

Redi-Flo Variable Frequency Drive

(USA) Installation and Operating Instructions



This equipment contains voltages that may be as great as 1000 volts! Electrical shock can cause serious or fatal injury. Only qualified personnel should attempt the start-up procedure or troubleshoot this equipment.

PRECAUTIONS:



WARNING: Do not touch any circuit board, power device or electrical connection before you first ensure that power has been disconnected and there is no high voltage present from this equipment or other equipment to which it is connected. Electrical shock can cause serious or fatal injury. Only qualified personnel should attempt the start-up procedure or troubleshoot this equipment.



WARNING: Be sure the system is properly grounded before applying power. Do not apply AC power before you ensure that grounds are connected. Electrical shock can cause serious or fatal injury.



WARNING: Do not remove cover for at least five (5) minutes after AC power is disconnected to allow capacitors to discharge. Electrical shock can cause serious or fatal injury.



CAUTION: Disconnect motor leads (T1, T2 and T3) from control before you perform a “Megger” test on the motor. Failure to disconnect motor from the control will result in extensive damage to the control. The control is tested at the factory for high voltage / leakage resistance as part of Underwriter Laboratory requirements.



CAUTION: Do not connect AC power to the Motor terminals T1, T2 and T3. Connecting AC power to these terminals may result in damage to the control.

QUICK START GUIDE

QUICK START GUIDE

Note: The RediFlo trade name is used only in the United States, other parts of the world refer to the Redi-Flo2 pump as the MP1 and the Redi-Flo4 pumps as SPE. They may be referred to as either in this manual.

To operate the Redi-Flo VFD system, simply:

1. Submerge the Redi-Flo2 (MP1) or Redi-Flo4 (SPE) pump in the water to be pumped. (Note: insure pump is rotating in the correct direction, see page 6)

2. Connect the motor leads to the Redi-Flo VFD. (Note: With RF4 Variable Performance Pumps you must have an adapter cord to connect to Redi-Flo VFD.

#3 and #4 for operation with generator only. WARNING: Do not let the generator run out of gas while powering the VFD. If it surges and creates excessive voltage, internal VFD damage could result.

3. If using a generator, start the generator and allow it to warm up.

4. If the generator has a circuit breaker, close the breaker and check the output voltage from the generator. The output voltage must be within the specified ranges (refer to Technical Specifications, at the end of this manual) to ensure proper operation and prevent damage to the system. If the voltage is too high or too low, adjustments to the generator must be performed to allow the system to run.

5. Plug the Redi-Flo VFD into a generator or connect to utility power supply. The unit accepts 115V or 230V sources. Refer to the Input Power Terminals section for wiring instructions.

6. The VFD will initialize and be ready to drive the motor. After the initialization screen appears, the following will be displayed:

DIAG	STOP ¹ MP1 ²	LOCAL
MOTOR VOLTS		0.0V ³
MOTOR CURR		0.0A ⁴
MOTOR FREQ		0.00Hz ⁵
PROG	0.00r	MAIN

- 1) Status (Stop or Fwd)
- 2) Pump type (MP1 or SPE)
- 3) Motor voltage (output voltage)
- 4) Motor current (output current)
- 5) Motor frequency (output freq in Hz)

The VFD defaults to MP1 (Redi-Flo2) operation. To change to Redi-Flo4 press:

- 1) Press PROG soft key
- 2) Press ENTER button
- 3) Use ▲ arrow button to switch between MP1 and SPE
- 4) Press ENTER button
- 5) Press DIAG soft key to return to main display

7. To begin pumping, press the FWD key to start the motor and use the ▲ and ▼ arrow keys to increase or decrease speed. Continuous holding of the arrow key will increase the rate of speed change. The STOP key is used to stop the pump.

8. Pressing the ENTER key allows the user to quickly set the speed to any given value by using the ▲ and ▼ arrows to change speed and the left/right arrow keys to cursor between digits.

9. When powering down, unplug the Redi-Flo VFD from the generator BEFORE removing the motor lead from the Redi-Flo VFD or turning off the generator.

PRE-INSTALLATION CHECKLIST

Components of Your Redi-Flo VFD System

Your Redi-Flo Variable Performance Pump system should contain the following components:

1. Redi-Flo Variable Frequency Drive, (See Figure 1)
2. Either a Redi-Flo2® (MP1) pump and motor with lead (Figure 2) or a Redi-Flo4™ (SPE) Variable Performance pump, motor, lead, lead/plug and RF4 x VFD adapter cord (Figure 3)

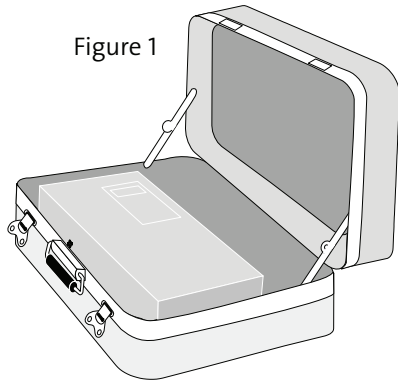


Figure 1



Redi-Flo2®
(MP1)

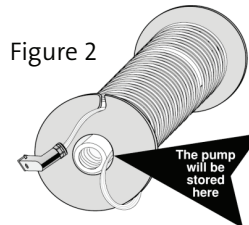


Figure 2

The pump
will be
stored
here

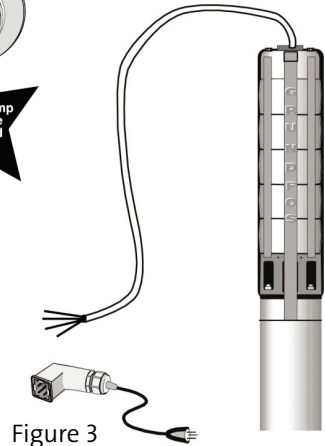


Figure 3

Redi-Flo4®
(SPE)

To operate the system you will also need:

1. A discharge hose or pipe to connect to the pump (See Figure 4).
2. An electrical plug to connect the Redi-Flo VFD power cord to your portable generator may be needed if the supplied plug is not compatible with your generator (See Figure 5).
3. Safety cable and hardware for lowering and lifting the pump (See Figure 6).
4. The Redi-Flo VFD can alternately be operated from single-phase 230VAC supplies. This requires the replacement of the standard power cord with a cord designed for 230V receptacles. Grundfos does not supply a 230V power cord.

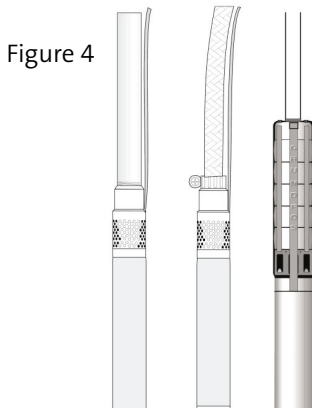


Figure 4

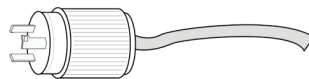


Figure 5

The exact type of plug used will depend upon your generator. The Redi-Flo VFD is supplied with a standard NEMA 5-15P, 115V, 3 prong plug.



Redi-Flo2®

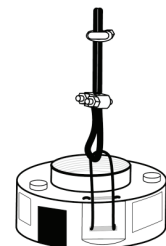


Figure 6

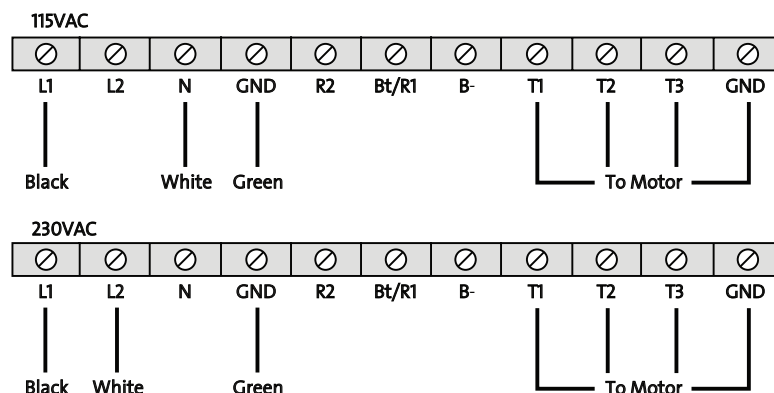
Redi-Flo4®

ASSEMBLING THE REDI-FLO VFD SYSTEM

Input power terminals

The input voltage can be changed between 115V and 230V by changing the line input connections as shown below:

Warning – If the Redi-Flo VFD is miswired for the incoming voltage, internal damage may occur to the drive.



Reverse Rotation Test

Connect the motor lead to the Redi-Flo VFD and test the rotation of the pump. Submerge the pump in water, start it at its slowest speed and make sure the pump shaft is turning counterclockwise (when viewed from the top). If the rotation is incorrect, switching any two power leads (with POWER OFF) will correct the problem.



Attaching the Pump to the Pipe

When connecting piping to the pump, a back-up wrench should be used. After the first section of pipe has been attached to the pump, the safety cable should be connected to the pump (as shown in figure 6). Do not clamp to the pump. When raising the pump, be careful not to place bending stress on the pump by picking it up by the pump end only. It is recommended that a safety cable be attached to the pump (using special brackets and cables, sold separately) anytime plastic pipe or flexible tubing is used. A check valve may also be added to Redi-Flo2® pumps to prevent fluid from flowing back into the pump after it is turned off (backflow prevention). A check valve is standard on Redi-Flo4™ pumps. Always check to ensure joints are fastened securely. The use of a torque arrestor is not required when using the Redi-Flo VFD.

Lowering the Pump into the Well

Make sure the electrical motor leads are not cut or damaged in any way when the pump is being lowered into the well. Do not use the motor leads to support the weight of the pump. To protect against surface water entering the well and contaminating the well, the well should be finished off utilizing a locally approved well seal.

The motor lead should be secured to the discharge pipe at frequent intervals to prevent sagging, looping and possible motor lead damage. Teflon® wire ties are recommended for environmental applications.

IMPORTANT

Plastic pipe and tubing tend to stretch under load. This stretching must be taken into account when securing the motor lead to the riser pipe or tubing. Leave three to four inches of slack between clipped points. This tendency to stretch will also affect the calculation of the pump setting depth. When plastic pipe or tubing is used, it is recommended that a safety cable be attached to the pump to raise and lower it. Redi-Flo4™ pumps are designed to accommodate this cable and Redi-Flo2® pumps can be fitted with a safety cable bracket (part number 1A0019).

ASSEMBLING THE REDI-FLO VFD SYSTEM

Operating Conditions

To ensure the Redi-Flo Variable Performance Pumping system operates properly, follow these guidelines:

- The Redi-Flo2® or Redi-Flo4™ pump must be installed vertically with the discharge end pointed upwards.
- The electrical voltage supply to the Redi-Flo VFD must always be within + or - 10% of the specified power supply
- For best performance when operating on a generator, 115V generators should be set at 120V without load and 230V generators should be set at 240V without load. Use a separate meter to set voltage; do not rely on built-in meters found on generators.
- The pump and motor must always be completely submerged in fluid to ensure lubrication and cooling of the motor.
- The temperature of the fluid being pumped should be according to the technical specifications shown in the motor specifications.
- The installation depth of the pump should always be at least three feet below the maximum drawdown level of the well.
- Redi-Flo pumps are not recommended for well development or pumping fluid containing abrasives.
- Redi-Flo2® pumps are not recommended for continuous operation applications.
- The warranty of the Redi-Flo pumps will be void if other than the Redi-Flo VFD is used or if corrosive fluids are pumped.
- The service life of dedicated Redi-Flo pumps may be compromised if the ambient water quality exceeds one or more of the following values:

pH<5 DO>2 ppm H₂S>1 ppm CL->500 ppm TDS>1000 ppm

Adherence to Environmental Regulations

When handling and operating the Redi-Flo Variable Performance Pump system, all environmental regulations concerning the handling of hazardous materials must be observed. When the pump is taken out of operation, great care should be taken to ensure that the pump contains no hazardous materials that might cause injury to human health or to the environment.

Purging a Well

If the pump is used to purge a well, start the pump at minimum speed and gradually increase to desired speed. Redi-Flo products are not recommended for well development.

Generator Usage

Minimum generator size

For generators with voltage regulation

For generators without voltage regulation

Recommended for optimal performance

(Redi-Flo2/Redi-Flo4)

2500/3400 watts at 115/230VAC, single phase

5000/6700 watts at 115/230VAC, single phase

4000/5400 watts at 115/230 VAC, single phase
with voltage regulation

REDI-FLO VFD SPECIAL FEATURES

Dual Input Capability

Redi-Flo VFD can accept 115V or 230V single phase input voltage

Enclosure

The Redi-Flo VFD NEMA 4 enclosure is designed for outdoor duty and is resistant to damage as a result of incidental exposure to rain.

UL Approvals

The Redi-Flo VFD is UL Listed to U.S. and Canadian electrical safety standards.

Dual Functionality

The Redi-Flo VFD can change from operating Redi-Flo2® (MP1) to Redi-Flo4™ (SPE) Variable Performance pumps with a few keystrokes.

Torque Boost

The Redi-Flo VFD is equipped with a torque boost (voltage boost) feature to aid in start-up under severe conditions.

Optimized Volts/Frequency (V/Hz) Pattern

The Redi-Flo VFD V/Hz pattern is specially optimized to allow the most efficient operation of Redi-Flo2® and Redi-Flo4™ variable performance pumps.

REDI-FLO VFD KEYPAD OVERVIEW

Overview

The keypad is used to program the control parameters, to operate the pump and to monitor the status and outputs of the pump.



Indicator Lights

JOG - (Green) lights when Jog is active.

FWD - (Green) lights when FWD direction is commanded.

STOP - (Red) lights when motor STOP is commanded.

JOG - Press JOG to select the preprogrammed jog speed. After the jog key has been pressed, hold the FWD or REV keys to run the motor in the direction that is needed. The JOG key is only active in the local mode.

FWD - Press FWD to initiate forward rotation of the motor. (Active in Local and Jog modes).

REV - Press REV to initiate reverse rotation of the motor. (Not active).

STOP - Press STOP to stop the motor. This key is operational in all modes of operation unless it has been disabled by the Keypad Stop parameter in the Keypad (programming) Setup Block.

LOCAL - Press LOCAL to change between the local (keypad) and remote operation.

PROG (soft key) - Press PROG soft key to enter the program mode. While in the program mode the PROG key is used to edit a parameter setting.

DIAG (soft key) - Press DIAG soft key to return to the main display window.



◀ ▶ (Left and Right Arrow).

Press ◀ or ▶ to move the cursor when navigating through the programming menus.

ENTER - Press ENTER to save parameter value changes. In the display mode the ENTER key is used to directly set the local speed reference. It is also used to select other operations when prompted by the keypad display.

HELP - Provides help at each display screen, setup parameter and fault. Press to view/close help information.

▲ ▼ (UP and Down Arrow).

Press ▲ or ▼ to increment or decrement the value of the parameter being displayed. Also, when the fault log or parameter list is displayed, these keys will scroll up and down through the list. In the local mode pressing the ▲ or ▼ key will increase or decrease motor speed.

MOTOR CONTROL VIA KEYPAD

The Redi-Flo VFD can operate the motor in three (3) different ways from the keypad.

1. Speed adjustment using the Keypad arrow keys
2. Speed adjustment with Keypad entered values
3. JOG Command

1) Keypad arrow speed control

Press FWD, then press or hold the up arrow key ▲ to increase speed or use the down arrow key ▼ to reduce motor speed. Continuously holding the arrow key will cause the speed to change in larger increments.

2) Keypad speed entered value

Press the ENTER key and use the ▲ ▼ keys to adjust digits and the ◀ ▶ keys to cursor to the desired digit. Press ENTER when finished selecting desired motor speed to return to the display mode. Press and release the FWD key to run the motor in the desired direction at the programmed speed. Press STOP to stop the pump.

3) JOG Command

The JOG key can be used to ramp the pump up to a predetermined speed in the forward or reverse direction. Press the JOG key then hold the FWD key, and the pump will ramp to the speed set in PROG/Jog Settings/Jog Speed. The pump will continue to run until the FWD key is released.

MENU/ESC key - Advanced Programming

For advanced programming features, please refer to the full programming guide found at the Baldor website: www.Baldor.com The manual can be found under Support – installation and operation manuals. It is Baldor manual number MN740, Series H2 Inverter.

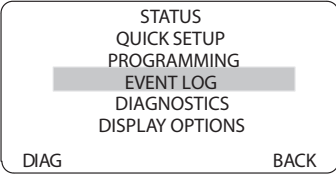
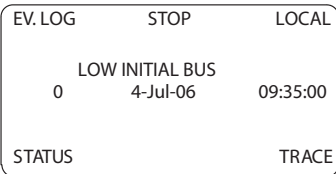
Troubleshooting Guide

The RediFlo VFD requires very little maintenance and should provide years of trouble free operation when installed and applied correctly. Occasional visual inspection and cleaning should be considered to ensure tight wiring connections and to remove dust, dirt, or foreign debris which can reduce heat dissipation. Operational failures or warnings called “Faults” are displayed on the keypad display as they occur. A log of these faults and the time each occurred is kept in the Event Log.

Event Log

Press the Menu key, select Event Log and press Enter.

If an error is displayed during operation, press the “Help” key to learn more about the error. If more than one error was logged, access the Event Log and examine each error entry at the time of the event to learn more about the error.

Action	Description	Display	Comments
Press Menu	Displays top level menu options.		Press ▲ or ▼ to move cursor over the “EVENT LOG” selection. Press Enter to view the event log.
Event Log Display	Displays error name, Entry # and time the error occurred. LOW INITIAL BUS 0 Date Time Entry # DD/MM/YY HH:MM 0-9		Press ▲ or ▼ to view next entry. Press R to display Trace menu. Press A to return to Status Menu.

FAULT MESSAGES

Type	Fault Message Display	Description
	No fault exists	Control is operating properly, no faults recorded.
F	Unknown system fault	Reset the control. Restore parameter values to factory settings.
F	Configuration	Reset the control. Restore parameter values to factory settings.
F	SPI timeout	Serial Peripheral Interface (SPI) failure between control board and power board. Check connections.
F	Param checksum	Reset the control. Restore parameter values to factory settings.
F	New base ID	Changing the Power Base, Control board, or new firmware will most often cause this error. Reset the control. Restore parameter values to factory settings.
F	Over current	Motor current exceeded peak limit. Check: motor connections, motor load, increase accel/decel times.
F	Desaturation	Output current exceeds desat limit. Check: motor for short circuit, motor load, increase accel/decel times.
F	Ground fault	Ground Fault detected (output current leakage to ground). Disconnect motor, check motor for insulation leakage to ground.
F	Logic supply	Logic power supply failure detected.
F	Power Base Fault	Usually occurs with other faults. Fault detected in power base, see FPGA in event log trace.
F	Low Initial BUS	Bus volt less than 200/400/500V on 230/460/575V units at power up. Check: line volt, resistors on R1/ R2.
F	Current Sense	Occurs on power up, motor current sensor(s) out of tolerance.
F	User ref	Internal reference power supply out of tolerance.
F	User 24 V	24V at J1-23 and J1-24 out of spec. Check 24V, if below, remove wiring from terminal strip, re-check.
F	Current reference	Reference volt for current readings out of tolerance.
F	Overload - 1 minute	Peak output current exceeded the 1 minute rating value. Check motor and wires, Level 2 Pk CUR Limit value, Accel time or reduce motor load. Change Level 2 Drive Protect, Overload to "Foldback" and try again.
F	Overload - 3 seconds	Peak output current exceeded the 3 second rating value. Check motor and wires, Level 2 Pk CUR Limit value, Accel time or reduce motor load. Change Level 2 Drive Protect, Overload to "Foldback" and try again.
F	Motor Overload	Motor current exceeded preset limits: 125% for 590 sec., 150% for 150 sec. or 200% for 50 sec.
F	Following Error	Speed error beyond Set Speed Band parameter value. Verify motor is not overloaded.
F	DC Bus High	DC Bus V over 405/810/1000V for 230V/460V/575V units. Check line volt, decel rates, resistor on R1/ R2.
F	DC Bus Low	DC Bus V below 220/440/550V for 230V/460V/575V units. Check line volt, B+ to B- voltage.
F	Drive Over TEMP	Heatsink temp exceeded 85/95°C. Verify ambient does not exceed 45°C. Clean fans and heatsink.
F	Drive Low TEMP	Heatsink temp is less than allowed (-10°C).
F	External trip	Connection at J2-16 is open and P2201 is set to ON.
F	Torque Proving	Failed to measure current in one or more motor phases. Check motor connections or open motor contacts.
F	Regen R or PWR	Excessive resistor power dissipation. Check resistor ratings, extend decel times, or add larger braking kit.
F	EEPROM fault (Powerbase EE, Control EE, Flt Log Mem, NV memory)	EE memory. Reset the control. Restore parameter values to factory settings.
F	Internal Config	Software boot error. Reset the control. Restore parameter values to factory settings.
F	Dyn Brake Desat	Dynamic braking current limit exceeded. Check for shorted braking resistor circuit.
A	Line Loss	All 3 input phases lost. Check input circuit breaker, fuses or input contacts.
A	Phase Loss	One input phase lost. Check input circuit breaker, fuses or input contacts.
F	U Upper Fault	Power transistor gate fault on T1.
F	U Lower Fault	Power transistor gate fault on T1.
F	V Upper Fault	Power transistor gate fault on T2.
F	V Lower Fault	Power transistor gate fault on T2.
F	W upper fault	Power transistor gate fault on T3.
F	W lower fault	Power transistor gate fault on T3.
F	Ph 1 pulse	Phase 1 (T1) curr limiting via pulse by pulse method; check motor: spiking loads, chattering contacts.
F	Ph 2 pulse	Phase 2 (T2) curr limiting via pulse by pulse method; check motor: spiking loads, chattering contacts.
F	Ph 3 pulse	Phase 3 (T3) curr limiting via pulse by pulse method; check motor: spiking loads, chattering contacts.
F	Network Timeout	Forced network fault. Possible reason: watchdog, timing, user control.
F	Memory	Option card problem, memory failure.
A	Aux Filter Setup	Filter Source should be set to Raw Speed when destination is set to Speed Loop.
F	Power Base FPGA	Power base communication loss or invalid FPGA version.
A	Sel FB Source	Encoder Source Not Selected/Feedback Board is absent. Choose the appropriate card for encoder feedback.

F = Fault, A = Alarm

FAULT MESSAGES – (CONTINUED)

F	Download	Parameter download from keypad or network has failed. Verify parameter set compatibility.
F	Parameter	Parameters momentarily locked. Wait 30 seconds, try again
A	Invalid FB Sel	Feedback board not installed on this slot. Select an encoder feedback board as encoder source.
F	ADC Calib Fault	Internal ADC calibration voltages out of range.
F	Encoder Loss	Encoder detected but has poor or no signal. Check encoder wiring.
F	Over Speed	Rotor speed over 110% maximum speed limit.
F	DC Bus Short	For UL testing only. Call Baldor for service.
A	Motor Overtemp	Motor has overheated, check: cooling system or blocked air flow.
A	Fan Loss	Fan circuit is seeing low current or over current. Check fan circuit.
F	DC PK Overvolt	Bus peak voltage rating exceeded. Check: AC input lines; sizing of dynamic brake.
A	Line Sag	All 3 phase input lines have sagged below 70% of nominal. Check input line quality
F	Brake Desat	Dynamic brake de-saturation has occurred. Check dynamic brake circuit.
F	Pre-charge Fault	Dynamic Brake miswired, AC Input too low, Bus Capacitors shorted or Input Single Phasing
A	Drive Disabled	Motion command given with drive disabled. Check: drive enable input.
A	Drive Enabled	Drive enabled during parameter download. Drive must be disabled.
A	PB Power Supply	Power base logic power supply output is too low.
A	AC Input High	Correct the AC input line voltage high condition.
A	Initial Pos	The initial position reading from the absolute position feedback could not be read or is out of expected range.
A	Invalid Res Sel	The feedback source selected is not a resolver board
F	Resolver Loss	Resolver detected but has poor or no signal. Check resolver wiring
A	PF Setup	Pulse follower option board setup incorrect. Check Master PPR, receive, transmit ratio and input type.
A	Option Not Found	Option Board for the feature requested is not installed.
F	Pos Cnt Overflow	Position counter has exceeded max or min range.
A	Opt1 Protocol or Opt2 Protocol	Invalid protocol selected for OPT communication card 1 or card 2.
A	Excess Faults/Hr	The allowed number of faults/hour has been exceeded.
F	Motor Overload	Motor overloaded. Check motor load. Verify motor rated amps parameter.
F	PLC Mode Trip	PLC Mode Trip. PLC action has generated this trip. Check PLC program logic.
F	Macro Read	Read macro from EE PROM failed.
F	Macro Rec Length	Macro end command was not found during macro execution.
F	Macro CMD Inval	Invalid macro command was found.
F	Macro CMD Failed	Execution of a macro command generated an error.

F = Fault, A = Alarm

TECHNICAL SPECIFICATIONS

DESCRIPTION	MP1	SPE
Part I	Rated Power & Markings	
Single Phase Input Voltage	115V +/- 10% or 230V +/- 10%	
Output Voltage	3 X 230V	
Continuous Output Current	8.7A @ 1x115v (input)	
Part II	Fundamental Parameters	
Control System	PWM	
Output Voltage	Clamp @ 230V	
Carrier Freq.	Selectable: 1-5 KHz	
Freq. Resolution	0.01Hz	
Input Freq. Range	48 – 62 Hz	
Maximum Output Frequency	400 Hz	100 Hz*
Base Frequency	400 Hz	100 Hz
Torque Boost	0 – 15% Nominal Voltage	
V/F Pattern	Selectable Linear/Square Law	
Accel Time	0 – 3600 Seconds	
Decel Time	0 – 3600 seconds	
Accel/Decel Pattern	Linear	

* The SPE can operate up to 100Hz on 115v but in cases of higher pump loads the motor amperage could exceed the VFD output rating, causing an over amperage fault.

TECHNICAL SPECIFICATIONS

Part III	I/O Capabilities
+24VDC	+24VDC, 200 mA supply
Common	24VDC common
2 Analog Outputs	0-5VDC, function programmable
Analog Input	0-5VDC, 0-10VDC, 4-20mADC, Potentiometer, for speed control
Digital Inputs	Start, Stop, Reset
Digital Opto-Outputs	60 mA, 10-30VDC, function programmable
Digital Relay Outputs	5 A, 10-30 VDC or 230 VAC function programmable
Part IV	Protective Functions
Ground Fault	Ground Fault detection for Equipment Protection
Overcurrent	Output Short Circuit
	Locked Rotor
Over Voltage	400VDC
Under Voltage	200VDC
Motor Overload	Vt & Ct = 150% for 60sec
Line Start Lock Out	VFD will not start upon input power application
Line Transient Rating	860 VAC, 810J MOV Between any power input terminal & Ground 360 VAC, 380 J MOV Between any two power input terminals
Part V	Ambient Operating Conditions
Operating Temp.	-10 to 45 degree C
Storage Temp.	-10 to 65 degree C
Humidity	10 to 90% RH, Non-Condensing
Vibration	0.5G, Max / 10-60 Hz
Elevation	3300 ft. without derating
Max source fault current	5 Kamps
Enclosure rating	UL Type 4, No Direct Sunlight

WARRANTY SERVICE

To obtain warranty service, contact the Distributor or Dealer from which it was purchased to obtain instructions. Under no circumstances should defective product be returned to the Distributor, Dealer, or GRUNDFOS without a Return Materials Authorization (RMA).

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Subject to alterations.

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