IM213

ITT

Commercial Water

Goulds Pumps

S-Drive™ Constant Pressure Aquavar SPD™

Variable Speed Pump Control

Installation, Operation & Maintenance

Models Covered:
S-Drive™
Aquavar SPD™
(5 – 30 HP)

GOULDS PUMPS

Goulds Pumps is a brand of ITT Corporation.

www.goulds.com

Engineered for life

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Note:

- Use Copper wire only.
- Suitable for use in a pollution degree 2 micro-environment.
- Motor overload protection provided at 110% of full load current.
- In order to maintain the environmental rating integrity of the enclosure, all openings must be closed by equipment rated 3, 3R, 3S, 4, 4X, 6 or 6P.
- Maximum Ambient temperature range -22º F to 122º F.
- Maximum Humidity: 95% at 104º F non-condensing.

! Safety Instructions

Section 1

Important: Read all safety information prior to installation of the Controller.

Note

This is a **SAFETY ALERT SYMBOL**. When you see this symbol on the controller, pump or in this manual, look for one of the following signal words and be alert to the potential for personal injury or property damage. Obey all messages that follow this symbol to avoid injury or death.

DANGER	Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.
WARNING	Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.
CAUTION	Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.
CAUTION	Used without a safety alert symbol indicates a potentially hazardous situation which, if not avoided, could result in property damage.
NOTE	Indicates special instructions which are very important and must be followed.

Note

All operating instructions must be read, understood, and followed by the operating personnel. Goulds Pumps accepts no liability for damages or operating disorders which are the result of non-compliance with the operating instructions.

1. This manual is intended to assist in the installation, operation and repair of the system and must be kept with the system.
2. Installation and maintenance **MUST** be performed by properly trained and qualified personnel.
3. Review all instructions and warnings prior to performing any work on the system.
4. Any safety decals **MUST** be left on the controller and/or pump system.
5. **DANGER** Hazardous voltage — The system **MUST** be disconnected from the main power supply before attempting any operation or maintenance on the electrical or mechanical part of the system. Failure to disconnect electrical power before attempting any operation or maintenance can result in electrical shock, burns or death.
6. **CAUTION** Hazardous Pressure — When in operation, the motor and pump could start unexpectedly and cause serious injury.

System Components

Section 2

Please review the S-Drive components and insure that you have all the parts and are familiar with their names. Be sure to inspect all components Goulds Pumps supplies for shipping damage.

S-Drive Variable Speed Controller:

1. S-Drive Controller
2. Pressure Transducer with Cable
3. Conduit Plate Caps

Warning

⚠WARNING Hazardous voltage

⚠CAUTION Hazardous Pressure

DO NOT power the unit or run the pump until all electrical and plumbing connections, especially the pressure sensor connection, are completed. The pump should not be run dry. All electrical work must be performed by a qualified technician. Always follow the National Electrical Code (NEC), or the Canadian Electrical Code (CEC) as well as all local, state and provincial codes. Code questions should be directed to your local electrical inspector or code enforcement agency. Failure to follow electrical codes and OSHA safety standards may result in personal injury or equipment damage. Failure to follow manufacturer's installation instructions may result in electrical shock, fire hazard, personal injury, death, damage to equipment, unsatisfactory performance and may void manufacturer's warranty.

Controller Product Code Information

SPD Y XXXX F

- F = WITH OUTPUT FILTER
  BLANK = NO OUTPUT FILTER
- 4 DIGITS FOR HP
  5 HP = 0050
  7.5 HP = 0075
  10 HP = 0100
  15 HP = 0150
  20 HP = 0200
  25 HP = 0250
  30 HP = 0300
- 1 DIGIT FOR INPUT VOLTAGE
  230 VOLT = 2
  460 VOLT = 4
  575 VOLT = 5
- SERIES

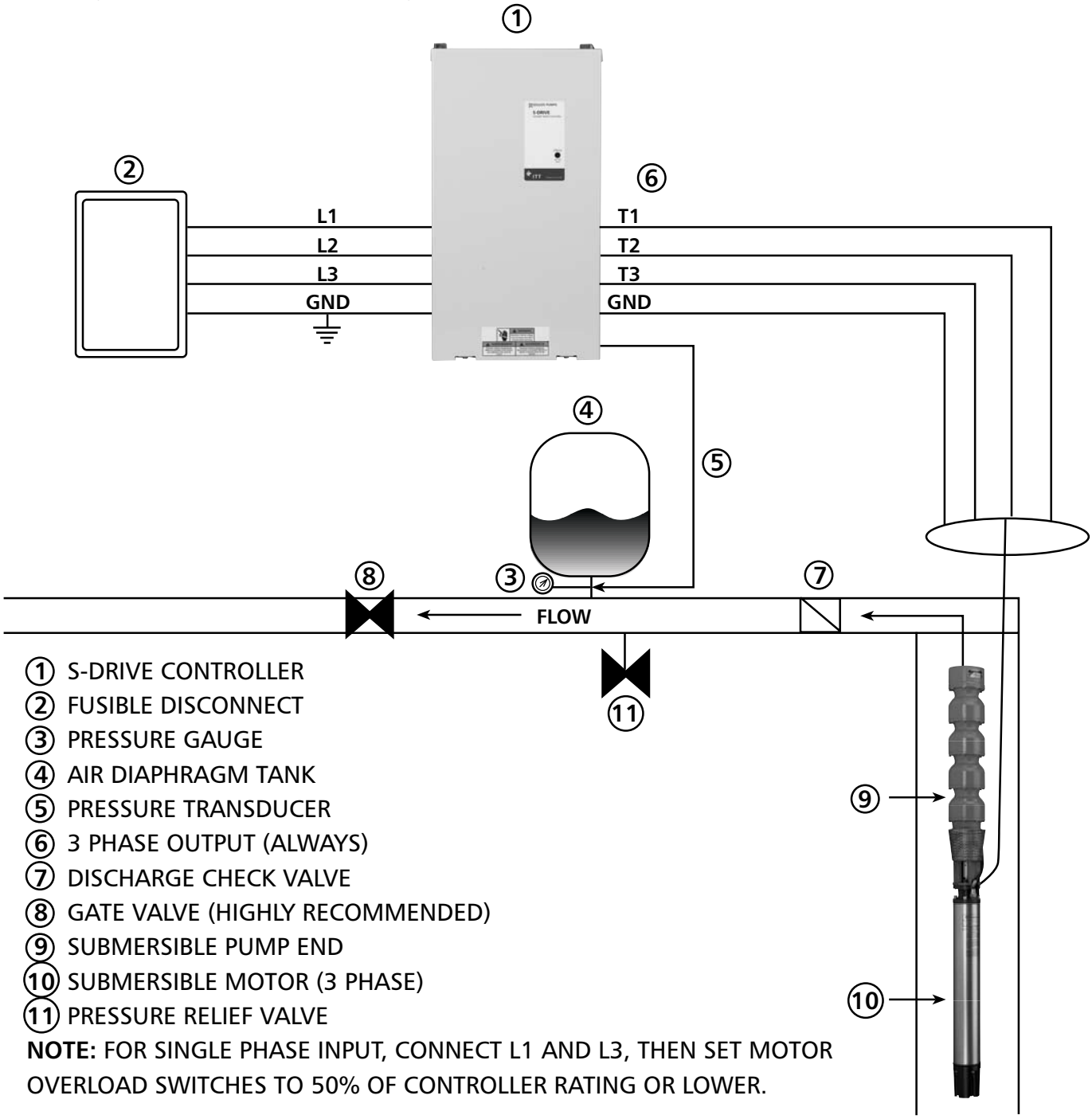
System Design

Section 3

Note

Systems MUST be designed by qualified technicians only and meet all applicable state and local code requirements.

The following diagrams show a typical system using the S-Drive Constant Pressure Controller. Diagram #1 shows a typical set up for a submersible system.

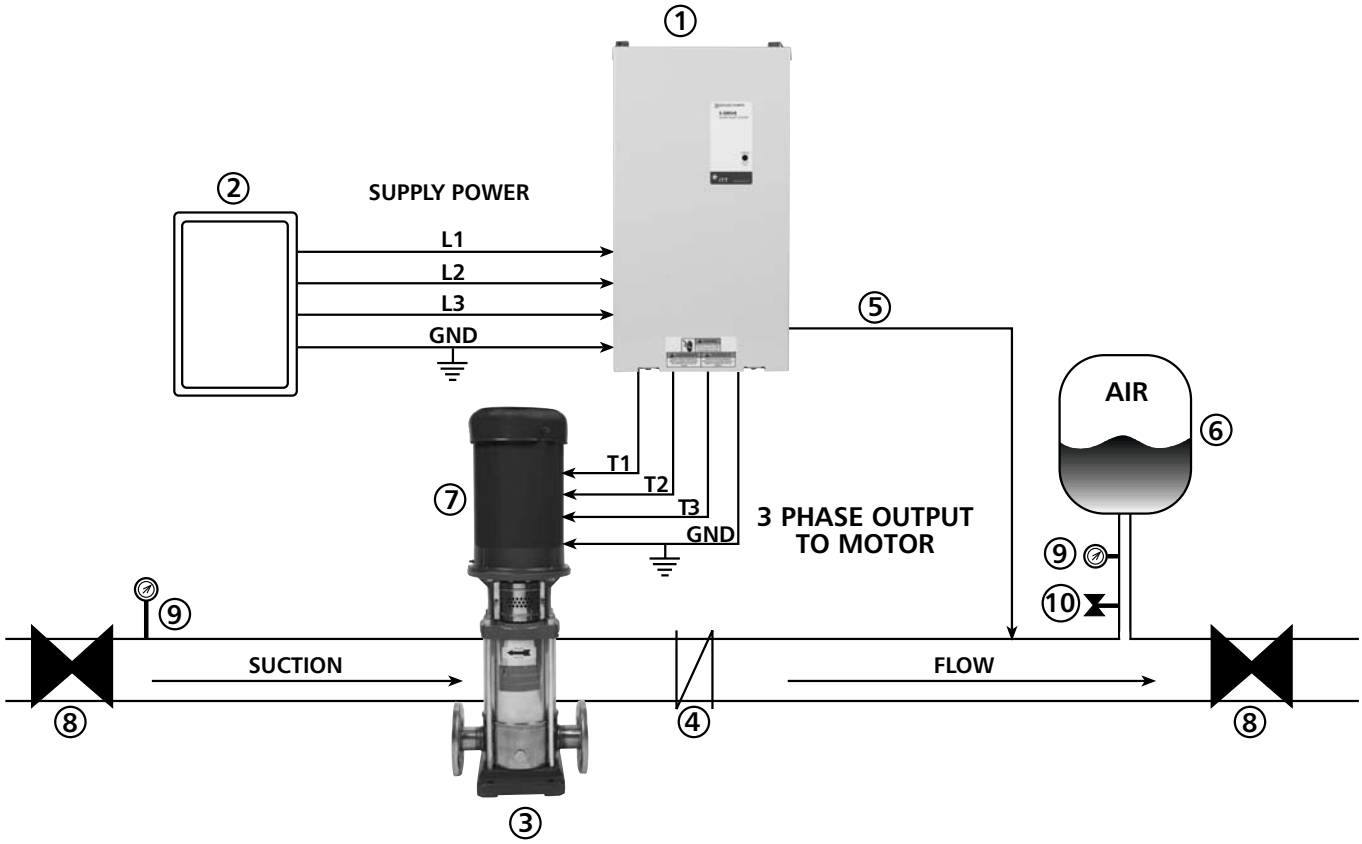


① S-DRIVE CONTROLLER
② FUSIBLE DISCONNECT
③ PRESSURE GAUGE
④ AIR DIAPHRAGM TANK
⑤ PRESSURE TRANSDUCER
⑥ 3 PHASE OUTPUT (ALWAYS)
⑦ DISCHARGE CHECK VALVE
⑧ GATE VALVE (HIGHLY RECOMMENDED)
⑨ SUBMERSIBLE PUMP END
⑩ SUBMERSIBLE MOTOR (3 PHASE)
⑪ PRESSURE RELIEF VALVE

NOTE: FOR SINGLE PHASE INPUT, CONNECT L1 AND L3, THEN SET MOTOR OVERLOAD SWITCHES TO 50% OF CONTROLLER RATING OR LOWER.

Section 3 (continued)

Diagram #2 shows a set-up for municipal water connection.



① SPD CONTROLLER
② FUSIBLE DISCONNECT
③ CENTRIFUGAL PUMP
④ CHECK VALVE
⑤ PRESSURE TRANSDUCER (CABLE ASSEMBLY)
⑥ AIR DIAPHRAGM TANK
⑦ 3 PHASE MOTOR
⑧ GATE VALVE (BALL VALVE)
⑨ PRESSURE GAUGE
⑩ PRESSURE RELIEF VALVE

NOTES: For single phase input power, use L1 and L3 terminals and adjust motor overload switches to 50% of controller rating or lower.

Piping

Section 4

General

Note

All plumbing work must be performed by a qualified technician. Always follow all local, state and provincial codes.

A proper installation requires a pressure relief valve, a ¼" female N.P.T. threaded fitting for the pressure sensor, and properly sized pipe. Piping should be no smaller than the pump discharge and/or suction connections. Piping should be kept as short as possible. Avoid the use of unnecessary fittings to minimize friction losses.

⚠CAUTION Hazardous Pressure

Some pump and motor combinations supplied with this system can create dangerous pressure. Select pipe and fittings accordingly per your pipe suppliers' recommendation. Consult local codes for piping requirements in your area.

All joints must be airtight. Use Teflon tape or another type of pipe sealant to seal threaded connections. Please be careful when using thread sealant as any excess that gets inside the pipe may plug the pressure sensor.

Galvanized fittings or pipe should never be connected directly to the stainless steel discharge head or casing as galvanic corrosion may occur. Barb type connectors should always be double clamped.

Pressure Tank, Pressure Relief Valve and Discharge Piping

Use only "pre-charged" tanks on this system. Do not use galvanized tanks. Select an area that is always above 34º F (1.1º C) in which to install the tank, pressure sensor and pressure relief valve. If this is an area where a water leak or pressure relief valve blow-off may damage property, connect a drain line to the pressure relief valve. **Run the drain line from the pressure relief valve to a suitable drain or to an area where water will not damage property.**

Pressure Tank, System Pressure

Sizing – A bladder tank (not included) is used to cushion the pressure system during start-up and shut-down. It should be sized to at least 20% of the total capacity of your pump. Example: If your pump is sized for 100 GPM then size your tank for at least 20 gal. total volume, not draw down. Pre-charge your bladder tank to 10-15 PSI below your system pressure. The controller is pre-set for 50 PSI at the factory. Therefore a 35-40 PSI pre-charge in your tank would be required. Use the higher tank pre-charge setting if the system drifts over 5 PSI at a constant flow rate. NOTE: Pre-charge your tank before filling with water!

Caution

⚠CAUTION Hazardous Pressure

Maximum working pressure of HydroPro bladder tank is 125 psi.

Installing the Pressure Sensor

The pressure sensor requires a ¼" FNPT fitting for installation. Install the pressure sensor with the electrical connector pointing up to avoid clogging the pressure port with debris. Install the pressure sensor in a straight run of pipe away from elbows or turbulence. For optimum pressure control install the pressure sensor in the same straight run of pipe as the pressure tank. Ensure the pressure sensor is within 10ft of the pressure tank. Installing the pressure sensor far away from the pressure tank may result in pressure oscillations. **Do not install the pressure sensor in a location where freezing can occur**. A frozen pipe can cause damage to the pressure sensor.

Piping

Section 4 (continued)

The pressure sensor cable is prewired to the controller. The cable can be shortened for a cleaner installation. Longer cable lengths are available, consult factory. Maximum recommended pressure sensor cable length is 300ft. Avoid leaving a coil of pressure sensor cable as this can induce unwanted transient voltages and noise into the system. Do not run the pressure sensor cable alongside the input or output wiring. Maintain a distance of at least 8" between the pressure sensor cable and input or output wiring.

Ensure the pressure sensor cable is connected as follows: Brown to terminal 7 (24VDC SUPPLY), White to terminal 6 (TRANSDUCER INPUT), Drain to chassis. Connecting the Drain wire to the chassis electrically connects the sensor case to the chassis of the controller. In some cases this drain wire must be disconnected from the controller chassis. In cases where the there is grounded metal piping which is continuous between the transducer and the motor or the transducer is installed in grounded metal piping, a ground loop can result so the drain wire must be disconnected from the chassis. In cases where there are sections of nonmetallic piping between the transducer and motor or the transducer is installed in ungrounded piping this drain wire should be connected to the controller chassis.

Mounting the Controller

Section 5

General

Mount the controller in a well ventilated, shaded area using 4 screws. The controller must be mounted vertically. Be sure to leave 8 inches of free air space on every side of the unit. The controller must be in an area with an ambient between -22º F and 122º F. If installation is above 3300 feet above sea level, ambient temperatures are derated 1% per 330 feet above 3300 feet. The altitude limit for this controller is 6500 ft. Do not install above 6500 ft.

Mounting the Controller

Section 5 (continued)

Note

Do not block the heat sink (fins) and fans and do not set anything on the units.

Warning

⚠WARNING
Hazardous voltage

The controller access cover should always be securely fastened to the control box due to the dangerous voltage/shock hazard inside the unit. A lock can be used to prevent unwanted entry.

Power Supply and Wiring

Section 6

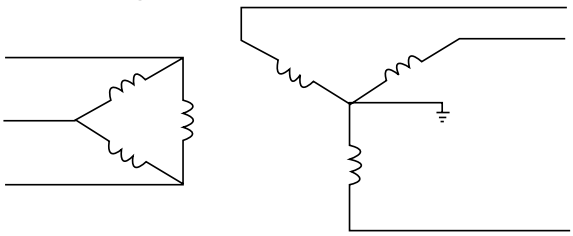
Power Supply

Note

Installation and maintenance MUST be performed by properly trained and qualified personnel. Always follow the National Electrical Code (NEC) or Canadian Electric Code (CEC), as well as all state, local and provincial codes when wiring the system.

The type of transformer and the connection configuration feeding a drive plays an important role in its performance and safety. The following is a brief description of some of the more common configurations and a discussion of their virtues and shortcomings. Always ask what type of power system the site has before sizing the drive.

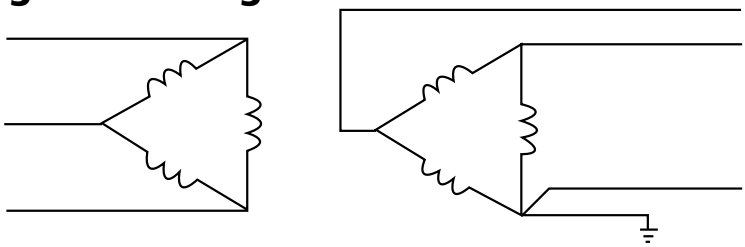
Delta/Wye with grounded Wye neutral



This configuration is one of if not the most common. It provides rebalancing of unbalanced voltage with a 30 degree phase shift. Depending on the output connections from the drive to motor, the grounded neutral may be a path for common mode current caused by the drive output.

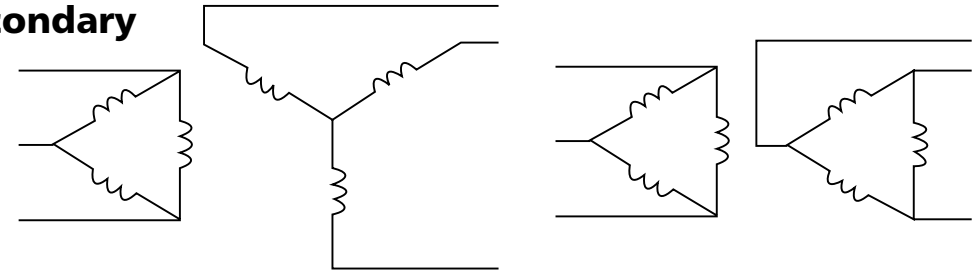
Section 6 (continued)

Delta/Delta with grounded leg



Another common configuration providing voltage rebalancing with no phase shift between input and output. Again, depending on the output connections from the drive to motor, the grounded neutral may be a path for common mode current caused by the drive output.

Ungrounded secondary



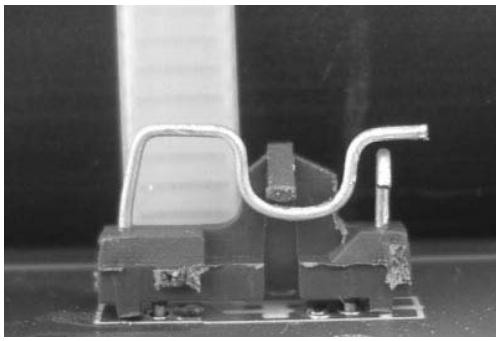
Grounding of the transformer secondary is essential to the safety of personnel as well as the safe operation of the drive. Leaving the secondary floating can permit dangerously high voltages between the chassis of the drive and the internal power structure components. In many cases this voltage could exceed the rating of the EMC filter and input MOV protection devices of the drive causing a catastrophic failure. In all cases, the input power to the drive should be referenced to ground. If the transformer can not be grounded, then an isolation transformer must be installed with the secondary of the transformer grounded.

Warning

⚠WARNING Hazardous voltage

If a power system with an ungrounded secondary is used, the line to ground EMC filter components and line to ground MOV protection must be disconnected or damage to the controller can result.

To remove the line to ground EMC filter components, locate the jumper shown below. The jumper is on the left hand side of the controller on the main board. Move to the disconnected position shown below.



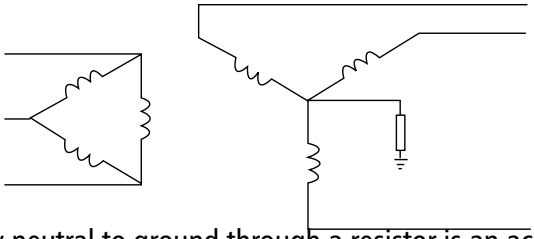
Section 6 (continued)

To remove the line to ground MOV protection, locate the jumper shown below. The jumper is located between the input and output terminal blocks on the main board. Move to the position shown.

For Frame Size 1 Controllers:

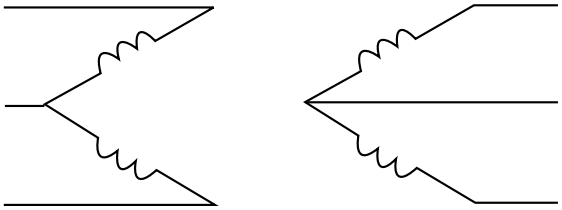
For Frame Sizes 2 and 3 Controllers:

Resistance grounding and ground fault protection



Connecting the Wye secondary neutral to ground through a resistor is an acceptable method of grounding. Under a short circuit secondary condition, any of the output phases to ground will not exceed the normal line to line voltage. This is within the rating of the MOV input protection devices on the drive. The resistor is often used to detect ground current by monitoring the associated voltage drop. Since high frequency ground current can flow through this resistor, care should be taken to properly connect the drive motor leads using the recommended cables and methods. In some cases, multiple drives on one transformer can produce a cumulative ground current that can trigger the ground fault interrupt circuit.

Open Delta (consult factory)



This type of configuration is common on 230 volt systems. From time to time it may be encountered where only single phase power is available and three-phase power is required. The technique uses two single phase transformers to derive a third phase. When used to power a drive this configuration must be derated to about 70% of the single phase rating of one transformer. This system provides poor regulation and it is possible that only the two line connected phases will provide power. In this case the drive must be derated to 50 % of its rating. (Ex. A 20 HP 230 volt drive now becomes a 10 HP 230 volt drive.)

Section 6 (continued)

Single Phase Connection

For small drives with diode rectifier front end it is possible to run a three phase output with a single phase input. Only part of the three phase input bridge is used. Ripple current becomes 120 Hz rather than 360. This places a greater demand on the DC filter components (capacitor bank and DC choke). The result is that the drive must be derated to 50% current.

The chart below shows the full load output current ratings of the controller when single phase or 3 phase power is used. If single phase input power is used the Motor Overload switches must be set to 50% or lower.

			Nominal HP Rating		Controller Full Load Output Current Rating	
Supply Voltage	**Frame Size**	**Model Number**	**3 Phase Input**	**1 Phase Input**	**3 Phase Input**	**1 Phase Input**
208/230	1	SPD20050	5.0	2.0	17.8	8.1
		SPD20050F				
	2	SPD20075	7.5	3.0	26.4	10.9
		SPD20075F				
		SPD20100	10.0	5.0	37.0	17.8
		SPD20100F				
	3	SPD20150	15.0	7.5	47.4	26.4
		SPD20150F				
		SPD20200	20.0	10.0	60.6	33.0
		SPD20200F				
	4	SPD20250	25.0	12.0	76.0	40.2
		SPD20250F				
		SPD20300	30.0	15.0	94.0	47.4
		SPD20300F				
460	1	SPD40050	5.0		8.9	
		SPD40050F				
		SPD40075	7.5		13.2	
		SPD40075F				
	2	SPD40100	10.0		18.5	
		SPD40100F				
		SPD40150	15.0		23.7	
		SPD40150F				
		SPD40200	20.0		30.3	
		SPD40200F				
	3	SPD40250	25.0		37.5	
		SPD40250F				
		SPD40300	30.0		47.0	
		SPD40300F				

Section 6 (continued)

Conduit, Wire and Fuse Sizing

The use of metal conduit with metal conduit connectors is recommended for all electrical connections. Use the NEC or CEC to determine the required conduit size for the application.

Refer to the chart below for the minimum allowable wire size for each controller. Note that these wire sizes are not adjusted for voltage drop due to long cable lengths. Refer to the wire sizing chart in the appendix to determine the maximum length for the input cable. Refer to the motor manual for maximum output cable length. The maximum recommended voltage drop on both input and output cable combined is 5%. Standard wire sizing charts give maximum cable lengths for only input or output cables. Because of this the lengths given in the table must be adjusted so the total voltage drop does not exceed 5%. For example, if the input wire sizing chart in the appendix gives the maximum length of 400' and only 100' is used then only 25% of the total voltage drop (1.25% drop) is used. The maximum output cable length read from the motor's wire sizing chart must then be adjusted to 75% of its value so that the maximum voltage drop of 5% is not exceeded.

Use only fast acting class T fuses. The wire used for the input power connections on models SPD20300 and SPD20300F must have a temperature rating of 90ºC minimum. All other wire must be rated 75 ºC minimum. The chart below shows the recommended sizes for wire and fuses for each controller. Note that the wire sizes were not adjusted for voltage drop due to long cable lengths.

Maximum Ambient Temperature →							20ºC		30ºC		40ºC		50ºC	
Voltage	Frame Size	Model Number	Full Load Output Current	Nominal HP	Fuse Size	Generator Size (VA)	Input Cable Min. AWG	Output Cable Min. AWG	Input Cable Min. AWG	Output Cable Min. AWG	Input Cable Min. AWG	Output Cable Min. AWG	Input Cable Min. AWG	Output Cable Min. AWG
230	1	SPD20050	17.8	5.0	30.0	7700	10	14	10	14	10	12	8	12
		SPD20050F												
	2	SPD20075	26.4	7.5	40.0	11400	8	12	8	10	8	10	6	8
		SPD20075F												
		SPD20100	37.0	10.0	50.0	16000	8	10	8	8	6	8	4	8
		SPD20100F												
	3	SPD20150	47.4	15.0	70.0	20500	4	8	4	8	4	6	3	6
		SPD20150F												
		SPD20200	60.6	20.0	80.0	26200	4	6	4	6	4	4	2	4
		SPD20200F												
	4	SPD20250	76.0	25.0	110.0	32800	2	4	2	4	1	3	1/0	2
		SPD20250F												
		SPD20300	94.0	30.0	135.0	40600	**2***	3	**1***	3	**1***	2	**1/0***	1
		SPD20300F												
460	1	SPD40050	8.9	5.0	15.0	7700	14	14	14	14	14	14	14	14
		SPD40050F												
		SPD40075	13.2	7.5	20.0	11400	12	14	12	14	12	14	10	14
		SPD40075F												
	2	SPD40100	18.5	10.0	30.0	16000	10	14	10	14	10	12	8	12
		SPD40100F												
		SPD40150	23.7	15.0	40.0	20500	8	12	8	12	8	10	6	10
		SPD40150F												
		SPD40200	30.3	20.0	50.0	26200	8	10	8	10	6	10	4	8
		SPD40200F												
	3	SPD40250	37.5	25.0	60.0	32400	6	8	6	8	4	8	4	8
		SPD40250F												
		SPD40300	47.0	30.0	70.0	40600	4	8	4	8	4	6	3	6
		SPD40300F												

* 90ºC Wire Required on input to controller.

Power Supply and Wiring

Section 6 (continued)

Input Power and Line Transformer Requirements

The line input voltage and transformer power must meet certain phase and balance requirements. **If you or your installing electrical contractor is in doubt of the requirements, the following provide guidelines for installation. When in doubt contact the local power utility or the factory**.

Before connecting power to the controller measure the line to line and line to ground voltage from the power source. The line to line voltage must be in the range of 195Vac to 265Vac (230V +/– 15%) for 230V models and 391Vac to 529Vac (460V +/– 15%) for 460V models. The maximum phase to phase imbalance is +/– 3%. If the phase to phase imbalance is greater than +/– 3% then an isolation transformer may be necessary. The line to ground voltage must be less than 110% of the nominal (230V or 460V) line to line voltage. If the line to ground voltage is not in this range the EMC filter and MOV components may need to be removed (see section on "Ungrounded secondary" transformers) or an isolation transformer with a grounded secondary may be necessary.

If an isolation transformer is used, the best choice is ONE three phase, six winding transformer. A delta primary is best for third harmonic cancellation. A wye secondary avoids circulating current problems and provides the very desirable option of grounding the secondary neutral for minimum voltage stress and ripple to ground. The transformer should have a KVA rating at least 1.1 times the maximum connected HP. A K factor of 6 is sufficient if transformer impedence is greater than 2%. A K Factor of 5 is sufficient if transformer impedence is greater than 3%. The transformer manufacturer may provide derating for non K Factor rated transformers to operate at the drive produced K Factor levels.

Other transformer configurations are acceptable. **Three single phase transformers can be used if they are identical for phase to phase symmetry and balance**. A wye connected primary neutral should never be grounded. Great care should be taken with delta primary delta secondary configurations. Any lack of phase to phase symmetry could result in circulating currents and unacceptable transformer heating.

Warning

⚠WARNING Hazardous voltage

Never use phase converters with drives as nuisance tripping and possible damage may occur. Instead, use single phase input power and 50% derate factor.

Warning

⚠WARNING Hazardous voltage

"Open Delta" power systems should be sized using the 50% derate factor. Consult factory.

Starting the System

Section 7

Output Power Connections

⚠ DANGER Hazardous voltage

Run the motor lead wire from the motor or conduit box through metal conduit to the bottom of the controller. Use metal conduit and metal conduit connectors. Size the conduits according to the NEC, CEC or local codes. Connect conduit and insert the wires through the second or third opening from the left. Choose the opening that fits or is larger than the conduit used. If the opening is larger than the conduit, use conduit bushings to attach the conduit to the controller.

Section 7 (continued)

Consult motor manual to determine the wire size for the application. Ensure the ground connection to the motor is continuous. Connect wires to the output terminal block labeled T1/U, T2/V, T3/W, and GND/⏚ . Connect the ground wire to the terminal labeled GND/⏚. Connect the other phase leads to T1/U, T2/V and T3/W.

For CentriPro Motors, connecting T1/U to Red, T2/V to Black and T3/W to Yellow will give the correct rotation.

Danger

⚠ DANGER Hazardous voltage

The controller has high leakage current to ground. The output terminals marked "GND" or "⏚" must be directly connected to the motor ground. Failure to properly ground the controller or motor will create an electrical shock hazard.

Input Power Connections

⚠ DANGER Hazardous voltage

Make sure disconnect switches or circuit breakers are securely in the OFF position before making this connection. Run the input power wires from the fused disconnect through metal conduit to the bottom of the controller. Use metal conduit and metal conduit connectors. Size the conduits according to the NEC, CEC or local codes. Use the wire sizing chart in the appendix to determine the size of the input power wires. Connect the conduit and insert the wires into the far left opening on the controller. Connect wires to the "INPUT" terminal block. Connect the ground wire to the terminal labeled GND. For three phase input, connect the input phase wires to L1, L2 and L3. For single phase input, connect the input wires to L1 and L3. If single phase input is used the motor overload switches must be set to 50% or lower.

Caution

The wire used for input power connections on models SPD20300 and SPD20300F must have a temperature rating of **90ºC minimum**.

Danger

⚠ DANGER Hazardous voltage

The controller has a high leakage current to ground. The input terminals marked "GND" must be directly connected to the service entrance ground. Failure to properly ground the controller or motor will create an electrical shock hazard.

Note

If single phase input power is used the Motor Overload switches must be set to 50% or lower or nuisance input phase loss errors can result.

Note

Do not use GFCI protection with this controller. Nuisance tripping will result.

Danger

⚠ DANGER Hazardous voltage

Status Code Indicator Light is not a voltage indicator! Always turn off disconnect switch and circuit breaker and wait 5 minutes before servicing.

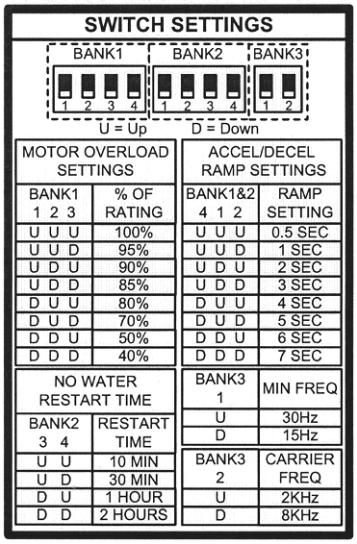
Danger

⚠ DANGER Hazardous voltage

The controller will remain electrically charged for 5 minutes after power is turned off. Wait 5 minutes after disconnecting power before opening controller access cover as there is a severe shock hazard.

Section 7 (continued)

Setting the Motor Overload Switches



The Motor Overload Setting Switches adjust the level of motor overload current protection necessary to protect the motor in case of an over current condition.

Bank 1 switches 1, 2 and 3 allow adjustment of the motor overload setting. These switches adjust the motor overload protection as a percentage of the full load output current rating of the controller. Choose a motor overload setting that meets or is less than the motor's SFA rating. For example, if the full load output current rating of the controller is 37A and the motor SFA rating is 33A, the motor overload setting should be set to 85% (33A/37A = 89%, next lowest setting is 85%).

In applications where the pump and motor are not used to the full capacity the system may not draw current close to the motor's SFA rating. In this case choose a motor overload setting that is close to the actual full load running current.

Note

If single phase input power is used the motor overload switches must be set to 50% or lower or nuisance input phase loss errors can result.

The chart below shows the motor overload setting for each model.

			Motor Overload Setting							
Supply Voltage	**Frame Size**	**Model Number**	**100%**	**95%**	**90%**	**85%**	**80%**	**70%**	**50%**	**40%**
208/230	1	SPD20050	17.8	16.9	16.0	15.1	14.2	12.5	8.9	7.1
		SPD20050F								
	2	SPD20075	26.4	25.1	23.8	22.4	21.1	18.5	13.2	10.6
		SPD20075F								
		SPD20100	37.0	35.2	33.3	31.5	29.6	25.9	18.5	14.8
		SPD20100F								
	3	SPD20150	47.4	45.0	42.7	40.3	37.9	33.2	23.7	19.0
		SPD20150F								
		SPD20200	60.6	57.6	54.5	51.5	48.5	42.4	30.3	24.2
		SPD20200F								
	4	SPD20250	76.0	72.2	68.4	64.6	60.8	53.2	38.0	30.4
		SPD20250F								
		SPD20300	94.0	89.3	84.6	79.9	75.2	65.8	47.0	37.6
		SPD20300F								
460	1	SPD40050	8.9	8.5	8.0	7.6	7.1	6.2	4.5	3.6
		SPD40050F								
		SPD40075	13.2	12.5	11.9	11.2	10.6	9.2	6.6	5.3
		SPD40075F								
	2	SPD40100	18.5	17.6	16.7	15.7	14.8	13.0	9.3	7.4
		SPD40100F								
		SPD40150	23.7	22.5	21.3	20.1	19.0	16.6	11.9	9.5
		SPD40150F								
		SPD40200	30.3	28.8	27.3	25.8	24.2	21.2	15.2	12.1
		SPD40200F								
	3	SPD40250	37.5	35.6	33.8	31.9	30.0	26.3	18.8	15.0
		SPD40250F								
		SPD40300	47.0	44.7	42.3	40.0	37.6	32.9	23.5	18.8
		SPD40300F								

Section 7 (continued)

Caution

Failure to properly set the Motor Overload Setting switches can result in loss of motor overload protection and will void the motor warranty. Nuisance tripping or motor damage can occur if these switches are not set properly.

Setting the Acceleration/Deceleration Switches

Switch 4 from bank 1 and switches 1 and 2 from bank 2 control the acceleration/deceleration ramp times. The acceleration/deceleration switches (ACCEL/DECEL RAMP SETTINGS) control how fast the controller will change the speed of the motor. The ramp setting is the time it takes the motor to change from minimum speed to maximum speed. For example, if the ramp setting is set to 1 second and the minimum speed is set to 30Hz, the motor will ramp up from 30Hz to 60Hz in 1 second. A faster ramp setting should be used in systems where the flow rate can change quickly. This means that the motor can react faster to maintain the set pressure. A slower ramp setting should be used in systems where the flow rate changes slowly or where fast changes in speed can cause water hammer or pressure surges.

Setting the No Water Restart Time Switches

Switches 3 and 4 from bank 2 control the no water restart time. The no water (dry well) restart time switches control the time between a no water (dry well) error and the restart of the system. For example, if the no water restart time switches are set to 30 minutes, the system will restart 30 minutes after a no water (dry well) error has been detected. For the 10 minute restart time, the controller will not restart if 5 faults are detected within 60 minutes. All other settings will continue to restart after the chosen restart time.

Note

Failure to properly set the motor overload switches can result in nuisance no water (dry well) faults.

Setting the Minimum Frequency Switch

Switch 1 from bank 3 controls the minimum frequency. The minimum frequency switch controls the slowest speed that the motor will run. For submersible pump/motor applications these switches must always be set to 30Hz minimum speed. For above ground applications with high suction pressure, the 15Hz setting can be used to prevent pressure oscillation at low speeds. In some cases the suction pressure may be high enough that the pump exceeds the pressure setting at 30Hz. In this case the 15Hz setting can be used.

Caution

Failure to properly set the minimum frequency switch can result in motor damage and will void the motor warranty. The minimum frequency must be set to 30Hz for submersible applications.

Setting the Carrier Frequency Switch

Switch 2 from bank 3 controls the carrier frequency. For model numbers without the F suffix, the switch can be used to change the output carrier frequency to avoid audible noise issues in above ground applications. For model numbers with the F suffix, this switch is disabled and the carrier frequency is always set to 2 kHz.

Starting the System

Section 7 (continued)

Setting the Pressure

When power is applied the pump will start and the system pressure will increase to the factory preset pressure (50 PSI if SP1 is enabled and a 300 PSI sensor is used or 75PSI if SP2 is enabled and a 300 PSI sensor is used). After the pressure has stabilized, use the increase (INC) or decrease (DEC) pressure adjust pushbuttons to adjust the pressure setting. **Push and Hold** the increase or decrease pushbutton until the desired pressure setting is reached. The new pressure setting will save when the system goes into standby mode (solid green light/pump off). Pressure set point 1 will be adjusted and stored when the SP2/SP1 switch input is open. Pressure set point 1 is preset to 50 PSI when used with a 300 PSI transducer. Pressure set point 2 will be adjusted and stored when the SP2/SP1 switch input is closed. Pressure set point 2 is preset to 75 PSI when used with a 300 PSI transducer.

Motor Rotation Direction

If the pressure/flow seems low or the system is indicating Motor Overload error check the motor rotation direction. Turn the breaker/disconnect switch to the off position and wait 5 minutes. Switch any two leads on the controller output (T1/U, T2/V or T3/W). Turn the breaker/disconnect switch to the on position. Observe pressure and flow. If the pressure or flow still seems low check plumbing.

For CentriPro Motors, connecting T1/U to Red, T2/V to Black and T3/W to Yellow will give the correct rotation.

Note

It is possible for the pump to maintain constant pressure with a low flow or a high suction head even if the pump is rotating backwards. While the pump is running use an amp probe on one of the output power leads connected to the motor and compare the current draw between the two rotation directions. The lowest current reading indicates the pump is running in the correct direction.

System Status

The status indicator light displays the status of the controller. A constant green status code indicates that the pump is in standby mode (pump not running). A blinking green status code indicates that the pump is running. A constant orange light indicates the input voltage is low. A blinking or constant red light indicates a problem with the controller or system. Refer to the access cover side panel for a list of status codes. See Section 9 for more details.

Danger

⚠ DANGER
Hazardous voltage

The status code indicator light is not a voltage indicator! Always turn off disconnect switch and circuit breaker and wait 5 minutes before servicing.

Input and Output Functions

Section 8

CONTROL TERMINALS		
POSITION	FUNCTION	DESCRIPTION
1	COM	SIGNAL COMMON
2	RUN/STOP	CLOSED = RUN OPEN = STOP
3	COM	SIGNAL COMMON
4	HAND/AUTO	CLOSED = HAND OPEN = AUTO
5	COM	SIGNAL COMMON
6	INPUT	TRANSDUCER INPUT
7	+24V	24VDC SUPPLY
8	+5V	5VDC SUPPLY
9	COM	SIGNAL COMMON
10	ANALOG OUTPUT	4-20mA OUTPUT
11	SP2/SP1	CLOSED = SETPOINT2 OPEN = SETPOINT1
12	PRESSURE DROP	CLOSED = 20PSI OPEN = 5PSI
13	RELAY1 - NO	MOTOR RUN STOP: NC = COM RUN: NO = COM
14	RELAY1 - NC	
15	RELAY1 - COM	
16	RELAY2 - NO	SYSTEM FAULT OK: NC = COM FAULT: NO = COM
17	RELAY2 - NC	
18	RELAY2 - COM	

The control terminal strips allow for a variety of input and output functions.

Warning: Turn off all power to the controller before wiring devices to the control terminals.

Warning: Inputs RUN/STOP, HAND/AUTO, SP2/SP1 and PRESSURE DROP are switch inputs. Do not connect power to these inputs or damage to the controller will result. Only connect non-powered switch contacts to these inputs.

RUN/STOP: This input allows the pump/motor to be turned on and off by an external switch. Connect the contacts of a non-powered external switch to terminals 1 (COM) and 2 (RUN/STOP). When the switch is closed the controller is in RUN mode (output to motor is enabled). When the switch is open the controller is in STOP mode (output to motor is disabled).

HAND/AUTO: This input allows the controller to run the motor at full speed without the use of a pressure transducer. This input can be controlled by an external non-powered switch. Connect the contacts of a non-powered external switch to terminals 3 (COM) and 4 (HAND/AUTO). When the switch is closed the controller is in HAND mode. While in HAND mode the RUN/STOP input is used to start and stop the motor and the pressure transducer input is ignored. When the switch is open the controller is in AUTO mode. While in AUTO mode the controller uses the pressure transducer feedback to control the speed of the motor.

INPUT and +24V: These terminals are the transducer feedback and transducer power supply. Connect the white lead from the transducer cable to terminal 6 (INPUT). Connect the brown lead from the transducer cable to terminal 7 (+24V). Connecting the drain (bare) wire to the chassis allows grounding of the case of the pressure transducer. The controller is configured with a 300 PSI 4-20mA output pressure transducer.

ANALOG OUTPUT: This output is a 4-20mA signal based on motor speed (4mA = 0Hz, 20mA = 60Hz) and can be connected to external monitoring or external control devices. Connect terminal 10 (ANALOG OUTPUT) to the 4-20mA input of the external device. Connect terminal 9 (COM) to the negative side of the current loop on the external device. The external device must have an input resistance (impedance) in the range of 45Ω to 250Ω. The maximum output voltage is 24V.

SP2/SP1: This input allows the system to operate at one of 2 pressure settings. This input can be controlled by an external non-powered switch. Connect the contacts of a non-powered external switch to terminals 5 (COM) and 11 (SP2/SP1). When the switch is closed pressure set point 2 is enabled (preset to 75 PSI when used with a 300 PSI transducer). When the switch is open pressure set point 1 is enabled (preset to 50 PSI when used with a 300 PSI transducer).

PRESSURE DROP: This input allows the user to select the amount of pressure drop in the system before the pump starts. This input can be controlled by an external non-powered switch. Connect the contacts of a non-powered external switch to terminals 5 or 9 (COM) and 12 (PRESSURE DROP). When the switch is closed the system pressure will drop 20 PSI (when used with a 300 PSI transducer) before restarting the pump. When the switch is open the system pressure will drop 5 PSI (when used with a 300 PSI transducer) before restarting the pump.

RUN RELAY: This output indicates when the pump/motor is running. This output can be used to control power to a light, an alarm or other external device. When the pump/motor is off terminal 13 (RELAY1 – NO) will be open and terminal 14 (RELAY 1 – NC) will be connected to terminal 15 (RELAY1 – COM). When the pump/motor is on terminal 13 (RELAY1 – NO) will be connected to terminal 15 (RELAY1 – COM) and terminal 14 (RELAY 1 – NC) will be open. The relay rating is 250Vac, 5 amps maximum.

FAULT RELAY: This output indicates when the system is faulted. This output can be used to control power to a light, an alarm or other external device. When the system is not faulted terminal 16 (RELAY2 – NO) will be open and terminal 17 (RELAY 2 – NC) will be connected to terminal 18 (RELAY2 – COM). When the system is faulted terminal 16 (RELAY2 – NO) will be connected to terminal 18 (RELAY2 – COM) and terminal 17 (RELAY 2 – NC) will be open. The relay rating is 250Vac, 5 amps maximum.

Troubleshooting

Section 9

General

The S-Drive and Aquavar SPD drive are self-diagnosing controllers. If a problem occurs, observe the Status Code Indicator Light on the front of the unit. No Status Code Indicator Light means either no or low input voltage (less than 140Vac).

Danger

⚠ DANGER Hazardous voltage

Status Code Indicator Light is not a voltage indicator! Always turn off disconnect switch and circuit breaker and wait 5 minutes before servicing. High voltage may still remain on controller.

Refer to the status code label on the side of the controller access cover to diagnose system errors.
See the following diagram.

STATUS CODES	
GREEN LIGHT CODES	
CONSTANT	STANDBY
BLINKING	PUMP RUNNING
ORANGE LIGHT CODES	
CONSTANT	UNDER VOLTAGE
RED LIGHT CODES	
CONSTANT	REPLACE CONTROLLER
2 BLINKS	NO WATER/LOSS OF PRIME
3 BLINKS	SENSOR FAULT
4 BLINKS	PUMP OR MOTOR BOUND
5 BLINKS	SHORT CIRCUIT/GROUND FAULT
6 BLINKS	INPUT PHASE LOSS
7 BLINKS	TEMPERATURE
8 BLINKS	OVER VOLTAGE
9 BLINKS	MOTOR OVERLOAD

Red Flashes	Fault Code	Restart Action
Constant	Replace Controller	Controller will not restart. Power must be reset to clear the fault.
2 Blinks	No Water/Loss of Prime	Controller will restart automatically according to the No Water Restart Time switches (switches 3&4 of bank 2).
3 Blinks	Sensor Fault	Controller will restart automatically when the sensor signal is within the valid operating range.
4 Blinks	Pump or Motor Bound	Controller will restart automatically 5 times. After 5 faults the power must be reset to clear the fault.
5 Blinks	Short Circuit/Ground Fault	Controller will not restart. Power must be reset to clear the fault.
6 Blinks	Input Phase Loss	Controller will restart automatically 5 times. After 5 faults the power must be reset to clear the fault.
7 Blinks	Temperature	Controller will restart automatically when temperature is within the operating range of the controller.
8 BLINKS	Over Voltage	Controller will restart automatically when the input voltage is within the operating range of the controller.
9 Blinks	Motor Overload	Controller will restart automatically.

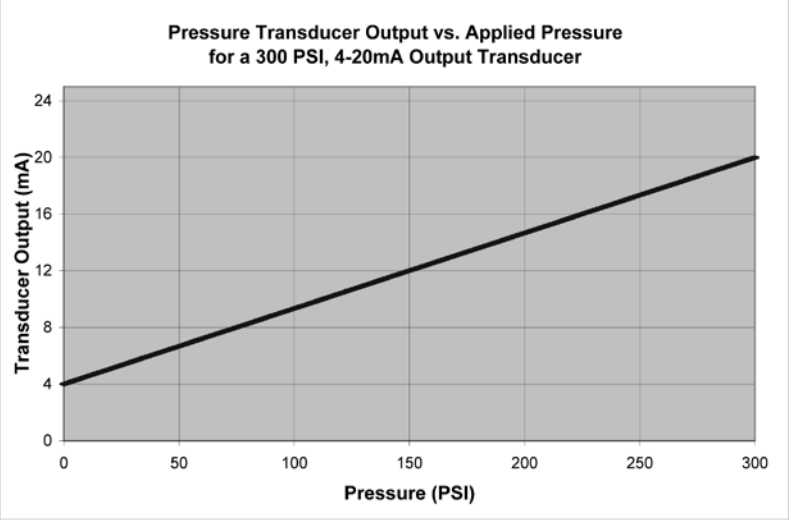
Use the following table to help troubleshoot problems.

No Light		
Controller Status		**Description**
Low/No Input Voltage		Check the input voltage to the controller. Measure the input voltage between phases using an AC Voltmeter. This voltage should be greater than 140Vac for the status indicator light to turn on.
Green Light Codes		
Flashes	**Controller Status**	**Description**
Constant	Standby	Constant Green Light indicates the pump is off. The system is in Standby mode when there is no flow in the system and the pressure setting has been reached or the RUN/STOP input is set to STOP (open switch).
Blinking	Pump Running	Flashing Green Light indicates the pump is running.

Troubleshooting

Orange Light Codes		
Flashes	**Controller Status**	**Description**
Constant	Low Input Voltage	Constant orange light indicates the system input voltage is low. For 230V units, the orange light will be indicated when the input voltage is between 140Vac and 170Vac. For 460V units, the orange light will be displayed when the input voltage is between 140Vac and 310Vac.
		Red Light Codes
Constant Red	Controller Error	Internal controller fault. The controller may be internally damaged. Verify the error by turning power off, waiting 5 minutes then apply power. If the error persists, replace controller.
2 Blinks	No Water/Loss Of Prime	This fault can be caused by: • Water supply level in well falls below suction inlet of pump. • Plugged suction screen. • Restriction in pipe between pump and pressure sensor. • Air bound pump. • Deadheaded pump, pump running against a closed valve. • Filling long irrigation lines on start-up • Incorrect setting of Motor Overload Setting switches. **In systems where the motor operates at less than Service Factor Amps the controller may show a false No Water/Loss of Prime fault. Reducing the motor overload setting will eliminate the false readings.** If problem persists, please verify supply capacity. The controller will automatically restart according to the No Water Restart Time switches.
3 Blinks	Sensor Fault	This fault can be caused by: • Disconnected sensor. Disconnect sensor from sensor cable connector and reconnect to ensure a good connection. • Disconnected sensor cable lead inside the controller. Check for loose wires where the sensor cable connects to the circuit board by tugging on each wire. • Broken wire in the sensor cable. • Miswired sensor cable. Check that the wires are connected to the correct terminals on the control terminal block. Connect terminal 7 (24VDC SUPPLY) to the Brown wire. Connect terminal 6 (TRANSDUCER INPUT) to the White wire. Connect the drain wire to chassis. • Failed sensor. To diagnose this failure a meter capable of reading milliamperes (mA) and DC voltage (VDC) is required. - Set the meter to read DC voltage (VDC) - Place the black lead on terminal 5 (COM) and the red lead on terminal 7 (24VDC SUPPLY) - If functioning properly, the DC voltage will be 24VDC +/- 15%. If this voltage is not present, disconnect all control terminals and repeat the measurement. If voltage does not recover, replace controller.

Troubleshooting

Red Light Codes (continued)		
Flashes	**Controller Status**	**Description**
3 Blinks (contd.)		- Disconnect the White wire in the sensor cable from terminal 6. - Set the meter to read DC current (mA) - Connect the black lead from the meter to terminal 6 (TRANSDUCER INPUT) - Connect the red lead from the meter to the White wire in the sensor cable. - The meter will display the output of the sensor. If functioning properly, the output of the sensor will be between 4mA and 20mA depending on the pressure in the system. Refer to the chart below to determine the sensor feedback at various pressures.  The following formula gives the transducer output based on applied pressure: $Output\ Current = \left[\left(\frac{Output\ Current\ Range}{Pressure\ Range}\right) x\ System\ Pressure\right] + 4mA$ Where: • Output Current is the transducer output • Output Current Range is the maximum output signal of the transducer minus the minimum output signal of the transducer. In this case: Output Current Range = 20mA – 4mA, or 16mA • Pressure Range is the pressure that corresponds to the maximum output signal. For a 300 PSI transducer the Pressure Range = 300 PSI – 0 PSI = 300 PSI • System Pressure is the system pressure as read on the pressure gauge.

Troubleshooting

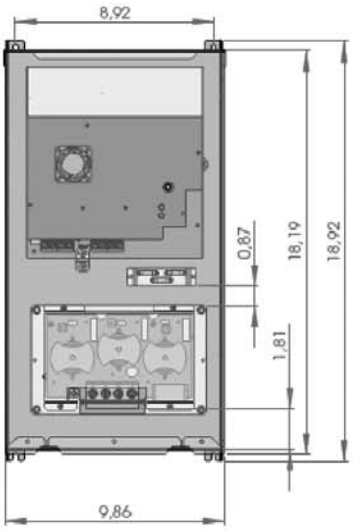
Red Light Codes (continued)		
Flashes	**Controller Status**	**Description**
4 Blinks	Pump or Motor Bound	This fault can be caused by: • Mechanical binding from debris in pump. • Electrical failure of the motor. • Incorrect setting of Motor Overload Setting switches. • Incorrect rotation. • Motor phase loss. This fault will be displayed if the output current exceeds 125% of the controller rating. The controller will attempt to restart 5 times. If the condition persists the controller will lock out and will need to be reset. Verify the error by turning power to controller off for 5 minutes and then on. Pump/Motor/Wiring must be checked if fault persists.
5 Blinks	Short Circuit	This fault can be caused by: • Electrical failure of the motor • Electrical failure of wiring between controller and motor. This fault will be displayed if the output current exceeds 150% of the controller rating. Verify the error by turning power to controller off for 1 minute and then on. If error persists, motor and wiring between controller and motor must be checked. Turn power off for 5 minutes. Remove the three motor wires from the terminal block. Check output wiring and motor for shorting phase to phase and phase to ground. Refer to motor's manual for information on resistance readings and megger readings.
6 Blinks	Input Phase Loss	This fault can be caused by: • Disconnected input power phase. • Incorrect Motor Overload Setting switches. When using single phase input power the Motor Overload Setting switches must be set to 50% or lower. For three phase input operation; this fault will be displayed if the phase to phase input voltage is more than 25% lower than the nominal. The controller will attempt to restart 5 times. If the condition persists the controller will lock out and will need to be reset.
7 Blinks	Temperature	This fault can be caused by: • High ambient temperature. The maximum ambient temperature rating is 122 ºF (50ºC). • Low ambient temperature. The minimum ambient temperature rating is -22ºF (-30ºC). This fault will be displayed if the ambient temperature is greater than 122ºF (50ºC) or less than -22ºF (-30ºC). Do not install the controller where it will be exposed to direct sunlight. Check for a fan failure. The fans on the back of the controller will turn on only when needed. The fans will turn on when the motor is running and the heatsink temperature reaches 104 ºF (40ºC).

Troubleshooting

Red Light Codes (continued)		
Flashes	**Controller Status**	**Description**
8 Blinks	Over Voltage	This fault can be caused by: • High input voltage. This fault will be displayed if the phase to phase input voltage is greater than 275V for 230V units and 560V for 460V units.
9 Blinks	Motor Overload	This fault can be caused by: • Mechanical binding from debris in pump. • Electrical failure of the motor. • Incorrect setting of Motor Overload Setting switches. • Incorrect rotation. The controller will protect the motor from over current by limiting the current applied to the motor. The current limit is set according to the Motor Overload Setting switches. This fault is displayed if the output frequency is reduced to limit the current to the motor by more than 10Hz for 5 minutes.

Controller Dimensions

SIZE 1



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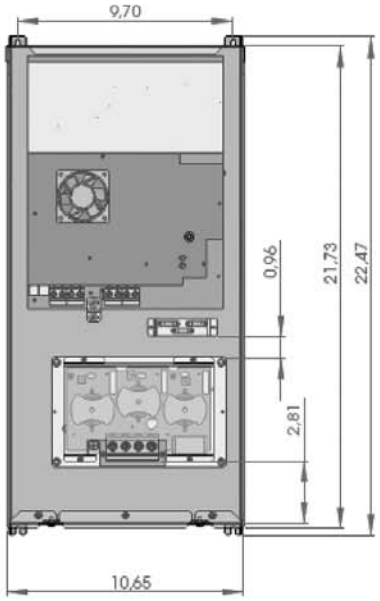

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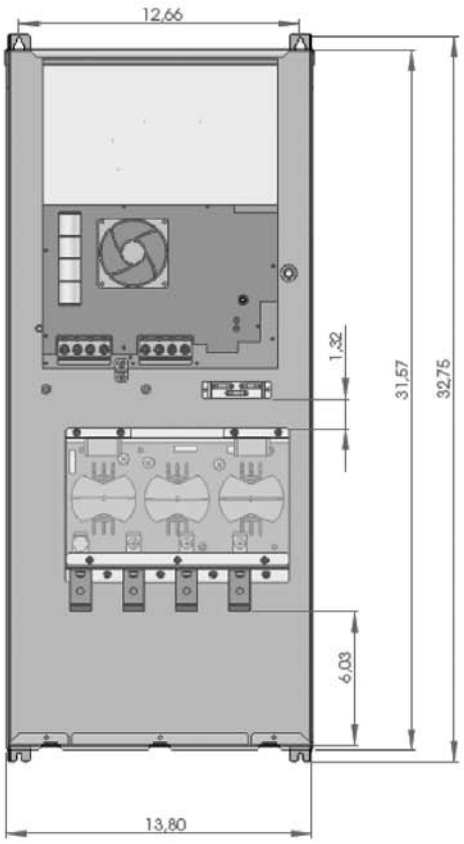

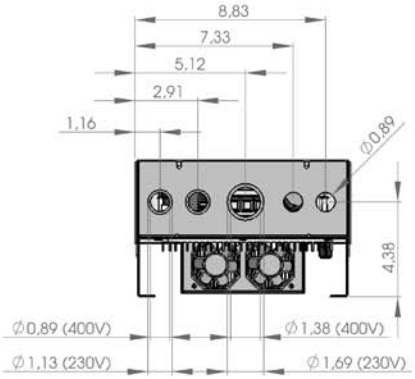

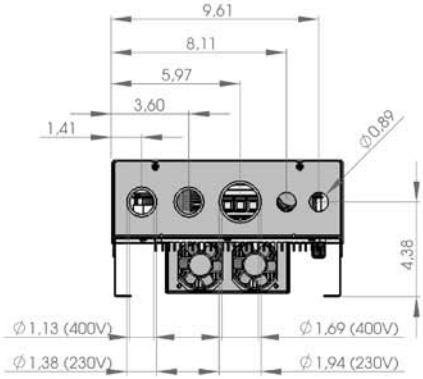

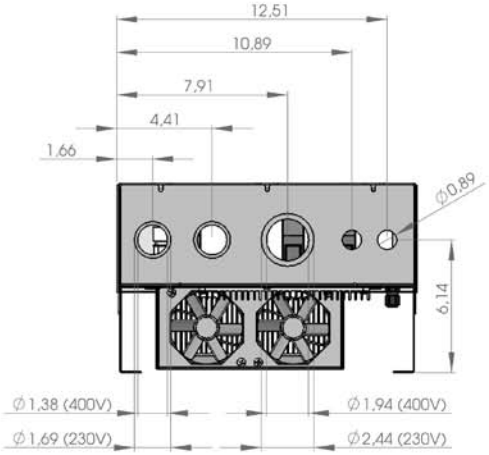

VFD Input Wire Sizing Charts

				Maximum Allowable Conductor Length (40˚C Ambient, 5% Voltage Drop)																				
	Ratings			Conductor Size (75˚C Rated Wire)																				
Controller Input	Motor HP	Motor SFA	Input Current	14	12	10	8	6	4	3	2	1	1/0	2/0	3/0	4/0	250	300	350	400	500	600	750	1000
230V, Single Phase Input	½	2.9	7.2	400	618	1020	1532	2348	3530	4242	5335	6358	7562	8633	10297	11821	13013	14156	15361	16333	17959	19017	20579	22421
	¾	3.8	9.4	301	467	775	1167	1790	2693	3236	4071	4851	5770	6587	7858	9021	9931	10803	11722	12465	13705	14513	15705	17111
	1	4.7	11.6	239	374	623	941	1445	2175	2615	3290	3921	4664	5325	6352	7293	8029	8734	9477	10078	11081	11734	12698	13834
	1½	6.1	15.1	**178**	282	475	721	1110	1673	2012	2533	3019	3592	4102	4894	5618	6186	6729	7302	7764	8537	9041	9784	10659
	2	7.6	18.8		**219**	375	574	887	1340	1612	2030	2421	2882	3291	3927	4509	4964	5400	5860	6232	6852	7256	7852	8555
	3	10.1	25.0			**273**	426	662	1003	1209	1524	1819	2165	2474	2953	3391	3734	4063	4409	4689	5156	5460	5909	6437
	5	17.0	42.1					378	583	708	896	1072	1279	1464	1749	2011	2216	2411	2617	2784	3062	3242	3510	3824
	7½	26.0	64.3						**366**	449	573	690	826	950	1137	1309	1444	1573	1708	1818	2000	2118	2294	2499
	10	33.0	81.7								**441**	534	643	742	890	1027	1135	1236	1343	1430	1574	1668	1806	1968
	15	47.4	117.3										**432**	504	609	706	783	854	930	992	1093	1158	1256	1369
230V, 3 Phase Input	½	2.9	3.4	818	1263	2087	3160	4908	7511	9123	11653	14168	17119	19844	24266	28469	32000	35524	39133	42344	47573	51360	56659	63177
	¾	3.8	4.5	623	962	1591	2410	3745	5731	6962	8893	10812	13064	15144	18519	21727	24421	27111	29865	32315	36306	39196	43240	48214
	1	4.7	5.5	501	776	1285	1948	3027	4633	5628	7189	8741	10562	12244	14972	17566	19744	21919	24146	26127	29354	31690	34960	38981
	1½	6.1	7.2	383	595	988	1499	2331	3568	4335	5538	6734	8137	9433	11536	13534	15213	16888	18604	20131	22617	24417	26936	30035
	2	7.6	8.9	304	474	790	1201	1869	2863	3478	4444	5404	6530	7571	9258	10862	12210	13555	14932	16157	18153	19598	21620	24107
	3	10.1	11.9	224	351	590	900	1403	2152	2615	3342	4065	4912	5696	6966	8173	9187	10199	11235	12158	13659	14747	16268	18140
	5	17.0	20.0		**196**	339	527	826	1272	1548	1981	2410	2915	3381	4136	4853	5456	6058	6674	7222	8114	8760	9665	10777
	7½	26.0	30.6				333	530	823	1005	1288	1570	1900	2206	2700	3170	3565	3959	4362	4720	5304	5727	6319	7045
	10	33.0	38.8				**254**	409	641	785	1009	1231	1492	1734	2124	2495	2806	3117	3435	3718	4178	4511	4978	5550
	15	46.0	54.1					**280**	447	553	713	874	1062	1237	1517	1784	2009	2232	2461	2664	2995	3234	3570	3980
	20	60.0	70.6							**412**	536	660	805	941	1156	1362	1536	1707	1883	2040	2294	2477	2735	3050
	25	76.0	89.4								**410**	509	624	734	905	1069	1207	1343	1482	1607	1808	1953	2158	2406
	30	94.0	110.6										**493**	584	722	856	969	1080	1193	1295	1459	1576	1742	1943
460V, 3 Phase Input	5	8.5	10.0	539	843	1409	2145	3339	5117	6219	7945	9662	11677	13537	16555	19424	21834	24239	26701	28893	32461	35045	38661	43109
	7½	13.0	15.3	**335**	534	906	1391	2174	3337	4059	5189	6312	7630	8847	10821	12697	14274	15846	17457	18890	21224	22913	25278	28186
	10	16.5	19.4		**406**	701	1087	1704	2622	3192	4082	4968	6006	6967	8522	10001	11244	12483	13752	14882	16721	18052	19916	22206
	15	23.0	27.1			**482**	763	1207	1868	2279	2918	3554	4301	4991	6108	7170	8062	8952	9863	10674	11994	12949	14286	15930
	20	30.0	35.3				**568**	909	1418	1734	2225	2715	3288	3819	4676	5491	6176	6859	7558	8180	9193	9925	10951	12211
	25	37.0	43.5					721	1135	1394	1792	2190	2656	3089	3784	4446	5003	5557	6124	6630	7452	8045	8878	9900
	30	47.0	55.3						874	1080	1395	1709	2077	2421	2969	3492	3932	4369	4816	5215	5863	6330	6987	7791
	40	60	70.6							**824**	1072	1320	1610	1882	2313	2725	3071	3414	3766	4079	4588	4954	5470	6100
	50	79	92.9								**785**	**976**	1198	1409	1738	2054	2320	2581	2850	3090	3479	3757	4151	4629
	60	90	105.9									**841**	**1036**	1225	1514	1793	2028	2259	2495	2707	3049	3293	3641	4061
	75	109	128.2											**990**	1230	1464	1660	1852	2049	2226	2511	2712	3001	3348
	100	145	170.6													**1072**	1224	1371	1521	1658	1875	2027	2248	2509
	125	180	211.8															**1083**	1207	1320	1499	1621	1803	2013
	150	220	258.8																	**1063**	1212	1312	1466	1638
	200	270	317.6																			**1052**	1182	1323

Lengths in **BOLD** require 90˚C wire

Input connections for models SPD20300 and SPD20300F require 90ºC wire

Notes

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Commercial Water

GOULDS PUMPS LIMITED WARRANTY

This warranty applies to all water systems pumps manufactured by Goulds Pumps.

Any part or parts found to be defective within the warranty period shall be replaced at no charge to the dealer during the warranty period. The warranty period shall exist for a period of twenty-four (24) months from date of installation or thirty (30) months from date of manufacture, whichever period is shorter.

A dealer who believes that a warranty claim exists must contact the authorized Goulds Pumps distributor from whom the pump was purchased and furnish complete details regarding the claim. The distributor is authorized to adjust any warranty claims utilizing the Goulds Pumps Customer Service Department.

The warranty excludes:

(a) Labor, transportation and related costs incurred by the dealer;
(b) Reinstallation costs of repaired equipment;
(c) Reinstallation costs of replacement equipment;
(d) Consequential damages of any kind; and,
(e) Reimbursement for loss caused by interruption of service.

For purposes of this warranty, the following terms have these definitions:

(1) "Distributor" means any individual, partnership, corporation, association, or other legal relationship that stands between Goulds Pumps and the dealer in purchases, consignments or contracts for sale of the subject pumps.
(2) "Dealer" means any individual, partnership, corporation, association, or other legal relationship which engages in the business of selling or leasing pumps to customers.
(3) "Customer" means any entity who buys or leases the subject pumps from a dealer. The "customer" may mean an individual, partnership, corporation, limited liability company, association or other legal entity which may engage in any type of business.

THIS WARRANTY EXTENDS TO THE DEALER ONLY.

GOULDS PUMPS

SPECIFICATIONS ARE SUBJECT TO CHANGE WITHOUT NOTICE.

IM213 Revision Number 0 November, 2008

Engineered for life