM LIM LO.	• Investigate cause of condition • Check parameter settings of 80.13 and 80.15
E223	PID LOW DEMAND Warning Only	The PS220 requires operating at a speed below minimum speed to maintain the set- point.	• Check for reference not set to 0 • Minimum speed 30.11 is set to high for the application. The Pump may be oversized for the system. • Check that Sleep Mode (75.03) is not set to disabled. • Check 79.16 is set to match 75.03
E224	START DELAY ACTIVE Warning Only	Start delay has been enabled.	• No action required. • Once delay period is complete the pump will start running.
E225	PRIMING ON Warning Only	Pump is running the priming function. It will run at full speed with all logic and protection turned off internally.	Warning only. It will run every time the start is received.
E226	STAGE TIMEOUT Alarm Warning Only	The stage requested did occur.	• Re issue a start command on this pump • Cycle the power to the drive.
E21A	BYPASS VALVE OPEN Warning Only	The PS220's minimum flow bypass valve control has triggered the signal for a relay to open a bypass valve.	• Warning message only. • NOTE: When the bypass closes there will not be a message stating this.
E21B	PIPE CLEAN RUNNING Warning Only	The PS220 is executing a pipe clean sequence.	• Verify that the sequence if operating based on parameter settings 83.21, 83.22 & 83.23
E21C	PIPE FILL RUNNING Warning Only	The PS220 Pipe-Fill function is running	• Warning only. No action required
E21D	PIPE FILL	The PS220 Pipe-Fill function is running	Warning only. No action required
E21E	COND 1 HI ALARM Warning Only	The signal level for Condition 1 has exceeded 80.08 COND 1 ALAMRM LIM HI	• Investigate cause of condition • Check parameter settings of 80.07 and 80.08
E21F	COND 1 LO ALARM Warning only	The signal level for Condition 1 has fallen below 80.09 COND 1 ALAMRM LIM LO.	• Investigate cause of condition • Check parameter settings of 80.07 and 80.09

Table A2 - 2

All PS220 Pump and System Fault Messages

Each message on the keypad displays the warning name as well as and unique code on the Keypad and store the event in the Event Log.

CODE (HEX)	WARNING	CAUSE	WHAT TO DO
E100	DRY RUN (PROGRAMMABLE FAULT FUNCTION 79.10)	The pump is operating in a dry running, or Dead Head condition.	• Check parameter 79.11 for correct vale. • If using a flow Meter check the electrical meter outputs value. • Re-tune SmartFlow. • Check Pump for wear • See Pump Protect E106 for additional remedies
E101	COND 1LO ALARM (PROGRAMMABLE FAULT FUNCTION 80.07)	The signal level for Condition 1 has fallen below the 80.09 COND 1 ALAMRM LIM LO.	• Investigate cause of condition • Check parameter settings of 80.07 and 80.08 • Check Sensor if installed.
E102	COND 1 HI ALARM (PROGRAMMABLE FAULT FUNCTION 80.07)	The signal level for Condition 1 has exceeded the 80.08 COND 1 ALAMRM LIM HI.	• Investigate cause of condition • Check parameter settings of 80.07 and 80.09 • Check Sensor if installed.
E103	COND 2 LO ALARM (PROGRAMMABLE FAULT FUNCTION 80.13)	The signal level for Condition 2 has fallen below 80.15 COND 2 ALAMR LIM LO	• Investigate cause of condition. • Check parameter settings of 80.13 and 80.14 • Check Sensor if installed.
E104	COND 2 HI ALARM (PROGRAMMABLE FAULT FUNCTION 80.13)	The signal level for Condition 2 has exceeded 80.14 COND 2 ALARM LIM HI	• Investigate cause of condition. • Check parameter settings of 80.13 and 80.15 for the correct value. • Check Sensor if installed.
E105	PUMP CLEANING RETRY	The Pump clean sequence failed to unclog the pump within the maximum number of retries set in parameter 83.18.	• Run additional cleaning sequences. • Dismantle pump and clean manually
E106	PUMP PROTECT (PROGRAMMABLE FAULT FUNCTION 79.01)	The actual process value is lower than protection limit	• Open the suction valve. • Check suction line for blockages. • The Foot valve not opening on suction lift applications. • Pump is not primed. • Pump is air locked, purge air from system. • Check discharge piping for breaks or excessive leaks. • Check for excessive amount of entrained air in suction system • Check for additional discharge line branches that may have been added to piping. • Check discharge piping static height compared to TDH output of the pump. • Transmitter may have failed showing a "Low Value"
E107	SMARTFLOW OVERFLOW	Error in the SmartFlow calculation routine	• Check Smartflow input parameters in group 77 • Perform another Smartflow tune. • Contact the PumpSmart application team.
E108	OVER PRESSURE	Pump is running at a pressure above requested.	• This may happen if the drive minimum speed is set too high relative to the speed required to make set-point pressure. Adjust minimum speed down as required.
E109	TUNE TIMED OUT	The Smartflow tune unable to be completed within 35 seconds.	• Drive needs to be in "Remote" Control. • Check pump is not current limited and achieve the required speed for the tune process. • See notes in the Configuration manual for Smartflow Tune.
E10A	MIN FLOW FAULT (PROGRAMMABLE FAULT FUNCTION 79.08)	The pump is operating below the safe continuous flow rate set in 79.09.	• Open the suction valve. • Check suction line for blockages. • The Foot valve not opening on suction lift applications. • Pump is not primed. • Pump is air locked, purge air from system. • Check discharge piping for breaks or excessive leaks. • Check for excessive amount of entrained air in suction system • Transmitter may have failed • Check for additional discharge line branches that may have been added to piping. • Check discharge piping static height compared to TDH output of the pump.
E10B	PUMP JAMMED	Pump is clogged	• Run additional cleaning sequences. • Dismantle pump and clean manually.
E10D	BASIC PUMP PROTECTION (PROGRAMMABLE FAULT FUNCTION 79.01)	The Pump is running at full speed and not able to achieve the set-point.	• Open the suction valve. • Check suction line for blockages. • The Foot valve not opening on suction lift applications. • Pump is not primed. • Pump is air locked, purge air from system. • Check discharge piping for breaks or excessive leaks. • Check for excessive amount of entrained air in suction system • Check for additional discharge line branches that may have been added to piping. • Check discharge piping static height compared to TDH output of

			the pump. • Transmitter may have failed showing a "Low Value"
E20A	TUNE FAILED	The SmartFlow tune failed	• Drive needs to be in "Remote" Control. • Check pump is not current limited and achieve the required speed for the tune process. • See notes in the Configuration manual for Smartflow Tune.

PS220 Variable Speed Drive and Motor Warning and Fault messages

Each warning message on the keypad displays the warning name as well as and unique code. The messages are listed in the ascending order of their fault codes

CODE (HEX)	WARNING	CAUSE	WHAT TO DO
A2B1	Overcurrent	Output current has exceeded internal fault limit.	• Check motor load. • Check acceleration times in parameter group 23 Speed reference ramp (speed control), 26 Torque reference chain (torque control) • check parameters 46.01 Speed scaling, • Check motor and motor cable (including phasing and delta/star connection). Check there are no contactors opening and closing in motor cable. • Check that the start-up data in parameter in Basic startup wizard (group 99) corresponds to the motor rating plate. • Check that there are no power factor correction capacitors or surge absorbers in motor cable.
A2B3	Earth leakage	Drive has detected load un-balance typically due to earth fault in motor or motor cable.	• Check there are no power factor correction capacitors or surge absorbers in motor cable. • Check for an earth fault in motor or motor cables by measuring the insulation resistances of motor and motor cable. Try running the motor in scalar control mode if allowed. (See parameter 99.04 Motor control mode.) • If no earth fault can be detected, contact your local ITT representative.
A2B4	Short circuit	Short-circuit in motor cable(s) or motor.	• Check motor and motor cable for cabling errors. • Check there are no power factor correction capacitors or surge absorbers in motor cable. • Perform Scalar Test
A2BA	IGBT overload	Excessive IGBT junction to case temperature. This warning protects the IGBT(s) and can be activated by a short circuit in the motor cable.	• Check motor cable. Check ambient conditions. • Check air flow and fan operation. Check heatsink fins for dust pick-up. • Check motor power against drive power.
A3A1	DC link overvoltage	Intermediate circuit DC voltage too high (when the drive is stopped).	• Check the supply voltage setting (parameter 95.01 Supply voltage). Note that the wrong setting of the parameter may cause the motor to rush uncontrollably or may overload the brake chopper or resistor. • Check the supply voltage. • With A3A1 or A3A2 on parallel- connected inverter modules, the auxiliary code indicates the affected module. The format of the code is 0x000X XX00, where "XXX" specifies the channel on the BCU control unit. • If the problem persists, contact your local ITT representative.
A3A2	DC link undervoltage	Intermediate circuit DC voltage too low (when the drive is stopped).	
A3AA	DC not charged	The voltage of the intermediate DC circuit has not yet risen to operating level.	
A480	Motor cable overload	Calculated motor cable temperature has exceeded warning limit.	• Check the settings of parameters 35.61 and 35.62. • Check the dimensioning of the motor cable in regard to required load.
A490	Incorrect temperature sensor setup	Sensor type mismatch	• Check the settings of temperature source parameters 35.1 and 35.21 against 91.21 and 91.24.
A491	External temperature 1 (Editable message text)	Measured temperature 1 has exceeded warning limit.	• Check the value of parameter 35.02 Measured temperature 1. • Check the cooling of the motor (or other equipment whose temperature is being measured). • Check the value of 35.13 Temperature 1 warning limit.
A4A0	Control board temperature	Control unit temperature is excessive.	• Check the auxiliary code. See actions for each code below.
	(none)	Temperature above warning limit	• Check ambient conditions. Check air flow and fan operation. • Check heatsink fins for dust pick-up.
	1	Thermistor broken	• Contact an ITT service representative for control unit replacement.

Each warning message on the keypad displays the warning name as well as and unique code. The messages are listed in the ascending order of their fault codes.

CODE (HEX)	WARNING	CAUSE	WHAT TO DO
A4A1	IGBT over temperature	Estimated drive IGBT temperature is excessive.	• Check ambient conditions. Check air flow and fan operation. • Check heatsink fins for dust pick-up. Check motor power against drive power.
A580	PU communication	Communication errors detected between the drive control unit and the power unit.	• Check the connections between the drive control unit and the power unit. • Check the auxiliary code (format XXXY YYZZ). With parallel-connected modules, "Y YY" specifies the affected BCU control unit channel (0: broadcast). "ZZ" specifies the error source • Check fan operation and connection. Replace fan if faulty. • The auxiliary code identifies the fan (1: Auxiliary fan 1, 2: Auxiliary fan 2). Check auxiliary fan(s) and connection(s). Replace faulty fan. • Make sure the front cover of the drive module is in place and tightened. If the commissioning of the drive requires that the cover is off, this warning will be generated even if the corresponding fault is defeated. Replace Drive cover is necessary.
A581	Fan	Cooling fan feedback missing.	
A582	Auxiliary fan missing	An auxiliary cooling fan (connected to the fan connectors on the control unit) is stuck or disconnected.	
A5A0	Safe torque off Programmable warning: 31.22 STO indication run/ stop	Safe torque off function is active, i.e. safety circuit signal(s) connected to connector XSTO is lost.	• Check safety circuit connections. For more information, see appropriate drive hardware manual.
A6A5	No motor data	Parameters in group 99 have not been set.	• Check that all the required parameters in group 99 have been set. • Note: It is normal for this warning to appear during the start-up and continue until the motor data is entered.
A6A6	Supply voltage unselected	The supply voltage has not been defined.	• Set supply voltage in parameter 95.01 Supply voltage.
A6D1	FBA A parameter conflict	The drive does not have a functionality requested by a PLC, or requested functionality has not been activated.	• Check PLC programming. • Check settings of parameter groups 50 Fieldbus adapter (FBA) and 54 FBA B settings.
A6D2	FBA B parameter conflict	The drive does not have a functionality requested by a PLC or requested functionality has not been activated.	• Check PLC programming. • Check settings of parameter groups 50 Fieldbus adapter (FBA) and 54 FBA B settings.
A6E5	AI parametrization	The current/voltage hardware setting of an analog input does not correspond to parameter settings.	• Check the auxiliary code. The code identifies the analog input whose settings are in conflict. • Adjust either the hardware setting (on the drive control unit) or parameter 12.15/12.25. • Note: Control board reboot (either by cycling the power or through parameter • 96.08 Control board boot) is required to validate any changes in the hardware settings.
A780	Motor stall Programmable warning: 31.24 Stall function	Motor is operating in stall region because of e.g. excessive load or insufficient motor power.	• Check motor load and drive ratings. Check fault function parameters.
A7AA	Extension AI parameterization	The hardware current/voltage setting of an analog input (on an I/O extension module) does not correspond to parameter settings.	• Adjust either the hardware setting on the module or the parameter to solve the mismatch. • Note: Control board reboot (either by cycling the power or through parameter 96.08 Control board boot) is required to validate any changes in the hardware settings.
A7C1	FBA A communication Programmable warning: 50.02 FBA A Comm loss function	Cyclical communication between drive and fieldbus adapter module A or between PLC and fieldbus adapter module A is lost.	• Check status of fieldbus communication. See user documentation of fieldbus interface. • Check cable connections. • Check if communication master is able to communicate.

CODE (HEX)	WARNING	CAUSE	WHAT TO DO
A7C2	FBA B communication Programmable warning: 50.32 FBA B Comm loss function	Cyclical communication between drive and fieldbus adapter module B or between PLC and fieldbus adapter module B is lost.	• Check status of fieldbus communication. See user documentation of fieldbus interface. • Check settings of parameter group 50 Fieldbus adapter (FBA). • Check cable connections. • Check if communication master is able to communicate.
A7CA	DDCS controller Comm loss Programmable warning: 60.59 DDCS controller Comm loss function	DDCS (fiber optic) communication between drive and external controller is lost.	• Check status of controller. See user documentation of controller. • Check settings of parameter group 60 DDCS communication. • Check cable connections. If necessary, replace cables.
A7CB	MF Comm loss Programmable warning: 60.09 M/F Comm loss function	Master/follower communication is lost.	• Check the auxiliary code. The code indicates which node address (defined by parameter 60.02 in each drive) on the master/follower link is affected. • Check settings of parameter group 60 DDCS communication. • Check cable connections. If necessary, replace cables.
A780	Motor stall Programmable warning: 31.24 Stall function	Motor is operating in stall region because of e.g. excessive load or insufficient motor power.	• Check motor load and drive ratings. Check fault function parameters.
A7AA	Extension AI parameterization	The hardware current/voltage setting of an analog input (on an I/O extension module) does not correspond to parameter settings.	• Adjust either the hardware setting on the module or the parameter to solve the mismatch. • Note: Control board reboot (either by cycling the power or through parameter • 96.08 Control board boot) is required to validate any changes in the hardware settings.
A7AB	Extension I/O configuration failure	The I/O extension module types and locations specified by parameters do not match the detected configuration.	• Check the auxiliary code. The code indicates which I/O extension module is affected.
A7C1	FBA A communication	Cyclical communication between drive and fieldbus adapter module or between PLC and fieldbus adapter module is lost.	• Check status of fieldbus communication. See user documentation of fieldbus interface. • Check if communication master is able to communicate.
A7C2	FBA B communication		
A7CA	DDCS controller Comm	DDCS (fiber optic) commu-nication between drive and external controller is lost.	• Check status of controller. See user documentation of controller. • Check settings of parameter group 60 DDCS communication. • Check cable connections. If necessary, replace cables.
A7CB	MF Comm loss	Master/follower communication is lost.	• Check the auxiliary code. The code indicates which node address (defined by parameter 60.02 in each drive) on the master/follower link is affected. • Check settings of parameter group 60 DDCS communication. • Check cable connections. If necessary, replace cables. • Drive was switched to Local when running Multipump. This is a warning message and will not affect operation
A7CE	EFB Comm loss Programmable warning: 58.14 Communication loss action	Communication breaks in embedded fieldbus (EFB) communication.	• Check the status of the fieldbus master (online/offline error etc.). • Check cable connections to the XD2D connector on the control unit.
A7EE	Control panel loss [Programmable warning: 49.05 Communication loss action]	Control panel (or PC tool) has stopped communicating.	• Check PC tool or control panel connection. • Check control panel connector. • Check mounting platform if being used. Disconnect and reconnect the control panel.
AFEB	Run enable missing	No run enable signal is received.	• Check setting of parameter 20.12 Run enable 1 source. • Switch signal on (e.g. in the fieldbus Control Word) or check wiring of selected source. • Check DI Status in 10.01. DIIL will be on the far left as a I. • Re-set E-Stop
AFEC	External power signal missing	95.04 Control board supply is set to External 24VDC, but no voltage is connected to the XPOW connector of the control unit.	• Check the external 24 V DC power supply to the control unit or change the setting of parameter 95.04.
AFF6	Identification run	Motor ID run will occur at next start or is in progress.	• Informative warning.

CODE (HEX)	WARNING	CAUSE	WHAT TO DO
2310	Overcurrent	Output current has exceeded internal fault limit.	• Check motor connections to make sure there are no leads touching grounded areas. • Check acceleration times in parameter group 23 Speed reference ramp 31.42 Overcurrent fault limit, 46.01 Speed scaling, 46.02 Frequency scaling and 46.03 Torque scaling. • Check motor and motor cable (including phasing and delta/star connection). Check there are no contactors opening and closing in motor cable. • Check that the start-up data in parameter group 99 corresponds to the motor rating plate. • Run Scalar Test. • Check that there are no power factor correction capacitors or surge absorbers in motor cable.
2330	Earth leakage Programmable fault: 31.20 Earth fault	Drive has detected load un-balance typically due to earth fault in motor or motor cable.	• Check there are no power factor correction capacitors or surge absorbers in motor cable. • Check for an earth fault in motor or motor cables by measuring the insulation resistances of motor and motor cable. Try running the motor in scalar control mode if allowed. (See parameter 99.04 Motor control mode.) • If no earth fault can be detected, contact your local ITT representative.
3130	Input phase loss Programmable fault: 31.21 Supply phase loss	Intermediate circuit DC voltage is oscillating due to missing input power line phase or blown fuse.	• Check input power line fuses. Check for loose power cable connections. • Check for input power supply imbalance.
3181	Wiring or earth fault Programmable fault: 31.23 Wiring or earth fault	The drive hardware is supplied from a common DC bus.	• Switch off the protection in parameter • 31.23.
		Incorrect input power and motor cable connection	• Check the power connections.
		Drive has detected load un-balance typically due to earth fault in motor or motor cable.	• Check there are no power factor correction capacitors or surge absorbers in motor cable. • Check for an earth fault in motor or motor cables by measuring the insulation resistances of motor and motor cable. Try running the motor in scalar control mode if allowed. (See parameter 99.04 Motor control mode.)
3210	DC link overvoltage	Excessive intermediate circuit DC voltage.	• Check that overvoltage control is on (parameter 30.30 Overvoltage control). Check that the supply voltage matches the nominal input voltage of the drive. Check the supply line for static or transient overvoltage. • Check deceleration time.
3220	DC link undervoltage	Intermediate circuit DC voltage is not sufficient because of a missing supply phase, blown fuse or fault in the rectifier bridge.	• Check supply cabling, fuses and switchgear. • With parallel-connected modules, check the auxiliary code (format XXXY YYZZ). "Y YY" specifies through which BCU control unit channel the fault was received.
3280	Standby timeout	Automatic restart failed	• Check the condition of the supply (voltage, cabling, fuses, switchgear).
3381	Output phase loss Programmable fault: 31.19 Motor phase loss	Motor circuit fault due to missing motor connection (all three phases are not connected).	• Connect motor cable. • Perform Motor Megger Test to check motor phases. 1600V megger is needed. • Run Scalar Test to confirm motor is a problem.
4000	Motor cable overload	Calculated motor cable temperature has exceeded warning limit.	• Check the settings of parameters 35.61 and 35.62. • Check the dimensioning of the motor cable in regard to required load.
4290	Cooling	Drive module temperature is excessive.	• Check ambient temperature. If it exceeds 40 °C (104 °F), ensure that load current does not exceed derated load capacity of drive. See appropriate Hardware manual. Check drive module cooling air flow and fan operation. • Check inside of cabinet and heatsink of drive module for dust pick-up. Clean whenever necessary.
4981	External temperature 1 (Editable message text)	Measured temperature 1 has exceeded fault limit.	• Check the value of parameter 35.02 measured temperature 1. • Check the cooling of the motor (or other equipment whose temperature is being measured). • Check the value of parameter 35.12 Temperature 1 fault limit.
5081	Auxiliary fan broken	An auxiliary cooling fan (connected to the fan connectors on the control unit) is stuck or disconnected.	• Check the auxiliary code. The auxiliary code identifies the fan (1: Auxiliary fan 1, 2: Auxiliary fan 2). • Check auxiliary fan(s) and connection(s). Replace faulty fan. • Make sure the front cover of the drive module is in place and tightened. If the commissioning of the drive requires that the cover is off, activate parameter 31.36 Aux fan fault bypass within 2 minutes from control unit reboot to temporarily suppress the fault. Replace faulty cover if needed.

CODE (HEX)	WARNING	CAUSE	WHAT TO DO
5093	Rating ID mismatch	The hardware of the drive does not match the information stored in the memory unit. This may occur after a firmware update or memory unit replacement.	• Cycle the power to the drive. • Cycle the control board in Parameter 96.01 (change to 1)
5681	PU communication	The way the control units 24vDC is connected does not correspond to parameter setting.	• Check setting of 95.04 Control board supply.
		Communication errors detected between the drive control unit and the power unit.	• Check the connection between the control unit and the power unit.
64A5	Licensing fault	Running the control program is prevented either because a restrictive license exists, or because a required license is missing.	• Record the auxiliary codes of all active licensing faults and contact your ITT representative for further instructions.
64B0	Memory unit detached	The memory unit was detached when the control unit was powered.	• Switch off the power to the control unit and reinstall the memory unit. • In case the memory unit was not actually removed when the fault occurred, check that the memory unit is properly inserted into its connector and its mounting screw is tight. Reboot the control unit (using parameter 96.08 Control board boot) or by cycling power. If the problem persists, contact your local ITT representative.
6581	Parameter system	Parameter load or save failed.	• Try forcing a save using parameter 96.07 Parameter save manually. Retry.
65A1	FBA A parameter conflict	The drive does not have a functionality requested by PLC, or requested functionality has not been activated.	• Check PLC programming. • Check settings of parameter groups 50 Fieldbus adapter (FBA) and 51 FBA A settings.
7080	Option module Comm loss	Communication between drive and an option module is lost.	• Check that all option modules are properly seated in their slots. • Check that all option modules or slot connectors are not damaged. To pinpoint the problem, try installing the modules into different slots one at a time.
7081	Control panel loss Programmable fault: 49.05 Communication loss action	Control panel (or PC tool) has stopped communicating.	• Check PC tool or control panel connection. • Check control panel connector. Disconnect and reconnect the control panel.

Each Fault message on the keypad displays the fault name as well as and unique code. The faults are listed in the ascending order of their fault codes. A fault will cause the drive the stop the pump.

CODE (HEX)	WARNING	CAUSE	WHAT TO DO
7084	Panel/PC tool version conflict	The current version of the control panel and/or PC tool does not support a function. (For example, older panel versions cannot be used as a source of external reference.)	• *Update control panel and/or PC tool. Contact your local ABB representative if necessary.*
7121	Motor stall Programmable fault: 31.24 Stall function	Motor is operating in stall region because of e.g. excessive load or insufficient motor power.	• *Check motor load and drive ratings. Check fault function parameters.*
7310	Overspeed	Motor is turning faster than highest allowed speed due to incorrectly set minimum/ maximum speed.	• *Check minimum/maximum speed settings, parameters 30.11 Minimum speed and 30.12 Maximum speed.* •*Check the motor disconnect to make sure is closed*
		Incorrect estimated speed.	• *Check the status of motor current measurement.* • *Perform a Normal, Advanced or Advanced Standstill ID run instead of, for example, a Reduced or Standstill ID run. See parameter 99.13 ID run requested.*
7582	MF Comm loss Programmable fault: 60.09 M/F Comm loss function	Master/follower communication is lost.	• *Check cables between Master and follower* • *Check node address and other setup parameters in Multipump wizard* • *Replace cables.* • *Drive is in Local in Multipump*
80A0	AI supervision Programmable fault: 12.03 AI supervision function	An analog signal is outside the limits specified for the analog input.	• *Check signal level at the analog input.* • *Check the wiring connected to the input.* • *Check the minimum and maximum limits of the input in parameter group 12 Standard AI.*
FB11	Memory unit missing	No memory unit is attached to the control unit.	• *Power down the control unit.* • *Check that the memory unit is properly inserted into the control unit.*
		The memory unit attached to the control unit is empty.	• *Power down the control unit. Attach a memory unit (with the appropriate firmware) to the control unit.*
FB12	Memory unit incompatible	The memory unit attached to the control unit is incompatible.	• *Power down the control unit. Attach a compatible memory unit.*
FB13	Memory unit FW incompatible	The firmware on the attached memory unit is incompatible with the drive.	• Power down the control unit. • Attach a memory unit with compatible firmware.
FB14	Memory unit FW load failed	The firmware on the attached memory unit could not be loaded to the drive.	• Power down the control unit. • Check that the memory unit is properly inserted into the control unit. • If the problem persists, replace the memory unit.

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PS220 Parameter Listing

GROUP 1	ACTUAL VALUES	DESCRIPTION	Scaling
1.01	MOTOR SPEED	Measured or estimated motor speed -30000 – 30000 RPM	See parameter 46.01
1.02	MOTOR SPEED ESTIMATED	Estimated motor speed in rpm. -30000 – 30000 RPM	
1.03	MOTOR SPEED %	Motor speed displayed as a percent of the synchronous speed. (-1000-1000.00%)	10=1%
1.04	ENCODER 1 SPEED FILTER	Speed of encoder 1 in rpm. -30000 – 30000RPM	-
1.05	ENCODER 2 SPEED	Speed of encoder 1 in rpm. -30000 – 30000RPM	-
1.06	OUTPUT FREQUENCY	Estimated drive output frequency in Hz. -600-600 Hz	See parameter 46.02
1.07	MOTOR CURRENT	Measured (absolute) motor current in A. 0-30000	See parameter 46.05
1.08	MOTOR CURRENT % OF MOTOR NOM	Shows the value of 01.07 Motor Current used in percent. 0-1000%	1=1%
1.10	MOTOR TORQUE	Motor torque in percent of the nominal motor torque. -1600-1600 %)	See parameter 46.03
1.11	DC VOLTAGE	Measured DC Bus link voltage. 0.00-2000.00V	10=1
1.13	OUTPUT VOLTAGE	Calculated motor voltage in VAC. 0-2000V	1=1V
1.14	OUTPUT POWER	Drive output power. The unit is selected by parameter 96.16 Unit selection. -32767-32767	See parameter 46.04
1.15	OUTPUT POWER % OF MOTOR NOM	Shows the value of 01.14 Output power in percent of the nominal power of the motor. -300 - 300.00%	10=1%
1.17	MOTOR SHAFT POWER	Estimated mechanical power at motor shaft. The unit is selected by parameter 96.16 Unit Selection. -327680-32767.00	1=1 unit
1.18	INVERTER GWh MOTORING	Amount of energy that has passed through the drive (towards the motor) in full giga- watt-hours. The minimum value is zero. 0-32767 GWh	1=1 GWh
1.19	INVERTER MWh MOTORING	Amount of energy that has passed through the drive (towards the motor) in full mega-watt-hours. Whenever the counter rolls over, 01.18 Inverter GWh motoring is incremented. The minimum value is zero. 0-1000 MWh	1=1 MWh
1.20	INVERTER kWh MOTORING	Amount of energy that has passed through the drive (towards the motor) in full kilo-watt-hours. Whenever the counter rolls over, 01.19 Inverter MWh motoring is incremented. The minimum value is zero. 0-1000kWh	10=1 kWh
1.21	U-PHASE CURRENT	Measured U-phase current. -3000-3000 A	See parameter 46.05
1.22	V-PHASE CURRENT	Measured V-phase current. -3000-3000 A	
1.23	W-PHASE CURRENT	Measured W-phase current. -3000-3000 A	
1.24	FLUX ACTUAL %	Used flux reference in percent of nominal flux of motor. 0-200%	1=1%
1.25	INU MOMENTARY cos	Momentary cosphi of the drive. -1.00 – 1.00	100=1
1.29	SPEED CHANGE RATE	Rate of actual speed change. Positive values indicate acceleration, negative values indicate deceleration. See also parameters 31.32 Emergency ramp supervision, 31.33 Emergency ramp supervision delay, 31.37 Ramp stop supervision and 31.38 Ramp stop supervision delay. -15000-15000 rpm/s	1=1 rpm/s
1.30	NORMAL TORQUE SCALE	Torque that corresponds to 100% of nominal motor torque. The unit is selected by parameter 96.16 Unit selection. Note: This value is copied from parameter 99.12 Motor nominal torque if entered. Otherwise the value is calculated from other motor data. 0.00 – xxx Nm or lb ft.	1=1 unit
1.31	AMBIENT TEMPERATURE	Measured temperature of incoming cooling air. The unit is selected by parameter 96.16 Unit Selection. -40 -200.0 °F	1=1
1.32	INVERTER GWh REGENERATING	Amount of energy that has passed through the drive (towards the supply) in full giga- watt-hours. The minimum value is zero. 0-32767	1=1 GWh
1.33	INVERTER MWh REGENERATING	Amount of energy that has passed through the drive (toward the supply) in full mega-watt-hours. Whenever the counter rolls over, 01.32 Inverter GWh regenerating is increment- ed. The minimum value is zero. 0-1000 MWh	1=1 MWh
1.34	INVERTER kWh REGENERATING	Amount of energy that has passed through the drive (towards the supply) in full kilo-watt-hours. Whenever the counter rolls over, 01.33 Inverter MWh regenerating is increment- ed. The minimum value is zero. 0-1000 kWh	1=1 kWh
1.35	MOT-REGEN ENERGY GWh	Amount of net energy (motoring energy – regenerating energy) that has passed through the drive in full gigawatt hours. -32768 – 32767 GWh	1=1 GWh
1.36	MOT-REGEN ENERGY MWh	Amount of net energy (motoring energy – regenerating energy) that has passed through the drive in full megawatt hours. Whenever the counter rolls over, 01.35 Mot – regen energy GWh is incremented or decremented.(-1000-1000 MWh	1=1 MWh
1.37	MOT-REGEN ENERGY kWh	Amount of energy (motoring energy - regenerating energy) that has passed through the drive in full kilowatt-hours. Whenever the counter rolls over, 01.36 Mot - regen energy MWh is incremented or decremented. (-999-999 kWh)	1=1 kWh
1.61	ABS MOTOR SPEED USED	Absolute value of 01.01 Motor speed used. 0.00-30000.00 rpm	See parameter 46.01
1.62	ABS MOTOR SPEED %	Absolute value of 01.03 Motor speed %. 0.00-1000.00%	10=1%
1.63	ABS OUTPUT FREQENCY	Absolute value of 01.06 Output frequency. 0.00-600.00 Hz	See parameter 46.02
1.64	ABS MOTOR TORQUE	Absolute value of 01.10 Motor torque. 0.0-1600.0%	See parameter 46.03
1.65	ABS OUTPUT POWER	Absolute value of 01.14 Output power. 0.00-32767.00	1=1 unit
1.66	ABS OUTPUT POWER % MOTOR NOM	Absolute value of 01.15 Output power % of motor nom. 0.00-300.00%	10=1%
1.68	ABS MOTOR SHAFT POWER	Absolute value of 01.17 Motor shaft power. (0.00-32767.00	1=1 unit

1.70	AMBIENT TEMPERATURE %	Measured temperature of incoming cooling air. The amplitude range of 0...100% corresponds to 0...60 °C or 32...140 °F. See also 01.31 Ambient temperature. -200.00-200.00%	1=1%
1.71	STEP-UP MOTOR CURRENT	Estimated motor current in A when a step-up transformer is in use. The value is calculated from parameter 01.07 using the step-up transformer ratio (95.40) and sine filter values 99.18 and 99.19. 0.00 - 30000.00 A	See parameter 46.05
1.72	U-PHASE RMS CURRENT	U-phase RMS current. 0.00 - 30000.00 A	
1.73	V-PHASE RMS CURRENT	V-phase RMS current. 0.00 - 30000.00 A	
1.74	W-PHASE RMS CURRENT	W-phase RMS current. (0.00 - 30000.00 A	
1.200	FLOW REF	Reference for flow control. 0 - 100000	1 = 1
1.201	FLOW ACTUAL	Actual flow feedback 0 - 100000	
1.202	PRESS REF	Reference for pressure control -1000000 - 10000000	
1.203	PRESS ACTUAL	Actual pressure feedback -10000000 - 21474836.47	
1.204	LEVEL REF	Reference for level control -21474836.47 - 21474836.47	
1.205	LEVEL ACTUAL	Actual level feedback -10000000 -100000	
1.206	TEMP REF	Reference for temperature control -2000 - 2000	
1.207	TEMP ACTUAL	Actual temperature feedback -2000 - 2000	
1.208	PUMP SPEED	Actual speed of pump, rpm. Will be different than motor speed if belt drive or gear drive is used. 0-10000	
1.209	SPECIFIC GRAVITY	Specific gravity of pumped liquid 0.00 - 100	
1.210	VISCOSITY	Value of viscosity being used by SmartFlow 0.00 - 60000	
1.212	SETPOINT 1	Setpoint #1 value. Limited by setpoint Min and Setpoint Max.	
1.213	MULTIPUMP FEEDBACK	Summed process feedback of all drives as seen by drive in a Multipump system. Typically used in Multipump Flow control. -10000000.0 – 100000000.0	
1.214	MULTI VAR SETPOINT	Calculated setpoint calculated by the PS220. Result setpoint when influenced by the second variable of Multivariable control.	
1.215	SETPOINT 2	Setpoint #2 value. Limited by setpoint Min and Setpoint Max.	
1.216	PROC TX2	Current value of process transmitter 2. 10000000.00 - 1000000.00	
1.217	SMARTFLOW	PS220's calculated Pump flow output 0 – 100000.0	
1.218	SMART TDH	PS220's calculated total dynamic head. 10000000.00 – 10000000.00	
1.219	BEP	Current operating efficiency as compared to best efficiency point 0.0 – 20000%	
1.220	FLOW ECONOMY	A relative measure of pumping efficiency. 0- 1000000 GPM/kW	
1.223	ENERGY SAVINGS	Calculated energy savings since last reset for Energy Savings Option 1 or 2. 0.00 – 1000000 US$	
1.224	RUN TIME	Elapsed time counter in hours since last reset. Runs whenever drive is turning the motor. 0.0 – 1000000 Hours	
1.225	KWH SINCE RST	KWh counter, kWh since last reset. 0.0 – 1000000 KWh	
1.226	PMP CLN RUN TIME (No Longer used)	Run time for the pump cleaning sequence when runtime is selected. No longer used.	
1.227	SYSTEM FLOW	Total flow rate for all pumps running in a Multipump system. -100000000.0 – 100000000.0	
1.228	TOTAL PMP VOLUME	Totalized Flow value for a single pump. -100000000.0 – 100000000.0	
1.229	TOTAL SYSTEM VOLUME	Total flow of all pumps when operated in Multipump. -100000000.0 – 214748364.7	
1.230	PROC TX1	Signal value of the Primary Process transmitter. -1000000.0 – 1000000.0	
1.231	MULTIPUMP SETPOINT	Setpoint seen by all of the drives in a Multipump system. -1000000.0 – 1000000.0	
1.233	START COMMAND	Indication of whether a start command has been received by the PS220 or not. 0-1	
1.234	EXT SETPOINT 1	External Setpoint 1 (Analog signal) sent to the drive SCALING IS per the AI assigned	
1.235	EXT SETPOINT 2	External Setpoint 2 (Analog signal) sent to the drive SCALING IS per the AI assigned	
1.236	WAKEUP CONDITION 2 VALUE	Wake up value for condition 2 if alarm response is set to sleep. -1000000.00 – 1000000.00	
1.237	WAKEUP CONDITION 1 VALUE	Wake up value for condition 1 if alarm response is set to sleep. – 1000000.00 – 1000000.00	
1.238	MULTIPUMP RUNTIME	Provides the length of time this drive pump has run in Multipump. Does not include sleeping. 0 – 65535.IE	
GROUP 3	INPUT REFERENCES	DESCRIPTION	Scaling
3.01	PANEL REFERENCE	Reference given from the control panel or PC tool. (-100000.00-1000000.00)	1=10
3.02	PANEL REFERENCE 2	Remote reference given from the control panel or PC tool. (-30000.00-30000.00)	1=10
3.05	FB A REFERENCE 1	Reference 1 received through fieldbus adapter A. (-100000.00-100000.00)	1=10
3.06	FB A REFERENCE 2	Reference 2 received through fieldbus adapter A. (-100000.00-100000.00)	1=10
3.07	FB B REFERENCE 1	Reference 1 received through fieldbus adapter B. (-100000.00-100000.00)	1=10
3.08	FB B REFERENCE 2	Reference 2 received through fieldbus adapter B. (-100000.00-100000.00)	1=10
3.09	EFB B REFERENCE 1	Scaled reference 1 received through the embedded fieldbus interface. The scaling is defined by 58.26 EFB ref1 type. (-30000.00-30000.00)	1=10
3.10	EFB B REFERENCE 2	Scaled reference 2 received through the embedded fieldbus interface. The scaling is defined by 58.27 EFB ref2 type. (-30000.00-30000.00)	1=10
3.11	DDCS CONTROLLER REF 1	Reference 1 received from the external (DDCS) controller. The value has been scaled according to parameter 60.60 DDCS controller ref1 type. See also section External controller interface. (-30000.00-30000.00)	1=10

3.12	DDCS CONTROLLER REF 2	Reference 2 received from the external (DDCS) controller. The value has been scaled according to parameter 60.60 DDCS controller ref1 type. (-30000.00-30000.00)	1=10
3.13	M/F or D2D REF1	Master/follower reference 1 received from the master. The value has been scaled according to parameter 60.10 M/F ref1 type. See also section Master/follower functionality. (-30000.00- 30000.00)	1-10
3.14	M/F or D2D REF2	Master/follower reference 1 received from the master. The value has been scaled according to parameter 60.10 M/F ref1 type. (-30000.00-30000.00)	1-10
3.30	FB A REFERENCE 1 INT32	(-2147483648-2147483647) Missing description	1=1
3.31	FB A REFERENCE 2 INT32	(-2147483648-2147483647)	1=1
3.51	IEC PANEL REFERENCE	Panel reference defined in the application program. (-100000.00-100000.00)	1=10
3.200	MUTIPUMP SPEED REF	Speed reference sent to the Master drive from the Multipump program 0-10000 RPM	1=1
3.201	MULTIPUMP TORQUE REF	Torque reference sent to the drive from the Multipump program -300 -300%	1=1
3.202	FOLLOWER_SETPOINT	Reference sent to the Follower drive(s) from the Multipump program 0-10000 RPM	?
3.203	APPL_STATUS_BITS	(0-32767)	1=1
3.204	TORQ REF	Torque reference sent to the drive -300 -300%	1=1
3.205	SPEED REF	Speed reference sent to the drive -0 -10000 RPM	1=1
GROUP 4	WARNINGS & FAULTS	DESCRIPTION	Scaling
4.01	TRIPPING FAULT	Code of the 1st active fault (the fault that caused the current trip).	
4.02	ACTIVE FAULT 2	Code of the 2nd active fault.	
4.03	ACTIVE FAULT 3	Code of the 3rd active fault.	
4.04	ACTIVE FAULT 4	Code of the 4th active fault.	
4.05	ACTIVE FAULT 5	Code of the 5th active fault.	
4.06	ACTIVE WARNING 1	Code of the 1st active warning.	
4.07	ACTIVE WARNING 2	Code of the 2nd active warning.	
4.08	ACTIVE WARNING 3	Code of the 3rd active warning.	
4.09	ACTIVE WARNING 4	Code of the 4th active warning.	
4.10	ACTIVE WARNING 5	Code of the 5th active warning.	
4.11	LATEST FAULT	Code of the 1st stored (non-active) fault.	
4.12	2ND LATEST FAULT	Code of the 2nd stored (non-active) fault.	
4.13	3RD LATEST FAULT	Code of the 3rd stored (non-active) fault.	
4.14	4TH LATEST FAULT	Code of the 4th stored (non-active) fault.	
4.15	5TH LATEST FAULT	Code of the 5th stored (non-active) fault.	
4.16	LATEST WARNING	Code of the 1st stored (non-active) warning.	
4.17	2ND LATEST WARNING	Code of the 2nd stored (non-active) warning.	
4.18	3RD LATEST WARNING	Code of the 3rd stored (non-active) warning.	
4.19	4TH LATEST WARNING	Code of the 4th stored (non-active) warning.	
4.20	5TH LATEST WARNING	Code of the 5th stored (non-active) warning.	
4.21	FAULT WORD 1	ACS880-compatible fault word 1. The bit assignments of this word correspond to FAULT WORD 1 in the ACS880. Parameter 04.120 Fault/Warning word compatibility determines whether the bit assignments are according to the ACS880 Standard or ACS800 System control program. Each bit can indicate several ACS880 events as listed below. This parameter is read-only. Reference the ABB ACS880 Firmware Manual for bit definition.	—

Bit	ACS800 fault name (04.120 = ACS800 Standard ctrl program)	ACS800 fault name (04.120 = ACS800 System ctrl program)
0	SHORT CIRC	SHORT CIRC
1	OVERCURRENT	OVERCURRENT
2	DC OVERVOLT	DC OVERVOLT
3	ACS800 TEMP	ACS800 TEMP
4	EARTH FAULT	EARTH FAULT
5	THERMISTOR	MOTOR TEMP M
6	MOTOR TEMP	MOTOR TEMP
7	SYSTEM_FAULT	SYSTEM_FAULT
8	UNDERLOAD	UNDERLOAD
9	OVERFREQ	OVERFREQ
10	Reserved	MPROT SWITCH
11	Reserved	CH2 COMM LOSS
12	Reserved	SC (INU1)
13	Reserved	SC (INU2)
14	Reserved	SC (INU3)
15	Reserved	SC (INU4)

0000h...FFFFh	ACS800-compatible fault word 1.	1 = 1

4.22	FAULT WORD 2	ACS880-compatible fault word 2. The bit assignments of this word correspond to FAULT WORD 1 in the ACS880. Parameter 04.120 Fault/Warning word compatibility determines whether the bit assignments are according to the ACS800 Standard or ACS800 System control program. Each bit can indicate several ACS880 events as listed below. This parameter is read-only. Reference the ABB ACS880 Firmware Manual for bit definition.	—

Bit	ACS800 fault name (04.120 = ACS800 Standard ctrl program)	ACS800 fault name (04.120 = ACS800 System ctrl program)
0	SUPPLY PHASE	SUPPLY PHASE
1	NO MOT DATA	NO MOTOR DATA
2	DC UNDERVOLT	DC UNDERVOLT
3	Reserved	CABLE TEMP
4	RUN ENABLE	RUN DISABLE
5	ENCODER ERR	ENCODER ERR
6	I/O COMM	IO COMM ERR
7	CTRL B TEMP	CTRL B TEMP
8	EXTERNAL FLT	SELECTABLE
9	OVER SWFREQ	OVER SWFREQ
10	AI < MIN FUNC	AI<MIN FUNC
11	PPCC LINK	PPCC LINK
12	COMM MODULE	COMM MODULE
13	PANEL LOSS	PANEL LOSS
14	MOTOR STALL	MOTOR STALL
15	MOTOR PHASE	MOTOR PHASE

0000h...FFFFh	ACS800-compatible fault word 2.	1 = 1

GROUP 5	DIAGNOSTICS	DESCRIPTION	Scaling
5.01	ON-TIME COUNTER	On-time counter. The counter runs when the drive is powered. (0-65535 days)	1=1 day
5.02	RUN-TIME COUNTER	Motor run-time counter. The counter runs when the inverter modulates. (0-65535 days)	1=1 day
5.04	FAN ON-TIME COUNTER	Running time of the drive cooling fan. Can be reset from the control panel by keeping Reset depressed for over 3 seconds. (0-65535 days)	1=1 day
5.09	TIME FROM POWER-UP	500-microsecond ticks elapsed since the last boot of the control unit. (0-4294967295)	1=1
5.11	INVERTER TEMPERATURE	Estimated drive temperature in percent of fault limit. The actual trip temperature varies according to the type of the drive. (40.0-160.0%) • 0.0% = 0 °C (32 °F) • 94% approx. = Warning limit • 100.0% = Fault limit	1=1%
5.22	DIAGNOSTIC WORD 3	Diagnostic word 3.	1=1
5.41	MAIN FAN SERVICE COUNTER	Displays the age of the main cooling fan as a percentage of its estimated lifetime. The estimate is based on the duty, operating conditions and other operating parameters of the fan. When the counter reaches 100%, a warning is generated. Can be reset from the control panel by keeping Reset depressed for over 3 seconds. (0-150%)	1=1%
5.42	AUX. FAN SERVICE COUNTER	Displays the age of the auxiliary cooling fan as a percentage of its estimated lifetime. The estimate is based on the duty, operating conditions and other operating parameters of the fan. When the counter reaches 100%, a warning is generated. Can be reset from the control panel by keeping Reset depressed for over 3 seconds. (0-150%)	1=1%
GROUP 6	CONTROL & STATUS WORDS	DESCRIPTION	Scaling
6.01	MAIN CONTROL WORD	The main 16 bit control word of the drive. The bit assignments of the word are as described in the ACS880 Firmware Manual. This parameter is read-only in Hex.	HEX
6.02	APPLICATION CONTROL WORD	Reference the ABB ACS880 Firmware Manual for parameter definition.	
6.03	FBA A TRANSPARENT CONTROL WORD	Displays the unaltered control word received from the PLC through fieldbus adapter A when a transparent communication profile is selected. This parameter is read-only. (00000000h-FFFFFFFFh)	HEX
6.04	FBA B TRANSPARENT CONTROL WORD	Displays the unaltered control word received from the PLC through fieldbus adapter B when a transparent communication profile is selected. See section Control word and Status word in the ACS880 Firmware Manual. This parameter is read-only. (00000000h-FFFFFFFFh)	HEX
6.05	EFBA TRANSPARENT CONTROL WORD	Displays the unaltered control word received from the PLC through the embedded fieldbus interface when a transparent communication profile is selected in parameter 58.25 Control profile. See section The Transparent profile in the ACS880 Firmware Manual. This parameter is read-only. (00000000h-FFFFFFFFh)	HEX
6.11	MAIN STATUS WORD	Main 16 bit status word of the drive. Parameter is read-only. (0000h-FFFFh)	HEX
6.16	DRIVE STATUS WORD 1	Drive status word 1. This parameter is read-only. See the ACS880 Firmware Manual for bit assignment.	BINARY ACTUAL BITS
6.17	DRIVE STATUS WORD 2	Drive status word 2. This parameter is read-only. See the ACS880 Firmware Manual for bit assignment.	BINARY ACTUAL BITS
6.18	START INHIBIT STATUS WORD	Start inhibit status word. This word specifies the source of the inhibiting condition that is preventing the drive from starting. After the condition is removed, the start command must be cycled. See bit-specific notes. See also parameter 06.25 Drive inhibit status word 2, and 06.16 Drive status word 1, bit 1. This parameter is read-only. See the ACS880 Firmware Manual for bit assignment. (0000h-FFFFh)	BINARY ACTUAL BITS
6.19	SPEED CONTROL STATUS WORD	This parameter is read-only. See the ACS880 Firmware Manual for bit assignment. (0000h-FFFFh)	BINARY ACTUAL BITS
6.20	CONSTANT SPEED STATUS WORD	Constant speed/frequency status word. Indicates which constant speed or frequency is active (if any). See also parameter 06.19 Speed control status word, bit 7, and section Constant speeds/frequencies (page 43). This parameter is read-only. See the ACS880 Firmware Manual for bit assignment. (0000h-FFFFh)	BINARY ACTUAL BITS
6.21	DRIVE STATUS WORD 3	This parameter is read-only. See the ACS880 Firmware Manual for bit assignment. (0000h-FFFFh)	BINARY ACTUAL BITS
6.25	DRIVE INHIBIT STATUS WORD 2	This word specifies the source of the inhibiting condition that is preventing the drive from starting. After the condition is removed, the start command must be cycled. See bit-specific notes. See also parameter 06.18 Start inhibit status word, and 06.16 Drive status word 1, bit 1. This parameter is read-only. See the ACS880 Firmware Manual for bit assignment. (0000h-FFFFh)	BINARY ACTUAL BITS
6.29-6.101	VARIOUS ACS880 CONTROL AND STATUS WORDS	Reference the ABB ACS880 Firmware Manual for parameter definition.	—
6.200	PUMP STATUS	The 16 bit Pump Status Word for the PS220	BINARY ACTUAL BITS
6.201	PUMP WATER FEATURE CW	The 16 bit PS220 Control Word for the PumpSmart water functions	BINARY ACTUAL BITS
6.202	PUMP WATER FEATURE SW	The 16 bit PS220 Status Word for the PumpSmart water functions	BINARY ACTUAL BITS
6.203	PUMPSMART ALARM WORD 1	The 16 bit PS220 Alarm word 1 (16 bit)	BINARY ACTUAL BITS
6.204	PUMPSMART ALARM WORD 2	The 16 bit PS220 Alarm word 2 (16 bit)	BINARY ACTUAL BITS

GROUP 7	SYSTEM INFORMATION	Reference the ACS880 Firmware Manual for detail
7.03	ABB ACS 880 DRIVE ID	Defines the PS220 Hardware Example: ACS880-01-04A6-2
7.05	ABB ACS 880 FIRMWARE	Defines the installed ABB Firmware Version. Example. 3.11.6.1
7.23	ITT APPLICATION	Defines the ITT M&C Application Firmware running.
7.30	PUMPSAMRT VERSION	Defines the PS220 installed Firmware version running.
GROUP 10	DIGITAL INPUT AND RELAY OUTPUT STATUS	DESCRIPTION
10.01	DI STATUS	Displays the electrical status of digital inputs DIIL and DI6 to DI1. Bits 0 to 5 reflect the status of DI1 to DI6. Bit 15 reflects the status of the DIIL input. Example: 100000000000001. DIL is on (All of the way to the left), and DI1 is on. (all the way to the right) This parameter is read-only.
10.21	RO STATUS	Status of the relay outputs. Viewed from left to right. RO1 is on the far right. 0000 is the format. Example: 00000001b = RO1 is energized, RO2…RO8 are de-energized.
10.XX Parameters not shown	Refer to the ABB ACS880 Firmware manual	Reference the ABB ACS880 Firmware Manual for parameter definition. All ACS880 parameters may not be supported.
GROUP 11	STANDARD DIO, FI, FO	DESCRIPTION
11.XX Parameters not shown	Refer to the ABB ACS880 Firmware manual	Reference the ABB ACS880 Firmware Manual for parameter definition. All ACS880 parameters may not be supported.
GROUP 12	ANALOG INPUTS	DESCRIPTION
12.01	AI TUNE	Triggers the analog input tuning function. Connect the signal to the input and select the appropriate tuning function.
12.03-12.05	AI SUPERVISION FUNCTIONS	See Configuration Manual
12.11	AI1 ACTUAL VALUE	Displays the value of analog input AI1 in mA or V (depending on whether the input is set to current or voltage by a hardware setting). (0-22mA)
12.12	AI1 SCALED VALUE	Displays the value of analog input AI1 after scaling. This parameter is read only. (0-32767.000)
12.15	AI1 UNIT SELECTION	Selects the unit for readings and settings related to analog input AI1. Note: This setting must match the corresponding hardware setting on the drive control unit. See Basic Wiring drawing in appendix A4. (mA or V)
12.17	AI1 MIN	Defines the minimum value for analog input AI1. Set the value actually sent to the drive when the analog signal from the external source / transmitter is at its minimum setting. (0-22mA or 0-10V)
12.18	AI1 MAX	Defines the maximum value for analog input AI1. Set the value actually sent to the drive when the analog signal from the external source / transmitter is at its maximum setting. (0-22mA or 0-10V)
12.19	AI1 SCALED AT AI1 MIN	Defines the real internal value that corresponds to the minimum analog input AI1 value defined by parameter 12.17 AI1 min. (0-32768.000)
12.20	AI1 SCALED AT AI1 MAX	Defines the real internal value that corresponds to the maximum analog input AI1 value defined by parameter 12.18 AI1 max. (0-32768.000)
12.21	AI2 ACTUAL VALUE	Displays the value of analog input AI2 in mA or V (depending on whether the input is set to current or voltage by a hardware setting). This parameter is read-only. (0-22.000mA or 0-10.00V)
12.22	AI2 SCALED VALUE	Displays the value of analog input AI2 after scaling. This parameter is read-only. (0-32767.000)
12.25	AI2 UNIT SELECTION	Selects the unit for readings and settings related to analog input AI2. Note: This setting must match the corresponding hardware setting on the drive control unit (see the hardware manual of the drive). Control board reboot (either by cycling the power or through parameter 96.08 Control board boot) is required to validate any changes in the hardware settings. (mA or V)
12.27	AI2 MIN	Defines the minimum value for analog input AI2. Set the value actually sent to the drive when the analog signal is at its minimum setting. (0-22mA or 0-10V)
12.28	AI2 MAX	Defines the maximum value for analog input AI2. Set the value actually sent to the drive when the analog signal is at its maximum setting. (0-22mA or 0-10V)
12.29	AI2 SCALED AT AI2 MIN	Defines the real value that corresponds to the minimum analog input AI2 value defined by parameter 12.27 AI2 min. (0-32768.000)
12.30	AI2 SCALED AT AI2 MAX	Defines the real value that corresponds to the maximum analog input AI2 value defined by parameter 12.28 AI2 max. (0-32768.000)
GROUP 13	ANALOG OUTPUTS	DESCRIPTION
13.11	AO1 ACTUAL VALUE	Displays the value of AO1 in mA. This parameter is read-only. (0.000-22.000mA)
13.12	AO1 SOURCE	Selects a signal to be connected to analog output AO1. Alternatively, sets the output to excitation mode to feed a constant current to a temperature sensor. Default source is Motor Speed Used.
13.16	AO1 FILTER TIME	Defines the filtering time constant for analog output AO1 in seconds. Default value is 0.100 seconds.
13.17	AO1 SOURCE MIN	Defines the real minimum value of the signal that corresponds to the minimum required AO1 output value. This is the engineering unit value for the minimum current value defined in parameter 13.19. (-32768.0 – 32768.0)
13.18	AO1 SOURCE MAX	Defines the real maximum value of the signal that corresponds to the maximum required AO1 output value. This is the engineering unit value for the maximum current value defined in parameter 13.20. (-32768.0 – 32768.0)
13.19	AO1 OUT AT AO1 SRC MIN	Defines the minimum output current value for analog output AO1. (0-22.000mA)
13.20	AO1 OUT AT AO1 SRC MAX	Defines the minimum output current value for analog output AO1. (0-22.000mA)
13.21	AO2 ACTUAL VALUE	Defines the maximum output current value for analog output AO1. (0-22.000mA)
13.22	AO2 SOURCE	Selects a signal to be connected to analog output AO2. Alternatively, sets the output to excitation mode to feed a constant current to a temperature sensor. Default source is Motor Current.
13.27	AO2 FILTER TIME	Defines the filtering time constant for analog output AO2 in seconds. Default value is 0.100 seconds.
13.27	AO2 SOURCE MIN	Defines the real minimum value of the signal that corresponds to the minimum required AO2 output value. This is the engineering unit value for the minimum current value defined in parameter 13.29. (-32768.0 – 32768.0)
13.28	AO2 SOURCE MAX	Defines the real maximum value of the signal that corresponds to the maximum required AO2 output value. This is the engineering unit value for the maximum current value defined in parameter 13.30. (-32768.0 – 32768.0)
13.29	AO2 OUT AT AO2 SRC MIN	Defines the minimum output value for analog output AO2. (0-22.000mA)
13.30	AO2 OUT AT AO2 SRC MAX	Defines the maximum output value for analog output AO2. (0-22.000mA)

13.91-13.92	AO1 AND AO2 DATA STORAGE	Reference the ABB ACS880 Firmware Manual for parameter definition. All ACS880 parameters may not be supported.
GROUP 14	I/O EXTENSION MODULE 1	DESCRIPTION
14.XX Parameters not shown	Refer to the ABB ACS880 Firmware manual	Reference the ABB ACS880 Firmware Manual for parameter definition. All ACS880 parameters may not be supported.
GROUP 15	I/O EXTENSION MODULE 2	DESCRIPTION
15.XX Parameters not shown	Refer to the ABB ACS880 Firmware manual	Reference the ABB ACS880 Firmware Manual for parameter definition. All ACS880 parameters may not be supported.
GROUP 16	I/O EXTENSION (SLOT 3)	DESCRIPTION
16.01	MODULE 3 TYPE	Activates (and specifies the type of) I/O extension module 1. NOTE: PumpSmart only sup- ports the FIO-11 module. Select FIO-11 here.
16.02	MODULE 3 LOCATION	Specifies the slot on the control unit of the drive into which the I/O extension module is installed. The PS220 PumpSmart must have the FIO-11 module physically loaded into slot 3 only.
16.03	MODULE 3 STATUS	Displays the status of I/O extension module in slot 3. This should display FIO-11 if it is installed and configured.
16.XX Parameters not shown	Refer to the ABB ACS880 Firmware manual	Reference the ABB ACS880 Firmware Manual for parameter definition. All ACS880 parameters may not be supported.
GROUP 19	OPERATING MODE	DESCRIPTION
19.01	ACTUAL CONTROL MODE	Displays the operating mode currently used. This is a read only parameter. Default value is Speed. (Speed, Torque)
19.17	LOCAL CONTROL DISABLE	Enables/disables local control (start and stop buttons on the control panel, and the local controls on the PC tool). WARNING! Before disabling local control, ensure that the control panel is not needed for stopping the drive.
19.20	SCALAR CONTROL REFERENCE UNIT	Selects the reference type for scalar motor control mode. Default is RPM. (RPM, Hz)
19.200	EXT 1 CONTROL MODE	Selects the external 1 control mode. Default is Speed. Torque is used for SmartControl
19.XX Parameters not shown	Refer to the ABB ACS880 Firmware manual	Reference the ABB ACS880 Firmware Manual for parameter definition. All ACS880 parameters may not be supported.
GROUP 20	START/STOP?DIRECTION	DESCRIPTION
20.XX Parameters not shown	Refer to the ABB ACS880 Firmware manual	Reference the ABB ACS880 Firmware Manual for parameter definition. All ACS880 parameters may not be supported.
GROUP 21	START/STOP MODE	DESCRIPTION
21.18	Auto restart time ⚠WARNING	The time allowed for the motor to restart after a short supply power failure when using Digital Inputs for starting and stopping. Setting to 0 seconds will allow for auto restarting. 74.02 Must be On. The function restarts the drive automatically and continues operation after a supply break. Make sure that no dangerous situations can occur.
21.XX Parameters not shown	Refer to the ABB ACS880 Firmware manual	Reference the ABB ACS880 Firmware Manual for parameter definition. All ACS880 parameters may not be supported.
GROUP 22	SPEED REFERENCE SELECTION	DESCRIPTION
22.XX Parameters not shown	Refer to the ABB ACS880 Firmware manual	Reference the ABB ACS880 Firmware Manual for parameter definition. All ACS880 parameters may not be supported.
GROUP 23	SPEED RAMP SETUP	DESCRIPTION
23.12	ACCELERATION TIME	Defines acceleration time. (Range = 0-1800 sec). Default is 5 sec.
23.13	DECELERATION TIME	Defines the deceleration time. (Range = 0-1800 sec). Default is 5 sec.
23.XX Parameters not shown	Refer to the ABB ACS880 Firmware manual	Reference the ABB ACS880 Firmware Manual for parameter definition. All ACS880 parameters may not be supported.
GROUPS 24 - 26	Refer to the ABB ACS880 Firmware manual	Reference the ABB ACS880 Firmware Manual for parameter definition. All ACS880 parameters may not be supported.
GROUP 28	FREQUENCY REFERENCE CHAIN	DESCRIPTION
28.52	CRITICAL FREQUENCY 1 LOW	Defines the low limit for critical frequency 1. Note: This value must be less than or equal to the value of 28.53 Critical frequency 1 high. Default value is 0. (0-500.00 Hz)
28.53	CRITICAL FREQUENCY 2 HIGH	Defines the high limit for critical frequency 1. Note: This value must be greater than or equal to the value of 28.52 Critical frequency 1 high. Default value is 0. (0-500.00 Hz)
28.54	CRITICAL FREQUENCY 2 LOW	Defines the low limit for critical frequency 2. Note: This value must be less than or equal to the value of 28.55 Critical frequency 2 high. Default value is 0. (0-500.00 Hz)
28.55	CRITICAL FREQUENCY 2 HIGH	Defines the high limit for critical frequency 2. Note: This value must be greater than or equal to the value of 28.54 Critical frequency 2 low. Default value is 0. (0-500.00 Hz)
28.56	CRITICAL FREQUENCY 3 LOW	Defines the low limit for critical frequency 3. Note: This value must be less than or equal to the value of 28.57 Critical frequency 1 high. Default value is 0. (0-500.00 Hz)
28.57	CRITICAL FREQUENCY 3 HIGH	Defines the high limit for critical frequency 3. Note: This value must be greater than or equal to the value of 28.56 Critical frequency 3 high. Default value is 0. (0-500.00 Hz)
28.XX Parameters not shown	Refer to the ABB ACS880 Firmware manual	Reference the ABB ACS880 Firmware Manual for parameter definition. All ACS880 parameters may not be supported.

GROUP 30	LIMITS	DESCRIPTION
30.11	MINIMUM SPEED	Defines the minimum allowed speed.
30.12	MAXIMUM SPEED	Defines the maximum allowed speed.
30.17	MAXIMUM CURRENT	Defines the maximum allowed motor current. Once this value is hit the motor will not go higher in speed. Therefore set-point may not be met.
30.20	MAXIMUM TORQUE %	User can define the maximum torque for the motor. Once this value is hit the motor will not go higher in speed. Default is 300 %. Range 0 – 1600%
30.30	OVERVOLTAGE CONTROL	Enables the overvoltage control of the intermediate DC link. Fast braking of a high inertia load causes the voltage to rise to the overvoltage control limit. To prevent the DC voltage from exceeding the limit, the overvoltage controller automatically decreases the braking torque. Note: If the drive is equipped with a brake chopper and resistor, or a regenerative supply unit, the controller must be disabled.
30.31	UNDERVOTLAGE CONTROL	Enables the undervoltage control of the intermediate DC link. If the DC voltage drops due to input power cut off, the undervoltage controller will automatically decrease the motor torque in order to keep the voltage above the lower limit. By decreasing the motor torque, the inertia of the load will cause regeneration back to the drive, keeping the DC link charged and preventing an undervoltage trip until the motor coasts to a stop. This will act as a power-loss ride-through functionality in systems with high inertia, such as a centrifuge or a fan.
30.XX	All other parameters not listed	Refer to the ABB ACS880 Firmware manual
GROUP 31	FAULT FUNCTIONS	DESCRIPTION
31.12	AUTORESET SELECTION	Selects faults that are automatically reset. The parameter is a 16-bit word with each bit corresponding to a fault type. Whenever a bit is set to 1, the corresponding fault is automatically reset. See the VFD Protection Wizard.
31.14	NUMBER OF TRIALS	Defines the maximum number of automatic resets that the drive is allowed to attempt within the time specified by 31.15 If the fault persists, subsequent reset attempts will be made at intervals defined by 31.16 Delay time. The faults to be automatically reset are defined by 31.12 Autoreset selection. The default is 0.
31.15	TOTAL TRIALS TIME	Defines a time window for automatic fault resets. If the "Number of trials" and the "Delay time" exceeds the "Total trials time" the PS220 will not be able to reset automatically. The fault will need to be reset manually. The default is 30 seconds.
31.16	DELAY TIME	Defines the time that the drive will wait after a fault (or a previous reset attempt) before attempting an automatic reset. The default is 0.
31.19	MOTOR PHASE LOSS	Selects how the drive reacts when a motor phase loss is detected. The default is fault.
31.20	EARTH FAULT	Selects how the drive reacts when an earth fault or current unbalance is detected in the motor or the motor cable. The default is fault.
31.21	SUPPLY PHASE LOSS	Selects how the drive reacts when a supply phase loss is detected. The default is fault.
31.22	STO INDICATION RUN/STOP	Selects which indications are given when one or both Safe torque off (STO) signals are switched off or lost. The indications also depend on whether the drive is running or stopped when this occurs. The default is fault/fault.
31.23	WIRING OR EARTH FAULT	Selects how the drive reacts to incorrect input power and motor cable connection (i.e. input power cable is connected to drive motor connection). Note: The protection must be disabled with drive/inverter hardware supplied from a common DC bus. The default is fault.
31.24	STALL FUNCTION (LOCKED ROTOR)	Selects how the drive reacts to a Motor Stall event. A stall occurs when the drive reaches a set current draw at a minimum frequency for a defined period of time.
31.30	OVERSPEED TRIP MARGIN	If actual speed exceeds the speed limit defined by parameter 30.11 or 30.12 by more than the value of this parameter, the drive trips on the 7310 Overspeed fault. Default is 500.
31.25	STALL CURRENT LIMIT	The defined Maximum current value before the stall function will activate. This is a percentage of rated current of the motor. The default is 200 %.
31.26	STALL SPEED LIMIT	The maximum speed at which the stall function will activate if the stall current is at its limit. The default is 200 RPM, or 15 Hz in scalar control.
31.28	STALL TIME	The time allowed before the stall function will activate. The default is 20 seconds.
31.35	MAIN FAN FAULT FUNCTION	Selects how the drive reacts when a main cooling fan fault is detected. The default is fault.
31.36	AUX FAN FAULT BYPASS	Temporarily suppresses auxiliary fan faults. Certain drive types have an auxiliary fan built into the front cover as standard. If the fan is sticking or disconnected, the control program first generates a warning A582, Auxiliary fan missing, then a fault 5081, Auxiliary fan broken. If it is necessary to operate the drive without the front cover (for example, during commissioning), this parameter can be activated to temporarily suppress the fault. Note: • The parameter must be activated within 2 minutes of control unit reboot (either by cycling the power or by parameter 96.08). • The parameter only suppresses the fault, not the warning. • The parameter will be in effect until the auxiliary fan is reconnected and detected, or until the next control unit reboot.
31.42	OVERCURRENT FAULT LIMIT	Sets a custom motor current fault limit. The drive automatically sets an internal motor current limit according to the drive hardware. The internal limit is appropriate in most cases, but this parameter can be used to set a lower current limit, for example, to protect a permanent magnet motor from demagnetization. With this parameter at 0.0 A, only the internal limit is in force. The default is 0.
GROUP 32	SUPERVISION	DESCRIPTION
32.01	SUPERVISION STATUS	Displays the status of the 3 Supervised signals. This is a 4 Bit Binary Display. 0000. Bit 0 is Supervision 1 on the right. (Example: 0001 signifies that Supervision 1 is active)

32.05	SUPERVISION 1 FUNCTION	Defines which signal(s) are to be used with the Supervision 1 function. The choices are: Disabled (Default); Low; High; Both: Abs Low; Abs High; Abs Both.
32.06	SUPERVISION 1 ACTION	Defines the Action taken when the Supervision 1 Function is activated: the choices are: No Action (Default); Warning; Fault; Fault if running.
32.07	SUPERVISION 1 SIGNAL	Defines the signal used for the Supervision 1fucntion. There are 16 choices. ITT recommends using the Analog Inputs used.
32.08	SUPERVISION 1 FILTER	Defines the time that the signal needs to be constant before activating the Supervision 1 function. The default is 1 second.
32.09	SUPERVISION 1LOW VALUE	Defines the Low Value that the signal needs to be at before activating the Supervision 1 function.
32.10	SUPERVISION 1 HIGH VALUE	Defines the High Value that the signal needs to be at before activating the Supervision 1 function.
32.15	SUPERVISION 2 FUNCTION	Defines which signal(s) are to be used with the Supervision 2 function. The choices are: Disabled (Default); Low; High; Both: Abs Low; Abs High; Abs Both.
32.16	SUPERVISION 2 ACTION	Defines the Action taken when the Supervision Function 2 is activated: the choices are: No Action (Default); Warning; Fault; Fault if running.
32.17	SUPERVISION 2 SIGNAL	Defines the signal used for the Supervision 2 function. There are 16 choices. ITT recommends using the Analog Inputs used.
32.18	SUPERVISION 2 FILTER	Defines the time that the signal needs to be constant before activating the Supervision 2 function. The default is 1 second.
32.19	SUPERVISION 2 LOW VALUE	Defines the Low Value that the signal needs to be at before activating the Supervision 2 function.
32.20	SUPERVISION 2 HIGH VALUE	Defines the High Value that the signal needs to be at before activating the Supervision 2 function.
32.25	SUPERVISION 3 FUNCTION	Defines which signal(s) are to be used with the Supervision 3 function. The choices are: Disabled (Default); Low; High; Both: Abs Low; Abs High; Abs Both.
32.26	SUPERVISION 3 ACTION	Defines the Action taken when the Supervision Function 3 is activated: the choices are: No Action (Default); Warning; Fault; Fault if running.
32.27	SUPERVISION 3 SIGNAL	Defines the signal used for the Supervision 3 function. There are 16 choices. ITT recommends using the Analog Inputs used.
32.28	SUPERVISION 3 FILTER	Defines the time that the signal needs to be constant before activating the Supervision 3 function. The default is 1 second.
32.29	SUPERVISION 3 LOW VALUE	Defines the Low Value that the signal needs to be at before activating the Supervision function.
32.30	SUPERVISION 3 HIGH VALUE	Defines the High Value that the signal needs to be at before activating the Supervision 3 function.
GROUP 35	MOTOR THERMAL PROTECTION	DESCRIPTION
35.01	MOTOR ESTIMATED TEMPERATURE	Displays the motor temperature as estimated by the internal motor thermal protection model (see parameters 35.50 - 35.55). The unit is selected by parameter 96.16 Unit selection. This parameter is read-only.
35.02	MEASURED TEMPERATURE 1	Displays the temperature received through the source defined by parameter 35.11 Temperature 1 source. The unit is selected by parameter 96.16 Unit selection.
35.11	TEMPERATURE 1 SOURCE	Selects the source from which measured temperature 1 is read. By default the ACS880 uses an internal calculation based on the actual motor feedback. This can be changed to disabled.
35.12	TEMPERATURE 1 FAULT LIMIT	Defines the fault limit for temperature monitoring function 1. When measured temperature 1 exceeds the limit, the drive trips on fault 4981 External temperature 1. The unit is selected by parameter 96.16 Unit selection. The default is 130C or 266F.
35.13	TEMPERATURE 1 WARNING LIMIT	Defines the warning limit for temperature monitoring function 1. When measured temperature 1 exceeds this limit, a warning, A491 External temperature1 is generated. The unit is selected by parameter 96.16 Unit selection. The default is 110C or 230F.
35.XX	All other parameters not listed	Refer to the ABB ACS880 Firmware manual
GROUP 40	PROCESS PID 1	DESCRIPTION
40.02	PROCESS PID ACTUAL	The actual scaled feedback used from the configured feedback source used for the PS220 Process PID Control tuning feedback.
40.03	PROCESS SETPOINT ACTUAL	The scaled setpoint (reference) used from the configured reference source used for the PS220 Process PID Control tuning feedback.
40.04	PROCESS PID DEVIATION ACTUAL	The difference in the Process Setpoint and the Process actual used to control the PS220 Process PID Control PID tuning functions.
40.08	PROCESS PID FEEDBACK SOURCE	Defines the source used with the PS220 for Process PID Control
40.26	Set 1 setpoint min	Defines minimum process control setpoint any value below this will not be used in the PID control.
40.27	Set 1 setpoint max	Defines maximum process control setpoint any value above this will not be used in the PID control.
40.31	PROCESS PID INVERSION (REGULATION MODE)	Determine when to regulate speed based on an increase or decrease in feedback to regulate the PS220 Process PID Control. Default is NOT INVERTED. An increase in feedback will decrease the speed.
40.32	PROCES PID GAIN	The value used in the PS220 Process PID Control tuning.
40.33	PROCESS PID INTEGRATION TIME	The value used in the PS220 Process PID Control tuning.
40.XX	All other parameters not listed	Reference the ABB ACS880 Firmware Manual for parameter definition. All ACS880 parameters may not be supported with the PS220.
GROUP 41 – 45	REFER TO THE ABB ACS880 FIRMWARE MANUAL	Reference the ABB ACS880 Firmware Manual for parameter definition. All ACS880 parameters may not be supported with the PS220.
GROUP 46	MONITORING SCALING SETINGS	DESCRIPTION
46.14	FILTER TIME POWER OUT	The filter time used when Smartflow is used for Process Control and Pump Protection. The default is 100ms. The recommended setting is 500ms.

GROUP 41 – 45	REFER TO THE ABB ACS880 FIRMWARE MANUAL	Reference the ABB ACS880 Firmware Manual for parameter definition. All ACS880 parameters may not be supported with the PS220.
GROUP 49	PANEL PORT COMMUNICATION	DESCRIPTION
49.04	COMMUNICATION LOSS TIME	Sets a timeout for control panel (or PC tool) communication. If a communication break lasts longer than the timeout, the action specified by parameter 49.05 Communication loss action is taken. The default is 10 seconds.
49.05	COMMUNICATION LOSS ACTION	Selects how the drive reacts to a control panel, or PC tool communication break. The default is warning.
49.14	PANEL REFERENCE	Can be used to set the reference when the keypad is configured for use as the reference. It will display in the units configured with the Process Control Wizard or RPM if in speed control or Speed Override.
49.XX	All other parameters not listed	Refer to the ABB ACS880 Firmware manual.
GROUP 50	FIELDBUS ADAPTER (MUST USE SLOT2)	DESCRIPTION
50.01	FBA A ENABLE	Enables/disables communication between the drive and fieldbus adapter A and specifies the slot the adapter is installed into.
50.02	FBA A COMM LOSS FUNC	Selects how the drive reacts upon a fieldbus communication break. The time delay is defined by parameter 50.03. The default is no action.
50.03	FBA A COMM LOSS T OUT	Defines the time delay before the Comm loss function is activated. Time count starts when the communication link fails to update the message. This value should be set to at least 3 times the transmit interval. The default is .3 seconds.
50.XX	All other parameters not listed	Refer to the ABB ACS880 Firmware manual and the Fieldbus Adapter Manual used for communications.
GROUP 51	FIELDBUS ADAPTER A SETTINGS	DESCRIPTION
51.01	FBA A TYPE	Displays the type of the connected fieldbus adapter module. Read Only 0 = Module is not found, or improperly connected, or is disabled by parameter 50.01 FBA A enable.
51.27	FBA A PAR REFRESH	Validates any changed fieldbus adapter module configuration settings. After refreshing, the value reverts automatically to Done. Note: This parameter cannot be changed while the drive is running.
51.31	D2FBA A COMM STATUS	Displays the status of the fieldbus adapter module communication.
51.XX	All other parameters not listed	Refer to the ABB ACS880 Firmware manual or the Fieldbus Adapter Manual used for communications
GROUP 52	FIELDBUS ADAPTER A DATA IN SETTINGS (AS VIEWED FROM THE TARGET)	DESCRIPTION
52.xx	All parameters.	Refer to the ABB ACS880 Firmware manual and the Fieldbus Adapter Manual used for communications.
GROUP 53	FIELDBUS ADAPTER A DATA OUT SETTINGS (AS VIEWED FROM THE TARGET)	DESCRIPTION
53.xx	All parameters.	Refer to the ABB ACS880 Firmware manual and the Fieldbus Adapter Manual used for communications.
GROUP 60	MULTIPUMP COMMUICATION SETUP	DESCRIPTION
60.02	PUMP ADDRESS	Selects the node address of the drive for Multipump D2D Master and D2D Follower communication. No two nodes may have the same address. Range is 1 – 6.
60.03	M/F Mode	Switches from D2D Master or D2D Follower when MultiPump is in operation. (This is a viewable only parameter.)
60.XX	All other parameters not listed	Refer to the ABB ACS880 Firmware manual
GROUP 74	START / STOP OPTIONS	DESCRIPTION
74.01	PS220 Keypad	Start /Stop controlled via the PS220 Keypad
	2 WIRE DI1 (DEFAULT)	Control at one external location Ext1 via 2-Wire switch assigned to DI1. DI1 is normally open. 0 = stop, 1 = start.
	3 W DI1P,2P	Control at one external location. Pulse start assigned to DI1 and pulse stop assigned to DI2. DI2 will be "normally closed".
	HOA DI1,2	Control Used for Hand-Off-Auto. DI1is assigned to Auto; DI2 is assigned to Hand (Speed Override).Both are normally open.
	HOA DI1,2 – DI5	Control at two external locations. EXT1: Hand-Off-Auto. DI1 is assigned to Auto, DI2 is assigned to Hand(Speed Over) EXT2: Auto. 2-Wire switch is assigned to DI5. This combination requires a preassigned switch (DI3) to switch between these 2 choices. All switches are normally open
	DI1P,2P – DI5	Control at two external locations. EXT1: Pulse start assigned to DI1 and pulse stop assigned to DI2. DI1 is normally open and DI2 is normally closed. EXT2: Auto is a 2-Wire start/stop switch assigned to DI5. Normally open. This requires a preassigned switch (DI3) to switch between these 2 choices.
	HOA DI1,2 – FB	Control at two external locations. EXT1: Hand-Off-Auto. DI1 is assigned to Auto, DI2 is assigned to Hand (Speed Override). EXT2: Fieldbus is the second control location. This requires a preassigned switch (DI3) to switch between these choices. All switches are

		Normally open
	2W DI1 - 2W DI5	EXT1: 2-Wire assigned to DI1. EXT2: 2-Wire switch at DI5. This requires a preassigned switch (DI3) to switch between these choices. All switches are "normally open"
	FIELDBUS	Start via Fieldbus control word. External control location 1 only.
	DI1P,2P – FB	Control at two external locations. EXT1: 3-Wire pulse start assigned to DI1 and pulse stop assigned to DI2. EXT2: Fieldbus control word. This requires a preassigned switch (DI3) to switch between these choices. DI1 and DI3 are normally open. DI2 is normally closed.
74.02	AUTO RESTART	Selects whether the PS220 will automatically restart after a power failure.
	OFF [default]	Not selected
	ON ⚠ WARNING	Selected. The PS220 will automatically restart if conditions permit. Parameter 21.18 must be 0 seconds. The function restarts the drive automatically and continues operation after a supply break. Make sure that no dangerous situations can occur.
74.03	STOP FUNCTION	Selects how the motor should stop during normal shutdown.
	RAMP [default]	Pump shuts down using the ramp rate.
	COAST	Power is cut immediately to motor allowing it to coast to a stop.
74.04	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 PS220 will start the motor. The start delay does not function in local control.
74.05	SPEED OVERRIDE	When active selects between PID control and Speed Control.
	DISABLED (DEFAULT)	The Speed Override function is not 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.
	DI3(INV)	Activates speed override mode via a digital input 3 inverse operation.
	HOA	Activates speed override mode via digital input 2 hand function.
	FIELDBUS	A fieldbus control word is used to activate the speed override mode.
74.06	SPD OVERRIDE REF	Defines the location of the override speed reference.
	AI1	Selects analog input 1 as the override speed reference.
	AI2	Selects analog input 2 as the override speed reference.
	KEYPAD (DEFAULT)	Selects the keypad as the speed reference
	FIELDBUS	Selects fieldbus as the speed reference set by FBA A Ref 1.
74.07	SPD OVERRIDE DFLT SPD	Defines the default value of the speed override speed reference. Default is 25% of motor speed in 99.09

GROUP 75	PROCESS CONTROL	DESCRIPTION
75.02	PRIMING DELAY	The time that the drive will run at full speed to prime. All functionality except for VFD protection is disabled during this time. The range is 0 – 6000 sec
75.03	SLEEP MODE	Defines the selections for SLEEP MODE.
	DISABLED	Function is disabled.
	MIN SPEED	Pump will enter sleep mode when the both the minimum speed and the process variable is achieved.
	INTELL SLEEP	Pump will enter sleep mode when the both the minimum flow and the process variable is achieved. The PS220 will determine the correct value proportionally based on operating speeds.
75.05	SLEEP VALUE	The percentage of the process value achieved while the PS220 runs at the minimum speed setting before entering the sleep mode. Default is 100%. Range is 0-??? Applies to 75.03 = Min Speed. The percentage of the process value achieved while the PS220 runs at the minimum flow setting before entering the sleep mode. Default is 100% of minimum flow value. Range is 0-??? Applies to 75.03 = INTELL SLEEP.
75.06	RESTART VALUE	The percentage value of the process variable that is allowed before the drive will resume operation and restart from the sleep mode. Wake-up level in % of setpoint value = Range is 0 – 500%. The default is 10%.
75.07	SLEEP DELAY	The time delay before the Ps220 will enter the sleep mode. Range 0-1800 sec. Default is 5 seconds.
75.08	RESTART DELAY	Time delay for the PS220 to resume operation and restart from the sleep mode. Range = 0 –1800 sec. Default = 10 second
75.09	SETPOINT MIN	Defines minimum process control setpoint any value below this will not be used in the PID control.
75.10	SETPOINT MAX	Defines maximum process control setpoint any value above this will not be used in the PID control.
75.16	FLOW BYPASS SOURCE	Selects the signal source for activating the bypass relay.
	OFF [DEFAULT]	Function is disabled.
	FLOW ACTUAL	An external flow meter signal is used to control the bypass valve relay output.
	SMARTFLOW	SmartFlow is used to control the bypass valve relay output.
75.17	FLOW BYPASS ON	This flow value that will trigger the Flow Bypass function. This value should be at full speed. The PS220 will determine the correct value proportionally based on operating speeds. Range = 0 – 100,000. Default is 0
75.18	FLOW BYPASS OFF RATIO	Defines the flow ratio for closing the Flow Bypass valve. Bypass valve closes when (Flow actual/ Flow Minimum) >= Flow Bypass Off Ration. The default is 2.1. The range is 0.0 – 5.0.
75.19	ON DELAY	The time delay to activate the flow bypass relay. Range 0 – 1800 sec. Default = 1 sec.
75.20	OFF DELAY	The time delay to de-activate the flow bypass relay. Range 0 – 1800 sec. Default = 1 sec.
75.21	FLOW RELAY START DELAY	The time delay that the flow must be below minimum flow to activate the Flow Bypass function. Range 0 – 200 sec. Default is 15 seconds.
75.22	PRESS INC SPEED	This the speed at which system curve compensation begins. At speeds below this, no compensation for increased resistance is made. The range is 0-3600rpm. 1200rpm is default.
75.23	PRESS INC % TIME	This the amount that PumpSmart will have increased the setpoint at maximum speed. The range is 0-100%. 0% is default.
75.24	MULTIVAR CTL	Selects the PS220 Multivariable Control feature.
	OFF [DEFAULT]	Disables Multivariable control
	ON	Multivariable control is active
75.25	MULTIVAR REF SOURCE	This parameter defines the source used in the Multivariable control function. Choices are from any available Analog Input. The selected Input will need to be fully configured as "Proc Trans 2"
75.26	LEVEL 1	This is the first level in which the Multivariable control function will scale the set-point as it is defined by the LO INTRCPT value and SPT LO value. LEVEL 1 is defined in units of the secondary process variable. Range: -10000-10000 Default = 0.
75.27	SPT LO	This is the lower limit set-point as related to LO INTRCPT. SPT LO is defined in units of the primary process variable or RPM when in speed control. Range: -20000 -20000 Default = 0.
75.28	LO INTRCPT	This is the lower limit level in which the Multivariable function will scale the set-point as defined by the SPT LO value. LO INTRCPT is defined in units of the secondary process variable. Range: -10000 to 10000 Default = 10000.
75.29	LEVEL 2	This is the upper level in which the Multivariable control function will scale the set-point as it is defined by the HI INTRCPT value and SPT HI value. LEVEL 2 is defined in units of the secondary process variable. Range: -10000 to 10000 Default = 10000.
75.30	SPT HI	This is the upper limit set-point as related to HI INTRCPT. SPT HI is defined in units of the primary process variable or RPM when in speed control. Range: -20000 to 20000 Default = 20000.
75.31	HI INTRCPT	This is the upper limit level in which the Multivariable function will scale the set-point as defined by the SPT HI value. HI INTRCPT is defined in units of the secondary process variable. Range: -10000 to10000 Default = 10000.

GROUP 76	ANALOG I/O CONFIG	DESCRIPTION	
76.01 76.02	Analog 1 Configuration Analog 2 Configuration All choices are available. Do not duplicate.	PROC TRANS 2	Used for the Multivariable control functionality.
		PROC TRANS 1	Used as the primaryprocesstransmitter for Control Mode.
		EXT SETPOINT1	Used for the Primary External Setpoint

		EXT SETPOINT2	Used for a Secondary External Setpoint for the Dual Setpoints functionality.
		FLOWMETER	Used when Flow is used for the Control Mode or for use with Smartflow Pump Protection
		DISCH PRESSURE	Used with Advanced SmartFlow.
		SUCTION PRESS	Used with Advanced SmartFlow
		DIFF PRESS	Used with Advanced SmartFlow
		TEMPERATURE	Used when Temperature is the primary Control Mode or when a temperature transmitter is requiredfor Specific Gravity correction with Smartflow.
		VISC/SG VALUE	Used when a correction is required for Specific Gravity with Smartflow.
		SPD OVRRD	Used for the external reference for the Speed Override functionality.
		LEVEL	Used when Level is the primary process transmitter for Control Mode.
		FLOW REF	Used for the Primary External Setpoint for the Flow Control Mode
		PRESSURE REF	Used for the Primary External Setpoint for the Pressure Control Mode
		TEMPERATURE REF	Used for the Primary External Setpoint for the Temperature Control Mode
		NOT SELECTED	Not used
`76.03-05	AIOPT1 ,AIOPT2, AIOPT3 Configuration	Same choices as above	Same choices as above
76.06	RO1 SOURCE (Default is Ready)	Selects the PS220 status to be indicated through relay outputs 1 selection. The relay energizes when the status meets the setting.	
	(0) FORCE OFF	Relay is nonfunctional.	
	(1) FORCE ON	Force the Relay output to be active.	
	(2) FAULT	A general VFD or PUMP related fault has occurred. Normally Closed.	
	(3) RUNNING	Drive is running the motor.	
	(4) FLOW BYP SMRT FLW	Minimum flow bypass is active using Smartflow.	
	(5) PIPE CLEAN	A pipe cleaning sequence is being executed.	
	(6) COND1 HI ALARM	Condition 1 HI Alarm is active.	
	(7) COND2 HI ALARM	Condition 2 HI Alarm is active.	
	(8) FLOW BYP EXT FLW	Minimum flow bypass is active using an external flowmeter.	
	(9) PUMP FLTS/WRNGS	A general pump related warning or fault has occurred.	
	(10) READY	Drive is ready to run.	
	(11) SECND PRTECT A	Secondary Protect A activation.	
	(12) SECND PRTECT B	Secondary Protect B activation.	
	(13) PCS REQ	A pump cleaning sequence has been requested.	
	(14) PCS EXE	A pump cleaning sequence is being executed.	
	(15) PUMP PROTECT	Pump protection is active.	
	(16) MULTI VAR ACTIVE	Multivariable control is active.	
	(17) SPEED OVERIDE	Speed override is active.	
	(18) COND1 LOW ALARM	Condition 1 LOW Alarm is active.	
	(19) COND2 LOW ALARM	Condition 2 LOW Alarm is active.	
	(20) START DELAY ACTIVE	Start Delay function is active.	
	(21) REMOTE	Drive is in remote mode.	
	(22) INV FAULT	A general VFD or PUMP related fault has occurred. Inverted operation.	
	OTHER	A specific parameter setting is active.	
76.07	RO2 SOURCE (Default is Running)	Selects the PS220 status to be indicated through relay outputs 1 selection. The relay energizes when the status meets the setting. Same 24 choices as 76.06.	
76.08	RO3 SOURCE (Default is Fault)	Selects the PS220 status to be indicated through relay outputs 1 selection. The relay energizes when the status meets the setting. Same 24 choices as 76.06.	
76.09	DI1	Selects the Digital input 1 function Refer to configuration guide for choices	
76.10	DI2	Selects the Digital input 2 function Refer to configuration guide for choices	
76.11	DI3	Selects the Digital input 3 function Refer to configuration guide for choices	
76.12	DI4	Selects the Digital input 4 function Refer to configuration guide for choices	
76.13	DI5	Selects the Digital input 5 function Refer to configuration guide for choices	
76.14	DI6	Selects the Digital input 6 function Refer to configuration guide for choices	
76.15	DIO1	Selects whether DIO1 is used as a digital input. Options are the same as the DI's.	
76.16	DIO2	Selects whether DIO2 is used as a digital input. Options are the same as the DI's.	
76.17	DIO1 OUTPT SOURCE	Selects the PS220 status to be indicated through relay outputs DO1 selection. The relay energizes when the status meets the setting. DO1 is limited to 200 MA with the 24vDC pin. Same 24 choices as 76.06.	
76.18	DIO2 OUTPT SOURCE	Selects the PS220 status to be indicated through relay outputs DO2 selection. The relay energizes when the status meets the setting. DO2 is limited to 200 MA with the 24vDC pin. Same 24 choices as 76.06.	
GROUP 77	SMARTFLOW	DESCRIPTION	

77.01	PUMP TYPE	Defines the type of pump being used.
	DISABLED	Disables the SmartFlow function
	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
77.02	CALC METHOD	Selects the calculation method depending on the power curve shape. A suction and discharge transmitter or differential pressure transmitter is required for BHP/TDH and TDH
	BHP [DEFAULT]	Select BHP for a constantly rising power curve.
	BHP/TDH	Select BHP/TDH for a non-constantly rising power curve.
	TDH	Select TDH if power curve is flat.
77.03	BEP FLOW	Flow at the pump Best Efficiency Point (BEP) at rated speed. Range: 0-10,000.
77.04	PUMP RATED SPD	Speed at which pump data (QBEP, PBEP, and PSO) is entered. Range 0 – 18000 RPM Scalar mode units are Hz. Default = MAXIMUM SPEED.
77.05	BEP POWER	Power at the pump Best Efficiency Point (BEP) at rated speed. Must be at SG = 1.0. Range 0 – 3000.00.
77.06	SO POWER	Power at the pump shut-off condition (SO) at rated speed. Must be at SG = 1.0. Range: 0 – 3000.00.
77.07	BEP TDH	The pump Total Dynamic Head (TDH) at the Best Efficiency Point (BEP) at rated speed.
77.08	SO TDH	The pump Total Dynamic Head (TDH) at Shut-Off (closed valve condition) at rated speed.
77.09	SUCTION DIA	Pump nominal suction diameter. If LANGUAGE = ENGLISH (US), the units are in inches. MM for all other languages. Range 0.00 – 1000.00.
77.10	DISCHARGE DIA	Pump nominal discharge diameter. If LANGUAGE = ENGLISH (US), the units are in inches. MM for all other languages. Range 0.00 – 1000.00.
77.11	DELTA Z	The suction and discharge pressure gage height differential with respect to the Centerline of the pump. If LANGUAGE = ENGLISH (US), the units are in Ft. M for all other languages. Range 0.0 – 1000.0.
77.12	SPD RATIO	The input speed to output speed ratio. Range 0.00 – 20.00. Used for pumps with belt drives.
77.13	DP SOURCE	Identifies the configured analog input to be used for the differential pressure source.
	NOT USED [DEFAULT]	
	PROC TRANS 1	Select if using the primary process transmitter
	PROCE TRANS 2	Select if using the secondary process transmitter
	DIFFERENTIAL PRESSURE	Select if using a differential pressure transmitter.
77.14	DISC PRES SOURCE	Identifies the configured analog input to be used for the discharge pressure source.
	NOT USED [DEFAULT	
	PROC TRANS 1	Select if using the primary process transmitter
	PROCE TRANS 2	Select if using the secondary process transmitter
	DISCHARGE PRESSURE	Select if using a separate suction pressure transmitter.
77.15	SUC PRES SOURCE	Identifies the configured analog input to be used for the discharge pressure source.
	NOT USED [DEFAULT	
	PROC TRANS 1	Select if using the primary process transmitter
	PROCE TRANS 2	Select if using the secondary process transmitter
	S PRESSURE	Select if using a separate suction pressure transmitter.
77.20	CALC SO SOURCE	
	AFFINITY [DEFAULT]	Estimates power at shut-off using the affinity laws.
	TUNED VALUE	Uses the power at shut-off characteristic curve developed during the tune function.
	TUNE	A Smartflow Tune function will be required to calculate the actual SO value and to create the unique flow characteristic model used to determine Smartflow value for the pump in service.
77.22	P MAG CORR	An eddy current correction factor for magnetic drive pumps. Visible only if 77.01 TYPE = MAG DRIVE. Range: 0.00 – 100.00. If LANGUAGE = ENGLISH (US), the units are in BHP. KW for all other languages.
77.23	QACT FILTER	Defines the filter time constant for QACT. Range is 0-10 sec. Default is 1. Recommended is 5.
77.24 - 33	Various Parameters	Not used in the current Version of the software.
77.34	MECH LOSS	Mechanical loss correction factor. When losses are greater than 20%-30% of the overall pump power consumed a correction may need to be made. If LANGUAGE = ENGLISH (US), the units are in BHP. KW for all other languages. Default is 0.
GROUP 78	FLUID PROPERTIES	DESCRIPTION
78.01	PATM	The local barometric pressure. 14.7 PSI is normal
78.02	SG SEL	Selects SG source
	SG RATED [DEFAULT]	Uses the value parameter 78.03 SG RATED
	SG CALC (T)	Calculates SG as a function of temperature using the SG Calculation logic.
	AI – ANALOG INPUT	SG is set via an analog input signal (refer to Group 76 setup). Linear scale: 4mA=SG MIN, 20mA = SG MAX.
	DI – DIGITAL INPUT	SG can be toggled between parameter 78.04 SG MIN and 78.06 SG MAX via user defined digital input.
78.03	SG RATED	Specific Gravity, Rated. Setting range is 0.00 – 10.00.
78.04	SG MIN	Specific Gravity, Minimum. Setting range is 0.00 – 10.00.
78.05	SG MID	Specific Gravity, Midway. Setting range is 0.00 – 10.00.
78.06	SG MAX	Specific Gravity, Maximum. Setting range is 0.00 – 10.00.

78.07	TEMP RATED	Temperature, Rated. If LANGUAGE = ENGLISH (US), the units are in F Deg (default = 104), C Deg (default = 40) for all other languages. Setting range: -200.0 – 1000.0.
78.08	TEMP MIN	Temperature, minimum. If LANGUAGE = ENGLISH (US), the units are in F Deg. (default = 0), C Deg (default = -18) for all other languages. Setting range: -200.0 – 1000.0.
78.09	TEMP MID	Temperature, midway. If LANGUAGE = ENGLISH (US), the units are in F Deg. (default =104), C Deg (default = 40) for all other languages. Setting range: -200.0 – 1000.0.
78.10	TEMP MAX	Temperature, Maximum. If LANGUAGE = ENGLISH (US), the units are in F Deg. (default =104), C Deg (default = 40) for all other languages. Setting range: -200.0 – 1000.0.
GROUP 79	PUMP PROTECTION	DESCRIPTION
79.01	PUMP PROTECT CTRL	Basic Pump Protection Activation. NOTE: Not available in Local Control or with Speed control
	DISABLED [DEFAULT]	Protection is disabled
	WARNING	The PumpSmart PS220 will issue a warning message of "Basic Pump Protection". The pump will continue to run at the maximum allowed speed while not achieving the setpoint requirement.
	ALARM AND CONTROL	The PumpSmart PS220 will respond based on the Protections Options. If there are "Error Resets" allowed, the drive will respond with a "Basic Pump Protect Retry" Message. If a hard fault occurs it will display the message "Basic Pump Protection Fault". The fault will have to be reset, and the drive issued a start command again.
79.02	PROTECTION LIMIT	The percentage value difference between the operating setpoint, and the actual setpoint, at which the Basic Pump Protection Function becomes active. The default value is 97%.
79.03	PROTECTION DELAY	The time delay for any Pump Protection actions to be taken. This applies to Basic Pump Protection, Secondary Protect A and /B, Min Flow, Dry Run and Run Out. 0 deactivates any protection. Setting range: 0– 200 sec. Default is
79.04	SP OVRRD PMP PROT	Pump Protection is active when speed override is initiated.
	DISABLED [DEFAULT]	Speed Override Pump Protection is inactive.
	ENABLED	Speed Override Pump Protection is active.
79.05	PUMP FAULT RESET	Determines the number of automatic fault resets or retries allowed before a fault condition will become active. Selection range is 0 – 19. The Default is 0. A "0" also deactivates this function. The counter resets if a stop command is issued or the condition has passed and the PS220 runs without further incident for 5 minutes. Not Applicable for DRY RUN.
79.06	PUMP RESET DELAY	The time delay before the PS220 will wait before attempting an automatic retry or reset. The Range is 0 -3600 sec. Default is 60 Seconds
79.07	Q ACT SOURCE	Identifies the source of the flow readings used for the pump protection feature.
	SMARTFLOW [DEFAULT]	The PS220 will use the Smartflow calculated flow values
	FLOW METER	The PS220 will use an external flow meter.
79.08	MIN FLOW CTRL	Minimum Flow Pump Protection Activation
	DISABLED [DEFAULT]	Protection is disabled.
	WARNING	The PS220 generates a "Min Flow Warning" only.
	ALARM AND CONTROL	The PumpSmart PS220 will indicate that the pump is running at or below minimum flow with a message "Min Flow Warning", after the response delay time has expired. The event will be stored in the Event Log. The PS220 will then respond based on the Protections Options. If there are "Error Resets allowed, the drive will respond with a Min Flow Retry Message. If a hard fault occurs it will display the message "Min Flow Fault". The fault will have to be reset, and the drive issued a start command again.
79.09	MIN FLOW	Defines the safe minimum flow of the pump at pump rated speed.
79.10	DRY RUN CTRL	Dry Run Pump Protection Activation
	DISABLED (DEFAULT)	Protection is disabled.
	FAULT	The PS220 will Faults and the motor coasts to a stop. A fault message "Dry Run Fault" will be displayed. This fault is not resettable by Pump Fault Reset (79.05).
	WARNING	The PS220 generates a "Dry Run Warning" only. No other action will be taken.
79.11	DRY RUN FACTOR	Coefficient for determining dry-run power, Range= 0 – 2.00 Default is .95
GROUP 79	PUMP PROTECTION	DESCRIPTION
79.12	RUNOUT CTRL	Runout Flow Pump Protection Activation
	DISABLED [DEFAULT]	Protection is disabled.
	WARNING	The PS220 generates a Runout warning only. No further action is taken.
79.13	RUNOUT FLOW	Defines the Runout flow of the pump at pump rated speed.
79.14	SECONDARY PROTECT A	Loss of the Digital Input configured for this Function.
	DISABLED [DEFAULT]	Protection is disabled
	ALARM	The PS220 generates a warning only "Secondary Protect A". No further action is taken.
	ALARM AND CONTROL	The PumpSmart PS220 will indicate a "Secondary Protect A" warning message, after the response delay time has expired. The event will be stored in the Event Log. The PS220 will then respond based on the Protections Options.

79.15	SECONDARY PROTECT B	Loss of the Digital Input configured for this Function.
	DISABLED [DEFAULT]	Protection is disabled
	ALARM	The PS220 generates a warning only "Secondary Protect B". No further action is taken.
	ALARM AND CONTROL	The PumpSmart PS220 will indicate a "Secondary Protect B" warning message, after the response delay time has expired. The event will be stored in the Event Log. The PS220 will then respond based on the Protections Options.
79.16	CONFIG MIN SPEED	The selection to allow the PS220 to run at either its Minimum Speed, or at Zero Speed (0) when required for the Functionality as configured.
	SPEED = 0	The drive will stay at zero (0) speed when the "Alarm and Control" functional routine is actively running for "Pump Protection". This also will allow the "Sleep Function" to activate.
	SPEED = MIN SPEED	The PS220 will remain at minimum speed when the "Alarm and control" functional routine is actively running for Pump protection, or when the "Sleep Function" is disabled in PID Control.
79.17	STP DELAY MIN SPD	The time period used with various PS220 functions where the drive will remain at minimum speed. Functional Pump Protection and Control routines will continue as configured after this time has expired.
GROUP 80	CONDITION MONITORING	DESCRIPTION
80.01	CONDITION STATUS	A 1 indicates the condition is active

BIT	FUNCTION DESCRIPTION
0	Enabled
1	Cond1 High Alarm
2	Cond1 High Warning
3	Cond1 Low Warning
4	Cond1 Low Alarm
5	Cond2 High Alarm
6	Cond2 High Warning
7	Cond2 Low Warning
8	Cond 2 Low Alarm
13	Sleep Active
14	Min Speed Active

Parameter	Name	Value/Range	NOTES
80.04	COND 1 SOURCE	None [Default] Flow Actual Pressure Actual Level Actual Speed Torque Power Current Temperature Actual SmartFlow PROC TRANS 1 PROC TRANS 2	Select the source of the signal to be monitored. The source can either be from an external transmitter wired to an available analog input or it can be an internal signal as selected by the parameter number.
80.05	COND 1 WRN LIM HI	-10000 to +10000 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. Inactive if set to 0.
80.06	COND 1 WRN LIM LO	-10000 to +10000 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. Inactive if set to 0.
80.07	COND 1 ALARM	DISABLED [default]	Protection is inactive.
		ALARM ONLY	Selecting ALARM ONLY will issue a Keypad message showing that an ALRM LIM HI or ALRM LIM LO condition is detected. No further action is taken.
		MIN SPD	Selecting MIN SPD will issue a Keypad message showing that an ALRM LIM HI or ALRM LIM LO condition is detected and will drop to MIN SPEED. If the alarm does not reset itself after the MIN SPD STP DLY the PS220 will fault.
		SLEEP	The PS220 will shut down and go into a sleep mode if an ALRM LIM HI or ALRM LIM LO condition is detected. It will "wake up" according to the value in 80.22.
		FAULT	The PS220 faults if an ALRM LIM HI or ALRM LIM LO condition is detected. A Keypad notice is issued

80.08	COND 1 ALRM LIM HI	-10000 to +10000 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 80.16). Inactive if set to 0.
80.09	COND 1 ALRM LIM LO	-10000 to +10000 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 80.16). Inactive if set to 0.
80.10	COND 2 SOURCE	None [Default] Flow Actual Pressure Actual Level Actual Speed Torque Power Current Temperature Actual SmartFlow PROC TRANS 1 PROC TRANS 2	Select the source of the signal to be monitored. The source can either be from an external transmitter wired to an available analog input or it can be an internal signal as selected by the parameter number.
80.11	COND 2 WRN LIM HI	-10000 to +10000 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 80.16). Inactive if set to 0.
80.12	COND 2 WRN LIM LO	-10000 to +10000 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 80.16). Inactive if set to 0.
80.13	COND 2 ALARM	DISABLED [default]	Protection is inactive.
		ALARM ONLY	Selecting ALARM ONLY will issue a Keypad message showing that an ALRM LIM HI or ALRM LIM LO condition is detected. No further action is taken.
		MIN SPD	Selecting MIN SPD will issue a Keypad message showing that an ALRM LIM HI or ALRM LIM LO condition is detected and will drop to MIN SPEED. If the alarm does not reset itself after the MIN SPD STP DLY the PS220 will fault.
		SLEEP	The PS220 will shut down and go into a sleep mode if an ALRM LIM HI or ALRM LIM LO condition is detected. It will "wake up" according to the value in 80.22.
		FAULT	The PS220 faults if an ALRM LIM HI or ALRM LIM LO condition is detected. A Keypad notice is issued.
80.14	COND 2 ALRM LIM HI	-10000 to +10000 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. Inactive if set to 0.
80.15	COND 2 ALRM LIM LO	-10000 to +10000 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. Inactive if set to 0.
80.16	COND RESP DELAY	0-3600 sec 20 sec [default]	The delay period prior to activation of a COND 1 or COND 2 WRN OR ALRM
80.17	PROC TRANS 1 UNITS	None [default]	Select from the available 13 options.
80.18	MIN SPD STP DLY	0-3600 sec 60 sec [default]	The time which the PS220 will operate at min speed during an alarm condition if it does not reset. If the time expires the PS220 will fault.
80.19	CONDITION ENABLE	When running Always [Default]	Allows selection of when condition monitoring warnings and alarms will be triggered.
80.20	PROC TRANS 2 UNITS	None [default]	Select from the available 13 options: PSI, BAR, MPa, M, FT, in, cm, GPM, M3HRS, BPH, Ls, F, C.
80.21	COND 1 HYSTERESIS	-10000 to +10000 .20 [default]	The monitored difference (window) between the warning and alarm values, and the actual values used to activate or deactivate the Condition 1 event. It prevents a condition from continuously activating and deactivating when the monitored value fluctuates above and below the High or Low limits
80.22	COND 2 HYSTERESIS	-10000 to +10000 .20 [default]	The monitored difference (window) between the warning and alarm values, and the actual values used to activate or deactivate the Condition 2 event. It prevents a condition from continuously activating and deactivating when the monitored value fluctuates above and below the High or Low limits

GROUP 81	MULTIPUMP	DESCRIPTION	
81.01	MODE	Selects how multiple PS220 units operate together in parallel to satisfy the set-point. Multipump control is disabled. (Default) Synchronous Speed. Lag pumps start as needed and all pumps regulate to the set-point at the same speed or torque.	
81.02	VALUE DECREASE	Defines the percentage difference decrease between the system set point versus the actual value to initiate staging of an available lag pump. Setting range = 0.0 – 100.0% of set point.	
81.03	VALUE INCREASE	Defines the increase in the systems set point desired when lag pumps start. This value is cumulative for each additional lag pump that stages on. This is used to compensate for higher friction losses form increased flow rate in systems that need to be overcome as additional pumps add more flow into the system. The formula used is Set point Increase = Value Decrease - Value Increase Setting range = 0.0 – 100.0% of set point. The default setting for is equal to the value set in 81.02. (No increase in setpoint as additional pumps stage on) The setpoint will decrease at the same rate as pumps destage.	
81.04	STAGE/DESTAGE METHOD	Selects the method of staging or de-staging pumps in the MultiPump system. Pumps stage and de-stage based on speed or Torque. Default) Pumps stage and de-stage based on the process variable values.	
81.09	STAGE 2	Selects the control value at which lag pump 1 should be turned on. Setting range = 0.0 – 100.0% of MAXIMUM SPEED/Torque or the actual Process variable.	
81.10	STAGE 3	Selects the control value at which lag pump 2 should be turned on. Setting range = 0.0 – 100.0% of MAXIMUM SPEED/Torque or the actual Process variable.	
81.11	STAGE 4	Selects the control value at which lag pump 3 should be turned on. Setting range = 0.0 – 100.0% of MAXIMUM SPEED/Torque or the actual Process variable.	
81.13	DESTAGE 2	Selects the control value at which lag pump 1 should be turned off. Setting range = 0.0 – 100.0% of MAXIMUM SPEED/Torque or the actual Process variable.	
81.14	DESTAGE 3	Selects the control value at which lag pump 2 should be turned off. Setting range = 0.0 – 100.0% of MAXIMUM SPEED/Torque or the actual Process variable.	
81.15	DESTAGE 4	Selects the control value at which lag pump 3 should be turned off. Setting range = 0.0 – 100.0% of MAXIMUM SPEED/Torque or the actual Process variable.	
81.17	STAGE 5	Selects the control value at which lag pump 5 should be turned on. Setting range = 0.0 – 100.0% of MAXIMUM SPEED/Torque or the actual Process variable.	
81.18	STAGE 6	Selects the control value at which lag pump 6 should be turned on. Setting range = 0.0 – 100.0% of MAXIMUM SPEED/Torque or the actual Process variable.	
81.21	DESTAGE 5	Selects the control value at which lag pump 4 should be turned off. Setting range = 0.0 – 100.0% of MAXIMUM SPEED/Torque or the actual Process variable.	
81.22	DESTAGE 6	Selects the control value at which lag pump 6 should be turned off. Setting range = 0.0 – 100.0% of MAXIMUM SPEED/Torque or the actual Process variable.	
81.23	MULTIPUMP RUNTIME RESET	Selecting Reset clears the operating hours accumulated on this drive only when running in MultiPump operation.	
81.31	SWITCH LEAD TIME	Defines the elapsed actual motor runtime time the D2D Master (Lead) will run before switching to the next available D2D Follower (lag) in the system. 0.00 hours disables the function, including alternating when a fault may occur. For the equivalent of disabling the alternating function and allowing for alternation during a fault, set the value to 99999.00 Setting range is .01 to 99999.00 hours. Maximum hours =11.5 years.	
81.32	SWITCH LEAD	Allows for the manual switching of the lead (D2D Master) via this parameter. Selections are: Disabled (default), pump 1, pump 2, pump 3, pump 4, pump 5 and pump 6. This parameter returns to disabled after a selection is made. Manual switch shall function only through the D2D Master using the D2D Master's keypad, or PC tool.	
81.33	MAX PUMPS ON	Defines the maximum number of pumps that can stage on, and then continue to run as required.	
81.34	MIN PUMPS ON	Defines minimum number of pumps that can run at any one time or when de-staging has been completed. De-staging is ignored on any pump less than this number.	
81.36	SWITCH LEAD SLP COUNT	Defines the elapsed number of times the D2D Master (lead) pump goes into sleep mode. After this count the DS2D Master will be automatically transferred to the next available D2D Follower in the sequence. Any value greater than 0 automatically sets parameter 81.31 to 0 disabling switching based on hours.	
81.38	DESTAGE PROOF TIME	Elapsed time required before the de-staging of a lag pump will occur. De- stage value and the reference value must both be met during this timeframe. Setting range 0-900 seconds. Default is 20 seconds.	
81.39	STAGE PROOF TIME	Elapsed time required for the staging of a lag pump will occur. The stage value and the value decrease value must both be met during this timeframe. Setting range 0-900 seconds. Default is 20 seconds	
81.41	Follower Switch Factor	This allows for the automatic balancing of D2D Follower (lag) pumps if used on a system with significantly unequal run times. It will use this number as a multiplier of the switch hours to offset the unequal time differences to eventually equal them out over time. The default is 0	
Group 83	WATER FUNCTIONS	Value/Range	Notes
83.01	EXE P CLEAN SEQ		Defines how the cleaning sequence is executed.
		NOT SEL (DEFAULT)	The pump cleaning sequence is disabled.
		P CTRL DI3	The pump cleaning system is executed using DI3.
		PS220	The pump cleaning system is executed by the PS220 automatically.

83.02	REQ P CLEAN SEQ	Applicable only when 83.01 is set to PS220.	Defines what triggers the request of the pump cleaning sequence.
		NOT SEL (DEFAULT)	Disable the Automatic execution of the PCS
		TORQ	The request is triggered when 1.10 MOTOR TORQUE exceeds the value set in 83.03 TORQ REQ for the 83.04 TON REQ.
		Time of Day	This request is triggered when the time of day is reached,
		TORQ OR TIME of Day	This request is triggered by either motor torque or run time.
83.03	TORQUE REQ	0.0-200.0% 120% [default]	Defines the motor torque threshold value in % above nominal motor torque to trigger the execution of the pump cleaning sequence.
83.04	TON REQ	0-100 Seconds 5s [default]	Time period before the pump cleaning sequence can be triggered once the threshold torque is reached,
83.05	RUN TIME REQ	24-hour clock time in Hours, Minutes, and seconds.	Defines the time of the day at which the pump cleaning sequence executes automatically.
83.06	NUM OF CYCLES	1-10 2 [default]	Defines the number of cycles the pump cleaning sequence can execute.
83.07	FWD RUN SPD	0.0-100.0% 100% [default]	Defines the forward running speed in % of parameter 30.12, MAXIMUM SPEED.
83.08	FWD RUN TIME	0.0-100.0 Seconds 7s [default]	Defines the forward running time of the pump cleaning sequence.
83.09	FWD RUN ACC	0.0-100.0 Seconds 1s [default]	Defines the forward acceleration rate during the execution of the cleaning cycle.
83.10	FWD RUN DEC	0.0-100.0 Seconds 2s [default]	Defines the forward deceleration rate during the execution of the cleaning cycle.
83.11	ZERO SPEED PAUSE	0.0-100.0 Seconds 7s [default]	Defines the pause time during the pump cleaning sequence that the pump does not run when switching from forward to reverse rotation.
83.12	REV RUN SPD	0.0-100.0% 80% [default]	Defines the reverse running speed in % of parameter 30.12, MAXIMUM SPEED.
83.13	REV RUN TIME	0.0-100.0 Seconds 7s [default]	Defines the reverse running time of the pump cleaning sequence.
83.14	REV RUN ACC	0.0-100.0 Seconds 2 Seconds [default]	Defines the forward acceleration rate during the execution of the cleaning cycle.
83.15	REV RUN DEC	0.0-100.0 Seconds 01Seconds [default]	Defines the reverse deceleration rate during the pump cleaning sequence.
83.16	SEQUENCE TIMER	0-100 Seconds 30 Seconds [default]	Defines the value in seconds, after which a pump cleaning sequence retry is attempted.
83.17	SEQUENCE COUNTER	0-10 5 [default]	The number of times the PCS will run sequentially when executed.
83.18	SEQUENCE EXCEED		Action and message displayed when the number of sequences in 83.17 has been completed and the torque value monitored is still at or above the value in 83.03. The 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.
		FAULT [default]	The drive faults and must be manually reset. The Keypad displays a PUMP CLOGGED fault message.
83.19	SNORE TIME	The elapsed runtime before the Snore function is activated. Range: 0 – 10,000 hrs. Default is zero hours which disables this function.	
83.20	TORQUE COEFF	Defines the torque coefficient setting needed to activate the snore function. Range: 0.00 – 1.00.	
83.21	PIPE CLEAN ENABLE	Enables the pipe clean function. The pump will ramp to maximum speed for the cycle time and then return to normal operation.	
	DISABLED [DEFAULT]	Disables the pipe clean function.	
	ENABLE ON START	Enables the pipe clean function on every start command.	
	ENABLE ON TIME	Enables the pipe clean function based on elapsed time from 83.22.	
83.22	PIPE CLEAN TIME INTERVAL	The elapsed runtime hours that will enable the Pipe Clean Function when enabled. Once the setting is reached the pipe clean function is started. Range 0 – 10,000hrs. 100 hours (default)	
83.23	PIPE CLEAN CYCLE TIME	The time spent at maximum speed during the Pipe Cleaning cycle. Range 0 - 1800 sec. Default is 600 seconds	
83.24	PIPE FILL ENABLE	Enable the pipe fill function	
	DISABLE [DEFAULT]	Disable the pipe fill function	
	ENABLE	Enable the pipe fill function. (DI6 control does not function)	

83.25	PIPE FILL TIME	Maximum total time that the pipe fill function will execute. It will stop prior if a value is entered in 83.27 for Process PID control.
83.26	PIPE FILL SPEED	Speed at which the pump will operate at during pipe fill.
83.27	PIPE FILL STOP VALUE	Defines the actual value used in the primary PID control mode to stop the pipe fill function. When this value is achieved the PS220 will resume normal pump control. The units are not shown but are the same as defined in the PID control mode.
GROUP 84	TOTALIZER AND ENGERY SAVINGS	DESCRIPTION
84.01	TOTL SYS VOL STPT	Defines the totalized system volume set point. Once this value is achieved, the pump will automatically turn off. Range = 999999. Default = 0. A Zero (0) disable this function. This will not function in Multipump, or Basic Speed Control.
84.02	TOTL VOLUME RESET	Resets actual signal 1.228 TOTAL PMP VOLUME to 0 and allows for the pump to be restarted.
	DISABLED [DEFAULT]	This is the default selection.
	RESET	Actual signal 1.228 is reset to 0 and the pump can be restarted.
84.03	$/KWHR	Cost of energy in $. For English(Am) = $;
84.04	BASELINE POWER	Baseline Power in HP (English Am) or kW (This is the HP This is the HP consumed if a fixed speed motor is used. This is not the rated HP of the Motor installed. Setting range = 0.0 – 1000.0.
84.05	ENERGY SAVE METHD	Defines if the savings should be tracked only when the pump is running (OP1).(OP2) is for savings when the drive is in sleep mode in addition to when running.
84.06	ENERGY SAVE RESET	Resets the savings to zero.
84.07	KWH AT RESET	Total kWh since last reset. Add to parameter 1.225 kWh to obtain total kWh. Viewable only.
84.08	OPER. HRS SINCE RESET	Operating hours since last reset.
84.13	RESET OPER HOURS	Resets operating hours.
GROUPS 90 - 93	Refer to the ABB ACS880 Firmware manual	Reference the ABB ACS880 Firmware Manual for parameter definition. All ACS880 parameters may not be supported.
GROUP 95	HARDWARE CONFIGURATION	DESCRIPTION
95.01	SUPPLY VOLTAGE	Selects the supply voltage range. This parameter is used by the drive to determine the nominal voltage of the supply network. The parameter also affects the current ratings and the DC voltage control functions (trip and brake chopper activation limits) of the drive. WARNING! An incorrect setting may cause the motor to rush uncontrollably, or the brake chopper or resistor to overload. Note: The selections shown depend on the hardware of the Drive. If only one voltage range is valid for the drive, it is selected by default.
95.04	CONTROL BOARD SUPPLY	Specifies how the control unit of the drive is powered.
	INTERNAL 24VDC	This is the default selection
	EXTERNAL 24VDC	The drive control unit is powered from an external power supply connected to the XPOW terminal.
95.XX Parameters not shown	Refer to the ABB ACS880 Firmware manual	Reference the ABB ACS880 Firmware Manual for parameter definition. All ACS880 parameters may not be supported.
GROUP 96	SYSTEM	DESCRIPTION
96.01	LANGUAGE	Selects the language of the parameter interface and other displayed information when viewed on the control panel. Notes: • Not all languages supported. • This parameter does not affect the languages visible in the Drive composer PC tool.
96.02	PASS CODE	Pass codes can be entered into this parameter to activate different access levels.
96.03	ACCESS LEVELS ACTIVE	Shows which access levels have been activated by passcodes entered into parameter 96.02 Pass code. This parameter is read-only.
96.06	Parameter Restore	Choices are: Done (Default) Restore Defaults Clear All Reset All Fieldbus Settings
96.07	PARAMETER SAVE MANUALLY	Saves the valid parameter values to permanent memory. This parameter should be used to store values sent from a fieldbus, or when using an external power supply to the control board as the supply might have a very short hold-up time when powered off. Note: A new parameter value is saved automatically when changed from the PC tool or control panel but not when altered through a fieldbus adapter connection.
96.08	Control Board Boot	Power cycles the drive and the firmware. Change this to a "1" from a "0". Typically used to clear any parameter corruption that might have occurred.
96.XX Parameters not shown	Refer to the ABB ACS880 Firmware manual	Reference the ABB ACS880 Firmware Manual for parameter definition. All ACS880 parameters may not be supported.
GROUPS 97 & 98	Refer to the ABB ACS880 Firmware manual	Reference the ABB ACS880 Firmware Manual for parameter definition. All ACS880 parameters may not be supported.
GROUP 99	MOTOR DATA	DESCRIPTION
99.03	MOTOR TYPE	Selects the motor type. Note: This parameter cannot be changed while the drive is running.
99.04	MOTOR CONTROL MODE	Selects motor control mode. Available options are DTC and Scalar. Scalar control can be used to assist in identifying problems associated with VFD faults related to the motor load and motor connections. Smartflow and Smartflow Pump protection will not function in Scalar Control.

99.06	MOTOR NOMINAL CURRENT	Defines the nominal motor current. Must be equal to the value on the motor rating plate. If multiple motors are connected to the drive, enter the total current of the motors. Notes: • Correct motor operation requires that the magnetizing current of the motor does not exceed 90% of the nominal current of the drive. • This parameter cannot be changed while the drive is running.
99.07	MOTOR NOMINAL VOLTAGE	Defines the nominal motor voltage supplied to the motor. This setting must match the value on the rating plate of the motor. This parameter cannot be changed while the drive is running.
99.08	MOTOR NOMINAL FREQUENCY	Defines the nominal motor frequency. This setting must match the value on the rating plate of the motor. This parameter cannot be changed while the drive is running.
99.09	MOTOR NOMINAL SPEED	Defines the nominal motor speed. The setting must match the value on the rating plate of the motor. This parameter cannot be changed while the drive is running.
99.10	MOTOR NOMINAL POWER	Defines the nominal motor power. The setting must match the value on the rating plate of the motor. The unit is selected by parameter 96.16, Unit selection. This parameter cannot be changed while the drive is running.
99.16	Motor Phase Order	Define how the drive fires the IBGT for the output phase of the motor. Choices are : UWV UVW. Used to correct Motor rotation.
99.XX Parameters not shown	Refer to the ABB ACS880 Firmware manual	Reference the ABB ACS880 Firmware Manual for parameter definition. All ACS880 parameters may not be supported.

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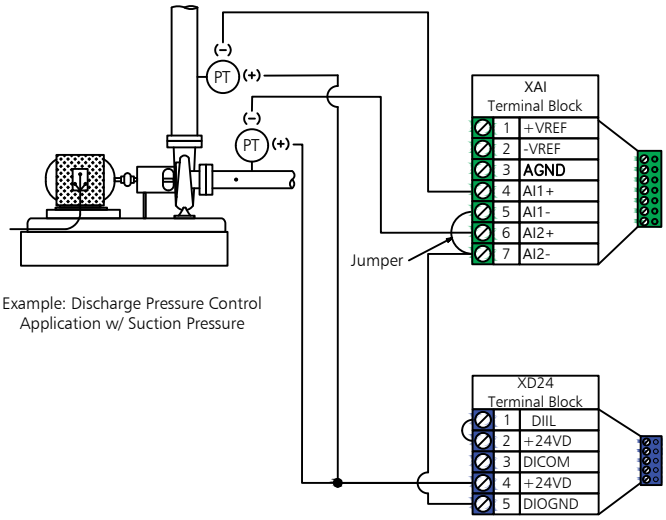
PS220 BASIC WIRING

Instruments Loop Powered By PumpSmart

Multiple Transmitters/Jumpers

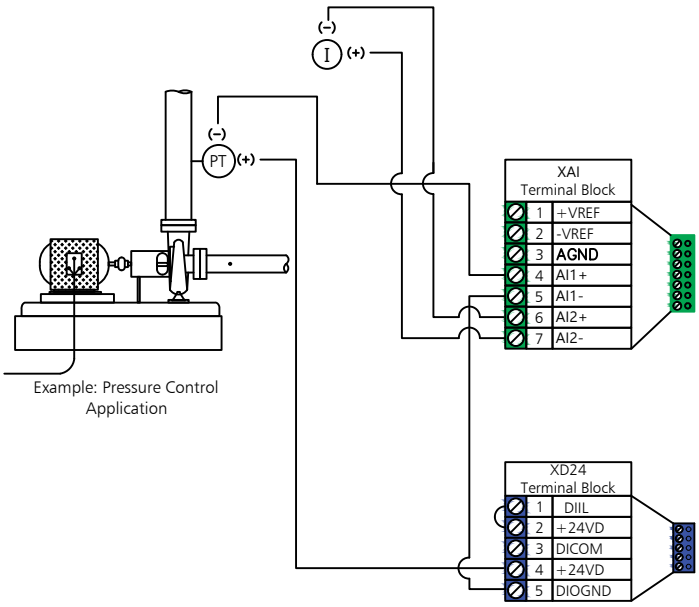
JUMPERS

When PumpSmart is powering a 2-wire process transmitter, the current loop must be completed with a jumper from the PS220 analog input negative terminal to XD24-5. In cases where multiple transmitters are powered you may jumper between each analog input negative then to XD24-5.



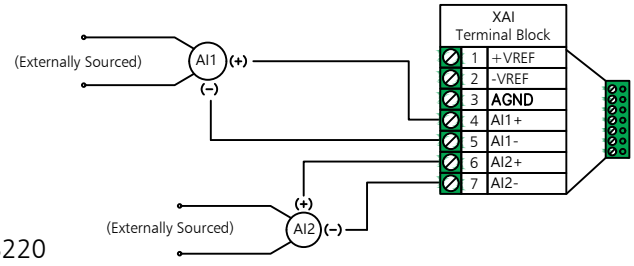
Example: Discharge Pressure Control Application w/ Suction Pressure

Example-2-wire process transmitter and remote 4-20 mA reference (setpoint) signal from PLC or DCS.



Example: Pressure Control Application

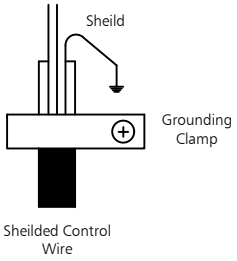
Example-Externally powered process and reference signal connections. These signals must provide 4 - 20mA, or 0 - 10VDC to the Analog inputs.

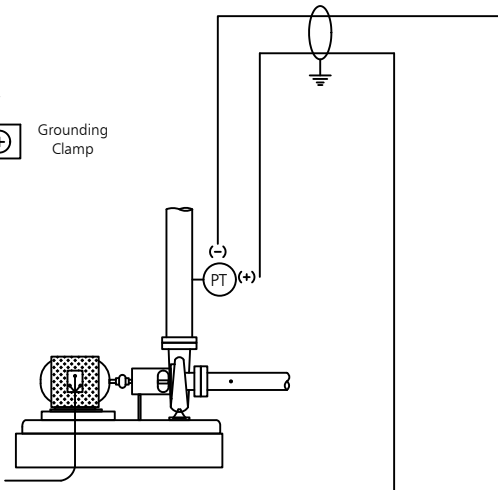


NOTICE

All instrumentation shielding must be terminated at grounding lugs provided by the PS220. 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 in the conduit box.



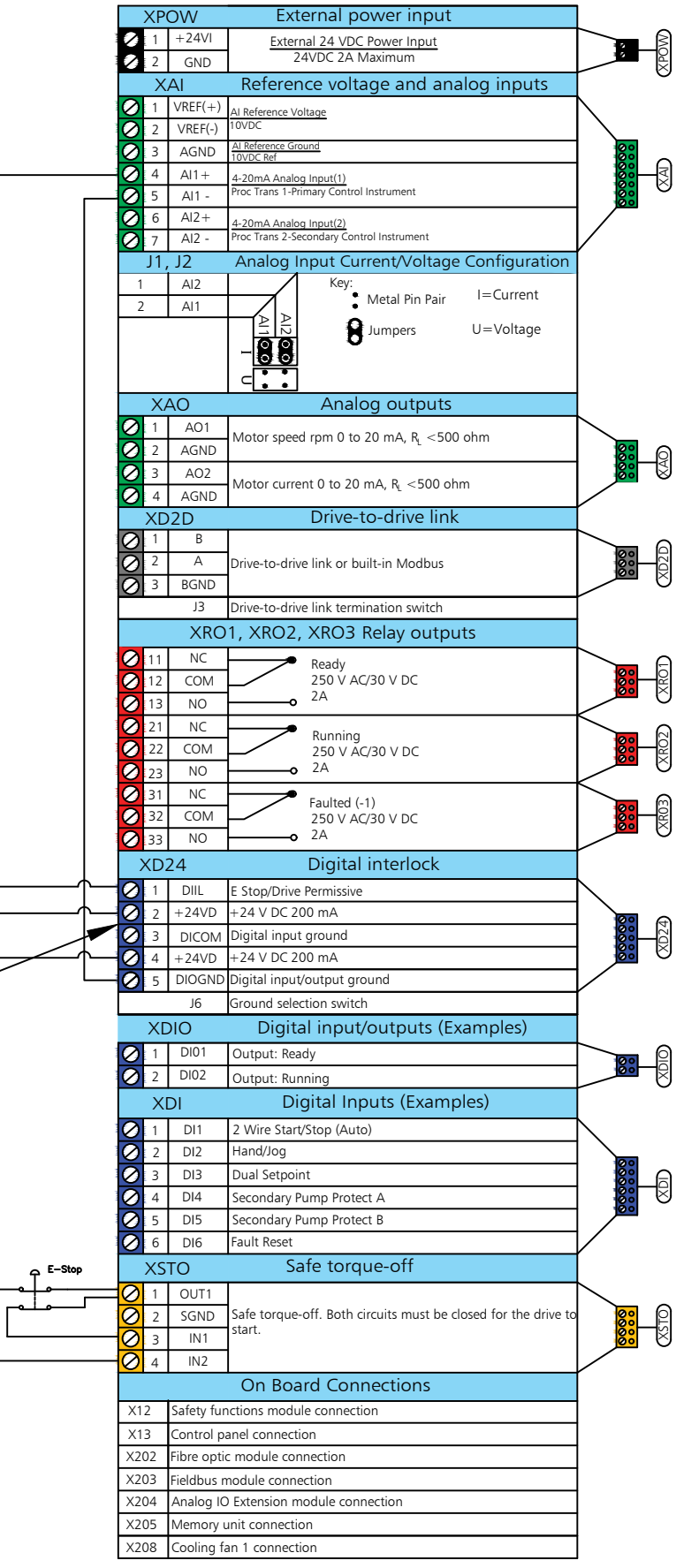


Example: Pressure Control Application

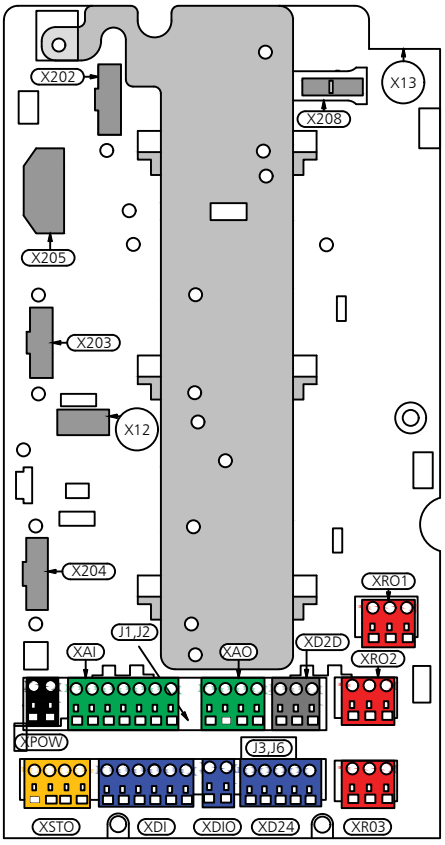
The DIIL is a drive permissive and must be closed (24Vdc) for the drive to operate. A jumper is installed at the factory. If using the DIIL drive permissive, remove the jumper and replace with appropriate contact block.

!! NOTE !!

Jumpers are installed at the factory. If using safe torque-off remove jumpers and replace with appropriate contact blocks or safe torque-off switch. Note, both inputs must be closed for drive to run motor. See Hardware Manual for detail on wiring Safe Torque-Off.



Control connections	Description
2 differential analog inputs(XAI) "Green"	Current input: 4(0) to 20 mA R_{IN}: 100 ohm Voltage input: 2(0) to 10 V R_{IN}: 200 Kohm Resolution: 11 bit + sign bit
2 differential analog outputs (XAO) "Green"	0 to 20 mA, R_{LOAD} <500 ohm Frequency range: 0-300 Hz Resolution: 11 bit + sign bit
6 digital inputs (XDI) "Blue"	Input type: NPN/PNP (DI1 to DI5), NPN (DI6) DI6 (XDI:6) can alternatively be used as an input for a PTC thermistor
Digital input interlock (XD24) "Blue"	Input type: NPN/PNP
2 digital inputs/outputs (XDIO) "Blue"	As input: 24 V LOGIC LEVELS: "0" <5 V, "1"> 15 V R_{IN}: 2.0 Kohm Filtering:0.25 ms As output: Total output current from 24 V DC is limited to 200 mA Can be set as pulse train input and output
3 relay outputs (XRO1, XRO2, XRO3) "Red"	250 V AC/30 V DC, 2A
Safe torque-off (XSTO) "Gold"	For the drive to start, both connections must be closed.
Drive-to-drive link (XD2D) "Gray"	Physical layer: EIA-485 (RS485)
Built-in Modbus	Not Accessable
Assistant control panel/ PC tool connection	Connector:RJ-45

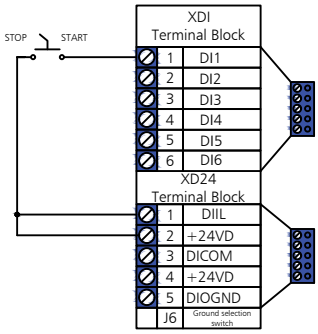


PS220 Basic Wiring PS220			
K05637A	SHEET 1 OF 2	REV 1	Issue –
Drawing is not to scale Dimensions in inches [mm]	Drawn: HCLT 10-28-16 Checked:BDECOOK 10-28-16		

PS220 284

Start / Stop Options - Single External Control Locations

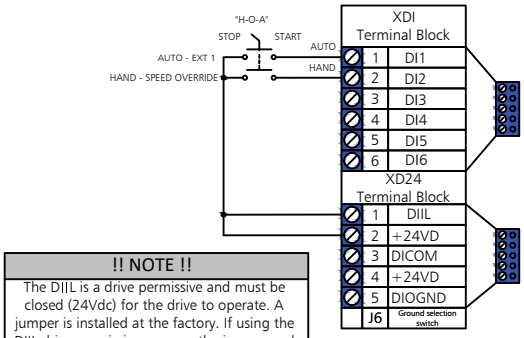
2 Wire Start /Stop



Note: Set Start/Stop 74.01 to 2 Wire DI1

Be Sure J6 is in the ON position (Default)

H-O-A



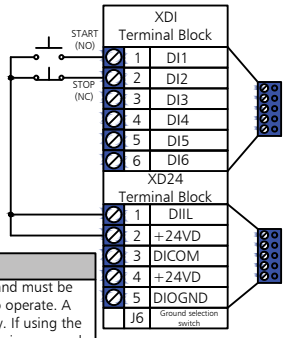
!! NOTE !!

The DIIL is a drive permissive and must be closed (24Vdc) for the drive to operate. A jumper is installed at the factory. If using the DIIL drive permissive, remove the jumper and replace with appropriate contact block.

Note: Set Start/Stop 74.01 to HOA DI1,2

3 Wire Start /Stop

[Momentary Push Buttons]



!! NOTE !!

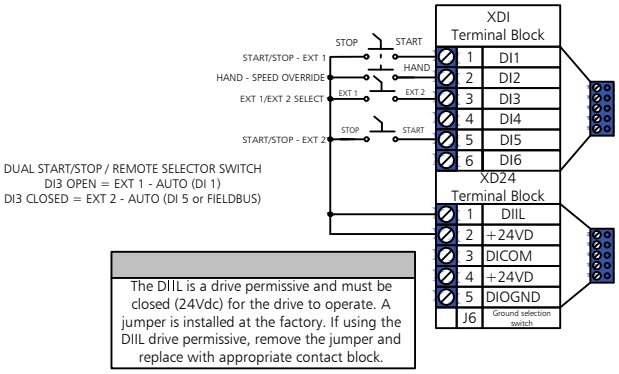
The DIIL is a drive permissive and must be closed (24Vdc) for the drive to operate. A jumper is installed at the factory. If using the DIIL drive permissive, remove the jumper and replace with appropriate contact block.

Note: Set Start/Stop 74.01 to 3W DI1P, DI2P

Start / Stop Options - Dual External Control Locations

H-O-A Dual Start/Stop Locations

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 located at the pump (EXT 2) and the another in the control room (EXT 1). When digital input 3 is activated the start/stop source is the pump (EXT 2).

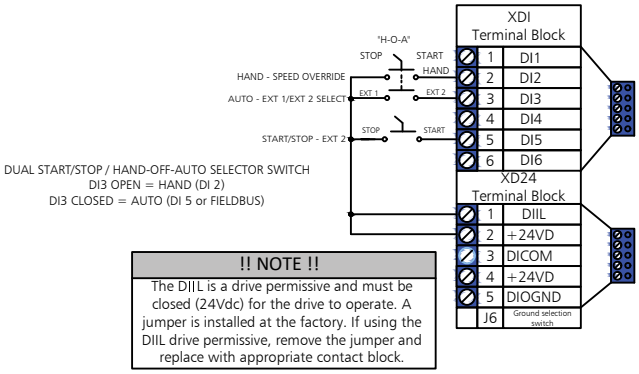


The DIIL is a drive permissive and must be closed (24Vdc) for the drive to operate. A jumper is installed at the factory. If using the DIIL drive permissive, remove the jumper and replace with appropriate contact block.

Note:
Set Start/Stop 74.01 to HOA DI1,2 DI5

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 one Hand-off-Auto switch in the field (by the pump) and requires that in hand mode the pump runs in Speed Override located at the pump and in Auto mode the pump is controlled in the control room or other remote location.

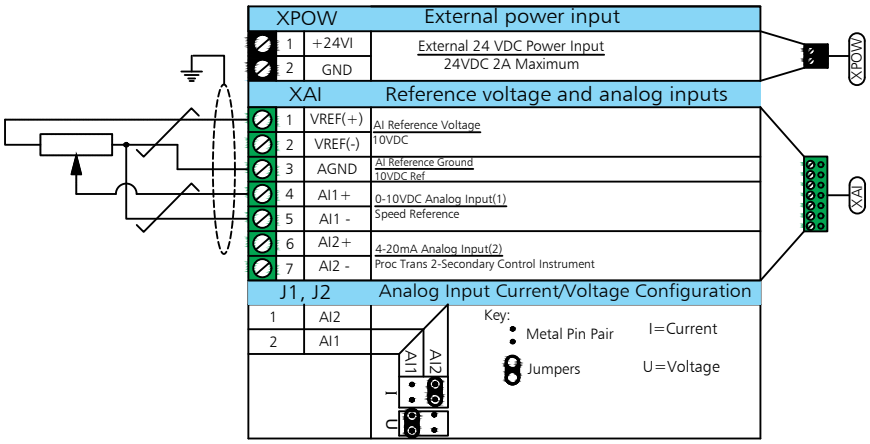


!! NOTE !!

The DIIL is a drive permissive and must be closed (24Vdc) for the drive to operate. A jumper is installed at the factory. If using the DIIL drive permissive, remove the jumper and replace with appropriate contact block.

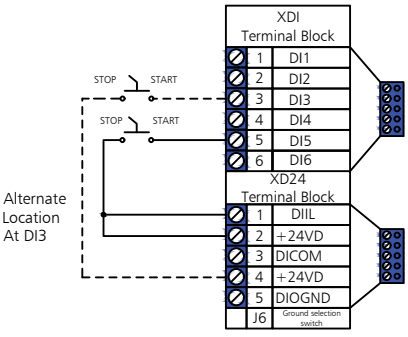
Note:
Set Start/Stop 74.01 to HOA DI1,2 - DI5
For Fieldbus as second Start/Stop location, set 74.01 to HOA DI1,2 - FB

Potentiometer Option - Used to vary the Process Control Setpoint or a Speed Reference



Note:
Move AI1 Jumper to Voltage position U
Set AI1 unit selection 12.15 to V

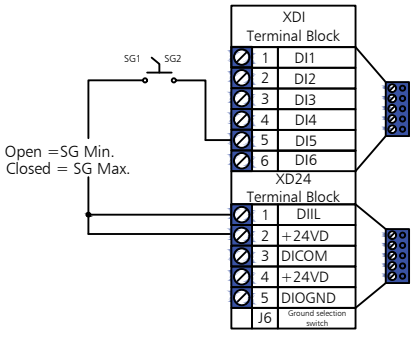
Speed Override Option



Note:
Set SPEED OVERRIDE 74.05 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



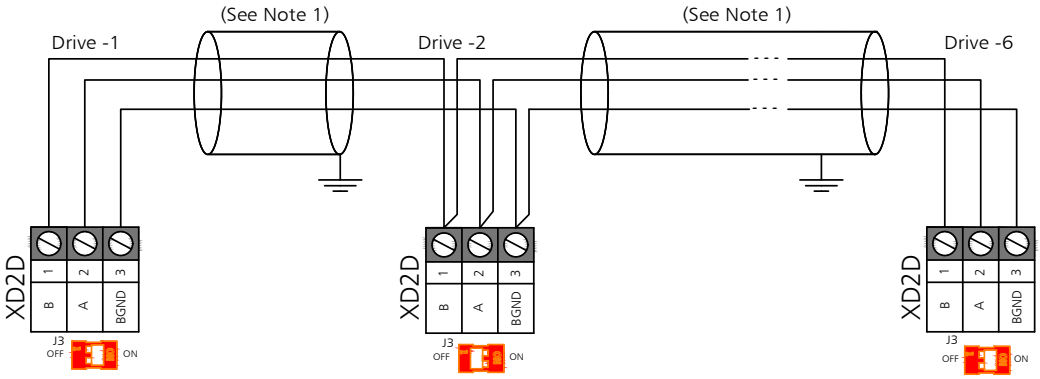
Note:
Set SG SEL 78.02 to DI.
Set DI5 76.13 to SG SELECT.

PS220 Basic Wiring PS220			
K05637A	SHEET 2 OF 2	REV 1	Issue –
Drawing is not to scale Dimensions in inches [mm]	Drawn: HCLT 10-28-16 Checked:BDECOOK 10-28-16		

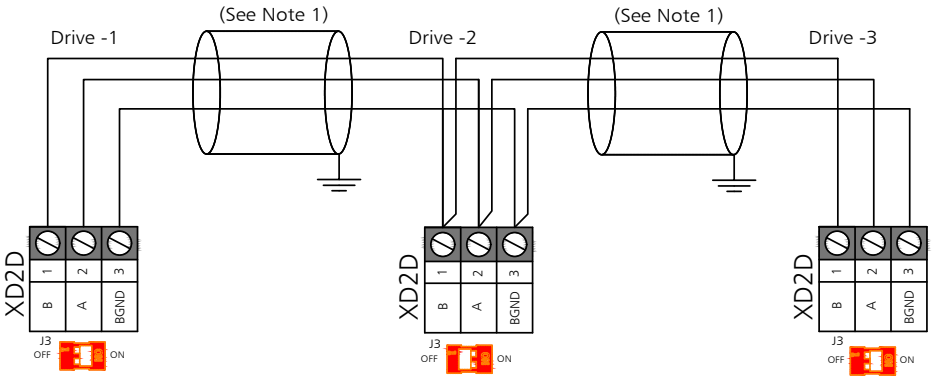
PS220 - Multi-Pump Connections

RS-485 Connections between PS220 Drives

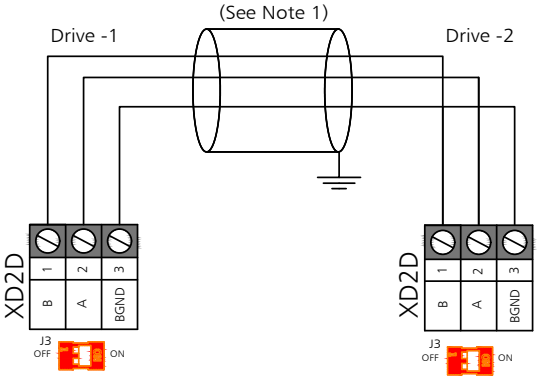
6 - Drive Arrangement



3 - Drive Arrangement



2 - Drive Arrangement



NOTES:
1. For drive-to-drive link (XD2D) connections use Belden 8770, 18 AWG, 3 conductor, shielded cable, or equivalent.

PS220 Multi-Pump Connections			
K05741A	SHEET 1 OF 1	REV 3	Issue –
Drawing is not to scale Dimensions in inches [mm]	Drawn: HCLT 10–28–16		
	Checked: APERRY 7–1–21		

Ecodesign Regulation

Commission Regulation EU 2019/1781, amendment (EU) 2021/341 sets new requirements for electric motors and variable speed drives.

The International Energy Agency works with countries around the world to shape energy policies for a secure and sustainable future. ABB's electric motors and variable speed drives (VSD), which offer the highest levels of energy efficiency, can therefore play a crucial role in containing worldwide energy consumption and in reducing CO2 emissions.

The European Union plan targets meeting energy efficiency and CO2 emission goals to reduce greenhouse gas emissions to limit the average global temperature increase to 1.5°C. With these ambitions in mind, EU member countries have agreed about new requirements in the regulation EU 2019/1781.
This latest Ecodesign Regulation (EU) 2019/1781 came into effect in October 2019 and it applies to low-voltage induction electric motors rated at less than 1,000 V alternating current (AC) and to variable speed drives (VSD). The regulation will be implemented in two steps starting on July 1, 2021. The second stage, which expands the scope further and increases the requirements for motors, commences two years later, on July 1, 2023.

Scope from July 1, 2021 for AC drives
The Ecodesign Regulation covers three-phase drives with a diode rectifier rated from 0.12 to 1000 kW.

IE2 efficiency class mandatory for AC drives:
- 3-phase drives in power range 0.12 – 1000 kW (diode rectifier)

Exclusions:
- Cabinets containing a module that has already been conformity assessed
- Regenerative drives
- Low harmonic drives (THD <10%)
- Single phase drives
- AC drives with multiple AC outputs
- Medium voltage drives, DC drives and traction drives

ITT Type Code	Short Type Code	Frame size	Minimum input frequency (Hz)	Maximum input frequency (Hz)	Apparent power (no overload) kVA	Nominal rms output current, no overload capacity I2,IEC (A)	Typical motor power in no-overload use kW	IE class of the complete drive module (CDM) according to EN50598-2	Relative Losses 90% nominal frequency 100 % nominal current	Relative Losses 50% nominal frequency 100 % nominal current	Relative Losses 0% nominal frequency 100 % nominal current	Relative Losses 90% nominal frequency 50 % nominal current	Relative Losses 50% nominal frequency 50 % nominal current	Relative Losses 0% nominal frequency 50 % nominal current	Relative Losses 50% nominal frequency 25 % nominal current	Relative Losses 0% nominal frequency 25 % nominal current	Nominal input voltage	Maximum operating temp. without derate (°C)
208-230 Vac																		
K03550A01	ACS880-01-04A6-2	R1	48	63	1.8	4.6	0.75	IE2	3.4	3.1	2.8	2.6	2.4	2.3	2.2	2.1	230	40
K03550A02	ACS880-01-06A6-2	R1	48	63	2.6	6.6	1.1	IE2	3.4	3	2.7	2.4	2.3	2.1	1.9	1.9	230	40
K03550A03	ACS880-01-07A5-2	R1	48	63	3	7.5	1.5	IE2	3.3	2.9	2.7	2.3	2.2	2	1.9	1.8	230	40
K03550A04	ACS880-01-10A6-2	R1	48	63	4.2	10.6	2.2	IE2	3.6	3.1	2.8	2.3	2.1	2	1.7	1.7	230	40
K03550A05	ACS880-01-16A8-2	R2	48	63	6.7	16.8	4	IE2	3.2	2.8	2.5	2.1	1.9	1.8	1.6	1.5	230	40
K03550A06	ACS880-01-24A3-2	R2	48	63	9.7	24.3	5.5	IE2	3.8	3.1	2.7	1.9	1.7	1.6	1.3	1.2	230	40
K03550A07	ACS880-01-031A-2	R3	48	63	12	31	7.5	IE2	2.9	2.5	2.2	1.6	1.5	1.4	1.2	1.1	230	40
K03550A08	ACS880-01-046A-2	R4	48	63	18	46	11	IE2	3	2.4	2	1.6	1.3	1.2	1	1	230	40
K03550A09	ACS880-01-061A-2	R4	48	63	24	61	15	IE2	3.3	2.6	2.1	1.6	1.4	1.2	1	0.9	230	40
K03550A10	ACS880-01-075A-2	R5	48	63	30	75	18.5	IE2	3.2	2.4	1.9	1.6	1.3	1.1	0.9	0.9	230	40
K03550A11	ACS880-01-087A-2	R5	48	63	35	87	22	IE2	3.4	2.5	2	1.7	1.3	1.1	0.9	0.9	230	40
K03550A12	ACS880-01-115A-2	R6	48	63	46	115	30	IE2	3	2.3	2	1.6	1.3	1.2	1	0.9	230	40
K03550A13	ACS880-01-145A-2	R6	48	63	58	145	37	IE2	3.4	2.5	2.1	1.6	1.3	1.2	0.9	0.8	230	40
K03550A14	ACS880-01-170A-2	R7	48	63	68	170	45	IE2	2.9	2.2	1.9	1.4	1.2	1.1	0.9	0.8	230	40
K03550A15	ACS880-01-206A-2	R7	48	63	82	206	55	IE2	3.2	2.4	2	1.5	1.2	1.1	0.9	0.8	230	40
K03550A16	ACS880-01-274A-2	R8	48	63	109	274	75	IE2	3.2	2.3	2	1.4	1.2	1.1	0.8	0.8	230	40
380-415 Vac																		
K03561A01	ACS880-01-02A4-3	R1	48	63	1.7	2.4	0.75	IE2	2.6	2.3	2.2	2.1	2.0	2.0	1.9	1.9	400	40
K03561A02	ACS880-01-03A3-3	R1	48	63	2.3	3.3	1.1	IE2	2.3	2.0	1.9	1.8	1.7	1.6	1.5	1.5	400	40
K03561A03	ACS880-01-04A0-3	R1	48	63	2.8	4	1.5	IE2	2.1	1.9	1.7	1.6	1.5	1.4	1.3	1.3	400	40
K03561A04	ACS880-01-05A6-3	R1	48	63	3.9	5.6	2.2	IE2	2.0	1.8	1.6	1.4	1.3	1.2	1.1	1.1	400	40
K03561A05	ACS880-01-07A2-3	R1	48	63	5.5	8	3	IE2	2.0	1.8	1.6	1.3	1.2	1.1	1.0	1.0	400	40
K03561A06	ACS880-01-09A4-3	R1	48	63	6.9	10	4	IE2	2.1	1.8	1.6	1.3	1.2	1.1	1.0	0.9	400	40
K03561A07	ACS880-01-12A6-3	R1	48	63	8.9	12.9	5.5	IE2	2.4	2.0	1.8	1.2	1.1	1.0	0.8	0.8	400	40
K03561A08	ACS880-01-017A-3	R2	48	63	11.8	17	7.5	IE2	2.0	1.7	1.5	1.1	1.0	0.9	0.8	0.7	400	40
K03561A09	ACS880-01-025A-3	R2	48	63	17.3	25	11	IE2	2.4	2.0	1.7	1.2	1.1	1.0	0.8	0.7	400	40
K03561A10	ACS880-01-032A-3	R3	48	63	22.2	32	15	IE2	1.8	1.5	1.3	1.0	0.9	0.8	0.7	0.6	400	40
K03561A11	ACS880-01-038A-3	R3	48	63	26.3	38	18.5	IE2	2.0	1.7	1.4	1.0	0.9	0.9	0.7	0.7	400	40
K03561A12	ACS880-01-045A-3	R4	48	63	31.2	45	22	IE2	1.7	1.4	1.1	0.9	0.8	0.7	0.5	0.5	400	40
K03561A13	ACS880-01-061A-3	R4	48	63	42.3	61	30	IE2	1.9	1.5	1.3	0.9	0.8	0.7	0.5	0.5	400	40
K03561A14	ACS880-01-072A-3	R5	48	63	49.9	72	37	IE2	1.7	1.3	1.1	0.8	0.7	0.6	0.5	0.5	400	40
K03561A15	ACS880-01-087A-3	R5	48	63	60.3	87	45	IE2	1.9	1.4	1.2	0.9	0.7	0.6	0.5	0.4	400	40
K03561A16	ACS880-01-105A-3	R6	48	63	72.7	105	55	IE2	1.7	1.3	1.1	0.8	0.7	0.6	0.5	0.5	400	40
K03561A17	ACS880-01-145A-3	R6	48	63	100.5	145	75	IE2	2.0	1.5	1.2	0.9	0.8	0.7	0.5	0.5	400	40
K03561A18	ACS880-01-169A-3	R7	48	63	117.1	169	90	IE2	1.7	1.4	1.1	0.9	0.7	0.6	0.5	0.5	400	40
K03561A19	ACS880-01-206A-3	R7	48	63	142.7	206	110	IE2	2.0	1.5	1.3	0.9	0.8	0.7	0.5	0.5	400	40
K03561A20	ACS880-01-246A-3	R8	48	63	170.4	246	132	IE2	1.8	1.3	1.1	0.8	0.7	0.6	0.5	0.4	400	40
K03561A21	ACS880-01-293A-3	R8	48	63	203	293	160	IE2	1.8	1.3	1.1	0.9	0.7	0.7	0.5	0.5	400	40
K03561A22	ACS880-01-363A-3	R9	48	63	251.5	363	200	IE2	1.9	1.4	1.3	0.9	0.7	0.7	0.5	0.5	400	40
K03561A23	ACS880-01-430A-3	R9	48	63	297.9	430	250	IE2	1.9	1.5	1.3	0.9	0.8	0.7	0.5	0.5	400	40
440-500 Vac																		
K03552A01	ACS880-01-04A8-5	R1	48	63	4.2	4.8	2.2	IE2	1.8	1.6	1.5	1.4	1.3	1.2	1.1	1.1	500	40
K03552A02	ACS880-01-07A6-5	R1	48	63	6.6	7.6	4	IE2	1.7	1.5	1.4	1.2	1.1	1.1	1	0.9	500	40
K03552A03	ACS880-01-11A0-5	R1	48	63	9.5	11	5.5	IE2	1.9	1.6	1.5	1.1	1	0.9	0.8	0.7	500	40
K03552A04	ACS880-01-014A-5	R2	48	63	12	14	7.5	IE2	1.6	1.4	1.3	1	0.9	0.8	0.7	0.7	500	40
K03552A05	ACS880-01-021A-5	R2	48	63	18	21	11	IE2	1.8	1.6	1.4	1	0.9	0.8	0.7	0.7	500	40
K03552A06	ACS880-01-027A-5	R3	48	63	23	27	15	IE2	1.4	1.3	1.1	0.9	0.8	0.8	0.6	0.6	500	40
K03552A07	ACS880-01-034A-5	R3	48	63	29	34	18.5	IE2	1.6	1.4	1.2	0.9	0.8	0.8	0.7	0.6	500	40
K03552A08	ACS880-01-040A-5	R4	48	63	35	40	22	IE2	1.2	1.1	0.9	0.7	0.7	0.6	0.5	0.5	500	40
K03552A09	ACS880-01-052A-5	R4	48	63	45	52	30	IE2	1.3	1.1	1	0.7	0.7	0.6	0.5	0.5	500	40
K03552A10	ACS880-01-065A-5	R5	48	63	56	65	37	IE2	1.3	1	0.9	0.7	0.6	0.6	0.5	0.4	500	40
K03552A11	ACS880-01-077A-5	R5	48	63	67	77	45	IE2	1.4	1.1	0.9	0.7	0.6	0.5	0.4	0.4	500	40
K03552A12	ACS880-01-096A-5	R6	48	63	83	96	55	IE2	1.4	1.1	1	0.7	0.7	0.6	0.5	0.5	500	40
K03552A13	ACS880-01-124A-5	R6	48	63	107	124	75	IE2	1.6	1.2	1.1	0.8	0.7	0.6	0.5	0.5	500	40
K03552A14	ACS880-01-156A-5	R7	48	63	135	156	90	IE2	1.4	1.1	0.9	0.7	0.6	0.6	0.5	0.4	500	40
K03552A15	ACS880-01-180A-5	R7	48	63	156	180	110	IE2	1.5	1.2	1	0.8	0.7	0.6	0.5	0.4	500	40
K03552A16	ACS880-01-240A-5	R8	48	63	208	240	132	IE2	1.4	1.1	0.9	0.7	0.6	0.6	0.5	0.4	500	40
K03552A17	ACS880-01-302A-5	R9	48	63	262	302	200	IE2	1.5	1.2	1	0.7	0.6	0.6	0.5	0.4	500	40
K03552A18	ACS880-01-361A-5	R9	48	63	313	361	200	IE2	1.5	1.2	1.1	0.8	0.6	0.6	0.5	0.4	500	40
K03552A19	ACS880-01-414A-5	R9	48	63	359	414	250	IE2	1.6	1.2	1.1	0.8	0.7	0.6	0.5	0.5	500	40
525-690 Vac																		
K03554A01	ACS880-01-07A4-7	R3	48	63	8.8	7.4	5.5	IE2	1.2	1.1	1	0.9	0.9	0.8	0.8	0.8	690	40
K03554A02	ACS880-01-09A9-7	R3	48	63	12	9.9	7.5	IE2	1.1	1	0.9	0.8	0.7	0.7	0.6	0.6	690	40
K03554A03	ACS880-01-14A3-7	R3	48	63	17	14.3	11	IE2	1.1	1	0.9	0.7	0.7	0.6	0.6	0.5	690	40
K03554A04	ACS880-01-019A-7	R3	48	63	23	19	15	IE2	1.2	1	0.9	0.7	0.7	0.6	0.5	0.5	690	40
K03554A05	ACS880-01-023A-7	R3	48	63	27	23	18.5	IE2	1.2	1.1	0.9	0.7	0.7	0.6	0.5	0.5	690	40
K03554A06	ACS880-01-027A-7	R3	48	63	32	27	22	IE2	1.3	1.1	1	0.8	0.7	0.6	0.5	0.5	690	40
K03554A07	ACS880-01-035A-7	R5	48	63	42	35	30	IE2	1	0.8	0.7	0.6	0.6	0.5	0.4	0.4	690	40
K03554A08	ACS880-01-042A-7	R5	48	63	50	42	37	IE2	1.1	0.8	0.7	0.6	0.5	0.5	0.4	0.4	690	40
K03554A09	ACS880-01-049A-7	R5	48	63	59	49	45	IE2	1.1	0.9	0.8	0.6	0.5	0.5	0.4	0.4	690	40
K03554A10	ACS880-01-061A-7	R6	48	63	73	61	55	IE2	1.2	1	0.9	0.7	0.7	0.6	0.5	0.5	690	40
K03554A11	ACS880-01-084A-7	R6	48	63	100	84	75	IE2	1.3	1	0.9	0.8	0.7	0.6	0.5	0.5	690	40
K03554A12	ACS880-01-098A-7	R7	48	63	117	98	90	IE2	1.2	1	0.9	0.7	0.7	0.6	0.5	0.5	690	40
K03554A13	ACS880-01-119A-7	R7	48	63	142	119	110	IE2	1.3	1.1	0.9	0.8	0.7	0.6	0.5	0.5	690	40
K03554A14	ACS880-01-142A-7	R8	48	63	170	142	132	IE2	1.2	0.9	0.8	0.7	0.6	0.6	0.5	0.5	690	40
K03554A15	ACS880-01-174A-7	R8	48	63	208	174	160	IE2	1.3	1	0.9	0.7	0.6	0.6	0.5	0.5	690	40
K03554A16	ACS880-01-210A-7	R9	48	63	251	210	200	IE2	1.2	0.9	0.8	0.7	0.6	0.6	0.5	0.5	690	40

Fuses - heat dissipation chart

ePrism ITT PART NO.	POWER (hp)	RATED CURRENT (A)	RECOMMENDED FUSE SIZE UL	HEAT DISSIPATION (BTU/hr.)	HEAT DISSIPATION (Watts)	AIR FLOW (ft^3/min)	AIR FLOW (m^3/hr.)
NEMA 1	**230 volt**						
K03550A01	1	4.4	600V, 15A, Bussmann# JJS-15, Type T	249	73	26	44
K03550A02	1.5	6.3	600V, 15A, Bussmann# JJS-15, Type T	321	94	26	44
K03550A03	2	7.1	600V, 15A, Bussmann# JJS-15, Type T	416	122	26	44
K03550A04	3	10.1	600V, 20A, Bussmann# JJS-20, Type T	587	172	26	44
K03550A05	5	16	600V, 25A, Bussmann# JJS-25, Type T	792	232	52	88
K03550A06	7.5	23.1	600V, 40A, Bussmann# JJS-40, Type T	1150	337	52	88
K03550A07	10	29.3	600V, 50A, Bussmann# JJS-50, Type T	1559	457	79	134
K03550A08	15	44	600V, 80A, Bussmann# JJS-80, Type T	1706	500	79	134
K03550A09	20	58	600V, 100A, Bussmann# JJS-100, Type T	2150	630	165	280
K03550A10	25	71	600V, 125A, Bussmann# JJS-125, Type T	2320	680	165	280
K03550A11	30	83	600V, 125A, Bussmann# JJS-125, Type T	2491	730	165	280
K03550A12	40	109	600V, 150A, Bussmann# JJS-150, Type T	2866	840	256	435
K03550A13	50	138	600V, 200A, Bussmann# JJS-200, Type T	3207	940	256	435
K03550A14	60	162	600V, 250A, Bussmann# JJS-250, Type T	4299	1260	265	450
K03550A15	75	196	600V, 300A, Bussmann# JJS-300, Type T	5118	1500	265	450
K03550A16	100	260	600V, 400A, Bussmann# JJS-400, Type T	7166	2100	324	550
NEMA 12	230 volt						
K03551A01	1	4.4	600V, 15A, Bussmann# JJS-15, Type T	249	73	26	44
K03551A02	1.5	6.3	600V, 15A, Bussmann# JJS-15, Type T	321	94	26	44
K03551A03	2	7.1	600V, 15A, Bussmann# JJS-15, Type T	416	122	26	44
K03551A04	3	10.1	600V, 20A, Bussmann# JJS-20, Type T	587	172	26	44
K03551A05	5	16	600V, 25A, Bussmann# JJS-25, Type T	792	232	52	88
K03551A06	7.5	23.1	600V, 40A, Bussmann# JJS-40, Type T	1150	337	52	88
K03551A07	10	29.3	600V, 50A, Bussmann# JJS-50, Type T	1559	457	79	134
K03551A08	15	44	600V, 80A, Bussmann# JJS-80, Type T	1706	500	79	134
K03551A09	20	58	600V, 100A, Bussmann# JJS-100, Type T	2150	630	165	280
K03551A10	25	71	600V, 125A, Bussmann# JJS-125, Type T	2320	680	165	280
K03551A11	30	83	600V, 125A, Bussmann# JJS-125, Type T	2491	730	165	280
K03551A12	40	109	600V, 150A, Bussmann# JJS-150, Type T	2866	840	256	435
K03551A13	50	138	600V, 200A, Bussmann# JJS-200, Type T	3207	940	256	435
K03551A14	60	162	600V, 250A, Bussmann# JJS-250, Type T	4299	1260	265	450
K03551A15	75	196	600V, 300A, Bussmann# JJS-300, Type T	5118	1500	265	450
K03551A16	100	260	600V, 400A, Bussmann# JJS-400, Type T	7166	2100	324	550

ePrism ITT PART NO.	POWER (hp)	RATED CURRENT (A)	RECOMMENDED FUSE SIZE UL	HEAT DISSIPATION (BTU/hr.)	HEAT DISSIPATION (Watts)	AIR FLOW (ft^3/min)	AIR FLOW (m^3/hr.)
NEMA 1	400 volt						
K03561A01	1.0	2.3	690V, 25A, Bussmann# 170M1561, Type DIN 43620: 000	102	30	26	44
K03561A02	2.0	3.1	690V, 25A, Bussmann# 170M1561, Type DIN 43620: 000	136	40	26	44
K03561A03	3.0	3.8	690V, 25A, Bussmann# 170M1561, Type DIN 43620: 000	177	52	26	44
K03561A04	4.0	5.3	690V, 25A, Bussmann# 170M1561, Type DIN 43620: 000	249	73	26	44
K03561A05	5.0	7.6	690V, 25A, Bussmann# 170M1561, Type DIN 43620: 000	321	94	26	44
K03561A06	7.5	9.5	690V, 25A, Bussmann# 170M1561, Type DIN 43620: 000	416	122	26	44
K03561A07	7.5	12	690V, 25A, Bussmann# 170M1561, Type DIN 43620: 000	587	172	26	44
K03561A08	10.0	16	690V, 40A, Bussmann# 170M1563, Type DIN 43620: 000	792	232	52	88
K03561A09	15.0	24	690V, 40A, Bussmann# 170M1563, Type DIN 43620: 000	1150	337	52	88
K03561A10	20.0	30	690V, 63A, Bussmann# 170M1565, Type DIN 43620: 000	1559	457	79	134
K03561A11	25.0	36	690V, 63A, Bussmann# 170M1565, Type DIN 43620: 000	1918	562	79	134
K03561A12	30.0	43	690V, 80A, Bussmann# 170M1566, Type DIN 43620: 000	2276	667	79	134
K03561A13	40.0	58	690V, 100A, Bussmann# 170M1567, Type DIN 43620: 000	3095	907	165	280
K03561A14	50.0	68	690V, 125A, Bussmann# 170M1568, Type DIN 43620: 000	3811	1117	165	280
K03561A15	60.0	83	690V, 160A, Bussmann# 170M1569, Type DIN 43620: 000	3822	1120	165	280
K03561A16	75.0	100	690V, 315A, Bussmann# 170M3817, Type DIN 43620: 1	4419	1295	256	435
K03561A17	100.0	138	690V, 315A, Bussmann# 170M3817, Type DIN 43620: 1	4913	1440	256	435
K03561A18	125.0	161	690V, 450A, Bussmann# 170M5809, Type DIN 43620: 2	6620	1940	265	450
K03561A19	150.0	196	690V, 500A, Bussmann# 170M5810, Type DIN 43620:2	7882	2310	265	450
K03561A20	200.0	234	690V, 630A, Bussmann# 170M5812, Type DIN 43620: 2	11260	3300	324	550
K03561A21	250.0	278	690V, 800A, Bussmann# 170M6812D, Type DIN 43620: 3	13307	3900	324	550
K03561A22	300.0	345	690V, 1000A, Bussmann# 170M6814D, Type DIN 43620: 3	16378	4800	677	1150
K03561A23	350.0	400	690V, 1250A, Bussmann# 170M8554D, Type DIN 43620: 3	20473	6000	677	1150
NEMA 12	400 volt						
K03562A01	1.0	2.3	690V, 25A, Bussmann# 170M1561, Type DIN 43620: 000	102	30	26	44
K03562A02	2.0	3.1	690V, 25A, Bussmann# 170M1561, Type DIN 43620: 000	136	40	26	44
K03562A03	3.0	3.8	690V, 25A, Bussmann# 170M1561, Type DIN 43620: 000	177	52	26	44
K03562A04	4.0	5.3	690V, 25A, Bussmann# 170M1561, Type DIN 43620: 000	249	73	26	44
K03562A05	5.0	7.6	690V, 25A, Bussmann# 170M1561, Type DIN 43620: 000	321	94	26	44
K03562A06	7.5	9.5	690V, 25A, Bussmann# 170M1561, Type DIN 43620: 000	416	122	26	44
K03562A07	7.5	12	690V, 25A, Bussmann# 170M1561, Type DIN 43620: 000	587	172	26	44

K03562A08	10.0	16	690V, 40A, Bussmann# 170M1563, Type DIN 43620: 000	792	232	52	88
K03562A09	15.0	24	690V, 40A, Bussmann# 170M1563, Type DIN 43620: 000	1150	337	52	88
K03562A10	20.0	30	690V, 63A, Bussmann# 170M1565, Type DIN 43620: 000	1559	457	79	134
K03562A11	25.0	36	690V, 63A, Bussmann# 170M1565, Type DIN 43620: 000	1918	562	79	134
K03562A12	30.0	43	690V, 80A, Bussmann# 170M1566, Type DIN 43620: 000	2276	667	79	134
K03562A13	40.0	58	690V, 100A, Bussmann# 170M1567, Type DIN 43620: 000	3095	907	165	280
K03562A14	50.0	68	690V, 125A, Bussmann# 170M1568, Type DIN 43620: 000	3811	1117	165	280
K03562A15	60.0	83	690V, 160A, Bussmann# 170M1569, Type DIN 43620: 000	3822	1120	165	280
K03562A16	75.0	100	690V, 315A, Bussmann# 170M3817, Type DIN 43620: 1	4419	1295	256	435
K03562A17	100.0	138	690V, 315A, Bussmann# 170M3817, Type DIN 43620: 1	4913	1440	256	435
K03562A18	125.0	161	690V, 450A, Bussmann# 170M5809, Type DIN 43620: 2	6620	1940	265	450
K03562A19	150.0	196	690V, 500A, Bussmann# 170M5810, Type DIN 43620:2	7882	2310	265	450
K03562A20	200.0	234	690V, 630A, Bussmann# 170M5812, Type DIN 43620: 2	11260	3300	324	550
K03562A21	250.0	278	690V, 800A, Bussmann# 170M6812D, Type DIN 43620: 3	13307	3900	324	550
K03562A22	300.0	345	690V, 1000A, Bussmann# 170M6814D, Type DIN 43620: 3	16378	4800	677	1150
K03562A23	350.0	400	690V, 1250A, Bussmann# 170M8554D, Type DIN 43620: 3	20473	6000	677	1150

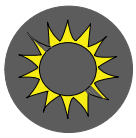
ePrism ITT PART NO.	**POWER (hp)**	RATED CURRENT (A)	RECOMMENDED FUSE SIZE UL	HEAT DISSIPATION (BTU/hr.)	HEAT DISSIPATION (Watts)	AIR FLOW (ft^3/min)	AIR FLOW (m^3/hr.)
NEMA 1	480 volt						
K03552A01	3	4.8	600V, 10A, Bussmann# JJS-10, Type T	249	73	26	44
K03552A02	5	7.6	600V, 15A, Bussmann# JJS-15, Type T	416	122	26	44
K03552A03	7.5	11	600V, 20A, Bussmann# JJS-20, Type T	587	172	26	44
K03552A04	10	14	600V, 25A, Bussmann# JJS-25, Type T	792	232	52	88
K03552A05	15	21	600V, 35A, Bussmann# JJS-35, Type T	1150	337	52	88
K03552A06	20	27	600V, 40A, Bussmann# JJS-40, Type T	1559	457	79	134
K03552A07	25	34	600V, 50A, Bussmann# JJS-50, Type T	1918	562	79	134
K03552A08	30	40	600V, 60A, Bussmann# JJS-60, Type T	2276	667	79	134
K03552A09	40	52	600V, 80A, Bussmann# JJS-80, Type T	3095	907	165	280
K03552A10	50	65	600V, 90A, Bussmann# JJS-90, Type T	3811	1117	165	280
K03552A11	60	77	600V, 110A, Bussmann# JJS-110, Type T	3822	1120	165	280
K03552A12	75	96	600V, 150A, Bussmann# JJS-150, Type T	4419	1295	256	435
K03552A13	100	124	600V, 200A, Bussmann# JJS-200, Type T	4913	1440	256	435
K03552A14	125	156	600V, 225A, Bussmann# JJS-225, Type T	6620	1940	265	450
K03552A15	150	180	600V, 300A, Bussmann# JJS-300, Type T	7882	2310	265	450
K03552A16	200	240	600V, 350A, Bussmann# JJS-350, Type T	11260	3300	324	551
K03552A17	250	302	600V, 400A, Bussmann# JJS-400, Type T	14331	4200	677	1150
K03552A18	300	361	600V, 500A, Bussmann# JJS-500, Type T	16378	4800	677	1150
K03552A19	350	414	600V, 600A, Bussmann# JJS-600, Type T	20473	6000	677	1150
NEMA 12	480 volt						
K03553A01	3	4.8	600V, 10A, Bussmann# JJS-10, Type T	249	73	26	44
K03553A02	5	7.6	600V, 15A, Bussmann# JJS-15, Type T	416	122	26	44
K03553A03	7.5	11	600V, 20A, Bussmann# JJS-20, Type T	587	172	26	44
K03553A04	10	14	600V, 25A, Bussmann# JJS-25, Type T	792	232	52	88
K03553A05	15	21	600V, 35A, Bussmann# JJS-35, Type T	1150	337	52	88
K03553A06	20	27	600V, 40A, Bussmann# JJS-40, Type T	1559	457	79	134
K03553A07	25	34	600V, 50A, Bussmann# JJS-50, Type T	1918	562	79	134
K03553A08	30	40	600V, 60A, Bussmann# JJS-60, Type T	2276	667	79	134
K03553A09	40	52	600V, 80A, Bussmann# JJS-80, Type T	3095	907	165	280
K03553A10	50	65	600V, 90A, Bussmann# JJS-90, Type T	3811	1117	165	280
K03553A11	60	77	600V, 110A, Bussmann# JJS-110, Type T	3822	1120	165	280
K03553A12	75	96	600V, 150A, Bussmann# JJS-150, Type T	4419	1295	256	435
K03553A13	100	124	600V, 200A, Bussmann# JJS-200, Type T	4913	1440	256	435
K03553A14	125	156	600V, 225A, Bussmann# JJS-225, Type T	6620	1940	265	450
K03553A15	150	180	600V, 300A, Bussmann# JJS-300, Type T	7882	2310	265	450
K03553A16	200	240	600V, 350A, Bussmann# JJS-350, Type T	11260	3300	324	551
K03553A17	250	302	600V, 400A, Bussmann# JJS-400, Type T	14331	4200	677	1150
K03553A18	300	361	600V, 500A, Bussmann# JJS-500, Type T	16378	4800	677	1150
K03553A19	350	393	600V, 600A, Bussmann# JJS-600, Type T	20473	6000	677	1150

ePrism ITT PART NO.	POWER (hp)	RATED CURRENT (A)	RECOMMENDED FUSE SIZE UL	HEAT DISSIPATION (BTU/hr.)	HEAT DISSIPATION (Watts)	AIR FLOW (ft^3/min)	AIR FLOW (m^3/hr.)
NEMA 1	525-690 volt						
K03554A01	5	7	600V, 15A, Bussmann# JJS-15, Type T	389	114	79	134
K03554A02	7.5	9.4	600V, 20A, Bussmann# JJS-20, Type T	488	143	79	134
K03554A03	10	13.6	600V, 30A, Bussmann# JJS-30, Type T	706	207	79	134
K03554A04	15	18	600V, 40A, Bussmann# JJS-40, Type T	935	274	79	134
K03554A05	20	22	600V, 50A, Bussmann# JJS-50, Type T	1123	329	79	134
K03554A06	25	27	600V, 50A, Bussmann# JJS-50, Type T	1382	405	79	134
K03554A07	40	41	600V, 60A, Bussmann# JJS-60, Type T	2948	864	165	280
K03554A08	50	52	600V, 80A, Bussmann# JJS-80, Type T	3405	998	165	280
K03554A09	50	52	600V, 80A, Bussmann# JJS-80, Type T	3822	1120	165	280
K03554A10	60	62	600V, 110A, Bussmann# JJS-110, Type T	4419	1295	256	435
K03554A11	75	77	600V, 150A, Bussmann# JJS-150, Type T	4913	1440	256	435
K03554A12	100	99	600V, 150A, Bussmann# JJS-150, Type T	6620	1940	265	450
K03554A13	125	125	600V, 200A, Bussmann# JJS-200, Type T	7882	2310	265	450
K03554A14	150	144	600V, 250A, Bussmann# JJS-250, Type T	11260	3300	324	550
K03554A15	200	180	600V, 300A, Bussmann# JJS-300, Type T	13307	3900	324	550
K03554A16	250	242	600V, 400A, Bussmann# JJS-400, Type T	14331	4200	677	1150
NEMA 12	525-690 volt						
K03555A01	5	7	600V, 15A, Bussmann# JJS-15, Type T	740	217	165	280
K03555A02	7.5	9.4	600V, 20A, Bussmann# JJS-20, Type T	969	284	165	280
K03555A03	10	13.6	600V, 30A, Bussmann# JJS-30, Type T	1361	399	165	280
K03555A04	15	18	600V, 40A, Bussmann# JJS-40, Type T	1672	490	165	280
K03555A05	20	22	600V, 50A, Bussmann# JJS-50, Type T	1972	578	165	280
K03555A06	25	27	600V, 50A, Bussmann# JJS-50, Type T	2252	660	165	280
K03555A07	40	41	600V, 60A, Bussmann# JJS-60, Type T	2948	864	165	280
K03555A08	50	52	600V, 80A, Bussmann# JJS-80, Type T	3405	998	165	280
K03555A09	50	52	600V, 80A, Bussmann# JJS-80, Type T	3822	1120	165	280
K03555A10	60	62	600V, 110A, Bussmann# JJS-110, Type T	4419	1295	256	435
K03555A11	75	77	600V, 150A, Bussmann# JJS-150, Type T	4913	1440	256	435
K03555A12	100	99	600V, 150A, Bussmann# JJS-150, Type T	6620	1940	265	450
K03555A13	125	125	600V, 200A, Bussmann# JJS-200, Type T	7882	2310	265	450
K03555A14	150	144	600V, 250A, Bussmann# JJS-250, Type T	11260	3300	324	550
K03555A15	200	180	600V, 300A, Bussmann# JJS-300, Type T	13307	3900	324	550
K03555A16	250	242	600V, 400A, Bussmann# JJS-400, Type T	14331	4200	677	1150

PS220 INSTALLATION QUICK REFERENCE - WALL MOUNT UNITS

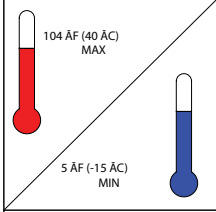
ACS880-ITT01 NEMA 1 / NEMA 12

ACS880-ITT01 IP21 / IP55



NO DIRECT SUNLIGHT

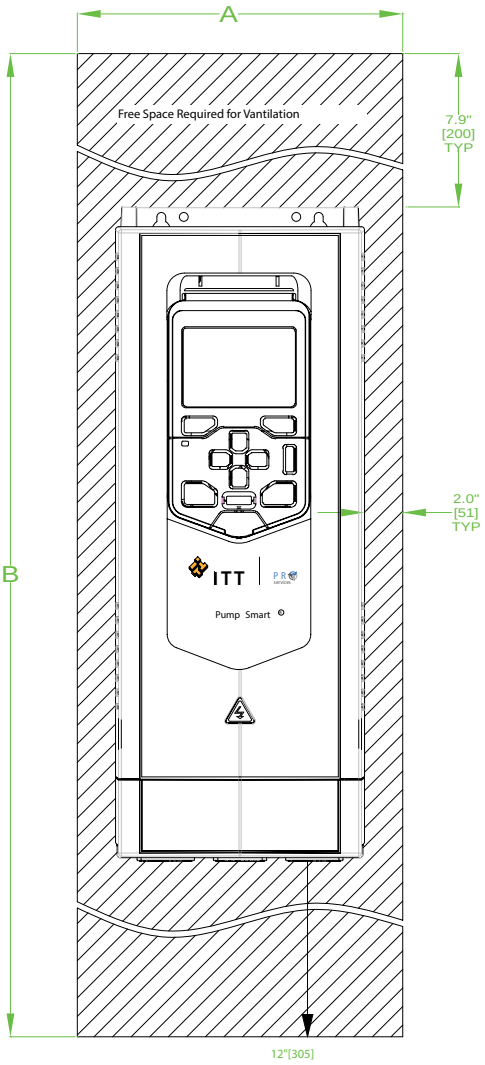
3300 ft (1000M)



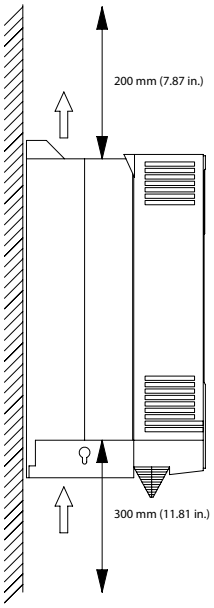
5-95% RELATIVE
HUMIDITY
NO CONDENSATION
NO CORROSIVE GASES

Refer to Hardware
Manual Technical
Data for application
guidelines outside of
the above listed limits

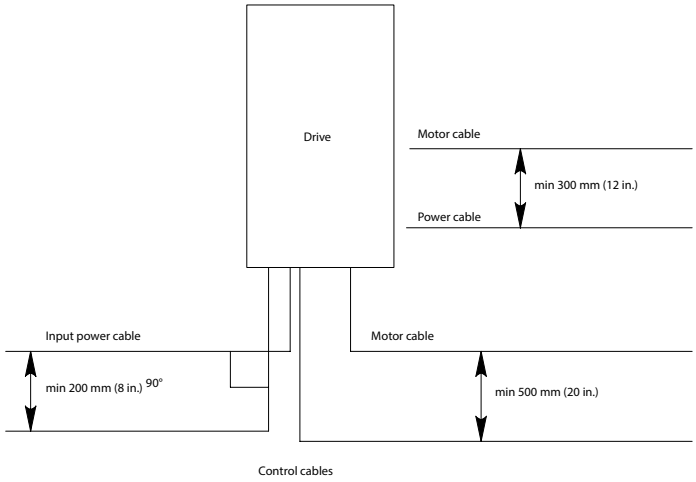
IP21~NEMA1
IP55~NEMA 12



Cooling Air Flow
Side View



Control/Power Wiring Layout

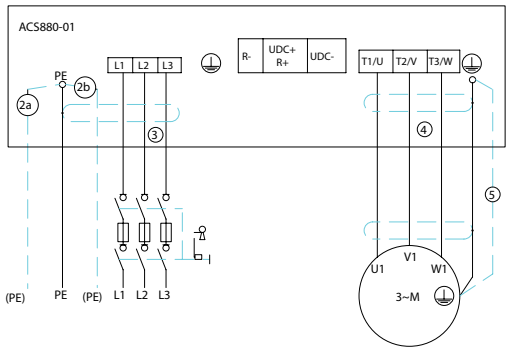


WARNING

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 the ACS880 Installation Manual for additional installation details

Mains/Power Wiring



1	Fuses and disconnect supplied by customer
2	Use a separate grounding PE cable (2a) or a cable with a separate PE conductor (2b) if the conductivity of the shield does not meet the requirements for the PE conductor.
3	360-degree grounding is recommended if shielded cable is used. Ground the other end of the input cable shield or PE conductor at the distribution board.
4	360-degree grounding is required.
5	Use a separate grounding cable if the shield does not meet the requirements of IEC 61439-1 and there is no symmetrically constructed grounding conductor in the cable

Note:
If there is a symmetrically constructed grounding conductor on the motor cable in addition to the conductive shield, connect the grounding conductor to the grounding terminal at the drive and motor ends.
Do not use an asymmetrically constructed motor cable for motors above 30kW. Connecting its fourth conductor at the motor end increases bearing currents and causes extra wear.

Basic Dimensions & Weights

Frame	IP21					UL type 1				
	H1 mm	H2 mm	W mm	D mm	Weight kg	H1 in.	H2 in.	W in.	D in.	Weight lb
R1	409	370	155	226	6	16.11	14.57	6.10	8.89	13
R2	409	370	155	249	8	16.11	14.57	6.10	9.80	18
R3	475	420	172	261	10	18.71	16.54	6.77	10.28	22
R4	576	490	203	274	18.5	22.70	19.30	7.99	10.80	41
R5	730	596	203	274	23	28.74	23.46	7.99	10.79	51
R6	726	569	251	357	45	28.60	22.40	9.92	14.09	99
R7	880	600	284	365	55	34.70	23.60	11.22	14.37	121
R8	963	681	300	386	70	37.90	26.82	11.81	15.21	154
R9	955	680	380	413	98	37.59	26.77	14.96	16.27	216
Frame	IP55					UL type 12				
	H1 mm	H2 mm	W mm	D mm	Weight kg	H1* in.	H3 in.	W** in.	D in.	Weight lb
R1	450	-	162	292	6	17.72	-	6.38	11.50	20
R2	450	-	161	315	8	17.72	-	6.38	12.40	18
R3	525	-	180	327	10	20.70	-	7.09	12.87	22
R4	576	-	203	344	18.5	22.70	-	7.99	13.54	41
R5	730	-	203	344	23	28.73	-	7.99	13.54	51
R6	726	-	252	421	45	28.60	-	9.92	16.46	99
R7	880	-	284	423	55	34.66	-	11.18	16.65	121
R8	963	-	300	452	72	37.90	-	11.81	17.78	159
R9	955	-	380	477	100	37.59	-	14.96	18.78	220

H1 Height with cable entry box
H2 Height without cable entry box (option +P940)
H3 Height with hood
W Width with cable entry box
D Depth with cable entry box
* Hood increases height with 155 mm (6.10 in) in frames R4 to R8 and with 230 mm (9.06 in) in frame R9.
** Hood increases height with 23 mm (0.91 in) in frames R4 and R5,40 mm (1.57 in) in frames R6 and R7 and 50 mm (1.97 in) in frames R8 and R9.
Note 1: For more information on dimensions, see chapter Dimension drawings.
Note 2: For dimensions of option +P940 and +P944, SEE ACS880-01 +P940/+P944 drives for cabinet installation supplement (3AUA0000145446 [English]).
Note 3: For dimensions of option +C135, see flange mounting kit installation supplement (3AXD50000019100 [English]). For weights of the drive without cable entry box see ACS880-01

Cable Entry

Frame	Cable lead-throughs		L1,L2,L3,T1/U,T2/V,T3/W						Grounding terminals	
		Ă*	Wire size	T (Wire screw)		I	T (Terminal nut)		Max. wire size	
	pcs	in.	kcmil/AWG	M...	lbf-ft	in.	M...		AWG	lbf-ft
R1	2	0.67	18...10	-	0.4	0.31	-	-	4	1.3
R2	2	0.67	18...10	-	0.4	0.31	-	-	4	1.3
R3	2	0.83	20...6	-	1.3	0.39	-	-	4	1.3
R4	2	0.94	20...2	-	2.4	0.70	-	-	4	2.1
R5	2	1.26	10...2/0	M8	11	0.70	-	-	2	2.1
R6	2	1.77	4...300 MCM	M10	22.1	1.18	-	-	350 MCM	7.2
R7	2	2.13	3/0...400 MCM (4...300 MCM)	M10	29.5 (22.1**)	1.18	-	-	350 MCM	7.2
R8	4	1.77	2 x (1/0...300 MCM)	M10	29.5	1.18	M10	17.7	2x 350 MCM	7.2
R9	4	2.13	2 x (3/0...400 MCM)	M12	51.6	1.18	M10	17.7	2x 350 MCM	7.2

* maximum cable diameter accepted. Cable connector inside diameter: ¾"(frames R1 and R2), 1" (R3). For the lead-through plate hole diameters, see chapter dimension drawings.
** 525...690 V drives

Frame	Cable lead-throughs		L1,L2,L3,T1/U,T2/V,T3/W						Grounding terminals	
		Ă*	Wire size	T (Wire screw)		I	T (Terminal nut)		Max. wire size	
	pcs	mm	mm ^{2}	M...	N·m	mm	M...	N·m	mm ^{2}	N·m
R1	2	17	0.75...6	-	0.6	8	-	-	25	1.8
R2	2	17	0.75...6	-	0.6	8	-	-	25	1.8
R3	2	21	0.5...16	-	1.7	10	-	-	25	1.8
R4	2	24	0.5...35	-	3.3	18	-	-	25	2.9
R5	2	32	6...70	M8	15	18	-	-	35	2.9
R6	2	45	25...150	M10	30	30	-	-	185	9.8
R7	2	54	95...240 (25...150**)	M10	40 (30**)	30	-	-	185	9.8
R8	4	45	2 x (50...150)	M10	40	30	M10	24	2x185	9.8
R9	4	54	2 x (95...240)	M12	70	30	M10	24	2x185	9.8

* maximum cable diameter accepted. For the lead-through plate hole diameters, see chapter dimension drawings.
** 525...690 V drives
Note: When you use a cable size smaller than what is accepted by the terminal, remove the terminal and use suitable cable lugs for connecting the cable directly under the head of the bolt.

Installation Checklist

Checklist

Check the mechanical and electrical installation of the drive before start-up Go through the checklist together with another person

WARNING! Only qualified electricians are allowed to carry out the work described below Follow the complete safety instructions of the drive. Ignoring the safety instructions can cause injury or death. Open the main disconnector of the drive and lock it to open position. Measure to ensure that the drive is not powered.

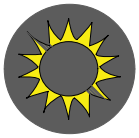
Check that...
1. The ambient operating conditions meet the specification in chapter Technical data.
2. If the drive will be connected to an IT (ungrounded) supply network : Optional EMC filters of type +E200 and +E202 have been disconnected. Consult ABB for the instructions.
3. If the drive has been stored over one year : The electrolytic DC capacitors in the DC link of the drive have been reformed.
4. There is an adequately sized protective earth (ground) conductor between the drive and the switchboard.
5. There is an adequately sized protective earth (ground) conductor between the motor and the drive.
6. All protective earth (ground) conductors have been connected to the appropriate terminals and the terminals have been tightened (pull conductors to check).
7. The supply voltage matches the nominal input voltage of the drive. Check the type designation label.
8. The input power cable has been connected to appropriate terminals, the phase order is right, and the terminal have been tightened (pull conductors to check).
9. Appropriate supply fuses and disconnector have been installed.
10. The motor cable has been connected to appropriate terminals, the phase order is right, and the terminals have been tightened (pull conductors to check).
11. The brake resistor cable (if present) has been connected to appropriate terminals, and the terminals have been tightened (pull conductors to check)
12. The motor cable (and the resistor cable, if present) has been routed away from other cables)
13. No power factor compensation capacitors have been connected to the motor cable.
14. The control cables (if any) have been connected to the control unit.
15. If a drive bypass connection will be used : The direct-on-line contactor of the motor and the drive output contactor are either mechanically or electrically interlocked (cannot be closed simultaneously).
16. There are no tools, foreign objects or dust from drilling inside the drive.
17. Drive and motor connection box covers are in place.
18. The motor and the driven equipment are ready for start-up.

PS220 Installation Quick Reference Wall Mount Units

	Drawing is not to scale Dimensions in inches [mm]	Drawn: HCLT 8-08-16 Checked: BDECOOK 8-08-16	SHEET 1 OF 1	B04933A	REV 0	Issue -

PS220 INSTALLATION QUICK REFERENCE - FLOOR MOUNT UNITS

ACS880-07 IP22 / 42 and IP54

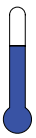


NO DIRECT SUNLIGHT

3300 ft (1000M)

NEMA1/NEMA12

104 ÂF (40 ÂC) MAX



5 ÂF (-15 ÂC) MIN

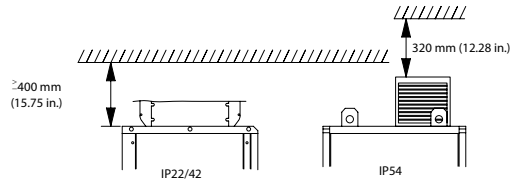
5-95% RELATIVE HUMIDITY
NO CONDENSATION
NO CORROSIVE GASES

Refer to Hardware Manual Technical Data for application guidelines outside of the above listed limits

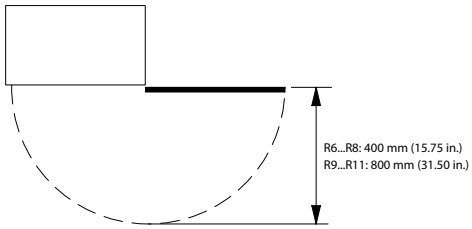
IP21~NEMA1
IP55~NEMA 12

Front		Side		Above*	
mm	in.	mm	in.	mm	in.
150	5.91	-	-	400	15.75

*measured from the base plate of the cabinet top. Note: 320 mm (12.28 in.) is required for fan replacement of IP54 cabinets.



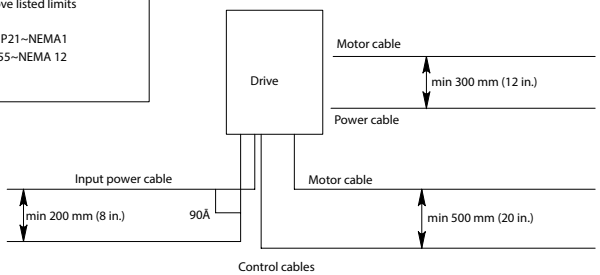
Door opening:



Frame size	Height 1)				Width 2)		Depth 3)		Weight	
	IP22/42		IP54							
	mm	in.	mm	in.	mm	in.	mm	in.	kg	lb
R6	2145	84.45	2315	91.14	430	16.93	673	26.50	240	530
R7	2145	84.45	2315	91.14	430	16.93	673	26.50	250	560
R8	2145	84.45	2315	91.14	430	16.93	673	26.50	265	590
R9	2145	84.45	2315	91.14	830	32.68	698	27.48	375	830
R10	2145	84.45	2315	91.14	830	32.68	698	27.48	530	1170
R11	2145	84.45	2315	91.14	830	32.68	698	27.48	580	1280

1) For marine contruction (option +C121) extra height is 10 mm (0.39 in.)due to the fastening bars at the bottom of the cabinet.
2) Extra width with brake resistors (option +D151): SAFURxxxFxxx 400 mm (15.75 in.). 2xSAFURxxxFxxx 800 mm (19.68 in.). Extra width for frames R6 to R8 with EMC filter (option +E202): 200 mm (7.87 in.). Total width of R6 to R9 frame sizes with molded case circuit breaker (option +F289) is 830 mm (32.68 in.)
3) For drives with marine fastening bars (option +C121): Depth is 757 mm.

Control/Power Wiring Layout



Standard Cable Entry
IP22/42 & IP54
ACS880-07 are all bottom Entry/exit

Input and Motor Cable terminal sizes (per phase) and tightening torques are given below. The maximum allowed width of the cable lug is 1.5 inches.

*M10 is the extended enclosure: 30...44 Nm tightening torque
The maximum width of cable lug is 38 mm.

IEC

Frame size	Number of holes in the lead-through plate for the power cables. Hole diameter 60 mm.	Terminals L1,L2,L3,U2,V2,W2,UDC+/R+, UDC- and R-			Grounding Terminals	
		Max. phase conductor size mm²	Bolt size	Tightening torque	Bolt size	Tightening torque
R6	6	185	M10	20...40 N·m	M10	30...44 N·m
R7	6	185				
R8	6	1x240 or 2x185	M12	50...75 N·m		
R9	9	3x240				
R10	12	3x240 or 4x185				
R11	12	3x240 or 4x185				

US

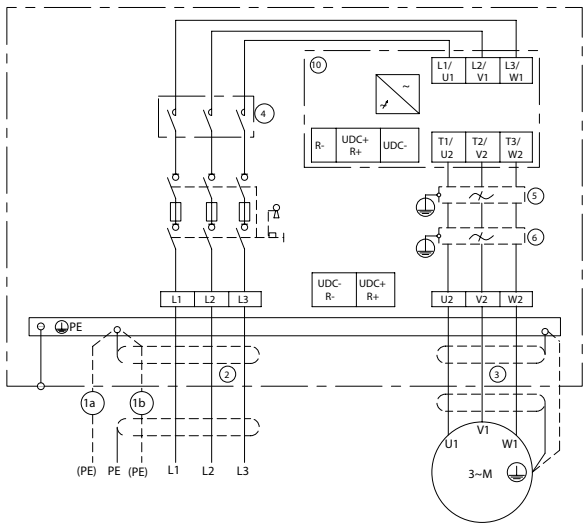
Frame size	Terminals L1,L2,L3,U2,V2,W2,UDC+/R+,UDC- and R-			Grounding Terminals	
	Max. phase conductor size AWG/kcmil	Busbar bolt size - Hole spacing	Tightening torque bf-ft	Bolt size	Tightening torque bf-ft
R6	350 MCM	M10 (⅜") x 2-1.75"	15...30	M10 (⅜")	22...32
R7					
R8	1x500 MCM or 2x350 MCM	M12 (7/16") x 2-1.75"	37...55		
R9	2x500 MCM				
R10	1x500 MCM or 4x350 MCM	M12 (7/16") x 4-1.75"			
R11	1x500 MCM or 4x350 MCM				

⚠ 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 the ACS880 Installation Manual for additional installation details

Mains/Power Wiring



**Disconnect / fusing provided by ITT on extended enclosure ACS880-07

1) Use a separate grounding PE cable (1a) or a cable with a seperate PE conductor (1b) if the conductivity of the shield does not meet the requirements for the PE conductor.
2) 360-degree grounding is recommended if shielded cable is used. Ground the other end of the input cable shield or PE conductor at the distribution board.
3) 360-degree grounding is required.
4) Line contactor (option +F250)
5) Common mode filter (option +E208)
6) du/dt filter or sine filter (options +E205 and +E206)
7) Use a separate grounding cable if the shield does not meet the requirements of IEC 61439-1 and there is no symmetically constructed grounding conductor in the cable.
8) Terminals of frame R9 cabinet:

R-	UDC+ R+	UDC-

9) Drive module
10) Fast acting fuses are required to protect drive. Fuse operating times should be less than 0.1 sec.
UL-Standard T/L type fuses
IEC-Standard gG or aR type fuses
Refer to Technical Data Section for details

Installation checklist

Check that...
1. The ambient operating conditions meet the specification in chapter Technical data.
2. The drive cabinet has been fixed to floor, and if necessary due to vibration etc, also from top to the wall or roof.
3. The cooling air will flow freely in and out of the drive cabinet.
4. If the drive will be connected to an IT (ungrounded) or a corner grounded TN network: The optional EMC filter (+E200, +E202) of the drive (if any) has been disconnected.
5. If the drive has been stored over one year: The electrolytic DC capacitors in the DC link of the drive have been reformed. See Converter module capacitor reforming instructions (3BFE64059629 [English])
6. There is an adequately sized protective earth (ground) conductor between the drive and the switchboard and the conductor has been connected to appropriate terminal. Proper grounding has been measured according to the regulations.
7. There is an adequately sized protective earth (ground) conductor between the motor and the drive and the conductor has been connected to appropriate terminal. Proper grounding has been measured according to the regulations.
8. Only for drives with option +D150: There is an adequately sized protective earth (ground) conductor between the user-installed brake resistor and the drive and the conductor has been connected to appropriate terminal. Proper grounding has been measured according to the regulations.
9. The supply voltage matches the nominal input voltage of the drive. Check the type designation label.
10. The voltage setting of the auxiliary voltage transformer (T21) is correct.
11. The input power cable has been connected to appropriate terminals, the phase order is right, and the terminal have been tightened (pull conductors to check).
12. The motor cable has been connected to appropriate terminals, the phase order is right, and the terminals have been tightened (pull conductors to check).
13. The motor cable (and the resistor cable, if present) has been routed away from other cables)
14. No power factor compensation capacitors have been connected to the motor cable.
15. If a drive bypass connection will be used: The direct-on-line contactor of the motor and the drive output contactor are either mechanically or electrically interlocked (cannot be closed simultaneously).
16. The external brake resistor (if present) has been connected to the appropriate terminals, and the terminals have been tightened (pull the conductors to check.)
17. The brake resistor cable has been routed away from other cables.
18. The control cables have been connected to the appropriate terminals, and the terminals have been tightened (pull the conductors to check.)
19. There are no tools, foreign objects or dust from drilling inside the drive.
20. All shrouds and cover of the motor connection box are in place. Cabinet doors have been closed.
21. The motor and the driven equipment are ready for start.

Typical power cable sizes

Drive type	Frame size	IEC [1]		US [2]
		Cu cable type	Al cable type	Cu cable type
		mm²	mm²	AWG/kcmil per phase
U_N = 400V				
ACS880-07-0105A-3	R6	3x50	3x70	1
ACS880-07-0145A-3	R6	3x95	3x120	2/0
ACS880-07-0169A-3	R7	3x120	3x150	3/0
ACS880-07-0206A-3	R7	3x150	3x240	250 MCM
ACS880-07-0246A-3	R8	2 x (3x70)	2 x (3x95)	300 MCM
ACS880-07-0293A-3	R8	2 x (3x95)	2 x (3x120)	2 x 3/0
ACS880-07-0363A-3	R9	2 x (3x120)	2 x (3x185)	2 x 4/0
ACS880-07-0430A-3	R9	2 x (3x150)	2 x (3x240)	2 x 250 MCM
ACS880-07-0505A-3	R10	3 x (3x95)	3 x (3x150)	2x500 MCM or 3x250 MCM
ACS880-07-0585A-3	R10	3 x (3x120)	3 x (3x185)	2x600 MCM or 3x300 MCM
ACS880-07-0650A-3	R10	3 x (3x150)	3 x (3x240)	2x700 MCM or 3x350 MCM
ACS880-07-0725A-3	R11	3 x (3x185)	4 x (3x185)	3x500 MCM or 4x300 MCM
ACS880-07-0820A-3	R11	3 x (3x240)	4 x (3x240)	3x600 MCM or 4x400 MCM
ACS880-07-0880A-3	R11	3 x (3x240)	4 x (3x240)	3x600 MCM or 4x400 MCM
U_N = 500V				
ACS880-07-0096A-5	R6	3x50	3x70	1
ACS880-07-0124A-5	R6	3x95	3x95	2/0
ACS880-07-0156A-5	R7	3x120	3x150	3/0
ACS880-07-0180A-5	R7	3x150	3x185	250 MCM
ACS880-07-0240A-5	R8	2 x (3x70)	2 x (3x95)	300 MCM
ACS880-07-0260A-5	R8	2 x (3x70)	2 x (3x95)	2 x 2/0
ACS880-07-0302A-5	R9	2 x (3x120)	2 x (3x185)	2 x 250 MCM
ACS880-07-0361A-5	R9	2 x (3x120)	2 x (3x185)	2 x 250 MCM
ACS880-07-0414A-5	R9	2 x (3x150)	2 x (3x240)	2 x 250 MCM
ACS880-07-0460A-5	R10	3 x (3x95)	3 x (3x150)	2x400 MCM or 3x4/0
ACS880-07-0503A-5	R10	3 x (3x95)	3 x (3x150)	2x500 MCM or 3x250 MCM
ACS880-07-0583A-5	R10	3 x (3x120)	3 x (3x185)	2x600 MCM or 3x300 MCM
ACS880-07-0635A-5	R10	3 x (3x150)	3 x (3x240)	2x700 MCM or 3x350 MCM
ACS880-07-0715A-5	R11	4 x (3x185)	4 x (3x185)	3x500 MCM or 4x300 MCM
ACS880-07-0820A-5	R11	4 x (3x240)	4 x (3x240)	3x600 MCM or 4x400 MCM
U_N = 690V				
ACS880-07-0061A-7	R6	3x25	3x35	4
ACS880-07-0084A-7	R6	3x35	3x50	3
ACS880-07-0098A-7	R7	3x50	3x70	2
ACS880-07-0119A-7	R7	3x70	3x95	1/0
ACS880-07-0142A-7	R8	3x95 [3]	3x120	2/0
ACS880-07-0174A-7	R8	3x120 [3]	2 x (3x70)	4/0
ACS880-07-0210A-7	R9	3x185	2 x (3x95)	300 MCM
ACS880-07-0271A-7	R9	3x240	2 x (3x120)	400 MCM
ACS880-07-0330A-7	R10	2 x (3x120)	3 x (3x120)	2x250 MCM or 3x2/0
ACS880-07-0370A-7	R10	2 x (3x120)	3 x (3x120)	2x300 MCM or 3x3/0
ACS880-07-0425A-7	R11	3 x (3x95)	3 x (3x120)	2x350 MCM or 3x4/0
ACS880-07-0470A-7	R11	3 x (3x95)	3 x (3x150)	2x400 MCM or 3x4/0
ACS880-07-0522A-7	R11	3 x (3x120)	3 x (3x185)	2x500 MCM or 3x250 MCM
ACS880-07-0590A-7	R11	3 x (3x150)	3 x (3x185)	2x600 MCM or 3x300 MCM
ACS880-07-0650A-7	R11	3 x (3x150)	3 x (3x240)	2x700 MCM or 3x350 MCM

1. The cable sizing is based on max. 9 cables laid on a cable ladder side by side, three ladder type trays one on top of the other, ambient temperature 30ÂC, PVC insulation, surface temperature 70ÂC (EN 60204-1 and IEC 60364-5-52/2001). For other conditions, size the cables according to local saftey regulations, appropriate input voltage and the load current of the drive.
2. The cable sizing is based on NEC Table 310-16 for copper wires, 75ÂC (167ÂF) wire insulation ar 40ÂC (104ÂF) ambient temperature. Not more than three current-carryoing conductors in raceway or cable or earth (directly buried). For other conditions, size the cable according to local saftey regulations, appropriate input voltage and the load current of the drive.

PS220 Installation Quick Reference Floor Mount Units

	Drawing is not to scale Dimensions in inches [mm]	Drawn: HCLT 5-11-16 Checked: Brad 5-24-16	SHEET 1 OF 1	B04934A	REV 0	Issue -

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http://www.ittproservices.com

PumpSmart

ITT Goulds Pumps Inc.
240 Fall Street
Seneca Falls, NY 13148
USA

Form IOM.PS220.en-US.2021-09
The original instruction is in English. All non-English instructions are translations of the original instruction.