



VS1PF AC Drive for Pump and Fan Applications

Version 2.0

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Important:

Be sure to check www.baldor.com for the latest software, firmware and drivers for your VS1 product. Also, you can download the latest version of this manual in Adobe Acrobat PDF format.

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The VS1PF is a variable frequency drive with features to support the pump and fan market as well as providing functionality that can be used to control many other variable speed applications. This manual is intended for qualified electrical personnel familiar with installing, programming, and maintaining AC Drives.

This manual contains information on:

- Installing and wiring the VS1PF drive
- Programming the drive
- Troubleshooting the drive

1.1 Getting Assistance from Baldor

For technical assistance, call your local Baldor District Sales Office. Before calling, please review the troubleshooting section of this manual and check the Baldor website at www.baldor.com for additional information. When you call technical support, you will be asked for the drive model number or catalog number and this instruction manual number.

1.2 Safety Notice

This equipment contains voltages that may be as high as 1000 volts! Electrical shock can cause serious or fatal injury. Only qualified personnel should attempt the start-up procedure or troubleshoot this equipment. This equipment may be connected to other machines that have rotating parts or parts that are driven by this equipment. Improper use can cause serious or fatal injury. Only qualified personnel should attempt the startup procedure or troubleshoot this equipment.

PRECAUTION: Classifications of cautionary statements

WARNING: Indicates a potentially hazardous situation which, if not avoided, could result in injury or death.

CAUTION: Indicates a potentially hazardous situation which, if not avoided, could result in damage to property.

WARNING: This manual is intended as a guide for proper installation. Baldor Electric Company cannot assume responsibility for the compliance or the noncompliance to any code, national, local or otherwise, for the proper installation of this drive or associated equipment. A hazard of personal injury and/or equipment exists if codes are ignored during installation.

WARNING: Only qualified electrical personnel familiar with the construction and operation of this equipment and the hazards involved should install, adjust, operate, or service this equipment. Read and understand this manual and other applicable manuals in their entirety before proceeding. Failure to observe this precaution could result in severe bodily injury or loss of life.

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 that you are completely familiar with the safe operation of this equipment. This equipment may be connected to other machines that have rotating parts or parts that are controlled by this equipment. Improper use can cause serious or fatal injury. Only qualified personnel should attempt the start-up procedure or troubleshoot this equipment.

WARNING: Do not use motor overload relays with an automatic reset feature. These are dangerous since the process may injure someone if a sudden or unexpected automatic restart occurs. If manual reset relays are not available, disable the automatic restart feature using external control wiring.

WARNING: This unit has an automatic restart feature that will start the motor whenever input power is applied and a RUN (FWD or REV) command is issued. If an automatic restart of the motor could cause injury to personnel, the automatic restart feature of the VS1PF should be disabled.

WARNING: Be sure the system is properly grounded before applying power. Do not apply AC power before you ensure that all grounding instructions have been followed. Electrical shock can cause serious or fatal injury.

WARNING: Do not remove cover for at least ten (10) minutes after AC power is disconnected to allow capacitors to discharge. Dangerous voltages are present inside the equipment. Electrical shock can cause serious or fatal injury.

WARNING: Improper operation of control may cause violent motion of the motor shaft and driven equipment. Be certain that unexpected motor shaft movement will not cause injury to personnel or damage to equipment. Certain failure modes of the control can produce peak torque of several times the rated motor torque.

WARNING: Motor circuit may have high voltage present whenever AC power is applied, even when motor is not rotating. Electrical shock can cause serious or fatal injury.

WARNING: Unexpected motor start will occur when the BX terminal is turned OFF. The user must ensure that automatic start up of the driven equipment will not cause injury to operating personnel or damage to the driven equipment. In addition, the user is responsible for providing suitable audible or visual alarms or other devices to indicate that this function is enabled and the drive may start at any moment. Failure to observe this precaution could result in severe bodily injury or loss of life.

WARNING: Dynamic brake resistors may generate enough heat to ignite combustible materials. Keep all combustible materials and flammable vapors away from brake resistors.

WARNING: You must provide an external, hardwired emergency stop circuit outside of the drive circuitry. This circuit must disable the system in case of improper operation. Uncontrolled machine operation can result if this procedure is not followed. Failure to observe this precaution could result in bodily injury.

WARNING: This drive contains high voltage capacitors that take time to discharge after removal of main supply. Before working on the drive, ensure isolation of main supply from line inputs. Wait ten (10) minutes for capacitors to discharge to safe voltage levels. Failure to observe this precaution could result in severe bodily injury or loss of life.

WARNING: DC Bus capacitors retain hazardous voltages after input power has been disconnected. After disconnecting input power, wait ten (10) minutes for the DC Bus capacitors to discharge and then check the voltage with a voltmeter to ensure the DC bus capacitors are discharged before touching any internal components. Failure to observe this precaution could result in severe bodily injury or loss of life.

WARNING: Be sure to perform maintenance only after checking that the bus has discharged to less than 30 VDC. The bus capacitors may retain a charge after power is turned off. Failure to observe this precaution could result in severe bodily injury or loss of life.

WARNING: The drive start/stop control circuitry includes solid-state components. If hazards due to accidental contact with moving machinery or unintentional flow of liquid, gas or solids exist, an additional hardwired stop circuit may be required to remove the AC line to the drive. When the AC line is removed, there will be a loss of any inherent regenerative braking effect that might be present - the motor will coast to a stop. An auxiliary braking method may be required.

WARNING: The motor shaft may rotate during the tuning procedure. Be certain that unexpected motor shaft movement will not cause injury to personnel or damage to equipment.

WARNING: Auto-tuning enables the drive and motor rotation may occur. Be certain that unexpected motor shaft movement will not cause injury to personnel or damage to equipment. Failure to observe this precaution could result in severe bodily injury or loss of life.

WARNING: Caution must be exercised when the Inverter Temperature function is enabled as the motor will start to run automatically after AC input power is applied. Personal injury may result if caution is not exercised.

WARNING: Caution must be exercised when the Restart After Fault Reset Selection is enabled, as the motor will start to run automatically after the fault is reset. Personal injury may result if caution is not exercised.

WARNING: Caution must be exercised when the Number of Auto-Restart Tries is enabled, as the motor will start to run automatically after the fault is reset. Personal injury may result if caution is not exercised.

WARNING: Do not touch the inverter with hands or other objects while performing the Self-Diagnostic Function because current is flowing to the inverter output. Personal injury may result if caution is not exercised.

WARNING: Be sure to disconnect and lock out the drive input power while performing maintenance. Wait ten (10) minutes for capacitors to discharge to safe voltage levels before removing the cover to the drive. Failure to observe this precaution could result in severe bodily injury or loss of life.

WARNING: Be sure to verify that the DC bus has discharged before performing maintenance on the drive. After disconnecting incoming power and waiting ten (10) minutes, remove cover and ensure voltage is not present on the drive power input terminals. Verify that the DC bus voltage has discharged to a level less than 30Vdc by measuring across terminals P2(+) to N(-) with a digital voltmeter set for DC voltage measurements. Failure to observe this precaution could result in severe bodily injury or loss of life.

WARNING: Do not remove the cover of the Dynamic Braking Unit while power is applied or the unit is in operation; otherwise electric shock could occur.

WARNING: Do not run the Dynamic Braking Unit (DBU) with the front cover removed. Failure to comply could result in electric shock due to high voltage terminals or charged capacitor exposure.

WARNING: Do not remove the cover except for periodic inspections or wiring, even if the input power is not applied; otherwise, you may contact live parts causing an electric shock.

WARNING: Wiring and periodic inspections should be performed at least 10 minutes after disconnecting the input power and after checking the DC link voltage is discharged with a meter (below DC 30V); otherwise, you may get an electric shock.

WARNING: Operate the switches with dry hands; otherwise, you may get an electric shock.

WARNING: Do not use wire or cable with damaged insulation; otherwise, you may get an electric shock.

WARNING: Do not subject wires and cables to scratches, excessive stress, heavy loads or pinching; otherwise, you may get an electric shock.

WARNING: Install the Dynamic Braking Unit (DB unit) on a non-flammable surface. Do not place flammable material nearby; otherwise, fire could occur.

WARNING: Disconnect the input power if the inverter or DB unit gets damaged; otherwise, the result could be a secondary accident and fire.

WARNING: Do not connect the braking resistor directly to the DC terminal (P/B1, N) of the DB unit; otherwise, fire could occur.

WARNING: Do not touch DB unit, Inverter and the resistor right after the power is disconnected. The resistor may still be hot.

WARNING: Do not allow lint, paper, wood chips, dust, metallic chips or other foreign matter into the DB unit; otherwise, fire or accident could occur.

WARNING: Do not apply power to a damaged inverter or to DB unit with missing parts even if the installation is complete; otherwise, electric shock or fire could occur.

CAUTION: The user is responsible for conforming with all applicable local, national, and international codes. Failure to observe this precaution could result in damage to, or destruction of, the equipment.

CAUTION: Disconnect motor leads (U, V & W) from control before you perform a dielectric withstand 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 U, V and W. Connecting AC power to these terminals may result in damage to the control.

CAUTION: Baldor recommends not to use "Grounded Leg Delta" transformer power leads that may create ground loops. Instead, we recommend using a four wire Wye.

CAUTION: Only Baldor cables should be used to connect the keypad and control. These are special cables to protect the control and keypad. Damage associated with other cable types are not covered by the Baldor warranty.

CAUTION: If an M-Contactor is installed, the control must be disabled for at least 200mSec before the M Contactor is opened. If the M-Contactor is opened while the control is supplying voltage and current to the motor, the control may be damaged. Before the control is enabled, the M-Contactor must be closed for at least 200mSec.

CAUTION: Use of power correction capacitors on the output of the drive can result in erratic operation of the motor, nuisance tripping, and/or permanent damage to the drive. Remove power correction capacitors before proceeding. Failure to observe this precaution could result in damage to, or destruction of, the equipment.

CAUTION: Suitable for use on a circuit capable of delivering not more than 65,000 RMS symmetrical amperes. 240V drives or 480V drives volts maximum, 7.5 HP - 700HP.

CAUTION: Apply the rated torque to terminal screws. Loose screws can cause short circuit and malfunction. Tightening the screws too much can damage the terminals and cause short circuit and malfunction.

CAUTION: Do not leave wire fragments inside the inverter. Wire fragments can cause faults, breakdowns and malfunctions.

CAUTION: A contactor or other device that routinely disconnects and reapplies the AC line to the drive to start and stop the motor can cause drive hardware damage. The drive is designed to use control input signals that will start and stop the motor. If used, the input device must not exceed one operations per minute or drive damage can occur. Failure to observe this precaution can result in damage to, or destruction of equipment.

CAUTION: Driving the 4-20 mA analog input from a voltage source could cause component damage. Verify proper configuration prior to applying input signals.

CAUTION: Operating the drive prior to correcting the cause of the Over Current Fault may permanently damage the output IGBT power transistors.

CAUTION: The motor may be overheated by frequent use of the Flux Brake function

CAUTION: When using a standard induction motor, setting the voltage/frequency (V/F) ratio value much higher than linear V/F pattern could result in torque shortage or motor overheating due to over-energizing.

CAUTION: If the boost value is set too high, it may cause motor overheating or over saturation.

1.3 Unpacking and Inspection

- Step 1. Remove the inverter from its packing and inspect its exterior for shipping damage. If damage is apparent, notify the shipping agent and your sales representative.
- Step 2. Remove the cover and inspect the inverter for any apparent damage or foreign objects. Ensure that all mounting hardware and terminal connection hardware is properly seated, securely fastened, and undamaged.
- Step 3. Check the nameplate on the VS1PF inverter. Verify that the inverter unit is the correct horsepower and input voltage for the application.

General Information and Ratings 2

The VS1PF is a variable frequency PWM drive capable of operating in open-loop, volts-per-hertz mode and in a sensorless vector control (SVC) mode.

This chapter contains information about the VS1PF drive, including how to identify the drive.

2.1 Identifying the Drive by Model Number

Each drive can be identified by its model number, as shown in figure 2.1. The model number is on the shipping label and the drive nameplate. The model number includes the drive and any options.

Drive model numbers for the VS1PF drive are provided in table 2.1.

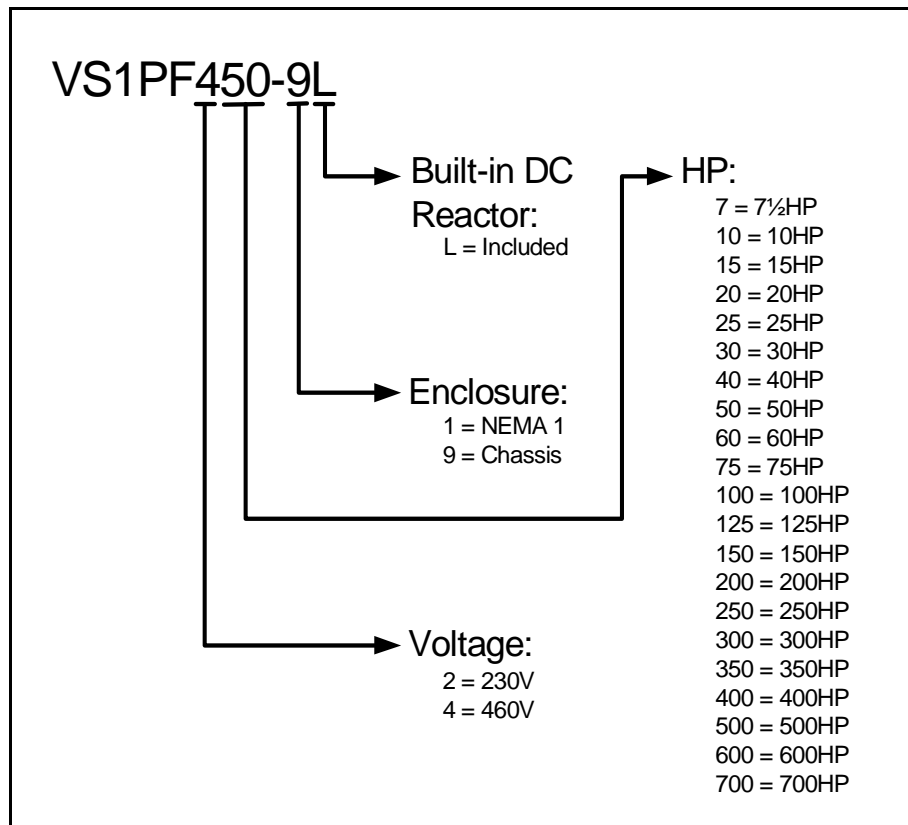


Figure 2-1: Identifying the Drive by Model Number

2.2 Identifying the Drive by Model Number

Table 2.1 provides drive ratings for VS1PF Model.

Table 2.1 – Drive Ratings, Model Numbers and Frame Sizes

Catalog No.	Input Volt	Frame Size	Output						Watts Loss
			Normal Duty			Heavy Duty			
			HP	KW	Continuous Amps	HP	KW	Continuous Amps	Watts
VS1PF27-1	230	A	7.5	5.5	24	5	3.7	17	222
VS1PF210-1	230	B	10	7.5	32	7.5	5.5	23	285
VS1PF215-1	230	B	15	11	46	10	7.5	33	425
VS1PF220-9	230	C	20	15	60	15	11	44	485
VS1PF225-9	230	C	25	18.5	74	20	15	54	552
VS1PF230-9	230	E	30	22	88	25	18.5	68	532
VS1PF240-9	230	E	40	30	115	30	22	84	680
VS1PF47-1	460	A	7.5	5.5	12	5	3.7	8	189
VS1PF410-1	460	B	10	7.5	16	7.5	5.5	11	263
VS1PF415-1	460	B	15	11	24	10	7.5	17	326
VS1PF420-9	460	C	20	15	30	15	11	22	335
VS1PF425-9	460	C	25	18.5	39	20	15	28	423
VS1PF430-9	460	E	30	22	45	25	18.5	34	488
VS1PF440-9	460	E	40	30	61	30	22	44	680
VS1PF450-9	460	G	50	37	75	40	30	55	1188
VS1PF460-9	460	G	60	45	91	50	37	66	1214
VS1PF475-9	460	H	75	55	110	60	45	80	1762
VS1PF4100-9	460	L	100	75	152	75	55	111	2886
VS1PF4125-9	460	L	125	90	183	100	75	134	2865
VS1PF4150-9L*	460	N	150	110	223	125	90	164	2834
VS1PF4200-9L*	460	N	200	132	264	150	110	194	3164
VS1PF4250-9L*	460	P	250	160	325	200	132	240	3834
VS1PF4300-9L*	460	R	300	200	413	250	160	317	4214
VS1PF4350-9L*	460	R	350	220	432	250	200	317	4214
VS1PF4400-9L*	460	R	400	280	547	300	200	401	5414
VS1PF4500-9	460	S	500	315	613	350	220	450	9264
VS1PF4600-9	460	T	600	375	731	400	280	536	7314
VS1PF4700-9	460	T	700	450	877	500	315	643	8814

* These models include a built-in DC link inductor

2.3 Storage Guidelines

If you need to store the drive, follow these recommendations to prolong drive life and performance:

- Store the drive within an ambient temperature range of -20° to +65 C°.
- Store the drive within a relative humidity range of 0% to 90%, non-condensing.
- Do not expose the drive to a corrosive atmosphere.

Installing the Drive 3

This chapter provides information that must be considered when planning a VS1PF drive installation and provides drive mounting information and installation site requirements.

WARNING: Only qualified electrical personnel familiar with the construction and operation of this equipment and the hazards involved should install, adjust, operate, or service this equipment. Read and understand this manual and other applicable manuals in their entirety before proceeding. Failure to observe this precaution could result in severe bodily injury or loss of life.

CAUTION: Use of power correction capacitors on the output of the drive can result in erratic operation of the motor, nuisance tripping, and/or permanent damage to the drive. Remove power correction capacitors before proceeding. Failure to observe this precaution could result in damage to, or destruction of, the equipment.

CAUTION: The user is responsible for conforming with all applicable local, national, and international codes. Failure to observe this precaution could result in damage to, or destruction of, the equipment.

3.1 General Requirements for the Installation Site

It is important to plan properly before installing a VS1PF to ensure that the drive's environment and operating conditions are satisfactory.

The area behind the drive must be kept clear of all control and power wiring. Power connections may create electromagnetic fields that may interfere with control wiring or components when run in close proximity to the drive.

Read the recommendations in the following sections before continuing with the drive installation.

Handle the inverter with care to prevent damage to the plastic components. Do not hold the inverter by the front cover.

Do not mount the inverter in a location where excessive vibration (0.6G or less) is present such as on a press or other moving equipment.

3.1.1 Operating Conditions

Before deciding on an installation site, consider the following guidelines:

- Protect the cooling fan by avoiding dust or metallic particles.
- Do not expose the drive to a corrosive atmosphere.
- Protect the drive from moisture and direct sunlight.
- Verify that the drive location will meet the environmental conditions specified in table 3.1.

Table 1-1: Ambient Temperatures and Mounting Clearances

Ambient Temperature		Derate	Minimum Mounting Clearances
Minimum	Maximum		
-10° C (14° F)	50° C (122° F)	20%	2" (50mm)
	40° C (104° F)	0%	2" (50mm)

Install in a location where temperature is within the permissible range.

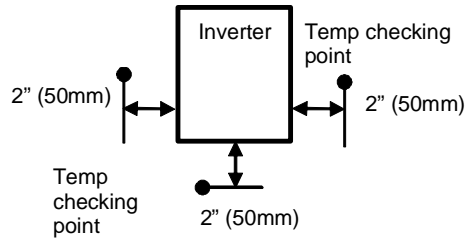


Figure 3-1: Mounting Clearances

3.1.2 Minimum Mounting Clearances

Refer to figure 3.2 for the minimum mounting clearances. Refer to section 3.1.3 for drive mounting dimensions.

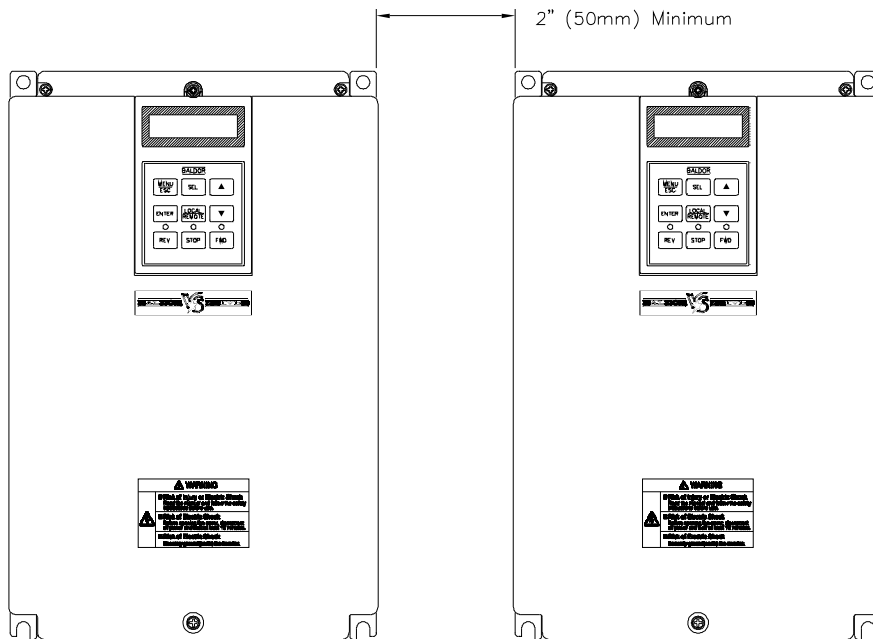


Figure 3-2: Minimum Mounting Clearances

The inverter will be very hot during operation. Install it on a non-combustible surface.

Mount the inverter on a flat, vertical and level surface. During operation, the inverter must be in a vertical position (top up) to allow proper heat dissipation. Also leave sufficient clearances around the inverter.

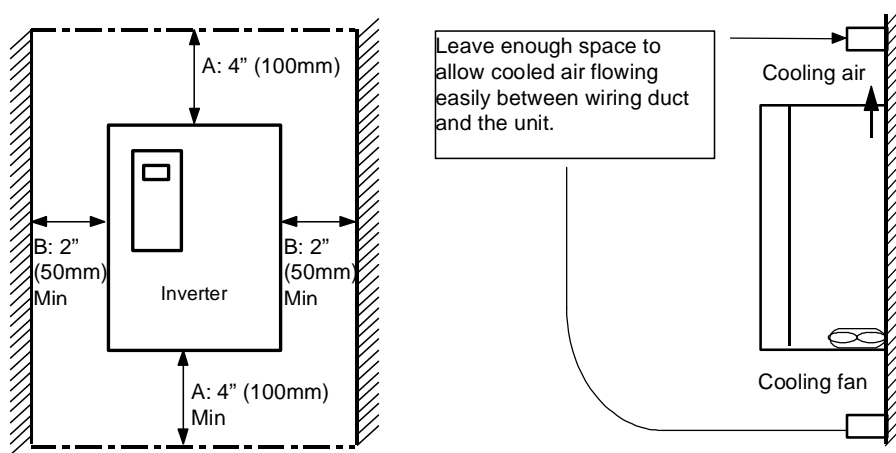


Figure 3-3: Recommended Cabinet Layout

Do not mount the inverter in direct sunlight or near other heat sources.

The inverter should be mounted in a Pollution Degree 2 environment (an environment where non-conducting pollution is allowed with temporary conductivity due to condensation). If the inverter is going to be installed in an environment with a high level of dust, metallic particles, mists, corrosive gases, or other contaminants, the inverter must be located inside the appropriate electrical enclosure with the proper NEMA or IP rating.

When two or more inverters are installed or a ventilation fan is mounted in the inverter panel, the inverters and ventilation fan must be installed in the proper configuration with extreme care taken to keep the ambient temperature of the inverters below the permissible value. If they are installed in improper positions, the ambient temperature of the inverters will rise.

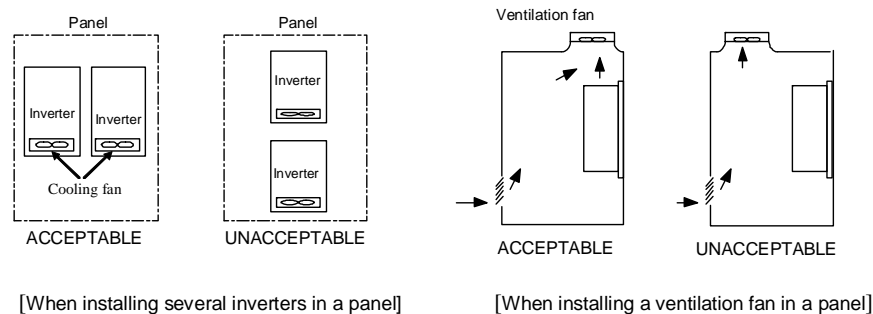
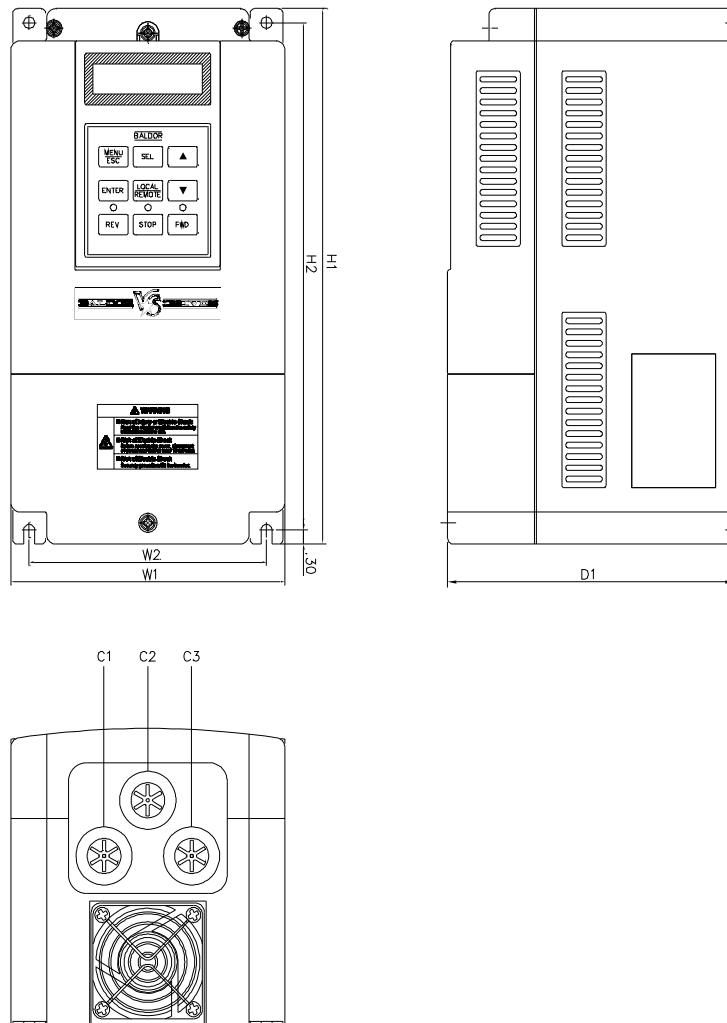


Figure 3-4: Proper Ventilation Configuration

Install the inverter using screws or bolts to insure the inverter is firmly fastened.

3.2 Mounting Dimensions for the VS1PF Drive

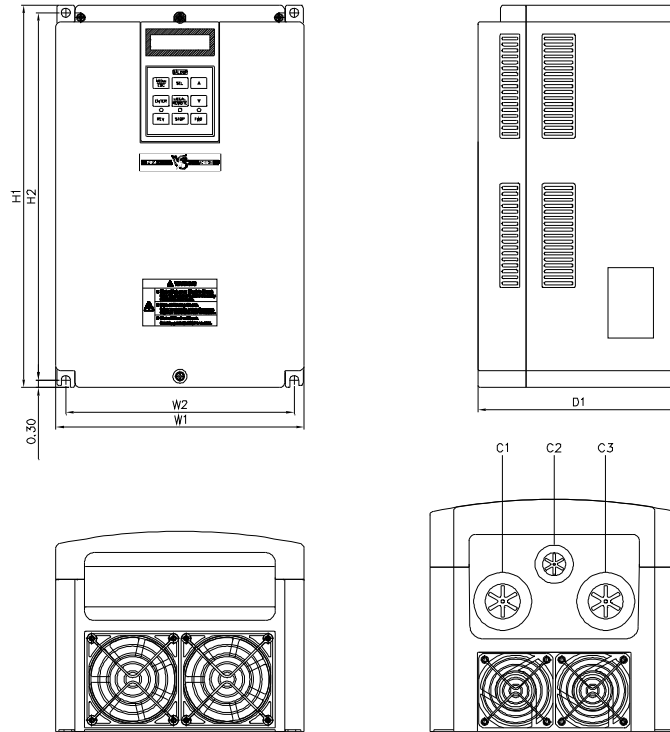
3.2.1 7.5 HP (230V/460V) Frame A



Model	W1	W2	H1	H2	D1	C1	C2	C3	Enclosure Type
VS1PF27-1 VS1PF47-1	5.91 (150)	5.12 (130)	11.18 (284)	10.69 (269)	6.16 (156.6)	0.98 (24)	0.98 (24)	0.98 (24)	IP20 UL Type 1

Figure 3-5: 7.5 HP (230V/460V) Frame A [inches (mm)]

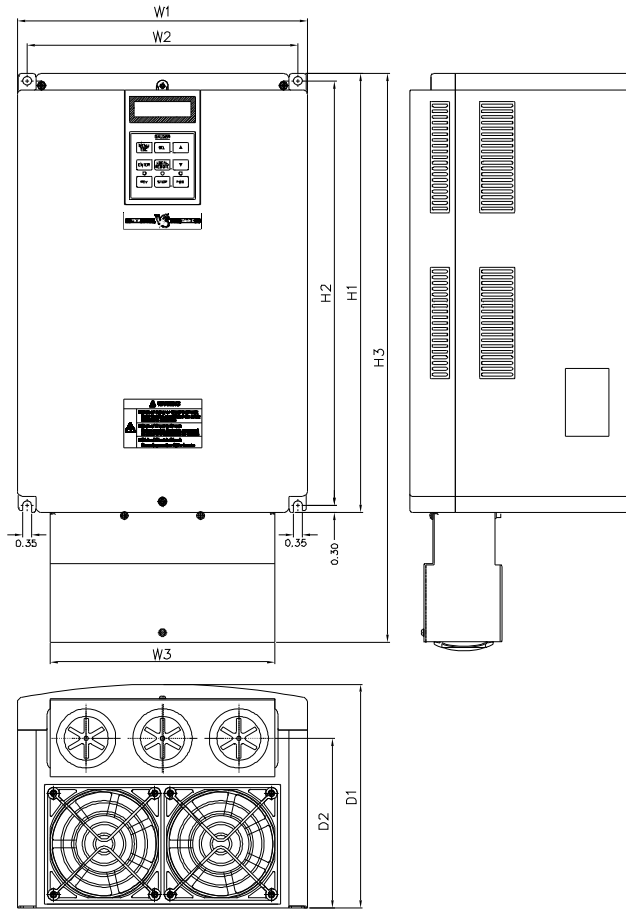
3.2.2 10 HP - 40 HP (230V/460V) Frames B, C, and E



Model	W1	W2	W3	H1	H2	D1	C1	C2	C3	Enclosure Type
VS1PF210-1 VS1PF410-1	7.87 (200)	7.09 (180)	0.23 (6)	11.18 (284)	10.69 (269)	7.16 (182)	1.37 (35)	0.98 (24)	1.37 (35)	IP20 UL Type 1
VS1PF215-1 VS1PF415-1	7.87 (200)	7.09 (180)	0.23 (6)	11.18 (284)	10.69 (269)	7.16 (182)	1.37 (35)	0.98 (24)	1.37 (35)	IP20 UL Type 1
VS1PF220-9 VS1PF420-9	9.84 (250)	9.06 (230)	0.35 (9)	15.16 (385)	14.57 (370)	7.91 (201)	-	-	-	IP00 UL Open
VS1PF225-9 VS1PF425-9	9.84 (250)	9.06 (230)	0.35 (9)	15.16 (385)	14.57 (370)	7.91 (201)	-	-	-	IP00 UL Open
VS1PF230-9 VS1PF430-9	11.97 (304)	11.18 (284)	0.35 (9)	18.11 (460)	17.52 (445)	9.21 (234)	-	-	-	IP00 UL Open
VS1PF240-9 VS1PF440-9	11.97 (304)	11.18 (284)	0.35 (9)	18.11 (460)	17.52 (445)	9.21 (234)	-	-	-	IP00 UL Open

Figure 3-6: 10 - 40 HP (230V/460V) Frames B, C & E [inches (mm)]

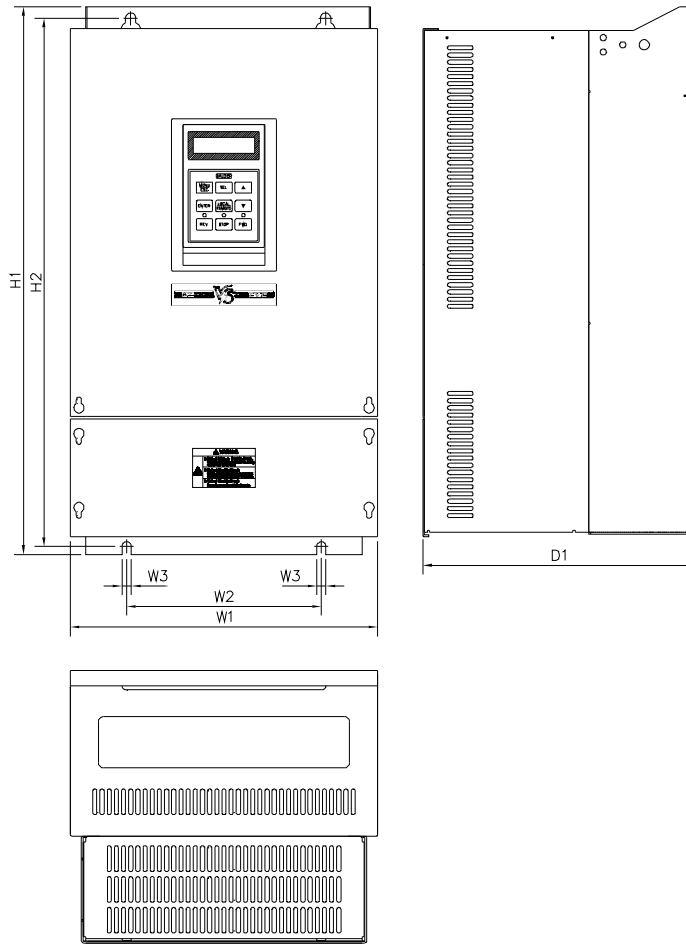
3.2.3 20HP - 40 HP (230V/460V) Frames C and E with Conduit Option Used



Model	W1	W2	W3	H1	H2	H3	D1	D2	Enclosure Type
VS1PF220-9 VS1PF420-9	9.84 (250)	9.06 (230)	7.9 (200.8)	15.16 (385)	14.57 (370)	17.88 (454.2)	7.91 (201)	5.74 (146)	IP20 UL Type 1
VS1PF225-9 VS1PF425-9	9.84 (250)	9.06 (230)	7.9 (200.8)	15.16 (385)	14.57 (370)	17.88 (454.2)	7.91 (201)	5.74 (146)	IP20 UL Type 1
VS1PF230-9 VS1PF430-9	11.97 (304)	11.18 (284)	9.29 (236)	18.11 (460)	17.52 (445)	23.59 (599.2)	9.21 (234)	6.98 (177.5)	IP20 UL Type 1
VS1PF240-9 VS1PF440-0	11.97 (304)	11.18 (284)	9.29 (236)	18.11 (460)	17.52 (445)	23.59 (599.2)	9.21 (234)	6.98 (177.5)	IP20 UL Type 1

Figure 3-7: 20 - 40 HP Frames C & E with Conduit Option Used [inches (mm)]

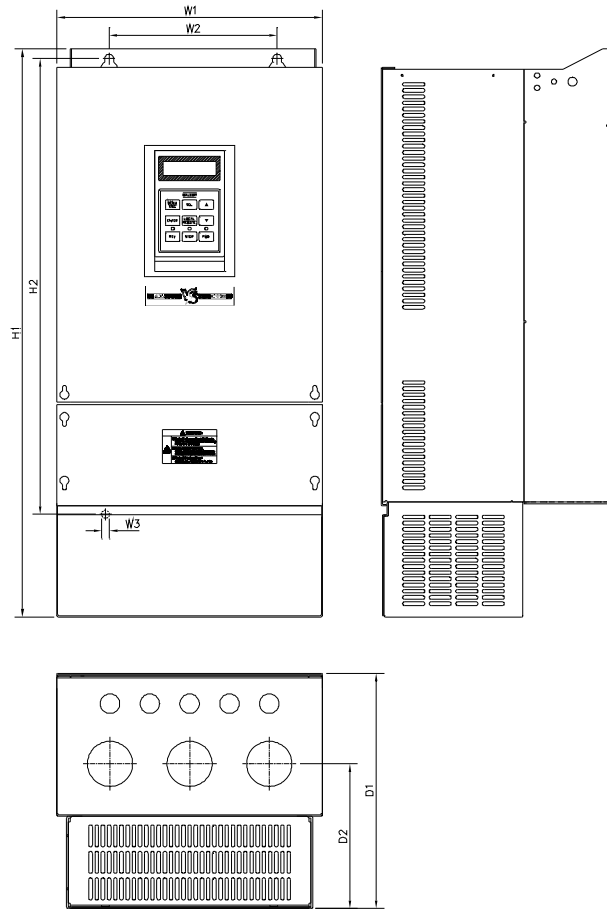
3.2.4 50 HP - 75 HP (460V) Frames G and H.



Model	W1	W2	W3	H1	H2	D1	Enclosure Type
VS1PF450-9 VS1PF460-9	11.81 (300)	7.48 (190)	0.35 (9)	21.02 (534)	20.28 (515)	10.46 (265.6)	IP00 UL Open
VS1PF475-9	11.81 (300)	7.48 (190)	0.35 (9)	21.02 (534)	20.28 (515)	22.52 (292.6)	IP00 UL Open

Figure 3-8: 50 HP - 75 HP (460V) Frames G and H [inches (mm)]

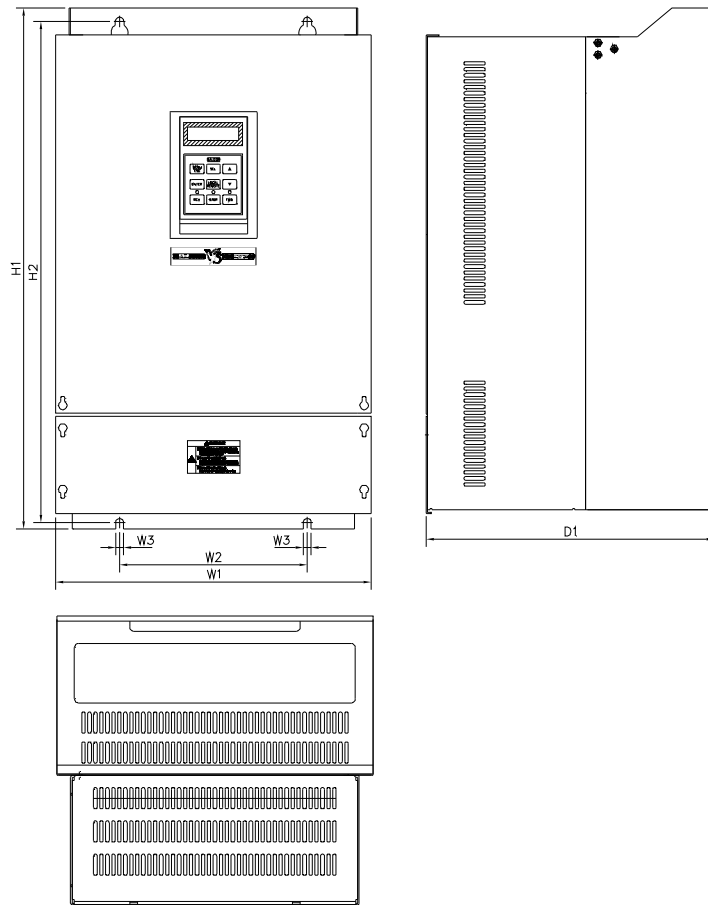
3.2.5 50 HP - 75 HP (460V) Frames G and H UL Open Type with Conduit Option Used.



Model	W1	W2	W3	H1	H2	D1	D2	Enclosure Type
VS1PF450-9 VS1PF460-9	11.81 (300)	7.48 (190)	0.35 (9)	25.28 (642)	20.28 (515)	10.46 (265.6)	6.43 (163.4)	IP20 UL Type 1
VS1PF475-9	11.81 (300)	7.48 (190)	0.35 (9)	25.28 (642)	20.28 (515)	11.52 (292.6)	7.5 (190.4)	IP20 UL Type 1

Figure 3-9: 50 HP - 75 HP (460V) Frames G and H UL Open Type w/ Conduit Kit Used [inches (mm)]

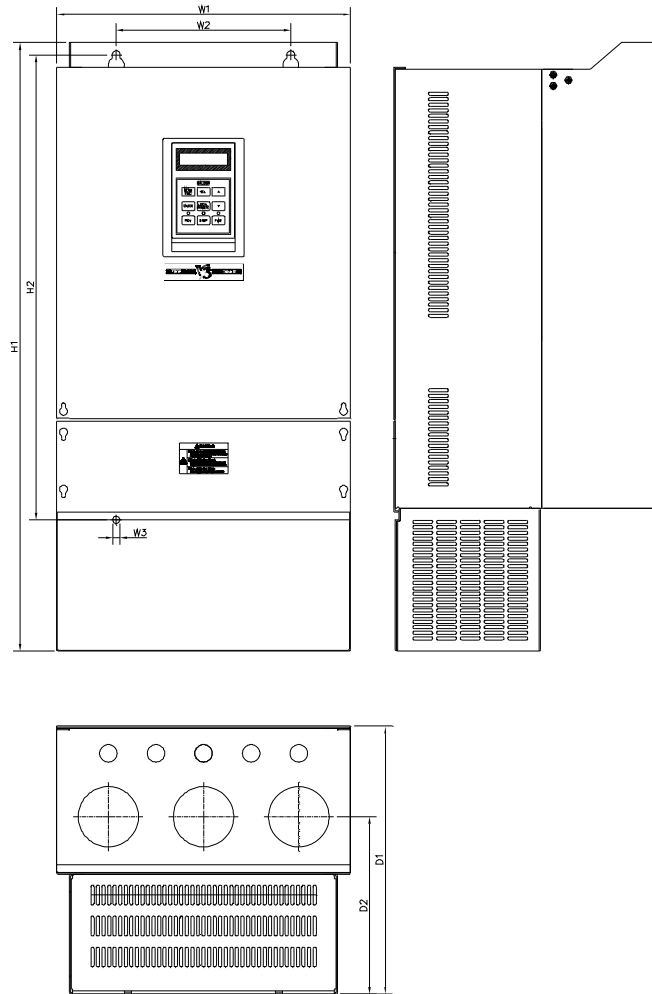
3.2.6 100 HP- 125 HP (460V) Frame L



Model	W1	W2	W3	H1	H2	D1	Enclosure Type
VS1PF4100-9	14.57	8.66	0.35	24.02	23.09	13.29	IP00
VS1PF4125-9	(370)	(220)	(9)	(610)	(586.5)	(337.6)	UL Open

Figure 3-10: 100 HP - 125 HP (460V) Frame L [inches (mm)]

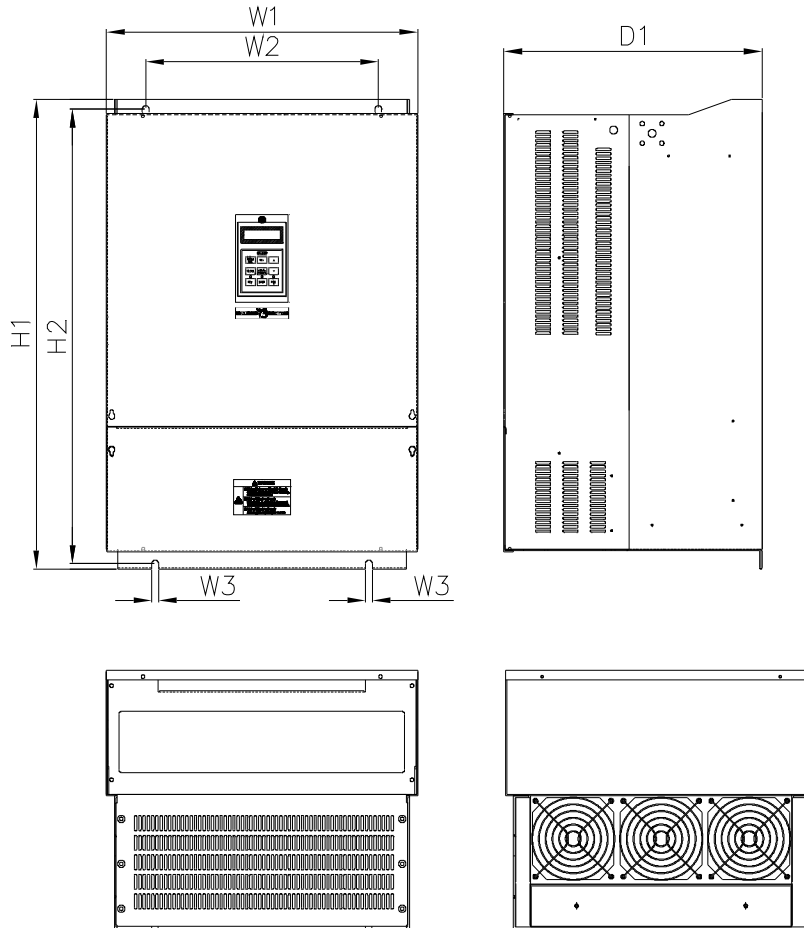
3.2.7 100 HP ~ 125 HP (460V) Frame L with Conduit Option Used



Model	W1	W2	W3	H1	H2	D1	D2	Enclosure Type
VS1PF4100-9	14.57	8.66	0.35	30.22	23.09	13.29	8.8	IP20
VS1PF4125-9	(370)	(220)	(9)	(767.5)	(586.5)	(337.6)	(223.4)	UL Type 1

Figure 3-11: 100 HP ~ 125 HP (460V) Frame L with conduit option used [inches (mm)]

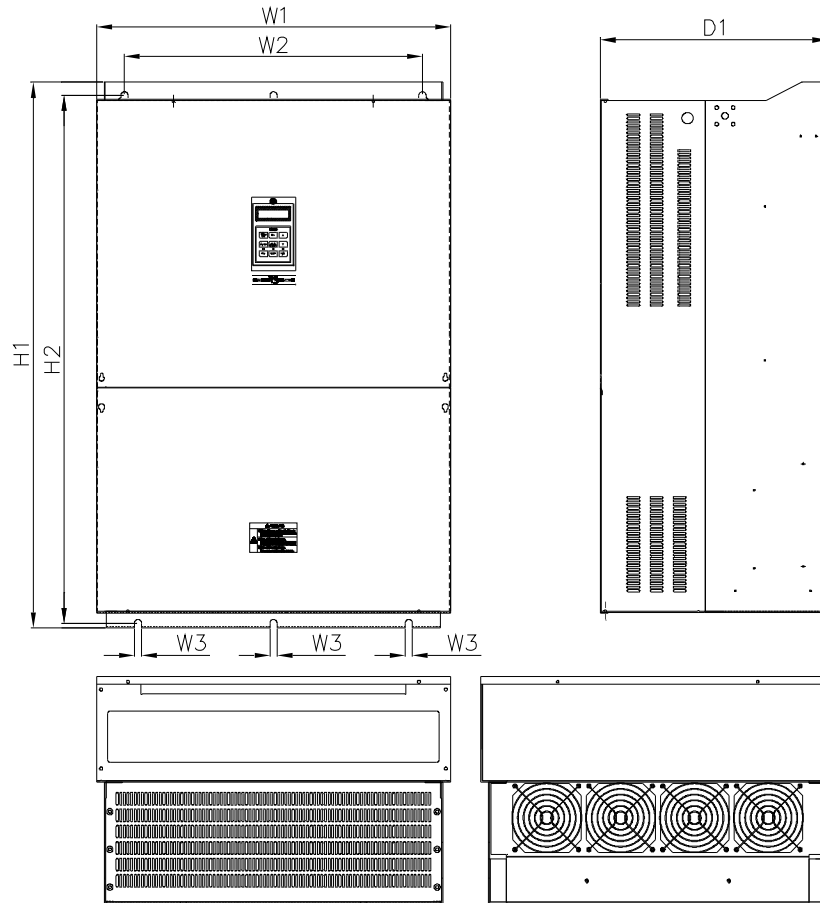
3.2.8 150 HP - 250 HP (460V) Frames N & P



Model	W1	W2	W3	H1	H2	D1	Enclosure Type
VS1PF4150-9L VS1PF4200-9L	20.08 (510)	15.00 (381)	0.43 (11)	30.26 (768.5)	29.29 (744)	16.64 (422.6)	IP00 UL Open
VS1PF4250-9L	20.08 (510)	15.00 (381)	0.43 (11)	33.23 (844)	32.26 (819.5)	16.64 (422.6)	IP00 UL Open

Figure 3-12: 150 HP - 250 HP (460V) Frames N and P [inches (mm)]

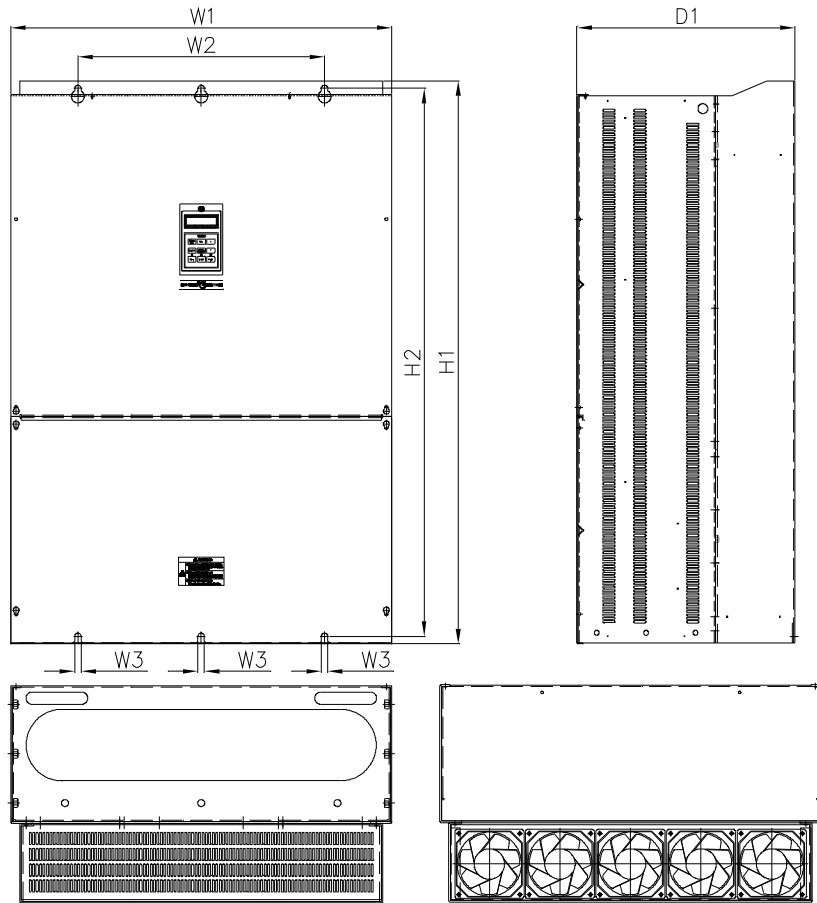
3.2.9 300 HP - 400 HP(460V) Frame R



Model	W1	W2	W3	H1	H2	D1	Enclosure Type
VS1PF4300 - 9L	27.17	22.87	0.55	41.85	40.49	17.70	IP00
VS1PF4350 - 9L	(690)	(581)	(14)	(1063)	(1028)	(449.6)	UL Open
VS1PF4400 - 9L							

Figure 3-13: 300 HP - 400 HP (460V) Frame R [inches (mm)]

3.2.10 500 HP - 700 HP (460V) Frames S and T



Model	W1	W2	W3	H1	H2	D1	Enclosure Type
VS1PF4500 - 9	30.39 (772)	19.69 (500)	0.51 (13)	44.90 (1140.5)	43.70 (1110)	17.40 (442)	IP00 UL Open
VS1PF4600 - 9 VS1PF4700 - 9	36.30 (922)	22.83 (580)	0.55 (14)	51.28 (1302.5)	50.06 (1271.5)	19.49 (495)	IP00 UL Open

Figure 3-14: 500 HP - 700 HP (460V) Frames S and T [inches (mm)]

3.3 Mounting Dimensions

Catalog No.	Dimensions in (mm)					Weight	
	H1	H2	W1	W2	D1	lb	kg
VS1PF27-1	11.18(284)	10.69(269)	5.91(150)	5.12(130)	6.16(156)	10.8	4.9
VS1PF210-1	11.18(284)	10.69(269)	7.87(200)	7.09(180)	7.16(182)	13.2	6.0
VS1PF215-1	11.18(284)	10.69(269)	7.87(200)	7.09(180)	7.16(182)	13.2	6.0
VS1PF220-9	15.16(385)	14.57(370)	9.84(250)	9.06(230)	7.91(201)	28.7	13.0
VS1PF225-9	15.16(385)	14.57(370)	9.84(250)	9.06(230)	7.91(201)	28.7	13.0
VS1PF230-9	18.11(460)	17.52(445)	11.97(304)	11.18(284)	9.21(234)	44.1	20.0
VS1PF240-9	18.11(460)	17.52(445)	11.97(304)	11.18(284)	9.21(234)	44.1	20.0
VS1PF47-1	11.18(284)	10.69(269)	5.91(150)	5.12(130)	6.16(156)	10.8	4.9
VS1PF410-1	11.18(284)	10.69(269)	7.87(200)	7.09(180)	7.16(182)	13.2	6.0
VS1PF415-1	11.18(284)	10.69(269)	7.87(200)	7.09(180)	7.16(182)	13.2	6.0
VS1PF420-9	15.16(385)	14.57(370)	9.84(250)	9.06(230)	7.91(201)	27.6	12.5
VS1PF425-9	15.16(385)	14.57(370)	9.84(250)	9.06(230)	7.91(201)	27.6	12.5
VS1PF430-9	18.11(460)	17.52(445)	11.97(304)	11.18(284)	9.21(234)	44.1	20.0
VS1PF440-9	18.11(460)	17.52(445)	11.97(304)	11.18(284)	9.21(234)	44.1	20.0
VS1PF450-9	21.02(534)	20.28(515)	11.81(300)	7.48(190)	10.46(266)	59.5	27.0
VS1PF460-9	21.02(534)	20.28(515)	11.81(300)	7.48(190)	10.46(266)	59.5	27.0
VS1PF475-9	21.02(534)	20.28(515)	11.81(300)	7.48(190)	11.52(293)	64.0	29.1
VS1PF4100-9	24.02(610)	23.09(586.5)	14.57(370)	8.66(220)	13.29(338)	92.6	42.1
VS1PF4125-9	24.02(610)	23.09(586.5)	14.57(370)	8.66(220)	13.29(338)	92.6	42.1
VS1PF4150-9L	30.26(768.5)	29.29(744)	20.08(510)	15.00(381)	16.64(423)	222.7	101.2
VS1PF4200-9L	30.26(768.5)	29.29(744)	20.08(510)	15.00(381)	16.64(423)	222.7	101.2
VS1PF4250-9L	30.26(768.5)	29.29(744)	20.08(510)	15.00(381)	16.64(450)	251.3	114.2
VS1PF4300-9L	41.85(1063)	40.49(1028)	27.17(690)	22.87(581)	17.70(450)	441.9	200.9
VS1PF4350-9L	41.85(1063)	40.49(1028)	27.17(690)	22.87(581)	17.70(450)	441.9	200.9
VS1PF4400-9L	41.85(1063)	40.49(1028)	27.17(690)	22.87(581)	17.70(450)	441.9	200.9
VS1PF4500-9	44.90(1140.5)	43.70(1110)	30.39(772)	19.69(500)	17.70(442)	535.7	243.5
VS1PF4600-9	51.28(1302.5)	50.06(1271.5)	36.30(922)	22.83(580)	19.49(495)	837.7	380.8
VS1PF4700-9	51.28(1302.5)	50.06(1271.5)	36.30(922)	22.83(580)	19.49(495)	837.7	380.8

4.1 Grounding the Drive

WARNING: This manual is intended as a guide for proper installation. Baldor Electric Company cannot assume responsibility for the compliance or the noncompliance to any code, national, local or otherwise, for the proper installation of this drive or associated equipment. A hazard of personal injury and/or equipment exists if codes are ignored during installation.

WARNING: This drive contains high voltage capacitors that take time to discharge after removal of main supply. Before working on the drive, ensure isolation of main supply from line inputs. Wait ten (10) minutes for capacitors to discharge to safe voltage levels. Failure to observe this precaution could result in severe bodily injury or loss of life.

WARNING: Only qualified electrical personnel familiar with the construction and operation of this equipment and the hazards involved should install, adjust, operate, or service this equipment. Read and understand this manual and other applicable manuals in their entirety before proceeding. Failure to observe this precaution could result in severe bodily injury or loss of life.

WARNING: DC Bus capacitors retain hazardous voltages after input power has been disconnected. After disconnecting input power, wait ten (10) minutes for the DC Bus capacitors to discharge and then check the voltage with a voltmeter to ensure the DC bus capacitors are discharged before touching any internal components. Failure to observe this precaution could result in severe bodily injury or loss of life.

NOTE: Use the dedicated ground terminal to ground the drive. Do not use mounting screws/bolts or chassis screws for grounding.

The drive Safety Ground - \oplus must be connected to system ground. Ground impedance must conform to the requirements of national and local industrial safety regulations and/or electrical codes. The integrity of all ground connections should be checked periodically.

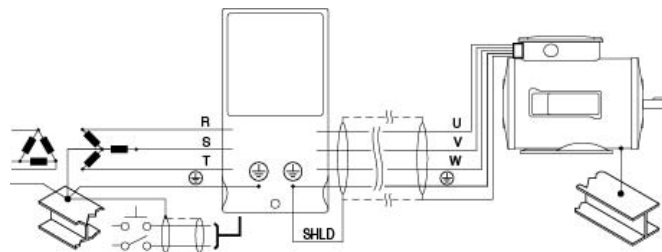


Figure 4-1: Typical Grounding

Ground Fault Monitoring

If a system ground fault monitor is to be used, only Type B devices should be used to avoid nuisance tripping.

Safety Ground - \oplus

This is the safety ground for the drive that is required by code. One of these points must be connected to adjacent building steel (girder, joist), a floor ground rod, or bus bar. Grounding points must comply with national and local industrial safety regulations and/or electrical codes.

Motor Ground

The motor ground must be connected to one of the ground terminals on the drive.

Shield Termination - SHLD

The safety ground terminal provides a grounding point for the motor cable shield. The **motor cable** shield connected to this terminal (drive end) should also be connected to the motor frame (motor end). Use a shield terminating or EMI clamp to connect the shield to the safety ground terminal.

When shielded cable is used for **control and signal wiring**, the shield should be grounded at the source end only, not at the drive end.

4.1.1 RFI Filter Grounding

Using drives with RFI filters may result in relatively high ground leakage currents. Therefore, a **filter must only be used in installations with grounded AC supply systems and be permanently installed and solidly grounded** (bonded) to the building power distribution ground.

Ensure that the incoming supply neutral is solidly connected (bonded) to the same building power distribution ground. Grounding must not rely on flexible cables and should not include any form of plug or socket that would permit inadvertent disconnection. Some local codes may require redundant ground connections. The integrity of all connections should be checked periodically.

4.1.2 Grounding Guidelines

- The VS1PF uses high-frequency switching on its output making it possible for leakage current to flow. Ground the inverter to avoid electrical shock. Use caution to prevent the possibility of personal injury. Maximum ground impedance is 100 ohms for 230V class drives and 10 ohms for 460V class drives.
- Drive ground connections must be made to the dedicated ground terminal on the power terminal block. Do not make ground connections to mounting screws/bolts or to the chassis screws.
- When making/removing connection to/from the drive, the ground conductor must be the first one connected and the last one removed.
- At a minimum, the ground wire should meet the specifications listed below. The ground wire should be as short as possible and should be connected to ground as near as possible to the inverter.


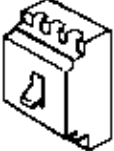

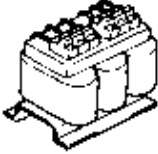
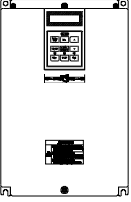
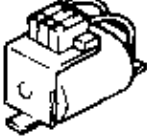

Table 4-1: Minimum Ground Wire Size

Inverter Capacity		Minimum Ground Wire Size, AWG or kcmil (mm ²)	
HP	KW	230V Class	460V Class
7.5 to 10	5.5 to 7.5	10 (5.5)	12 (3.5)
15 to 20	11 to 15	6 (14)	8 (8)
25 to 40	18.5 to 30	4 (22)	6 (14)
50 to 75	37 to 55	-	4 (22)
100 to 125	75 to 90	-	2 (38)
150 to 200	110 to 132	-	1/0 (60)
250 to 350	160 to 280	-	4/0 (100)
400 to 600	315 to 375	-	300 (150)
700	450	-	400 (200)

4.2 Connecting Peripheral Devices to the VS1PF Drive

The following devices are required to operate the inverter. Proper peripheral devices must be selected and correct connections made to ensure proper operation. An incorrectly applied or installed inverter can result in system malfunction or reduction in product life as well as component damage. You must read and understand this manual thoroughly before proceeding.

Table 4-2: Peripheral Devices for the VS1PF Drive

	AC Source Supply	Use a power source with a voltage within the permissible range of inverter input power rating.
	Input Circuit Breaker or Fused Disconnect	Select circuit breakers or fuses in accordance with applicable national and local codes.
	Inline Magnetic Contactor	Install if necessary. When installed, do not use it for the purpose of starting or stopping the drive.
	AC Reactor	An AC reactor can be used to reduce the harmonics and is required when the VS1PF is installed on a power source that is rated greater than 10 times the KVA rating of the drive.
	Installation and wiring	To provide reliable operation, install the inverter in the proper orientation and with proper clearances. Incorrect terminal wiring could result in equipment damage.
	DC Inductor	A DC inductor may be used together with or in place of an AC reactor if necessary to reduce harmonics.
	To motor	Do not connect power factor capacitors, surge arrestors or radio frequency filters to the output side of the inverter.

4.3 Power Wiring

4.3.1 Wiring Precautions

CAUTION: Use of power correction capacitors on the output of the drive can result in erratic operation of the motor, nuisance tripping, and/or permanent damage to the drive. Remove power correction capacitors before proceeding. Failure to observe the precaution could result in damage to, or destruction of, the equipment.

- The internal circuits of the inverter will be damaged if the incoming power is connected and applied to output terminals (U, V, W).
- Use ring terminals with insulated barrels when wiring the input power and motor wiring.
- Do not leave wire fragments inside the inverter as they can cause faults, breakdowns, and malfunctions.
- For input and output, use wires with sufficient size to ensure voltage drop of less than 2%.
- Motor torque may decrease when operating at low frequencies and there is a long distance from the drive to the motor. For applications requiring operation at low frequencies, ensure that the motor is close to the drive or that the wire gauge is large enough to prohibit excessive voltage drop.
- The main circuit of the inverter contains high frequency noise, and can hinder communication equipment near the inverter. To reduce noise, install line noise filters on the input side of the inverter.
- Always ensure the LCD display and the DC bus voltage indicator LED are OFF before working on the drive or connected equipment. The DC bus capacitors may hold high-voltage even after the power is disconnected. Use caution to prevent the possibility of personal injury.
- A contactor or other device that routinely disconnects and reapplies the AC line to the drive to start and stop the motor can cause drive hardware damage. The drive is designed to use control input signals that will start and stop the motor. If used, the input device must not exceed one operation per minute or drive damage can occur. Failure to observe this precaution can result in damage to, or destruction of, the equipment.
- If an M-Contactor is installed, the control must be disabled for at least 200mSec before the M-Contactor is opened. If the M-Contactor is opened while the control is supplying voltage and the current to the motor, the control may be damaged. Before the control is enabled, the M-Contactor must be closed for at least 200mSec.

4.4 Power Disconnect

A power disconnect should be installed between the input power service and the drive for a fail safe method to disconnect power. The drive will remain in a powered-up condition until all input power is removed from the drive and the internal bus voltage is depleted.

4.5 Protective Devices

Recommended fuse sizes are based on the following:

115% of maximum continuous current for time delay

150% of maximum continuous current for Fast or Very Fast action

Note: These recommendations do not consider harmonic currents or ambient temperature greater than 45°C. Be sure a suitable input power protection device is installed. Use the recommended fuses and wire sizes shown in Table 4-1 (based on the use of copper conductor wire rated at 75°C and specified for NEMA B motors).

Fast Action Fuses: 240VAC, Buss®KTN; 460VAC, Buss®KTS

Very Fast Action: 240VAC, Buss®JJN; 460VAC, Buss®JJS

Semiconductor: 240VAC, Ferraz Shawmut A50QS

Buss® is a trademark of Cooper Industries, Inc.

4.6 Electrical Installation

All interconnection wires between the drive, AC power source, motor, host control and any operator interface stations should be in metal conduits or shielded cable must be used. Use listed closed loop connectors that are of appropriate size for wire gauge being used. Connectors are to be installed using crimp tool specified by the manufacturer of the connector. Only class 1 wiring should be used.

4.6.1 Input Power Connections

All cables must be shielded and the shields must be grounded at the enclosure cable entrance.

1. Connect the three phase input power wires to an appropriate interrupter and protection
2. Connect the three phase AC input power leads to terminate R, S and T of the power input terminal board (See figure 4-2).

Table 4-3: Fuse & Wire Size and Terminal Torque Tightening Specifications

Inverter Rating		External Fuse Ratings		Tightening Torque		Wire Size			
						R(L1),S(L2),T(L3), & G		U, V, W	
Volts	HP	Current	Voltage	lb-in	N-m	AWG or kcmil	mm ²	AWG or kcmil	mm ²
230 V	7.5HP	40	250	6.2 to 10.6	0.70 to 1.20	10	5.5	10	5.5
	10HP	60				8	8	8	8
	15HP	80		21.2 to 27.6	2.40 to 3.12	6	14	6	14
	20HP	100		26.6 to 33.2	3.00 to 3.75	4	22	4	22
	25HP	125		53.1 to 79.7	6.00 to 9.01	2	38	2	38
	30HP	150				2	38	2	38
	40HP	200				1/0	60	1/0	60
460 V	7.5HP	20	600	6.2 to 10.6	0.70 to 1.20	12	3.5	12	3.5
	10HP	30				12	3.5	12	3.5
	15HP	40				10	5.5	10	5.5
	20HP	60		26.6 to 33.2	3.00 to 3.75	8	8	8	8
	25HP	70		53.1 to 79.7	6.00 to 9.01	6	14	6	14
	30HP	80				4	22	4	22
	40HP	100				4	22	4	22
	50HP	125		58.4 to 75.9	6.60 to 8.58	2	38	2	38
	60HP	150				2	38	2	38
	75HP	175				2	38	2	38
	100HP	250		77.9 to 105.9	8.80 to 11.97	1/0	60	1/0	60
	125HP	250		158.3 to 186.6	17.89 to 21.09	1/0	60	1/0	60
	150HP	350				4/0	100	4/0	100
	200HP	400				4/0	100	4/0	100
	250HP	450				300	150	300	150
	300HP	700				400	200	400	200
	350HP	700				400	200	400	200
	400HP	800				500	250	500	250
	500HP	900				700	325	700	325
600HP	1000	2x400	2x200			2x400	2x200		
700HP	1200	2 x 500	2x250	2x500	2x250				

Note: Wire sizes based on 75°C copper wire.

Fuses based on 45°C ambient, max continuous output and no harmonic current.

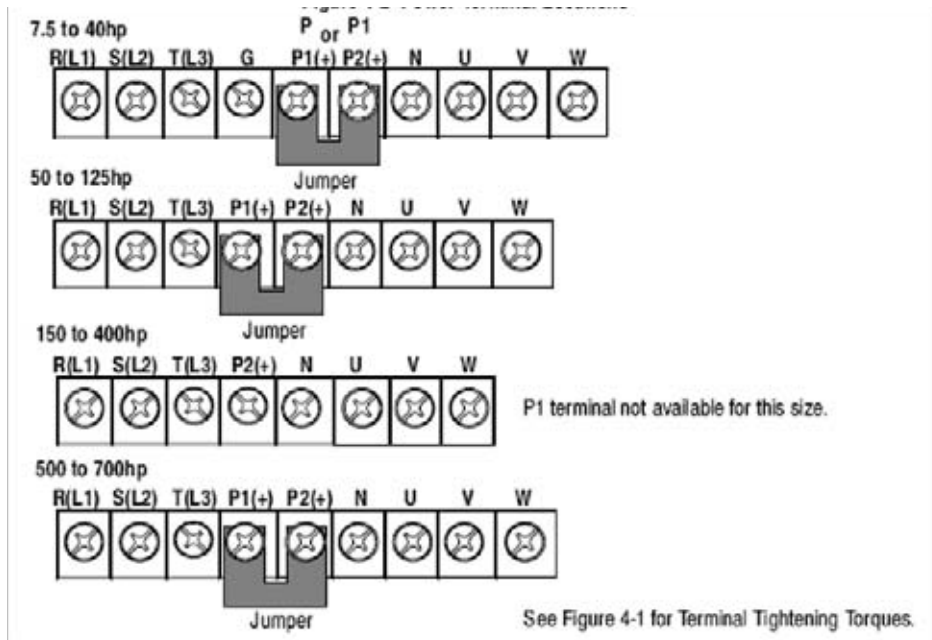


Figure 4-2: Terminal Locations

4.6.2 Motor Connections

All cables must be shielded and the shields must be grounded at the enclosure cable entrance.

1. Remove covers. Cover removal is described in Chapter 3 of this manual.
2. Connect the motor leads to terminal U, V, and W (see figure 4-2 for location).

Long Motor Leads

The wire leads that connect the motor to the control are critical in terms of sizing, shielding and the cable characteristics. Short cable runs are usually trouble free but fault-monitoring circuitry can produce numerous faults when long cables (over 100 feet) are used. For 100 to 300ft, reactor is recommended if motor does not have ISR wire. Over 300 ft, Baldor recommends adding an optional load reactor to the output of the control. For reactors, refer to Appendix D of this manual.

The load reactor and/or common mode choke should be placed in close physical proximity to the control. Unexpected faults may occur due to excessive charging current required for motor cable capacitance.

If you use long motor leads and experience trips due to current overload conditions and are not sure how to correctly size and connect the optional lead reactors, please contact your Baldor representative. Baldor is always glad to assist.

4.7 Power Terminals

Table 4-4: Power Terminals

Symbol	Description
R(L1), S(L2), T(L3)	AC Line Voltage Input
G	Earth Ground
P1(+), P2(+)	External DC Link Inductor (P1(+)-P2(+)) Connection Terminals (Jumper must be removed).
P2(+), N(-) or P(+), N(-)	DB Unit (P2(+)-N(-)) Connection Terminals
U, V, W	3 Phase Power Output Terminals to Motor

Note: For single phase power input, make connections to R(L1) and S(L2). Derate drive by 50%.

4.7.1 Power and Motor Connection Example (7.5 HP to 40 HP inverters)

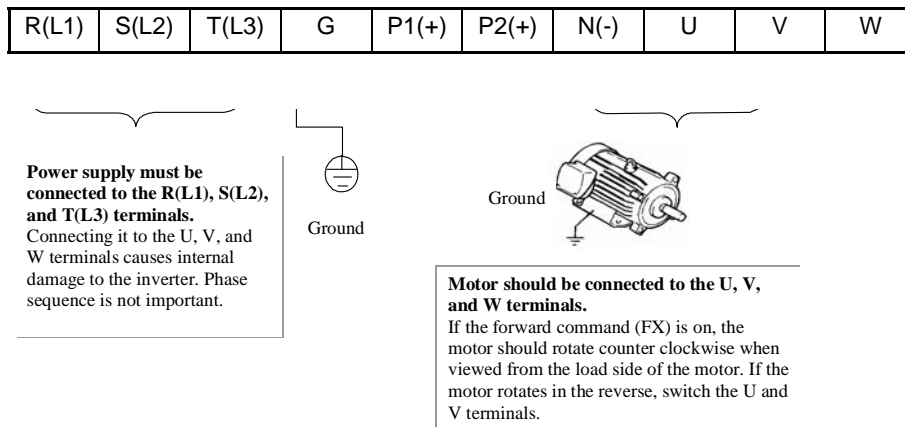


Figure 4-3: Power and Motor Connection Example (7.5HP to 40HP Inverters)

4.7.2 Powerup Procedure

1. Remove all power from the drive
2. Disconnect the motor from the load (including coupling and/or inertia wheels)
3. Turn power on. Be sure there are no faults
4. Set the following parameters for the values displayed on the motor nameplate:

BAS01 Motor hp	BAS02 Motor Voltage	BAS03 Motor Base Frequency
BAS04 Motor Current	BAS05 Motor RPM	
5. Verify the following parameter values are set:

BAS08 Start Stop Source = Keypad	BAS09 Speed Reference Source = Keypad
----------------------------------	---------------------------------------

WARNING: The motor shaft will rotate during this procedure. Be certain that unexpected motor shaft movement will not cause injury to personnel or damage to equipment.

6. Press FWD key and the motor shaft should rotate
7. Press STOP key and the motor shaft should stop
8. Press REV key and the motor shaft should rotate
9. Press STOP key and the motor shaft should stop

10. Remove all power from the drive
11. Couple the motor to its load
12. Verify freedom of motion of motor shaft
13. Verify the motor coupling is tight without backlash

4.8 Connection Diagrams

4.8.1 Connection Diagram for 7.5 HP ~ 40 HP Drives

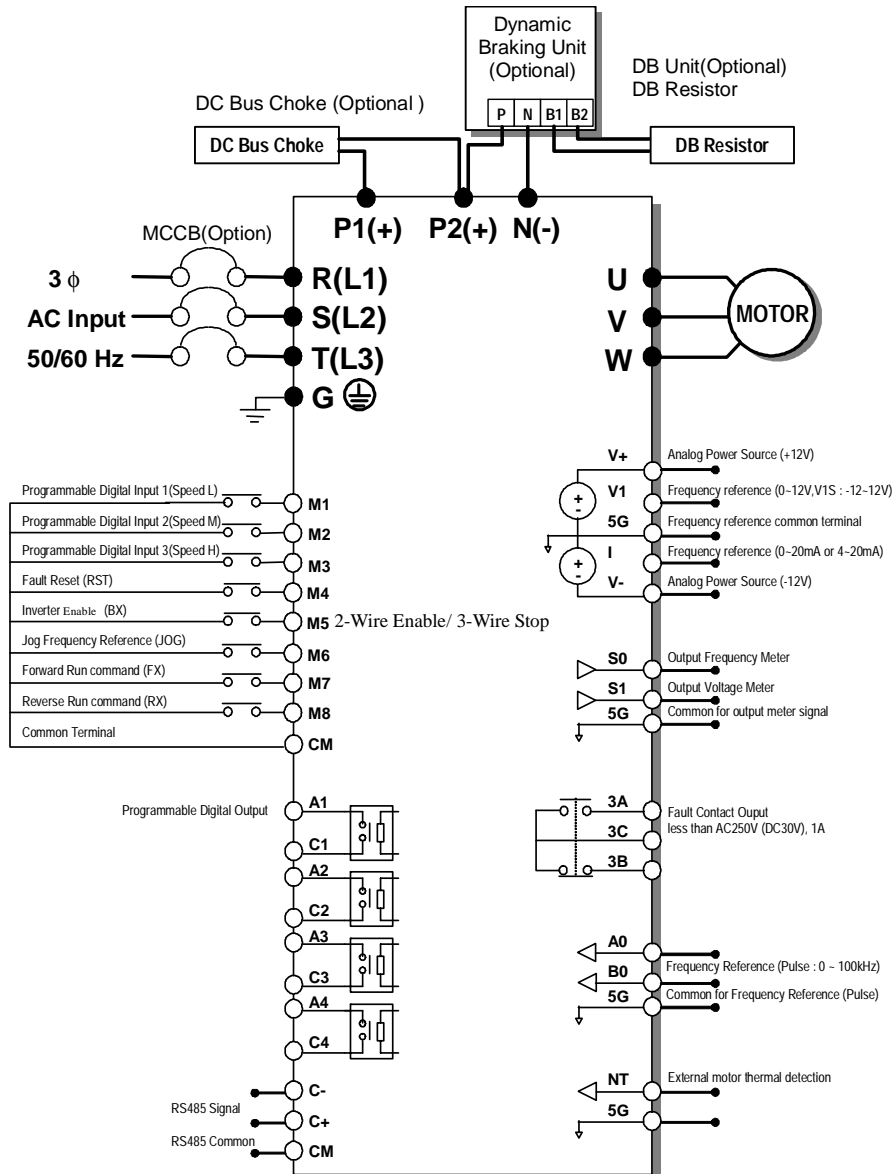


Figure 4-4: Connection Diagram 7.5HP to 40HP Drives

Note: 5G is Common Ground for Analog Input/Output.

Note: Use Terminal V1 for V1, V1S (0 to 12V, -12 to 12V) input.

4.8.2 Connection Diagram for 50 HP ~ 125 HP and 500 HP ~ 700 HP Drives

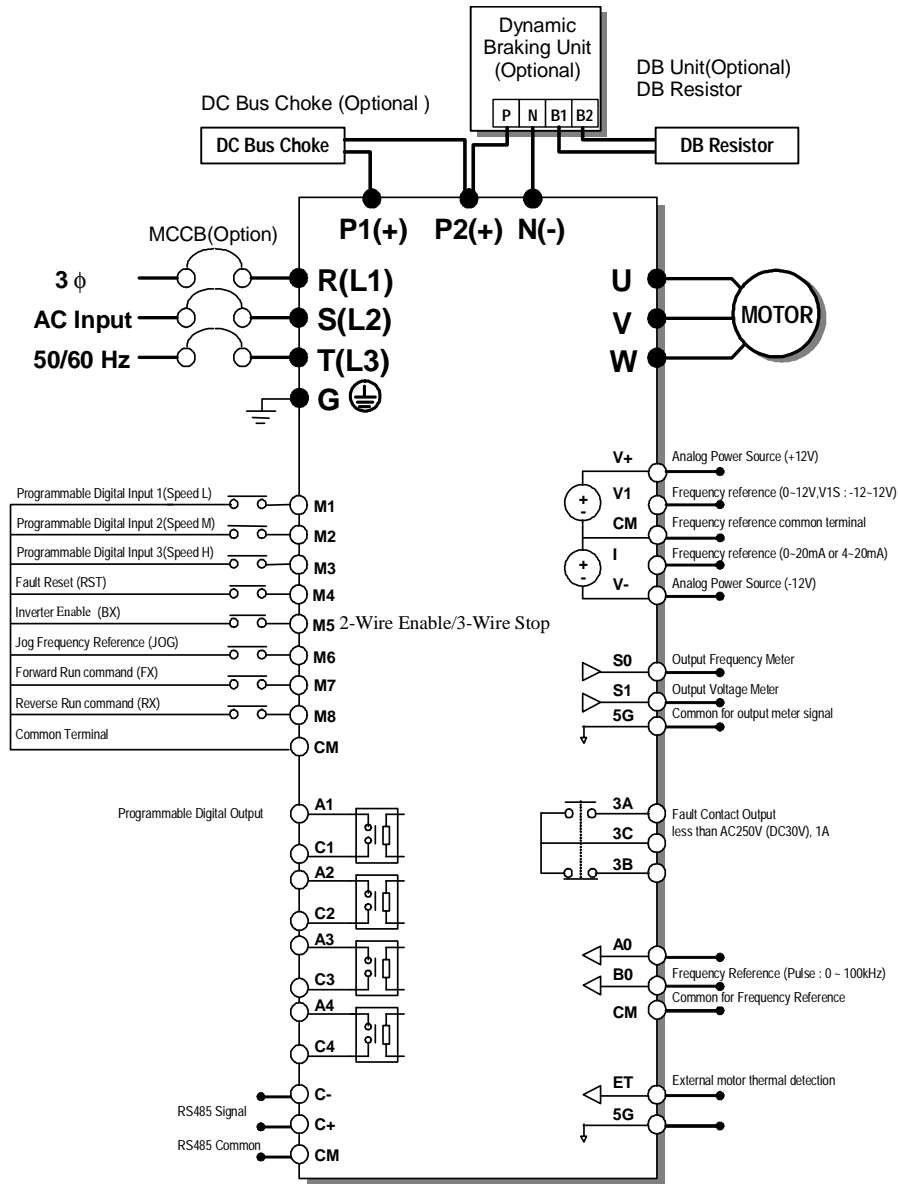


Figure 4-5: Connection Diagram for 50HP to 125HP and 500HP to 700HP Drives

Note: 5G is Common Ground for Analog Meter Output (S0, S1) and external Motor Thermal Detection (ET).

Note: Use Terminal V1 for V1, V1S (0 to 12V, -12 to 12V) input.

4.8.3 Connection Diagram for 150 HP ~ 400 HP Drives

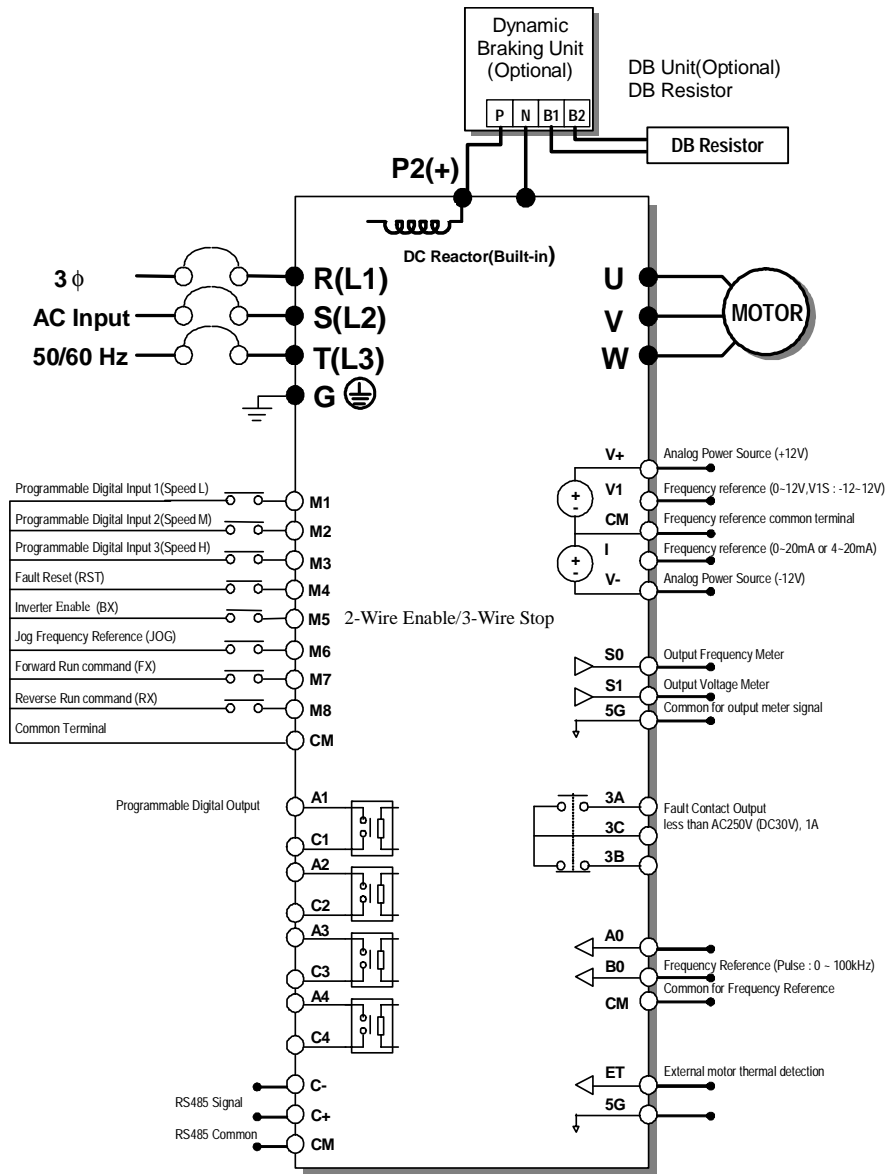


Figure 4-6: Connection Diagram 150HP to 400HP Drives

Note: 5G is Common Ground for Analog Meter Output (SO, S1) and external Motor Thermal Detection (ET).

Note: Use Terminal V1 for V1, V1S (0 to 12V, -12 to 12V) input.

This chapter describes how to connect the signal and I/O terminal strip for stop and remote control signals.

WARNING: This drive contains high voltage capacitors that take time to discharge after removal of main supply. Before working on the drive, ensure isolation of main supply from line inputs. Wait ten (10) minutes for capacitors to discharge to safe voltage levels. Failure to observe this precaution could result in severe bodily injury or loss of life.

WARNING: Only qualified electrical personnel familiar with the construction and operation of this equipment and the hazards involved should install, adjust, operate, or service this equipment. Read and understand this manual and other applicable manuals in their entirety before proceeding. Failure to observe this precaution could result in severe bodily injury or loss of life.

WARNING: DC Bus capacitors retain hazardous voltages after input power has been disconnected. After disconnecting input power, wait ten (10) minutes for the DC Bus capacitors to discharge and then check the voltage with a voltmeter to ensure the DC bus capacitors are discharged before touching any internal components. Failure to observe this precaution could result in severe bodily injury or loss of life.

CAUTION: Apply the rated torque to terminal screws. Loose screws can cause short circuit and malfunction. Tightening the screws too much can damage the terminals and cause short circuit and malfunction.

CAUTION: Do not leave wire fragments inside the inverter. Wire fragments can cause faults, breakdowns and malfunctions.

5.1 Motor Start/Stop Precautions

WARNING: The drive start/stop control circuitry includes solid-state components. If hazards due to accidental contact with moving machinery or unintentional flow of liquid, gas or solids exist, an additional hardwired stop circuit may be required to remove the AC line to the drive. When the AC line is removed, there will be a loss of any inherent regenerative braking effect that might be present - the motor will coast to a stop. An auxiliary braking method may be required.

CAUTION: A contactor or other device that routinely disconnects and reapplies the AC line to the drive to start and stop the motor can cause drive hardware damage. The drive is designed to use control input signals that will start and stop the motor. If used, the input device must not exceed one operation per minute or drive damage can occur. Failure to observe this precaution can result in damage to, or destruction of equipment.

Important points to remember about I/O wiring:

- Always use copper wire.
- Wire with an insulation rating of 600V or greater is recommended.
- Control and signal wires should be separated from power wires by at least 1 foot (0.3 meters).

5.2 Stop Circuit Requirements

WARNING: You must provide an external, hardwired emergency stop circuit outside of the drive circuitry. This circuit must disable the system in case of improper operation. Uncontrolled machine operation can result if this procedure is not followed. Failure to observe this precaution could result in bodily injury.

In addition to the operational stop, you must provide a hardwired emergency stop external to the drive. The emergency stop circuit must contain only hardwired electromechanical components. Operation of the emergency stop must not depend on electronic logic (hardware or software) or on the communication of commands over an electronic network or link. Note that the hardwired emergency stop can be used at any time to stop the drive.

5.2.1 Wiring Precautions

CM and 5G terminals are insulated from each other. Do not connect these terminals together or to the power ground.

Use shielded wires or twisted wires for control circuit wiring, and separate these wires from the main power circuits and other high voltage circuits (115V relay circuits).

28 AWG (0.0804mm²) to 16 AWG (1.25mm²) wire is recommended for connections to TER1 and TER2 control terminals.

22 AWG (0.33mm²) to 14 AWG (2.0mm²) wire is recommended for connections to TER3 and TER4 control terminals.

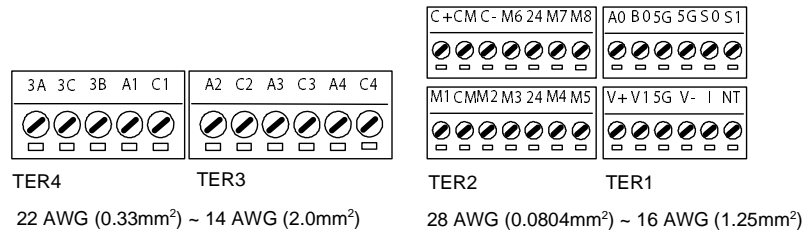


Figure 5-1: Control Terminal Diagram

5.2.2 Maximum Control Wire Length Recommendations

Do not exceed control wiring length of 100 feet (30 meters). Control signal cable length is highly dependent on electrical environment and installation practices. To improve noise immunity, the I/O terminal block common must be connected to ground terminal/protective earth.

5.2.3 Check Points on Wiring

- Program the drive to disable auto restart after power failure. Otherwise, the inverter will automatically start upon return of power.
- Do not install jumpers on the control circuit input terminals such as FX, RX.

5.3 Terminal Wiring (Control I/O)

5.3.1 7.5 to 40HP (230V/460V Class)

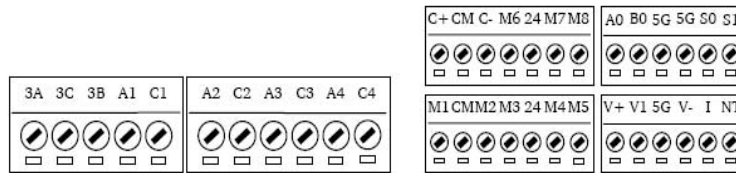
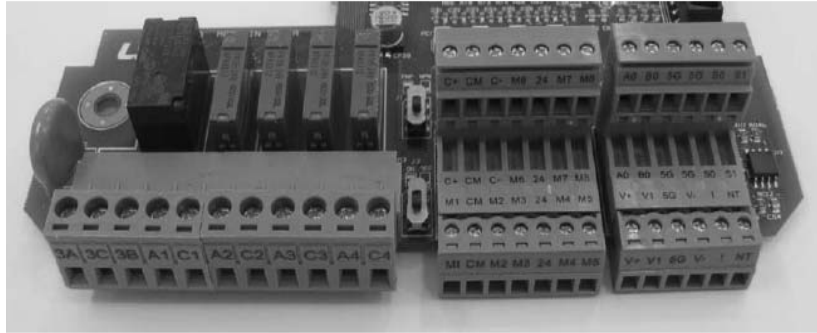


Figure 5-2: 7.5 to 40HP Terminal Wiring

5.3.2 50 to 700HP (460V Class)

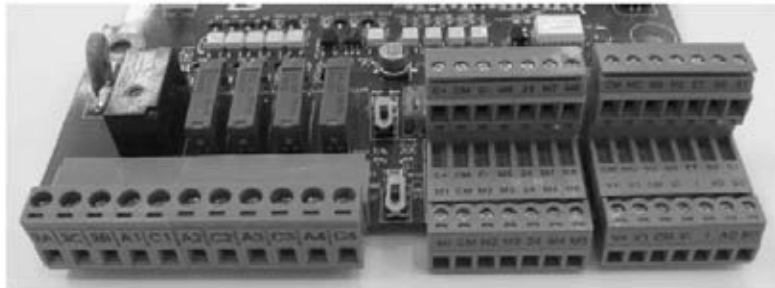


Figure 5-3: 50 to 700HP (460V Class)

5.3.3 Control Terminal Descriptions

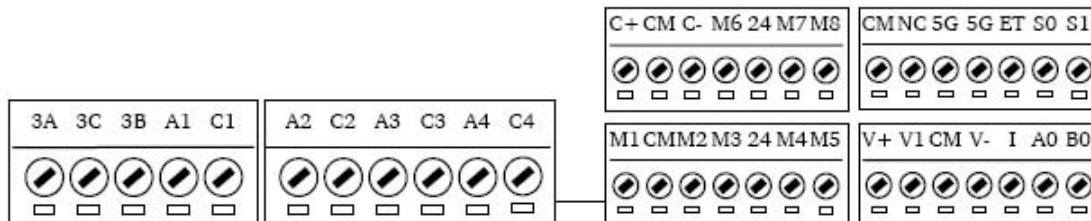


Figure 5-4: 50 to 700 HP Terminal Wiring

Table 5-1: Control Terminal Descriptions

Type	Symbol	Name	Description	Parameter	
Inputs	Digital Inputs (Factory Defaults Shown)	M1, M2, M3	Programmable Digital Input 1, 2, 3	Defines Programmable Digital Inputs. (Preset Speeds 1, 2, 3)	I/O - 20, 21,22
		FX [M7]	Forward Run Command	Forward Run When Closed and Stopped When Open.	I/O - 26
		RX [M8]	Reverse Run Command	Reverse Run When Closed and Stopped When Open.	I/O - 27
		JOG [M6]	Jog Frequency Reference	Runs at Jog Frequency when the Jog Signal is ON. The Direction is set by the FX (or RX) Signal.	I/O - 25
		BX [M5]	Inverter Enable 2-Wire Enable 3-Wire Stop	When the BX Signal is Open the Output of the Inverter is Turned Off. When Motor uses an Electrical Brake to Stop, BX is used to Turn Off the Output Signal. Take caution when BX Signal is OFF (Not Turned Off by Latching) and FX Signal (or RX Signal) is ON. If so, motor continues to Run.	I/O - 24
		RST [M4]	Fault Reset	Used for Fault Reset.	I/O - 23
		CM	Sequence Common (NPN) / 24V Com.	Common terminal for NPN contact input and also common for the external 24V supply.	
		24	Sequence Common (PNP) / Ext. +24Vdc supply	Common 24V terminal for PNP contact input. Can also be used as a 24Vdc external power supply (maximum output: +24V, 50mA)	
	Analog inputs	V+, V-	Analog Power Source (+12V,-12V)	Power supply for Analog Frequency Setting. Maximum Output: +12V, 100mA, -12V, 100mA.	
		V1	Frequency Reference (Voltage)	Used by a DC 0-10V or -10to 10 V input to set the frequency reference. (Input impedance is 20 k)	
		I	Frequency Reference (Current)	Used by a 4-20mA input to set the frequency reference. (Input impedance is 249 ohms)	
		A0, B0	Frequency Reference (Pulse)	Used by a pulse input to set the frequency reference.	
		5G (7.5HP to 40HP) CM (50HP to 700HP)	Frequency Reference Common Terminal	Common Terminal for Analog Frequency Reference Signal.	
	External motor thermal detection	NT(7.5 HP to 40 HP) ET (50 HP to 700 HP)	External motor thermal detection	Motor thermal sensor input. Used to prevent motor from overheating by using a NTC or PTC thermal sensor.	
		5G	Common for NT (or ET)	Common Terminal for External motor thermal detection.	
	RS485 terminals	C+, C-	RS485 signal High, Low	RS485 signal (See RS485 communication in Appendix E of this manual for more details.)	
		CM	RS485 common	Common Ground. Terminal for RS485 interface.	
	Outputs	Voltage	S0, S1,5G	Programmable Voltage Output	Voltage output for one of the following: Output Frequency, Output Current, Output Voltage, DC Link Voltage. Default is set to Output Frequency. (Maximum Output Voltage and Output Current are 0-12V and 1mA).
3A N.O., 3B N.C., 3C Com			Fault Contact Output	Energizes when a fault is present. (AC250V, 1A; DC30V, 1A) Fault: 3A-3C Closed Normal: 3B-3C Closed	
Relay		A1 to A4, C1 to C4	Programmable Digital Output	Defined by Programmable Digital Output terminal settings (AC250V, 1A; DC30V, 1A)	I/O - 76 -79 = A1 to A4 Common = C1 to C4

Note: M1 to M8 terminals are User Programmable.

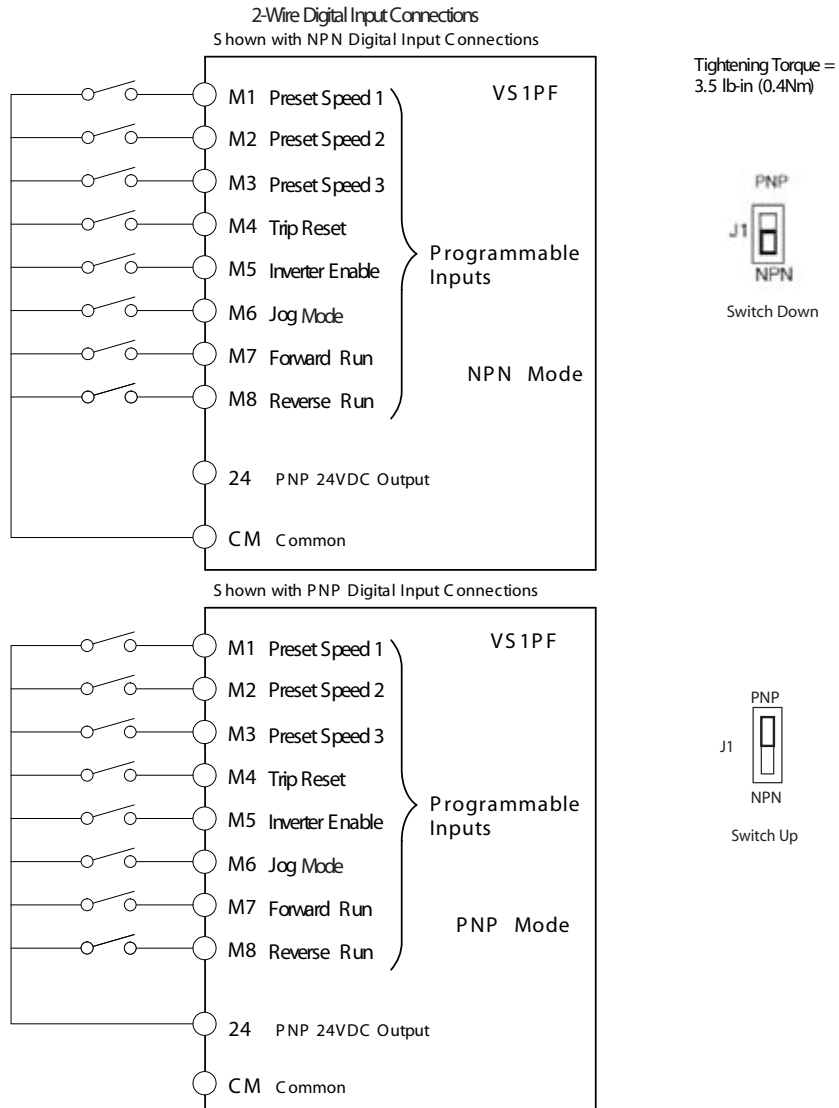


Figure 5-5: 2-Wire Digital Input Connections

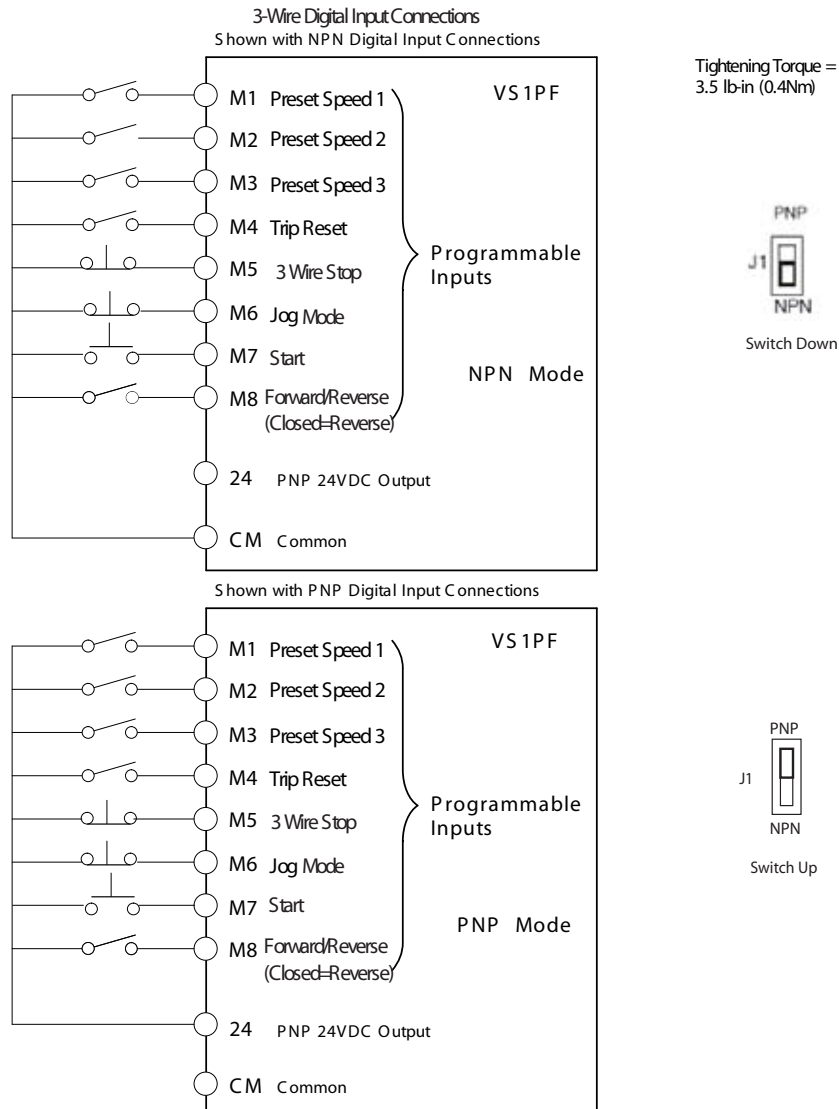


Figure 5-6: 3-Wire Digital Input Connections

5.4 Sink Mode (NPN mode) / Source Mode (PNP mode)

The VS1PF provides Sink/Source(NPN/PNP) modes for digital input terminals. The logic of the input terminals can be set to Sink Mode (NPN mode) or Source mode (PNP mode) by using the J1 switch. Configuration is shown below.

Sink mode (NPN mode)

Put J1 switch down to set to Sink mode (NPN mode). CM terminal (24V GND) is common terminal for digital inputs. The factory default is Sink mode (NPN mode).

Source mode (PNP mode) - Internal Power Supply used

Put J1 switch up to set to Source mode (PNP mode). Terminal 24 (24V Power Supply) is supply terminal for digital inputs.

Source mode (PNP mode) - External Power Supply used

Put J1 switch up to set to Source mode (PNP mode). To use an external 24V Power supply, provide a connection between the external Power Supply (-) terminal and teh CM(24V Common) terminal.

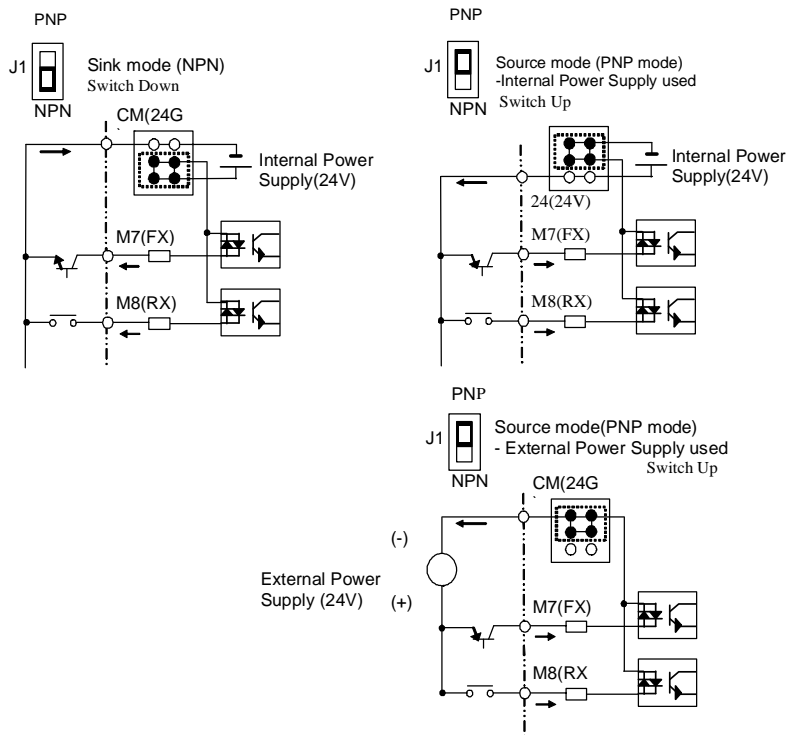


Figure 5-7: Sink Mode/Source Mode Configuration

NOTE: I/O terminals labeled “Common” **are not** referenced to the safety ground terminal and are designed to greatly reduce common mode interference.

CAUTION: Driving the 4-20mA analog input from a voltage source could cause component damage. Verify proper configuration prior to applying input signals.

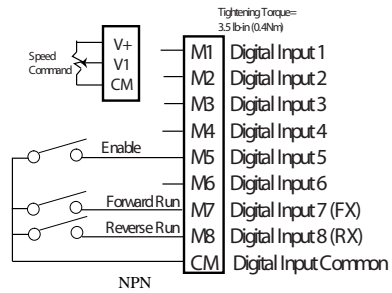
5.5 Connection Mode Examples

5.5.1 2-Wire with Speed Pot Control

Run/Stop operation is controlled by M7 and M8 but motor speeds is controlled by the Speed Pot (V1).

Changes from Factory Settings:

Parameter	Setting
FN2-60	Drive Mode = 0(V/F)
BAS-08	Start/Stop Source = 2 (2-WireCntl)
BAS-09	Speed Ref. Source = 2 (0-10V)
BAS-10	Accel Time = 15 sec
BAS-11	Decel Time = 25 sec
IO-1	Filter TC for V1 input = 10
IO-2	Min Volts for V1 input = 0V
IO-3	Min Freq for Min Volts = 0.00Hz
IO-4	Max Volts for V1 Input = 10V
IO-5	Max Freq for Max Volts = 60.0Hz
IO-26	Digital Input 7=FX (Forward Run)
IO-27	Digital Input 8=RX (Reverse Run)



M7	CLOSED Motor starts to rotate in Forward direction with Accel time BAS-10 to speed set by pot. OPEN Motor decelerates to stop with Decel Time BAS-11.
M8	CLOSED Motor starts to rotate in Reverse direction with Accel time BAS-10 to speed set by pot. OPEN Motor decelerates to stop with Decel Time BAS-11.

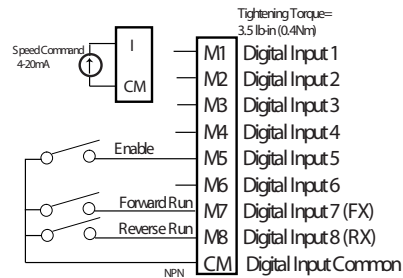
Figure 5-8: 2-Wire with Speed Pot Control Connection Diagram

5.5.2 2-Wire with 4-20mA Control

Run/Stop operation is controlled by M7 and M8 but motor speed is controlled by the 4-20mA Input(1).

Changes from Factory Settings:

Parameter	Setting
FN2-60	Drive Mode = 0(V/F)
BAS-08	Start/Stop Source = 2 (2-WireCntl)
BAS-09	Speed Ref. Source = 3 (4-20mA)
BAS-10	Accel Time = 15 sec
BAS-11	Decel Time = 25 sec
IO-6	Filter TC for 4-20 input = 10
IO-7	Min A for I input = 4mA
IO-8	Min Freq for Min Volts = 0.00Hz
IO-9	Max A for I Input = 10V
IO-10	Max Freq for Max Volts = 60.0Hz
IO-26	Digital Input 7=FX (Forward Run)
IO-27	Digital Input 8=RX (Reverse Run)



M7	CLOSED Motor starts to rotate in Forward direction with Accel time BAS-10 to speed set by pot. OPEN Motor decelerates to stop with Decel Time BAS-11.
M8	CLOSED Motor starts to rotate in Reverse direction with Accel time BAS-10 to speed set by pot. OPEN Motor decelerates to stop with Decel Time BAS-11.

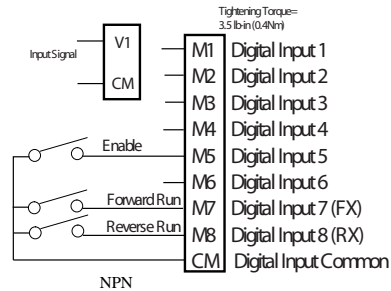
Figure 5-9: 2-Wire with 4-20MA Control

5.5.3 2-Wire with 0-10V Reference Control

Run/Stop operation is controlled by M7 and M8 but motor speed is controlled by a 0-10V signal.

Changes from Factory Settings:

Parameter	Setting
FN2-60	Drive Mode = 0(V/F)
BAS-08	Start/Stop Source = 2 (2-WireCtrl)
BAS-09	Speed Ref. Source = 2 (0-10V)
BAS-10	Accel Time = 15 sec
BAS-11	Decel Time = 25 sec
IO-1	Filter TC for V1 input = 10
IO-2	Min Volts for V1 input = 0V
IO-3	Min Freq for Min Volts = 0.00Hz
IO-4	Max Volts for V1 Input = 10V
IO-5	Max Freq for Max Volts = 60.0Hz
IO-26	Digital Input 7=FX (Forward Run)
IO-27	Digital Input 8=RX (Reverse Run)



- M7 CLOSED Motor starts to rotate in Forward direction with Accel time BAS-10 to speed set by input signal.
OPEN Motor decelerates to stop with Decel Time BAS-11.
- M8 CLOSED Motor starts to rotate in Reverse direction with Accel time BAS-10 to speed set by input signal.
OPEN Motor decelerates to stop with Decel Time BAS-11.

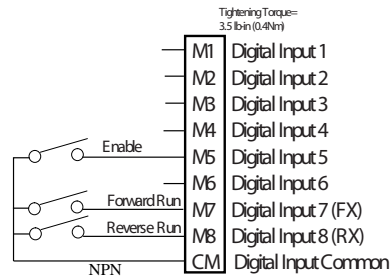
Figure 5-10: 2-Wire with 0-10V Reference Control

5.5.4 2-Wire Start/Stop with Keypad Reference

The Keypad mode allows the control to be operated from the keypad but the Run/Stop operation is controlled by M7 and M8.

Changes from Factory Settings:

Parameter	Setting
FN2-60	Drive Mode = 0(V/F)
BAS-08	Start/Stop Source = 2-WireCtrl
BAS-09	Speed Ref. Source = 0 (Keypad)
BAS-10	Accel Time = 15 sec
BAS-11	Decel Time = 25 sec
IO-26	Digital Input 7=FX (Forward Run)
IO-27	Digital Input 8=RX (Reverse Run)



- M7 CLOSED Motor starts to rotate in Forward direction with Accel time BAS-10.
OPEN Motor decelerates to stop with Decel Time BAS-11.
- M8 CLOSED Motor starts to rotate in Reverse direction with Accel time BAS-10.
OPEN Motor decelerates to stop with Decel Time BAS-11.

Figure 5-11: 2-Wire Start/Stop with Keypad Reference

5.5.5 2-Wire with EPOT Control

Run/Stop operation is controlled by M7 and M8 but motor speed is controlled by switches at Digital Inputs M1 and M2.

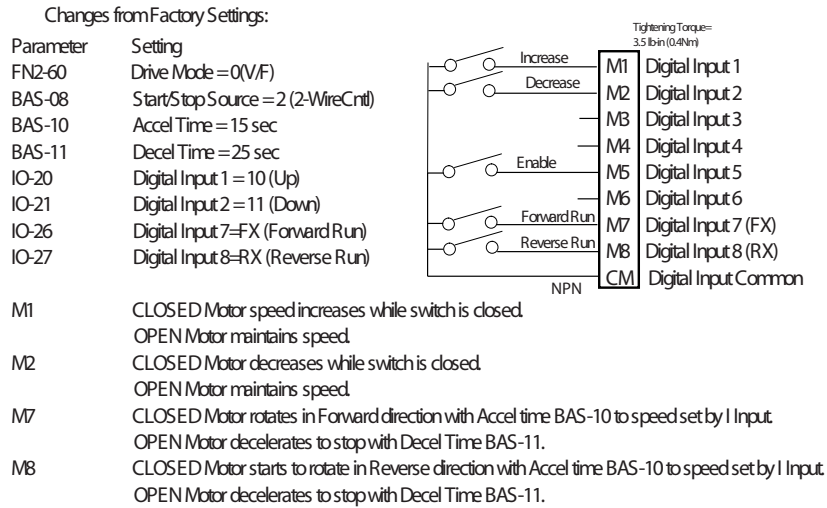


Figure 5-12: 2-Wire With EPOT Control

5.5.6 3-Wire with Speed Pot Control

Start/Direction/Stop is controlled by M7, M8, and M5 but motor speed is controlled by the Speed Pot (V1).

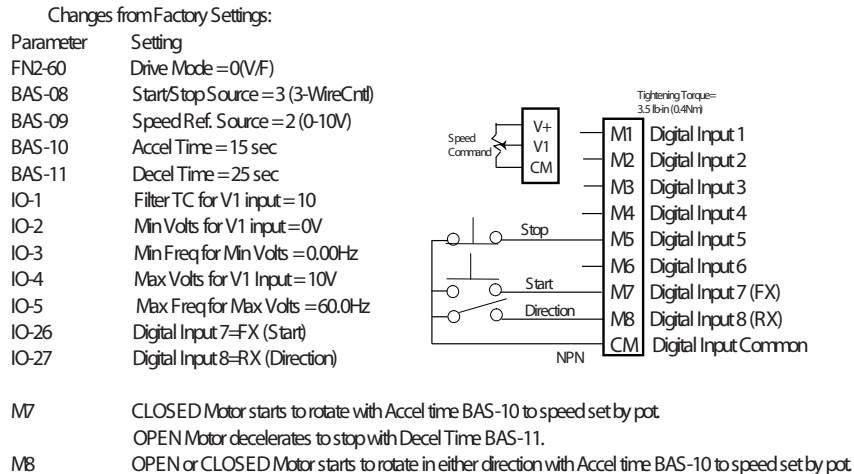


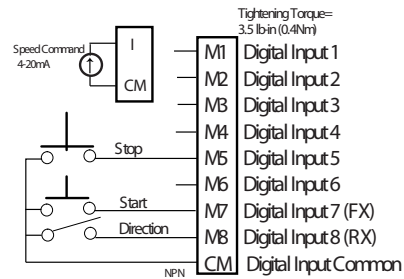
Figure 5-13: 3-Wire with Speed Pot Control

5.5.7 3-Wire with 4-20mA Control

Start/Direction/Stop is controlled by M7, M8, and M5 but motor speed is controlled by the 4-20mA Input (I).

Changes from Factory Settings:

Parameter	Setting
FN2-60	Drive Mode = 0(V/F)
BAS-08	Start/Stop Source = 3 (3-WireCtrl)
BAS-09	Speed Ref. Source = 3 (4-20mA)
BAS-10	Accel Time = 15 sec
BAS-11	Decel Time = 25 sec
IO-6	Filter TC for 4-20 input = 10
IO-7	Min A for I input = 4mA
IO-8	Min Freq for Min Volts = 0.00Hz
IO-9	Max A for I Input = 10V
IO-10	Max Freq for Max Volts = 60.0Hz
IO-26	Digital Input 7=FX (Start)
IO-27	Digital Input 8=RX (Direction)



- M7 CLOSED Motor starts to rotate with Accel time BAS-10 to speed set by I input.
OPEN Motor decelerates to stop with Decel Time BAS-11.
- M8 OPEN or CLOSED Motor starts to rotate in either direction with Accel time BAS-10 to speed set by I input.

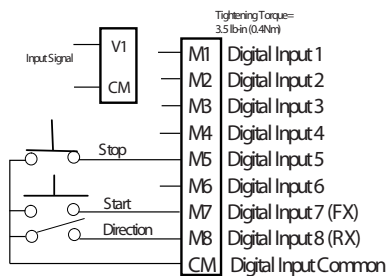
Figure 5-14: 3-Wire with 4-20mA Control

5.5.8 3-Wire with 0-10V Reference Control

Start/Direction/Stop is controlled by M7, M8, and M5 but motor speed is controlled by a 0-10V signal.

Changes from Factory Settings:

Parameter	Setting
FN2-60	Drive Mode = 0(V/F)
BAS-08	Start/Stop Source = 3 (3-WireCtrl)
BAS-09	Speed Ref. Source = 2 (0-10V)
BAS-10	Accel Time = 15 sec
BAS-11	Decel Time = 25 sec
IO-1	Filter TC for V1 input = 10
IO-2	Min Volts for V1 input = 0V
IO-3	Min Freq for Min Volts = 0.00Hz
IO-4	Max Volts for V1 Input = 10V
IO-5	Max Freq for Max Volts = 60.0Hz
IO-26	Digital Input 7=FX (Start)
IO-27	Digital Input 8=RX (Direction)



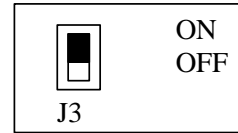
- M7 CLOSED Motor starts to rotate with Accel time BAS-10 to speed set by input signal.
OPEN Motor decelerates to stop with Decel Time BAS-11.
- M8 OPEN or CLOSED Motor starts to rotate in either direction with Accel time BAS-10 to speed set by input signal.

Figure 5-15: 3-Wire with 0-10V Reference Control

5.6 RS485 Circuit Wiring

Table 5-2: RS485 Circuit Wiring

C+	CM	C-	M6	24	M7	M8
M1	CM	M2	M3	24	M4	M5



Use C+ (RS485 signal High), C- (RS485 signal LOW) in TER 2. Turn the J3 switch ON (Upward) to connect the termination resistor (120 ohm). J3 switch is on the left side of the TER2.

Table 5-3: Communication Specifications

Item	Specification
Transmission type	Bus method, Multi drop Link System
Number of inverters	Up to 31
Transmission distance	Within 3900 ft (1200m) Max. (2300 ft desired)
Recommendable cable	0.75mm ² (18AWG), Shielded Twisted-pair Cable

Table 5-4: Communication Terminals Specifications

Item	Specification
Installation	C+, C-, CM terminals on the control terminal block
Power supply	Insulated from the inverter power supply

Refer to Appendix E for additional information regarding RS485 communications.

5.7 Technical Specifications

Please see Appendix A - Technical Specifications for detailed electrical information on the VS1PF Drive.

6.1 Mode Descriptions

The VS1PF drive can be in several different modes that each have a different function. The information displayed on the LCD portion of the keypad as well as the function of the keys may change based upon which mode the drive is in.

The following sub-sections give a definition of each of the modes.

6.1.1 Operation Mode

The operation mode is the mode from which the drive is normally run (Start/Stop/Adjust Speed). The functionality of the keypad is determined by how the drive is programmed for the source of logic control and/or for the source of the speed reference. For example, if the keypad is set as the source for forward, reverse, and stop commands and the keypad is set as the source for the speed reference, then the keypad provides the ability to start and stop the drive as well as modifying the commanded speed.

The operation mode also provides a monitor display that indicates several key states and variables that are useful while running the drive (e.g. speed, current).

The operation mode will be entered automatically upon power-up of the drive, regardless of the mode the drive was in prior to removing power. There is also a time-out setting in the drive that will cause the drive to automatically return to the operation mode should there not be any keypad activity for the user selectable time period.

6.1.2 Group Mode (Program)

The VS1PF parameters are organized into eight parameter groups. To view/program the parameters, the "Group" mode is used to select the desired parameter group.

6.1.3 Parameter Mode (Program)

The parameter mode consists of two modes defined in the following sections.

6.1.3.1 Parameter View Mode

This level is entered from the "Group" mode. This mode is used to view parameter values within the selected group.

6.1.3.2 Parameter Edit Mode

The mode that is used to modify the setting/value of the VS1PF is defined as the "Parameter Edit Mode". This mode is accessed from the "Parameter View Mode".

6.2 Keypad Components

The LCD keypad can display up to 32 alphanumeric characters (2 lines by 16 characters), and various settings can be checked directly from the display. The following is an illustration of the keypad with a description of the components.

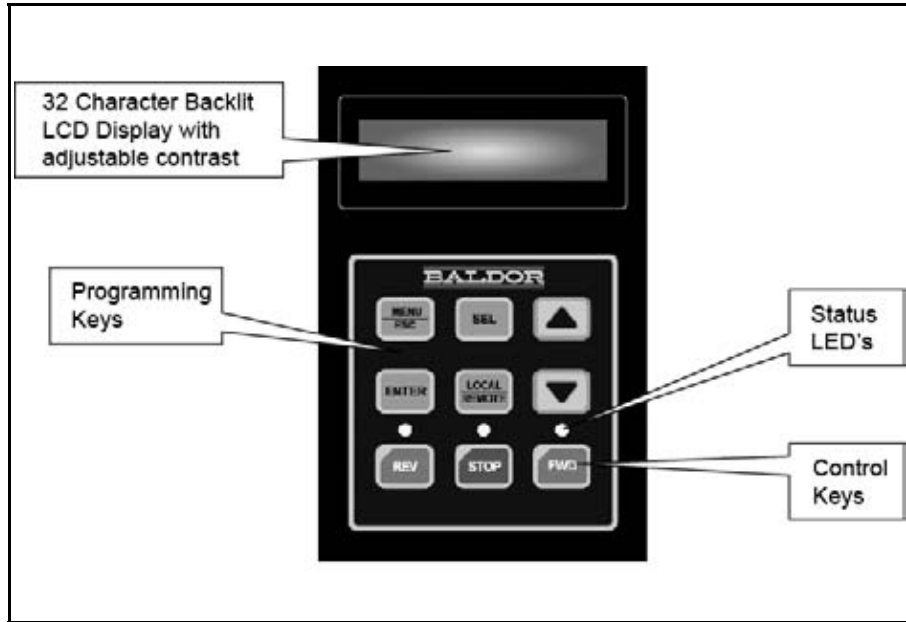


Figure 6-1: Keypad Components

6.2.1 Display Description

The backlit LCD display is used to monitor specific operational parameters of the drive as well as serving as the primary interface while viewing and modifying parameters.

6.2.2 LED Descriptions

There are 3 LED's located above the control keys (REV, STOP, FWD).

6.2.2.1 Reverse LED

The left-most LED, located above the REV control key, is green. If the drive is stopped, the LED will be off. Upon starting the drive in the reverse direction, the LED will flash at approximately a 2Hz rate while the motor is accelerating to the target speed. Upon reaching the target speed, the LED will illuminate continuously. If the direction is changed, the LED will flash while decelerating towards zero and will turn off once the motor has started rotating forward and is accelerating to the target speed in the forward direction. Upon stopping the drive, the LED will flash while decelerating and then will turn off upon drive disable. If the drive is programmed for coast stop, the LED will turn off immediately upon execution of the stop command.

6.2.2.2 Stop / Fault LED

The center LED, located above the STOP control key, is red. If the drive is stopped but ready to run, the LED will be on continuously. If the drive is faulted or any other condition exists that will prohibit the drive from running when a start or run command is issued, the LED will be flashing at approximately a 2Hz rate. The LED will be off any time the drive is supplying power to the motor.

6.2.2.3 Forward LED

The right-most LED, located above the FWD control key, is green. If the drive is stopped, the LED will be off. Upon starting the drive in the forward direction, the LED will flash at approximately a 2Hz rate while the motor is accelerating to the target speed. Upon reaching the target speed, the LED will illuminate continuously. If the direction is changed, the LED will flash while decelerating towards zero and will turn off once the motor has started rotating reverse and is accelerating to the target speed in the reverse direction. Upon stopping the drive, the LED will flash while decelerating and then will turn off upon drive disable. If the drive is programmed for coast stop, the LED will turn off immediately upon execution of the stop command.

6.3 Key Description

Table 6-1: Key Descriptions




Graphic	Name	Function
	Stop/Reset	<p>All modes:</p> <ul style="list-style-type: none"> •If the drive is running, stops the drive, even if the keypad is not the control source (always active). •If the drive is not running and is faulted, resets the fault if the condition causing the fault has been remedied. •If the drive is not running and is not faulted, no action. •The stop button always takes priority over other commands.
	Stop Key	<p>All modes:</p> <ul style="list-style-type: none"> •If the keypad is not programmed as the control source, no action. •If forward operation of the drive is programmed to be inhibited, no action. •If the drive is stopped and faulted, no action, regardless of the control source. •If the drive is stopped, not faulted, and the keypad is programmed as the control source, the motor will start in the forward direction and continue to run upon release of the button. •If the drive is running in the reverse direction, the motor will decelerate to zero and then ramp to the programmed speed in the forward direction.
	Reverse	<p>All modes:</p> <ul style="list-style-type: none"> •If the keypad is not programmed as the control source, no action. •If reverse operation of the drive is programmed to be inhibited, no action. •If the drive is stopped and faulted, no action, regardless of the control source. •If the drive is stopped, not faulted, and the keypad is programmed as the control source, the motor will start in the reverse direction and continue to run upon release of the button. •If the drive is running in the forward direction, the motor will decelerate to zero and then ramp to the programmed speed in the reverse direction.

Table 6-1: Key Descriptions

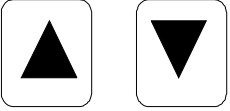




Graphic	Name	Function
	<p>Up/Down Arrows</p>	<p>Operation Mode:</p> <ul style="list-style-type: none"> •If the keypad is not programmed as the speed reference source (or as PID reference source), no action. •If the keypad is programmed as the speed reference source (or as PID reference source), the up/down keys change the commanded speed reference (or PID reference). <p>Group Mode:</p> <ul style="list-style-type: none"> •The up/down keys are used to scroll through the program groups. When the end of the list of program groups is reached, the continued actuation of the key in that direction will wrap around back to the opposite end of the list. <p>Parameter View Mode:</p> <ul style="list-style-type: none"> •The up/down keys will increment/decrement the parameter number that is being viewed within a group. When the highest parameter in the list is reached, a subsequent push of the up arrow will wrap around to the lowest parameter in the list. When the lowest parameter in the list is reached, the down arrow will wrap around to the highest parameter. <p>Parameter Edit Mode:</p> <ul style="list-style-type: none"> •The up/down keys will increment/decrement the value of the selected digit of the selected parameter. If the selected digit is incremented past 9, it will change to a 0 and automatically increment the digit to its left by 1 count. If the selected digit is decremented past 0, it will change to a 9 and automatically decrement the digit to its left by 1 count. If a value is incremented/decremented to its upper/lower limit, no further adjustments in that direction will take place.
	<p>Select</p>	<p>Operation Mode:</p> <p>Used to select various monitor screens. Multiple run time displays will be defined and the select key is used to switch between these screens.</p> <p>Group Mode:</p> <ul style="list-style-type: none"> •Same action as the up arrow <p>Parameter View Mode:</p> <ul style="list-style-type: none"> •Same action as the up arrow <p>Parameter Edit Mode:</p> <ul style="list-style-type: none"> •When the parameter edit mode is entered, the cursor will highlight the least significant digit (right-most digit) of the value for numerical parameters. The select key is used to select the next most significant digit (effectively move the cursor to the left by one position). When the left-most digit is reached, a subsequent push of the select key will cause the cursor to select the least significant digit of the value. •When editing the value of an enumerated parameter (a parameter where the value is chosen from a list), the select key has no action. •When editing the value of a bit parameter, the select key moves the cursor to the left by one bit. When the cursor is on the left-most bit, a subsequent push of the select key will cause the cursor to select the least significant bit of the parameter value.

Table 6-1: Key Descriptions

Graphic	Name	Function
	Enter	<p>Operation Mode:</p> <ul style="list-style-type: none"> •Used to select various monitor screens like the select key. The only difference is that it will navigate you through the monitor screens in the opposite sequence from the select key. <p>Group Mode:</p> <ul style="list-style-type: none"> •Used to enter the parameter view mode within the selected group. <p>Parameter View Mode:</p> <ul style="list-style-type: none"> •Used to enter the parameter edit mode for the selected parameter. <p>Parameter Edit Mode:</p> <ul style="list-style-type: none"> •Used to accept the new value for the parameter that is being edited.
	Menu/ Escape	<p>Operation Mode:</p> <ul style="list-style-type: none"> •Pressing the menu/escape key will place the drive in the group mode. <p>Group Mode:</p> <ul style="list-style-type: none"> •Pressing the menu/escape key will place the drive in the operation mode. <p>Parameter View Mode:</p> <ul style="list-style-type: none"> •Pressing the menu/escape key will place the drive in the group mode. <p>Parameter Edit Mode:</p> <ul style="list-style-type: none"> •Pressing the menu/escape key will abort the change in the parameter value and place the drive in the parameter view mode, restoring the previous value of the parameter prior to entering the parameter edit mode.
	Local/ Remote	<p>All Modes:</p> <ul style="list-style-type: none"> •Pressing the local/remote button will toggle between what is defined in the drive as local and remote. Parameters shall be implemented to define the action of this button. For example, the button could be disabled, it could be used to toggle the reference source, it could be used to toggle the control source, or it could be used to toggle both the reference and control source.

6.4 About Parameters

To program the drive for a specific application, you adjust the appropriate parameters. The parameters are used to define characteristics of the drive.

There are three types of parameters:

- Numbered List Parameters (Enumerated Parameters)

Numbered list parameters allow a selection from two or more options.

Each item is represented by a number.

Example: Start/Stop Source (BAS-08)

- Bit Parameters

Bit parameters have individual bits associated with features or conditions. If the bit is 0, the feature is off or the condition is false. If the bit is 1, the feature is on or the condition is true.

Example: Flying Start Selection (FN2-22)

- **Numeric Parameters**

These parameters have a single numerical value (for example, 0.1 volts).

Example: Motor Nameplate Current (BAS-04)

Parameters also have an attribute that defines whether the parameter is configurable, tunable, or read-only.

Configurable parameters can be adjusted or changed only while the drive is stopped.

Tunable parameters can be adjusted or changed while the drive is running or stopped.

Read-only parameters cannot be adjusted (can only be viewed).

Parameters have an additional attribute that determines when the user has access to the parameter. The two levels of access are BASIC and ADVANCED. The access level for parameters is set in parameter FN2-90.

6.5 How Parameters are Organized

Parameters are organized into six standard parameter groups and two additional option groups which only appear when the appropriate option is installed on the drive.

- The **Basic Parameter Group (BAS)** contains parameters that are very basic in nature and typically what are required to start up most applications.
- The **Drive Parameter Group (DRV)** contains parameters that allow the implementation of the more common application enhancements.
- The **Function 1 Parameter Group (FN1)** contains parameters that allow the implementation of custom setup of certain applications and standard operation modes of the drive.
- The **Function 2 Parameter Group (FN2)** contains parameters that allow the implementation of custom setup of certain applications and standard operation modes of the drive.
- The **I/O Parameter Group (I/O)** contains parameters that are used to customize the function of the drive's inputs and outputs (analog and digital).
- The **Application Parameter Group (APP)** contains parameters that are used to set up customer applications requiring the use of the PID loops in the drive. Additional parameters are included to manage the operation of a second motor with the drive utilizing a separate group of motor parameters.
- The **Extension Parameter Group (EXT)** contains parameters that support extension option boards. This group will not appear unless an option board requiring parameter support is installed on the drive.
- The **Communications Parameter Group (COM)** contains parameters that are used to support a communications option board when installed. This group will not appear unless an option board requiring parameter support is installed on the drive.

6.6 Moving Between Parameter Groups

When the Menu/Escape key is pressed from the operation mode, the drive will enter the Group Mode allowing the user to select which menu group they desire to enter. The below graphic depicts the screens in this mode and the navigation between screens. Once in this mode, pressing the Enter key takes you into the parameter view mode; pressing the Program/Escape key takes you back to the operation mode:

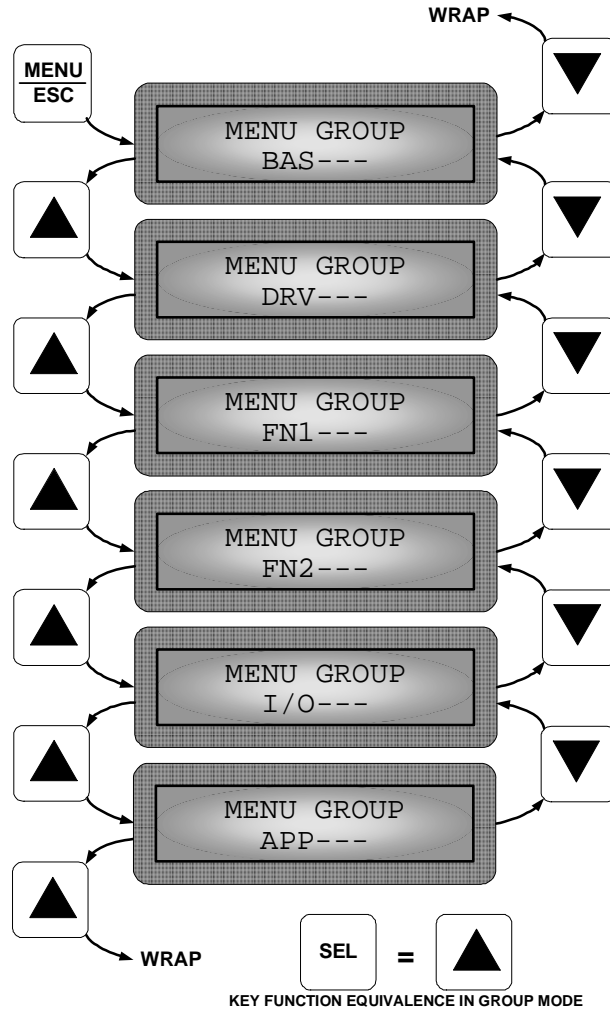
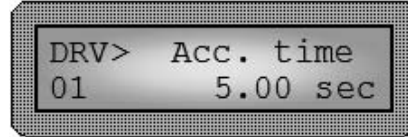


Figure 6-2: Menu Grouping

6.7 Changing Between Parameters within a Group

When in the Group Mode, pressing the Enter key places the drive in the Parameter View Mode so that the parameters within the selected group can be viewed. The below graphic shows a typical parameter while in the view mode:



The up and down arrows allow navigation within the list of parameters for a particular group. The group is displayed in the top left corner of the display and the parameter number is displayed in the bottom left corner of the display. A text description and the current value of the parameter is also shown on the display.

6.8 Modifying the Value of a Parameter

From the Parameter View Mode, the value can be edited (contingent on the attributes of the given parameter and the current state of the drive) by pressing the ENTER key placing the product in the Parameter Edit Mode. While in this mode, all available character placeholders of the parameter value are displayed in reversed video. The cursor will automatically be placed on the right-most character (least significant digit) and will be flashing from reverse video to normal video at approximately a 2Hz rate. The below graphic shows a typical parameter while in the Parameter Edit Mode:



The up, down, and select keys are used to modify the value of the parameter. The ENTER key is used to accept the value and the ESC/MENU is used to abort the modification of the parameter value.

6.9 Monitoring Display Parameters

When the drive powers up, it will automatically enter the operation mode thus allowing the display of monitor and status information pertinent to the normal operation of the drive. Multiple screens are available as depicted below. The below graphic outlines the contents of the displays available after power-up and while in the operation mode:

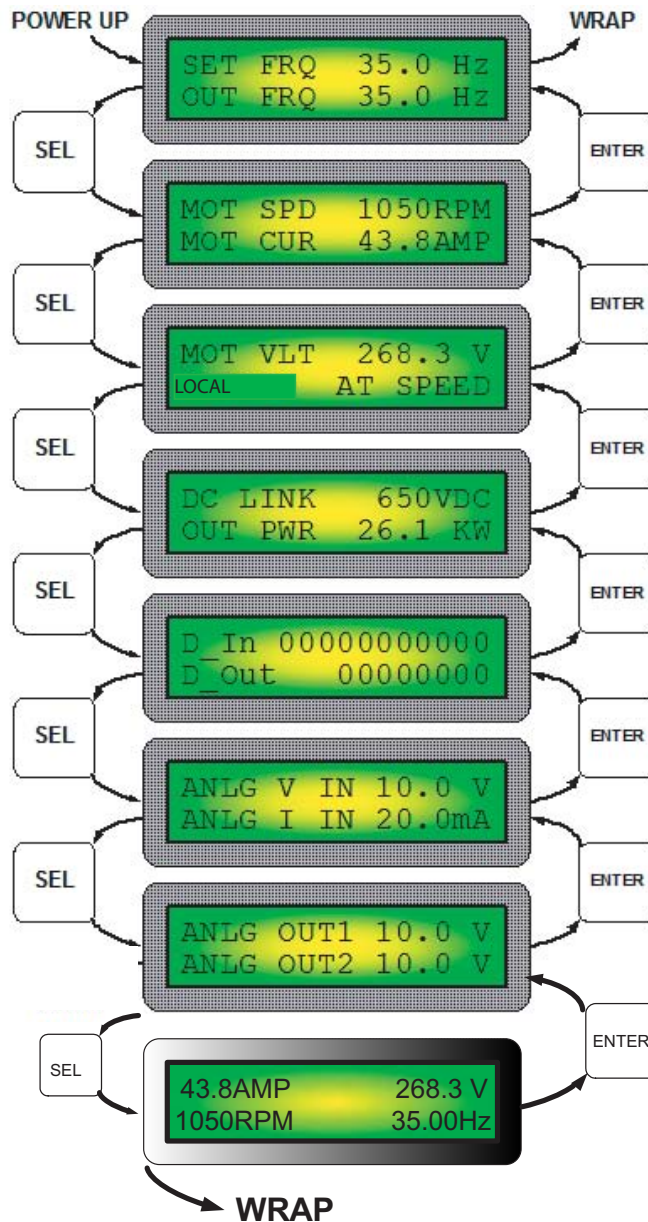


Figure 6-3: Operation Mode Monitor Displays

6.10 Reviewing the Active Fault Status

When the VS1PF experiences a condition that causes a fault, the drive will immediately disable power to the motor. The STOP/FAULT LED will blink and the cause of the fault will be displayed in parameter DRV-12 (the display will automatically display this parameter). By pressing the ENTER key, the output frequency that was being output by the drive at the time of the fault will be displayed. Pressing the UP arrow will display the output current that was being supplied by the drive when the fault occurred. Pressing the UP arrow again will display the status of the drive during the fault (e.g. accelerating, decelerating, at speed). Pressing the MENU/ESC key returns to the parameter view mode.

6.11 Resetting the Parameters to the Factory Default

From the operation mode, press the MENU/ESC button to place the drive in the group mode. Press the UP arrow until the FN2 (Function Group 2) is displayed. Press the ENTER key to enter the parameter view mode. Press ENTER to modify the value of the Jump Code to 93 and press ENTER. This will place you in the parameter view mode viewing Parameter FN2-93 "Factory Set". Press the ENTER key to modify the value of FN2-93. Use the UP arrow to select "All Groups" or to select just one group that you wish to reset to defaults. Press ENTER to carry out the action or press MENU/ESC to abort the procedure.

Note: Parameter FN93 in the Advanced Display group will not be shown unless FN2-90 = Advanced.

6.12 Parameter Upload/Download Using Keypad

6.12.1 Copying Parameters to Keypad

The parameter set for the VS1PF can be stored in the keypad for the purpose of copying them into a different drive or for archiving them for maintenance purposes (e.g. if the parameters are being temporarily changed for a different application and need to be returned to the original setup later). This is useful for programming multiple drives to have the same parameter setting. The LCD Keypad can read (upload) the parameter settings from the inverter memory and can write (download) them to other drives.

6.12.2 Downloading Stored Parameters from Keypad to Drive

From the operation mode, press the MENU/ESC button to place the drive in the group mode. Press the UP arrow until the FN2 (Function Group 2) is displayed. Press the ENTER key to enter the parameter view mode. Press ENTER to modify the value of the Jump Code to 92 and press ENTER. This will place you in the parameter view mode viewing Parameter FN2-92 "Parameter Write". Press the ENTER key to modify the value of FN2-92. Use the UP arrow to select "YES". Press ENTER to carry out the action or press MENU/ESC to abort the procedure.

Note: Parameter FN91 and 92 are in Advanced Display group and will not be shown unless FN2-90 = Advanced.

Note: Parameter FN2-95 saves changed parameter values to non-volatile memory within the drive.

See parameter descriptions for further explanation.

7.1 Overview

The following information is provided for each parameter listed in this chapter along with its description:

Parameter Number:	Unique number assigned to each parameter.
Parameter Name:	Unique name assigned to each parameter.
LCD Display:	Display shown on LCD screen when parameter is accessed.
Range:	Predefined parameter limits or selections. Note that a negative Hz value indicates reverse rotation.
Default:	Factory default setting.
Access:	Parameter access level. Basic (reduced parameter set) Advanced (full parameter set)
See also:	Associated parameters that may provide additional or related information.

The parameters are presented in numerical order within each of the six groups (Basic, Drive, Function1, Function 2, Input/Output, Application, External Option, and Communication Option). Appendix X contains a list of parameters by name cross-referenced to parameter number.

Parameters are organized into Parameter Groups:

- The **Basic Parameter Group (BAS)** contains parameters that are very basic in nature and typically what are required to start up most applications.
- The **Drive Parameter Group (DRV)** contains parameters that allow the implementation of the more common application enhancements.
- The **Function 1 Parameter Group (FN1)** contains parameters that allow the implementation of custom setup of certain applications and standard operation modes of the drive.
- The **Function 2 Parameter Group (FN2)** contains parameters that allow the implementation of custom setup of certain applications and standard operation modes of the drive.
- The **I/O Parameter Group (I/O)** contains parameters that are used to customize the function of the drive's inputs and outputs (analog and digital).
- The **Communications Parameter Group (COM)** contains parameters that are used to support a communications option board when installed. This group will not appear unless an option board requiring parameter support is installed on the drive.
- The **Application Parameter Group (APP)** contains parameters that are used to set up customer applications requiring the use of the PID loops in the drive. Additional parameters are included to manage the operation of a second motor with the drive utilizing a separate group of motor parameters.
- The **Extension Parameter Group (EXT)** contains parameters that support extension option boards. This group will not appear unless an option board requiring parameter support is installed on the drive.

7.2 Basic Group Parameters

BAS-00 Jump to Desired Code

LCD Display: Jump Code

Range: 1 to 12

Default: 1

Access: Basic

Comm Addr: 9100

See Also: N/A

Sets the code to which to jump within the Basic group. Used for frequent access. Used to facilitate quicker access to a desired parameter.

BAS-01 Motor Nameplate HP

LCD Display: Motor-HP

Range:

1HP	75HP
2HP	100HP
3HP	125HP
5HP	150HP
7.5HP	200HP
10HP	250HP
15HP	300HP
20HP	350HP
25HP	400HP
30HP	450HP
40HP	500HP
50HP	600HP
60HP	700HP

Default: Varies based on voltage and frame size of the inverter.

Access: Basic

Comm Addr: 9101

See Also: BAS-02, BAS-03, BAS-04, BAS-05

Gathered from motor nameplate - select horsepower (HP) value here.

BAS-02 Motor Nameplate Voltage

LCD Display: MotorNP Volt

Range: 0 to 600[V]

Default: Varies based on the voltage of the inverter.

Access: Basic

Comm Addr: 9102

See Also: BAS-01, BAS-03, BAS-04, BAS-05

Gathered from motor nameplate - enter motor voltage (V) here.

BAS-03 Motor Nameplate Base Frequency

LCD Display: MotorBase Hz
Range: 30 to 120[Hz]
Default: 230V and 460V inverters=60Hz
380V inverters=50Hz
Access: Basic
Comm Addr: 9103
See Also: BAS-01, BAS-02, BAS-04, BAS-05

Gathered from motor nameplate - Enter base frequency (Hz) here.

BAS-04 Motor Nameplate Current

LCD Display: MotorNP Curr
Range: 1.0 to 999.9[A]
Default: Varies based on voltage and frame size of the inverter.
Access: Basic
Comm Addr: 9104
See Also: BAS-01, BAS-02, BAS-03, BAS-05

Gathered from motor nameplate - Enter full load motor nameplate amps (FLA) here.

BAS-05 Motor Nameplate RPM

LCD Display: MotorBaseRPM
Range: 500 to 3600[RPM]
Default: Varies based on voltage and frame size of the inverter.
Access: Basic
Comm Addr: 9105
See Also: BAS-01, BAS-02, BAS-03, BAS-04

Gathered from motor nameplate - Enter motor base RPM (RPM) here.

BAS-06 Minimum Frequency

LCD Display: Min Freq
Range: FN1-32 to BAS-07[Hz]
Default: 0.50[Hz]
Access: Basic
Comm Addr: 9106
See Also: BAS-07, FN1-32

Application specific - determine minimum motor speed in frequency (Hz). Enter value here.

BAS-07 Maximum Frequency

LCD Display: Max Freq
Range: BAS-06 to 120.00[Hz]
Default: 230V and 460V inverters=60.00Hz
380V inverters=50.00Hz
Access: Basic
Comm Addr: 9107
See Also: BAS-06

Application specific -- determine maximum motor speed in frequency (Hz). Enter value here.

BAS-08 Start/Stop Source

LCD Display: Start Source
Range: Keypad
3-Wire Cntl
2-Wire Cntl
Int.485
Default: Keypad
Access: Basic
Comm Addr: 9108
See Also: BAS-09, I/O-20 to I/O-27

Application specific - from what control source will your drive be controlled? Enter control source here.

BAS-09 Speed Reference Source

LCD Display: SpdRefSource
Range: Keypad-1
0 to +10V
-10V to +10V
4 to 20mA
Sum of 0 to 10V and 4 to 20mA
Pulse
Int 485
Ext PID
Default: Keypad-1
Access: Basic
Comm Addr: 9109
See Also: BAS-08, I/O-01 to I/O-19

Application specific -- from what speed reference will the drive's speed be controlled? Select that speed reference source here.

BAS-10 Acceleration Time

LCD Display: Accel Time
Range: 0 to 6000[sec]
Default: 7.5 to 125HP=20.0[sec]
150 to 700HP=60.0[sec]
Access: Basic
Comm Addr: 910A
See Also: BAS-11, FN1-02, FN1-04, FN1-05, FN1-73

The inverter targets the speed reference when accelerating or decelerating. When reference frequency for Accel and Decel (FN1-73) is set to "Maximum Frequency", the acceleration time is the time taken by the motor to reach maximum frequency from 0 Hz. When FN1-73 is set to "Delta Frequency", the acceleration and deceleration time is the time taken to reach a target frequency (instead the maximum frequency) from the previous frequency setting.

The acceleration and deceleration time can be changed to a preset time via programmable digital inputs. By setting M1 to M8 to "XCEL-L", "XCEL-M", "XCEL-H" respectively, the 1 to 7 Accel and Decel time set in I/O-50 to I/O-63 are selected by the binary inputs of the M1 to M8.

NOTE: Set the Accel time for more than 0.5 sec for smooth acceleration. Setting it for too short a time period may cause sub-optimal starting performance.

BAS-11 Deceleration Time

LCD Display: Decel Time
Range: 0 to 6000[sec]
Default: 7.5 to 125HP=30.0[sec]
150 to 700HP=90.0[sec]
Access: Basic
Comm Addr: 910B
See Also: BAS-10, FN1-03, FN1-04, FN1-05, FN1-73

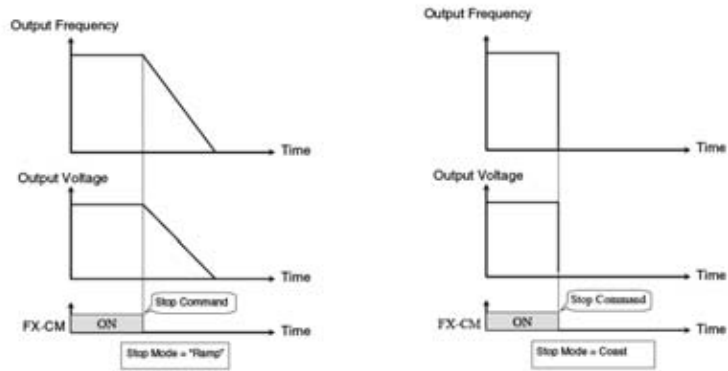
The deceleration time is the time taken by the motor to reach 0 Hz from BAS-07 [Maximum Frequency]. Refer to BAS-10 for additional information.

BAS-12 Stop Mode

LCD Display: Stop Mode
Range: Ramp: Inverter stops by the deceleration pattern.
Coast: Inverter cuts off its output immediately when the stop signal is given.
DC Brake: Inverter stops with DC injection braking. Inverter outputs DC voltage when the frequency reaches the DC injection braking frequency during deceleration.
Flux-Brake: Fast stop converts the regenerating energy into heat at the motor
Default: Ramp
Access: Basic
Comm Addr: 910C

See Also: N/A

Sets the stopping method for the inverter.



NOTE: The motor may be overheated by frequent use of the Flux Brake function.

NOTE: Motor movement may continue due to motor/load inertia. Coast down time is application/load specific.

7.3 Drive Group Parameters

DRV-00 Jump to Desired Code

LCD Display: Jump Code
Range: 1 to 92
Default: 1
Access: Basic
Comm Addr: 9200
See Also: N/A

Sets the code to which to jump within the Drive group. Used for frequent access. Used to facilitate quicker access to a desired parameter.

DRV-05 Preset Speed 1

LCD Display: PreSetSpd 1
Range: 0.00 to BAS-07[Hz]
Default: 10.00[Hz]
Access: Basic
Comm Addr: 9205
See Also: DRV-06, DRV-07, I/O-20 to I/O-27

Sets Multi-step frequency 1 during operation.

The inverter outputs preset frequencies set in parameters DRV-05 to 07 according to the Programmable Digital Input terminals configured as "speed-L", "speed-M", "speed-H" and "speed-X". The output frequencies are determined by the binary combination of M1 to M8 as shown in the table above. The frequency setting method of "speed 0" is determined by BAS-09. See I/O-31 to 42 descriptions for preset speeds 4 to 15.

Binary Input Combination			Output Freq	Preset Speed
Speed-H	Speed-M	Speed-L		
0	0	0	Speed Setpoint	Speed 0
0	0	1	DRV-05	1
0	1	0	DRV-06	2
0	1	1	DRV-07	3

DRV-06 Preset Speed 2

LCD Display: PreSetSpd 2
Range: 0.00 to BAS-07[Hz]
Default: 20.00[Hz]
Access: Basic
Comm Addr: 9206
See Also: DRV-05, DRV-07, I/O-20 to I/O-27

Sets Preset Speed 2 during operation. Refer to DRV-05 for additional information.

DRV-07 Preset Speed 3

LCD Display: PreSetSpd 3
Range: 0.00 to BAS-07[Hz]
Default: 30.00[Hz]
Access: Basic
Comm Addr: 9207
See Also: DRV-05, DRV-06, I/O-20 to I/O-27

Sets PreSet Speed 3 during operation. Refer to DRV-05 for additional information.

DRV-08 Output Current

LCD Display: Current
Range: n/a [A]
Default: Read Only
Access: Basic
Comm Addr: 9208
See Also: N/A

This code displays the output current of the inverter in RMS Amps.

DRV-09 Motor Speed

LCD Display: Speed
Range: n/a [rpm]
Default: Read Only
Access: Basic
Comm Addr: 9209
See Also: FN2-47

Displays the motor speed in RPM while the motor is running. Use the following equation to scale the mechanical speed using FN2-47 [Gain for Motor Speed display] if you want to change the motor speed display to rotation speed (r/min) or mechanical speed (m/min). Where:

f = Output Frequency

P = Number of Motor Poles

$$\text{Motor speed} = 120 \times (f/P) \times FN2-47$$

DRV-10 DC Link Voltage

LCD Display: Bus Voltage
Range: n/a [V]
Default: Read Only
Access: Basic
Comm Addr: 920A
See Also: N/A

Displays internal DC link voltage for the inverter in DC volts.

DRV-12 Current Trip Display**LCD Display:** Fault**Range:**

Fault (Trip)	LCD Keypad display
Over-Current 1	Over Current 1
Over-Voltage	Over Voltage
External Trip Input	Ext. Trip
Emergency Stop (Not Latched)	BX
Low-Voltage	Low Voltage
Ground Fault	Ground Fault
Over-Heat on Heat sink	Over Heat
Electronic Thermal Trip	E-Thermal
Over-Load Trip	Over Load
Inverter H/W Fault - EEP Error - ADC Offset - WDOG Error - In-Phase Open	HW-Diag
Over-Current 2	Over Current 2
Output Phase Loss	Phase Open
Inverter Over-Load	Inv. OLT

Default: Read Only**Access:** Basic**Comm Addr:** 920C**See Also:** FN2-01 to FN2-05

This code displays the current fault (trip) status of the inverter.

Press the **ENTER** key before pressing the **STOP(RESET)** key to check the fault content(s): output frequency, output current, and whether the inverter was accelerating, decelerating, or at speed at the time the fault occurred. Press the **ENTER** key to exit.

The fault contents will be moved to FN2-01 to FN2-05 when the **STOP(RESET)** key is pressed. For more detail, please refer to Chapter 9, Troubleshooting and Maintenance.

NOTE: There are "WDOG error", "EEP error", "Input Phase Open" and "ADC Offset" faults for the inverter hardware. Inverter will not reset when a hardware fault occurs. Repair the fault before turning on the power.

NOTE: Only the highest-level fault will be displayed when multiple faults occur. The rest of the faults can be monitored in FN2-01 to 05 [Fault history]. Cycle the power when the fault is cleared.

DRV-15 Reference/Feedback Frequency Display

LCD Display: Ref Fbk Freq

Range: n/a [Hz]

Default: Read Only

Access: Basic

Comm Addr: 920F

See Also: APP-02, I/O-86 to I/O-88

Displays the Reference Frequency and Feedback Frequency while PID operation. **Displayed only** when "Yes" is selected in APP-02.

When APP-02 [PID operation selection] is set to "YES," reference and feedback values are displayed in Hz. When APP-02 [PID operation selection] is set to "YES," and APP-06 [PID feedback selection] is set (one of the I, V1, Pulse) and the desired unit is set in I/O-86 [V1 Unit Sel], I/O-87 [I Unit Sel], I/O-88 [PulseUnitSel] according to the selection in APP-06, PID reference and feedback value will be displayed in user-selected unit.

DRV-16 Speed Unit Selection

LCD Display: Speed Units

Range: Hz
RPM

Default: Hz

Access: Basic

Comm Addr: 9210

See Also: N/A

Setting this parameter to Hz will display frequency [Hz]. Setting it to RPM will display speed [RPM].

DRV-17 Display Time-Out

LCD Display: LCDTimeOut

Range: 0 to 1200[sec]

Default: 300[sec]

Access: Basic

Comm Addr: 9211

See Also: N/A

Sets the time period of keypad inactivity after which the display will automatically revert back to the monitor screens in the operation mode.

DRV-18 PID Parameter

LCD Display: PIDParameter

Range: n/a[Hz]

Default: Read Only

Access: Advanced

Comm Addr: 9212

See Also: APP-02

Allows user to monitor PID controller's reference/feedback value and inverter's command/output frequency. **Displayed only** when "Yes" is selected in APP-02.

Displays PID controller's reference/feedback value and inverter's command/output frequency. When APP-02 [PID operation selection] is set to "YES," reference and feedback values are displayed in Hz.

When APP-02 [PID operation selection] is set to "YES," and APP-06 [PID feedback selection] is set (one of the I, V1, Pulse) and the desired unit is set in I/O-86 [V1 Unit Sel], I/O-87 [I Unit Sel], I/O-88 [PulseUnitSel] according to the selection in APP-06, PID reference and feedback value as well as Inverter command and output frequency will be displayed in percent [%] unit.

DRV-19 AD Parameter

LCD Display: AD Parameter

Range: [n/a]

Default: Read Only

Access: Basic

Comm Addr: 9213

See Also: N/A

Allows user to monitor the AD conversion value of Analog input. AD value of the Analog input used for Freq mode, PID or Ext. PID reference/feedback can be monitored here.

DRV-20 EXT-PID Parameter

LCD Display: EXT PID Para

Range: [n/a]

Default: Read Only

Access: Advanced

Comm Addr: 9214

See Also: N/A

Allows user to monitor ExtPID controller's reference/ feedback/ output value. **Displayed only** when APP-80 is set to "Yes".

When APP-80 [Ext. PID operation selection] is set to "YES," reference and feedback are displayed in Percent unit.

When APP-02 [PID operation selection] is set to "YES," and APP-06 [PID feedback selection] is set (one of the I, V1, Pulse) and the desired unit is set in I/O-86 [V1 Unit Sel], I/O-87 [I Unit Sel], I/O-88 [PulseUnitSel] according to the selection in APP-06, PID reference and feedback value will be displayed by percent [%] unit.

DRV-22 Keypad Auto/Manual Selection - Control Source Select

LCD Display: LocalRemKey

Range: **Cntl&RefStop** = Control & Reference from keypad - if drive is running when LOCAL/REMOTE is pressed, drive stops
Control Stop = Control only from keypad - if drive is running when LOCAL/REMOTE is pressed, drive stops
Ref Only = Reference only from keypad
Cntl&Ref Run = Control & Reference from keypad - if drive is running when LOCAL/REMOTE is pressed, drive continues to run
Control Run = Control only from keypad - if drive is running when LOCAL/REMOTE is pressed, drive continues to run
Disable = LOCAL/REMOTE key is disabled

Default: Cntl &RefStop

Access: Basic

Comm Addr: 9216

See Also: N/A

Allows user to select the capability of the LOCAL/REMOTE key on the keypad.

DRV-23 Keypad Removal Reference Mode

LCD Display: KeyRefMode

Range: Minimum Speed
Last Speed
Preset Speed 1
Stop
Fault

Default: Minimum Speed

Access: Basic

Comm Addr: 9217

See Also: N/A

When keypad is removed from drive, drive reference changes to what you select here or controls stopping or faulting the drive.

DRV-91 Drive Mode 2

LCD Display: Drive Mode2

Range: Keypad
3-Wire Cntl
2-Wire Cntl

Default: 3-Wire Cntl

Access: Advanced

Comm Addr: 925B

See Also: N/A

Used to select an alternate control mode via a digital input when communications is used as the primary control mode. **Displayed only** when one of I/O-20 through 27 is set to [LOC/REM] and BAS-08 and BAS-09 are set to [int485].

DRV-92 Frequency Mode 2

LCD Display: Freq mode2

Range: Keypad
0 ~ +10V
10V ~ +10V
4 ~ 20mA
0~10V+4~20mA
Pulse

Default: Keypad

Access: Advanced

Comm Addr: 925C

See Also: N/A

Used to select an alternate control mode via a digital input when communications is used as the primary control mode. **Displayed only** when one of I/O-20 through 27 is set to [LOC/REM] and BAS-08 and BAS-09 are set to [int485].

7.4 Function Group 1 Parameters

FN1-00 Jump to Desired Code Number within FN1 Group

LCD Display: Jump Code

Range: 1 to 74

Default: 1

Access: Basic

Comm Addr: 9300

See Also: N/A

Sets the parameter number to which to jump within function group 1. Allows quick access to a desired parameter.

FN1-01 Run Prevention

LCD Display: RunPrevent

Range: None
Forward Prevented
Reverse Prevented

Default: None

Access: Basic

Comm Addr: 9301

See Also: N/A

This function prevents operation of the motor in either reverse or forward direction. This function may be used for loads that rotate only in one direction such as fans and pumps.

FN1-02 Acceleration Pattern

LCD Display: AccelPattern

Range: Linear
S-Curve
U-Curve

Default: Linear

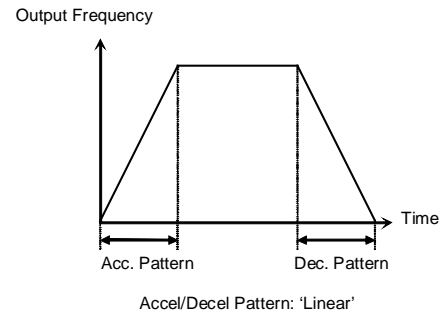
Access: Basic

Comm Addr: 9302

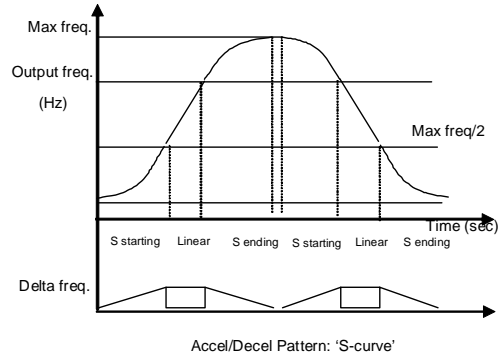
See Also: N/A

Used to define the shape of the acceleration ramp.

Linear: A general pattern for constant torque applications. (Factory default)



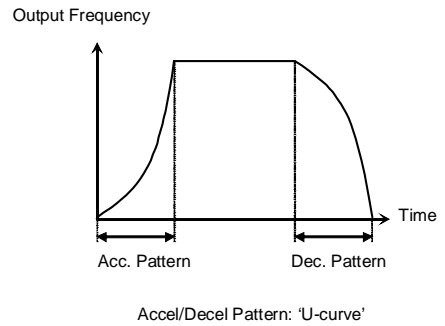
S-curve: Allows the motor to accelerate and decelerate smoothly. The actual acceleration and deceleration time will be about 40% longer than the time set in BAS-10 and BAS-11 as shown in the figure at right. Lessens shock during acceleration and deceleration, and prevents objects from sliding on conveyors or other moving equipment.



Actual accel time = Preset accel time + Preset accel time * Starting curve percent/2 + Preset accel time * Ending curve percent/2.

Actual decel time = Preset decel time + Preset decel time * Starting Curve percent/2 + Preset decel time * Ending curve percent/2.

U-curve: This pattern provides more efficient control of acceleration and deceleration in typical winding machine applications.



FN1-03 Deceleration Pattern

LCD Display: DecelPattern

Range: Linear
S-Curve
U-Curve

Default: Linear

Access: Basic

Comm Addr: 9303

See Also: N/A

Sets the Deceleration Pattern. See FN1-02 [Acceleration Pattern] for additional information.

FN1-04 Start Curve for S-Curve Accel/Decel Pattern

LCD Display: Start SCurve

Range: 1-100[%]

Default: 50%

Access: Basic

Comm Addr: 9304

See Also: N/A

Sets the percent of the ramp value used to form a curve at the start of the accel/decel cycle. Setting to a higher value decreases the linear zone. **Displayed only** when FN1-02 or FN1-03 is set to [S-Curve].

FN1-05 End Curve for S-Curve Accel/Decel Pattern

LCD Display: End SCurve

Range: 1-100[%]

Default: 50

Access: Basic

Comm Addr: 9305

See Also: N/A

Sets the percent of the ramp value used to form a curve at the start of the accel/decel cycle. Setting to a higher value decreases the linear zone. **Displayed only** when FN1-02 or FN1-03 is set to [S-Curve].

FN1-10 Pre-Heat

LCD Display: Pre-HeatMode

Range: No
Yes

Default: No

Access: Advanced

Comm Addr: 930A

See Also: FN1-11, FN1-12, I/O-20, I/O-27

This function prevents condensation from forming inside a stopped motor in a humid area by supplying DC current to the motor continuously. Pre-heat function is activated when FN1-10 [Pre-Heat] is set to "YES", one of the Programmable digital input terminals in I/O-20 to 27 set to "Pre-Heat" and the defined terminal is turned ON. It is only active when the motor is stopped.

NOTE: Parameter change is disabled during pre-heat function. Remove the pre-heat enable command from the digital input to allow programming.

FN1-11 Pre-Heat Value

LCD Display: PreHeatLevel

Range: 1 to 50 [%]

Default: 30 [%]

Access: Advanced

Comm Addr: 930B

See Also: FN1-10, I/O-20 -I/O-27, FN1-12

Set as a percentage of motor rated current. **Displayed only** when FN1-10 is set to "YES".

FN1-12 Pre-Heat Duty Cycle

LCD Display: Pre-HeatPerc

Range: 1 to 100 [%]

Default: 50[%]

Access: Advanced

Comm Addr: 930C

See Also: FN1-10, FN1-11, I/O-20 -I/O-27

Sets the percentage of time for a 10 second period that current is supplied to the motor. A 100% setting, DC current is continuously supplied to the motor. Will only be displayed when FN1-10 is set to "YES". NOTE: Reduce FN1-11 [Pre-heat value] or FN2-12 [Pre-heat duty] when inverter or motor is overheated.

FN1-20 Start Mode

LCD Display: Start Mode

Range: Accel = Drive accelerates to commanded speed immediately upon receiving a run command
DC Start = Drive initially applies a DC current to the motor and then accelerates to commanded speed upon receiving a run command
Flying-Start = Used to start the drive into a rotating load and then accelerate it to the commanded speed

Default: Accel

Access: Advanced

Comm Addr: 9314

See Also: FN1-21, FN1-22

Sets the starting method of the inverter.

NOTE: When using the flying Start setting, performance is improved when the commanded direction is equivalent to the direction that the load is rotating. If the rotational speed of the load is less than 50% of rated RPM, the flying-start feature will work properly even if the rotational direction is opposite from the commanded direction.

NOTE: DC-start is disabled when FN1-21 or 22 is set to "0".

NOTE: DC-start is de-activated in Sensorless mode.

NOTE: The drive may trip with the fault "No Motor Trip" if there is an output phase loss during the DC-Start.

FN1-21 Starting DC Injection Braking Time

LCD Display: DCBrkStrtTm

Range: 0.0-60.0[sec]

Default: 0

Access: Advanced

Comm Addr: 9315

See Also: FN1-20, FN1-22

Sets the duration of the time that DC current is applied to the motor prior to acceleration.

Displayed only when FN1-20 is set to DC-Start.

FN1-22 Starting DC injection Braking Value

LCD Display: DC StrtValue

Range: 0-150[%]

Default: 50%

Access: Advanced

Comm Addr: 9316

See Also: FN1-20, FN1-21

Sets the amount of DC Current applied to the motor in percent of BAS-04 [Motor Nameplate Current]. **Displayed only** when FN1-20 is set to "DC-Start".

NOTE: Do not set FN1-22 [Starting DC Magnetizing Value] higher than Inverter Rated Current; otherwise, Motor Overheating or Overload Trip may occur. Refer to FN1-21 for additional information on DC-Braking.

FN1-24 DC Injection Braking On-Delay Time

LCD Display: DC Brk Time

Range: 0.10 to 60.00 [sec]

Default: 0.10[sec]

Access: Advanced

Comm Addr: 9318

See Also: BAS-12, FN1-25, FN1-26, FN1-27

Sets a delay time after the output reaches the DC injection braking frequency before beginning DC current injection. **Displayed only** when BAS-12 is set to "DC Brake".

FN1-25 DC Injection Braking Frequency

LCD Display: DC Brk Hz

Range: 0.10 to 60.00 [Hz]

Default: 5.00[Hz]

Access: Advanced

Comm Addr: 9319

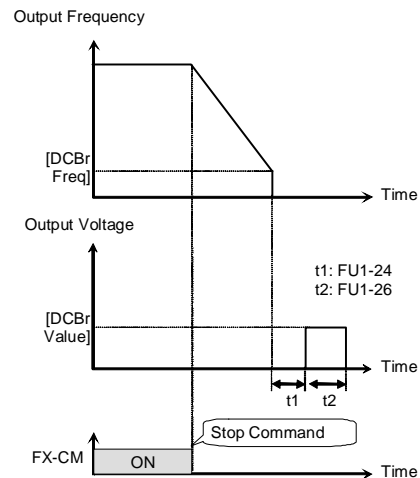
See Also: BAS-12, FN1-24, FN1-26, FN1-27

Sets the frequency at which the inverter starts to output DC voltage during deceleration.

Displayed only when BAS-12 is set to "DC Brake".

When BAS-12 [Stop mode] is set to "DC Brake", the inverter decelerates until this level is reached and then begins DC Braking.

By introducing a DC voltage to the motor windings, this function will stop the motor more abruptly.



FN1-26 DC Injection Braking Time

LCD Display: DC Brk Time

Range: 0.0 to 60.0 [sec]

Default: 1.0[sec]

Access: Advanced

Comm Adr: 931A

See Also: BAS-12, FN1-24, FN1-25, FN1-27

Sets the time that DC current is applied to the motor. **Displayed only** when BAS-12 is set to "DC Brake".

FN1-27 DC Injection Braking Value

LCD Display: DC Brk Value

Range: 0-200[%]

Default: 50%

Access: Advanced

Comm Addr: 931B

See Also: BAS-12, FN1-24, FN1-25, FN1-26

Sets the level of DC current applied to the motor. set as a percentage of BAS-04 [Motor Nameplate Current]. **Displayed only** when BAS-12 is set to "DC Brake".

NOTE: To optimize DC injection braking functionality, set FN1-25 less than or equal to 5Hz.

NOTE: Do not set this value higher than Inverter rated current; doing so may lead to motor overheating or an overload trip.

FN1-28 Safety Stop

LCD Display: Safety Stop

Range: No
Yes

Default: No

Access: Advanced

Comm Addr: 931C

See Also: N/A

This function is used to safely stop a high inertia load when there is a power outage. The rotational energy in the load is used to keep the drive energized by regenerating energy from the load to the DC bus of the drive. If a power failure occurs while Safety Stop is active, the inverter will decelerate the load at a rate necessary to maintain the DC bus voltage at the proper level during the stop. The deceleration time will depend upon the connected inertia. Should the Safety Stop function not operate optimally for the connected inertia, then FN2-46 [Inertia Rate] may need adjusting. If the inertia is too large, the drive may trip while attempting a Safety Stop. For this situation, incrementally adjust FN2-46 to a higher value until proper operation is achieved.

NOTE: This function is effective for high inertia loads that may have excessive coast times should there be a power failure.

FN1-29 Power Source Frequency

LCD Display: Line Freq
Range: 40.00 to 120.00[Hz]
Default: 60.00[Hz]
Access: Advanced
Comm Addr: 931D
See Also: N/A

Sets input power frequency.

NOTE: If line frequency is changed, related frequencies such as Max frequency and Base frequency are automatically changed. To set the related frequencies differently from line frequency, the user should set each parameter manually.

FN1-32 Starting Frequency

LCD Display: Start Freq
Range: 0.01-10.00[Hz]
Default: 0.50[Hz]
Access: Advanced
Comm Addr: 9320
See Also: N/A

Sets the frequency at which the inverter starts to output voltage. This parameter determines the absolute lowest operating frequency and sets the minimum allowable value for BAS-06 [Minimum Frequency].

FN1-33 Frequency Limit Selection

LCD Display: Freq Limit
Range: Yes
Default: Read Only
Access: Advanced
Comm Addr: 9321
See Also: N/A

Indicates that BAS-06 and BAS-07 are in control of the minimum and maximum frequencies.

FN1-35 High Limit Frequency

LCD Display: F-Limit Hi
Range: BAS-06 to BAS-07
Default: Read Only
Access: Advanced
Comm Addr: 9323
See Also: N/A

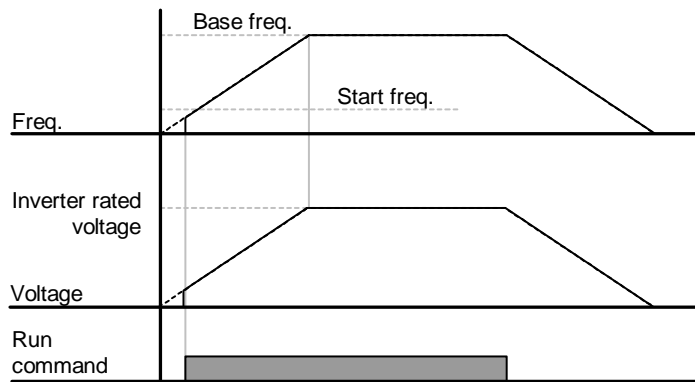
Reflects the value set in BAS-07 [Maximum Frequency]

FN1-40 Volts/Hz Pattern

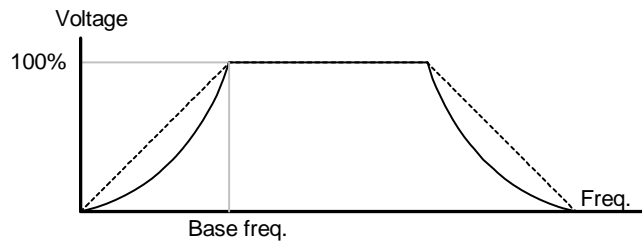
LCD Display: V/F Pattern
Range: Linear
Square
V/F
Default: Linear
Access: Advanced
Comm Addr: 9328
See Also: N/A

See the following for examples.

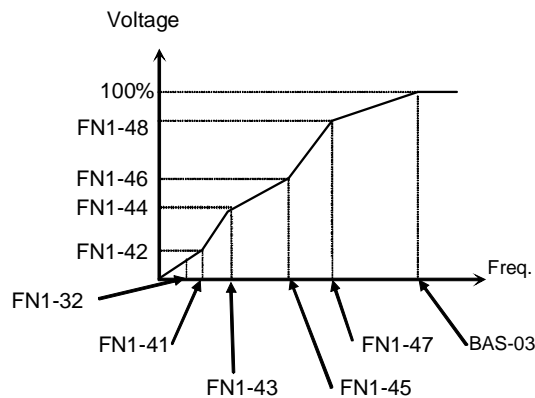
Sets the pattern of voltage/frequency ratio. Select the proper V/F pattern according to the load. The motor torque is dependent on this V/F pattern.



Linear: Maintains a linear Volts/frequency ratio from zero to Base frequency. This is appropriate for constant torque applications. The performance will be improved with the use of FN2-67 to 69 [Torque boost].



Square: Used where variable torque is required. Maintains squared volts/hertz ratio. Appropriate applications are fans, pumps, etc.



User-Defined: Used for special applications. Users can adjust the volts/Hz ratio according to the application. This is accomplished by setting the voltage and frequency, respectively, at four points between starting frequency and base frequency. The four points of voltage and frequency are set in FN1-41 through FN1-48.

NOTE: When User V/F pattern is active, FN2-67[Forward Torque Boost] and FN2-68[Reverse Torque Boost] are deactivated.

NOTE: When using a standard induction motor, setting the voltage/frequency (V/F) ratio value much higher than linear V/F pattern could result in torque shortage or motor overheating due to over-energizing.

FN1-41 User V/F - Frequency 1

LCD Display: User V/F F1
Range: 0.00 to BAS-07[Hz]
Default: 15.00Hz
Access: Advanced
Comm Addr: 9329
See Also: N/A

Sets Frequency 1 in User Defined V/F Pattern. **Displayed only** when "User V/F" is selected in FN1-40 [V/F pattern]. Users can make a custom V/F pattern by setting four points between FN1-32 [Starting Frequency] and BAS-03 [Motor Nameplate Base Frequency]. Values in lower-numbered parameters can not be set higher than those in higher-numbered parameters.

FN1-42 User V/F - Voltage 1

LCD Display: User V/F V1

Range: 0-100[%]

Default: 25%

Access: Advanced

Comm Addr: 932A

See Also: N/A

Sets Voltage 1 in User Defined V/F Pattern. **Displayed only** when "User V/F" is selected in FN1-40 [V/F pattern]. Set as a percentage in BAS-02 [Motor Nameplate Voltage]. Values in lower-numbered parameters can not be set higher than those in higher-numbered parameters.

FN1-43 User V/F - Frequency 2

LCD Display: User V/F F2

Range: 0.00 to BAS-07[Hz]

Default: 30.00

Access: Advanced

Comm Addr: 932B

See Also: N/A

Sets Frequency 2 in User Defined V/F Pattern. **Displayed only** when "User V/F" is selected in FN1-40 [V/F pattern]. Users can make a custom V/F pattern by setting four points between FN1-32 [Starting Frequency] and BAS-03 [Motor Nameplate Base Frequency]. Values in lower-numbered parameters can not be set higher than those in higher-numbered parameters.

FN1-44 User V/F - Voltage 2

LCD Display: User V/F V2

Range: 0-100[%]

Default: 50[%]

Access: Advanced

Comm Addr: 932C

See Also: N/A

Sets Voltage 2 in User Defined V/F Pattern. **Displayed only** when "User V/F" is selected in FN1-40 [V/F pattern]. Set as a percentage in BAS-02 [Motor Nameplate Voltage]. Values in lower-numbered parameters can not be set higher than those in higher-numbered parameters.

FN1-45 User V/F - Frequency 3

LCD Display: User V/F F3

Range: 0.00 to BAS-07[Hz]

Default: 45.00[Hz]

Access: Advanced

Comm Addr: 932D

See Also: N/A

Sets Frequency 3 in User Defined V/F Pattern. **Displayed only** when "User V/F" is selected in FN1-40 [V/F pattern]. Users can make a custom V/F pattern by setting four points between FN1-32 [Starting Frequency] and BAS-03 [Motor Nameplate Base Frequency]. Values in lower-numbered parameters can not be set higher than those in higher-numbered parameters.

FN1-46 User V/F - Voltage 3

LCD Display: User V/F V3

Range: 0-100[%]

Default: 75%

Access: Advanced

Comm Addr: 932E

See Also: N/A

Sets Voltage 3 in User Defined V/F Pattern. **Displayed only** when "User V/F" is selected in FN1-40 [V/F pattern]. Set as a percentage in BAS-02[Motor Nameplate Voltage]. Values in lower-numbered parameters can not be set higher than those in higher-numbered parameters.

FN1-47 User V/F - Frequency 4

LCD Display: User V/F F4

Range: 0.00 to BAS-07[Hz]

Default: 60.00[Hz]

Access: Advanced

Comm Addr: 932F

See Also: N/A

Sets Frequency 4 in User Defined V/F Pattern. **Displayed only** when "User V/F" is selected in FN1-40 [V/F pattern]. Users can make a custom V/F pattern by setting four points between FN1-32 [Starting Frequency] and BAS-03 [Motor Nameplate Base Frequency]. Values in lower-numbered parameters can not be set higher than those in higher-numbered parameters.

FN1-48 User V/F - Voltage 4

LCD Display: User V/F V4

Range: 0-100[%]

Default: 100[%]

Access: Advanced

Comm Addr: 9330

See Also: N/A

Sets Voltage 4 of User Defined V/F Pattern. **Displayed only** when "User V/F" is selected in FN1-40 [V/F pattern]. Set as a percentage in BAS-02[Motor Nameplate Voltage]. Values in lower-numbered parameters can not be set higher than those in higher-numbered parameters.

FN1-49 Input Voltage Adjustment

LCD Display: VAC 460.0V

Range: 73 to 115[%]

Default: 100[%]

Access: Advanced

Comm Addr: 9331

See Also: N/A

This parameter is utilized when the input voltage to the inverter is different from the rated voltage of the inverter. The low voltage trip level is affected by this parameter. The setting of this parameter should only be changed when the input voltage fluctuates outside the allowable limits of the nominal voltage.

FN1-51 Energy Save

LCD Display: Energy Save

Range: None
Manual
Auto

Default: None

Access: Advanced

Comm Addr: 9333

See Also: N/A

Reduces the output voltage in applications that do not require high torque and current when operating at a steady state speed. The inverter reduces its output voltage after accelerating to the reference frequency. This function may cause over-current trips due to the lack of output torque with fluctuating loads. When Energy Save is ON, it may take longer to stop during deceleration.

FN1-52 Energy Saving%

LCD Display: Manual Save%

Range: 0-30[%]

Default: 0

Access: Advanced

Comm Addr: 9334

See Also: N/A

Sets the amount by which output voltage will be decreased according to load status. For fan or pump applications, energy consumption can be dramatically reduced by decreasing the output voltage when light or no load is connected. **Displayed only** when FN1-51 is set to [Manual].

FN1-54 Integrating Wattmeter

LCD Display: KiloWattHour

Range: n/a

Default: Read Only

Access: Basic

Comm Addr: 9335, 9336

See Also: N/A

Displays both MWh and kWh. **Example:** 1500 kWh
kWh can be read at 0x9336 and MWh can be read at 0x9335.
Max Cumulative value is displayed in FN1-54 as shown below. **Example:** 9,999,999.9kWh
Press [ENTER] key for 5 sec to reset the value stored in FN1-54.

NOTE: FN1-54 value may differ from the actual value due to the tolerances.

FN1-55 Inverter Temperature

LCD Display: Drive temp.

Range: 0 to 160[°C]

Default: Read Only

Access: Advanced

Comm Addr: 9337

See Also: N/A

Displays IGBT's surface temperature.

FN1-56 Motor Temperature

LCD Display: Motor Temp.

Range: 0 to 160[°C]

Default: Read Only

Access: Advanced

Comm Addr: 9338

See Also: N/A

Displays motor temperature detected by external thermal sensor.

FN1-57 No Motor Selection

LCD Display: No Motor Sel

Range: No
Yes

Default: Yes

Access: Advanced

Comm Addr: 9339

See Also: N/A

This parameter is utilized to generate a trip when the output current is below the threshold set in parameter FN1-58 [Trip Current Level]. This may be useful in applications that utilize a contactor or disconnect between the drive and the motor.

When this parameter is set to "Yes" and the output current remains less than the value set in FN1-58 for a longer period of time than that set in FN1-59, a HW-Diag Trip will occur displaying the message "No Motor Trip".

FN1-58 Trip Current Level

LCD Display: NoMotorLevel

Range: 5 to 100[%]

Default: 25%

Access: Advanced

Comm Addr: 933A

See Also: N/A

See FN1-57 for information regarding this parameter. Value is a percentage of BAS-04 [Motor nameplate Current].

FN1-59 Trip Time Setting

LCD Display: NoMotor Time
Range: 0.5 to 10.0[sec]
Default: 5.0[sec]
Access: Advanced
Comm Addr: 933B
See Also: N/A

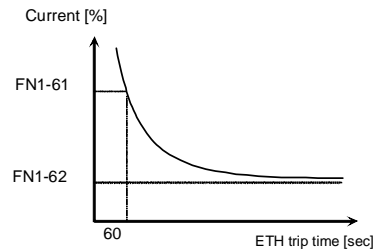
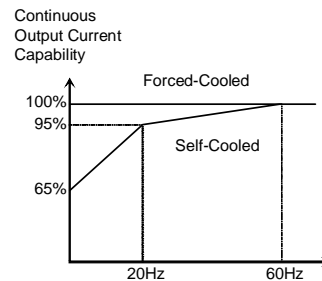
See FN1-57 for information regarding this parameter.

FN1-60 Electronic Thermal Selection

LCD Display: ETH Select
Range: No
Yes
Default: Yes
Access: Advanced
Comm Addr: 933C
See Also: N/A

Protects the motor from overheating without using external thermal relay. Inverter calculates the temperature rise in the motor based on several parameters and determines whether or not the motor is overheated from excessive load current. Inverter will disable its output and display a trip message when the electronic thermal feature is activated.

Activate the ETH parameters by setting this parameter to "Yes". ETH level is set as a percentage of BAS-04 [Motor Nameplate Current].



FN1-61 Electronic Thermal Level for 1 Minute

LCD Display: ETH 1min
Range: FN1-62 to 200[%]
Default: 150[%]
Access: Advanced
Comm Addr: 933D
See Also: N/A

This is the reference current when the inverter determines the motor has overheated. For the default setting, a trip will occur when 150% of rated motor current in BAS-04 flows for one minute. Set as a percentage of BAS-04 [Motor Nameplate Current]. Sets the maximum level of current the motor can tolerate continuously for 1 minute. Cannot be set below FN1-62[Electronic Thermal Level for Continuous]. **Displayed only** when FN1-60 is set to YES.

FN1-62 Electronic Thermal Level for Continuous Operation

LCD Display: ETH Cont
Range: 50 to FN1-61(maximum 150)[%]
Default: 120[%]
Access: Advanced
Comm Addr: 933E
See Also: N/A

This is the current at which the motor can run continuously. Generally, this value is set to "100%", which means the motor rated current as set in BAS-04. This value must be less than FN1-61 [ETH 1min]. Set as a percentage of BAS-04 [Motor Nameplate Current]. **Displayed only** when FN1-60 is set to YES.

FN1-63 Characteristic Selection (Motor Type)

LCD Display: Motor Type
Range: Self-Cool (Cooled by fan connected directly to the motor's shaft)
Forced-Cool(Cooled by fan powered by separate motor.)
Default: Self-Cool
Access: Basic
Comm Addr: 933F
See Also: N/A

To make the ETH function (Motor i^2t) work correctly, the motor cooling method must be selected correctly according to the motor.

[Self-cool] is a motor that has a cooling fan connected directly to the shaft of the motor. The cooling effects of a self-cooled motor decrease when the motor is running at low speeds. The Motor heats easily when operating at low speed, compared to the motor at high speed with the same current. The motor current is derated as the motor speed decreases.

[Forced-cool] is a motor that uses a separate motor to power a cooling fan. As the motor speed changes, the cooling effect does not change. FN1-62 [Electronic thermal level for continuous] set value is utilized regardless of operating frequency.

NOTE: Even if the motor current changes frequently due to load fluctuation or acceleration and deceleration, the inverter calculates the i^2t and accumulates the value to protect the motor.

FN1-64 Overload Warning Level

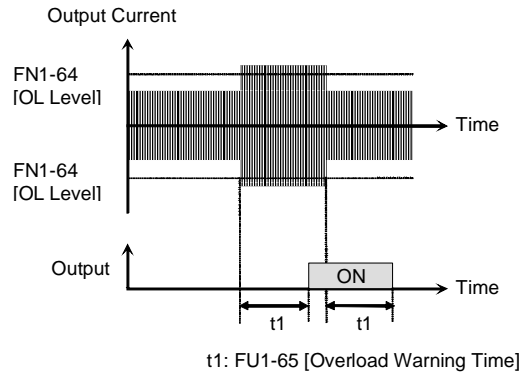
LCD Display: OL Level
Range: 30 to110[%]
Default: 110[%]
Access: Advanced
Comm Addr: 9340

See Also: N/A

Sets the current level at which an alarm will signal at a relay or multi-function output terminal. (Reference FN1-65 and FN1-66). Set as a percentage of BAS-04 [Motor Rated Current].

A programmable digital output is used to annunciate an overload alarm. To make the overload alarm available, program one of the digital outputs defined in parameters I/O-76 to I/O-79 to a value of "OL".

An alarm will be generated when the output current has exceeded this level for a period of time longer than that defined in parameter FN1-65 [Overload Warning Time]. If the current returns to a level below this threshold, then the digital output will deactivate following a period of time defined in FN1-65.



FN1-65 Overload Warning Time

LCD Display: OL Time
Range: 0.0 to 30.0[sec]
Default: 1.0[sec]
Access: Advanced
Comm Addr: 9341
See Also: N/A

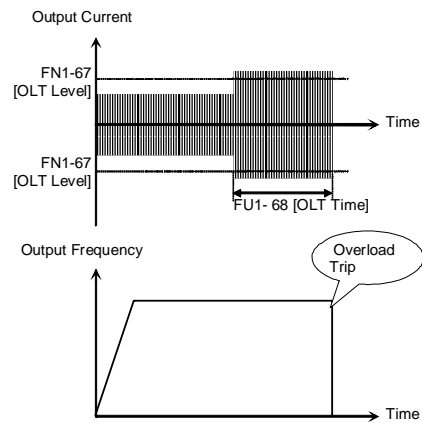
Sets the amount of time a current over FN1-64 [Overload Warning Level] will be tolerated. After this time has elapsed, an alarm signal will be issued if Overload continues. See FN1-64 for additional information regarding this parameter.

FN1-66 Overload Trip Selection

LCD Display: OLT Select
Range: No (Inverter will NOT be disabled)
Yes (Inverter WILL be disabled)
Default: Yes
Access: Advanced
Comm Addr: 9342
See Also: N/A

Specifies whether or not the inverter will be disabled when the motor is overloaded.

Inverter disables its output and displays a fault message when the output current exceeds FN1-67 [Overload Trip Level] for the time FN1-68 [Overload Trip Time]. Overload trip Operation is shown in the figure at right. This function protects the inverter and motor from abnormal load conditions.



FN1-67 Overload Trip Level

LCD Display: OLT Level

Range: 30-150[%]

Default: 150[%]

Access: Advanced

Comm Addr: 9343

See Also: N/A

Sets the level of current required to trigger an overload trip. **Displayed only** when FN1-66 is set to "Yes". Set as a percentage of BAS-04 [Motor Nameplate Current].

FN1-68 Overload Trip Delay Time

LCD Display: OLT Time

Range: 0.0 to 60.0[sec]

Default: 60.0[sec]

Access: Advanced

Comm Addr: 9344

See Also: N/A

Sets the amount of time a current over FN1-67 [Overload Trip Level] will be tolerated. After this time has elapsed, an overload trip will occur if Overload continues. **Displayed only** when FN1-66 is set to "Yes".

FN1-69 Input/Output Phase Loss Protection**LCD Display:** PhaseLossSel**Range:** 000 to 111 (Bit Set)

Bit 2	Bit 1	Bit 0	
0	0	1	Output phase loss protection enabled. Inverter output is shut down and stopped.
0	1	0	Input phase loss protection enabled. Inverter output is shut down and stopped.
1	0	0	Enabled at drive by-pass function
1	1	1	Enabled during All Conditions

Default: 100**Access:** Advanced**Comm Addr:** 9345**See Also:** N/A

Used to disable the inverter output in case of phase loss in either input power or inverter output.

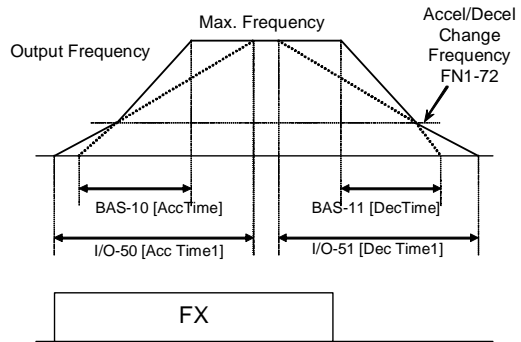
FN1-71 Stall Prevention Level**LCD Display:** Stall Level**Range:** 30-150[%]**Default:** 110[%]**Access:** Advanced**Comm Addr:** 9347**See Also:** N/A

Sets the current level required to activate stall preventin function during Accel, Steady State or Decel. Set as a percentage of BAS-04 [Motor Nameplate Current]. Do not set this value higher than the inverter's rated current. NOTE: Stall level will be automatically reduced if inverter is operated at a frequency higher than the base frequency.

FN1-72 Accel/Decel Change Frequency**LCD Display:** Acc/Dec Ch F**Range:** 0 to BAS-07[Hz]**Default:** 0[Hz]**Access:** Advanced**Comm Addr:** 9348**See Also:** N/A

This function is used to change Accel/Decel ramp at a certain frequency. This is useful in textile machine applications. For example, when stop command is activated while running at 100Hz, inverter swiftly decelerates and changes the ramp at this frequency, leading to soft stop.

NOTE: If Accel/Decel change frequency is set and "XCEL-L", XCEL-M", and XCEL-H" defined in Programmable digital terminals are ON, Multi Accel/Decel operation has the priority.



FN1-73 Reference Frequency for Accel and Decel

LCD Display: Acc/Dec Freq

Range: Max Freq=Based on Max Frequency
Delta Freq=Based on the change in commanded Frequency

Default: Max Freq

Access: Advanced

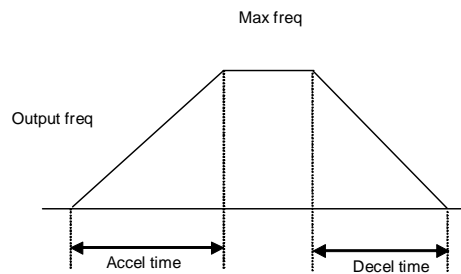
Comm Addr: 9349

See Also: N/A

Sets the reference frequency for acceleration and deceleration. If a pre-determined Accel/Decel time from a frequency to a target frequency is required, set this parameter to "Delta freq".

Max freq:

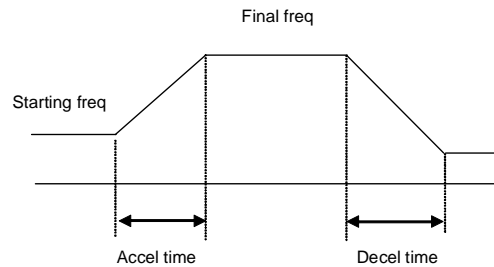
The Accel/Decel time is the time that it takes to reach the maximum frequency from 0 Hz.



FN1-73 is set to Max. Freq

Delta freq:

The Accel/Decel time is the time that it takes to reach a target frequency from a previous frequency.



FN1-73 is set to Delta Freq

FN1-74 Accel/Decel Time Scale

LCD Display: Time Scale

Range: 0.01 Sec=Can be adjusted in increments of 0.01 second.
0.1 Sec=Can be adjusted in increments of 0.1 second.
1 Sec=Can be adjusted in increments of 1 second.

Default: 0.1 sec

Access: Advanced

Comm Addr: 934A

See Also: N/A

Sets the resolution and upper limit for Accel/Decel time settings. When scale is set to "0.01 sec", Accel/Decel time is changed by 10 mSec increments. The maximum setting is 60 seconds. When scale is set to "[0.1 sec]", Accel/Decel time is changed by 100 mSec increments. The maximum setting is 600 seconds. When scale is set to "1 sec", Accel/Decel time is changed by 1 sec increments. The maximum setting "is 6000 seconds.

FN1-80 Up Down Freq Save Mode

LCD Display: UpDn Save Mode

Range: No
Yes

Default: No

Access: Basic

Comm Addr: 9350

See Also: N/A

If YES is selected, the drive will remember the frequency of the last operation and when the drive is restarted, the drive will operate the motor at that frequency.

FN1-81 Up Down Save Freq

LCD Display: UpDn Save Freq

Range: Start Frequency to 60HZ

Default: Read Only

Access: Basic

Comm Addr: 9351

See Also: N/A

Displays the saved frequency for the drive to return to if FN1-80 is set to YES.

FN1-90 Safety STOP Inertia Rate

LCD Display: STOP Inertia

Range: 1 to 9999

Default: 10

Access: Advanced

Comm Addr: 925A

See Also: N/A

This parameter is used to find a proper inertial value for safety STOP function. The suitable value can be found while lowering it when receiving an OV trip or raising an LV trip during safety STOP procedure.

7.5 Function Group 2 Parameters

FN2-00 Jump to Desired Code within FN2 Group

LCD Display: Jump Code

Range: 1-95

Default: 1

Access: Basic

Comm Addr: 9400

See Also: N/A

Sets the code number to which to jump within function group 2. Allows quick access to a desired parameter.

FN2-01 Last Trip 1

LCD Display: Last Trip-1

Range: n/a

Default: Read Only

Access: Basic

Comm Addr: 9401

See Also: N/A

Stores information on the type of fault as well as the frequency, current and Accel/Decel status at the time of the fault.

By pressing [ENTER] and [SEL] key, the frequency, current, and operational status at the time of the fault can be reviewed.

When the fault condition is reset via the STOP/RST key on the keypad or using a digital input terminal, information displayed from DRV-12 will be moved to Last Trip-1. In addition, the previous fault info stored in Last Trip-1 will be automatically moved to Last Trip-2. Therefore, the most recent fault info will always be stored in Last Trip-1.

Up to 5 faults can be saved in FN2-01 to 05 [Fault history]. The lowest numbered fault such as "Last trip 1" is the most recent. After pressing the [ENTER] key, use the [SEL] key to review the operation status at the time of the fault (Output freq., current, Accel/Decel/Constant Run) and fault type. Press the [ENT] key to escape.

FN2-02 Last Trip 2

LCD Display: Last Trip-2

Range: n/a

Default: Read Only

Access: Basic

Comm Addr: 9402

See Also: N/A

By pressing [ENTER] and [SEL] key, the frequency, current, and operational status at the time of the fault can be reviewed. Lowest Last Trip Number contains information on most recent fault. See Last Trip-1 for further information.

FN2-03 Last Trip 3

LCD Display: Last Trip-3

Range: n/a

Default: Read Only

Access: Basic

Comm Addr: 9403

See Also: N/A

By pressing [ENTER] and [SEL] key, the frequency, current, and operational status at the time of the fault can be reviewed. Lowest Last Trip Number contains information on most recent fault. See Last Trip-1 for further information.

FN2-04 Last Trip 4

LCD Display: Last Trip-4

Range: n/a

Default: Read Only

Access: Basic

Comm Addr: 9404

See Also: N/A

By pressing [ENTER] and [SEL] key, the frequency, current, and operational status at the time of the fault can be reviewed. Lowest Last Trip Number contains information on most recent fault. See Last Trip-1 for further information.

FN2-05 Last Trip 5

LCD Display: Last Trip-5

Range: n/a

Default: Read Only

Access: Basic

Comm Addr: 9405

See Also: FN2-01

By pressing [ENTER] and [SEL] key, the frequency, current, and operational status at the time of the fault can be reviewed. Lowest Last Trip Number contains information on most recent fault.

FN2-06 Erase Trips

LCD Display: ClrFaultLog

Range: No=Don't Clear
Yes=Clear

Default: No

Access: Advanced

Comm Addr: 9406

See Also: N/A

Clears all Fault History stored in Last Trip-1 through Last Trip-5.

FN2-07 Dwell Time

LCD Display: Dwell Time

Range: 0-10[sec]

Default: 0.0[sec]

Access: Advanced

Comm Addr: 9407

See Also: FN2-08

Sets the time for dwell operation. Setting this parameter to 0.0[sec] disables the dwell function.

FN2-08 Dwell Frequency

LCD Display: Dwell Freq

Range: FN1-32 to BAS-07[Hz]

Default: 5.00[Hz]

Access: Advanced

Comm Addr: 9408

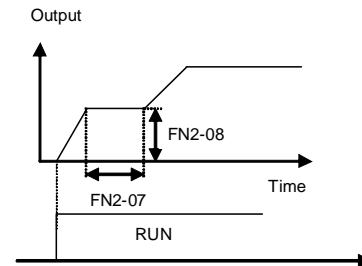
See Also: N/A

If parameter FN2-07 is programmed to a non-zero value and then the drive is commanded to start at a frequency that is greater than that programmed in FN2-08, the drive will run at the frequency programmed in FN2-07 for the duration programmed in FN2-07 before accelerating to the final commanded frequency.

NOTE: If the dwell time in parameter FN2-07 is programmed to 0 seconds, the dwell function is disabled and parameter FN2-08 will not be visible in the parameter list.

NOTE: To avoid operational problems, do not set the dwell frequency in parameter FN2-08 greater than the final frequency.

NOTE: The dwell function is not available in sensorless mode of operation.



FN2-10 Frequency Jump Selection

LCD Display: SkipFreqEnbl

Range: No
Yes

Default: No

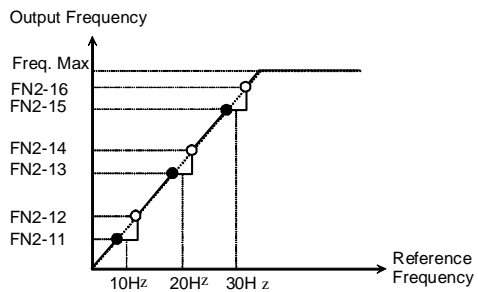
Access: Basic

Comm Addr: 940A

See Also: N/A

Specifies whether or not certain frequencies will be jumped to help prevent undesirable resonance and vibration on the structure of the machine. Three different jump frequency ranges may be set. The frequencies will not be avoided during acceleration or deceleration, only during continuous operation.

NOTE: When the reference frequency is set between the jump frequency low/high limit, the drive will run at the low limit frequency.



NOTE: If any 2 ranges are overlapped, the lowest limit will establish the combined low limit.

NOTE: Jump freq. is ignored during Accel/Decel.

FN2-11 Jump Frequency 1 Low

LCD Display: Skip Freq1Lo
Range: FN1-32 to FN2-12[Hz]
Default: 10.00[Hz]
Access: Basic
Comm Addr: 940B
See Also: N/A

Sets the lower limit of frequency range 1 to jump. **Displayed only** when FN2-10 is set to "Yes".

FN2-12 Jump Frequency High Limit 1

LCD Display: SkipFreq1Hi
Range: FN2-11 to BAS-07[Hz]
Default: 15.00[Hz]
Access: Basic
Comm Addr: 940C
See Also: N/A

Sets the upper limit of frequency range 1 to jump. **Displayed only** when FN2-10 is set to "Yes".

FN2-13 Jump Frequency Low Limit 2

LCD Display: SkipFreq2Lo
Range: FN1-32 to FN2-14[Hz]
Default: 20.00[Hz]
Access: Basic
Comm Addr: 940D
See Also: N/A

Sets the lower limit of frequency range 2 to jump. **Displayed only** when FN2-10 is set to "Yes".

FN2-14 Jump Frequency High Limit 2

LCD Display: SkipFreq2Hi
Range: FN2-13 to BAS-07[Hz]
Default: 25.00[Hz]
Access: Basic
Comm Addr: 940E
See Also: N/A

Sets the upper limit of frequency range 2 to jump. **Displayed only** when FN2-10 is set to "Yes".

FN2-15 Jump Frequency Low Limit 3

LCD Display: SkipFreq3Lo
Range: FN1-32 to FN2-16[Hz]
Default: 30.00[Hz]
Access: Basic
Comm Addr: 940F
See Also: N/A

Sets the lower limit of frequency range 3 to jump. **Displayed only** when FN2-10 is set to "Yes".

FN2-16 Jump Frequency High Limit 3

LCD Display: SkipFreq3Hi
Range: FN2-15 to BAS-07[Hz]
Default: 35.00[Hz]
Access: Basic
Comm Addr: 9410
See Also: N/A

Sets the upper limit of frequency range 3 to jump. **Displayed only** when FN2-10 is set to "Yes".

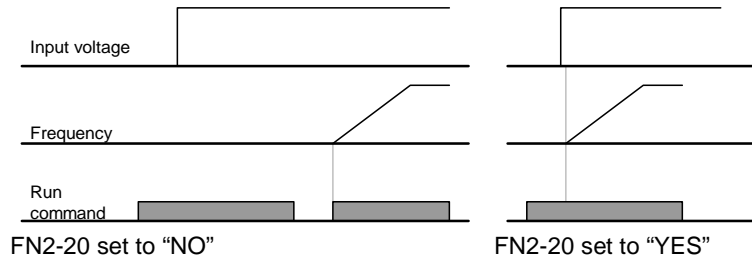
FN2-20 Power ON Start Selection

LCD Display: Auto Restart
Range: No=Off (Motor will not start acceleration when power is applied)
Yes=On (Motor will start acceleration when power is applied)
Default: No
Access: Advanced
Comm Addr: 9414
See Also: N/A

Specifies whether or not the drive will automatically start when power is applied to the drive if a digital input that is programmed as a run command is on at the time power is applied.

With FN2-20 programmed to “No”, if the drive is running when a power outage occurs and a run command is present when power returns, then the run command must be cycled off and then back on in order to start the drive. When parameter FN2-20 is programmed to “Yes”, the drive will automatically restart when power is restored after a power outage as long as the digital input that is used to run the drive is enabled at the time power returns. This situation may cause the drive to restart into a rotating motor. See parameter FN2-22 to set up the drive for restarting under this condition.

NOTE: If the NF2-20 is set to “Yes”, ensure that appropriate warnings are present at the motor and connected load to indicate that the drive may automatically start.



Warning: Caution must be exercised when this function is enabled as the motor will start to run automatically after AC input power is applied. Personal injury may result if caution is not exercised.

FN2-21 Restart After Fault Reset Selection

LCD Display: FaultRestart

Range: No=Off (Motor will not restart when fault condition is reset)
Yes=On (Motor will restart when fault condition is reset)

Default: No

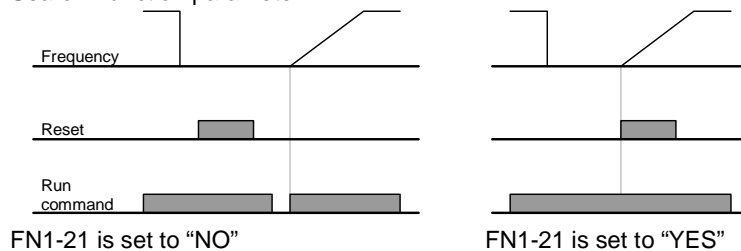
Access: Advanced

Comm Addr: 9415

See Also: N/A

Specifies whether the motor will automatically restart after a fault condition is reset while run command is on. If set to "No", user must restart the inverter by cycling the run command after the fault has been reset.

If set to "Yes", inverter will restart after the RST (reset) terminal has reset a fault. If the motor is rotating at the time the fault is reset, the inverter may trip. To avoid this trip, use "Speed Search" function parameter FN2-22.



Warning: Caution must be exercised when the Restart After Fault Reset Selection function is enabled, as the motor will start to run automatically after the fault is reset. Personal injury may result if caution is not exercised.

FN2-22 Interrupt Power Fault

LCD Display: IPF Mode
Range: No
Yes
Default: No
Access: Advanced
Comm Addr: 9416
See Also: N/A

If this parameter is set to "YES," it is used to automatically start the drive without tripping while the power is restored after an interrupt power fault. This function enables the inverter to Flying-Start in order to reach target frequency without tripping regardless of FN1-20 Starting Mode.

Note: For safety reasons, the Run command only functions when FN2-20 is set to Auto Restart. If FN2-22 is set to "NO," the Run command must be cycled off and then back on in order to start the drive.

FN2-23 Gain During Speed Search

LCD Display: FlyingStrtGn
Range: 30 to 160 [%]
Default: 50
Access: Advanced
Comm Addr: 9417
See Also: N/A

Sets the Gain used for Speed Search PI Controller. Set this value according to load inertia set in FN2-46.

FN2-24 Speed Search Type Selection

LCD Display: Search Type
Range: Estimated SS
Real SS
Default: Estimated SS
Access: Advanced
Comm Addr: 9418
See Also: N/A

This function is used to select current gain during speed search when setting is Estimated SS. Set this value in % according to BAS-04 Motor Nameplate Current. This function is used to permit automatic restarting after Power On Fault Reset and IPF without waiting for the motor to stop. FN2-46 Load Inertia must be set at correct value.

FN2-26 Number of Auto-Restart Tries

LCD Display: RestartTries

Range: 0-10

Default: 0

Access: Advanced

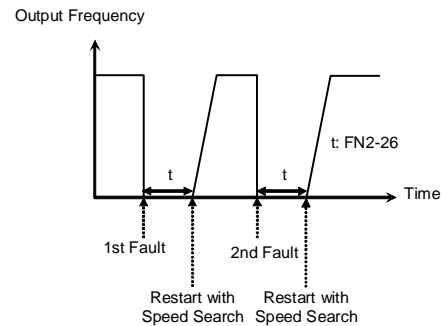
Comm Addr: 9419

See Also: N/A

Allows a tripped drive to automatically reset itself after a fault thus making provisions for automatic restart. The number of retries is set in parameter FN2-25 and the delay before attempting the fault reset and restart of the drive is programmed in FN2-26. Should the reset/restart attempts exceed the number programmed in FN2-25, then the drive will latch the fault, display an appropriate fault message and prohibit an automatic restart. If the application is such that the motor will still be rotating when the restart occurs, then the speed search function in parameter FN2-22 should be utilized.

The automatic restart function will be disabled when a low voltage trip occurs or when the drive enable signal is removed.

Note: Upon successful restart of the drive after a fault and then continuous operation for 30 seconds, the internal retry counter is increased by a count of 1; for each 30 second period of running after this, the counter is incremented until it is equal to the restart tries programmed in FN2-25.



Warning: Caution must be exercised when the Number of Auto-Restart Tries is enabled, as the motor will start to run automatically after the fault is reset. Personal injury may result if caution is not exercised.

FN2-27 Delay Time Before Auto-Retry

LCD Display: RestartDelay

Range: 0.0-60.0[sec]

Default: 1.0[sec]

Access: Advanced

Comm Addr: 941A

See Also: FN2-25

Sets the time between Auto-Restart tries.

Displayed only when FN2-25 is set at 1 or above.

FN2-41 Number of Motor Poles

LCD Display: Motor Poles

Range: 2-12

Default: 4

Access: Advanced

Comm Addr: 9429

See Also: N/A

Enter the number of poles for the motor. Used to display the motor speed. If you set this value to 2, inverter will display 3600 rpm instead of 1800 rpm at 60Hz output frequency. Caution should be exercised when sizing a drive for a motor with more than 4 poles to ensure that the motor full load amps does not exceed the continuous amp capability of the drive.

FN2-42 Motor Slip

LCD Display: Motor Slip RPM

Range: 0.00 to 10.00

Default: Calculated [Hz]

Access: Advanced

Comm Addr: 9429

See Also: N/A

Displays the calculated motor slip.

FN2-44 No Load Motor Current (RMS)

LCD Display: MotorMagCurr

Range: 0.5 to 999.9[A]

Default: Automatically set based on motor nameplate data

Access: Advanced

Comm Addr: 942C

See Also: N/A

This parameter is to be set to the no load (magnetizing) amps of the motor. If the motor magnetizing amps are not known, then disconnect all loads (including gearing) from the motor shaft and run the motor in V/Hz mode at approximately 3/4 speed (e.g. 45 Hz for a 60 Hz motor) and then records the amps as indicated in the monitor display for motor amps. The value recorded should then be entered into FN2-44. The proper setting of this parameter is required to ensure optimum operation in sensorless mode of operation.

NOTE: When setting the motor nameplate data in the basic (BAS) menu, FN2-44 as well as other motor related parameters is automatically defaulted to factory values. These values are appropriate for most applications but may need adjusting if performance needs to be optimized.

FN2-45 Motor Efficiency

LCD Display: Efficiency

Range: 70-100[%]

Default: Automatically set based on motor nameplate data

Access: Advanced

Comm Addr: 942D

See Also: N/A

Enter the motor efficiency from the motor nameplate. Parameter is automatically changed according to motor capacity. This value is used to calculate the output wattage displayed in the monitor screens.

FN2-46 Load Inertia**LCD Display:** Inertia Rate**Range:** 0 to 40**Default:** 0**Access:** Advanced**Comm Addr:** 942E**See Also:** N/A

Sets the load inertia rate. Used for sensorless control, Minimum Accel/Decel, Optimum Accel/Decel and Speed search. For optimal control performance, this value must be set correctly. Install a DB unit or regenerative converter to improve the performance.

Set "0" for loads that have load inertia less than 10 times that of motor inertia.

Set "1" for loads that have load inertia about 10 times that of motor inertia.

FN2-47 Gain for Motor Speed Display**LCD Display:** RPMDisplayGn**Range:** 1 to 1000[%]**Default:** 100%**Access:** Basic**Comm Addr:** 942F**See Also:** N/A

Changes the motor speed display to rotating speed (r/min) or mechanical speed (e.g. ft/min). The display is calculated by the following equations.

$$\text{Rotating speed (r/min)} = \frac{(120 \times f)}{P}$$

Where:
 f = Output Frequency
 P = Number of Motor Poles

$$\text{Mechanical speed (ft/min)} = \text{Rotating speed} \times \text{Motor RPS Display Gain [FN2-47]}$$

FN2-48 Carrier Frequency**LCD Display:** Carrier Freq**Range:** Varies based on size of inverter:

Inverter Size [HP]	Carrier Frequency Range [kHz]
7.5 to 30	2 to 15
40	2 to 10
50 to 100	2 to 4
125 to 350	2 to 3
400 to 700	1.5 to 2

Default: Varies based on size of inverter:

Inverter Size [HP]	Carrier Frequency Default [kHz]
7.5 to 30	5.0
40	5.0
50 to 100	4.0
125 to 350	3.0
400 to 700	2.0

Access: Advanced

Comm Addr: 9430

See Also: N/A

Sets the carrier frequency for the PWM output.

Affects the audible sound of the motor, noise emission from the inverter, inverter temperature, and leakage current. If the ambient temperature where the inverter is installed is high, or other equipment may be affected by potential inverter noise, set this value lower. If the value is set above 10 kHz, reduce the rated current by 5% per 1 kHz. Setting Carrier frequency set below 1.5 [kHz] when FN2-60 [Control mode selection] is set to Sensorless can result in reduced performance.

FN2-49 PWM Type Selection

LCD Display: PWMTechnique

Range: Normal (Operation via Carrier (switching) frequency.)
Low Leakage (Change (Carrier) switching frequency pattern to reduce leakage current.)

Default: Normal

Access: Advanced

Comm Addr: 9431

See Also: N/A

Noise and leakage current can be reduced without changing carrier frequency by decreasing the switching cycle. "Low Leakage" is used to reduce Leakage current by decreasing switching cycle. Reducing the Carrier frequency may increase noise.

NOTE: When Low leakage is selected while carrier frequency is set lower than 2.0 kHz in FN2-48, FN2-48 value is automatically set to 2.0 kHz.

FN2-60 Control Mode Selection

LCD Display: Control Mode

Range: V/F=Volts/Frequency Control
Slip Compen=Slip Compensation Control
Sensorless=Sensorless Control

Default: V/F

Access: Basic

Comm Addr: 943C

See Also: N/A

Sets the control mode for the drive.

V/F control: Controls the voltage/frequency ratio via the setting in parameter FN1-40. Use the torque boost function when a greater starting torque is required (see parameters FN2-67 to FN2-69).

Slip compensation: Maintains constant motor speed. To keep the motor speed constant, the output frequency varies within the limit of slip frequency according to the load current. For example, when the motor speed decreases below the reference speed (frequency) due to a heavy load, the inverter increases the output frequency above the reference frequency to increase the motor speed.

Sensorless Control: Refer to Chapter 8 “Customizing the Drive for your Application” for more information on this topic.

FN2-61 Auto-Tuning Selection

LCD Display: AutoTuneEnbl

Range: NO (Parameters will NOT be automatically measured.)
Static

Default: No

Access: Basic

Comm Addr: 943D

See Also: N/A

The auto tuning function automatically measures the motor parameters needed for control selected in FN2-60 [Control mode] such as stator resistance, rotor resistance and leakage inductance. The rated current, voltage, and RPM from in the motor nameplate should be entered before performing auto tuning.

FN2-62 Stator Resistance of Motor

LCD Display: %Rs

Range: 0.00 to 99.99[%]

Default: 4%

Access: Advanced

Comm Addr: 943E

See Also: N/A

Automatically set during autotune or can be used to manually enter the stator resistance of the motor.

FN2-63 Leakage Inductance of Motor

LCD Display: %Lsigma

Range: 0.0 to 999.9[%]

Default: 12%

Access: Advanced

Comm Addr: 943F

See Also: N/A

Automatically set during autotune or can be used to manually enter the leakage inductance of the stator and rotor of the motor.

FN2-64 Pre-excitation Time

LCD Display: PreEx Time

Range: 0 to 60[sec]

Default: 1.0[sec]

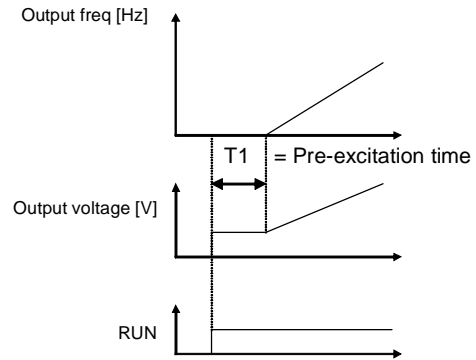
Access: Advanced

Comm Addr: 9440

See Also: N/A

When a run command is issued to the drive, the drive excites the motor with its magnetizing current at 0 Hz for the duration programmed in FN2-64 prior to accelerating the drive to its set frequency.

Displayed only when FN2-60 is set to "Sensorless".



FN2-67 Manual/AutoTorque Boost Selection

LCD Display: Torque Boost

Range: Manual
Auto

Default: Manual

Access: Advanced

Comm Addr: 9443

See Also: N/A

Used to increase the starting torque at low speed by increasing the output voltage of the inverter. If the boost value is set higher than required, it may cause the motor flux to saturate, causing an over-current trip. Increase the boost value when there is excessive distance between inverter and motor to compensate for voltage drop in wiring.

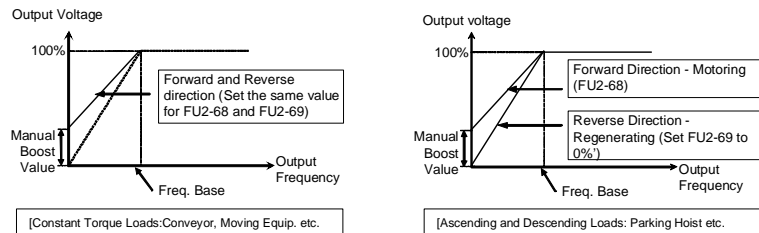
Manual: Values set in FN2-68 [Forward torque boost] and FN2-69 [Reverse torque boost] are utilized.

Auto: Inverter outputs high starting torque by automatically boosting torque according to the load characteristic.

NOTE: When "2nd Func" is used on a digital input to select between two different motors, auto torque boost is only applied to the 1st motor. Manual torque boost must be used for the 2nd motor.

NOTE: Auto torque boost is not available when FN2-60 [Control Mode] is set to "sensorless".

NOTE: Conduct Auto tuning in FN2-61 [Auto tuning] first to use Auto torque boost effectively.



FN2-68 Forward Torque Boost

LCD Display: Fwd Boost

Range: 0-15[%]

Default: 2

Access: Basic

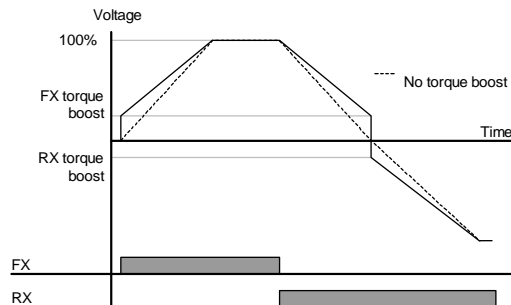
Comm Addr: 9444

See Also: N/A

Sets the level of torque boost applied to a motor during forward run. Set as a percentage of inverter rated voltage.

NOTE: When FN1-40 [Volts/Hz Pattern] is set to "User V/F", FN2-67 to 69 [Torque boost] is ignored.

NOTE: Increase this value when the motor does not produce enough torque or inverter to motor wiring is excessive. If this value is set too high, Overcurrent trip may occur.



NOTE: If the torque boost value is 0 when DC start is enabled, a "No Motor Trip" may occur.

Caution: If the boost value is set too high, it may cause motor overheating or over saturation.

FN2-69 Reverse Torque Boost

LCD Display: Rev Boost

Range: 0-15[%]

Default: 2

Access: Basic

Comm Addr: 9445

See Also: N/A

Sets the level of torque boost applied to a motor during reverse run. Set as a percentage of inverter rated voltage. See FN2-68 [Forward Torque Boost] for additional information.

Caution: If the boost value is set too high, it may cause motor overheating or over saturation.

FN2-80 Power-On Display

LCD Display: PowerOn Disp

Range: 0 to 6

Default: 0

Access: Basic

Comm Addr: 9450

See Also: Monitoring Display Parameters section 6.9

Sets the parameters to be displayed on the keypad when power is first applied to the drive.

FN2-82 Software Version

LCD Display: S/W Version

Range: Ver X.XX - X.X

Default: Read Only

Access: Basic

Comm Addr: 9452

See Also: N/A

Displays the inverter software version (example 0.5 - 2.0).

FN2-83 Last Trip Time

LCD Display: LastTripTime

Range: X:XX:XX:XX:XX:X (Year:Month:Day:Hour:Minute)

Default: n/a

Access: Basic

Comm Addr: 9453

See Also: N/A

Displays the time elapsed since last trip occurred. User can calculate the time of the last trip time from this value.

Automatically reset when a trip occurs.

FN2-84 Power On Time

LCD Display: PwrOn-Time
Range: X:XX:XX:XX:XX:X (Year:Month:Day:Hour:Minute)
Default: Read Only
Access: Basic
Comm Addr: 9454
See Also: N/A

Displays time since Power was turned ON. It is not reset automatically.

FN2-85 Run Time

LCD Display: Run-Time
Range: X:XX:XX:XX:XX:X (Year:Month:Day:Hour:Minute)
Default: Read Only
Access: Basic
Comm Addr: 9455
See Also: N/A

Displays the amount of time that the drive has been run. It is not reset automatically.

FN2-87 Power Set

LCD Display: %PowerSet
Range: 0.1 to 400.0[%]
Default: 100.0[%]
Access: Advanced
Comm Addr: 9457
See Also: N/A

Used to scale the inverter output power displayed in FN1-54 [KiloWattHour].

FN2-90 Parameter Display

LCD Display: Para. Disp
Range: Basic (Displays basic parameters)
Advanced (Displays all parameters)
Diff Para (Displays parameters set differently from factory setting.)
Default: Advanced
Access: Basic
Comm Addr: 945A
See Also: N/A

Specifies which parameters are available to be viewed.

FN2-91 Read Parameter

LCD Display: Param. Read
Range: No
Yes
Default: No
Access: Advanced
Comm Addr: 945B
See Also: N/A

Setting the parameter to “Yes” causes the parameters to be copied from the drive to the keypad. This can be used to set the parameters of other drives equivalent to the setup in the original drive (see FN2-92).

NOTE: Perform a parameter save using parameter FN2-95 prior to copying the parameters from the drive to the keypad.

FN2-92 Write Parameter

LCD Display: Param. Write
Range: No
Yes
Default: No
Access: Advanced
Comm Addr: 945C
See Also: N/A

Setting this parameter to “Yes” causes the parameters to be copied from the keypad to the drive. This can be used to set the parameters of other drives equivalent to the setup in the original drive (see FN2-91).

NOTE: After downloading parameters from the keypad to the drive, autotune should be executed if the drive is to operate in sensorless mode.

NOTE: Perform a parameter save using parameter FN2-95 prior to copying the parameters from the drive to the keypad.

FN2-93 Initialize Parameters

LCD Display: FactorySet

Range: No=No initialization.
All Groups=All parameter groups are initialized back to factory defaults.
BAS=Only BAS Group is initialized.
DRV=Only Drive Group is initialized
FN1=Only Function Group 1 is initialized.
FN2=Only Function Group 2 is initialized.
I/O=Only I/O Group is initialized.
EXT=Only EXT Group is initialized.
COM=Only COM Group is initialized.
APP=Only APP Group is initialized.

Default: No

Access: Advanced

Comm Addr: 945D

See Also:

Initializes parameters back to factory default values. Each parameter group can be initialized separately.

NOTE: Set BAS-01 through 05 [Motor parameters] again after this function.

NOTE: Parameter initialization will not clear trip information. Instead, use FN2-06 [Erase trips].

FN2-94 Parameter Write Protection

LCD Display: Param Lock

Range: 0 to 9999

Default: 0

Access: Basic

Comm Addr: 945E

See Also: N/A

This function is used to prevent the parameters from being changed. When the parameters are locked, the display arrow changes from solid to dashed line. The lock and unlock code is "12".

FN2-95 Save Parameter

LCD Display: Param Save

Range: No
Yes

Default: No

Access: Basic

Comm Addr: 945F

See Also: N/A

Setting FN2-95 to "Yes" causes the changed parameters to be saved to non-volatile memory. Normally parameters are saved when power is removed from the drive, but when performing a Read Parameter using FN2-91, the parameters need to be saved prior to execution of the read function.

7.6 I/O (Input/Output) Group Parameters

I/O-00 Jump to Desired Code Number within I/O Group

LCD Display: Jump Code

Range: 1 to 98

Default: 1

Access: Basic

Comm Addr: 9500

See Also: N/A

Sets the code to which to jump within the Input/Output group. Allows quick access to a desired parameter.

I/O-01 Filtering Time Constant for V1 Input

LCD Display: V1 Filter

Range: 0-9999[mSec]

Default: 10[mSec]

Access: Advanced

Comm Addr: 9501

See Also: N/A

Filtering time constant for V1 signal input. Increase this value if the V1 signal is affected by noise and causing unstable operation of the inverter. Increasing this value makes response time slower. Refer to Chapter 8 "Customizing for your Application" for more information on Analog Inputs. **Displayed only** when BAS-09 is set to "0 to +10V", "-10V to +10V" or "0 to 10V + 4 to 20 mA".

I/O-02 V1 Input Minimum Voltage

LCD Display: V1 Min Volt

Range: 0.00 to 10.00[V]

Default: 0.00[V]

Access: Advanced

Comm Addr: 9502

See Also: N/A

Sets the minimum voltage of the V1 input at which inverter outputs minimum frequency. Refer to Chapter 8 "Customizing for your Application" for more information on Analog Inputs. **Displayed only** when BAS-09 is set to "0 to +10V", "-10V to +10V" or "0 to 10V + 4 to 20 mA".

I/O-03 Frequency Corresponding to V1 Input Minimum Voltage

LCD Display: V1 Min Freq

Range: 0.00 to BAS-07[Hz] or
0.00 to 100.00[user selected units]

Default: 0.00[Hz]

Access: Advanced

Comm Addr: 9503

See Also: N/A

Sets the inverter output minimum frequency (or target value) when there is the minimum voltage (I/O-02) on the V1 terminal. Refer to Chapter 8 "Customizing for your Application" for more information on Analog Inputs. **Displayed only** when BAS-09 is set to "0 to +10V", "-10V to +10V" or "0 to 10V + 4 to 20 mA".

I/O-04 V1 Input Maximum Voltage

LCD Display: V1 Max Volt

Range: 0.00 to 12.00[V]

Default: 10.00[V]

Access: Advanced

Comm Addr: 9504

See Also: N/A

Sets the maximum voltage of the V1 input at which the inverter outputs maximum frequency. Refer to Chapter 8 "Customizing for your Application" for more information on Analog Inputs. **Displayed only** when BAS-09 is set to "0 to +10V", "-10V to +10V" or "0 to 10V + 4 to 20 mA".

I/O-05 Frequency Corresponding to V1 Input Maximum Voltage

LCD Display: V1 Max Freq

Range: 0.00 to BAS-07[Hz] or
0.00 to 100.00[user selected units]

Default: 60.00[Hz]

Access: Advanced

Comm Addr: 9505

See Also: N/A

Sets the inverter output maximum frequency (or target value) when there is the maximum voltage (I/O-04) on the V1 terminal. Refer to Chapter 8 "Customizing for your Application" for more information on Analog Inputs. **Displayed only** when BAS-09 is set to "0 to +10V", "-10V to +10V" or "0 to 10V + 4 to 20 mA".

I/O-06 Filtering Time Constant for I Signal Input

LCD Display: I In Filter

Range: 0-9999[mSec]

Default: 10

Access: Advanced

Comm Addr: 9506

See Also: N/A

Command Freq setting via "I" input terminal when BAS-09 [Speed Reference Source] is set to "4 to 20 mA" or 0 to 10 V + 4 to 20 mA". Filtering time constant for "I" signal input. If the "I" signal is affected by noise and causing unstable operation of the inverter, increase this value. Increasing this value makes response time slower. Refer to Chapter 8 "Customizing for your Application" for more information on Analog Current Input.

A User-selected unit will be displayed when either the APP-02 [PID operation selection] or the APP-80 [Ext. PID operation selection] is set to "Yes," and one of the following is entered in I/O-87 [Current input user unit selection]: Percent, Bar, mBar, kPa, or Pa. **Displayed only** when BAS-09 is set to "4 to 20mA", or "0 to 10V + 4 to 20 mA".

I/O-07 I Input Minimum Current

LCD Display: I In MinCurr

Range: 0.00 to 20.00[mA]

Default: 4.00

Access: Advanced

Comm Addr: 9507

See Also: N/A

Sets the minimum current of the "I" input at which the inverter outputs minimum frequency. Refer to Chapter 8 "Customizing for your Application" for more information on Analog Current Input. **Displayed only** when BAS-09 is set to "4 to 20mA", or "0 to 10V + 4 to 20 mA".

I/O-08 Frequency Corresponding to I Input Minimum Current

LCD Display: I In MinFreq

Range: 0.00 to BAS-07[Hz] or
0.00 to 100.00[user selected units]

Default: 0.00[Hz]

Access: Advanced

Comm Addr: 9508

See Also: N/A

Sets the inverter output minimum frequency (or target value) when there is minimum current (I/O-07) input on the "I" terminal. Refer to Chapter 8 "Customizing for your Application" for more information on Analog Current Input. **Displayed only** when BAS-09 is set to "4 to 20mA", or "0 to 10V + 4 to 20 mA".

I/O-09 I Input Max Current

LCD Display: I In MaxCurr

Range: I/O-07 to 20.00

Default: 20.00[mA]

Access: Advanced

Comm Addr: 9509

See Also: N/A

Sets the maximum current of the "I" input at which the inverter outputs maximum frequency. Refer to Chapter 8 "Customizing for your Application" for more information on Analog Current Input. **Displayed only** when BAS-09 is set to "4 to 20mA", or "0 to 10V + 4 to 20 mA".

I/O-10 Frequency Corresponding to I Input Max Current

LCD Display: I In MaxFreq
Range: 0.00 to BAS-07[Hz] or
0.00 to 100.00[user selected units]
Default: 60.00[Hz]
Access: Advanced
Comm Addr: 950A
See Also: N/A

Sets the inverter output maximum frequency (or target value) when there is the maximum current input (I/O-09) on the "I" terminal. Refer to Chapter 8 "Customizing for your Application" for more information on Analog Current Input. **Displayed only** when BAS-09 is set to "4 to 20mA", or "0 to 10V + 4 to 20 mA".

I/O-11 Pulse Input Method

LCD Display: Pulse InSlct
Range: A+B
A
Default: A
Access: Advanced
Comm Addr: 950B
See Also: N/A

Sets the frequency setting input method, either A or A+B. Refer to Chapter 8 "Customizing for your Application" for more information on Pulse Input. **Displayed only** when BAS-09 is set to "Pulse".

I/O-12 Pulse Input Filter

LCD Display: Pulse InFltr
Range: 0-9999[mSec]
Default: 10
Access: Advanced
Comm Addr: 950C
See Also: N/A

Sets the embedded filter constant for Pulse Input. Increase filter time when the noise interference causes unstable operation. Increasing this value makes response time slower. Refer to Chapter 8 "Customizing for your Application" for more information on Pulse Input. **Displayed only** when BAS-09 is set to "Pulse".

I/O-13 Pulse Input Minimum Frequency

LCD Display: PulseMinimum
Range: 0.0 to 10.0 [kHz]
Default: 0.0[kHz]
Access: Advanced
Comm Addr: 950D
See Also: N/A

Sets the minimum frequency of the Pulse Input. Refer to Chapter 8 “Customizing for your Application” for more information on Pulse Input. **Displayed only** when BAS-09 is set to “Pulse”.

I/O-14 Frequency Corresponding to I/O-13 Pulse Input Minimum Frequency

LCD Display: PulseMnHzOut
Range: 0.00 to FN1-30[Hz] or
0.00 to 100.00[user selected units]
Default: 0.00[Hz]
Access: Advanced
Comm Addr: 950E
See Also: N/A

Sets the inverter’s minimum output frequency at minimum Pulse input frequency as set in I/O-13[Pulse Input Min Frequency]. Refer to Chapter 8 “Customizing for your Application” for more information on Pulse Input. **Displayed only** when BAS-09 is set to “Pulse”.

I/O-15 Pulse Input Maximum Frequency

LCD Display: PulseMaximum
Range: 0.0 to 100.0 [kHz]
Default: 10.0[kHz]
Access: Advanced
Comm Addr: 950F
See Also: N/A

Sets the maximum frequency of the Pulse input. Refer to Chapter 8 “Customizing for your Application” for more information on Pulse Input. **Displayed only** when BAS-09 is set to “Pulse”.

I/O-16 Frequency Corresponding to I/O-15 Pulse Input Maximum Frequency

LCD Display: PulseMxHzOut
Range: 0.00 to BAS-07[Hz] or 0.00 to 100.00[user selected units]
Default: 60.00[Hz]
Access: Advanced
Comm Addr: 9510
See Also: N/A

Sets the inverter’s maximum output frequency at maximum Pulse input frequency as set in I/O-15 [Pulse Input Max Frequency]. Refer to Chapter 8 “Customizing for your Application” for more information on Pulse Input. **Displayed only** when BAS-09 is set to “Pulse”.

I/O-17 Criteria for Analog Input Signal Loss

LCD Display: Wire Broken
Range: None=Disabled (Does not check the analog input signal loss)
half of x1=Activated when drops below 50% of the minimum set value (I/O-02, I/O-07, I/O-13)
below x1=Activated when drops below the minimum set value (I/O-02, I/O-07, I/O-13).
Default: None

Access: Advanced

Comm Addr: 9511

See Also: N/A

Sets the level at which it is determined that analog input signal has been lost. When the analog input signal is lost, inverter displays the following:

Display	Description
LOV	Loss of Analog input signal, V1
LOI	Loss of Analog input signal, I
LOA	Loss of pulse reference frequency

I/O-18 Operating Selection at Loss of Frequency Reference

LCD Display: Lost Command

Range: None=Continue operation at last frequency before command was lost.
Free Run=Coast to stop. (Output disabled)
Stop=Decel to stop.

Default: 0

Access: Advanced

Comm Addr: 9512

See Also: N/A

Sets the Drive Mode that will be utilized if the frequency command is lost. Used when frequency command is supplied via V1 or I terminal or via communication option.

I/O-19 Waiting Time after Loss of Frequency Reference

LCD Display: Time Out

Range: 0.1-120.0[sec]

Default: 1.0[sec]

Access: Advanced

Comm Addr: 9513

See Also: N/A

Sets the time the inverter takes to determine if the frequency command has been lost. If there is no command input within this time period, the inverter begins operating via the method specified in I/O-18 [Selection of Drive Mode After Loss of Frequency Command].

I/O-20 Programmable Digital Input Terminal 'M1' Definition**LCD Display:** DI M1 Define**Range:**

Setting Range	Description
Speed-L	Preset Speed 1
Speed-M	Preset Speed 2
Speed-H	Preset Speed 3
XCEL-L	Accel/Decel Preset Speed 1
XCEL-M	Accel/Decel Preset Speed 2
XCEL-H	Accel/Decel Preset Speed 3
Dc-brake	DC injection braking during stop
2nd Func	Enables 2nd motor function
Exchange	Bypass to commercial line power
Reserved	Reserved for future use
Up	Increase drive speed in E-pot mode
Down	Decrease speed in E-pot mode
2WEnbl/3WStop	3 wire stop/2 wire Enable
Ext Trip	External trip input
Reserved	Reserved for future use
iTerm Clear	Used for PID control
Open-loop	Exchange between PID mode and V/F mode
LOC/REM	Exchange between Drv-91, 92 Local or Remote Mode
Analog Hold	Hold the analog input signal speed
XCEL stop	Disable Accel and Deccel
P Gain2	Used for PID control
Reserved	Reserved for future use
Interlock 1	Used only in MMC Operation
Interlock 2	
Interlock 3	
Interlock 4	
Speed-X	Additional Step frequency selection
RST	Reset faults
BX	BX (Drive Disable)
JOG	Jog Mode
FX	Forward Run in 2 wire/Start in 3 wire mode
RX	Reverse Run in 2 wire/direction change in 3 wire mode
ANA CHG	Analog input Switch-over from V to I
Ext.PID Run	Activate External PID loop
Firestat	Drive runs at Preset Speed 1
Freezestat	Drive runs at Preset Speed 2
Up/Dn Clr	Clears the drive

Default: Speed-L**Access:** Basic**Comm Addr:** 9514**See Also:** N/A

Specifies the function of Programmable Digital Input Terminal M1. Refer to Chapter 8 "Customizing for your Application" for more information.

I/O-21 Programmable Digital Input Terminal 'M2' Definition

LCD Display: DI M2 Define

Range: See I/O-20

Default: Speed-M

Access: Basic

Comm Addr: 9515

See Also: N/A

Specifies the function of Programmable Digital Input Terminal M2. See Parameter I/O-20 [Programmable Digital Input Terminal M1 Definition] for codes.

I/O-22 Programmable Digital Input Terminal 'M3' Definition

LCD Display: DI M3 Define

Range: See I/O-20

Default: Speed-H

Access: Basic

Comm Addr: 9516

See Also: N/A

Specifies the function of Programmable Digital Input Terminal M3. See Parameter I/O-20 [Programmable Digital Input Terminal M1 Definition] for codes.

I/O-23 Programmable Digital Input Terminal 'M4' Definition

LCD Display: DI M4 Define

Range: See I/O-20

Default: RST

Access: Basic

Comm Addr: 9517

See Also: N/A

Specifies the function of Programmable Digital Input Terminal M4. See Parameter I/O-20 [Programmable Digital Input Terminal M1 Definition] for codes.

I/O-24 Programmable Digital Input Terminal 'M5' Definition

LCD Display: DI M5 Define

Range: See I/O-20

Default: 2WEnbl/3WStop

Access: Basic

Comm Addr: 9518

See Also: N/A

Specifies the function of Programmable Digital Input Terminal M5. See Parameter I/O-20 [Programmable Digital Input Terminal M1 Definition] for codes.

I/O-25 Programmable Digital Input Terminal 'M6' Definition

LCD Display: DI M6 Define

Range: See I/O-20

Default: Jog

Access: Basic

Comm Addr: 9519

See Also: N/A

Specifies the function of Programmable Digital Input Terminal M6. See Parameter I/O-20 [Programmable Digital Input Terminal M1 Definition] for codes.

I/O-26 Programmable Digital Input Terminal 'M7' Definition

LCD Display: DI M7 Define

Range: See I/O-20

Default: FX

Access: Basic

Comm Addr: 951A

See Also: N/A

Specifies the function of Programmable Digital Input Terminal M7. See Parameter I/O-20 [Programmable Digital Input Terminal M1 Definition] for codes.

I/O-27 Programmable Digital Input Terminal 'M8' Definition

LCD Display: DI M8 Define

Range: See I/O-20

Default: RX

Access: Basic

Comm Addr: 951B

See Also: N/A

Specifies the function of Programmable Digital Input Terminal M8. See Parameter I/O-20 [Programmable Digital Input Terminal M1 Definition] for codes.

I/O-28 Terminal Input Status

LCD Display: DigInStatus

Range: 00000000000 to 11111111111

Default: Read Only

Access: Basic

Comm Addr: 951C

See Also: N/A

Displays the input status of control terminals M1 through M8 and P4 through P6. P4, P5, P6 will only be valid when an expansion board is installed.

LCD Keypad Display

Input T/M	P6	P5	P4	M8	M7	M6	M5	M4	M3	M2	M1
	bit 10	bit 9	bit 8	bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
OFF status	0	0	0	0	0	0	0	0	0	0	0
ON status	1	1	1	1	1	1	1	1	1	1	1

I/O-29 Filtering Time Constant for Programmable Digital Input Terminals

LCD Display: DigIn Filter
Range: 2 to 1000[mSec]
Default: 15[mSec]
Access: Advanced
Comm Addr: 951D
See Also: N/A

Adjusts the responsiveness of the Input terminals. Useful when noise level is high. Higher values result in slower response times.

NOTE: When using a digital input to sequence the drive with a bypass contactor (digital input set to “Exchange”), set this parameter greater than 100mSec to avoid chattering of the output command thus resulting in a malfunction in the bypass operation.

I/O-30 Jog Frequency Setting

LCD Display: Jog Speed
Range: 0.00 to BAS-07[Hz]
Default: 10.00[Hz]
Access: Basic
Comm Addr: 951E
See Also: N/A

Sets the frequency for Jog operation. See I/O-31 to 42 and DRV-05 to 07 for additional information. **Displayed only** when one of I/O-20 through 27 is set to either JOG, Speed_L, Speed_M, or Speed_H.

I/O-31 Preset Speed 4

LCD Display: PreSetSpd4
Range: 0.00 to BAS-07[Hz]
Default: 40.00[Hz]
Access: Basic
Comm Addr: 951F
See Also: N/A

Sets Step Frequency 4. **Displayed only** when one of I/O-20 through 27 is set to either JOG, Speed-L, Speed-M, or Speed-H.

I/O-32	<p>Preset Speed 5</p> <p>LCD Display: PreSetSpd5</p> <p>Range: 0.00 to BAS-07[Hz]</p> <p>Default: 50.00[Hz]</p> <p>Access: Basic</p> <p>Comm Addr: 9520</p> <p>See Also: N/A</p> <p>Sets Step Frequency 5. Displayed only when one of I/O-20 through 27 is set to either JOG, Speed-L, Speed-M, or Speed-H.</p>
I/O-33	<p>Preset Speed 6</p> <p>LCD Display: PreSetSpd6</p> <p>Range: 0.00 to BAS-07[Hz]</p> <p>Default: 40.00[Hz]</p> <p>Access: Basic</p> <p>Comm Addr: 9521</p> <p>See Also: N/A</p> <p>Sets Step Frequency 6. Displayed only when one of I/O-20 through 27 is set to either JOG, Speed-L, Speed-M, or Speed-H.</p>
I/O-34	<p>Preset Speed 7</p> <p>LCD Display: PresetSpd7</p> <p>Range: 0.00 to BAS-07[Hz]</p> <p>Default: 30.00</p> <p>Access: Basic</p> <p>Comm Addr: 9522</p> <p>See Also: N/A</p> <p>Sets Step Frequency 7. Displayed only when one of I/O-20 through 27 is set to either JOG, Speed-L, Speed-M, or Speed-H.</p>
I/O-35	<p>Preset Speed 8</p> <p>LCD Display: PreSetSpd8</p> <p>Range: 0.00 to BAS-07[Hz]</p> <p>Default: 20.00[Hz]</p> <p>Access: Basic</p> <p>Comm Addr: 9523</p> <p>See Also: N/A</p> <p>Sets Step Frequency 8. Displayed only when one of I/O-20 through 27 is set to Speed-X.</p>

I/O-36 Preset Speed 9

LCD Display: PreSetSpd9
Range: 0.00 to BAS-07[Hz]
Default: 10.00[Hz]
Access: Basic
Comm Addr: 9524
See Also: N/A

Sets Step Frequency 9. **Displayed only** when one of I/O-20 through 27 is set to Speed-X.

I/O-37 Preset Speed 10

LCD Display: PreSetSpd10
Range: 0.00 to BAS-07[Hz]
Default: 20.00[Hz]
Access: Basic
Comm Addr: 9525
See Also: N/A

Sets Step Frequency 10. **Displayed only** when one of I/O-20 through 27 is set to Speed-X.

I/O-38 Preset Speed 11

LCD Display: PresetSpd11
Range: 0.00 to BAS-07[Hz]
Default: 30.00[Hz]
Access: Basic
Comm Addr: 9526
See Also: N/A

Sets Step Frequency 11. **Displayed only** when one of I/O-20 through 27 is set to Speed-X.

I/O-39 Preset Speed 12

LCD Display: PreSetSpd12
Range: 0.00 to BAS-07[Hz]
Default: 40.00[Hz]
Access: Basic
Comm Addr: 9527
See Also: N/A

Sets Step Frequency 12. **Displayed only** when one of I/O-20 through 27 is set to Speed-X.

I/O-40 Preset Speed 13

LCD Display: PreSetSpd13
Range: 0.00 to BAS-07[Hz]
Default: 50.00[Hz]
Access: Basic

Comm Addr: 9528

See Also: N/A

Sets Step Frequency 13. **Displayed only** when one of I/O-20 through 27 is set to Speed-X.

I/O-41 Preset Speed 14

LCD Display: PreSetSpd14

Range: 0.00 to BAS-07[Hz]

Default: 40.00[Hz]

Access: Basic

Comm Addr: 9529

See Also: N/A

Sets Step Frequency 14. **Displayed only** when one of I/O-20 through 27 is set to Speed-X.

I/O-42 Step Frequency 15

LCD Display: PresetSpd15

Range: 0.00 to BAS-07[Hz]

Default: 30.00[Hz]

Access: Basic

Comm Addr: 952A

See Also: N/A

Sets Step Frequency 15. **Displayed only** when one of I/O-20 through 27 is set to Speed-X.

I/O-50 Acceleration Time 1 (for Preset Speed)

LCD Display: Acc Time-1

Range: 0-6000[sec]

Default: 20.0[sec]

Access: Advanced

Comm Addr: 9532

See Also: N/A

XCEL-H	XCEL-M	XCEL-L		
0	0	1	Acc/Dec Time 1	I/O-50 and I/O-51
0	1	0	Acc/Dec Time 2	I/O-52 and I/O-53
0	1	1	Acc/Dec Time 3	I/O-54 and I/O-55
1	0	0	Acc/Dec Time 4	I/O-56 and I/O-57
1	0	1	Acc/Dec Time 5	I/O-58 and I/O-59
1	1	0	Acc/Dec Time 6	I/O-60 and I/O-61
1	1	1	Acc/Dec Time 7	I/O-62 and I/O-63

Displayed only when one of the I/O-20 through 27 is set to XCEL-L XCEL-M, or XCEL-H

I/O-51 Deceleration Time 1 (for Preset Speed)

LCD Display: Dec Time-1

Range: 0-6000[sec]

Default: 20.0[sec]

Access: Advanced

Comm Addr: 9533

See Also: N/A

Displayed Only when one of the I/O-20 through 27 is set to XCEL-L, XCEL-M or XCEL-H.

I/O-52 Acceleration Time 2

LCD Display: Acc Time-2

Range: 0-6000[sec]

Default: 30.0[sec]

Access: Advanced

Comm Addr: 9534

See Also: N/A

Displayed Only when one of the I/O-20 through 27 is set to XCEL-L, XCEL-M or XCEL-H.

I/O-53 Deceleration Time 2

LCD Display: Dec Time-2

Range: 0-6000[sec]

Default: 30.0[sec]

Access: Advanced

Comm Addr: 9535

See Also: N/A

Displayed Only when one of the I/O-20 through 27 is set to XCEL-L, XCEL-M or XCEL-H.

I/O-54 Acceleration Time 3

LCD Display: Acc Time-3

Range: 0-6000[sec]

Default: 40.0[sec]

Access: Advanced

Comm Addr: 9536

See Also: N/A

Displayed Only when one of the I/O-20 through 27 is set to XCEL-L, XCEL-M or XCEL-H.

I/O-55 Deceleration Time 3

LCD Display: Dec Time-3

Range: 0-6000[sec]

Default: 40.0[sec]

Access: Advanced

Comm Addr: 9537

See Also: N/A

Displayed Only when one of the I/O-20 through 27 is set to XCEL-L, XCEL-M or XCEL-H.

I/O-56 Acceleration Time 4

LCD Display: Acc Time-4

Range: 0-6000[sec]

Default: 50.0[sec]

Access: Advanced

Comm Addr: 9538

See Also: N/A

Displayed Only when one of the I/O-20 through 27 is set to XCEL-L, XCEL-M or XCEL-H.

I/O-57 Deceleration Time 4

LCD Display: Dec Time-4

Range: 0-6000[sec]

Default: 50.0[sec]

Access: Advanced

Comm Addr: 9539

See Also: N/A

Displayed Only when one of the I/O-20 through 27 is set to XCEL-L, XCEL-M or XCEL-H.

I/O-58 Acceleration Time 5

LCD Display: Acc Time-5

Range: 0-6000[sec]

Default: 40.0[sec]

Access: Advanced

Comm Addr: 953A

See Also: N/A

Displayed Only when one of the I/O-20 through 27 is set to XCEL-L, XCEL-M or XCEL-H.

I/O-59 Deceleration Time 5

LCD Display: Dec Time-5

Range: 0-6000[sec]

Default: 40.0[sec]

Access: Advanced

Comm Addr: 953B

See Also: N/A

Displayed Only when one of the I/O-20 through 27 is set to XCEL-L, XCEL-M or XCEL-H.

I/O-60 Acceleration Time 6
LCD Display: Acc Time-6
Range: 0-6000[sec]
Default: 30.0[sec]
Access: Advanced
Comm Addr: 953C
See Also: N/A
Displayed Only when one of the I/O-20 through 27 is set to XCEL-L, XCEL-M or XCEL-H.

I/O-61 Deceleration Time 6
LCD Display: Dec Time-6
Range: 0-6000[sec]
Default: 30.0[sec]
Access: Advanced
Comm Addr: 953D
See Also: N/A
Displayed Only when one of the I/O-20 through 27 is set to XCEL-L, XCEL-M or XCEL-H.

I/O-62 Acceleration Time 7
LCD Display: Acc Time-7
Range: 0-6000[sec]
Default: 20.0[sec]
Access: Advanced
Comm Addr: 953E
See Also: N/A
Displayed Only when one of the I/O-20 through 27 is set to XCEL-L, XCEL-M or XCEL-H.

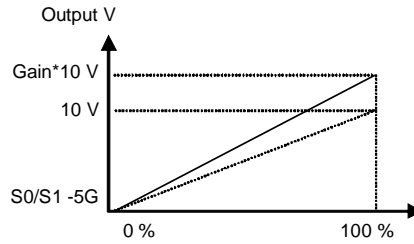
I/O-63 Deceleration Time 7
LCD Display: Dec Time-7
Range: 0-6000[sec]
Default: 20.0[sec]
Access: Advanced
Comm Addr: 953F
See Also: N/A
Displayed Only when one of the I/O-20 through 27 is set to XCEL-L, XCEL-M or XCEL-H.

I/O-70 S0 Output Item Selection
LCD Display: AnlgOutS0Sel
Range: Frequency=Output Frequency
Current=Output Current
Voltage=Output Voltage
DC Link Vtg=Inverter DC Link Voltage
Ext PID Out=Ext PID Out

Default: Frequency
Access: Basic
Comm Addr: 9546
See Also: N/A

Sel	Output	Output Value Determined by:
Frequency	Inverter output frequency	$(\text{Output freq.} / \text{Max. freq.}) \times 10\text{V} \times (\text{IO-71 or 73}) / 100$
Current	Inverter output current	$(\text{Output current} / \text{Rated current}) \times 10\text{V} \times (\text{IO-71 or 73}) / 100$
Voltage	Inverter output voltage	$(\text{Output voltage} / \text{Max. output voltage}) \times 10\text{V} \times (\text{IO-71 or 73}) / 100$
DC Link Vtg	DC link voltage of inverter	$(\text{DC link voltage} / \text{Max. DC link voltage}) \times 10\text{V} \times (\text{IO-71 or 73}) / 100$
Ext PID Out	External PID output	$(\text{External PID output} / 10000) \times 10\text{V} \times \text{S0, S1 output gain (I/O-71, 73)} / 100$

NOTE: Maximum DC Link Voltage for 200V class is 410V and for 400V class 820V.



I/O-71 S0 Output Adjustment

LCD Display: AnlgOutS0Gn
Range: 10 to 200[%]
Default: 100[%]
Access: Advanced
Comm Addr: 9547
See Also: N/A

When connecting the Analog output to a meter, the value can be adjusted according to various meter specifications.



I/O-72 S1 Output Item Selection

LCD Display: AnlgOutS1Sel
Range: Frequency=Output Frequency
Current=Output Current
Voltage=Output Voltage
DC Link Vtg=Inverter DC Link Voltage
Ext PID Out=Ext PID Out

Default: Voltage
Access: Basic
Comm Addr: 9548
See Also: N/A

Refer to I/O-70 for additional information.

I/O-73 S1 Output Adjustment

LCD Display: AnlgOutS1Gn
Range: 10 to 200[%]
Default: 100[%]
Access: Advanced
Comm Addr: 9549
See Also: N/A

Refer to I/O-70 for additional information.

I/O-74 Frequency Detection Level

LCD Display: FreqDet Freq
Range: 0.00 to BAS-07[Hz]
Default: 30.00[Hz]
Access: Advanced
Comm Addr: 954A
See Also: N/A

Used along with I/O-76-79 [Programmable Digital Auxiliary Output Terminal]. See [FDT-#] in I/O-76 to 79.

To use Programmable Digital output terminal Q1, Q2, and Q3, an option board must be installed.

I/O-75 Frequency Detection Bandwidth

LCD Display: FreqDet Band
Range: 0.00 to BAS-07[Hz]
Default: 10.00[Hz]
Access:
Comm Addr: 954B
See Also: N/A

Refer to I/O-74 for additional information.

I/O-76 Programmable Digital Output Terminal Definition (Aux Terminal)**LCD Display:** RlyOut 1 Def**Range:**

Setting Range	Description
None	None
FDT-1	Output frequency arrival detection
FDT-2	Specific frequency level detection
FDT-3	Frequency detection with pulse
FDT-4	Frequency detection 1 with contact closure
FDT-5	Frequency detection 2 with contact closure
OL	Overload Detection
IOL	Inverter Overload detection
OV	Stalling
LV	Over voltage detection
OH	Low voltage detection
Lost Command	Lost command detection
RUN	Inverter running detection
STOP	Inverter stop detection
Steady	Steady speed detection
INV line	By-Pass
COMM line	
Speed Search	Speed search mode detection
Ready	Inverter ready detection
MMC	Used for MMC operation
Critical Trip	Non-resettable fault

Default: None**Access:** Basic**Comm Addr:** 954C**See Also:** N/A

The auxiliary contact closes when the defined condition has occurred. See Chapter 8 "Customizing for your application" for details about the digital output functions.

I/O-77 Programmable Digital Output Terminal Define**LCD Display:** RlyOut 2 Def**Range:** See I/O-76 for Range Information**Default:** None**Access:** Basic**Comm Addr:** 954D**See Also:** N/A

See Chapter 8 "Customizing for your application" for details about the digital output functions.

I/O-78 Programmable Digital Output Terminal Define**LCD Display:** RlyOut 3 Def**Range:** See I/O-76 for Range Information**Default:** None

Access: Basic

Comm Addr: 954E

See Also: N/A

See Chapter 8 "Customizing for your application" for details about the digital output functions.

I/O-79 Programmable Digital Output Terminal Define

LCD Display: RlyOut4 Def

Range: See I/O-76 for Range Information

Default: None

Access: Basic

Comm Addr: 954F

See Also: N/A

See Chapter 8 "Customizing for your application" for details about the digital output functions.

I/O-80 Fault Output Relay Setting (3A, 3B, 3C)

LCD Display: FltRly Mode

Range: 000 to 111 (Bit Set)

Bit	Setting	Display	Description
Bit 0 (LV)	0	000	Fault output relay does not operate at "Low voltage" trip.
	1	001	Fault output relay operates at "Low voltage" trip.
Bit 1 (Trip)	0	000	Fault output relay does not operate at any fault.
	1	010	Fault output relay operates at any fault except "Low voltage" and "BX" (inverter disable) fault.
Bit 2 (Retry)	0	000	Fault output relay does not operate regardless of the retry number.
	1	100	Fault output relay operates when the retry number set in FN2-26 decreases to 0 by faults. Disabled while Auto retry is ON.

Default: 010 (bit)

Access: Basic

Comm Addr: 9550

See Also: N/A

Allows the fault output relay to operate when a fault occurs. The output relay terminals are 3A, 3B, 3C where 3A-3C is a normally open contact and 3B-3C is a normally closed contact.

When several faults occur at the same time, Bit 1 has the first priority. (Active order: Bit 1->Bit 2->Bit3)

I/O-81 Terminal Output Status

LCD Display: DigOutStatus

Range: 00000000 to 11111111

Output Terminals	3A-3C	Q3	Q2	Q1	AUX4	AUX3	AUX2	AUX1
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
OFF status	0	0	0	0	0	0	0	0
ON status	1	1	1	1	1	1	1	1

Default: Read Only

Access: Basic

Comm Addr: 9551

See Also: N/A

Displays the output status of control terminals.

I/O-82 Waiting Time after Fault Output Relay On

LCD Display: FltRlyOnDly

Range: 0 to 9999[sec]

Default: 0[sec]

Access: Advanced

Comm Addr: 9552

See Also: N/A

Fault relay output is delayed for the set time.

I/O-83 Waiting Time after Fault Output Relay Off

LCD Display: FltRlyOffDly

Range: 0 to 9999[sec]

Default: 0[sec]

Access: Advanced

Comm Addr: 9553

See Also: N/A

Fault relay output is turned OFF after the set time.

I/O-84 Fan Control Selection (50 to 700HP)

LCD Display: Fan Mode

Range: 0=Power On Fan (Fan ON when inverter power is ON)
1=Run Fan (Fan ON when inverter runs (outputs its frequency))
2=Temper-Fan(Fan ON when inverter temp exceeds the preset value in I/O-85)

Default: 0

Access: Advanced

Comm Addr: 9554

See Also: N/A

Only functional for inverters 50HP and higher.

I/O-85 Fan Temperature (50 to 700HP)

LCD Display: Fan Temper

Range: 0 to 70[°C]

Default: 70[°C]

Access: Advanced

Comm Addr: 9555

See Also: N/A

Only available for inverters 50HP and higher. Determines temperature at which fan turns on when I/O-84 is set to "Temper-Fan".

I/O-86 Input User Unit Selection

LCD Display: Unit Sel

Range: Percent (Flow rate, pressure and temp are displayed in [%].)
Bar (Pressure is displayed in [Bar].)
mBar (Pressure is displayed in [mBar].)
kPa (Pressure is displayed in [kPa].)
PSi (Pressure is displayed by [PSi].)
Pa (Pressure is displayed in [Pa].)

Default: Percent

Access: Advanced

Comm Addr: 9556

See Also: N/A

Set "Yes" in more than one code among APP-02 [PID operation selection], APP-80 [Ext. PID operation selection] and APP-62 [PID Bypass selection]. Then, select one of the desired units among Percent, Bar, mBar, kPa, PSi, and Pa in this field. In this case, all unit displays related to inverter target frequency are changed. When APP-02 [PID operation selection], APP-80 [Ext. PID operation selection] and APP-62 [PID Bypass selection] are set to "0", I/O-86, -87, -88 are initialized to Percent [%]. If DRV-16 is changed to [Rpm], unit display is changed from [%] to [Rpm].

I/O-87 Unit Maximum Value

LCD Display: Unit Max Val

Range: 0.1 to 999.9 [%]

Default: 100.0 [%]

Access: Advanced

Comm Addr: 9557

See Also: N/A

Sets the maximum value for Input User Unit Selection (I/O-86).

I/O-90 Inverter Number

LCD Display: Drive Addr

Range: 1 to 250

Default: 1

Access: Advanced

Comm Addr: 955A

See Also: N/A

Sets the inverter ID which is used with RS485 communication with PCs or PLCs.

I/O-91 Baud Rate

LCD Display: Baud Rate

Range: 1200[bps]
2400[bps]
4800[bps]
9600[bps]
19200[bps]
38400[bps] (Available only when the external communication option card is installed)

Default: 9600[bps]

Access: Advanced

Comm Addr: 955B

See Also: N/A

Sets the Baud Rate (communication speed) of RS485 Communication. To make the multi-drop system, connect the terminal C+ to other inverter's C+ and C- to C-.

I/O-92 Operating Method at Loss of Frequency Reference

LCD Display: COM Lost Cmd

Range: None: Continuous operation after loss of communication signal.
Free Run: Inverter cuts off its output after determining loss of communication signal.
Stop: Inverter stops by its Decel pattern and Decel time after determining loss of communication signal.

Default: None

Access: Advanced

Comm Addr: 955C

See Also: N/A

Specifies which operating method will be in place if frequency reference is lost. **Displayed only** when BAS-08 or BAS-09 is set to "Int. 485".

I/O-93 Waiting Time after Loss of Frequency Reference

LCD Display: COM TimeOut

Range: 0.1 to 120[sec]

Default: 1.0[sec]
Access: Advanced
Comm Addr: 955D
See Also: N/A

Determines whether the signal is lost. **Displayed only** when BAS-08 or BAS-09 is set to "Int. 485".

I/O-94 Communication Response Delay Time

LCD Display: Delay Time
Range: 2 to 1000[mSec]
Default: 5[mSec]
Access: Advanced
Comm Addr: 955E
See Also: N/A

For communication using RS-232 to RS-485 converter. It should be set properly according to RS-232 to RS-485 converter specifications.

I/O-95 A or B Contact

LCD Display: DigIn Invert
Range: 0000000000 to 1111111111
Default: 0000000000
Access: Advanced
Comm Addr: 955F
See Also: N/A

Programs input contact logic (Normal Open-A/Normal close-B Contact) for M1, M2, M3, M4, M5, M6, M7, M8, P4, P5, and P6. P4 through P6 can only be programmed when the expansion is installed.

Input T/M	P6	P5	P4	M8	M7	M6	M5	M4	M3	M2	M1
	bit 10	bit 9	bit 8	bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
0: NO 1: NC	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1

I/O-96 Input Time

LCD Display: In CheckTime
Range: 1 to 1000[mSec]
Default: 1[mSec]
Access: Advanced
Comm Addr: 9560
See Also: N/A

When Multi-step speed or Multi-Accel/Decel operation is active, inverter determines the input to be valid after this amount of time elapses.

I/O-97 Overheat Trip Selection**LCD Display:** OvrHtTripSel**Range:** 000 to 111 (Bit Set)

Bit set			Function
2	1	0	
		1	Motor overheat trip setting (tripped at I/O-98)
	1		-Reserved-
1			External temperature sensor selection (PTC/ NTC)

Default: 010 (Bit)**Access:** Advanced**Comm Addr:** 9561**See Also:** N/A

Inverter Overheat protection is active regardless of motor temp setting condition. Bit 1 is reserved for future use.

I/O-98 Motor Overheat Trip Temperature**LCD Display:** MotTripTemp**Range:** 0 to 255[°C]**Default:** 110[°C]**Access:** Advanced**Comm Addr:** 9562**See Also:** N/A

Sets the temperature at which motor overtrip is detected.

7.7 Application Group Parameters

APP-00 Jump to Desired Code Number within the APP Group

LCD Display: Jump Code

Range: 1 to 97

Default: 1

Access: Basic

Comm Addr: 9800

See Also: N/A

Sets the code to which to jump within the Application Group. Allows quick access to a desired parameter.

APP-01 Application Mode Selection

LCD Display: App Mode

Range: None
MMC

Default: None

Access: Advanced

Comm Addr: 9701

See Also: N/A

Sets the application mode. If MMC is selected, parameters APP-40 through APP-71 are displayed.

I/O-76 through 79 [Programmable digital Aux relay output] is automatically set to "MMC". If less than 4 aux motors are connected, the remaining relays can be used for other functions.

Note: I/O-76 through 79 value is not initialized automatically even though "None" is set after setting "MMC". In this case, set I/O-76 through 79 again for desired selection.

APP-02 PID Operation Selection

LCD Display: Proc PI Mode

Range: No
Yes

Default: No

Access: Advanced

Comm Addr: 9802

See Also: N/A

Refer to Chapter 8 "Customizing for your Application" for more information on PID Operation.

APP-03 PID Feed Forward (F) Gain Selection

LCD Display: PID FFwd Gn

Range: 0.0-999.9[%]

Default: 0.0

Access: Advanced

Comm Addr: 9803

See Also: N/A

Sets the F Gain for the PID Controller, which is the gain to add the target value to the PID controller output. When it is set to 100%, the responsiveness (%) of output F gain from the controller reference value is 100%. Used when a fast response is needed. **Displayed only:** when APP-02 is set to "Yes".

NOTE: Control System output may become unstable if this value is set too high.

APP-04 PID Auxiliary Reference Mode Selection

LCD Display: Aux Ref Enbl

Range: No
Yes

Default: No

Access: Advanced

Comm Addr: 9804

See Also: N/A

Selects PID Aux Ref. Input Enable/Disable. See PID Block Diagram (Chapter 8) for details. **Displayed only:** when APP-02 is set to "Yes".

APP-05 PID Auxiliary Reference Signal Selection

LCD Display: Aux Ref Sel

Range: Keypad-1 Pulse
0~+10V Int. 485
-10V~+10V Ext PID
4~20mA
0~10V+4~20mA

Default: -10V to +10V

Access: Advanced

Comm Addr: 9805

See Also: N/A

Sets the source of Aux reference signal. When APP-04 is set to "No," BAS-09, Multi-step frequency, UP/DOWN, & Jog frequency become PID controller's reference. When APP-04 is set to "Yes," PID reference is issued from the value set here. **Displayed only:** when APP-02 is set to "Yes".

APP-06 PID Feedback Signal Selection

LCD Display: PID Fbk Src

Range: I
V1
V2
Pulse

Default: I

Access: Advanced

Comm Addr: 9806

See Also: N/A

Select the feedback signal for PID control. This can be set to one of "I" (4 to 20mA), "V1", "V2" and "Pulse" according to the signal (current or voltage) and the terminal (V1 (0-10V), V2 (Sub-B board)) or Pulse (0 to 100kHz). Refer to I/O 6 through 10 for I, I/O1 through 5 for V1, I/O-11 through 16 for Pulse and EXT-6 through 10 [V2 Analog Ref. Freq Setting] for V2. **Displayed only:** when APP-02 is set to "Yes".

APP-07 Meter I Maximum Value

LCD Display: Meter I Max
Range: 0 to 20.00 mA
Default: 20.00 mA
Access: Advanced
Comm Addr: 9807
See Also: N/A

Used if APP-06 is set to I. Set this value to maximum value of current feedback.

APP-08 Meter V Maximum Value

LCD Display: Meter V Max
Range: 0 to 12.00 V
Default: 10.00 V
Access: Advanced
Comm Addr: 9808
See Also: N/A

Used if APP-06 is set to VI. Set this value to maximum value of voltage feedback.

APP-09 Meter P Maximum Value

LCD Display: Meter P Max
Range: 0 to 100.0 kHz
Default: 100.0 kHz
Access: Advanced
Comm Addr: 9809
See Also: N/A

Used if APP-06 is set to Pulse. Set this value to maximum value of pulse feedback.

APP-11 Proportional (P) Gain for PID Controller

LCD Display: PID P Gain
Range: 0.0 to 999.9[%]
Default: 1.0[%]
Access: Advanced
Comm Addr: 980B
See Also: N/A

Sets the proportional gain for PID control. When P-Gain is set at 100% and I-Time at 0.0 second, it means the PID controller output is 100% for 100% error value. P-Gain is set to 50% and I- Time to 0.0 sec, PID controller output becomes 50% for 100% error value. **Displayed only:** when APP-02 is set to "Yes".

APP-12 Integral Time (I) Gain for PID Controller

LCD Display: PID I Time
Range: 0 to 32.0[sec]
Default: 10.0[sec]
Access: Advanced
Comm Addr: 980C
See Also: N/A

Sets the integral time for PID control. This is the time the PID controller takes to output 100% for 100% error value. For example, when it is set to 30 sec, 30 sec is taken for PID controller to output 100% for 100% error value. 100% error means feedback value is 0 to the preset reference value. **Displayed only:** when APP-02 is set to "Yes".

APP-13 Differential Time (D) Gain for PID Controller

LCD Display: PID D Time
Range: 0.0 to 100.0[mSec]
Default: 0.0[mSec]
Access: Advanced
Comm Addr: 980D
See Also: N/A

Sets the D time for the PID Controller, which is the output value corresponding to the variation of the error. The error is detected every 0.01 sec in VS1PF. If differential time is set to 0.01 sec and the percentage variation of error is 100% per 1 sec, 1% in 100% is output per 10mSec. **Displayed only:** when APP-02 is set to "Yes".

APP-14 High Limit Frequency for PID Control

LCD Display: PID Hi Limit
Range: 0.00 to BAS-07[Hz]
Default: 60.00[Hz]
Access: Advanced
Comm Addr: 980E
See Also: N/A

Sets the upper output frequency limit through the PID Controller. **Displayed only:** when APP-02 is set to "Yes".

APP-15 Low Limit Frequency for PID Control

LCD Display: PID LowLimit
Range: FN1-32 to APP-10[Hz]
Default: 0.50[Hz]
Access: Advanced
Comm Addr: 980F
See Also: N/A

Sets the lower output frequency limit through the PID Controller. **Displayed only:** when APP-02 is set to "Yes".

APP-16 PID Output Scale

LCD Display: PID OutScale
Range: 0.0 to 999.9[%]
Default: 100.0[%]
Access: Advanced
Comm Addr: 9810
See Also: N/A

Sets the scale of PID controller output. **Displayed only:** when APP-02 is set to "Yes".

APP-17 PID P2 Gain

LCD Display: PID P2 Gain
Range: 0.0 to 999.9[%]
Default: 100[%]
Access: Advanced
Comm Addr: 9811
See Also: N/A

Sets the second P-Gain for PID control. **Displayed only:** when APP-02 is set to "Yes".

APP-18 P Gain Scale

LCD Display: P Gain Scale
Range: 0 to 100[%]
Default: 100[%]
Access: Advanced
Comm Addr: 9812
See Also: N/A

Sets the conversion scale of P-Gain and P2-Gain. **Displayed only:** when APP-02 is set to "Yes".

APP-19 PID Output Inverse

LCD Display: PID OutInvt
Range: No
Yes
Default: No
Access: Advanced
Comm Addr: 9813
See Also: N/A

Sets PID controller's output inversion. **Displayed only:** when APP-02 is set to "Yes".

APP-20 PID U Curve Feedback Selection

LCD Display: PID U Fbk

Range: No
Yes

Default: No

Access: Advanced

Comm Addr: 9814

See Also: N/A

Converts linear pattern of a feedback sensor to the squared pattern without any additional settings. Useful for fan and pump applications.

NOTE: PID output value can be set to "0" by setting a Programmable digital input terminal (M1 to M8) to "Open loop" in I/O-20 to I/O-27.

NOTE: The accumulated value by I-Gain can be set to "0" by setting a Programmable digital input terminal (M1 to M8) to "iTerm Clear" in I/O-20 to I/O-27.

NOTE: The P-Gain 2 can be selected for PID controller by setting a Programmable digital input (I/O-20 to I/O-27) to "Open-loop".

NOTE: When APP-02 [PID operation selection] is set to "Yes", a desired display unit in I/O-86, -87, -88 [User Unit selection] is set among Speed, Percent, Bar, mBar, kPa, Pa. This selection will affect the value display of APP-06 [PID feedback selection]; all the parameter units related to inverter target frequency will be changed.

Displayed only: when APP-02 is set to "Yes".

APP-23 PrePID Reference Frequency

LCD Display: PrePID Freq

Range: 0.00 to BAS-07[Hz]

Default: 0.00[Hz]

Access: Advanced

Comm Addr: 9817

See Also: N/A

Specifies the inverter target frequency to be output until Pre PID operation is finished when Inverter Run signal is ON and Pre PID operation is selected.

Pre PID operation is a new function to enable smooth PID operation. For example, before pump operation is started, Pre PID fills water in the pump and pipe. Or Accel/Decel operation is performed before coil winding machine's speed reaches a certain level.

APP-24 PrePID Exit Level

LCD Display: PrePID Exit

Range: 0 to 100[%]

Default: 0[%]

Access: Advanced

Comm Addr: 9818

See Also: N/A

Sets the threshold value at which to start PID operation compared to feedback value received during Pre PID operation. If the feedback value exceeds the threshold value in APP-75, Pre PID operation ends and PID operation begins.

APP-25 PrePID Stop Delay

LCD Display: PrePID Delay
Range: 0 to 9999[sec]
Default: 600[sec]
Access: Advanced
Comm Addr: 9819
See Also: N/A

When feedback value is less than APP-75 value even though time set in APP-76 elapses, inverter signals system malfunction. It can be set by the user to fit the system in use.

APP-26 Pipe Broken

LCD Display: Pipe Broken
Range: No
Yes
Default: No
Access: Advanced
Comm Addr: 981A
See Also: N/A

If the detected value is below the setting of APP-24 and exceeds the value set of APP-25, the system shows "Pipe Broken" - signifying that there is a problem with the flow.

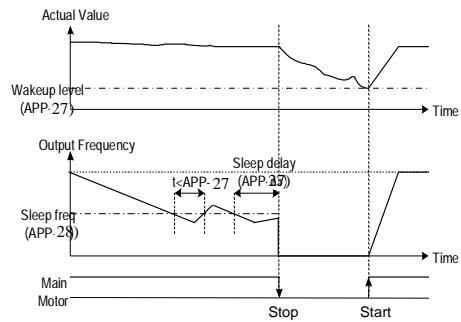
APP-27 Sleep Delay Time

LCD Display: Sleep Delay
Range: 0.0 to 9999[sec]
Default: 60.0[sec]
Access: Advanced
Comm Addr: 981B
See Also: N/A

Sleep function is initiated when flow demand is low. Inverter stops the motor when the motor runs below Sleep Frequency (APP-28) after Sleep Delay Time (APP-27) has elapsed. While in the sleep state, inverter keeps monitoring flow demand and initiates Wake-Up function when the real value of the controlling amount has increased above the Wake-Up level (APP-29).

NOTE: Sleep function is disabled if this value is set to "0".

NOTE: APP-02 must be set to YES to see this parameter, APP-28 and APP-29.



APP-28 Sleep Frequency

LCD Display: Sleep Freq
Range: 0.00 to BAS-07[Hz]
Default: 0.00[Hz]
Access: Advanced
Comm Addr: 981C
See Also: N/A

See APP-27 for information regarding sleep function.

APP-29 Wake-Up Level

LCD Display: WakeUp Level
Range: 0.0 to 100.0[%]
Default: 2.0[%]
Access: Advanced
Comm Addr: 981D
See Also: N/A

See APP-27 for information regarding sleep function.

APP-30 Second Motor Acceleration Time

LCD Display: 2nd Acc Time
Range: 0-6000[sec]
Default: 5.0[sec]
Access: Advanced
Comm Addr: 981E
See Also: N/A

Sets the acceleration time for the second motor. **Displayed only** when one of I/O-20 through 27 is set to [2nd Function].

APP-31 Second Motor Deceleration Time

LCD Display: 2nd Dec Time

Range: 0-6000[sec]

Default: 10.0[sec]

Access: Advanced

Comm Addr: 9815

See Also: N/A

Sets the deceleration time for the second motor. **Displayed only** when one of I/O-20 through 27 is set to [2nd Function].

APP-32 Second Motor Base Frequency

LCD Display: 2nd BaseFreq

Range: 30 to BAS-07[Hz]

Default: 60.00[Hz]

Access: Advanced

Comm Addr: 9820

See Also: N/A

Sets the frequency at which the inverter outputs its rated voltage to the second motor. Reference the motor nameplate. **Displayed only** when one of I/O-20 through 27 is set to [2nd Function].

APP-33 Second Motor V/F Pattern

LCD Display: 2nd V/F

Range: Linear
Square
User Defined V/F Pattern

Default: Linear

Access: Advanced

Comm Addr: 9821

See Also: N/A

Sets the V/F pattern for the second motor. **Displayed only** when one of I/O-20 through 27 is set to [2nd Function].

APP-34 Second Motor Forward Torque Boost

LCD Display: 2nd F-Boost

Range: 0 to 15[%]

Default: 2[%]

Access: Advanced

Comm Addr: 9822

See Also: N/A

Sets the level of torque boost applied to the second motor during forward run. Set as a percentage of Max Output Voltage. **Displayed only** when one of I/O-20 through 27 is set to [2nd Function].

APP-35 Second Motor Reverse Torque Boost

LCD Display: 2nd R-Boost

Range: 0-15[%]

Default: 2[%]

Access: Advanced

Comm Addr: 9823

See Also: N/A

Sets the level of torque boost applied to the second motor during reverse run. Set as a percentage of Max Output Voltage. **Displayed only** when one of I/O-20 through 27 is set to [2nd Function].

APP-36 Second Motor Stall Prevention Level

LCD Display: 2nd Stall

Range: 30 to 150[%]

Default: 100[%]

Access: Advanced

Comm Addr: 9824

See Also: N/A

Sets the current level required to activate stall prevention function for the second motor during Accel, steady state, or Decel. Set as a percentage of APP-29[Second Motor Rated Current]. **Displayed only** when one of I/O-20 through 27 is set to [2nd Function].

APP-37 Second Motor Electronic Thermal Level for 1 Minute

LCD Display: 2nd ETH 1min

Range: APP-28 to 200[%]

Default: 130%

Access: Advanced

Comm Addr: 9825

See Also: N/A

Sets the maximum level of current the motor can tolerate for 1 minute. Set as a percentage of [Second Motor Rated Current]. Cannot be set below APP-28[Second Motor Electronic Thermal Level for Continuous]. **Displayed only** when one of I/O-20 through 27 is set to "2nd Function".

APP-38 Second Motor Electronic Thermal Level for Continuous

LCD Display: 2nd ETH Cont

Range: 50 to FN2-27 (max 150)[%]

Default: 120[%]

Access: Advanced

Comm Addr: 9826

See Also: N/A

Sets the continuous current rating of the second motor. Set as a percentage of [Second Motor Rated Current]. Cannot be set above "Second Motor Electronic Thermal Level" for 1 Minute. **Displayed only** when one of I/O-20 through 27 is set to "2nd Function".

APP-39 Second Motor Rated Current

LCD Display: 2nd R-Curr

Range: 1 to 200[A]

Default: 3.6[A]

Access: Advanced

Comm Addr: 9827

See Also: N/A

Enter the rated current from the second motor nameplate. **Displayed only** when one of I/O-20 through 27 is set to "2nd Function".

APP-40 Number of Auxiliary Motor Run Display

LCD Display: Aux Mot Run

Range: 0 to 4

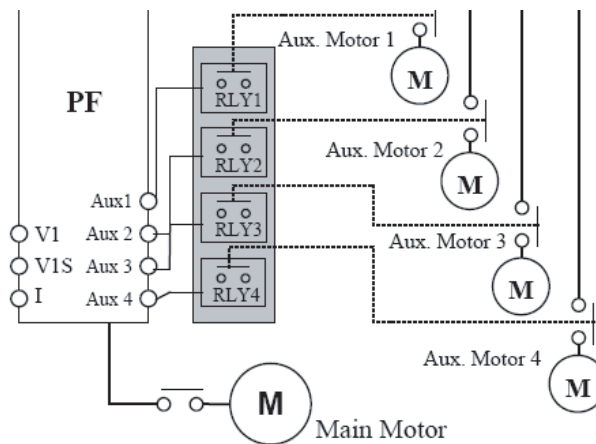
Default: 0

Access: Advanced

Comm Addr: 9828

See Also: N/A

Shows how many motors are being run by MMC control.



[MMC Diagram]

APP-41 Aux Motor Start Selection

LCD Display: Starting Aux

Range: 1 to 4

Default: 1

Access: Advanced

Comm Addr: 9829

See Also: N/A

Defines the starting auxiliary motor for MMC control.

APP-42 Operation Time Display on Auto Change

LCD Display: Auto Op Time

Range: N/A

Default: 00:00

Access: Advanced

Comm Addr: 982A

See Also: N/A

Displays the operation time after Auto Change is accomplished.

APP-43 The Number of Aux Motor

LCD Display: Nbr Aux's

Range: 0 to 7

Default: 4

Access: Advanced

Comm Addr: 982B

See Also: N/A

Sets the number of auxiliary motors connected to the inverter.

APP-44 F-in L-Out

LCD Display: F-in-L-out

Range: No
Yes

Default: Yes

Access: Advanced

Comm Addr: 972C

See Also: N/A

Sets auxiliary motor stop sequence.

APP-45 ALL Stop

LCD Display: ALL Stop

Range: No
Yes

Default: Yes

Access: Advanced

Comm Addr: 972D

See Also: N/A

Sets stop command for all auxiliary motors.

APP-47 Start Frequency of Aux Motor 1

LCD Display: Start Freq 1

Range: 0 to BAS-07

Default: 49.99 [Hz]
Access: Advanced
Comm Addr: 982F
See Also: N/A

Sets the starting frequency of Aux Motor 1.

APP-48 Start Frequency of Aux Motor 2

LCD Display: Start Freq 2
Range: 0 to BAS-07
Default: 49.99 [Hz]
Access: Advanced
Comm Addr: 9830
See Also: N/A

Sets the starting frequency of Aux Motor 2.

APP-49 Start Frequency of Aux Motor 3

LCD Display: Start Freq 3
Range: 0 to BAS-07
Default: 49.99 [Hz]
Access: Advanced
Comm Addr: 9831
See Also: N/A

Sets the starting frequency of Aux Motor 3.

APP-50 Start Frequency of Aux Motor 4

LCD Display: Start Freq 4
Range: 0 to BAS-07
Default: 49.99 [Hz]
Access: Advanced
Comm Addr: 9832
See Also: N/A

Sets the starting frequency of Aux Motor 4.

APP-51 Stop Frequency of Aux Motor 1

LCD Display: Stop Freq 1
Range: 0 to BAS-07
Default: 20.00 [Hz]
Access: Advanced
Comm Addr: 9833
See Also: N/A

Sets the stopping frequency of Aux Motor 1.

APP-52 Stop Frequency of Aux Motor 2

LCD Display: Stop Freq 2
Range: 0 to BAS-07
Default: 20.00 [Hz]
Access: Advanced
Comm Addr: 9834
See Also: N/A

Sets the stopping frequency of Aux Motor 2.

APP-53 Stop Frequency of Aux Motor 3

LCD Display: Stop Freq 3
Range: 0 to BAS-07
Default: 20.00 [Hz]
Access: Advanced
Comm Addr: 9835
See Also: N/A

Sets the stopping frequency of Aux Motor 3.

APP-54 Stop Frequency of Aux Motor 4

LCD Display: Stop Freq 4
Range: 0 to BAS-07
Default: 20.00 [Hz]
Access: Advanced
Comm Addr: 9836
See Also: N/A

Sets the stopping frequency of Aux Motor 4.

APP-58 Delay Time Before Operating Aux Motor

LCD Display: Aux Start DT
Range: 0.0 to 999.9 [sec]
Default: 5.0 [sec]
Access: Advanced
Comm Addr: 983A
See Also: N/A

Sets the time the inverter waits before starting the auxiliary motors.

APP-59 Delay Time Before Stopping Aux Motor

LCD Display: Aux Stop DT
Range: 0.0 to 999.9 [sec]
Default: 5.0 [sec]
Access: Advanced

Comm Addr: 983B

See Also: N/A

Sets the time the inverter waits before stopping the auxiliary motors.

APP-60 Accel Time When Number of Pumps Decreases

LCD Display: PID Acc Time

Range: 0 to 600.00 [sec]

Default: 2.0 [sec]

Access: Advanced

Comm Addr: 983C

See Also: N/A

Sets the acceleration time of the main motor by 0.1 sec when less auxiliary motors are connected.

APP-61 Decel Time When Number of Pumps Increases

LCD Display: PID Dec Time

Range: 0 to 600.00 [sec]

Default: 2.0 [sec]

Access: Advanced

Comm Addr: 983D

See Also: N/A

Sets the deceleration time of the main motor by 0.1 sec when more auxiliary motors are connected.

APP-62 PID Bypass Selection

LCD Display: Regul Bypass

Range: No
Yes

Default: No

Access: Advanced

Comm Addr: 983E

See Also: N/A

Used to bypass the PID operation selected in APP-02. Set this code to "Yes" when using MMC function without PID control. Frequency is determined by feedback of control amount instead of PID controller output.

APP-66 Auto Change Mode Selection

LCD Display: AutoCh_Mode

Range: EXCH_NONE
AUX_EXCH
MAIN_EXCH

Default: EXCH_NONE

Access: Advanced

Comm Addr: 9842

See Also: N/A

Used to change the running order of the motors to regulate their run-time when multiple motors are connected for MMC.

APP-67 Auto Change Time

LCD Display: AutoEx-Invt
Range: 00:00 to 99:00
Default: 72:00
Access: Advanced
Comm Addr: 9843
See Also: N/A

Used to protect motor from running alone for an extended time by changing operation to another motor.

APP-68 Auto Change Freq

LCD Display: AutoEx-Freq
Range: FN1-32 to BAS-07
Default: 20.00 [Hz]
Access: Advanced
Comm Addr: 9844
See Also: N/A

Changes operation to another motor when actual value of controlling amount is less than value set here.

APP-69 Inter-Lock Selection

LCD Display: Inter-lock
Range: No
Yes
Default: No
Access: Advanced
Comm Addr: 9845
See Also: N/A

When set to "Yes" M1-M4 can be used as the same activating condition for AX1-AX4. Programmable digital input terminals are activated when turned ON. If one terminal is turned OFF, all motors will start running except the motor connected to the OFF terminal. If the input signal is turned OFF during running inverter stops all the motors and restarts the operation with normal active motors.

APP-71 Pressure Difference for Aux Motor Start

LCD Display: Aux Su Diff
Range: 0 to 100%
Default: 2 [%]
Access: Advanced
Comm Addr: 9847
See Also: N/A

Sets the pressure difference between when the auxiliary motors are ON and auxiliary motor starting frequency.

APP-72 Pressure Difference for Aux Motor Stop

LCD Display: Aux Stp Diff
Range: 0 to 100%
Default: 2 [%]
Access: Advanced
Comm Addr: 9848
See Also: N/A

Sets the pressure difference between when the auxiliary motors are ON and auxiliary motor stopping frequency.

APP-80 Ext PID Operation Selection

LCD Display: Ext PI Mode
Range: No
Yes
Default: No
Access: Advanced
Comm Addr: 9850
See Also: N/A

APP-80 to 96 setting value is the same as APP-02 to 17. Ext PID can be used for controlling other system independently as an external PID controller using both PID controller in APP-02 and External PID controller using Ext PID output as an Inverter target frequency. See APP-02, APP-80 (to use Dual PID operation) for more details.

APP-81 Ext PID Reference Signal Selection

LCD Display: ExtPI RefSel
Range: I
V1
Pulse
Keypad
Default: Keypad
Access: Advanced
Comm Addr: 9851
See Also: N/A

APP-80 to 96 setting value is the same as APP-02 to 17. Can be set when APP-81 [Ext PID Ref selection] is set to "Keypad".

APP-82 Ext PID Reference Level

LCD Display: Ext PI Ref%
Range: 0.00 to 100.00[%]
Default: 50.00[%]
Access: Advanced
Comm Addr: 9852

See Also: N/A

APP-80 to 96 setting value is the same as APP-02 to 17.

APP-83 Ext PID Feedback Signal Selection

LCD Display: ExtPI FbkSel

Range: I
V1
Pulse

Default: I

Access: Advanced

Comm Addr: 9853

See Also: N/A

APP-80 to 96 setting value is the same as APP-02 to 17.

APP-85 Proportional (P) Gain for Ext PID Controller

LCD Display: ExtPID Pgain

Range: 0.0 to 999.9[%]

Default: 1.0%

Access: Advanced

Comm Addr: 9855

See Also: N/A

Sets the P Gain for the Ext PID Controller. APP-80 to 96 setting value is the same as APP-02 to 17.

APP-86 Integral Time (I) Gain for Ext PID Controller

LCD Display: ExtPID ITime

Range: 0.0 to 32.0[sec]

Default: 10.0[sec]

Access: Advanced

Comm Addr: 9856

See Also: N/A

Sets the I Gain for the Ext PID Controller. APP-80 to 96 setting value is the same as APP-02 to 17.

APP-87 Differential Time (D) Gain for Ext PID Controller

LCD Display: ExtPID DTime

Range: 0 to 2000[mSec]

Default: 0[mSec]

Access: Advanced

Comm Addr: 9857

See Also: N/A

Sets the D Gain for the Ext PID Controller. APP-80 to 96 setting value is the same as APP-02 to 17.

APP-88 High Limit Frequency for Ext PID Control

LCD Display: ExtPID Lmt-H

Range: 0 to 100[%]

Default: 100.00[%]

Access: Advanced

Comm Addr: 9858

See Also: N/A

Sets the upper output frequency limit through the Ext PID Controller. APP-80 to 96 setting value is the same as APP-02 to 17.

APP-89 Low Limit Frequency for Ext PID Control

LCD Display: ExtPID Lmt-L

Range: 0 to 30[%]

Default: 0[%]

Access: Advanced

Comm Addr: 9859

See Also: N/A

Sets the lower output frequency limit through the Ext PID Controller. APP-80 to 96 setting value is the same as APP-02 to 17.

APP-90 Ext PID Output Scale

LCD Display: ExtPID Scale

Range: 0.0 to 999.9[%]

Default: 100.0[%]

Access: Advanced

Comm Addr: 985A

See Also: N/A

APP-80 to 96 setting value is the same as APP-02 to 17.

APP-91 Ext PID P2 Gain

LCD Display: ExtPI P2Gain

Range: 0.0 to 999.9[%]

Default: 100.0[%]

Access: Advanced

Comm Addr: 985B

See Also: N/A

APP-80 to 96 setting value is the same as APP-02 to 17.

APP-92 Ext PID P Gain Scale

LCD Display: ExtPI PScale

Range: 0 to 100[%]

Default: 100[%]

Access: Advanced

Comm Addr: 985C

See Also: N/A

APP-80 to 96 setting value is the same as APP-02 to 17.

APP-93 Feed Forward (F) Gain for Ext PID Controller

LCD Display: ExtPI FFwdGn

Range: 0.0 to 999.9[%]

Default: 0.0[%]

Access: Advanced

Comm Addr: 985D

See Also: N/A

APP-80 to 96 setting value is the same as APP-02 to 17.

APP-95 Ext PID Output Inverse

LCD Display: ExtPI OutInv

Range: No
Yes

Default: No

Access: Advanced

Comm Addr: 985F

See Also: N/A

APP-80 to 96 setting value is the same as APP-02 to 17.

APP-97 Ext PID Loop Time

LCD Display: ExtPI LoopTm

Range: 50 to 200[mSec]

Default: 100[mSec]

Access: Advanced

Comm Addr: 9861

See Also: N/A

Sets the time to activate Ext PID controller. Set the desired value according to system.

APP-80 to 96 setting value is the same as APP-02 to 17.

7.8 Extension Group Parameters

EXT-00 Jump to Desired Code within the EXT Group

LCD Display: Jump Code
Range: 1 to 45
Default: 1
Access: Basic
Comm Addr: 9600
See Also: N/A

EXT-01 Type of SUB Board

LCD Display: Sub B/D
Range: Sub to E
Default: Read Only
Access: Basic
Comm Addr: 9601
See Also: N/A

EXT-40 Current Output Terminal 1 (CO1) Selection

LCD Display: Opt1CO1Slct
Range: Frequency
Current
Voltage
DC Link Voltage
Ext PID Out
Default: Frequency
Access: Advanced
Comm Addr: 9628
See Also: N/A

EXT-41 Adjust Gain of Current Output Terminal 1 (CO1)

LCD Display: Opt1CO1Gain
Range: 10 to 200[%]
Default: 100%
Access: Advanced
Comm Addr: 9629
See Also: N/A

EXT-42 Adjust Offset of Current Output Terminal 1 (CO1)

LCD Display: Opt1CO1Offst
Range: 0 to 100[%]
Default: 0[%]
Access: Advanced
Comm Addr: 962A
See Also: N/A

EXT-43 Current Output Terminal 2 (CO2) Selection

LCD Display: Opt1CO2Slct
Range: Frequency
Current
Voltage
DC Link Voltage
Ext PID Out
Default: Frequency
Access: Advanced
Comm Addr: 962B
See Also: N/A

EXT-44 Adjust Gain of Current Output Terminal 2 (CO2)

LCD Display: Opt1CO2Gain
Range: 10 to 200[%]
Default: 100[%]
Access: Advanced
Comm Addr: 962C
See Also: N/A

EXT-45 Adjust Offset of Current Output Terminal 2 (CO2)

LCD Display: Opt1CO2Offst
Range: 0 to 100[%]
Default: 0[%]
Access: Advanced
Comm Addr: 962D
See Also: N/A

7.9 Communications Group Parameters

COM-00 Jump to Desired Code within COM Group

LCD Display: Jump Code
Range: 1 to 60
Default: 1
Access: Basic
Comm Addr: 9700
See Also: N/A

COM-01 Type of SUB Board

LCD Display: Opt B/D
Range: RS485
Default: Read Only
Access: Basic
Comm Addr: 9701
See Also: N/A

COM-02 Option Mode

LCD Display: Opt Mode
Range: None
Command
Frequency
Cmd+Freq
Default: None
Access: Advanced
Comm Addr: 9702
See Also: N/A

COM-03 Option Version

LCD Display: Opt Version
Range: Ver X.X
Default: Read Only
Access: Advanced
Comm Addr: 9703
See Also: N/A

COM-60 Parity/Stop
LCD Display: Parity/Stop
Range: 8 None/1 Stop
8 None/2 Stop
8 Even/1 Stop
8 Odd/1 Stop
Default: 8 None/1 Stop
Access: Advanced
Comm Addr: 9760
See Also: N/A

COM-61 Opt Para-1
LCD Display: Opt Para-1
Range: 0 to FFFF
Default: 0
Access: Advanced
Comm Addr: 973D
See Also: N/A

COM-62 Opt Para-2
LCD Display: Opt Para-2
Range: 0 to FFFF
Default: 0
Access: Advanced
Comm Addr: 973E
See Also: N/A

COM-63 Opt Para-3
LCD Display: Opt Para-3
Range: 0 to FFFF
Default: 0
Access: Advanced
Comm Addr: 973F
See Also: N/A

COM-64 Opt Para-4
LCD Display: Opt Para-4
Range: 0 to FFFF
Default: 0
Access: Advanced
Comm Addr: 9740
See Also: N/A

COM-65 Opt Para-5
LCD Display: Opt Para-5
Range: 0 to FFFF
Default: 0
Access: Advanced
Comm Addr: 9741
See Also: N/A

COM-66 Opt Para-6
LCD Display: Opt Para-6
Range: 0 to FFFF
Default: 0
Access: Advanced
Comm Addr: 9742
See Also: N/A

COM-67 Comm Up Date
LCD Display: Comm Up Date
Range: 0 = No
1 = Yes
Default: 0
Access: Advanced
Comm Addr: 9743
See Also: N/A

For more information, refer to the appropriate manual for the expansion board installed in your system.

MN763DN DeviceNet
MN763MB Modbus
MN763PB ProfibusDP

This section is used to describe certain functions within the VS1PF in greater detail. Examples of information included in this chapter are PID, Autotune, Auto Restart, Custom V/Hz Curves and Sensorless Vector Control.

8.1 Setting Protection & Trip Levels

Table 8.1 – Setting Protection & Trip Levels

Parameter Name	Code	Description
Electronic thermal	FN1-60 FN1-61 FN1-62 FN1-63	Protects the motor from overheating without the use of an external thermal relay. Refer to parameter descriptions for more detail.
Overload alarm & trip	FN1-64 FN1-65 FN1-66 FN1-67 FN1-68	Warning alarm actuates and trip message is displayed when current above the threshold limit is detected for a prolonged period.

8.2 Setting Starting/Accel/Decel/Stopping Patterns

Table 8.2 – Setting Starting/Accel/Decel/Stopping Patterns

Parameter Name	Code	Description
Accel/Decel pattern	FN1-02 FN1-03	3 types of Accel/Decel pattern: Linear, S-curve, U-curve
Starting/Stopping method	FN1-20 BAS-12	4 types of stopping method
Frequency Limit selection	BAS-06 BAS-07	Limits the active frequency. Inverter operates at the freq range between upper freq limit [BAS-07] and lower freq limit [BAS-06]. If a higher or lower freq value is entered, it is automatically replaced by the limit value. Setting range: [BAS-07] Maximum freq to [FN1-32] starting freq.

8.3 Operation-starting Method

Table 8.3 – Operation-starting Method

Parameter Name	Code	Description
Starting method	FN2-20 FN2-21 FN2-25 FN2-26	Motor starting method: [FN2-20] Power-on run, [FN2-21] Restart after Fault Reset, [FN2-25] Number of Auto Restart Attempts [FN2-26] Delay Time Before Auto Restart See parameter description for more details.
Speed Search Selection	FN2-22 FN2-23 FN2-24	Speed search function is available during Accel, trip, momentary power failure, restart after fault reset and Speed search at auto restart. See parameter description for more details.

8.4 Setting Application Function

8.4.1 PID operation

Inverter can be used to maintain process control, e.g. flow rate, air volume or pressure via PID feedback control.

Table 8.4 – PID Parameters

Parameter Name	Code	Description
PID control setting	APP-02 to APP-25	Parameters for PID control setting

See Section 8.12.

8.4.2 Ext PID operation

External PID feedback control.

Table 8.5 – External PID Parameters

Parameter Name	Code	Description
ExtPID setting	APP-80 to APP-97	Parameters for Ext PID

External PID provides a second PID Loop. Setup is the same as primary PID. See Section 8.12 for more information.

8.4.3 Pre PID Operation

Helps to smooth the start of the PID control.

Table 8.6 – Pre PID Parameters

Parameter Name	Code	Description
PrePID setting	APP-23 to APP-25	Parameters for Pre PID operation

The Pre-PID function is useful in providing a startup period where the PID is inactive thus allowing for stabilization of the process before the PID is enabled. An example may be where you start up a pump at a minimum speed thus allowing the piping to fill up with fluid prior to releasing the control to the PID loop.

8.5 Jog and Multi-speed Operation

Table 8.7 – Jog and Multi-speed Operation

Parameter Name	Code	Description
Multi function input terminal setting	I/O-20 to 27	If I/O-20 to 27 are set by Speed-H, Speed-M, Speed-L, multi-speed operation up to 17 speeds is available.
Filter time constant for input terminal	I/O-29	Effective for eliminating noise problems on the digital inputs.
Speed reference value	DRV-05 to 07 I/O-31 to I/O-42	Speed reference value for each preset speed
Accel/Decel time setting for each step	I/O-50 to 63	Accel/Decel time for each preset speed
Jog freq.	I/O-30	Jog freq for jog operation setting

Table 8.8 – Speed Reference Selection

Speed-X	Speed-H	Speed-M	Speed-L	JOG	Speed Command	Parameter value
0	0	0	0	0	Main Speed Ref	n/a
X	X	X	X	1	Jog Speed	I/O-30
0	0	0	1	0	Preset Speed 1	DRV-05
0	0	1	0	0	Preset Speed 2	DRV-06
0	0	1	1	0	Preset Speed 3	DRV-07
0	1	0	0	0	Preset Speed 4	I/O-31
0	1	0	1	0	Preset Speed 5	I/O-32
0	1	1	0	0	Preset Speed 6	I/O-33
0	1	1	1	0	Preset Speed 7	I/O-34
1	0	0	0	0	Preset Speed 8	I/O-35
1	0	0	1	0	Preset Speed 9	I/O-36
1	0	1	0	0	Preset Speed 10	I/O-37
1	0	1	1	0	Preset Speed 11	I/O-38
1	1	0	0	0	Preset Speed 12	I/O-39
1	1	0	1	0	Preset Speed 13	I/O-40
1	1	1	0	0	Preset Speed 14	I/O-41
1	1	1	1	0	Preset Speed 15	I/O-42

Table 8.9 – Speed Reference Selection

Jog	Firestat	Freezestat	Resulting Speed Command	Mode
D1 M6	D1 M1	D1 M2		
Open	Closed	Closed	Run from Normal Speed Reference	
Closed	Closed	Closed	Run from Jog Speed Reference I/O-30	
Open	Closed	Open	Run at Preset Speed 2 DRV-06	Freezestat
Closed	Closed	Open	Run at Preset Speed 2 DRV-06	Freezestat
Open	Open	Closed	Run at Preset Speed 1 DRV-05	Firestat
Closed	Open	Closed	Run at Preset Speed 1 DRV-05	Firestat
Open	Open	Open	Run at Preset Speed 1 DRV-05	Firestat
Closed	Open	Open	Run at Preset Speed 1 DRV-05	Firestat

8.6 2nd Motor Operation

2nd function setting is used to run the two motors using one inverter by reconnection of the drive output to a 2nd motor using, for example, contactors. If the terminal defined for 2nd function signal input is turned ON, 2nd motor operation is valid. Only one motor is controlled at any one time

Table 8.10 – 2nd Motor Operation

Parameter Name	Code	Description
Programmable Digital Input terminals setting	I/O-20 to 27	2 nd motor operation is available with Programmable Digital Input terminals M1 to M8 set to 7 (2 nd Func).
Parameter setting for 2 nd motor operation	APP-30 to APP-39	Setting parameters necessary to operate 2 nd motor such as base freq., Accel/Decel time, Stall.

8.7 Energy-saving Operation

FN1-51 [Energy Save Level] adjusts the inverter output voltage to minimize the inverter output voltage during steady-state speed operation. Appropriate for energy-saving applications such as fan, pump and HVAC.

8.8 Operation Examples

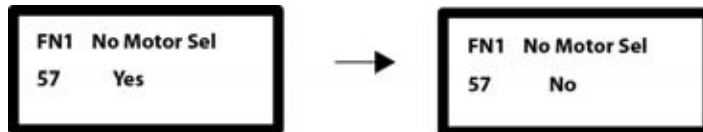
Note: -10~+10V mode enables Forward/Reverse rotation using $\pm 12V$ power via Analog input command. Refer to Chapter 7, Parameter description of BAS-09 for details.

Note: Use 0~+10V instead of -10V~+10V mode when FWD/REV Run Prevention is active. -10V~+10V mode enables the motor to run both FWD/REV directions.

Note: If the inverter is operated without a motor wired to it, trip occurs (as shown below) because the protection function is active by default. In this case, refer to the related parameters (FN1-57 to 59). To reset the trip, cycle power on the inverter.



If a simple trial run is needed without wiring a motor, such as to check on basic operation state, FN1-57(No Motor Sel) will need to be changed to [No] because the factory default is [Yes]



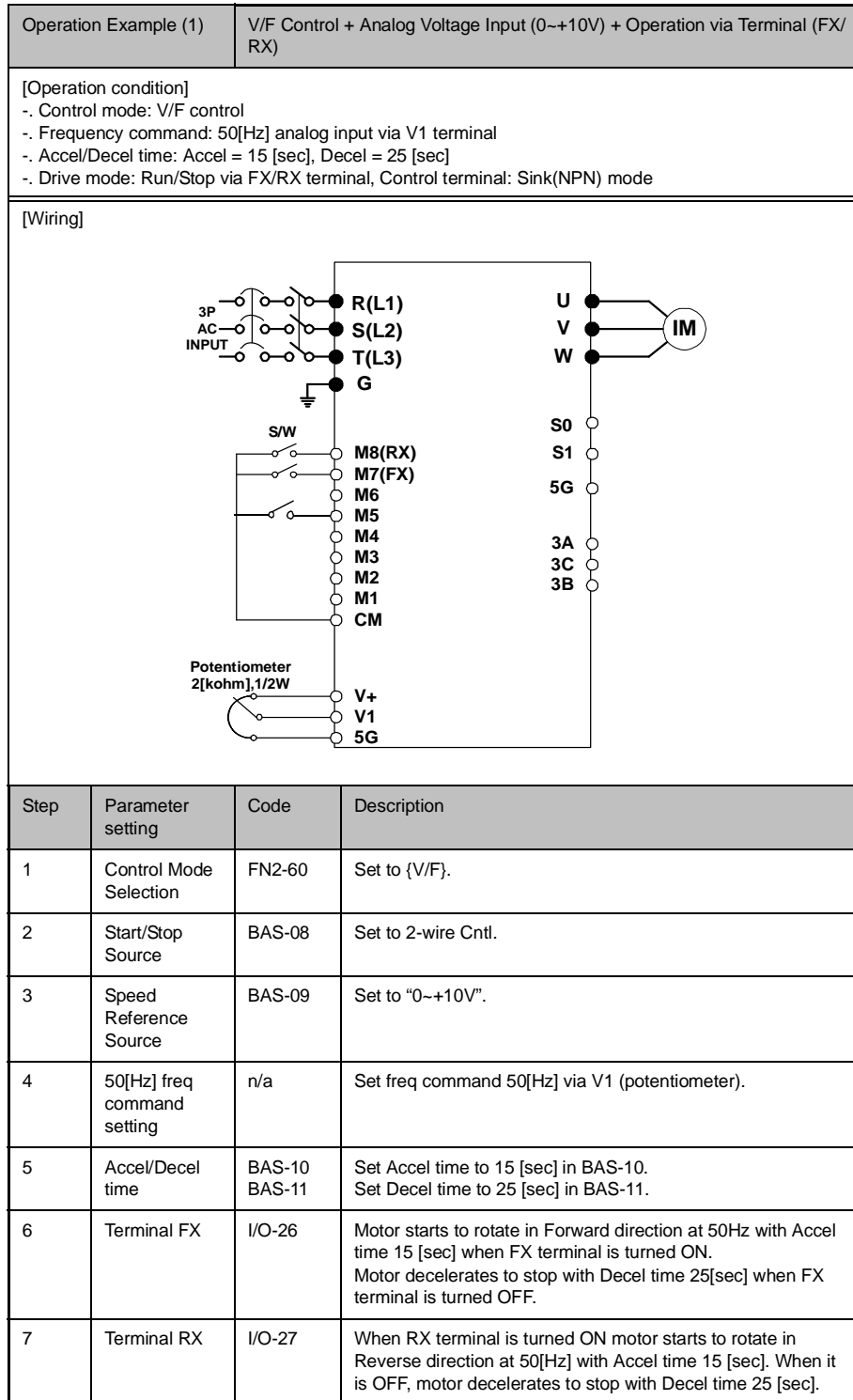


Figure 8.1 – Operation Example 1

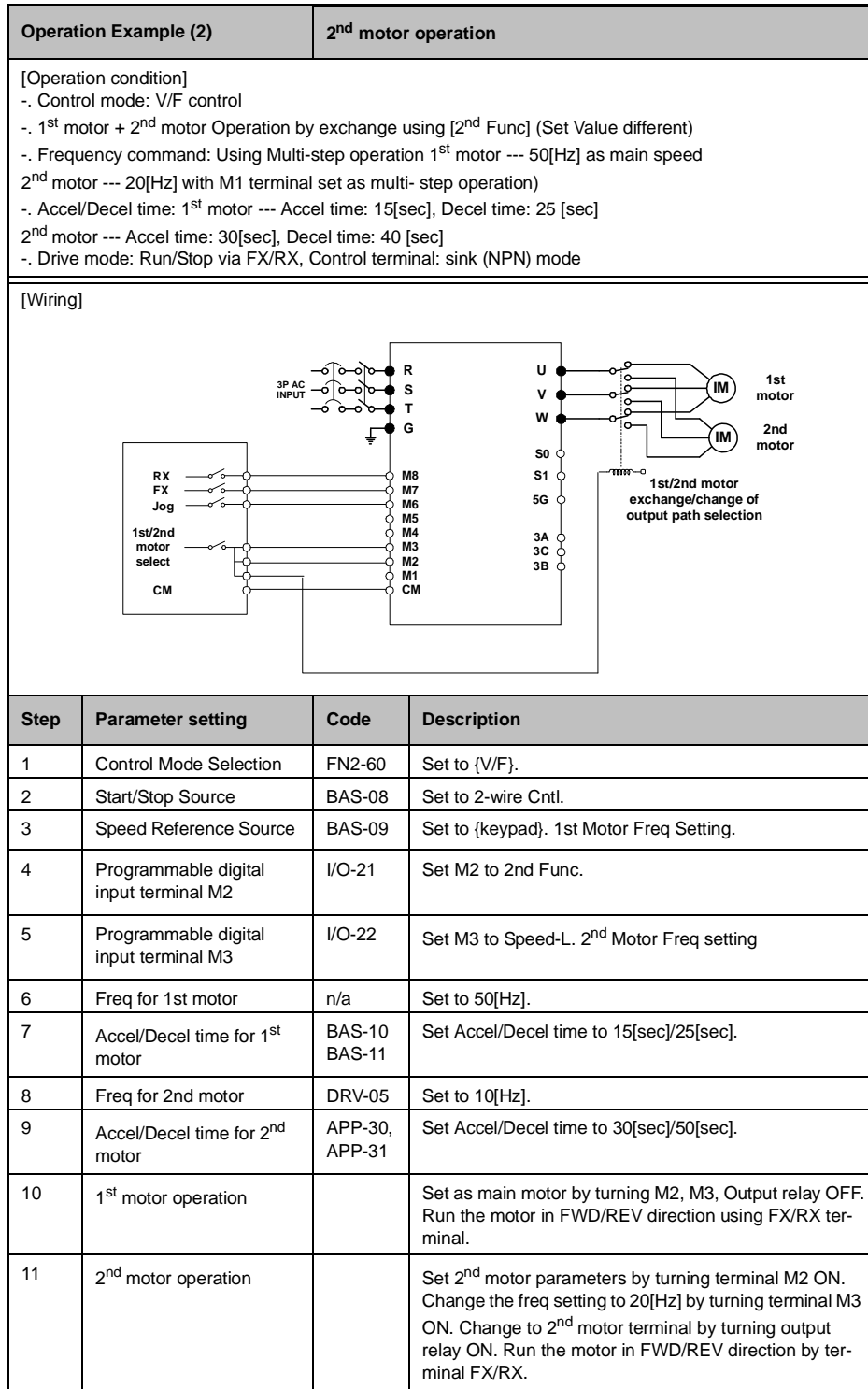


Figure 8.2 – Operation Example 2

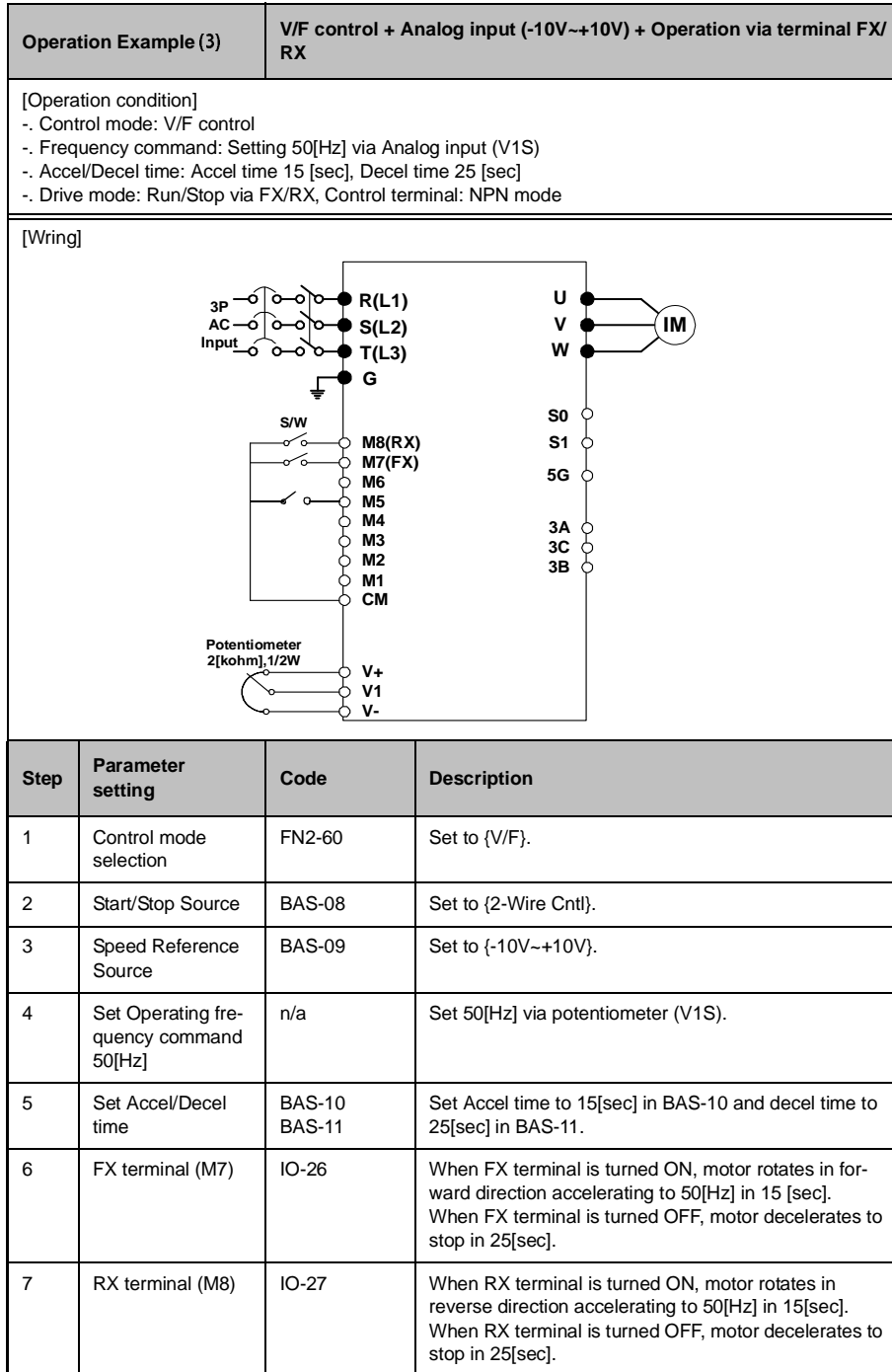


Figure 8.3 – Operation Example 3

8.9 Frequency Mode

8.9.1 Keypad Frequency Setting

Table 8.11 – Keypad Speed Reference

Group	Code	Parameter Name	Setting	Range	Initial	Unit
Basic Group	n/a	[Frequency Command]	-	0 to 120	0.00	Hz
	BAS-09	Speed Reference Source	Keypad	Keypad 0 ~ +10V -10V~+10V 4~20mA 0~10V+4~20mA Pulse Int. 485 Ext. PID	Keypad	
Set BAS-09 [Speed Reference Source] to "Keypad". From the operation mode, use the UP/DOWN arrow keys to set the frequency. The value can not be set above BAS-07 [Maximum Frequency].						

8.9.2 Frequency Setting via -10 to +10[V] Input

Table 8.12 – Bipolar Speed Reference

Group	Code	Parameter Name	Setting	Range	Initial	Unit
Basic Group	n/a	[Frequency Command]	-	0 to 120	0.00	Hz
	BAS-09	[Speed Reference Source]	- 10V~+10V 0V	Keypad 0 ~ +10V -10V~+10V 4~20mA 0~10V+4~20mA Pulse Int. 485 Ext. PID	Keypad	
I/O-1 to I/O-5	I/O-2	[V1 Input Minimum Voltage]	-	0 to+10V	0.0	V
	I/O-3	[Frequency Corresponding to I/O-2]	-	0 to BAS-07	0.00	Hz
	I/O-4	[V1 Input Max Voltage]	-	0 to+10	+10.00	V
	I/O-5	[Frequency Corresponding to I/O-4]	-	0 to BAS-07	60.00	Hz
Set BAS-09 [Speed Reference Source] to "-10V~+10V". The set frequency can be monitored using the speed reference monitor screen in the operation mode.						

Apply -10V to +10V signal between V1 and CM terminal.

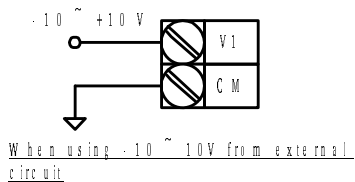


Figure 8.4 – Bipolar Reference Wiring

Output frequency corresponding to -10V to +10V input voltage to V1 terminal

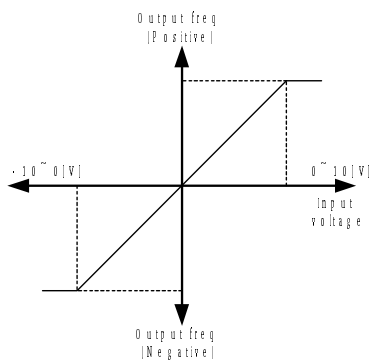


Figure 8.5 – Bipolar Operation

I/O-01 [Filter time constant for V1 input]: Effective for eliminating noise in the frequency reference circuit. Increase the filter time constant if steady operation cannot be performed due to noise. A higher setting results in slower response (t gets longer).

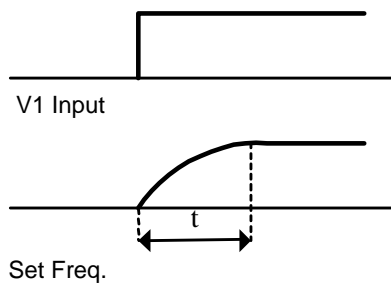


Figure 8.6 – Analog Input Filter

8.9.3 Frequency Setting via 0 to +10V Input or Potentiometer

Table 8.13 – Unipolar Speed Reference

Group	Code	Parameter Name	Setting	Range	Initial	Unit
Basic Group	n/a	[Frequency Command]	-	0 to 120	0.00	Hz
	BAS-09	[Speed Reference Sourcing]	0~+10V	Keypad 0 ~ +10V -10V~+10V 4~20mA 0~10V+4~20mA Pulse Int. 485 Ext. PID	Keypad	
I/O group	I/O-01	[Filter Time Constant for V1 Input]	10	0 to 9999	10	
	I/O-02	[V1 Input Min Voltage]	-	0 to 12	0	V
	I/O-03	[Frequency corresponding to I/O-02]	-	0 to BAS-07	0.00	Hz
	I/O-04	[V1 Input Max Voltage]	-	0 to 12	10	V
	I/O-05	[Frequency Corresponding to I/O-04]	-	0 to BAS-07	60.00	Hz

Set **BAS-09** [Speed Reference Source] to "0~+10V"
 0-10V can be directly applied from an external controller or a potentiometer connected on terminals V+, V1 and CM.

Wire the terminals as shown below.

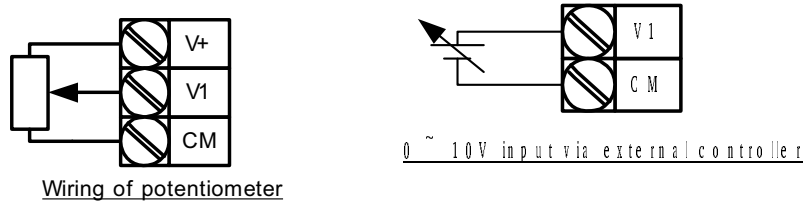


Figure 8.7 – Unipolar Reference Wiring

8.9.4 Frequency Setting via 4 to 20 mA Input

Table 8.14 – 4 to 20 mA Speed Reference

Group	Code	Parameter Name	Setting	Range	Initial	Unit
Basic Group	n/a	[Frequency Command]	-	0 to 120	0.00	Hz
	BAS-09	[Speed Reference Source]	4~20mA	Keypad 0 ~ +10V -10V~+10V 4~20mA 0~10V+4~20mA Pulse Int. 485 Ext. PID	Keypad	
I/O group	I/O-06	[Filter Time Constant for I Input]	10	0 to 9999	10	
	I/O-07	[I Input Minimum Current]	-	0 to 20	4	mA
	I/O-08	[Frequency Corresponding to I/O-07]	-	0 to BAS-07	0.00	Hz
	I/O-09	[I input Max Current]	-	0 to 20	20	mA
	I/O-10	[Frequency Corresponding to I/O-09]	-	0 to BAS-07	60.00	Hz
<p>Step 1. Set BAS-09 [Speed Reference Source] to “4~20mA”.</p> <p>Step 2. Frequency is set via 4 to 20mA input between I and CM terminal.</p>						

8.9.5 Frequency Setting via 0 to +10V Voltage Input + 4 to 20 mA Input

Table 8.15 – Speed Reference with Trim

Group	Code	Parameter Name	Setting	Range	Initial	Unit
Basic Group	n/a	[Frequency Command]	-	0 to 120	0.00	Hz
	BAS-09	[Speed Reference Source]	0~10V+4~20mA	Keypad 0 ~ +10V -10V~+10V 4~20mA 0~10V+4~20mA Pulse Int. 485 Ext. PID	Keypad	
<p>Step 1. Set BAS-09 [Speed Reference Source] to “0~10V+4~20mA”.</p> <p>Step 2. Override function available using Main/Auxiliary speed adjustment</p> <p>Step 3. Related code: I/O-01 to I/O-10</p>						

Override function allows more precise control and a faster response by combining Main and Auxiliary speed input. Fast response can be achieved via Main speed and precise control can be accomplished by Aux. speed if the accuracy of Main/Aux speed is set differently.

Follow the settings shown in the table below when Main speed is given via 4 to 20mA with Aux. speed via V1 terminal (0 to 10V).

When override function is used, select the Main/Aux. speed according to loads used.

Table 8.16 – Analog Input Setup

Group	Code	Parameter Name	Setting	Unit
I/O group	I/O-02	[VI Input Min Voltage]	0	V
	I/O-03	[Frequency Corresponding to I/O-02]	0.00	Hz
	I/O-04	[VI Input Max Voltage]	10.00	V
	I/O-05	[Frequency Corresponding to I/O-04]	5.00	Hz
	I/O-07	[I Input Minimum Current]	4	mA
	I/O-08	[Frequency Corresponding to I/O-08]	0.00	Hz
	I/O-09	[I Input Max Current]	20	mA
	I/O-10	[Frequency Corresponding to I/O-09]	60.00	Hz

After the above parameters are set, if 5V is applied to V1 with 12mA given to terminal I, output frequency would be 32.5Hz. If 0V is applied to V1 terminal with 12mA given to terminal I, output frequency would be 30.0Hz.

8.9.6 Frequency Setting via RS 485 Communication

Table 8.17 – RS485 Speed Reference

Group	Code	Parameter Name	Setting	Range	Initial	Unit
Basic Group	n/a	[Frequency Command]	-	0 to 120	0.00	Hz
	BAS-09	[Speed Reference Source]	Int. 485	Keypad 0 ~ +10V -10V~+10V 4~20mA 0~10V+4~20mA Pulse Int. 485 Ext. PID	Keypad	
Set BAS-09 [Speed Reference Source] to “Int. 485”. Related code: I/O-90 to I/O-94 Refer to Appendix C: RS485 communication.						

8.9.7 Operating Command via RS 485 Communication

Table 8.18 – RS485 Speed Reference

Group	Code	Parameter Name	Setting	Range	Initial	Unit
Basic Group	BAS-08	[Start/Stop Source]	Int. 485	Keypad 3-wire cntl 2-wire cntl Int. 485	Keypad	
I/O group	I/O-90	[Inverter Number]	-	1 to 250	1	
I/O group	I/O-91	[Baud Rate]	-	1200, 2400 4800, 9600 19200, 38400	9600	
Step 1: Set BAS-09 [Speed Reference Source] to “Int. 485”. Step 2: Set I/O-92 to I/O-94 correctly. Step 3: Drive operation is performed via RS485 communication.						

8.9.8 Direction Selection via -10V to +10V Input of V1 Terminal

Table 8.19 – Direction Control via Analog Input

Group	Code	Parameter Name	Setting	Range	Initial	Unit
Basic Group	BAS-09	[Speed Reference Source]	-10V~+10V	Keypad 0 ~ +10V -10V~+10V 4~20mA 0~10V+4~20mA Pulse Int. 485 Ext. PID	Keypad	
	BAS-08	[Start/Stop Source]	-	Keypad 3-wire cntl 2-wire cntl Int.485	Keypad	
Set BAS-09 to “-10V~+10V”. Inverter operates per the table below regardless of Start/Stop Source setting.						

Table 8.20 – Direction Control Logic

	FWD RUN Command	REV RUN Command
0 to +10 [V]	FWD RUN	REV RUN
-10 to 0 [V]	REV RUN	FWD RUN

Motor runs in Forward direction when input voltage to V1-CM is between 0 and 10[V] and FWD RUN command is active. When input voltage polarity is reversed to -10 to 0[V] during FWD RUN, motor decelerates to stop and runs in reverse direction.

Motor runs in Reverse direction when input voltage to V1-CM is between 0 and 10[V] and REV RUN command is active. When input voltage polarity is reversed to -10 to 0[V], motor decelerates to stop and runs in forward direction.

8.10 Up-Down (Electronic MOP)

Table 8.21 – Up-Down (Electronic MOP)

Group	Code	Parameter Name	Setting	Range	Default	Unit
I/O group	I/O-20 to I/O-27	[Multi-function Input Terminal M1 to M8 Selection]	Up Down		See Parameter Section	

Select terminals for Up-Down operation from M-1 to M-8.
If M7 and M8 are selected, set I/O-26 and I/O-27 to [Frequency Up command] and [Frequency Down command], respectively.

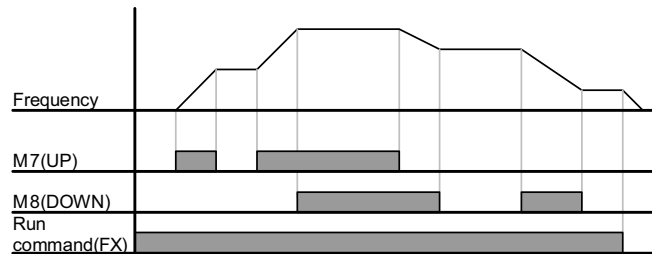


Figure 8.8 – Up-Down Sequencing

8.11 3-Wire

Table 8.22 – 3-Wire Control

Group	Display	Parameter Name	Setting	Range	Default	Unit
I/O group	I/O-20 to I/O-27	[Multi-function Input Terminal M1 to M8 Selection]		See Parameter Section	0	

Select the terminal from M-1 to M-8 for use as 3-Wire operation. Note that terminal M5 is dedicated to the Stop Input and is not programmable.

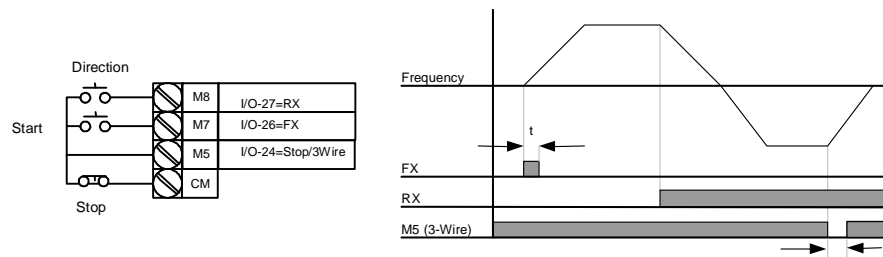


Figure 8.9 – 3-Wire Control Connections and Operation

Input signal is saved in 3-Wire operation. Therefore, inverter can be operated by Push-button switch. The duration of pulse (t) should not be less than 50msec.

8.12 PID Control

APP-02: PID Operation Selection.

This function can be used for Process control like flow, pressure, and air volume control.

To use this function, set APP-02 [proc PI mode] to "Yes". PID control detects the amount of feedback from a sensor and compares it with the target value. If the values differ, this function produces an output to eliminate the deviation. In other words, this control matches the feedback amount with the target value.

For HVAC or Pump applications, the PID control can be used to adjust the actual output by comparing a feedback with a 'Set-point' given to the inverter. This 'Set-point' can be in the form of Speed, Temperature, Pressure, Flow level, etc. The 'Set-point' and the feedback signals are provided externally to the inverter analog input terminals. The inverter compares the signals in calculating 'total-error' which is reflected in the inverter output.

NOTE: PID control can be bypassed to manual operation temporarily by defining one of the multifunction input terminals (M1~M8, P4~P6) to "Open-loop". The inverter will change to manual operation from PID control when this terminal is ON, and change back to PID control when this terminal is OFF.

[P Control] This is to compensate the error for a system input proportionally. This is used to make the controller to respond fast for an error. When P control is used alone, the system is easily affected by an external disturbance during steady state.

[I Control] This is to compensate the error of a system integrally. This is used to compensate the steady state error by accumulating them. Using this control alone makes the system unstable.

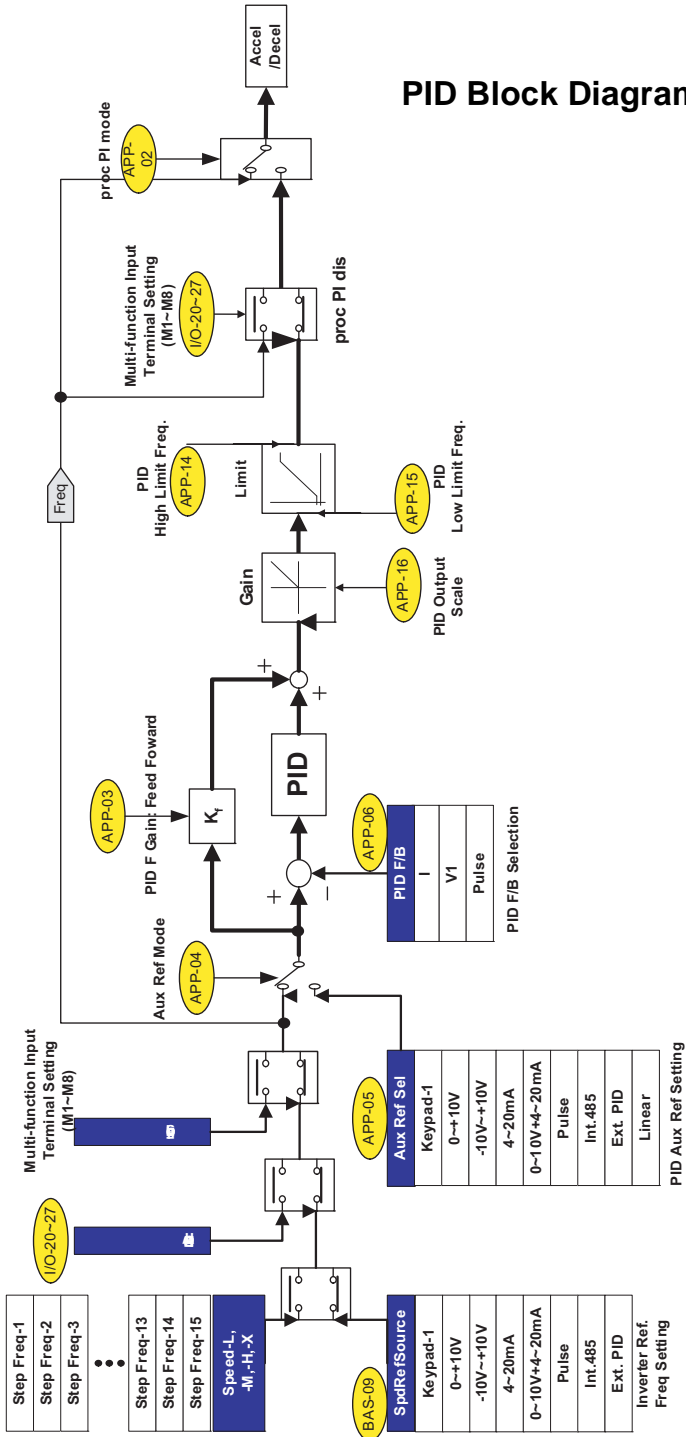
[PI control] This control is stable in many systems. If "D control" is added, it becomes the 3rd order system. In some systems this may lead to system instability.

[D Control] Since the D control uses the variation ratio of error, it has the merit of controlling the error before the error is too large. The D control requires a large control quantity at start, but has the tendency of increasing the stability of the system. This control does not affect the steady state error directly, but increases the system gain because it has an attenuation effect on the system. As a result, the differential control component has an effect on decreasing the steady state error. Since the D control operates on the error signal, it cannot be used alone. Always use it with the P control or PI control.

Parameter setting example for PID operation

1. Set APP-02 [PID operation selection] to "Yes."
2. Set APP-06 [PID feedback selection] to I, V1 or Pulse.
3. Set the unit to view feedback value in I/O-86~88 [User unit selection]. Then, all the units related to inverter target frequency is changed.
4. Set the appropriate value in APP-04~05 (Refer to the following PID block diagram).
5. When APP-04 is set to "No," BAS-09 [Freq Mode] becomes PID reference. If APP-04 is set to "Yes", the value set in APP-05 becomes PID reference. If setting one of I/O-20~27 [Programmable digital input terminal selection] to "Open loop" and turning the selected terminal On/Off, it is decided whether BAS-09 [Speed Reference Source] becomes Target freq or Target freq becomes PID Output.

PID Block Diagram



In general, the PID output becomes inverter's "Target Freq". In this case, PID is controlling the whole system and the PID output becomes the target freq of the system and inverter is operating according to Accel/Decel Time. PID control sampling time is 10msec.

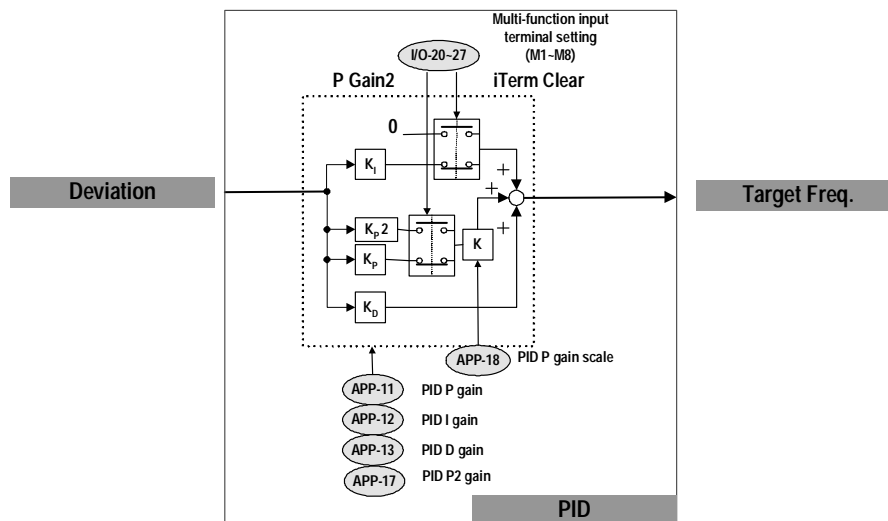


Figure 8.11 – PID Block Diagram

When it is set to 100%, the responsiveness (%) of output F gain from the controller reference value is 100%. Used when fast response is needed.

NOTE: Control System output may become unstable if this value is set too high.

APP-04 selects PID Aux Ref.Input Enable/Disable. See PID Block Diagram for details.

APP-05 sets the source of Aux reference signal.

NOTE: When APP-04 is set to "No," BAS-09, Multi-step frequency, UP/DOWN, Jog frequency become PID controller's reference and when set to "Yes," PID reference is issued from the set value in APP-05 [PID Aux Reference signal selection].

APP-06: PID Feedback Signal Selection

APP-11: P Gain for PID Control

APP-12: I Time for PID Control

APP-13: D Time for PID Control

APP-14: High Limit Frequency for PID Control

APP-15: Low Limit Frequency for PID Control

APP-06 selects the feedback signal for PID control. This can be set one of 'I' (4-20mA), 'V1', 'V2' and 'Pulse' according to the signal (current or voltage) and the terminal (V1 (0-10V), V2 (Sub-B board)) or Pulse (0~100kHz). Refer to I/O 6-10 for I, I/O1-5 for V1, I/O-11~16 for Pulse and EXT-6-10 [V2 Analog Ref. Freq setting] for V2.

APP-11 sets the proportional gain for PID control. When P-Gain is set at 100% and I-Time at 0.0 second, it means the PID controller output is 100% for 100% error value. P-Gain is set to 50 % and I- Time to 0.0 sec, PID controller output becomes 50% for 100% error value.

APP-12 sets the integral gain for PID control. This is the time the PID controller takes to output 100% for 100% error value. For example, when it is set to 30 sec, 30 sec is taken for PID controller to output 100% for 100% error value. 100% error means feedback value is 0 to the preset reference value.

APP-13 sets the differential gain for PID control.

APP-14 is the frequency upper limit at which the output frequency is limited during PID control.

APP-15 is the frequency lower limit at which the output frequency is limited during PID control.

APP-16: PID Output Scale

APP-17: PID P2 Gain

APP-18: P Gain Scale

APP-19: PID Output Inverse

APP-20: PID U Curve Feedback Selection

APP-16 sets the scale of PID controller output.

APP-17 sets the second P-Gain for PID control.

APP-18 sets the conversion scale of P-Gain and P2-Gain.

APP-19 [Output inversion] sets PID controller's output version.

APP-20 is useful for fan and pumps application. It converts linear pattern of a feedback sensor to the squared pattern without any setting.

PID output value can be set to '0' by setting a Programmable digital input terminals (M1 ~ M8) to 'Open loop' in I/O- I/O-20 ~ I/O-27.

The accumulated value by I-Gain can be set to '0' by setting a Programmable digital input terminal (M1 ~ M8) to 'Term Clear' in I/O-20 ~ I/O-27.

The P-Gain 2 can be selected for PID controller by setting a Programmable digital input (I/O-20 ~ I/O-27) to 'Open-loop'.

When APP-02 [PID operation selection] is set to "Yes," a desired display unit in I/O-86, -87, -88 [User Unit selection] is set among Speed, Percent, Bar, mBar, kPa, Pa, which affects value display of APP-06[PID feedback selection], all the parameter unit related to inverter target frequency is changed.

PID Wiring Example - Keypad Run/Stop and Keypad Reference

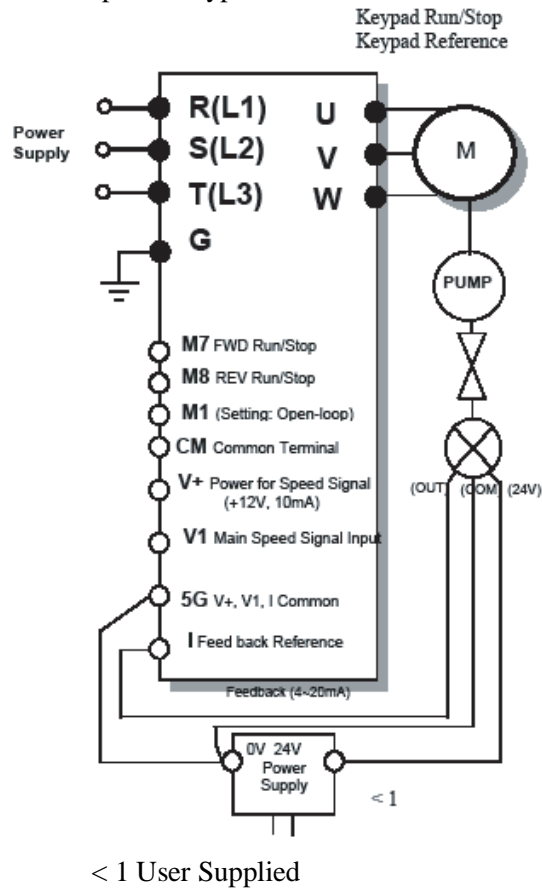


Figure 8.12 – PID Wiring Example - Keypad Run/Stop and Keypad Reference

PID Wiring Example - 2 Wire Run/Stop and Keypad Reference

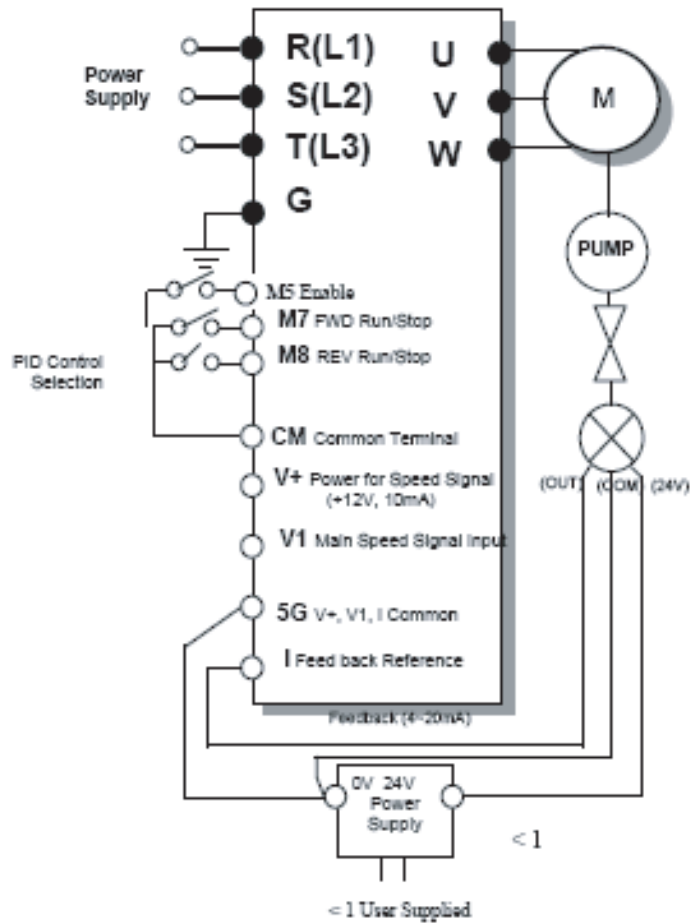


Figure 8.13 – PID Wiring Diagram - 2-Wire Run/Stop and Keypad Reference

PID Wiring Example - 2 Wire Run/Stop and POT = PID Reference

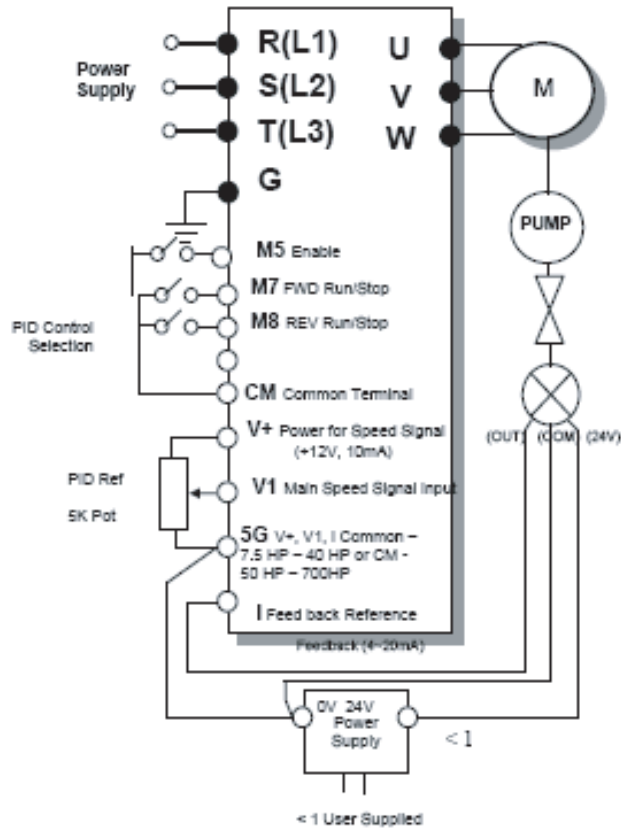


Figure 8.14 – PID Wiring Example - 2 Wire Run/Stop and POT = PID Reference

8.13 Auto-tuning

Table 8.23 – Auto-tuning

Group	Display	Parameter Name	Setting	Range	Default	Unit
Function Group 2	FN2-61	[Auto Tuning]	Yes	No Yes	No	-
	FN2-62	[Stator Resistance (Rs)]	-	Based on Drive Size	-	ohms
	FN2-63	[Leakage Inductance (Lo)]	-	Based on Drive Size	-	mH
Motor parameters will be automatically measured. The measured motor parameters can be used in Auto Torque Boost and Sensorless Vector Control.						
Auto-tuning enables the drive and motor rotation may occur. Be certain that unexpected motor shaft movement will not cause injury to personnel or damage to equipment. Failure to observe this precaution could result in severe bodily injury or loss of life.						

FN2-61: When set to “Yes” acknowledged by pressing the Enter key, Auto tuning is activated and the parameter being tuned will appear on the LCD keypad. When finished, “No” will be displayed.

FN2-62, FN2-63: The values of motor stator resistance and leakage inductance detected during autotune are displayed, respectively. When Auto tuning is skipped or parameters are reset to factory defaults, the default value corresponding to motor size (BAS-01) will be displayed.

Press the STOP/RST key on the keypad to stop the Auto Tuning.

If Auto tuning of FN2-62 and FN2-63 is interrupted, the default value will be set.

NOTE: Accurate values for stator resistance and leakage inductance are required for optimum performance of Sensorless vector control and Auto torque boost.

8.14 Sensorless Vector Control

Table 8.24 – Sensorless Vector Control

Group	Display	Parameter Name	Setting	Range	Default	Unit
Function Group 2	FN-60	[Control Mode Selection]	Sensorless	V/F Slip-Compen Sensorless	V/F	-
Basic Group	BAS-01	[Motor Nameplate HP]	-	7.5 to 700	-	HP
	BAS-05	[Motor Nameplate RPM]	-	500 to 3600	-	RPM
	BAS-04	[Motor Nameplate Current]	-	1.0 to 999.9	-	A
Function Group 2	FN2-44	[Motor No Load Current]	-	0.5 to 999.9	-	A
	FN2-62	[Stator Resistance (Rs)]	-	Based on Drive Size	-	Ohms
	FN2-63	[Leakage Inductance (Lσ)]	-	Based on Drive Size	-	mH
	FN2-64	[Pre-Excitation Time]	-	0.0 to 60.0	0.1	sec
NOTE: Motor parameters should be set properly for optimal performance. It is highly recommended FN2-61 [Auto tuning] be done prior to operating via Sensorless vector control.						

Ensure that the following parameters are entered correctly for optimal performance in Sensorless vector control.

BAS-01: Select HP of motor connected to inverter output.

BAS-05: Enter rated RPM from motor nameplate.

BAS-04: Enter motor nameplate rated current.

FN2-44: Enter the motor no load current.

If this value is unknown, follow these steps:

Step 1: After removing the load, set FN2-60[Control mode Selection] to “V/F control” and run the motor at

60Hz.

Step 2: Enter the current displayed in [Motor current] as motor no load current. If it is difficult to remove the

load from the motor shaft, enter a value equal to 40 to 50% of BAS-04[Motor nameplate current] or use the factory default.

FN2-62, FN2-63: Use the value of the parameters measured during FN2-61[Auto tuning] or use the factory default. FN2-62: This parameter provides a delay prior to accelerating the motor for pre-exciting the motor. The amount of the pre-exciting current is set in FN2-44[Motor No Load Current].

8.15 Multi-function Digital Output Terminal and Fault Output Relay

Table 8.25 – Digital Output Operation

Setting Range	Description
None	None
FDT-1	Output frequency arrival detection
FDT-2	Specific frequency level detection
FDT-3	Frequency detection with pulse
FDT-4	Frequency detection 1 with contact closure
FDT-5	Frequency detection 2 with contact closure
OL	Overload detection
IOL	Inverter overload detection
Stall	Stalling
OV	Over voltage detection
LV	Low voltage detection
OH	Inverter overheat detection
Lost Command	Lost command detection
Run	Inverter running detection
Stop	Inverter stop detection
Steady	Steady speed detection
INV line	By-Pass
COMM line	
Ssearch	Speed search mode detection
Ready	Inverter ready detection
MMC	Used for MMC operation
Critical Trip	Non-Resettable Fault

FDT-1

When the output frequency reaches the reference frequency (target frequency), AX-CX terminal is CLOSED.

Detecting Condition: Value (Ref. Freq-Output Freq) \leq Freq Detection Bandwidth (I/O-75)/2.

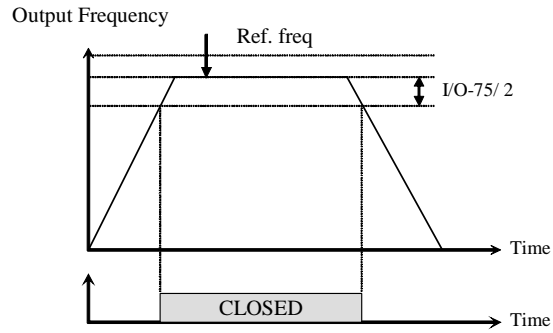


Figure 8.15 – AX-CS configured as “FDT-1”

AX: A1~A4, CX: C1~C4

FDT-2

AX-CX is CLOSED when the reference frequency is in I/O-75[FDT Bandwidth] centered on I/O-74[FDT Frequency], and the output frequency reaches I/O-75 countered on I/O-74.

Detecting Condition: FDT-1 condition & (Value (Output Freq-Freq Detection) \leq Freq Detection Bandwidth (I/O-75)/2)

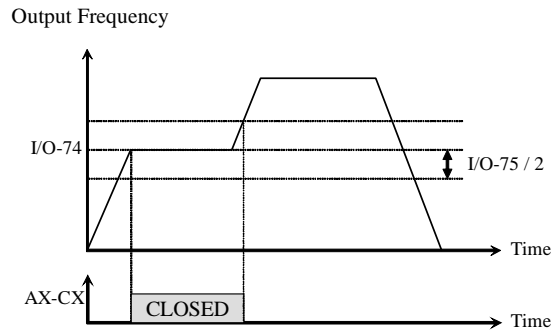


Figure 8.16 – AX-CX configured as “FDT-2”

FDT-3

AX-CX is CLOSED when the output frequency reaches the band centered on the FDT frequency. The output is OPENED when the output frequency goes outside the FDT bandwidth centered on the FDT frequency.

Detecting Condition: Value $(\text{Freq Detection (I/O-74)} - \text{Output Freq}) \leq \text{Freq Detection Bandwidth (I/O-75)/2}$.

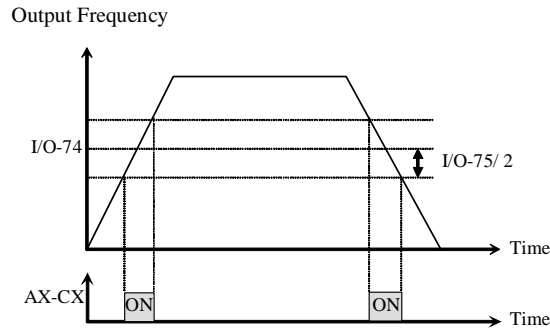


Figure 8.17 – AX-CX configured as “FDT-3”

FDT-4

AX-CX is CLOSED when the output frequency reaches the FDT frequency. The output is OPENED when the output frequency goes below the FDT bandwidth centered on the FDT frequency.

Detecting Condition:

During Accel: Output freq \geq Freq Detection

During Decel: Output freq $>$ (Freq Detection (I/O-74) - Freq Detection Bandwidth (I/O-75)/2)

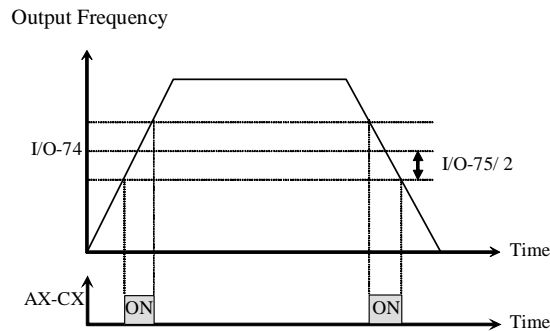


Figure 8.18 – AX-CX configured as “FDT-4”

FDT-5

This is the inverted output of [FDT-4].

Detecting Condition:

During Accel: Output freq \geq Freq Detection

During Decel: Output freq $>$ (Freq Detection (I/O-74) - Freq Detection Bandwidth (I/O-75)/2)

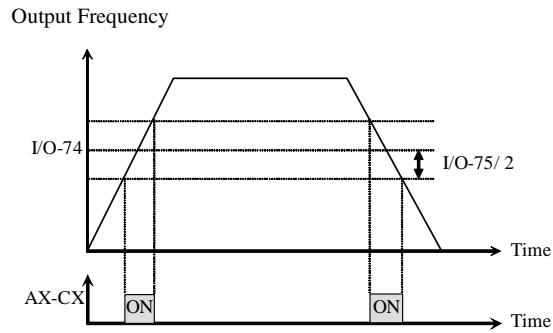
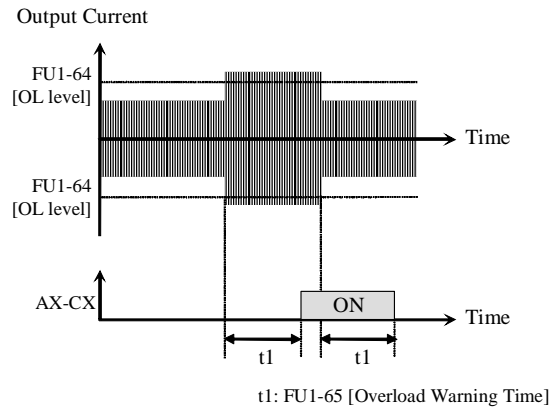


Figure 8.19 – AX-CX configured as “FDT-5”

OL

AX-CX is CLOSED when the output current has reached the FU1-64 [Overload Warning Level] for the FU1-65 [Overload Warning Time].



t1: FU1-65 [Overload Warning Time]

Figure 8.20 – AX-CX configured as “OL”

IOL

AX-CX is CLOSED when the output current is above the 110% of rated inverter current for 60 seconds. If this situation is continued for one minute, the inverter will cut off its output and displays 'IOL' (Inverter overload) Trip. See the nameplate for the rated inverter current.

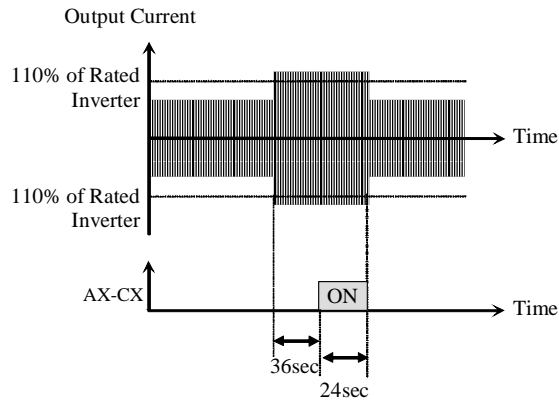


Figure 8.21 – AX-CX configured as "IOL"

Stall

AX-CX is CLOSED when the inverter is on the stall prevention mode.

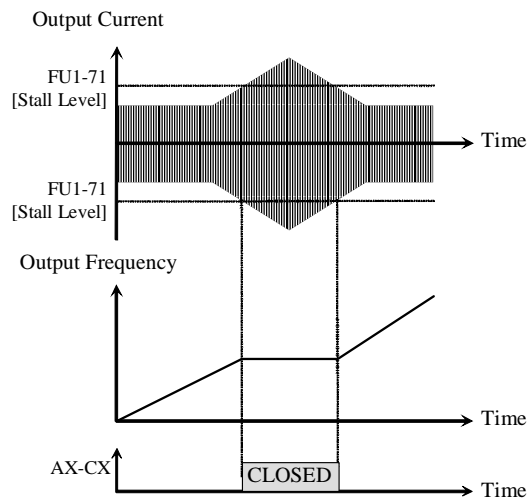


Figure 8.22 – AX-CX configured as "Stall"

OV

AX-CX is CLOSED when the DC link voltage is above the Over-voltage level.

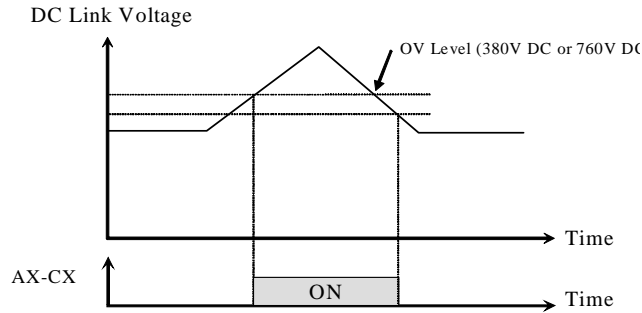


Figure 8.23 – AX-CX configured as “OV”

LV

AX-CX is CLOSED when the DC link voltage is below the Low-voltage level.

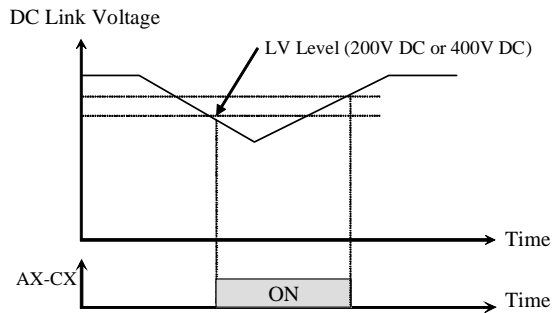


Figure 8.24 – AX-CX configured as “LV”

OH

AX-CX is CLOSED when the heat sink of the inverter is above the reference level.

Lost Command

AX-CX is CLOSED when frequency reference is lost.

Run

AX-CX is CLOSED when the inverter is running.

Stop

AX-CX is CLOSED when the inverter is stopped.

Steady

AX-CX is CLOSED when the inverter is running at constant speed.

INV line, COMM line

This function is used in conjunction with 'Exchange' function of Programmable digital input for commercial line exchange.

The following three conditions should be set:

- 1) Define one of the Programmable digital input terminals to "Exchange".
- 2) Define one of the Programmable digital output terminals to "INV line".
- 3) Define one of the Programmable digital output terminals to "COMM line".

NOTE: Set I/O-29 above 100 msec at Exchange operation. This helps to prevent chattering and momentary malfunction.

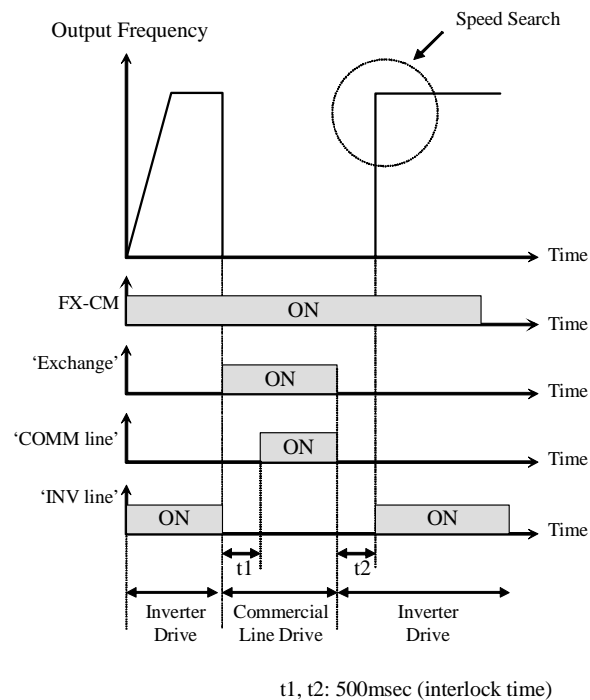


Figure 8.25 – AX-CX configured as "COMM line", "Exchange" and "INV line"

Search

AX-CX is CLOSED during the inverter is speed searching.

Ready

AX-CX is CLOSED when the inverter is ready to run.

MMC

Automatically set to 'MMC' when 'MMC' is selected in APP-01.

8.16 I/O-80 Fault Output Relay (3A, 3B, 3C)

This function is used to allow the fault output relay to operate when a fault occurs. The output relay terminal is 3A, 3B, 3C where 3A-3C is a normally open contact and 3B-3C is a normally closed contact.

Table 8.26 – Fault Relay Configuration

Bit	Setting	Display	Description
Bit 1 (LV)	0	000	Fault output relay does not operate at 'Low voltage' trip.
	1	001	Fault output relay operates at 'Low voltage' trip.
Bit 2 (Trip)	0	000	Fault output relay does not operate at any fault.
	1	010	Fault output relay operates at any fault except 'Low voltage' and 'BX' (inverter disable) fault.
Bit 3 (Retry)	0	000	Fault output relay does not operate regardless of the retry number.
	1	100	Fault output relay operates when the retry number set in FN2-25 decreases to 0 by faults. Disabled while Auto retry is ON.

When several faults occurred at the same time, Bit 1 has the first priority. (Active order: Bit 1->Bit 2->bit3)

WARNING: This drive contains high voltage capacitors that take time to discharge after removal of main supply. Before working on the drive, ensure isolation of main supply from line inputs. Wait ten (10) minutes for capacitors to discharge to safe voltage levels. Failure to observe this precaution could result in severe bodily injury or loss of life.

WARNING: Only qualified electrical personnel familiar with the construction and operation of this equipment and the hazards involved should install, adjust, operate, or service this equipment. Read and understand this manual and other applicable manuals in their entirety before proceeding. Failure to observe this precaution could result in severe bodily injury or loss of life.

The VS1PF constantly monitors operating status and provides the following means to determine drive status and to troubleshoot problems that may occur:

- LEDS on the drive
- Fault Codes displayed on LCD display
- Drive monitor and status parameters
- Entries in the fault queue

9.1 Verifying that DC Bus Capacitors are Discharged Before Servicing the Drive

WARNING: DC Bus capacitors retain hazardous voltages after input power has been disconnected. After disconnecting input power, wait ten (10) minutes for the DC Bus capacitors to discharge and then check the voltage with a voltmeter to ensure the DC bus capacitors are discharged before touching any internal components. Failure to observe this precaution could result in severe bodily injury or loss of life.

The drive's DC bus capacitors retain hazardous voltages after input power has been disconnected. Perform the following steps before touching any internal components:

Step 1. Turn off and lock out input power. Wait 10 minutes after drive's LCD display goes blank.

Step 2. Open the drive's cover.

Step 3. Verify that there is no voltage at the drive's input power terminals.

Step 4. Verify that the DC Bus voltage is less than 30VDC.

Step 5. Once the drive has been serviced, reattach the drive's cover.

Step 6. Reapply input power to the drive.

9.2 Determining Drive Status Using the STP/FLT LED

The STP/FLT LED can be used to determine at a quick glance the status of the drive. If the drive is stopped, but not faulted, this LED will be illuminated solid. If the drive is running, this LED will be off. If this LED is flashing, then this indicates that the drive is faulted thus requiring attention.

9.3 Fault Codes

Fault codes indicate conditions within the drive that require immediate attention. The drive responds to a fault by initiating a coast-to-stop sequence and turning off the power to the motor.

The integral keypad provides visual notification of a fault condition by displaying the following:

- Fault code on the display. (See table 9.1 for the fault code descriptions.)
- Flashing STP/FLT LED.

Critical Faults

Critical faults cannot be reset. There are four critical faults that can occur:

Table 8.1 – Critical Faults

No Motor Trip	If FN1-57 = YES and Motor Current < FN1-58 for longer than time specified in FN1-59, a trip is generated and "No Motor Trip" message is displayed.
Input Phase Open	One or more phases of the input power is open.
Wdog Error	CPU watchdog timer failure.
Fan Lock Trip	Cooling fan is inoperative (failed). Only available for 150hp and larger.

8.3.1 Manually Clearing Faults

Step 1. Note the code. of the fault condition on the display.

Step 2. Address the condition that caused the fault. Refer to Table 9-1 for a description of the fault and corrective actions. The cause must be corrected before the fault can be cleared.

Step 3. After corrective action has been taken, clear the fault and reset the drive by pressing the Stop button on the keypad or closing a digital input programmed to "RST".

8.3.2 Automatically Clearing Faults (Auto Restart Feature)

The auto restart feature provides the ability for the drive to automatically perform a fault reset followed by a start attempt without user or application intervention. This allows remote operation when the drive may be mounted in a location that is difficult to access. This feature can only be used for auto-resettable faults.

When an auto-resettable fault occurs, and FN2-21 (Fault Reset), is set to a value of "yes", a user configurable countdown timer, FN2-26, (Retry Delay), begins. When the time reaches zero, the drive attempts to automatically reset the fault. If the condition that caused the fault is no longer present, the fault will be reset and the drive will restart.

Table 9.2 – Fault Codes, Fault Description, and Corrective Action

Keypad Text	Protective Function	Description / Possible Cause.	Corrective Action
Over Current 1	Over Current Protection	<p>The inverter disables its output when the current exceeds 200% of the rated current.</p> <p>Possible Cause:</p> <ol style="list-style-type: none"> 1. Accel/Decel time too short for the inertia of the load. 2. Inverter rating too low for load requirements. 3. Starting into a rotating load. 4. Output short circuit or ground fault detected. 5. Mechanical brake applied too quickly or released too late. 6. Cooling fan failure resulting in component overtemp. 	<ol style="list-style-type: none"> 1. Increase Accel and/or Decel time. 2. Increase inverter capacity. 3. Restart only after motor has come to rest. 4. Enable Speed Search or Flying Restart function 5. Check output wiring. 6. Check brake for proper engage/release operation. 7. Check cooling fan and heat-sink. Clean as necessary.
<p>CAUTION: Operating the drive prior to correcting the cause of the Over Current Fault may permanently damage the output IGBTpower transistors.</p>			
Ground Fault	Ground Fault Protection	<p>The inverter disables its output when a ground fault is detected. The ground fault trip will occur when the ground current exceeds the internal set value. An Over Current trip may occur if the cause of ground current is due to a low resistance condition.</p> <p>Possible Cause:</p> <ol style="list-style-type: none"> 1. Ground condition occurred at the drive output. 2. Motor winding insulation damage. 3. Output wiring connection not insulated properly. 	<ol style="list-style-type: none"> 1. Check output power wiring for proper connection. 2. Check motor for isolation from ground. If a dielectric withstand test is performed, the motor must be disconnected from the drive output. 3. Verify that the wiring connections in the motor connection box are properly insulated.
Over Voltage	Over Voltage Protection	<p>The inverter disables its output if the DC bus voltage exceeds the rated value. (See Technical Specifications).</p> <p>Possible Cause:</p> <ol style="list-style-type: none"> 1. DC voltage may increase due to motor deceleration time too short for the load inertia. 2. High AC input voltage or surge. 	<ol style="list-style-type: none"> 1. Increase deceleration time, or add optional dynamic brake unit. 2. Check input line voltage. If necessary, add transformer.
Over Load	Current Limit Protection, (Overload Protection)	<p>The Inverter disables its output if the output current exceeds the continuous current rating for a prolonged period of time.</p> <p>Possible cause:</p> <ol style="list-style-type: none"> 1. Load is larger than drive rating. 2. Incorrect V/Hz curve setting. 3. Excessive torque boost 	<ol style="list-style-type: none"> 1. Decrease motor load. Verify load requirements match drive and motor rating. Verify connected load is free to rotate. If necessary, increase motor and/or inverter capacity. 2. Select correct V/Hz curve. 3. Decrease torque boost to proper value

Table 9.2 – Fault Codes, Fault Description, and Corrective Action

Over Heat	Inverter Over Heat	<p>The inverter disables its output if the heatsink reaches its over-temperature threshold.</p> <p>Possible cause:</p> <ol style="list-style-type: none"> 1. Cooling fan failure. 2. Air flow obstructed by debris 3. Ambient temperature exceeds 40 °C, (104°F) 	<ol style="list-style-type: none"> 1. Replace cooling fan. 2. Clean heatsink and remove obstructions from air flow channel. 3. Maintain ambient temperature below 40°C, (104°F)
E-Thermal	Electronic Thermal Overload	<p>The drive internal Motor Electronic Thermal Overload operates similar to a motor thermal switch to protect the motor from overheating damage.</p> <p>Attention: If the drive is being used in an application where more than one motor is connected to the drive, each motor must have its own thermal protective device.</p> <p>Possible cause:</p> <ol style="list-style-type: none"> 1. Motor overloaded 2. Drive and motor not sized correctly for the load. 3. ETH level set too low. 4. Incorrect V/Hz curve setting. 5. Low motor speed 	<ol style="list-style-type: none"> 1. Reduce driven load. 2. Install correctly rated inverter. 3. Set correct ETH parameter value. 4. Select correct V/Hz curve. 5. Raise operating speed or install externally powered motor cooling fan.
Ext. Trip	External Trip	<p>When External Trip is enabled, the drive will disable its output if an External Trip Signal, (normally open contact), is detected.</p> <p>Possible cause:</p> <ol style="list-style-type: none"> 1. Open circuit at the External Trip terminal. 	<p>Determine open circuit condition and correct problem, or disable External Trip function.</p>
Low Voltage	Low Voltage Protection	<p>The inverter disables its output if the DC Bus voltage falls below its low voltage detection level.</p> <p>Possible cause:</p> <ol style="list-style-type: none"> 1. Low input line voltage. 2. Electrical loading on the AC supply excessive. 3. Phase loss on AC input. 	<ol style="list-style-type: none"> 1. Check input line voltage, add transformer if necessary. 2. Increase AC input line capacity, or reconnect to alternate branch circuit. 3. Check AC line fuses and power wiring integrity.
Over Current 2	IGBT Short	<p>The inverter disables its output if an IGBT short is detected, or if an output short occurs.</p> <p>Possible cause:</p> <ol style="list-style-type: none"> 1. Short circuit between upper and lower IGBT. 2. Short circuit at inverter output. 3. Accel or Decel time too short for attached load inertia. 	<ol style="list-style-type: none"> 1. Check IGBT's as described later in this chapter. 2. Check output wiring and correct short circuit conditions. 3. Increase Accel /Decel time.

Table 9.2 – Fault Codes, Fault Description, and Corrective Action

Output Phase Open	Output Phase Open	<p>The inverter disables its output when one or more output phase (U, V, W), is open. The inverter monitors output current to detect an output phase loss.</p> <p>Possible cause:</p> <ol style="list-style-type: none"> 1. Faulty output contactor (if used). 2. Faulty output wiring. 	<ol style="list-style-type: none"> 1. Check output contactor operation. 2. Check output wiring.
BX	BX Protection (Instant Cut Off)	<p>Used for to immediately disable the inverter output and thus cause a coast-to-stop. The inverter instantly disables its output when the BX terminal is turned ON.</p> <p>Inverter returns to normal operation when the BX terminal is turned OFF.</p>	<ol style="list-style-type: none"> 1. Reset the input device that caused the BX protection. 2. Check the wiring to the input wired to the BX terminal.
<p>CAUTION: Unexpected motor start will occur when the BX terminal is turned OFF. The user must ensure that automatic start up of the driven equipment will not cause injury to operating personnel or damage to the driven equipment. In addition, the user is responsible for providing suitable audible or visual alarms or other devices to indicate that this function is enabled and the drive may start at any moment. Failure to observe this precaution could result in severe bodily injury or loss of life.</p>			
HW-Diag	Inverter H/W Fault	<p>A fault signal trips when one of the following occurs: Wdog, (Watch dog) error. EEP error, input phase open, NTC open, or ADC offset.</p> <p>Possible cause:</p> <ol style="list-style-type: none"> 1. Wdog error, (CPU fault). 2. EEP error, (Memory fault). 3. ADC Offset, (Current feedback circuit fault). 	Replace Drive.
COM Error CPU Error	Communication Error	<p>Fault trips when communication loss occurs between the keypad and the main control board.</p> <p>Possible cause:</p> <ol style="list-style-type: none"> 1. Faulty connection between keypad and inverter. 2. Inverter CPU failure. 	<ol style="list-style-type: none"> 1. Turn power off, then remove and replace keypad to assure proper connection. 2. Replace drive.
Inv. OLT	Inverter Overload	<p>The inverter disables its output when the output current exceeds the rated level, (110% for 1 minute, 130% for 4 seconds). When Inv. OLT occurs, it takes one minute to reset.</p> <p>Possible cause:</p> <ol style="list-style-type: none"> 1. Load exceeds inverter rating. 2. Incorrect inverter capacity selected 	<ol style="list-style-type: none"> 1. Verify driven load is mechanically free. Reduce load. 2. Select correct inverter capacity.

Table 9.2 – Fault Codes, Fault Description, and Corrective Action

NTC Open	NTC Open	<p>The inverter disables its output when the motor thermal is open.</p> <p>Possible cause:</p> <ol style="list-style-type: none"> 1. Wiring between drive and motor NTC/PTC is faulty. 2. Failed NTC/PTC. 	<ol style="list-style-type: none"> 1. Correct wiring problems between drive and motor NTC/PTC. 2. Replace NTC/PTC.
<p>LOP LOR LOV LOI LOX</p>	<p>Operating method on loss of speed reference</p>	<p>When there is a loss of the reference command, one of three methods of operation may be selected in parameter I/O-92: (1) Continue running at last reference level, (2) Coast stop, (3) Decelerate to a stop at programmed ramp rate.</p> <p>Possible cause:</p> <ol style="list-style-type: none"> 1. LOP - loss of reference from option (DPRAM time out). 2. LOR - loss of reference from remote (Network comm. Loss). 3. LOV - loss of reference from V1 (V1 analog signal loss). 4. LOI - loss of reference from I (I analog signal loss). 5. LOX - loss of reference from Sub-V2, ENC (V2, ENC analog signal loss). 	<ol style="list-style-type: none"> 1. Analyze the reference path and resolve reason for signal loss (e.g. broken wire, PLC programming error)

9.4 Troubleshooting

Table 9.3 – Troubleshooting

Condition	Check Points
Motor does not rotate	Verify AC input line voltage is within specified range. Check that motor wiring is correct. Verify commanded frequency is not 0. Check parameter BAS-08 is set correctly. Verify brake is released. Verify driven equipment is not jammed. Verify the drive is not faulted.
Motor rotates in wrong direction	Verify which direction is commanded, forward or reverse. Swap any two output motor leads.
Acceleration or Deceleration is erratic or unstable	Verify acceleration/deceleration time is set correctly for the load. Decrease Torque Boost, FN2-68, 69. Perform tuning procedure.
Motor current is excessive	Increase acceleration/deceleration time. Decrease load. Decrease Torque Boost, FN2-68, 69.
Motor speed will not increase	Verify Upper Limit Frequency, BAS-07, is set correctly. Decrease load. Decrease Torque Boost, FN2-68, 69.
Motor speed oscillates	Verify load conditions. Verify speed reference signal is stable.

9.5 How to Check Power Components

8.5.1 Diode Module and IGBT Module Check (7.5HP to 40HP)

Before checking the power components, disconnect the AC input supply and wait until the DC Bus voltage has completely discharged.

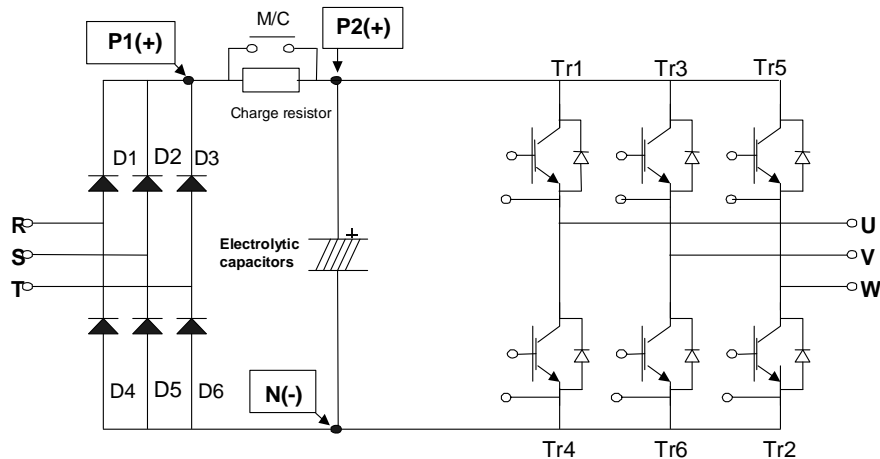


Figure 9.1 – Power Component Diagram

Disconnect the AC input, (R,S,T), and motor output, (U,V,W).

Use a voltmeter to verify terminals R,S,T & U,V,W & P, N are de-energized.

Use an ohmmeter to measure resistance values in accordance with Table 9.4. The measured value depends on the type of meter used, battery voltage level and drive rating. Measured values should be similar, device-to-device comparison.

Table 9.4 – Power Circuit Resistance Checks

Module		Test polarity		Check value (ohms)	Number	Test polarity		Check value (ohms)
		+	-			+	-	
Diode	D1	R	P1(+)	Low Resistance	D4	R	N(-)	High Resistance or Open
		P1(+)	R	High Resistance or Open		N(-)	R	Low Resistance
	D2	S	P1(+)	Low Resistance	D5	S	N(-)	High Resistance or Open
		P1(+)	S	High Resistance or Open		N(-)	S	Low Resistance
	D3	T	P1(+)	Low Resistance	D6	T	N(-)	High Resistance or Open
		P1(+)	T	High Resistance or Open		N(-)	T	Low Resistance
IGBT	Tr1	U	P2(+)	Low Resistance	Tr4	U	N(-)	High Resistance or Open
		P2(+)	U	High Resistance or Open		N(-)	U	Low Resistance
	Tr3	V	P2(+)	Low Resistance	Tr6	V	N(-)	High Resistance or Open
		P2(+)	V	High Resistance or Open		N(-)	V	Low Resistance
	Tr5	W	P2(+)	Low Resistance	Tr2	W	N(-)	High Resistance or Open
		P2(+)	W	High Resistance or Open		N(-)	W	Low Resistance

8.5.2 Diode module and IGBT module check (50HP to 125HP)

Before checking the power components, disconnect the AC input supply and wait until the DC Bus voltage has completely discharged.

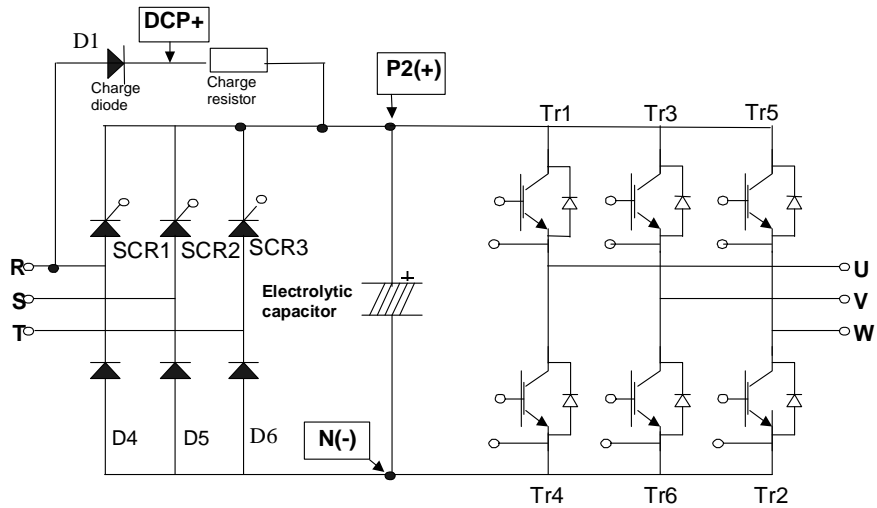


Figure 9.2 – Power Components Diagram

Disconnect the AC input, (R, S, T) and motor output, (U, V, W).

Use a voltmeter to verify terminals R, S, T and U, V, W and P2(+), N(-) are de-energized.

Use an ohmmeter to measure resistance values in accordance with Table 9.4. The measured value depends on the type of meter used, battery voltage level and drive rating. Measured values should be similar, device-to-device comparison.

Table 9.5 – Power Circuits Resistance Checks

Module		Test polarity		Check value	Number	Test polarity		Check value
		+	-			+	-	
Diode	D1	R	DCP+	Low Resistance	D4	R	N(-)	High Resistance or Open
		DCP+	R	High Resistance or Open		N(-)	R	Low Resistance
	D5	S	N(-)	High Resistance or Open	D6	T	N(-)	High Resistance or Open
		N(-)	S	Low Resistance		N(-)	T	Low Resistance
IGBT	Tr1	U	P2(+)	Low Resistance	Tr4	U	N(-)	High Resistance or Open
		P2(+)	U	High Resistance or Open		N(-)	U	Low Resistance
	Tr3	V	P2(+)	Low Resistance	Tr6	V	N(-)	High Resistance or Open
		P2(+)	V	High Resistance or Open		N(-)	V	Low Resistance
	Tr5	W	P2(+)	Low Resistance	Tr2	W	N(-)	High Resistance or Open
		P2(+)	W	High Resistance or Open		N(-)	W	Low Resistance

9.6 Maintenance and Inspections

The VS1PF series drives are industrial electronic products with advanced semiconductor elements. However, temperature, humidity, vibration and adverse atmosphere may affect continued satisfactory performance. Periodic inspection and maintenance should be performed to help avoid problems. Good housekeeping practice to maintain a clean, safe environment will prove worthwhile to ensure satisfactory drive operation.

WARNING: Be sure to disconnect and lock out the drive input power while performing maintenance. Wait ten (10) minutes for capacitors to discharge to safe voltage levels before removing the cover to the drive. Failure to observe this precaution could result in severe bodily injury or loss of life.

WARNING: Be sure to verify that the DC bus has discharged before performing maintenance on the drive. After disconnecting incoming power and waiting ten (10) minutes, remove cover and ensure voltage is not present on the drive power input terminals. Verify that the DC bus voltage has discharged to a level less than 30Vdc by measuring across terminals P2(+) to N(-) with a digital voltmeter set for DC voltage measurements. Failure to observe this precaution could result in severe bodily injury or loss of life.

NOTE: The correct output voltage can only be measured by using a TRUE RMS voltmeter. Other voltmeters, including digital voltmeters, are likely to display incorrect values caused by the high frequency PWM output power of the drive.

8.6.1 Periodic Inspection

It is advisable to establish a periodic inspection schedule for the drive and driven equipment. The inspection period timing will depend on operating environment. Inspections should be conducted more frequently in adverse conditions where there might be high vibration, dust, dirt, humidity, or corrosive atmosphere.

- Check for any loose mounting hardware and, if necessary, re-tighten to specified torque value.
 - Check that electrical connections are tight and secure.
 - Check the cooling fan and heatsink for debris. Remove obstructions as necessary.
- Visually inspect circuit boards for debris, foreign objects, or contamination. Gently clean or replace as necessary.

Appendix A

Technical Specifications

Appendix A provides technical specifications for the VS1PF drive.

Environment	
Altitude	3300 ft., (1000 m), max without derating
Vibration	0.6G, (5.9m/sec ²)
Ambient Operating Temperature	-10° to 40° C, (14° to 104° F) -10° to 50°C (14° to 122° F), 80% Load
Storage Temperature	-20° to 65° C, (-4× to 149× F)
Relative Humidity	90%, non-condensing
Cooling Method	Natural Convection / Forced Air Cooling, (Fan)
Atmosphere	Important: The drive must not be installed in an area exposed to volatile or corrosive gas, vapors or dust. If the drive will be stored for a time before installation, it must be stored in an area where it will not be exposed to a corrosive atmosphere.
Control	
Control Method	V/Hz, Sensorless Vector
Speed Reference Resolution	Digital command: 0.01Hz Analog signal command: 0.06 Hz, (Max freq., 60 Hz)
Frequency Accuracy	Digital command: 0.01% of Max output freq. Analog signal command: 0.1% of Max output freq.
V/Hz Curve	Linear, Squared (Pump and Fan), User custom V/Hz.
Overload Capacity	110% for 1 min. Normal Duty Ratings; 130% for 4 sec 150% for 1 min. Heavy Duty Ratings; 180% for 4 sec
Torque Boost	Manual Torque Boost (0 to 15% settable), Auto Torque Boost
Miscellaneous Specifications	
Short Circuit Rating	65kA, suitable for use on a circuit capable of delivering not more than 65,000 RMS Symmetrical amperes, 240/480V volts maximum
Agency Approvals	UL and cUL listed, CE marked

Operation		
Operation Method	Keypad / Terminal / Communication Operation	
Frequency Setting	Analog: 0 to 12V / -12V to 12V / 4 to 20mA or 0 to 20mA / Pulse / Ext-PID Digital: Keypad, Communications	
Input Signal	Start Signal	Forward, Reverse (2-wire); Start, Stop, Direction (3-wire)
	Multi-Step	Up to 18 Speeds can be set including Jog (Use Programmable Digital Input Terminal)
	Multi Step Accel/Decel Time	0.1 to 6,000 sec, Max 4 types can be set via Multi- Function Terminal. Accel/Decel Pattern: Linear, U-Curve, S-Curve Selectable
	Interlock Stop	Interrupts the Output of Inverter
	Jog	Jog Operation
	Fault Reset	Trip Status is Reset when Protection Function is Active
Output signal	Operating Status	Frequency Detection Level, Overload Alarm, Stalling, Over Voltage, Low Voltage, Inverter Overheating/ Running/ Stopping/ At Speed, Inverter By-Pass, Speed Searching
	Fault Output	Contact Output (3A, 3C, 3B): AC 250V 1A, DC 30V 1A
	Analog Output	Choose 2 from Output Frequency, Output Current, Output Voltage, DC Link Voltage (Output Voltage: 0 to 10V)
Operation Function	DC Braking, Frequency Limit, Frequency Jump, 2 nd Function, Slip Compensation, Reverse Rotation Prevention, Auto Restart, Inverter By-Pass, Auto-Tuning, PID Control, Flying Start, Safety Stop, Flux Braking, Low leakage, Pre-PID, Dual-PID, Pre-heat	
PROTECTION		
Inverter Trip	Over Voltage, Low Voltage, Over Current, Ground Fault, Inverter Overheat, Motor Overheat, Output Phase Open, Overload Protection, External Fault 1, 2, Communication Error, Loss of Speed Command, Hardware Fault, Option Fault, etc.	
Inverter Alarm	Stall Prevention, Overload Alarm, Thermal Sensor Fault	
DISPLAY		
Operation Information	Output Frequency, Output Current, Output Voltage, Frequency Set Value, Operating Speed, DC Voltage, Integrating Wattmeter, Fan ON time, Run-time, Last Trip Time	
Trip Information	Trips Indication when the Protection Function activates. Max. 5 Faults are saved. Last Trip Time.	

Terminal Strip Input	
M1 - M8	Multi-function programmable inputs.
CM	Common terminal
V1, Analog Voltage Input	-12 - +12 Vdc max.
I, Analog Current Input	0 – 20 mA, 250 Ohm input impedance
A0, B0	Pulse Input, 0~100kHz, 12 V
Terminal Strip Outputs	
V+, V-, Reference Power Supply	±12 Vdc Output, 100mA max. for 1KOhm to 5Kohm Potentiometer
S0, S1, Multi-function Analog Output Signals	0 to 12 dc, Vdc, 1 mA max.
A1-C1 to A4-C4, Multi-function Relay, Normally Open	250 Vac, 1A; 30Vdc, 1A Max
24, Power Supply	100 mA max output current
3A (normally open) 3B (normally closed) 3C (common)	Fault Relay Output Terminals: Max. 250 Vac, 1A 30 Vdc, 1A

PF Efficiency

Voltage (V)	HP	Efficiency (%)
230	7.5	95.7
	10	96.0
	15	96.0
	20	96.5
	25	96.8
	30	97.4
	40	97.6

Voltage (V)	HP	Efficiency (%)
460	7.5	96.3
	10	96.3
	15	96.9
	20	97.5
	25	97.5
	30	97.6
	40	97.6
	50	96.5
	60	97.1
	75	96.6
	100	96.0
	125	96.7
	150	97.3
	200	97.5
	250	97.5
	350	98.0
400	98.0	

Appendix B

Parameter Table

B.1 Parameters in Alphabetical Order by Name

Table A.1 – Parameters in Alphabetical Order by Name

Parameter Name	Number	Group	Page #	User Setting
2nd Acceleration Time	APP-30	Application	7-84	
2nd Base Frequency	APP-32	Application	7-85	
2nd Deceleration Time	APP-31	Application	7-85	
2nd Electronic Thermal Level for continuous	APP-38	Application	7-86	
2nd Electronic Thermal Level for 1 minute	APP-37	Application	7-86	
2nd Forward Torque Boost	APP-34	Application	7-85	
2nd Rated Motor Current	APP-39	Application	7-87	
2nd Reverse Torque Boost	APP-35	Application	7-86	
2nd Stall Prevention Level	APP-36	Application	7-86	
2nd V/F Pattern	APP-33	Application	7-85	
A or B contact	I/O-95	Input/Output	7-74	
Accel/Decel Change Frequency	FN1-72	Function 1	7-31	
Accel/Decel Time Scale	FN1-74	Function 1	7-32	
Acceleration Pattern	FN1-02	Function 1	7-14	
Acceleration Time	BAS-10	Basic	7-5	
Acceleration Time 1 (for Preset Speed)	I/O-50	Input/Output	7-64	
Acceleration Time 2	I/O-52	Input/Output	7-65	
Acceleration Time 3	I/O-54	Input/Output	7-65	
Acceleration Time 4	I/O-56	Input/Output	7-66	
Acceleration Time 5	I/O-58	Input/Output	7-66	
Acceleration Time 6	I/O-60	Input/Output	7-67	
Acceleration Time 7	I/O-62	Input/Output	7-67	
AD Parameter	DRV-19	Drive	7-11	
ALL Stop	APP-45	Application	7-88	
Adjust Gain of Current Output Terminal 1 (CO1)	EXT-41	Extension	7-96	
Adjust Gain of Current Output Terminal 2 (CO2)	EXT-44	Extension	7-97	
Adjust Offset of Current Output Terminal 1(CO1)	EXT-42	Extension	7-97	
Adjust Offset of Current Output Terminal 2(CO2)	EXT-45	Extension	7-97	
Auto Tuning Selection	FN2-61	Function 2	7-45	
Baud Rate Selection	I/O-91	Input/Output	7-74	
Carrier Frequency	FN2-48	Function 2	7-43	
Characteristic Selection (Motor Type)	FN1-63	Function 1	7-27	
Communication Response delay time	I/O-94	Input/Output	7-75	
Control Mode Selection	FN2-60	Function 2	7-45	
Criteria for Analog Input Signal Loss	I/O-17	Input/Output	7-57	

Table A.1 – Parameters in Alphabetical Order by Name

Parameter Name	Number	Group	Page #	User Setting
Current Input Terminal 2 (CO2) Selection	EXT-43	Extension	7-97	
Current Output Terminal 1 (CO1) Selection	EXT-40	Extension	7-96	
Current Trip Display	DRV-12	Drive	7-9	
D Gain for PID Control	APP-13	Application	7-80	
D Time for ExtPID	APP-87	Application	7-94	
DC Injection Braking Frequency	FN1-25	Function 1	7-17	
DC Injection Braking on-Delay Time	FN1-24	Function 1	7-17	
DC Injection Braking Time	FN1-26	Function 1	7-18	
DC Injection Braking Value	FN1-27	Function 1	7-18	
DC Link Voltage	DRV-10	Drive	7-8	
Deceleration Pattern	FN1-03	Function 1	7-5	
Deceleration Time	BAS-11	Basic	7-5	
Deceleration Time 1 (for Preset speed)	I/O-51	Input/Output	7-65	
Deceleration Time 2	I/O-53	Input/Output	7-65	
Deceleration Time 3	I/O-55	Input/Output	7-65	
Deceleration Time 4	I/O-57	Input/Output	7-66	
Deceleration Time 5	I/O-59	Input/Output	7-66	
Deceleration Time 6	I/O-61	Input/Output	7-67	
Deceleration Time 7	I/O-63	Input/Output	7-67	
Delay Time Before Auto Relay	FN2-27	Function 2	7-41	
Display Time-Out	DRV-17	Drive	7-10	
Drive Mode	DRV-91	Drive	7-2	
Dwell Frequency	FN2-08	Function 2	7-36	
Dwell Time	FN2-07	Function 2	7-36	
Electronic Thermal Level for 1 Minute	FN1-61	Function 1	7-27	
Electronic Thermal Level for Continuous	FN1-62	Function 1	7-27	
Electronic Thermal Selection	FN1-60	Function 1	7-26	
End Curve for S-Curve Accel/Decel Pattern	FN1-05	Function 1	7-6	
Energy Save	FN1-51	Function 1	7-24	
Energy Save %	Fn1-52	Function 1	7-24	
Erase Tips	FN2-06	Function 2	7-35	
Ext PID F Gain	APP-93	Application	7-97	
Ext PID Feedback Signal Selection	APP-83	Application	7-94	
Ext PID Loop Time	APP-97	Application	7-97	
Ext PID Operation Selection	APP-80	Application	7-93	
Ext PID Output Scale	APP-90	Application	7-95	
Ext PID Output Inverse	APP-95	Application	7-97	
Ext PID P Gain Scale	APP-92	Application	7-95	
Ext PID P2 Gain	APP-91	Application	7-95	
Ext PID Parameter	DRV-20	Drive	7-11	
Ext PID Reference Level	APP-82	Application	7-93	

Table A.1 – Parameters in Alphabetical Order by Name

Parameter Name	Number	Group	Page #	User Setting
Ext PID Reference Signal Selection	APP-81	Application	7-93	
F-in-L-Out	APP-44	Application	7-88	
Fan Con Sel (50 to 700 HP)	I/O-84	Input/Output	7-73	
Fan Temperature (50 ~700HP)	I/O-85	Input/Output	7-73	
Fault Output Relay Setting (3A, 3B, 3C)	I/O-80	Input/Output	7-71	
Filtering Time Constant for I Signal Input	I/O-06	Input/Output	7-53	
Filtering Time Constant for Programmable Digital Input Terminals	I/O-29	Input/Output	7-61	
Filtering Time Constant for V1 Signal Input	I/O-01	Input/Output	7-52	
Frequency Corresponding to I Input Maximum Current	I/O-10	Input/Output	7-55	
Frequency Corresponding to I Input Minimum Current	I/O-08	Input/Output	7-54	
Frequency Corresponding to I/O-13 Pulse Input Minimum Frequency	I/O-14	Input/Output	7-56	
Frequency Corresponding to I/O-15 Pulse Input Maximum Frequency	I/O-16	Input/Output	7-56	
Frequency Corresponding to V1 Input Maximum Voltage	I/O-05	Input/Output	7-53	
Frequency Corresponding to V1 Input Minimum Voltage	I/O-03	Input/Output	7-53	
Frequency Detection Bandwidth	I/O-75	Input/Output	7-69	
Frequency Detection Level	I/O-74	Input/Output	7-69	
Frequency Jump Selection	FN2-10	Function 2	7-36	
Frequency Limit Selection	FN1-33	Function 1	7-20	
Frequency Mode 2	DRV-92	Drive	7-3	
Gain During Speed Search	FN2-23	Function 2	7-40	
Gain for Motor Speed	FN2-47	Function 2	7-43	
High Limit Frequency	FN1-35	Function 1	7-20	
High Limit Frequency for Ext PID Control	APP-88	Application	7-95	
High Limit Frequency for PID Control	APP-14	Application	7-80	
I Gain for PID Control	APP-12	Application	7-80	
I Input Maximum Current	I/O-09	Input/Output	7-54	
I Input Minimum Current	I/O-07	Input/Output	7-54	
I Time for Ext PID	APP-86	Application	7-94	
Initialize Parameters	FN2-93	Function 2	7-51	
Input Time	I/O-96	Input/Output	7-59	
Input voltage adjustment	FN1-49	Function 1	7-24	
Input/Output Phase Loss Protection	FN1-69	Function 1	7-30	
Integrating Wattmeter	FN1-54	Function 1	7-24	
Interrupt Power Fault	FN2-22	Function 2	7-39	
Inverter Number	I/O-90	Input/Output	7-74	
Inverter Temperature	FN1-55	Function 1	7-25	
Jog Frequency Setting	I/O-30	Input/Output	7-61	
Jump Frequency 1 High	FN2-12	Function 2	7-37	
Jump Frequency 1 Low	FN2-11	Function 2	7-37	
Jump Frequency 2 High	FN2-14	Function 2	7-38	
Jump Frequency 2 Low	FN2-13	Function 2	7-37	
Jump Frequency 3 High	FN2-16	Function 2	7-36	

Table A.1 – Parameters in Alphabetical Order by Name

Parameter Name	Number	Group	Page #	User Setting
Jump Frequency 3 Low	FN2-15	Function 2	7-38	
Keypad Auto/Manual Select	DRV-22	Drive	7-2	
Keypad Removal Reference Mode	DRV-23	Drive	7-2	
Last trip 1	FN2-01	Function 2	7-34	
Last trip 2	FN2-02	Function 2	7-34	
Last trip 3	FN2-03	Function 2	7-34	
Last trip 4	FN2-04	Function 2	7-35	
Last trip 5	FN2-05	Function 2	7-35	
Last Trip Time	FN2-83	Function 2	7-48	
Leakage Inductance of Motor	FN2-63	Function 2	7-46	
Load Inertia	FN2-46	Function 2	7-46	
Low Limit Frequency for Ext PID Control	APP-89	Application	7-95	
Low Limit Frequency for PID Control	APP-15	Application	7-80	
Manual/Auto Torque Boost Selection	FN2-67	Function 2	7-46	
Maximum Frequency	BAS-07	Basic	7-4	
Meter I Maximum Value	APP-07	Application	7-79	
Meter V Maximum Value	APP-08	Application	7-79	
Meter P Maximum Value	APP-09	Application	7-79	
Minimum Frequency	BAS-06	Basic	7-3	
Motor Efficiency	FN2-45	Function 2	7-42	
Motor Nameplate Base Frequency	BAS-03	Basic	7-3	
Motor Nameplate Current	BAS-04	Basic	7-3	
Motor Nameplate HP	BAS-01	Basic	7-2	
Motor Nameplate RPM	BAS-05	Basic	7-3	
Motor Nameplate Voltage	BAS-02	Basic	7-2	
Motor Overheat Trip Temperature	I/O-98	Input/Output	7-76	
Motor Speed	DRV-09	Drive	7-4	
Motor Temperature	FN1-56	Function 1	7-25	
No Load Motor Current (RMS)	FN2-44	Function 2	7-42	
No Motor Selection	FN1-57	Function 1	7-25	
Number of Auto-Restart Tries	FN2-26	Function 2	7-41	
Number of Motor Poles	FN2-41	Function 2	7-41	
Operating Method at Loss of Frequency Reference	I/O-92	Input/Output	7-74	
Operating Selection at Loss of Frequency Reference	I/O-18	Input/Output	7-57	
Output Current	DRV-08	Drive	7-8	
Overheat Trip Selection	I/O-97	Input/Output	7-76	
Overload Trip Delay Time	FN1-68	Function 1	7-29	
Overload Trip Level	FN1-67	Function 1	7-29	
Overload Trip Selection	FN1-66	Function 1	7-28	
Overload Warning Level	FN1-64	Function 1	7-28	
P Gain Scale	APP-18	Application	7-81	

Table A.1 – Parameters in Alphabetical Order by Name

Parameter Name	Number	Group	Page #	User Setting
Parameter Display	FN2-90	Function 2	7-49	
Parameter Write Protection	FN2-94	Function 2	7-51	
PID Auxiliary Reference Mode Selection	APP-04	Application	7-78	
PID Auxiliary Reference Signal Selection	APP-05	Application	7-78	
PID Feed Forward (F) Gain Selection	APP-03	Application	7-77	
PID Feedback Signal Selection	APP-06	Application	7-78	
PID Operation Selection	APP-02	Application	7-77	
PID Output Inverse	APP-19	Application	7-81	
PID Output Scale	APP-16	Application	7-81	
PID P2 Gain	APP-17	Application	7-81	
PID Parameter	DRV-18	Drive	7-10	
PID U Curve Feedback Selection	APP-20	Application	7-82	
Pipe Broken	APP-26	Application	7-83	
Power ON Start Selection	FN2-20	Function 2	7-38	
Power On Time	FN2-84	Function 2	7-49	
Power Set	FN2-87	Function 2	7-49	
Power Source Frequency	FN1-29	Function 1	7-19	
Power-On Display	FN2-80	Function 2	7-48	
Pre-excitation Time	FN2-64	Function 2	7-46	
Pre-Heat	FN1-10	Function 1	7-16	
Pre-Heat Duty Cycle	FN1-12	Function 1	7-17	
Pre-Heat Value	FN1-11	Function 1	7-16	
PrePID Exit Level	APP-24	Application	7-82	
PrePID Reference Frequency	APP-23	Application	7-82	
PrePID Stop Delay	APP-25	Application	7-83	
Preset Frequency 1	DRV-05	Drive	7-7	
Preset Frequency 10	I/O-37	Input/Output	7-63	
Preset Frequency 11	I/O-38	Input/Output	7-63	
Preset Frequency 12	I/O-39	Input/Output	7-63	
Preset Frequency 13	I/O-40	Input/Output	7-63	
Preset Frequency 14	I/O-41	Input/Output	7-64	
Preset Frequency 15	I/O-42	Input/Output	7-64	
Preset Frequency 2	DRV-06	Drive	7-7	
Preset Frequency 3	DRV-07	Drive	7-8	
Preset Frequency 4	I/O-31	Input/Output	7-61	
Preset Frequency 5	I/O-32	Input/Output	7-62	
Preset Frequency 6	I/O-33	Input/Output	7-62	
Preset Frequency 7	I/O-34	Input/Output	7-62	
Preset Frequency 8	I/O-35	Input/Output	7-62	
Preset Frequency 9	I/O-36	Input/Output	7-63	
Pressure Difference for Aux Motor Start	APP-71	Application	7-92	
Pressure Difference for Aux Motor Stop	APP-72	Application	7-93	

Table A.1 – Parameters in Alphabetical Order by Name

Parameter Name	Number	Group	Page #	User Setting
Programmable Digital Input Terminal 'M1' Definition	I/O-20	Input/Output	7-58	
Programmable Digital Input Terminal 'M2' Definition	I/O-21	Input/Output	7-59	
Programmable Digital Input Terminal 'M4' Definition	I/O-23	Input/Output	7-59	
Programmable Digital Input Terminal 'M5' Definition	I/O-24	Input/Output	7-59	
Programmable Digital Input Terminal 'M6' Definitions	I/O-25	Input/Output	7-60	
Programmable Digital Input Terminal 'M7' Definitions	I/O-26	Input/Output	7-60	
Programmable Digital Input Terminal 'M8' Definition	I/O-27	Input/Output	7-60	
Programmable Digital Output Terminal (Aux Terminal)	I/O-76	Input/Output	7-70	
Programmable Digital Output Terminal Define	I/O-77	Input/Output	7-70	
Programmable Digital Output Terminal Define	I/O-78	Input/Output	7-70	
Programmable Digital Output Terminal Define	I/O-79	Input/Output	7-71	
Programmable Digital Input Terminal 'M3' Definition	I/O-22	Input/Output	7-59	
Proportional (P) Gain for Ext PID Controllers	APP-85	Application	7-94	
Proportional (P) Gain for PID Controller	APP-07	Application	7-79	
Pulse Input Filter	I/O-12	Input/Output	7-55	
Pulse Input Maximum Frequency	I/O-15	Input/Output	7-56	
Pulse Input Method	I/O-11	Input/Output	7-55	
Pulse Input Minimum Frequency	I/O-13	Input/Output	7-55	
PWM Type Selection	FN2-49	Function 2	7-44	
Read Parameter	FN2-91	Function 2	7-50	
Reference Frequency for Accel and Decel	FN1-73	Function 1	7-31	
Reference/Feedback Frequency Display	DRV-15	Drive	7-10	
Restart after Fault Reset	FN2-21	Function 2	7-39	
Run Prevention	FN1-01	Function 1	7-4	
Run-Time	FN2-85	Function 2	7-49	
S1 output selection	I/O-72	Input/Output	7-69	
Safety Stop	FN1-28	Function 1	7-19	
Save Parameter	FN2-95	Function 2	7-51	
Sleep Delay Time	APP-27	Application	7-84	
Sleep Frequency	APP-28	Application	7-85	
Software Version	FN2-82	Function 2	7-48	
Speed Reference Source	BAS-09	Basic	7-4	
Speed Search Type Selection	FN2-24	Function 2	7-40	
Speed Unit Selection	DRV-16	Drive	7-10	
Stall Prevention Level	FN1-71	Function 1	7-31	
Start Curve for S-Curve Accel/Decel Pattern	FN1-04	Function 1	7-6	
Start Mode	FN1-20	Function 1	7-16	
Start/Stop Source	BAS-08	Basic	7-4	
Starting DC Injection Braking Time	FN1-21	Function 1	7-17	
Starting DC Injection Braking Value	FN1-22	Function 1	7-17	
Starting Frequency	FN1-32	Function 1	7-19	

Table A.1 – Parameters in Alphabetical Order by Name

Parameter Name	Number	Group	Page #	User Setting
Stator Resistance of Motor	FN2-62	Function 2	7-45	
Stop Mode	BAS-12	Basic	7-5	
Terminal Input Status	I/O-28	Input/Output	7-60	
Terminal Output Status	I/O-81	Input/Output	7-72	
Torque Boost in Forward Direction	FN2-68	Function 2	7-47	
Torque Boost in Reverse Direction	FN2-69	Function 2	7-48	
Trip Current Level	FN1-58	Function 1	7-26	
Trip Time Setting	FN1-59	Function 1	7-26	
Type of SUB Boards	EXT-01	Extension	7-97	
Unit Maximum Value	I/O-87	Input/Output	7-73	
User V/F - Frequency 1	FN1-41	Function 1	7-21	
User V/F - Frequency 2	FN1-43	Function 1	7-22	
User V/F - Frequency 3	FN1-45	Function 1	7-22	
User V/F - Frequency 4	FN1-47	Function 1	7-23	
User V/F - Voltage 1	FN1-42	Function 1	7-22	
User V/F - Voltage 2	FN1-44	Function 1	7-22	
User V/F - Voltage 3	FN1-46	Function 1	7-23	
User V/F - Voltage 4	FN1-48	Function 1	7-23	
V1 Input Maximum Voltage	I/O-04	Input/Output	7-53	
V1 Input Minimum Voltage	I/O-02	Input/Output	7-52	
Voltage Input User Unit Selection	I/O-86	Input/Output	7-73	
Volts/Hz Pattern	FN1-40	Function 1	7-20	
Waiting time after Fault Output Relay Off	I/O-83	Input/Output	7-72	
Waiting time after Fault Output Relay On	I/O-82	Input/Output	7-72	
Waiting time after loss of freq. reference	I/O-93	Input/Output	7-75	
Waiting time after Loss of Frequency Reference	I/O-19	Input/Output	7-57	
Wake-Up Level	APP-29	Application	7-84	
Write Parameter	FN2-92	Function 2	7-50	

9.1 Parameters Sorted by Group and Parameter Number

Table A.2 – Parameters sorted by group and parameter number

Group	Number	Parameter Name	Page #	Tunable/ RW/RO	User Setting
Applications	APP-01	Application Mode Selection	7-77	RW	
Application	APP-02	PID Operation Selection	7-77	RW	
Application	APP-03	PID F Gain Selection	7-77	Tunable	
Application	APP-04	PID Auxiliary Reference Mode Selection	7-78	RW	
Application	APP-05	PID Auxiliary Reference Signal Selection	7-78	RW	
Application	APP-06	PID Feedback Signal Selection	7-78	RW	
Application	APP-07	Meter I Maximum Value	7-79	Tunable	
Application	APP-08	Meter V Maximum Value	7-79	Tunable	
Application	APP-09	Meter P Maximum Value	7-79	Tunable	
Application	APP-11	P Gain for PID Control	7-79	Tunable	
Application	APP-12	I Gain for PID Control	7-80	Tunable	
Application	APP-13	D Gain for PID Control	7-80	Tunable	
Application	APP-14	High Limit Frequency for PID Control	7-80	Tunable	
Application	APP-15	Low Limit Frequency for PID Control	7-80	Tunable	
Applications	APP-16	PID Output Scale	7-81	RW	
Application	APP-17	PID P2 Gain	7-81	RW	
Application	APP-18	P Gain Scale	7-81	RW	
Application	APP-19	PID Output Inverse	7-81	RW	
Application	APP-20	PID U Curve feedback select	7-82	RW	
Application	APP-23	PrePID Reference Frequency	7-82	Tunable	
Application	APP-24	PrePID Exit Level	7-82	Tunable	
Application	APP-25	PrePID Stop delay	7-83	Tunable	
Application	APP-26	Pipe Broken	7-83	RW	
Application	APP-27	Sleep Delay Time	7-83	Tunable	
Application	APP-28	Sleep Frequency	7-84	Tunable	
Application	APP-29	Wake-Up Level	7-84	Tunable	
Application	APP-30	2nd Acceleration Time	7-84	Tunable	
Application	APP-31	2nd Deceleration Time	7-85	Tunable	
Application	APP-32	2nd Base Frequency	7-85	RW	
Application	APP-33	2nd V/F Pattern	7-85	RW	
Application	APP-34	2nd Forward Torque Boost	7-85	RW	
Application	APP-35	2nd Reverse Torque Boost	7-85	RW	
Application	APP-36	2nd Stall Prevention Level	7-85	RW	
Application	APP-37	2nd Electronic Thermal Level for 1 minute	7-86	Tunable	
Application	APP-38	2nd Electronic Thermal Level for continuous	7-86	Tunable	
Application	APP-39	2nd Rated Motor Current	7-87	RW	
Application	APP-40	Number of Auxiliary Motor Run Display	7-87	RO	
Application	APP-41	Aux. Motor Start Selection	7-87	Tunable	
Application	APP-42	Operation Time Display on Auto Change	7-88	RO	
Application	APP-43	The Number of Aux Motor	7-88	Tunable	

Table A.2 – Parameters sorted by group and parameter number

Group	Number	Parameter Name	Page #	Tunable/ RW/RO	User Setting
Application	APP-44	F-in L-out	7-88	RW	
Application	APP-45	All Stop	7-88	RW	
Application	APP-47	Start Frequency of Aux. Motor 1	7-88	Tunable	
Application	APP-48	Start Frequency of Aux. Motor 2	7-88	Tunable	
Application	APP-49	Start Frequency of Aux. Motor 3	7-89	Tunable	
Application	APP-50	Start Frequency of Aux. Motor 4	7-89	Tunable	
Application	APP-51	Stop Frequency of Aux. Motor 1	7-89	Tunable	
Application	APP-52	Stop Frequency of Aux. Motor 2	7-90	Tunable	
Application	APP-53	Stop Frequency of Aux. Motor 3	7-90	Tunable	
Application	APP-54	Stop Frequency of Aux. Motor 4	7-90	Tunable	
Application	APP-58	Delay Time before Operating Aux Motor	7-90	Tunable	
Application	APP-59	Delay Time before Stopping Aux Motor	7-90	Tunable	
Application	APP-60	Accel time when the number of pump decreases	7-91	Tunable	
Application	APP-61	Decel time when the number of pump increases	7-91	Tunable	
Application	APP-62	PID Bypass Selection	7-91	RW	
Application	APP-66	Auto Change Mode Selection	7-91	Tunable	
Application	APP-67	Auto Change Time	7-92	Tunable	
Application	APP-68	Auto Change Freq	7-92	Tunable	
Application	APP-69	Inter-Lock Selection	7-92	Tunable	
Application	APP-71	Pressure Difference for Aux Motor Start	7-92	Tunable	
Application	APP-72	Pressure Difference for Aux Motor Stop	7-93	Tunable	
Application	APP-80	Ext PID Operation Selection	7-93	RW	
Application	APP-81	Ext PID Reference Signal Selection	7-93	RW	
Application	APP-82	Ext PID Reference Level	7-93	RW	
Application	APP-83	Ext PID Feedback Signal Selection	7-94	RW	
Application	APP-85	P Gain for ExtPID	7-94	RW	
Application	APP-86	I Time for ExtPID	7-94	RW	
Application	APP-87	D Time for ExtPID	7-94	RW	
Application	APP-88	High Limit Frequency for ExtPID Control	7-95	RW	
Application	APP-89	Low Limit Frequency for Ext PID Control	7-95	RW	
Application	APP-90	Ext PID Output Scale	7-95	RW	
Application	APP-91	Ext PID P2 Gain	7-95	RW	
Application	APP-92	Ext PID P Gain Scale	7-95	RW	
Application	APP-93	Ext PID F Gain	7-97	Tunable	
Application	APP-95	Ext PID Output Inverse	7-97	RW	
Application	APP-97	Ext PID Loop Time	7-97	RW	
Basic	BAS-01	Motor Nameplate HP	7-2	RW	
Basic	BAS-02	Motor Nameplate Voltage	7-2	RW	
Basic	BAS-03	Motor Nameplate Base Frequency	7-3	RW	
Basic	BAS-04	Motor Nameplate Current	7-3	RW	
Basic	BAS-05	Motor Nameplate RPM	7-3	RW	
Basic	BAS-06	Minimum Frequency	7-3	Tunable	

Table A.2 – Parameters sorted by group and parameter number

Group	Number	Parameter Name	Page #	Tunable/ RW/RO	User Setting
Basic	BAS-07	Maximum Frequency	7-4	Tunable	
Basic	BAS-08	Start/Stop Source	7-4	RW	
Basic	BAS-09	Speed Reference Source	7-4	RW	
Basic	BAS-10	Acceleration Time	7-5	Tunable	
Basic	BAS-11	Deceleration Time	7-5	Tunable	
Basic	BAS-12	Stop Mode	7-5	RW	
Drive	DRV-05	Step Frequency 1	7-7	Tunable	
Drive	DRV-06	Step Frequency 2	7-7	Tunable	
Drive	DRV-07	Step Frequency 3	7-8	Tunable	
Drive	DRV-08	Output Current	7-8	RO	
Drive	DRV-09	Motor Speed	7-8	RO	
Drive	DRV-10	DC Link Voltage	7-8	RO	
Drive	DRV-12	Current Trip Display	7-9	RO	
Drive	DRV-15	Reference/Feedback Frequency Display	7-10	RO	
Drive	DRV-16	Speed Unit Selection	7-10	Tunable	
Drive	DRV-17	Display Time-Out	7-10	Tunable	
Drive	DRV-18	PID Parameter	7-10	RO	
Drive	DRV-19	AD Parameter	7-11	RO	
Drive	DRV-20	Ext PID Parameter	7-11	RO	
Drive	DRV-22	Keypad Auto/Manual Select	7-12	RW	
Drive	DRV-23	Keypad Removal Reference Mode	7-12	Tunable	
Drive	DRV-91	Drive Mode	7-12	RW	
Drive	DRV-92	Frequency Mode 2	7-13	RW	
Extension	EXT-01	Type of SUB Boards	7-97	RO	
Extension	EXT-40	Current Output Terminal 1 (CO1) Selection	7-97	Tunable	
Extension	EXT-41	Adjust Gain of Current Output Terminal 1 (CO1)	7-97	Tunable	
Extension	EXT-42	Adjust Offset of Current Output Terminal 1(CO1)	7-98	Tunable	
Extension	EXT-43	Current Input Terminal 2 (CO2) Selection	7-98	Tunable	
Extension	EXT-44	Adjust Gain of Current Output Terminal 2 (CO2)	7-98	Tunable	
Extension	EXT-45	Adjust Offset of Current Output Terminal 2(CO2)	7-98	Tunable	
Function 1	FN1-01	Run Prevention	7-4	RW	
Function 1	FN1-02	Acceleration Pattern	7-4	RW	
Function 1	FN1-03	Deceleration Pattern	7-5	RW	
Function 1	FN1-04	Start Curve for S-Curve Accel/Decel Pattern	7-6	RW	
Function 1	FN1-05	End Curve for S-Curve Accel/Decel Pattern	7-6	RW	
Function 1	FN1-10	Pre-Heat	7-16	RW	
Function 1	FN1-11	Pre-Heat Value	7-16	RW	
Function 1	FN1-12	Pre-Heat Duty Cycle	7-17	RW	
Function 1	FN1-20	Start Mode	7-17	RW	
Function 1	FN1-21	Starting DC Injection Braking Time	7-17	RW	
Function 1	FN1-22	Starting DC Injection Braking Value	7-18	RW	

Table A.2 – Parameters sorted by group and parameter number

Group	Number	Parameter Name	Page #	Tunable/ RW/RO	User Setting
Function 1	FN1-24	DC Injection Braking on-Delay Time	7-18	RW	
Function 1	FN1-25	DC Injection Braking Frequency	7-18	RW	
Function 1	FN1-26	DC Injection Braking Time	7-19	RW	
Function 1	FN1-27	DC Injection Braking Value	7-19	RW	
Function 1	FN1-28	Safety Stop	7-20	RW	
Function 1	FN1-29	Power Source Frequency	7-20	RW	
Function 1	FN1-32	Starting Frequency	7-20	RW	
Function 1	FN1-33	Frequency Limit Selection	7-20	RW	
Function 1	FN1-35	High Limit Frequency	7-21	RO	
Function 1	FN1-40	Volts/Hz Pattern	7-21	RW	
Function 1	FN1-41	User V/F - Frequency 1	7-22	RW	
Function 1	FN1-42	User V/F - Voltage 1	7-23	RW	
Function 1	FN1-43	User V/F - Frequency 2	7-23	RW	
Function 1	FN1-44	User V/F - Voltage 2	7-23	RW	
Function 1	FN1-45	User V/F - Frequency 3	7-23	RW	
Function 1	FN1-46	User V/F - Voltage 3	7-24	RW	
Function 1	FN1-47	User V/F - Frequency 4	7-24	RW	
Function 1	FN1-48	User V/F - Voltage 4	7-24	RW	
Function 1	FN1-49	Input voltage adjustment	7-24	RW	
Function 1	FN1-51	Energy Save	7-25	RW	
Function 1	Fn1-52	Energy Save %	7-25	Tunable	
Function 1	FN1-54	Integrating Wattmeter	7-25	RO	
Function 1	FN1-55	Inverter Temperature	7-26	RO	
Function 1	FN1-56	Motor Temperature	7-26	RO	
Function 1	FN1-57	No Motor Selection	7-26	RW	
Function 1	FN1-58	Trip Current Level	7-26	RW	
Function 1	FN1-59	Trip Time Setting	7-27	RW	
Function 1	FN1-60	Electronic Thermal Selection	7-27	Tunable	
Function 1	FN1-61	Electronic Thermal Level for 1 Minute	7-27	Tunable	
Function 1	FN1-62	Electronic Thermal Level for Continuous	7-28	Tunable	
Function 1	FN1-63	Characteristic Selection (Motor Type	7-28	Tunable	
Function 1	FN1-64	Overload Warning Level	7-28	Tunable	
Function 1	FN1-65	Overload Warning Time	7-29	Tunable	
Function 1	FN1-66	Overload Trip Selection	7-29	Tunable	
Function 1	FN1-67	Overload Trip Level	7-30	Tunable	
Function 1	FN1-68	Overload Trip Delay Time	7-30	Tunable	
Function 1	FN1-69	Input/Output Phase Loss Protection	7-31	Tunable	
Function 1	FN1-71	Stall Prevention Level	7-31	RW	
Function 1	FN1-72	Accel/Decel Change Frequency	7-31	RW	
Function 1	FN1-73	Reference Frequency for Accel and Decel	7-32	RW	
Function 1	FN1-74	Accel/Decel Time Scale	7-32	Tunable	
Function 1	FN1-80	Up Down Frequency Save Mode	7-33	Tunable	

Table A.2 – Parameters sorted by group and parameter number

Group	Number	Parameter Name	Page #	Tunable/ RW/RO	User Setting
Function 1	FN1-81	Up Down Save Frequency	7-33	Tunable	
Function 1	FN1-90	Safety STOP inertia Rate	7-33	Tunable	
Function 2	FN2-01	Last trip 1	7-34	RO	
Function 2	FN2-02	Last trip 2	7-34	RO	
Function 2	FN2-03	Last trip 3	7-35	RO	
Function 2	FN2-04	Last trip 4	7-35	RO	
Function 2	FN2-05	Last trip 5	7-35	RO	
Function 2	FN2-06	Erase Tips	7-35	Tunable	
Function 2	FN2-07	Dwell Time	7-36	RW	
Function 2	FN2-08	Dwell Frequency	7-36	RW	
Function 2	FN2-10	Frequency Jump Selection	7-36	RW	
Function 2	FN2-11	Jump Frequency 1 Low	7-37	Tunable	
Function 2	FN2-12	Jump Frequency 1 High	7-37	Tunable	
Function 2	FN2-13	Jump Frequency 2 Low	7-37	Tunable	
Function 2	FN2-14	Jump Frequency 2 High	7-38	Tunable	
Function 2	FN2-15	Jump Frequency 3 Low	7-38	Tunable	
Function 2	FN2-16	Jump Frequency 3 High	7-38	Tunable	
Function 2	FN2-20	Power ON Start Selection	7-38	Tunable	
Function 2	FN2-21	Restart after Fault Reset	7-39	Tunable	
Function 2	FN2-22	Interrupt Power Fault	7-40	RW	
Function 2	FN2-23	Gain During Speed Search	7-40	Tunable	
Function 2	FN2-24	Speed Search Type Selection	7-40	Tunable	
Function 2	FN2-26	Number of Auto-Restart Tries	7-41	Tunable	
Function 2	FN2-27	Delay Time Before Auto Relay	7-41	Tunable	
Function 2	FN2-41	Number of Motor Poles	7-41	RW	
Function 2	FN2-42	Motor Slip	7-42	RW	
Function 2	FN2-44	No Load Motor Current (RMS)	7-42	RW	
Function 2	FN2-45	Motor Efficiency	7-42	RW	
Function 2	FN2-46	Load Inertia	7-43	RW	
Function 2	FN2-47	Gain for Motor Speed Display	7-43	Tunable	
Function 2	FN2-48	Carrier Frequency	7-43	Tunable	
Function 2	FN2-49	PWM Type Selection	7-44	RW	
Function 2	FN2-60	Control Mode Selection	7-44	RW	
Function 2	FN2-61	Auto Tuning Selection	7-45	RW	
Function 2	FN2-62	Stator Resistance of Motor	7-45	RW	
Function 2	FN2-63	Leakage Inductance of Motor	7-45	RW	
Function 2	FN2-64	Pre-excitation Time	7-46	RW	
Function 2	FN2-67	Manual/Auto Torque Boost Selection	7-46	RW	
Function 2	FN2-68	Torque Boost in Forward Direction	7-47	RW	
Function 2	FN2-69	Torque Boost in Reverse Direction	7-48	RW	
Function 2	FN2-80	Power-On Display	7-48	Tunable	

Table A.2 – Parameters sorted by group and parameter number

Group	Number	Parameter Name	Page #	Tunable/ RW/RO	User Setting
Function 2	FN2-82	Software Version	7-48	RO	
Function 2	FN2-83	Last Trip Time	7-48	RO	
Function 2	FN2-84	Power On Time	7-49	RO	
Function 2	FN2-85	Run-Time	7-49	RO	
Function 2	FN2-87	Power Set	7-49	Tunable	
Function 2	FN2-90	Parameter Display	7-49	Tunable	
Function 2	FN2-91	Read Parameter	7-50	RW	
Function 2	FN2-92	Write Parameter	7-50	RW	
Function 2	FN2-93	Initialize Parameters	7-51	RW	
Function 2	FN2-94	Parameter Write Protection	7-51	Tunable	
Function 2	FN2-95	Save Parameter	7-51	RW	
Input/Output	I/O-01	Filtering Time Constant for V1 Signal Input	7-52	Tunable	
Input/Output	I/O-02	V1 Input Minimum Voltage	7-52	Tunable	
Input/Output	I/O-03	Frequency Corresponding to V1 Input Minimum Voltage	7-52	Tunable	
Input/Output	I/O-04	V1 Input Maximum Voltage	7-53	Tunable	
Input/Output	I/O-05	Frequency Corresponding to V1 Input Maximum Voltage	7-53	Tunable	
Input/Output	I/O-06	Filtering Time Constant for I Signal Input	7-53	Tunable	
Input/Output	I/O-07	I Input Minimum Current	7-54	Tunable	
Input/Output	I/O-08	Frequency Corresponding to I Input Minimum Current	7-54	Tunable	
Input/Output	I/O-09	I Input Maximum Current	7-54	Tunable	
Input/Output	I/O-10	Frequency Corresponding to I Input Maximum Current	7-55	Tunable	
Input/Output	I/O-11	Pulse Input Method	7-55	Tunable	
Input/Output	I/O-12	Pulse Input Filter	7-55	Tunable	
Input/Output	I/O-13	Pulse Input Minimum Frequency	7-55	Tunable	
Input/Output	I/O-14	Frequency Corresponding to I/O-13 Pulse Input Minimum Frequency	7-56	Tunable	
Input/Output	I/O-15	Pulse Input Maximum Frequency	7-56	Tunable	
Input/Output	I/O-16	Frequency Corresponding to I/O-15 Pulse Input Maximum Frequency	7-56	Tunable	
Input/Output	I/O-17	Criteria for Analog Input Signal Loss	7-56	Tunable	
Input/Output	I/O-18	Operating Selection at Loss of Frequency Reference	7-57	Tunable	
Input/Output	I/O-19	Waiting time after Loss of Frequency Reference	7-57	Tunable	
Input/Output	I/O-20	Programmable Digital Input Terminal 'M1' Definition	7-58	Tunable	
Input/Output	I/O-21	Programmable Digital Input Terminal 'M2' Definition	7-59	Tunable	
Input/Output	I/O-22	Programmable Digital Input Terminal 'M3' Definition	7-59	Tunable	
Input/Output	I/O-23	Programmable Digital Input Terminal 'M4' Definition	7-59	Tunable	
Input/Output	I/O-24	Programmable Digital Input Terminal 'M5' Definition	7-59	Tunable	
Input/Output	I/O-25	Programmable Digital Input Terminal 'M6' Definitions	7-60	Tunable	
Input/Output	I/O-26	Programmable Digital Input Terminal 'M7' Definitions	7-60	Tunable	
Input/Output	I/O-27	Programmable Digital Input Terminal 'M8' Definition	7-60	Tunable	
Input/Output	I/O-28	Terminal Input Status	7-60	RO	

Table A.2 – Parameters sorted by group and parameter number

Group	Number	Parameter Name	Page #	Tunable/ RW/RO	User Setting
Input/Output	I/O-29	Filtering Time Constant for Programmable Digital Input Terminals	7-61	Tunable	
Input/Output	I/O-30	Jog Frequency Setting	7-61	Tunable	
Input/Output	I/O-31	Preset Frequency 4	7-61	Tunable	
Input/Output	I/O-32	Preset Frequency 5	7-62	Tunable	
Input/Output	I/O-33	Preset Frequency 6	7-62	Tunable	
Input/Output	I/O-34	Preset Frequency 7	7-62	Tunable	
Input/Output	I/O-35	Preset Frequency 8	7-62	Tunable	
Input/Output	I/O-36	Preset Frequency 9	7-63	Tunable	
Input/Output	I/O-37	Preset Frequency 10	7-63	Tunable	
Input/Output	I/O-38	Preset Frequency 11	7-63	Tunable	
Input/Output	I/O-39	Preset Frequency 12	7-63	Tunable	
Input/Output	I/O-40	Preset Frequency 13	7-63	Tunable	
Input/Output	I/O-41	Preset Frequency 14	7-64	Tunable	
Input/Output	I/O-42	Preset Frequency 15	7-64	Tunable	
Input/Output	I/O-50	Acceleration Time 1 (for Preset Speed)	7-64	Tunable	
Input/Output	I/O-51	Deceleration Time 1 (for Preset speed)	7-65	Tunable	
Input/Output	I/O-52	Acceleration Time 2	7-65	Tunable	
Input/Output	I/O-53	Deceleration Time 2	7-65	Tunable	
Input/Output	I/O-54	Acceleration Time 3	7-65	Tunable	
Input/Output	I/O-55	Deceleration Time 3	7-65	Tunable	
Input/Output	I/O-56	Acceleration Time 4	7-66	Tunable	
Input/Output	I/O-57	Deceleration Time 4	7-66	Tunable	
Input/Output	I/O-58	Acceleration Time 5	7-66	Tunable	
Input/Output	I/O-59	Deceleration Time 5	7-66	Tunable	
Input/Output	I/O-60	Acceleration Time 6	7-67	Tunable	
Input/Output	I/O-61	Deceleration Time 6	7-67	Tunable	
Input/Output	I/O-62	Acceleration Time 7	7-67	Tunable	
Input/Output	I/O-63	Deceleration Time 7	7-67	Tunable	
Input/Output	I/O-70	S0 output selection	7-67	Tunable	
Input/Output	I/O-71	S0 output adjustment	7-68	Tunable	
Input/Output	I/O-72	S1 output selection	7-68	Tunable	
Input/Output	I/O-73	S1 output adjustment	7-69	Tunable	
Input/Output	I/O-74	Frequency Detection Level	7-69	Tunable	
Input/Output	I/O-75	Frequency Detection Bandwidth	7-69	Tunable	
Input/Output	I/O-76	Programmable Digital Output Terminal (Aux Terminal)	7-70	Tunable	
Input/Output	I/O-77	Programmable Digital Output Terminal Define	7-70	Tunable	
Input/Output	I/O-78	Programmable Digital Output Terminal Define	7-70	Tunable	
Input/Output	I/O-79	Programmable Digital Output Terminal Define	7-71	Tunable	
Input/Output	I/O-80	Fault Output Relay Setting (3A, 3B, 3C)	7-71	Tunable	
Input/Output	I/O-81	Terminal Output Status	7-72	RO	
Input/Output	I/O-82	Waiting time after Fault Output Relay On	7-72	RW	

Table A.2 – Parameters sorted by group and parameter number

Group	Number	Parameter Name	Page #	Tunable/ RW/RO	User Setting
Input/Output	I/O-83	Waiting time after Fault Output Relay Off	7-72	RW	
Input/Output	I/O-84	Fan Con Sel (50 to 700 HP)	7-73	RW	
Input/Output	I/O-85	Fan Temperature (50 ~700HP)	7-73	Tunable	
Input/Output	I/O-86	Input User Unit Selection	7-73	RW	
Input/Output	I/O-87	Unit Maximum Value	7-73	RW	
Input/Output	I/O-90	Inverter Number	7-74	Tunable	
Input/Output	I/O-91	Baud Rate Selection	7-74	Tunable	
Input/Output	I/O-92	Operating Method at Loss of Frequency Reference	7-74	Tunable	
Input/Output	I/O-93	Waiting time after loss of freq. reference	7-75	Tunable	
Input/Output	I/O-94	Communication Response delay time	7-75	Tunable	
Input/Output	I/O-95	A or B contact	7-75	RW	
Input/Output	I/O-96	Input Time	7-76	RW	
Input/Output	I/O-97	Overheat Trip Selection	7-76	RW	
Input/Output	I/O-98	Motor Overheat Trip Temperature	7-76	RW	

Appendix C

CE Guidelines

C.1 CE Declaration of Conformity

Baldor indicates that the products are only components and not ready for immediate or instant use within the meaning of "Safety law of appliance", "EMC Law" or "Machine directive". The final mode of operation is defined only after installation into the user's equipment. It is the responsibility of the user to verify compliance.

C.2 EMC - Conformity and CE - Marking

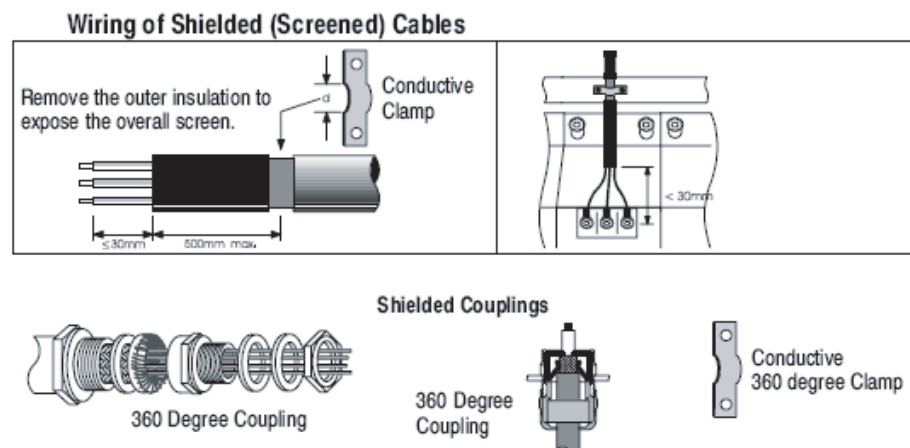
The information contained herein is for your guidance only and does not guarantee that the installation will meet the requirements of the council directive 89/336/EEC.

The purpose of the EEC directives is to state a minimum technical requirement common to all the member states within the European Union. In turn, these minimum technical requirements are intended to enhance the levels of safety both directly and indirectly.

Council directive 89/336/EEC relating to Electro Magnetic Compliance (EMC) indicates that it is the responsibility of the system integrator to ensure that the entire system complies with all relative directives at the time of installing into service.

Motors and controls are used as components of a system, per the EMC directive. Hence all components, installation of the components, interconnection between components, and shielding and grounding of the system as a whole determines EMC compliance.

The CE mark does not inform the purchaser which directive the product complies with. It rests upon the manufacturer or his authorized representative to ensure the item in question complies fully with all the relative directives in force at the time of installing into service, in the same way as the system integrator previously mentioned. Remember, it is the instructions of installation and use, coupled with the product, that comply with the directive.



EMC Installation Options

When installed for Class A or Class B operation, the control is compliant with EN55011 (1991)/ EN55022 (1994) for radiated emissions as described.

Grounding for Wall Mounting (Class A) also see Chapters 4 and 5.

Top cover must be installed.

- A single-star point (earth) is required.
- The protective earth connection (PE) to the motor must be run inside the screened cable or conduit between the motor and control and be connected to the protective earth terminal at the control.
- The internal/external AC supply filter must be permanently earthed.
- The signal/control cables must be screened.

Grounding for Enclosure Mounting (Class B) also see Chapters 4 and 5.

- The unit is installed for Class B operation when mounted inside an enclosure that has 10dB attenuation from 30 to 100MHz (typically the attenuation provided by a metal cabinet with no opening greater than 0.15m), using the recommended AC supply filter and having met all cable requirements.

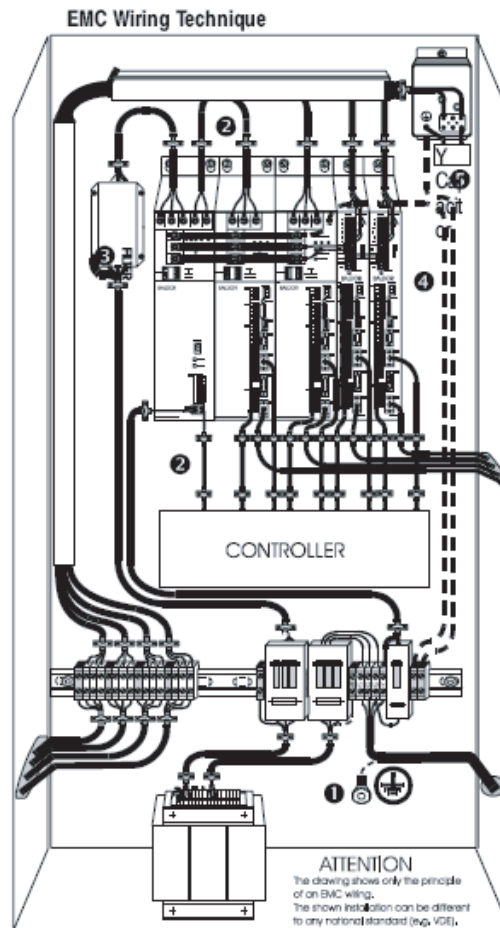
Note: Radiated magnetic and electric fields inside the cubicle will be high and components installed inside must be sufficiently immune.

- The control, external filter and associated equipment are mounted onto a conducting, metal panel. Do not use enclosures that use insulating mounting panels or undefined mounting structures. Cables between the control and motor must be screened or in conduit and terminated at the control.

Using CE approved components will not guarantee a CE compliant system!

1. The components used in the drive, installation methods used, materials selected for interconnection of components are important.
2. The installation methods, interconnection materials, shielding, filtering and grounding of the system as a whole will determine CE compliance.
3. The responsibility of CE mark compliance rests entirely with the party who offers the end system for sale (such as an OEM or system integrator).

Baldor products which meet the EMC directive requirements are indicated with a "CE" mark. A signed CE declaration of conformity is provided in this section.



1. **CABINET** The drawing shows an electroplated zinc coated enclosure, which is connected to ground. This enclosure has the following advantages:
 - All parts mounted on the back plane are connected to ground.
 - All shield (screen) connections are connected to ground. Within the cabinet there should be a spatial separation between power wiring (motor and AC power cables) and control wiring.
2. **SCREEN CONNECTIONS** All connections between components must use shielded cables. The cable shields must be connected to the enclosure. Use conductive clamps to ensure good ground connection. With this technique, a good ground shield can be achieved.
3. **EMC - FILTER** The EMI or main filter should be mounted next to the power supply (here BPS). For the connection to and from the main filter screened cables should be used. The cable screens should be connected to screen clamps on both sides. (Exception: Analog Command Signal).
4. **Grounding(Earth)** For safety reasons (VDE0160), all BALDOR components must be connected to ground with a separate wire. The diameter of the wire must be at minimum AWG#6 (10mm). Ground connections (dashed lines) must be made from the central ground to the regen resistor enclosure and from the central ground to the Shared Power Supply.
5. **Y-CAP ACITOR** The connection of the regeneration resistor can cause RFI (radio frequency interference) to be very high. To minimize RFI, a Y-capacitor is used. The capacitor should only be connected between the dynamic brake resistor housing and terminal pin R1 (lead from Lin).

C.3 EMC Installation Instructions

To ensure electromagnetic compatibility (EMC), the following installation instructions should be completed. These steps help to reduce interference.

Consider the following:

- Grounding of all system elements to a central ground point
- Shielding of all cables and signal wires
- Filtering of power lines

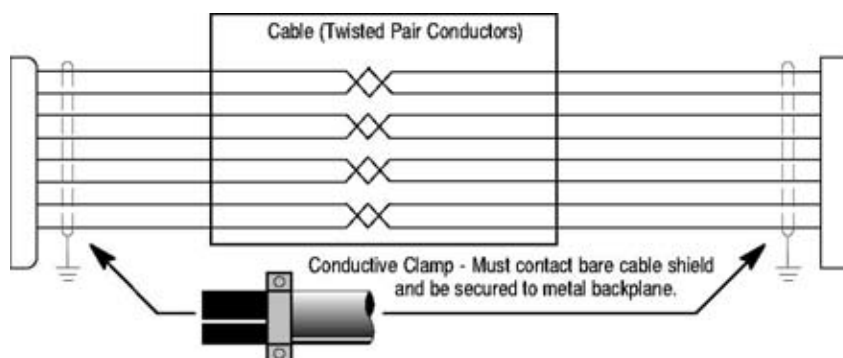
A proper enclosure should have the following characteristics:

- A) All metal conducting parts of the enclosure must be electrically connected to the back plane. These connections should be made with a grounding strap from each element to a central grounding point. [1]
- B) Keep the power wiring (motor and power cable) and control wiring separated. If these wires must cross, be sure they cross at 90 degrees to minimize noise due to induction.
- C) The shield connections of the signal and power cables should be connected to the screen rails or clamps. The screen rails or clamps should be conductive clamps fastened to the cabinet. [2]
- D) The cable to the regeneration resistor must be shielded. The shield must be connected to ground at both ends.
- E) The location of the AC mains filter has to be situated close to the drive so the AC power wires are as short as possible.
- F) Wires inside the enclosure should be placed as close as possible to conducting metal, cabinet walls and plates. It is advised to terminate unused wires to chassis ground. [1]
- G) To reduce ground current, use at least a 10mm² (6 AWG) solid wire for ground connections.

Note [1]: Grounding in general describes all metal parts which can be connected to a protective conductor, e.g. housing of cabinet, motor housing, etc. to a central ground point. This central ground point is then connected to the main plant (or building) ground.

Note [2]: Or run as twisted pair at minimum.

Example Cable Screens Grounding





Date: 07/11/07 **EC Declaration of Incorporation** Ref: DE00027-000

Manufacturer: Baldor Electric Company
Address: 5711 R.S Boreham Jr St, Fort Smith, Arkansas, USA
European Representative: Baldor UK Ltd,
Address: 6 Bristol Distribution Park, Hawley Drive, Bristol, BS32 0BF, U.K

Hereby declare that the product:

VSIPF AC Inverter Drive being one of:
VSIPF***.** (where ***.** = Product Variant)

is intended to be incorporated into machinery to constitute machinery covered by the EEC directive 98/37/EC, and 89/336/EEC; does therefore not in every respect comply with the provisions of these directives; and that the protection requirements of the following Council Directives and relevant Harmonised European standards must be applied:-

The Electromagnetic Compatibility Directive 89/336/EEC and its amending directives:-

User must follow the guidance given in this directive to meet all necessary protection requirements. Must be installed and operated with reference to the instructions in the product manual MN763. User must follow the guidance given in harmonised standards EN61000-6-2 (Generic Industrial Immunity) and EN61000-6-3 (Generic Light Industrial / residential Emissions) to meet necessary protection requirements of this directive.

Standard:	Title:	Comments:
EN 61800-3	<i>Adjustable speed electrical power drive systems – Part 3</i>	Compliant.
EN 61000-4 :2001	<i>Electromagnetic Compatability :Testing and measurement</i>	Compliant
EN 61000-2: 1997	<i>Electromagnetic Compatability: Environmental compatability levels</i>	Compliant

The Machinery Directive 98/37/EC and its amending directives:-

User must follow the guidance given in this directive to meet all necessary protection requirements. All instructions, warnings & safety information of the product manual MN763 must be adhered to. User must follow the guidance given in harmonised standard EN60204-1 (Safety of Machinery) to meet necessary protection requirements of this directive.

and furthermore declare that it may not be put into service before the machinery in which it will be incorporated is declared to comply with the provisions of directive 98/37/EC & 89/336/EEC as amended.

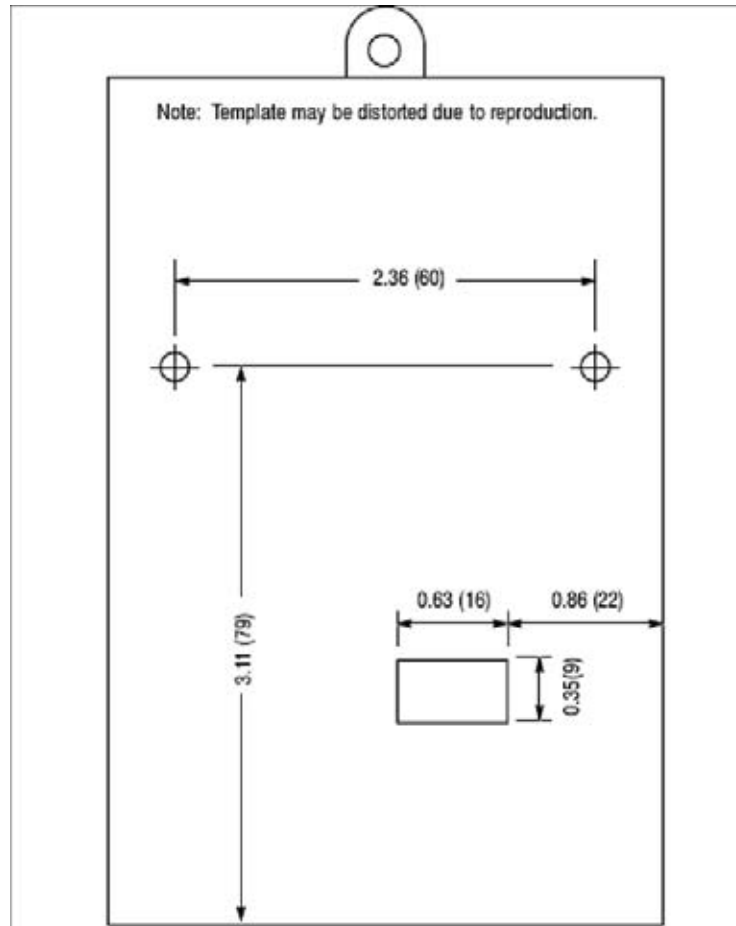
Signed:

Dr. Gerry Boast
Engineering Manager
Baldor UK Ltd

Appendix D

Options & Kits

D.1 Remote Keypad Option



1. Drill two mounting holes in the locations shows using Figure D-1 as a template.
2. Remove the keypad from the VS1PF.
3. Mount the remote keypad.
4. Attach one end of the remote cable in the keypad connector of the control.
5. Attach the other end of the remote cable to the remote keypad.

D.2 Dynamic Brake Unit

Refer to MN763DB for installation instructions for the Dynamic Brake Unit (DBU). VS1PF inverters do not have built-in Dynamic Brake hardware. When required, external DB Unit (Optional) and Brake Resistor(Optional) should be installed.

D.3 Conduit Kit

Table D-1 identifies each conduit kit by part number.

Table D.1 – Conduit Kit Models

Conduit Kit	HP	Drive Type	Frames	Hole Size Inches [mm]	Conduit Size Inches [mm]
VS1PF-NM1C	20 - 25	Standard	C	1 x 1.38 (35) 2 x 1.97 (50)	1" [27] 1.5" [41]
VS1PF-NM1D	20 - 25	Built-In DC Reactor	D	2 x 0.87 (22) 3 x 2.01 (51)	0.5" [16] 1.5" [41]
VS1PF-NM1E	30 - 40	Standard	E	1 x 1.97 (50) 2 x 1.97 (50)	1.5" [41] 1.5" [41]
VS1PF-NM1F	30 - 40	Built-In DC Reactor	F	2 x 0.87 (22) 3 x 2.01 (51)	0.5" [16] 1.5" [41]
VS1PF-NM1GH	50 - 75	Standard	G, H	5 x 0.87 (22) 3 x 2.01 (51)	0.5" [16] 1.5" [41]
VS1PF-NM1JK	50 - 75	Built-In DC Reactor	J, K	5 x 0.87 (22) 3 x 2.01 (51)	0.5" [16] 1.5" [41]
VS1PF-NM1L	100 - 125	Standard	L	5 x 0.87 (22) 3 x 2.99 (76)	0.5" [16] 2.5" [63]
VS1PF-NM1M	100 - 125	Built-In DC Reactor	M	5 x 0.87 (22) 3 x 2.99 (76)	0.5" [16] 2.5" [63]

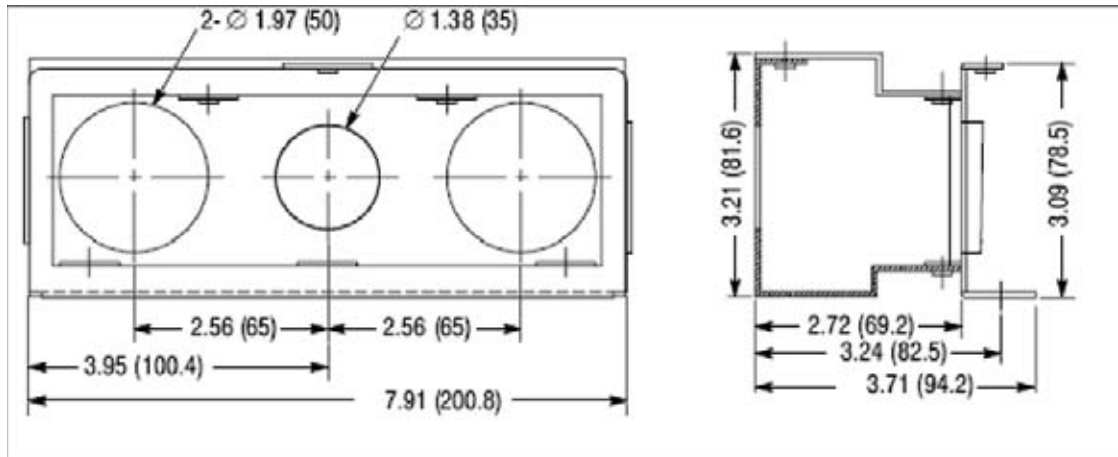


Figure D-1: Conduit Kit for VS1PF-NM1C 20-25 HP (Standard)

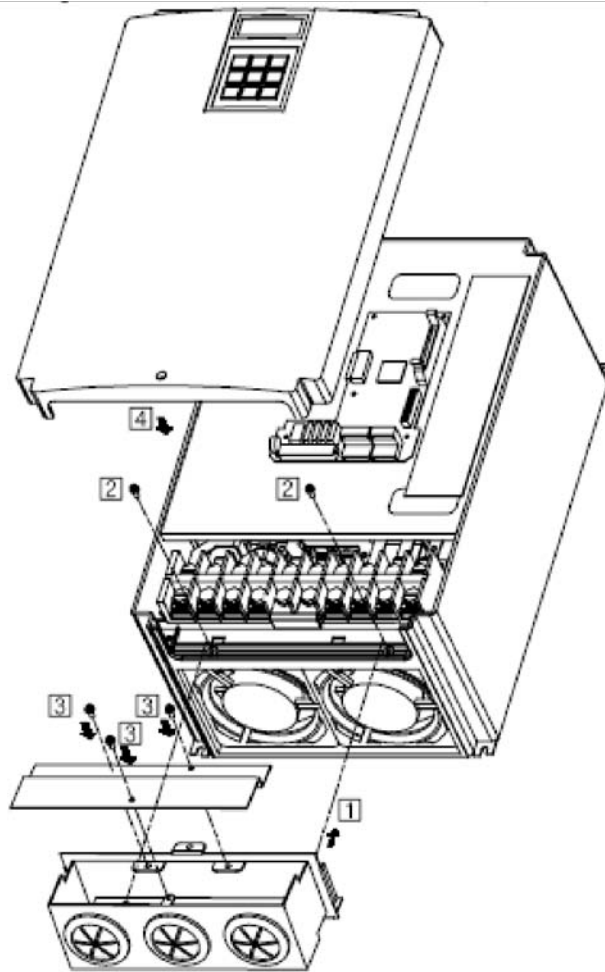


Figure D-2: Conduit Kit for VS1PF-NM1C, NM1E

- Step 1. Remove the cover from the drive, carefully remove the keypad cable from the drive.
- Step 2. Remove two screws [2] that hold the conduit plate in place. Retain the two screws.
- Step 3. Slide the conduit plate out of the drive chassis. Discard the plate.
- Step 4. Remove three screws [3] and the cover from the front of the conduit kit. Retain screws and cover.
- Step 5. Slide the new conduit kit [1] into the slots (above fans) where original conduit plate was removed.
- Step 6. Secure using the two screws [2] removed in step 2.
- Step 7. Connect conduits and make control and power connections.
- Step 8. Install the cover on conduit kit and secure using the three screws [3] removed in step 4.
- Step 9. Connect the keypad cable and install drive cover.

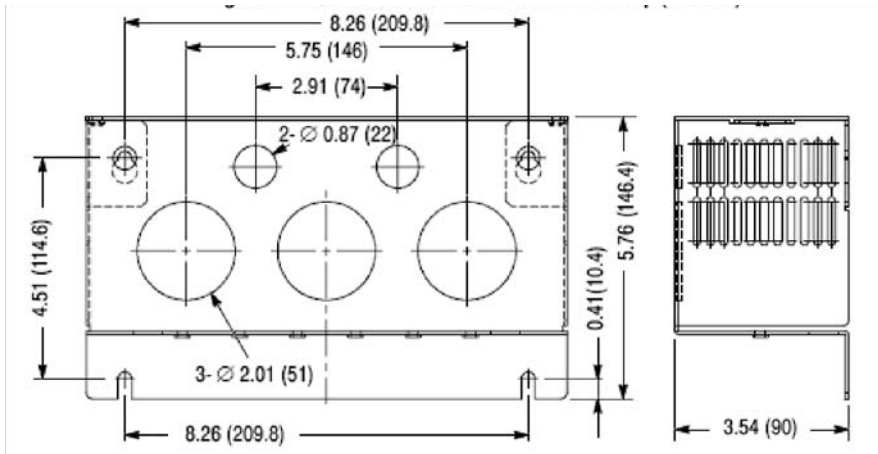


Figure D-3: Conduit Kit for VS1PF-NM1D 20-25 HP (Reactor)

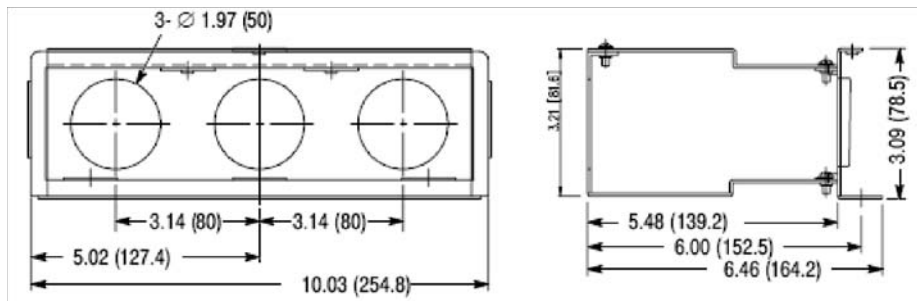


Figure D-4: Conduit Kit for VS1PF-NM1E 30-40 HP (Standard)

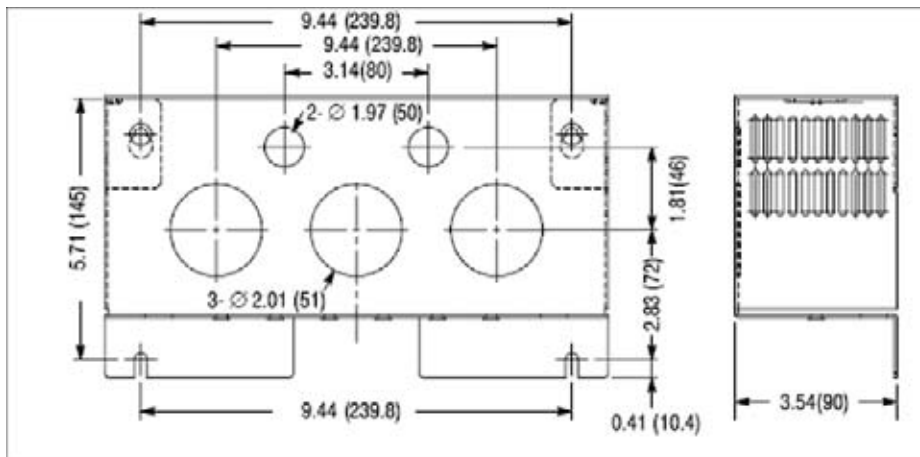


Figure D-5: Conduit Kit for VS1PF-NM1F 40-60 HP (Standard/Reactor)

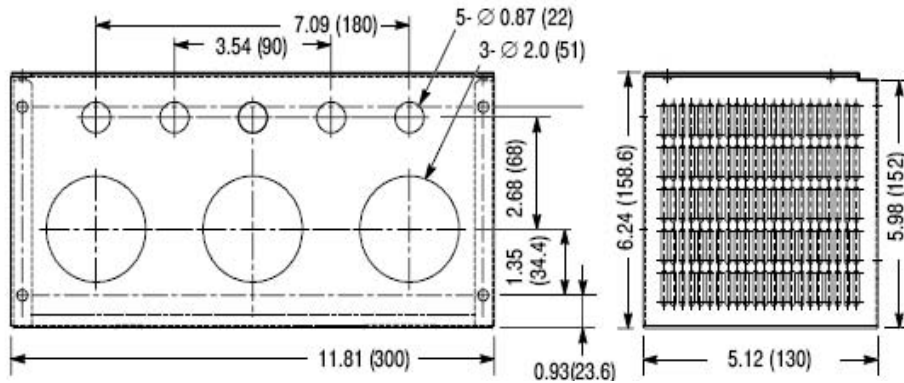


Figure D-6: Conduit Kit for VS1PF-NM1GH & VS1PF-NM1JK 50-75 HP (Standard/Reactor)

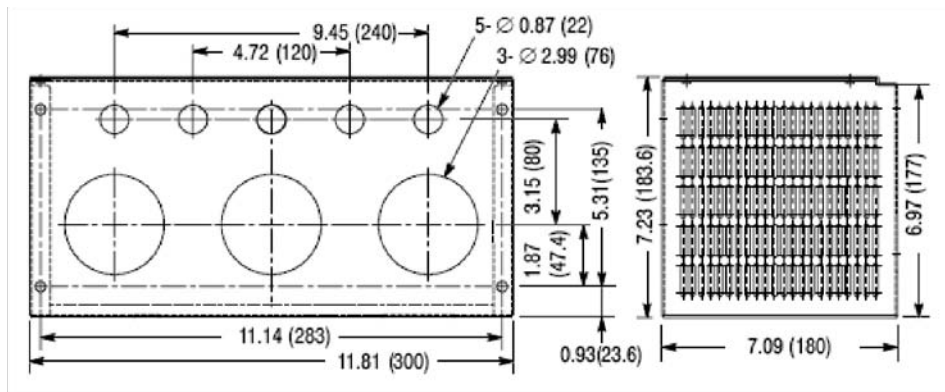


Figure D-7: Conduit Kit for VS1PF-NM1L & VS1PF-NM1M 100-125 HP (Standard/Reactor)

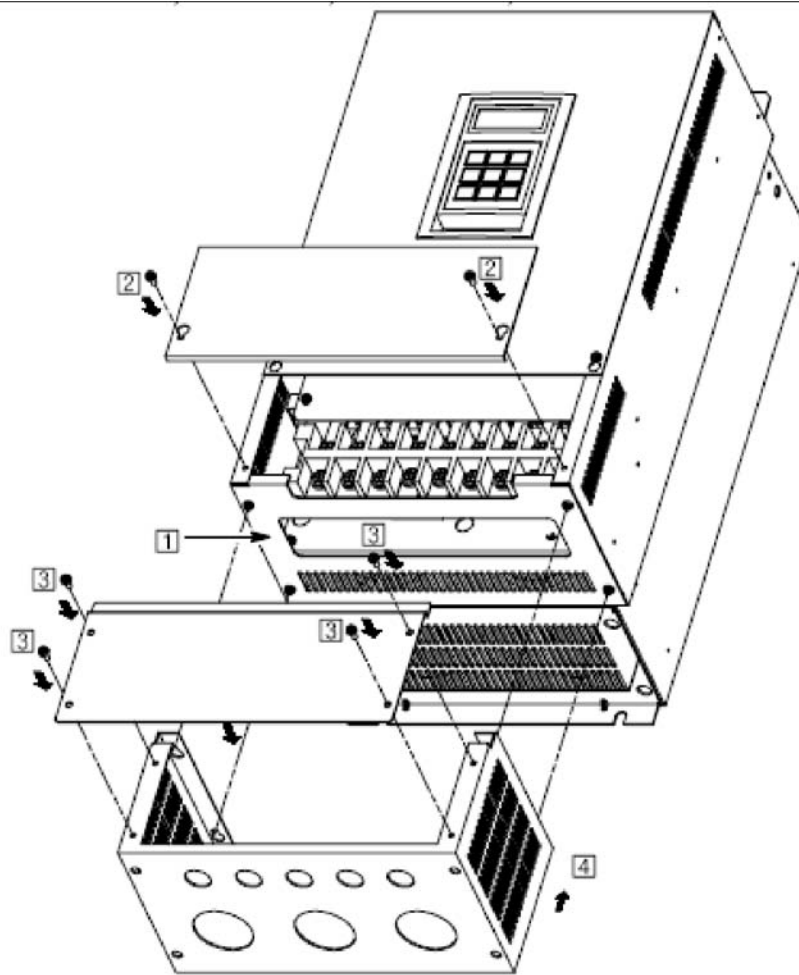


Figure D-8: VS1PF-NM1D, VS1PF-NM1F, VS1PF-NM1GH, VS1PF-NM1JK AND VS1PF-NM1LM

- Step 1. Loosen two screws [2] that hold the cover plate in place. Retain the two screws and plate.
- Step 2. Remove the lower cover [1] from the drive (Retain the 4 screws).
- Step 3. Install the 4 screws removed in step 2 but do not tighten them. Leave them loose enough to slip the new conduit cover [4] over the screw heads.
- Step 4. Remove 4 screws [3] and the cover from the front of the conduit kit. Retain screws and cover.
- Step 5. Slide the new conduit cover [4] over the screw heads (installed in step 3) and tighten screws.
- Step 6. Connect conduits and make control and power connections.
- Step 7. Install the cover on conduit kit and secure using the four screws [3] removed in step 4.
- Step 8. Install the drive cover plate over the two screws loosened in step 1 and tighten screws.

D.4 Recommended AC Reactor and DC Link Inductors

Table D-2 identifies the reactor rating. Contact your Baldor Sales office to order the correct reactor or inductor for your system if they are needed.

Model Number	Normal Duty HP	Heavy Duty HP	AC Reactor		DC Link Inductor	
			(mH)	Amps	(mH)	Amps
230VAC						
VS1PF27-1	7.5	5	0.39	30	1.37	29
VS1PF210-1	10	7.5	0.28	40	1.05	38
VS1PF215-1	15	10	0.2	59	0.74	56
VS1PF220-9	20	15	0.15	75	0.57	71
VS1PF225-9	25	20	0.12	96	0.49	91
VS1PF230-9	30	25	0.1	112	0.42	107
VS1PF240-9	40	30	0.07	160	0.34	152
460VAC						
VS1PF47-1	7.5	5	1.22	15	5.34	14
VS1PF410-1	10	7.5	1.14	20	4.04	19
VS1PF415-1	15	10	0.81	30	2.76	29
VS1PF420-9/9L*	20	15	0.61	38	2.18	36
VS1PF425-9/9L*	25	20	0.45	50	1.79	48
VS1PF430-9/9L*	30	25	0.39	58	1.54	55
VS1PF440-9/9L*	40	30	0.287	80	1.191	76
VS1PF450-9/9L*	50	40	0.232	98	0.975	93
VS1PF460-9/9L*	60	50	0.195	118	0.886	112
VS1PF475-9/9L*	75	60	0.157	142	0.753	135
VS1PF4100-9/9L*	100	75	0.122	196	0.436	187
VS1PF4125-9/9L*	125	100	0.096	237	0.352	225
VS1PF4150-9L*	150	125	0.081	289	* Built-In	
VS1PF4200-9L*	200	150	0.069	341		
VS1PF4250-9L*	250	200	0.057	420		
VS1PF4300-9L*	300	250	0.042	558		
VS1PF4350-9L*	350	250	0.042	558		
VS1PF4400-9L*	400	300	0.029	799		
VS1PF4500-9	500	350	0.029	799	0.09	836
VS1PF4600-9	600	400	0.024	952	0.076	996
VS1PF4700-9	700	500	0.024	952	0.064	1195

Appendix E

RS485/MODBUS Protocol

E.1 Introduction

The VS1PF AC Drive can be controlled and monitored by the sequence program of the PLC or other master module. The option card provides a terminal block for an RS485 ASCII/Modbus-RTU interface. Drives or other slave devices may be connected in a multi-drop configuration on the RS485 ASCII/Modbus-RTU network and may be monitored or controlled by a single PLC or PC.

- RS485 ASCII and Modbus-RTU open protocols are supported.
- Computer or other host acts as Master while inverters act as slaves.
- The inverter responds to Read/Write command from Master.

This appendix defines the specifics needed to set up a VS1PF on an RS-485 network running the Modbus-RTU protocol and documents the function codes and exception codes supported by the VS1PF. For a complete definition of the Modbus-RTU protocol and the content of specific messages see www.modbus.org.

E.2 Installation

1. Connect the RS485 communication line to the (C+), (C-) and (CM) control terminals .
2. Check the connections and turn ON the inverter.
3. This table documents the parameters within the VS1PF that are related to communications:

Number	Name	Comments
BAS-08	Start/Stop Source	Set to "Int485" for applications that require network control to start and stop the over the network.
BAS-09	Speed Reference Source	Set to "Int485" for applications that require network control of drive speed over the network.
I/O-(20-27)	Digital Inputs (pick one)	Set one of the digital inputs to LOC/REM to allow selection between control via the network (remote) and the selections defined in DRV-91 and DRV-92 (local).
DRV-91	Alt Start/Stop	Set to the desired method of providing start/stop control to the drive when in local mode.
DRV-92	Alt SPD Ref Source	Set to the desired method of providing a speed reference to the drive when in local mode.
I/O-90	Drive Address	Set to the desired Modbus-RTU address (note that each device on the network must have a unique address).
I/O-91	Baud Rate	Select the baud rate utilized by the Master device on the network. All devices on the network must utilize the same baud rate.
I/O-92	COM Lost Command	Set to desired drive response to a loss of communications.
I/O-93	COM Time Out	Set to the desired length of time before the drive responds to a loss of communications.
I/O-94	COM Response Delay	Set to the desired delay between the receipt of a message and the response by the drive. This setting may need to be adjusted from the factory default of 5mSec based on the specifications of the RS-485 interface of the master controller for the network.

4. Make connection to the master and other slave devices. The maximum number of drives that can be connected is 31. Maximum length of communication line is 2300 ft (700m).

E.3 Operation

1. Remove all power from the VS1PF control.
2. Disconnect the motor load from the control (terminals U, V and W). (Do not connect the motor load until stable communication between the master controller and the inverter is verified.)
3. Verify master controller and the inverter connections.
4. Turn ON the inverter.
5. Start the communications program on the master controller.
6. Verify proper communications and that the VS1PF is controlled as desired.
7. Remove all power from the VS1PF control.
8. Connect the motor load to the control (terminals U, V and W).
9. Turn ON the inverter.
10. Verify proper operation. See Troubleshooting at the end of this section to aid in resolving any remaining problems.

E.4 Performance Specifications

Communication Method	RS485 ASCII (RS232-485 converter)
Transmission Form	Bus method, Mult-drop Link System
Applicable inverter	VS1PF
Converter	Converter with RS232 card embedded
Number of inverters connected	Maximum 31 drives connectable
Transmission distance	Less than 700m recommended (Max. 1200m)

E.5 Hardware Specifications

Installation	Use C+, C-, CM terminals on control terminal block
Power supply	Provided by isolated power from the inverter power supply

E.6 Communications Specifications

Communication Speed*	38400*, 19200, 9600, 4800, 2400, 1200 bps selectable
Control Procedure	Asynchronous communication system
Communication System	Half duplex system
Character System	RS485 ASCII (8 bit), Modbus-RTU Binary (7/8 bit)
Start/Stop bit	Start 1 bit, Stop 1/2 bit
Error check	RS485 ASCII: Checksum (2byte) Modbus-RTU: CRC16 (2byte)
Parity Check	Even/Odd

* 38400 bps speed is only available with the optional expansion board VS1PF-MBUS.

E.7 RS485 ASCII Protocol (See E.8 for Binary Modbus-RTU)

Command message (Request)

ENQ	Inverter No.	CMD	Data	SUM	EOT
1 byte	2 bytes	1 byte	n bytes	2 bytes	1 byte

Normal response (Acknowledge Response)

ACK	Inverter No.	CMD	Data	SUM	EOT
1 byte	2 bytes	1 byte	n * bytes	2 bytes	1 byte

Negative response (Negative Acknowledge Response)

NAK	Inverter No.	CMD	Data	SUM	EOT
1 byte	2 bytes	1 byte	2 bytes	2 bytes	1 byte

Description:

- Request starts with "ENQ" and ends with "EOT".
- Acknowledge Response starts with "ACK" and ends with "EOT".
- Negative Acknowledge Response starts with "NAK" and ends with "EOT".
- "Inverter Number" is the address of Inverter used and indicated in 2 byte ASCII-HEX. (ASCII-HEX: Hexadecimal consists of '0' ~ '9', 'A' ~ 'F')
- *CMD: Capital letter ("IF Error" when small letter is used.)

Character	ASCII-HEX	Command
'R'	52h	Read
'W'	57h	Write
'X'	58h	Request for monitoring
'Y'	59h	Action for monitoring

Data: ASCII-HEX

Ex) when data value is 3000: 3000 (dec) = '0' 'B' 'B' '8'h = 30h 42h 42h 38h

- Error code: ASCII (20h ~ 7Fh)
- Receive/Send buffer size: Receive= 39 bytes, Send=44 bytes
- Monitor register buffer: 8 Words
- SUM: to check the communication error
SUM= ASCII-HEX format of lower 8 bits of (Inverter No. + CMD + DATA)

Ex) Command Message (Request) for reading one address from address "9000"

ENQ	Inverter No.	CMD	Address	Number of address	SUM	EOT
05h	"01"	"R"	"3000"	"1"	"AC"	04h
1	2	1	4	1	2	1

SUM = '0' + '1' + 'R' + '3' + '0' + '0' + '0' + '1'
 = 30h + 30h + 31h + 52h + 33h + 30h + 30h + 30h + 31h
 = 1A7h (Except Control value: ENQ, ACK, NAK, etc.)

E.7.1 Detailed Read Protocol

Read Request: Request for read successive 'N' number of WORD from address "XXXX"

ENQ	Inverter No.	CMD	Address	Number of address	SUM	EOT
05h	"01" - "1F"	"R"	"XXXX"	"1" - "8" = n	"XX"	04h
1	2	1	4	1	2	1

Total byte = 12. The quotation marks (" ") mean character

Acknowledge Response:

ACK	Inverter No.	CMD	Data	SUM	EOT
06h	"01" - "1F"	"R"	"XXXX"	"XX"	04h
1	2	1	N * 4	2	1

Total byte = 7 * n * 4 = Max. 39

Negative Acknowledge Response:

NAK	Inverter No.	CMD	Error Code	SUM	EOT
15h	"01" - "1F"	"R"	***	"XX"	04h
1	2	1	2	2	1

Total byte = 9

E.7.2 Detailed Write Protocol

Request for Write:

ENQ	Inverter No.	CMD	Address	Number of Address	SUM	EOT	EOT
05h	"01" - "1F"	"W"	"XXXX"	"1" - "8" = n	"XXXX..."	"XX"	04h
1	2	1	4	1 byte	n * 4	2	1

Total byte = 12 + n * 4 = Max. 44

Acknowledge response:

ACK	Inverter No.	CMD	Data	SUM	EOT
06h	"01" - "1F"	"W"	"XXXX..."	"XX"	04h
1	2	1	n * 4	2	1

Total byte = 7 + n * 4 = Max. 39

Negative Response

NAK	Inverter No.	CMD	Error Code	SUM	EOT
15h	"01" - "1F"	"W"	***	"XX"	04h
1	2	1	2	2	1

Total byte = 9

E.7.3 Detailed Monitor Register Protocol

- Monitor Register
- Request for Monitor Register

Monitor Register has the function to update data periodically after assigning the necessary data to be monitored continuously.

Request for Register of 'n' number of Addresses (non-successive)

ENQ	Inverter No.	CMD	Number of Address	Address	SUM	EOT
05h	"01" - "1F"	"X"	"1" ~ "8" = n	"XXXX..."	"XX"	04h
1	2	1	1	n * 4	2	1

Total byte = 8 + n * 4 = Max 40

Acknowledge Response:

ACK	Inverter No.	CMD	SUM	EOT
06h	"01" - "1F"	"X"	"XX"	04h
1	2	1	2	1

Total byte = 7

Negative Acknowledge Response:

NAK	Inverter No.	CMD	Error code	SUM	EOT
15h	"01" - "1F"	"X"	"**"	"XX"	04h
1	2	1	2	2	1

Total byte = 9

- Monitor Action

• Action Request for Monitor Register: Request to read data registered by Monitor Register.

ENQ	Inverter No.	CMD	SUM	EOT
05h	"01" - "1F"	"Y"	"XX"	04h
1	2	1	2	1

Total byte = 7

Acknowledge Response:

ACK	Inverter No.	CMD	Data	SUM	EOT
06h	"01" - "1F"	"Y"	"XXXX..."	"XX"	04h
1	2	1	n * 4 byte	2 byte	1 byte

Total byte = 7 + n * 4 = Max 39

Negative Response:

NAK	Inverter No.	CMD	Error Code	SUM	EOT
15h	"01" ~ "FA"	"Y"	"**"	"XX"	04h
1	2	1	2	2	1

Total byte = 9

E.7.4 Error code:

Error code	Display	Description
Illegal Function	IF	When the command received cannot be executed in the option card. It means that there is no corresponding command.
Illegal Data Address	IA	When parameter address received is invalid. When data is executed without Monitor Register.
Illegal Data Value	ID	When the data received is invalid.
Write Mode Error	WM	In case of Read Only or Write Disabled during operation.
Frame Error	FE	When the frame size, internal Num or Sum is incorrect.
Time Out Error	TO	When DPRAM communication is not working within a certain time.
DPRAM Off Line	DO	When DPRAM is Off Line.
Invalid ID Number	IN	When Inverter Number is incorrect.
Undefined Condition	UC	Except for the cases above.

E.8 Modbus-TRU Protocol

Use Modbus-RTU protocol. This is Open Protocol. Computer or other host acts as Master while inverters act as slaves. The inverter responds to Read/Write command from Master.

Note: Not all Modbus-RTU functions are supported by this communications board.

E.8.1 Available Function Code

Function Code	Description
3	Read Hold Register
4	Read Input Register
6	Preset Single Register
16	Preset Multiple Register

E.8.2 Exception Code

Exception Code	Display	Description
0x01		Illegal Function
0x02		Illegal Data Address
0x03		Illegal Data Value
0x06		Slave Device Busy
User Defined	0x15	1. Write Disable (Address for 0x0004 value is 0). 2. Read only parameter
User Defined	0x16	Framing Error

E.9 Baud Rate

1200, 2400, 4800, 9600, 19200, 38400 bps rates are available (factory setting is 9600 bps). See VS1PF parameter I/O-91 to change setting (MN763).

E.10 Broadcast Function

- The broadcast function is used when Command is given to all inverters connected to network.
- In the case of RS485, all inverters run without response (Slave>Master) when Command is given to inverter number 255 (0xFF).
- In the case of Modbus-RTU, all inverters run without response (Slave>Master) when Command is given to Inverter Number 0 (0x00).

E.11 Troubleshooting

Refer to this chapter when occurring problem in communication with computer while using this option card is encountered.

CPU LED Malfunction

Expected State	The inverter is not working normally or the inverter and the option card are not connected properly.
Corrective Measures	1. Verify the power is applied to the inverter. 2. Verify the option card is installed properly within the inverter when the inverter is working normally.

RXD and TXD LEDs malfunction

Check Points	Corrective Measures
Is the power applied to the converter?	Apply power to the converter.
Is the connection between the converter and the computer correct?	Refer to the converter manual.
Is the communication card installed within the inverter properly?	Refer to installation.
Does Master start the communication?	Start the communication.
Is the communication speed setting of the inverter correct?	Refer to installation.
Is the data format of User program correct?	Modify User program. User-made S/W for PC.
Is the communication between the converter and the option card correct?	Refer to installation.

ERR LED is working

State	Corrective Measures
Blinking intermittently	In case that the option card is receiving wrong data due to Noise or other causes, it is normal.
Blinking oppositely to CPU LED	Network is not communicated during TimeOut Setting. Verify the state of Master, (VS1PF: I/O-93)
Blinking simultaneously CPU LED	In case of occurring the communication trouble between the option card and the inverter, Power up and down the inverter. If this problem occurs continuously, contact Baldor district office.

Refer to COM group of VS1PF for Frequency (Speed)/Run command given by the option card.

E.12 Parameter Code (All parameter addresses are Hex values)

E.12.1 Common Area

<Common Area>: Common Area addresses are to be used commonly regardless of inverter models.

Some addresses are used only for specific inverter models.

When data is changed by Common Area parameter, its data is not saved. That is, the changed data is effective in the present state but the data is reset to the previous value after the inverter is reset or powered up/down.

Even though the inverter is reset or powered up/down, the changed data is effective in case of changing the data by each group parameter, not the Common Area.

Address	Parameter	Unit	R/W	Data Value (Description)					
0x0000	Rating	-	RO	4-7.5 hp, 5-10 hp, 6-15 hp, 7-20 hp, 8-25 hp, 9-30 hp, 10-40 hp, 11-50 hp, 12-60 hp, 13-75 hp, 14-100 hp, 15-125 hp, 16-150 hp, 17-200 hp, 18-250 hp, 19-300 hp, 20-350 hp, 21-400 hp, 22-500 hp, 23-600 hp, 24-700 hp					
0x0001	Input Volts	-	RO	0: 230VAC Class 1:460VAC Class					
0x0002	S/W Version	-	RO	Ex) 0x0100: Ver 1.00, 0x0110 : Ver 1.10					
0x0004	Speed Reference	0.01Hz	RW	Ex) 2796D = 27.96Hz					
0x0005	Run/Stop Command		RW	BIT 0	Stop				
				BIT 1	Forward Run (FX)				
				BIT 2	Reverse Run (RX)				
				BIT 3	Fault Reset (0-1)				
				BIT 4	Emergency Stop				
				BIT 5	Not Used				
			RO	BIT 6	Run/Stop	0	Terminal		
					BIT 7	Run/Stop	1	Keypad	
							2	Option	
				BIT 8		3	Int. 485		
						0-16	Multi-step Speed Freq.		
				BIT 9		17-19	Up Down Operation (Up, Down, UD Zero)		
						20-21	Not Used		
				BIT 10		22-25	Analog Operation (V1, V1S, I, VII)		
						26	Pulse		
BIT 11		27	Sub						
		28	Int. 485						
BIT 12		29	Option						
		30	Jog						
BIT 13		31	PID						
		Not Used							
		Not Used							
BIT 14	Not Used								
BIT 15	Set when Network malfunction occurs.								
0x0006	Acceleration Time	0.1 sec	R/W						

Address	Parameter	Unit	R/W	Data Value (Description)	
0x0007	Deceleration Time	0.1 sec	R/W		
0x0008	Output Current	0.1 A	RO		
0x0009	Output Frequency	0.01 Hz	RO		
0x000A	Output Voltage	0.1 V	RO		
0x000B	DC Link Voltage	0.1 V	RO		
0x000C	Ouput Power	0.1 kW	RO		
0x000D	Operating Status		RO	BIT 0	Stop
				BIT 1	Forward Run (FX)
				BIT 2	Reverse Run (RX)
				BIT 3	Fault (Trip)
				BIT 4	Accelerating
				BIT 5	Decelerating
			RO	BIT 6	Speed Arrival
				BIT 7	Forward Command
				BIT 8	DC Braking
				BIT 9	Not Used
				BIT10	Brake Open
				BIT11	Forward Run Command
				BIT12	Reverse Run Command
				BIT13	REM. R/S (Int. 485, OPT)
				BIT14	REM. Freq. (int. 485, OPT)
BIT15	Not Used				
0x000E	Trip Information		RO	BIT 0	OCT1
				BIT 1	OV
				BIT 2	EXT-A
				BIT 3	BX
				BIT 4	LV
				BIT 5	Not Used
				BIT 6	GF (Ground Fault)
				BIT 7	OH (Inverter overheat)
				BIT 8	ETH (Motor overheat)
				BIT 9	OLT (Overload trip)
				BIT10	HW-Diag
				BIT11	Not Used
				BIT12	OCT2
				BIT13	OPT (Option error)
BIT14	PO (Phase Open)				
BIT15	IOLT				

Address	Parameter	Unit	R/W	Data Value (Description)	
0x000F	Input Terminal Status	-	R	BIT 0	M1
				BIT 1	M2
				BIT 2	M3
				BIT 3	M4
				BIT 4	M5
				BIT 5	M6
				BIT 6	M7
				BIT 7	M8
				BIT 8	P4
				BIT 9	P5
				BIT10	P6
0X0010	Output Terminal Status	-	R	BIT 0	AUX1
				BIT 1	AUX2
				BIT 2	AUX3
				BIT 3	AUX4
				BIT 4	Q1 (OC1)
				BIT 5	Q2 (OC2)
				BIT 6	Q3 (OC3)
				BIT 7	30AC
BIT8-15	Not used				
0x0011	V1	-	R		0 - FFCO
0x0012	V2		R		0 - FFCO
0x0013	I		R		0 - FFCO
0x0014	RPM		R		
0x0015	Unit Display		R		0: Hz, 1:RPM
0x001A	Pole Number		R		
0x001C	Custom Version		R		
0xFFFF	Drive Series		R		9: VS1PF

* Refer to MN763 VS1PF manual for the communication address assignments.

E.12.2 Communication Option Setting

Address	NO.	Description	Factory Setting	Maximum	Minimum
9601	COM #01	Opt B/D	0	7	0
9602	COM #02	Opt Mode	0	3	0
9603	COM #03	Opt Version	2.2	-	-
963C	COM #60	Parity/Stop	0	3	0

* Inverter Number or communication speed is set in I/O-90, 91.

COM-01 [Opt B/D]

- Indicates the type of the option card installed.
- This value is automatically displayed when the option card is installed.

COM-02 [Opt Mode]

- Determines whether Run/Stop and Freq. command are set via communication.

Setting	Display	Description
0 (Default)	None	None command
1	Command	Run/Stop command via communication
2	Freq	Frequency command via communication
3	Cmd + Freq	Run/Stop and Frequency command via communication

COM-03 [Opt Version]

- Displays the version of the option card.

COM-60 [Parity/Stop]

- Sets Stop Bite or Parity Check

Setting	Display	Description
0	8None/1Stop	Data: 8bit, Stop: 1bit, Parity: None
1	8None/2Stop	Data: 8bit, Stop: 2bit, Parity: None
2	8Even/1Stop	Data: 8bit, Stop: 1bit, Parity: even
3	8Odd/1Stop	Data: 8bit, Stop: 1bit, Parity: odd

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