

KBVF SERIES

CHASSIS/IP-20 INVERTERS

Models KBVF-21D, 22D, 13, 23, 23D, 23P, 14, 24, 24D, 24P, 26D, 27, 29, 42, 45, 48

Variable Speed/Soft-Start AC Motor Drives
with Electronic Motor Overload Protection¹

Rated for 208-230 and 400/460 Volt 50 & 60 Hz

3-Phase & PSC AC Induction Motors from Subfractional thru 5 HP

Operates from 115, 208/230, and 400/460 Volt 50/60 Hz AC Line

TYPICAL APPLICATIONS

- Conveyors • Feeders • Packaging Equipment
- Pumps • Blowers • Printing Presses • Indexers
- Fans • Treadmills • Door & Gate Openers
- Portable Equipment used with GFCIs²



CUSTOM SOFTWARE

- All models can be factory programmed for applications that require special switching, timing, PLC functions, and GFCI operation.**

STANDARD FEATURES

- **Simple to Operate:** Does not require programming. Uses trimpots and jumpers, which are factory set for most applications.
- **Diagnostic LEDs:** Power on (PWR) and drive status (ST).
- **Signal Isolation:** Provides an isolated interface between non-isolated signal sources and the drive. (Standard on Models KBVF-42, 45, 48. See Note 3.)
- **Run/Fault Relay Output Contacts:** Can be used to turn on or off equipment or to signal a warning if the drive is put into the Stop Mode or a fault has occurred. (Standard on Models KBVF-42, 45, 48. See Note 3.)
- **Output Frequency Doubling:** Increases the motor speed up to two times the rated RPM.
- **Bidirectional Signal Operation (SIVFR required).**
- **Compatible with GFCIs (with optional software).**
- **Finger-Safe Cover:** Meets IP-20 standard.

PERFORMANCE FEATURES

- **Power Start™:** Provides more than 200% starting torque which ensures startup of high frictional loads.
- **Slip Compensation with Static Auto-Tune and Boost:** Provides excellent load regulation over a wide speed range.
- **Speed Range:** 60:1

PROTECTION FEATURES

- **Motor Overload (I^2t) with RMS Current Limit:** Provides motor overload protection which prevents motor burnout and eliminates nuisance trips.¹
- **Electronic Inrush Current Limit (EICL™):** Eliminates harmful inrush AC line current during startup.⁴
- **Short Circuit:** Prevents drive failure if a short circuit occurs at the motor (phase-to-phase).
- **Motor Filter:** Reduces harmful voltage spikes to the motor.⁵
- **Regeneration:** Eliminates tripping due to bus overvoltage caused by rapid deceleration of high inertial loads.
- **Undervoltage and Overvoltage:** Shuts down the drive if the AC line input voltage goes above or below the operating range.
- **AC Line Phase Loss Detection:** Shuts down the drive if one of the AC Line input phases is opened. Models KBVF-23P, 24P, 29, 42, 45, 48 only.
- **MOV Input Transient Suppression.**
- **Microcontroller Self Monitoring and Auto-Reboot.**

TRIMPOT ADJUSTMENTS

- Minimum Speed (MIN) • Maximum Speed (MAX) • Acceleration (ACC)
- Deceleration/Boost (DEC/B)⁶ • Slip Compensation (COMP) • Current Limit (CL)

DESCRIPTION

The KBVF Adjustable Frequency Drives provide variable speed control for standard 208-230 and 400/460 Volt 50 & 60 Hz 3-phase & PSC AC induction motors from subfractional thru 5 HP. The sine wave coded Pulse Width Modulated (PWM) output operates at a carrier frequency of 16 kHz, which provides high motor efficiency and low noise. Adjustable linear acceleration and deceleration are provided, making the drive suitable for soft-start applications.

Due to its user-friendly design, the KBVF is easy to install and operate. Tailoring to specific applications is accomplished with selectable jumpers and trimpots, which eliminate the computer-like programming required on other drives. However, for most applications no adjustments are necessary. For more advanced programming, PC based Drive-Link™ software is available.

Main features include adjustable RMS Current Limit and I^2t Motor Overload Protection¹. In addition, Adjustable Slip Compensation with Static Auto-Tune and Boost provides high torque and excellent load regulation over a wide speed range. Power Start™ delivers over 200% motor torque to ensure startup of high frictional loads. Electronic Inrush Current Limit (EICL™) eliminates harmful AC line inrush current.⁴ The drive is suitable for machine or variable torque (HVAC) applications.

For AC line and motor wiring, Models KBVF-21D, 22D, 13, 23, 23D, 23P, 14, 24, 24D, 24P, 26D contain quick-connect terminals. Models KBVF-27, 29, 42, 45, 48 contain a Barrier Terminal Block. Other features include adjustable trimpots (CL, MAX, MIN, DEC/B6 ACC, COMP), customer selectable jumpers (Line Voltage (dual voltage models only), Automatic-Manual Start/Reset, Motor Frequency, Frequency Multiplier, Forward/Reverse). Diagnostic LEDs are provided for power (PWR) and drive status (ST), bidirectional signal operation (SIVFR required). Models KBVF-29, 48 contain a built-in cooling fan.

A Signal Isolator and Run/Fault Relay Output Contacts (SIVFR) are provided on Models KBVF-45, 48 and are optional on all other models. Other optional accessories include Class "A" and "B" AC Line Filters, Dynamic Brake Module, Multi-Speed Board, Programming Kit, and Modbus Communication Module. A connector is provided for easy installation of accessories. With optional software, the drive can be programmed for DC Injection Braking. A 5 k Ω Main Speed Potentiometer is also included.

* Requires CE approved KBRF-250 Class A Industrial Standard RFI (EMI) Filter (Part No. 9509) or KBRF-350 Class B Residential Standard RFI (EMI) Filter (Part No. 9511). ** OEM application only.

Notes: 1. UL approved as an electronic overload protector for motors. 2. Requires optional software.

3. Signal Isolator and Run/Fault Relay is standard on Models KBVF-42, 45, 48 and optional on all other models.

4. Models KBVF-21D, 22D contain ICL in lieu of EICL™. 5. Only Models KBVF-21D, 22D, 13, 23, 23D, 14, 24, 24D, 26D contain Motor Filter. 6. In 50 Hz Mode, the DEC/B Trimpot automatically becomes Adjustable Boost.



TABLE 1 – GENERAL PERFORMANCE SPECIFICATIONS

Description	Specification	Factory Setting
115 Volt AC Line Input Voltage Operating Range (Volts AC, 50/60 Hz)	115 (±15%)	—
208/230 Volt AC Line Input Voltage Operating Range (Volts AC, 50/60 Hz)	208 (-15%) / 230 (+15%)	—
400/460 Volt AC Line Input Voltage Operating Range (Volts AC, 50/60 Hz)	380 (-15%) – 460 (+15%)	—
Maximum Load (% Current Overload for 2 Minutes)	150	—
Carrier, Switching Frequency (kHz)	16, 8	—
Signal Following Input Voltage Range ¹ (Volts DC)	0 – 5	—
Output Frequency Resolution (Bits, Hz)	10, 0.06	—
Minimum Speed Trippot (MIN) Range (% Frequency Setting)	0 – 40	0
Maximum Speed Trippot (MAX) Range (% Frequency Setting)	70 – 110	100
Acceleration Trippot (ACC) and Deceleration Trippot (DEC/B) Range (Seconds)	0.3 – 20	1.5
Boost Trippot (DEC/B) Range (50 Hz Only) (Volts/Hz)	0 – 30	5
Slip Compensation Trippot (COMP) Range at Drive Rating (Volts/Hz)	0 – 3	1.5
Current Limit Trippot (CL) Range (Amps AC): KBVF-21D	0.65 – 1.8	1.6
KBVF-22D	1.0 – 2.8	2.4
KBVF-13, 23, 23D, 23P	1.5 – 4.5	3.8
KBVF-14, 24, 24D, 24P	2.5 – 7.5	6.4
KBVF-26D	3.5 – 10.5	8.8
KBVF-27	4.0 – 12.5	10.7
KBVF-29	5.5 – 17.0	14.4
KBVF-42	1.3 – 3.7	3.2
KBVF-45	3.0 – 8.5	7.4
KBVF-48	5.0 – 15.5	13.3
Motor Frequency Setting (Hz) (Jumper J1)	50, 60	60
Output Frequency Multiplier (X1, X2) (Jumper J2) ²	1, 2	1
Minimum Operating Frequency at Motor (Hz)	0.3	—
Speed Range (Ratio)	60:1	—
Speed Regulation (30:1 Speed Range, 0 - Full Load) (% Base Speed) ³	2.5	—
Overload Protector Trip Time for Stalled Motor (Seconds)	6	—
AC Line Input Undervoltage/Overvoltage Trip Points for 115 Volt AC Line (±5%) (Volts AC) ⁴	76 – 141	—
AC Line Input Undervoltage/Overvoltage Trip Points for 208/230 Volt AC Line (±5%) (Volts AC) ⁴	151 – 282	—
AC Line Input Undervoltage/Overvoltage Trip Points for 400/460 Volt AC Line (±5%) (Volts AC) ⁴	302 – 567	—
Run/Fault Relay Output Contact Rating ⁵ (Amps at 30 Volts DC, 125 Volts AC, 250 Volts AC)	1, 0.5, 0.25	—
Operating Temperature Range (°C / °F)	0 – 45 / 32 – 113	—

Notes: 1. Models KBVF-42, 45, 48 contain built-in signal isolation. For other models, if a non-isolated signal is used, install the SIVFR - Signal Isolator (Part No. 9597). 2. Allows the motor to operate up to two times the rated RPM. Constant motor horsepower will result when operating the drive in the "X2" mode. 3. Dependent on motor performance. 4. Do not operate the drive outside the specified AC line input voltage operating range. 5. Models KBVF-42, 45, 48 only.

TABLE 2 – ELECTRICAL RATINGS & FEATURES

Model	Part No.	AC Line Input			Fuse or Circuit Breaker Rating (Amps)	Drive Output			Features by Model ⁵			Net Wt.	
		Volts AC (50/60 Hz)	Phase (φ)	Maximum Current (Amps AC)		Volt Range (Nominal) (Volts AC)	Maximum Continuous Load Current (RMS Amps/Phase)	Maximum Horsepower (HP (kW))	Motor Filter (See Figure 2)	Signal Isolator and Run/Fault Relay (See Figure 18)	AC Line and Motor Wiring (See Figure 17)	lbs	kg
KBVF-21D	9581	115	1	4.0	5	0 – 230	1.0	1/10 (.07)	S	0	QD	0.7	0.3
		208/230	1	2.5									
KBVF-22D	9572	115	1	6.0	10	0 – 230	1.5	1/4 (.18)	S	0	QD	1.3	0.6
		208/230	1	3.8									
KBVF-13	9957	115	1	9.6	15	0 – 230	2.4	1/2 (.37)	S	0	QD	1.3	0.6
KBVF-23	9958	208/230	1	6.0	10	0 – 230	2.4	1/2 (.37)	S	0	QD	1.3	0.6
KBVF-23D	9959	115	1	9.6	15	0 – 230	2.4	1/2 (.37)	S	0	QD	1.3	0.6
		208/230	1	6.0									
KBVF-14	9977	115	1	14.0	20	0 – 230	4.0	1 (.75)	S	0	QD	2.2	1.0
KBVF-24	9978	208/230	1	10.0	15	0 – 230	4.0	1 (.75)	S	0	QD	2.2	1.0
KBVF-24D	9979	115	1	14.0	20	0 – 230	4.0	1 (.75)	S	0	QD	2.2	1.0
		208/230	1	10.0									
KBVF-26D	9496	115	1	22.0	25	0 – 230	5.5	1½ (1.13) ¹	S	0	QD	2.9	1.3
		208/230	1	14.0									
KBVF-23P ²	9676	208/230	3	3.2	5	0 – 230	2.4	1/2 (.37)	N	0	QD	1.1	0.5
KBVF-24P ²	9677	208/230	3	5.2	10	0 – 230	4.0	1 (.75)	N	0	QD	2.0	0.9
KBVF-27	9591	208/230	1	17.0	20	0 – 230	6.7	2 (1.5)	N	0	TB	4.1	1.9
			3	8.0									
KBVF-29 ^{2,3}	9593	208/230	3	10.8	15	0 – 230	9.0	3 (2.25)	N	0	TB	4.6	2.1
KBVF-42 ^{2,4}	9645	400/460	3	2.3	5	0 – 400/460	2.0	1 (.75)	N	S	TB	2.8	1.3
KBVF-45 ^{2,4}	9590	400/460	3	5.3	10	0 – 400/460	4.6	3 (2.25)	N	S	TB	4.1	1.9
KBVF-48 ^{2,3,4}	9592	400/460	3	9.6	15	0 – 400/460	8.3	5 (3.75)	N	S	TB	4.6	2.1

Notes: 1. Model KBVF-26D is rated 2 HP (1.5 kW) for most premium efficiency motors. 2. Models KBVF-23P, 24P, 29, 42, 45, 48 contain AC Line Phase Loss Detection. 3. Models KBVF-29, 48 contain a built-in cooling fan. 4. Models KBVF-42, 45, 48 are rated 0 – 400 Volts AC for 50 Hz motor operation and 0 – 460 Volts AC for 60 Hz motor operation. 5. S = Standard Feature, N = Not Available, 0 = Optional Feature, QD = Quick-Connect Terminals for AC line and motor wiring, TB = Terminal Block for AC line and motor wiring.

YOU GET MORE WITH KBVF INVERTERS

Eliminate Motor Failure Due to Overload

The KBVF contains modified I²t Overload Protection.* Part of this function consists of a Current Limit (CL) circuit, which limits the drive current to a factory preset level of 160% of the rated motor current. The CL Trimpot can be used to recalibrate the drive current from 60% thru 200%. The circuit provides an overshoot function that allows most motors to develop more than 200% of starting and break-down torque. Figure 1 illustrates the time versus motor current relationship.

Standard I²t is undesirable because it causes nuisance tripping. It allows a very high motor current to develop and will turn the drive off after a short period of time.

KB's RMS Current Limit Circuit avoids this nuisance tripping while providing maximum motor protection.

If the motor is overloaded to 120% of full load (or 75% of the CL setting), the I²t timer starts. If the motor continues to be overloaded at the 120% level, the timer will shut down the drive after 30 minutes. If the motor is overloaded to 160% of full load, the drive will trip in 6 seconds.

*UL approved as an electronic overload protector for motors.

AC Motors Last Longer

AC drives produce very fast rising voltages that can be harmful to motor windings. Some motor manufacturers are now using spike resistant magnet wire that reduces the

chance of insulation breakdown. Unfortunately, many motors do not contain the spike resistant wire, especially motors below 1HP.

To substantially reduce the chance of motor winding damage, all KBVF inverters from 1/10 thru 1.5 HP contain built-in Motor Filters.* Figure 2 compares a typical inverter waveform with and without the motor filter. It can be observed that the waveform with the Motor Filter has a reduced rate of voltage rise and reduced voltage spikes.

*Models KBVF-21D, 22D, 13, 23, 23D, 14, 24, 24D, 26D contain the Motor Filter.

FIGURE 1 – Modified I²t Time vs. Motor Current

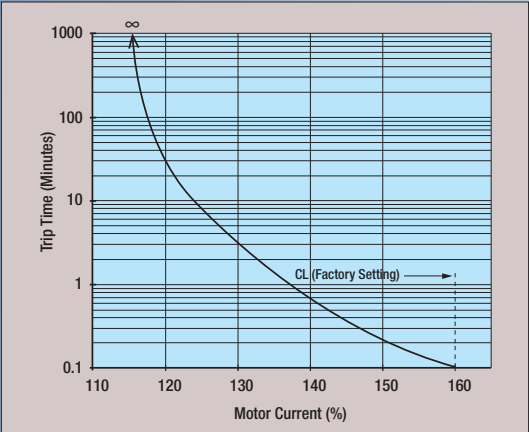


FIGURE 2 – Typical 3-Phase Inverter PWM Waveforms (230 Volt AC Line)

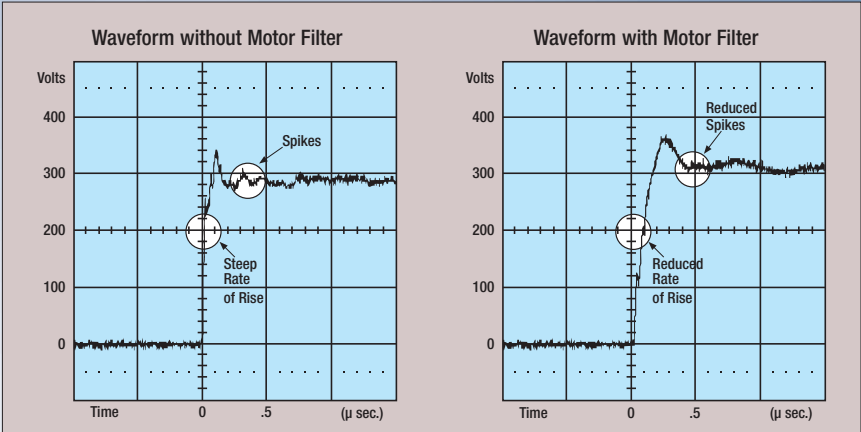
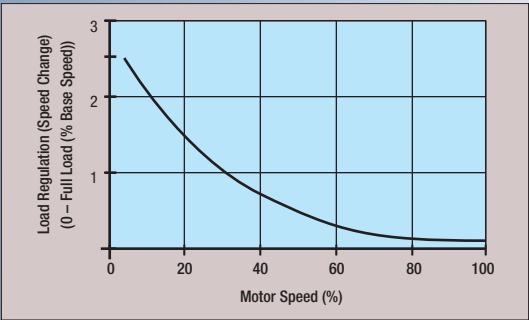


FIGURE 3 – Load Regulation vs. Motor Speed



Maintain Constant Motor Speed Under Varying Loads

The KBVF's unique microcontroller programming, with Static Auto-Tune and an active motor current algorithm with Boost, is used to stabilize motor speed. This feature activates each time the AC line is applied. Base speed load regulation is up to 2.5% over a 30:1 speed range. The KBVF contains a Slip Compensation Trimpot (COMP), which is factory calibrated for most motors. See Figure 3.

Status Indicators Save Installation Time

The drive contains two diagnostic LEDs. The "ST" LED is a tricolor LED which provides indication of a fault or abnormal condition. The information provided can be used to diagnose an installation problem such as incorrect input voltage, overload condition, and drive output miswiring. It also provides a signal which informs the user that all drive and microprocessor operating parameters are normal. When the AC line is applied to the drive, the "PWR" LED provides an indication of the presence of bus voltage and the proper operation of the logic power supply. See Table 3.

TABLE 3 – LED STATUS INDICATORS

LED	Drive Status	Color and Flash Sequence	Flash Rate	Color and Sequence ⁴ After Recovered Fault
ST (Status)	Normal Operation (Run)	Green	1 Sec. On / Off	—
	Overload (120% – 160% Full Load)	Red	On Continuously	Green
	I ² t (Drive Timed Out)	Red	0.25 Sec. On / Off	—
	Short Circuit	Red	1 Sec. On / Off	—
	Undervoltage	Red / Yellow	0.25 Sec. On / Off	Red / Yellow / Green ⁵
	Overvoltage	Red / Yellow	1 Sec. On / Off	Red / Yellow / Green ⁵
	Stop	Yellow	On Continuously	—
	Phase Loss Detection ^{1,2}	Yellow	0.04 Sec. On / 0.06 Sec. Off	—
	Communication Error ³	Green / Red	1 Sec. On / Off	Green
PWR (Power)	Buss and Logic Power Supply	Green	On Continuously	—

Notes: 1. Phase Loss Detection: Models KBVF-23P, 24P, 29, 42, 45, 48. 2. Requires AC line restart. 3. With DIVF Modbus Communication Module Installed. 4. All LED flash rates, after recovered faults, are 1 Sec. On / Off. 5. Drive will require manual restart to return the Status LED color to its normal flashing green.



Automation and Control

Eliminate Harmful Inrush Current

Most KBVF drives contain an Electronic Inrush Current Limit (EICL™) circuit.* The EICL™ prevents high AC inrush current each time power is applied to the drive. The EICL™ feature also allows the drive to be rapidly switched “on” and “off” with the AC line.

Some competitor's drives only use a thermistor type of inrush current limiter (ICL). The ICL operates favorably when the drive is initially connected to the AC line. The problem with the ICL occurs when the drive is disconnected from the AC line for a short period of time (1/2 – 2 minutes). During this time, the

main bus capacitors discharge. However, the ICL takes more than 3 minutes to cool down to the point where its resistance increases enough to limit inrush current. If the drive is reconnected to the AC line before the ICL has cooled, very high inrush current results, which can damage the drive's power bridge or can weld the contacts of the AC line switch. In many cases, the main circuit breaker or fuse will trip.

It could be suggested to leave the drive on continuously to avoid the restart problem. This philosophy does not work, since the drive could shut down due to momentary power outages or an operator inadvertently turning it off and then on.

Figure 4 shows the current surge of a drive with an ICL when started for the first time. The current surge is normal.

Figure 5 shows the current surge of a drive with an ICL after the drive is restarted after a 1 minute shutdown. The current surge is abnormally high and can damage the drive's power bridge and trip the main circuit breaker.

Figure 6 shows the current surge of the KBVF drive with an EICL™. The current surge is normal whether the drive is started for the first time or restarted anytime.

FIGURE 4 – Drive with ICL Started for the first time

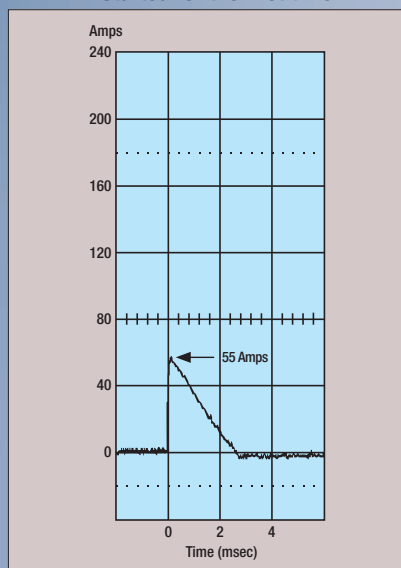


FIGURE 5 – Drive with ICL Restarted after 1 minute

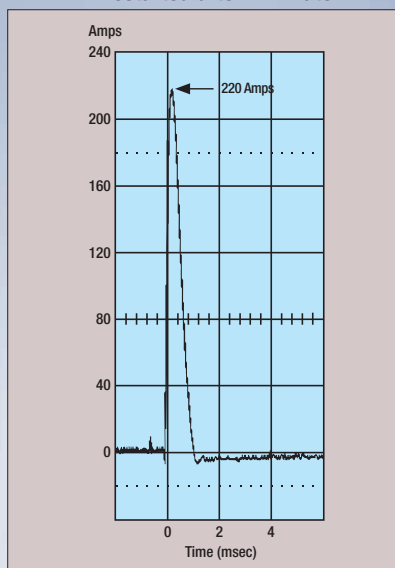


FIGURE 6 – Drive with EICL™ started for the first time or restarted anytime

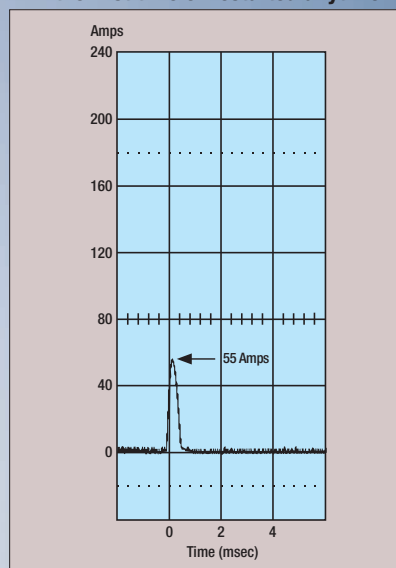


TABLE 4 – JUMPER SELECTABLE FEATURES

Description (Bold Indicates Factory Setting)	Location	Designation	KBVF-21D, 22D, 23D, 24D, 26D	KBVF-13, 23, 23P, 14, 24, 24P 27, 29, 42, 45, 48
AC Line Input Voltage (115, 230)	Upper PC Board	J1	✓	—
Automatic-Manual Start/Reset (A , M)	Lower PC Board	CON1	✓	✓
Forward or Reverse Direction (F , R)	Lower PC Board	CON2	✓	✓
Motor Frequency (50Hz, 60Hz)	Lower PC Board	J1	✓	✓
Frequency Multiplier (X1 , X2)	Lower PC Board	J2	✓	✓

OPTIONAL ACCESSORIES & FEATURES

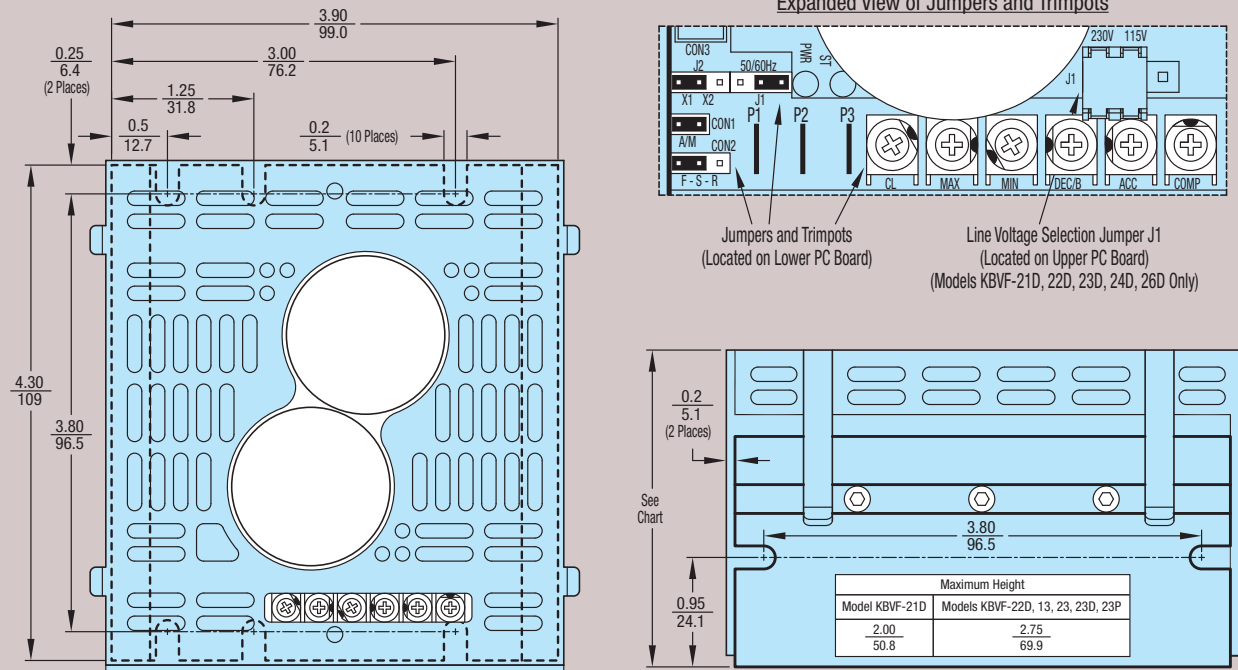
- **SIVFR Signal Isolator and Run/Fault Relay (Part No. 9597):** Provides isolation between a non-isolated signal voltage (0 to ± 2.5 thru 0 to ± 25 Volts DC) or current source (4 – 20 mA DC) and the drive. Can be used in single-ended or bidirectional mode. Run/Fault Relay Output Contacts are also provided, which can be used to turn on or off equipment or to signal a warning if the drive is put into the Stop Mode or a fault has occurred. Mounts on the end of the drive's heat sink.
Note: Models KBVF-42, 45, 48 contain built-in Signal Isolator and Run/Fault Relay Output Contacts.
- **DBVF – Dynamic Brake Module (Part No. 9598):** Provides up to 25% continuous braking and 200% instantaneous braking torque (maximum 1 HP (0.75 kW)).
- **Multi-Speed Board (Part No. 9503):** Provides multi-speed operation using external contacts or a PLC. Mounts on the end of the drive's heat sink.
- **Programming Kit (Part No. 9582):** Includes DownLoad Module™ (DLM) handheld programming device which uploads and downloads drive programs, PC to DLM serial communication cable, DLM to inverter communication cable, and PC Windows® based Drive-Link™ communication software. Contact our Sales Department for more information
- **DIVF Modbus Communication Module (Part No. 9568):** Allows the drive to communicate with PLCs, PCs, and HMIs with Modbus® RTU protocol utilizing a serial communication

cable. If a USB communication cable is required, purchase Part No. 19008.

*Other protocols available. Contact our Sales Department.

- **RFI Filters and Chokes:** Provide RFI and EMI Suppression. They comply with CE Council Directive 89/336/EEC relating to the Class A Industrial Standard and Class B Residential Standard. These filters are available for Models KBVF-21D, 22D, 13, 23, 23D, 14, 24, 24D, 26D, 27 only. See RFI Filters and Chokes Selection Guide Publication No. D-321 (Part No. A42027).
- **KBRK – Remote Keypad/Display (Part No. 9794):** Panel mount remote keypad/display is NEMA-4X / IP-65 washdown and watertight. Provides digital programming of the drive. For OEM “K” Series drives only. Contact our Sales Department.
- **IOVF – Input/Output Multi-Function Board (Part No. 9996):** Provides a variety of functions, which include preset frequency, up/down frequency control, signal isolation, isolated output voltage for controlling auxiliary devices, output relay contacts, and open collector outputs. Mounts on the end of the drive's heat sink.
- **Custom Software:** All models can be factory programmed for applications that require special switching, timing, PLC functions, and GFCI operation. Contact our Sales Department.

**FIGURE 7 – MODELS KBVF-21D, 22D, 13, 23, 23D, 23P MECHANICAL SPECIFICATIONS (Inches / mm)
(Model KBVF-22D Shown)**



**FIGURE 8 – MODELS KBVF-14, 24, 24D, 24P, 26D MECHANICAL SPECIFICATIONS (Inches / mm)
(Model KBVF-26D Shown) (See Figure 7 for Expanded View of Jumpers and Trim pots)**

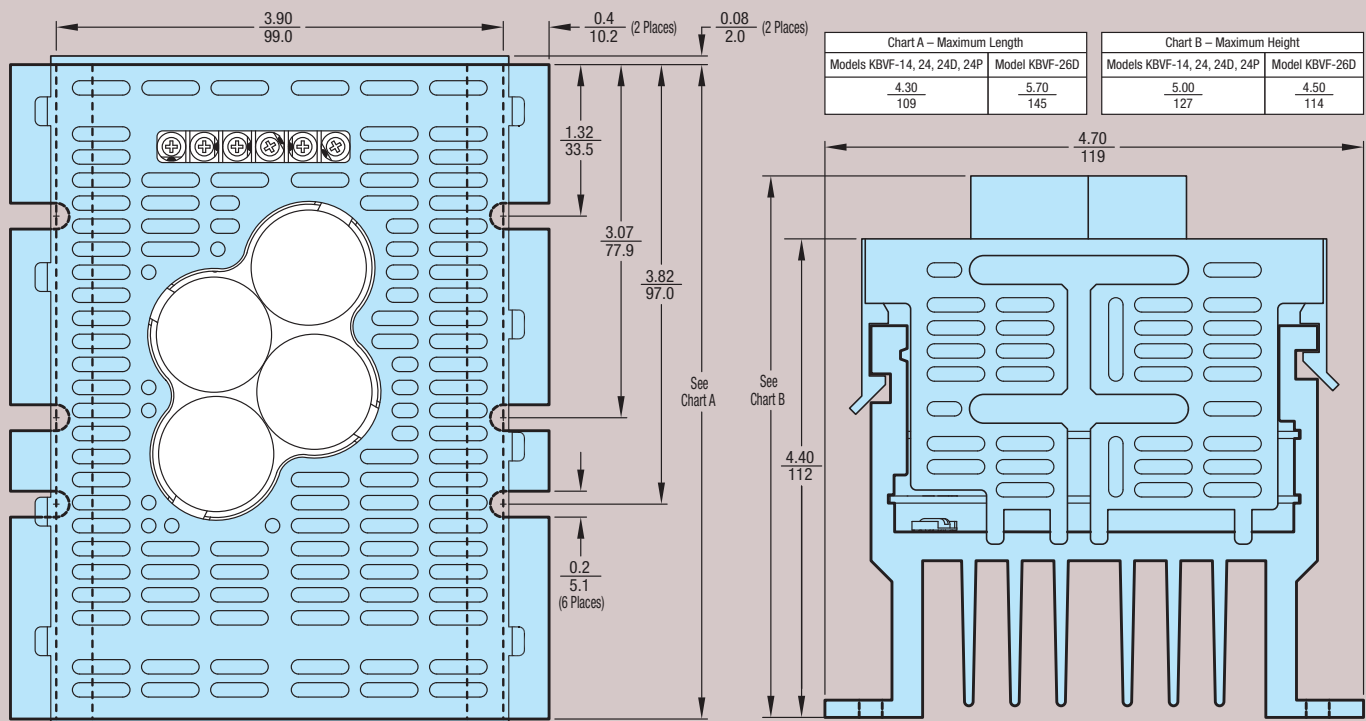


FIGURE 9 – MODELS KBVF-27, 29, 45, 48
MECHANICAL SPECIFICATIONS (Inches / mm)
 (See Figure 7 for Expanded View of Jumpers and Trimpots)

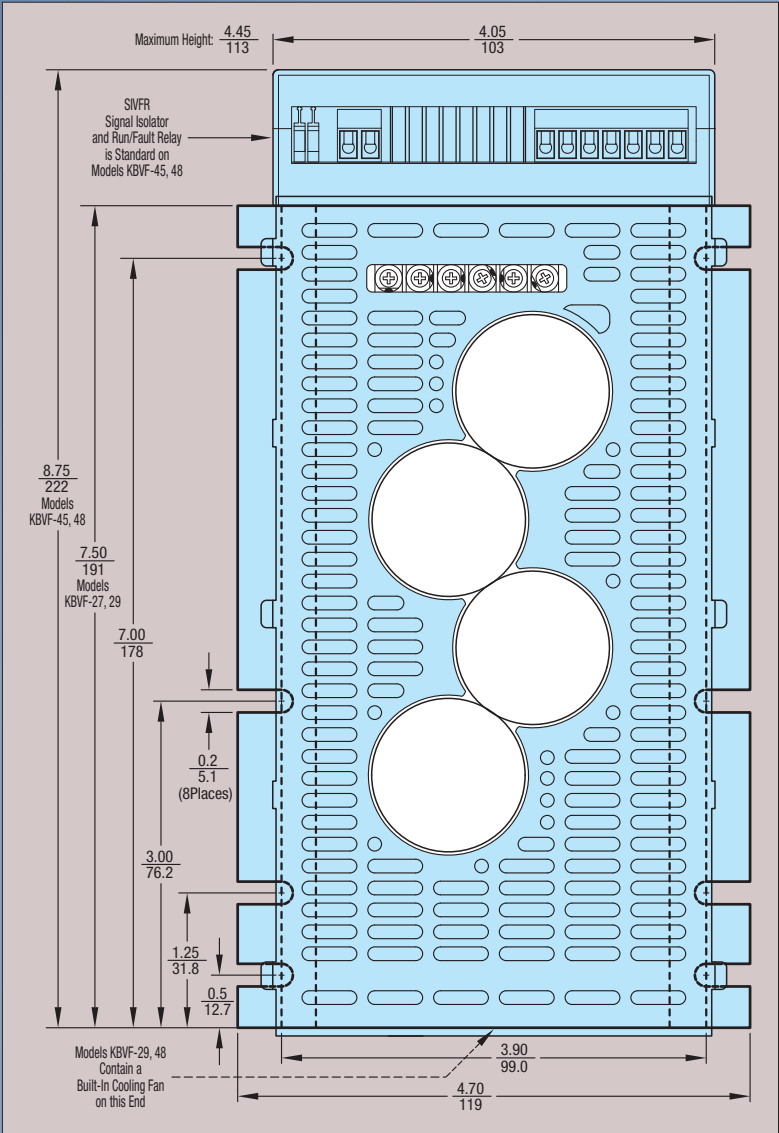


FIGURE 10 – MODELS KBVF-42
MECHANICAL SPECIFICATIONS (Inches / mm)
 (See Figure 7 for Expanded View of Jumpers and Trimpots)

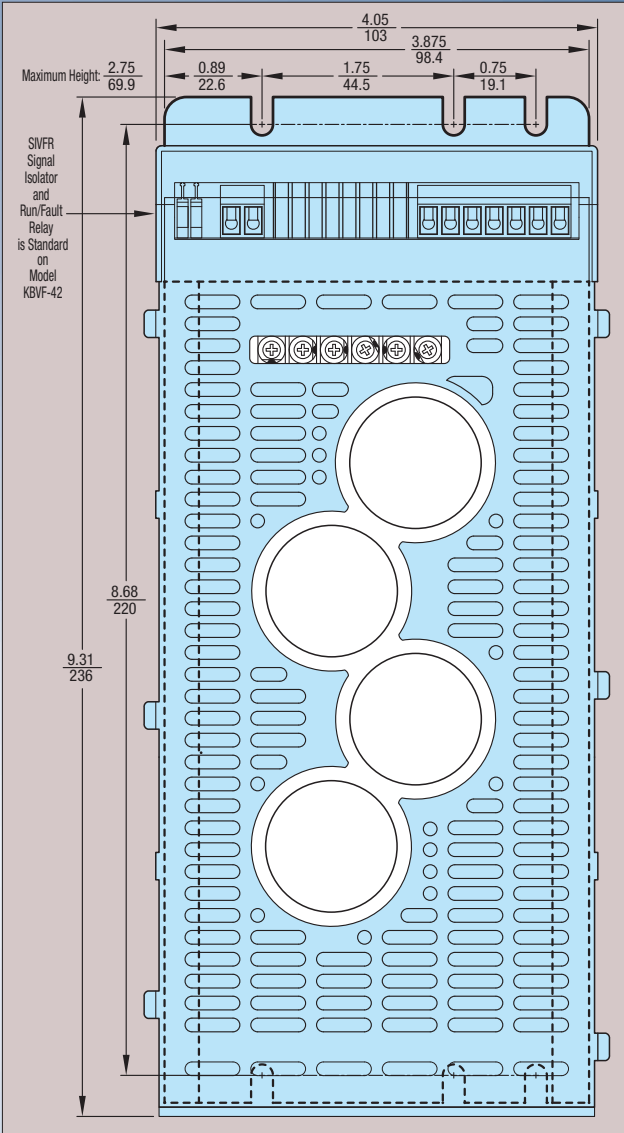



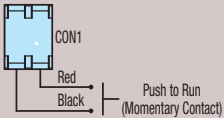
FIGURE 11 – AC LINE INPUT VOLTAGE SELECTION (DUAL VOLTAGE MODELS ONLY) – (J1 is Located on the Upper PC Board)

Models KBVF-21D, 22D, 23D, 24D		Model KBVF-26D Only	
230 Volt AC Line Input (Factory Setting) (J1 Installed in "230V" Position)	115 Volt AC Line Input (J1 Installed in "115V" Position)	230 Volt AC Line Input (Factory Setting) (J1 Installed in "230VAC" Position)	115 Volt AC Line Input (J1 Installed in "115VAC" Position)

FIGURE 12 – MOTOR & DRIVE OUTPUT FREQUENCY SELECTION – (J1 and J2 are located on the Lower PC Board)



60 Hz Motor Operation (Factory Setting) (J1 Installed in "60Hz" Position) (J2 Installed in "X1" Position)	50 Hz Motor Operation (J1 Installed in "50Hz" Position) (J2 Installed in "X1" Position)	120 Hz Output with 60 Hz Motor (J1 Installed in "60Hz" Position) (J2 Installed in "X2" Position)	100 Hz Output with 50 Hz Motor (J1 Installed in "50Hz" Position) (J2 Installed in "X2" Position)

FIGURE 13 – AUTOMATIC-MANUAL START/RESET
(CON1 is located on the Lower PC Board)

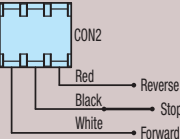
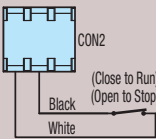
Automatic Start Operation (Factory Setting) (Jumper Installed)	Manual Start – Reset Operation* (Connector Installed)
	

*The drive can be factory programmed for Run/Stop operation with momentary contacts. **Notes:** 1. In Automatic Mode, the drive will automatically start when power is applied and a run command is given. The drive will automatically restart after a recovered fault, except for an I²t trip. 2. The Manual Start Mode is used to start the drive or restart the drive (reset) if a fault has occurred.

FIGURE 14 – FORWARD/REVERSE SPEED SELECTION
(CON2 is Located on the Lower PC Board)

Forward Speed Operation (Factory Setting) (Jumper Installed in "F" Position)	Reverse Speed Operation (Jumper Installed in "R" Position)
	
F - S - R	F - S - R

**FIGURE 15 – FORWARD-STOP-REVERSE
& ENABLE SWITCH CONNECTIONS***
(CON2 is Located on the Lower PC Board)

Forward-Stop-Reverse Operation (Connector Installed)	Forward Enable Operation (Connector Installed)
	

*The drive can be programmed for momentary contact operation.

FIGURE 16 – MAIN SPEED POTENTIOMETER CONNECTION
(Terminals P1, P2 & P3 are Located on the Lower PC Board)

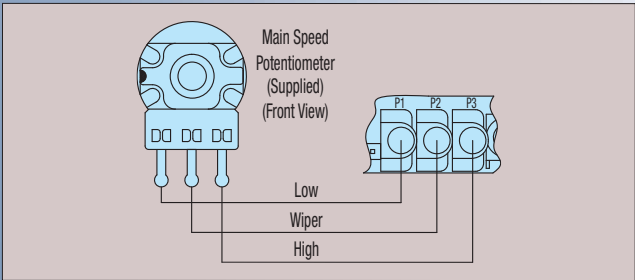
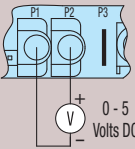
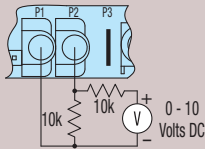
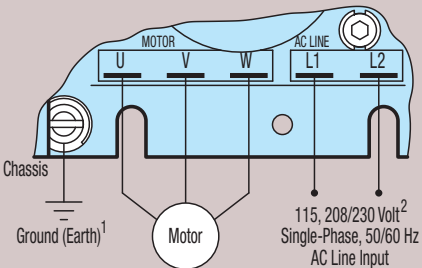
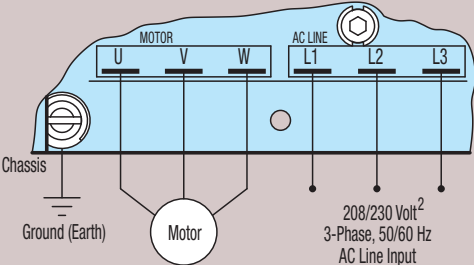
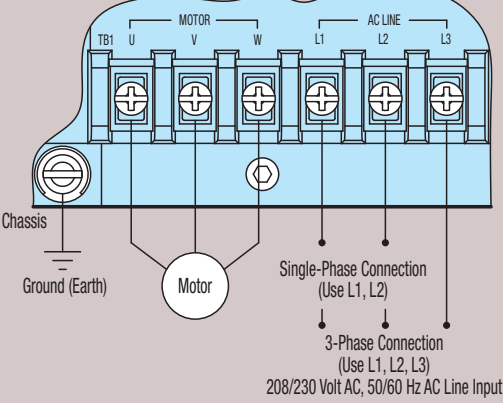
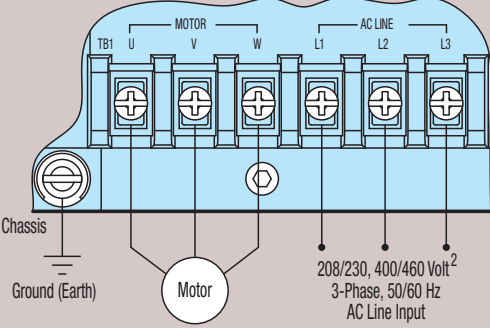


FIGURE 17 – VOLTAGE FOLLOWING CONNECTIONS*
(Terminals P1 & P2 are Located on the Lower PC Board)

0 – 5 Volts DC (Isolated)	0 – 10 Volts DC (Isolated)
	

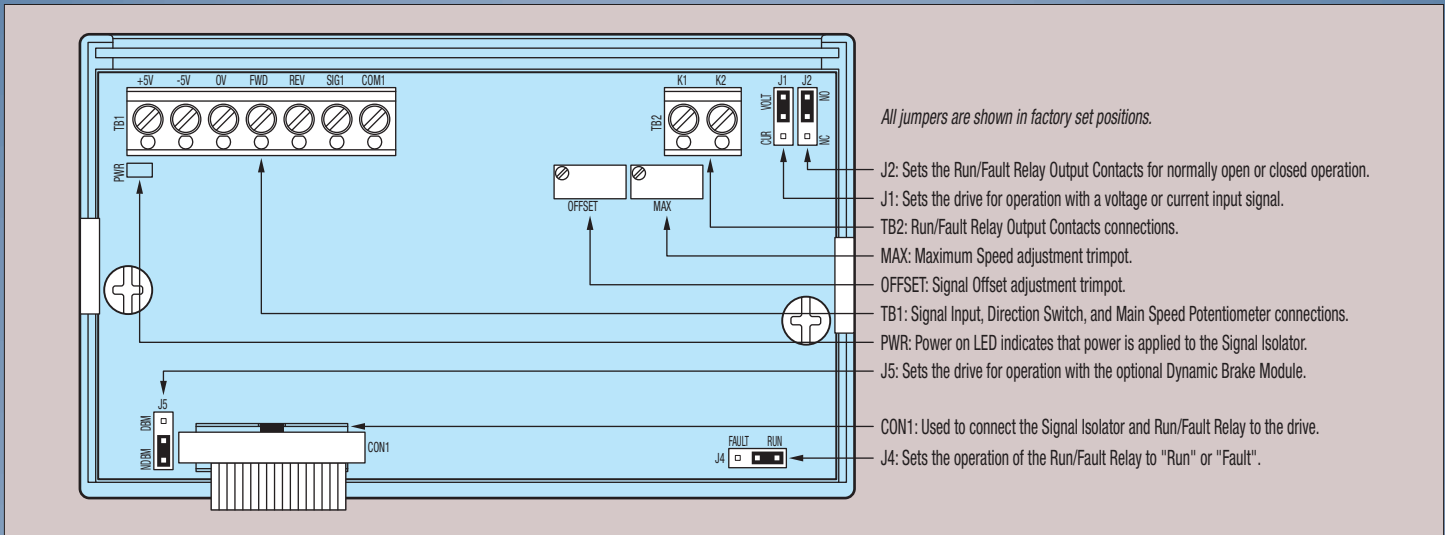
*If a non-isolated signal is used, install the SIVFR – Signal Isolator (Part No. 9597). (Do not Earth ground signal wiring.) Note: Models KBVF-42, 45, 48 contain built-in SIVFR - Signal Isolator.

FIGURE 18 – MOTOR & AC LINE INPUT CONNECTIONS
(Motor and AC Line Terminals are Located on the Upper PC Board)

<p>Models KBVF-21D, 22D, 13, 23, 23D, 14, 24, 24D, 26D – (Single-Phase AC Line Input)</p> 	<p>Models KBVF-23P, 24P – (3-Phase AC Line Input)³</p> 
<p>Model KBVF-27 – (Single Phase and 3-Phase AC Line Input)</p> 	
<p>Models KBVF-29, 42, 45, 48 – (3-Phase AC Line Input)³</p> 	

Notes: 1. Model KBVF-21D, due to its plastic case design, does not contain a ground screw. 2. Models KBVF-13, 14: 115 Volt AC line input only. Models KBVF-23, 23P, 24, 24P 27, 29: 208/230 Volt AC line input only. Models KBVF-21D, 22D, 23D, 24D, 26D: 115 Volt AC Line Input (with Jumper J1 set to "115V" position) and 208/230 Volt AC line input (with Jumper J1 set to "230V" position). Models KBVF-42, 45, 48: 400/460 Volt AC line input only. 3. Models KBVF-23P, 24P, 29, 42, 45, 48 contain AC Line Phase Loss Detection.

FIGURE 19 – SIVFR SIGNAL ISOLATOR & RUN/FAULT RELAY LAYOUT
(Standard on Models KBVF-42, 45, 48 and Optional on Other Models)



CONNECTION DIAGRAM FOR SIVFR SIGNAL ISOLATOR & RUN/FAULT RELAY

FIGURE 20 – UNIDIRECTIONAL VOLTAGE FOLLOWING SIGNAL INPUT CONNECTION
(J1 Set to "VOLT" Position)

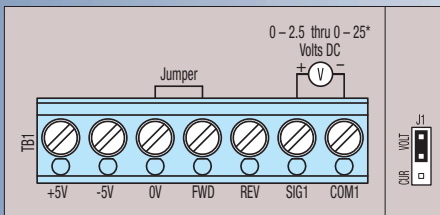


FIGURE 21 – BIDIRECTIONAL VOLTAGE FOLLOWING SIGNAL INPUT CONNECTION
(J1 Set to "VOLT" Position)

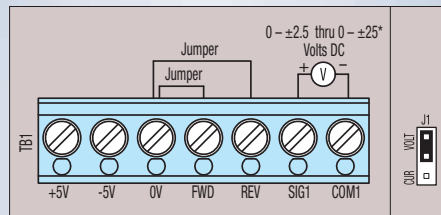


FIGURE 22 – CURRENT FOLLOWING SIGNAL INPUT CONNECTION
(J1 Set to "CUR" Position)

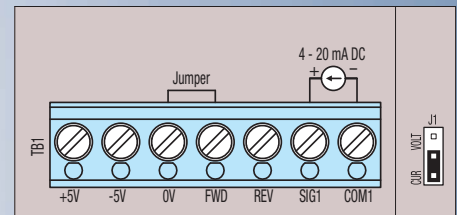


FIGURE 23 – MAIN SPEED POTENTIOMETER & F-S-R SWITCH CONNECTIONS
(J1 Set to "VOLT" Position)

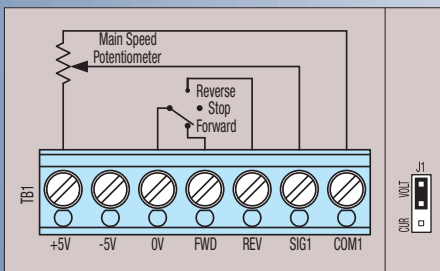


FIGURE 24 – BIDIRECTIONAL (WIGWAG) MAIN SPEED POTENTIOMETER CONNECTION
(J1 Set to "VOLT" Position)

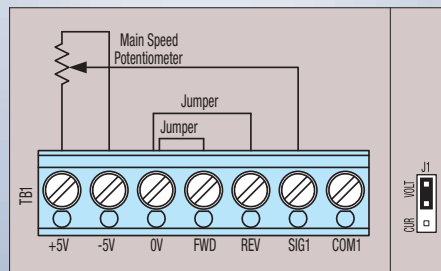


FIGURE 25 – FORM "C" CONTACT OR RELAY FORWARD-STOP-REVERSE CONNECTION

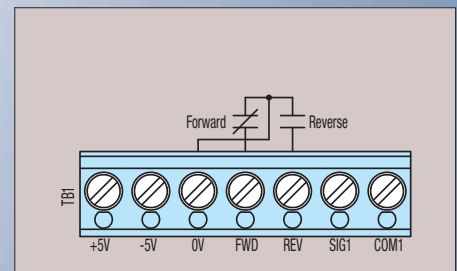


FIGURE 26 – OPEN COLLECTOR FORWARD-STOP-REVERSE CONNECTION

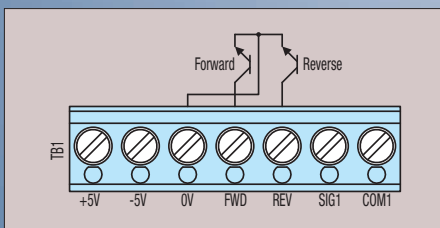


FIGURE 27 – RUN/FAULT RELAY CONNECTION (TB1)

Run/Fault Relay Output Contacts	Run/Fault Relay Set for Normally Open Contacts (J2 Set to "NO" Position) (Factory Setting)	Run/Fault Relay Set for Normally Closed Contacts (J2 Set to "NC" Position)



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