

User Guide

$\frac{1}{4}$ HP to 5 HP
Adjustable Voltage DC Drive

Focus 3



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Division of Emerson Electric Co.



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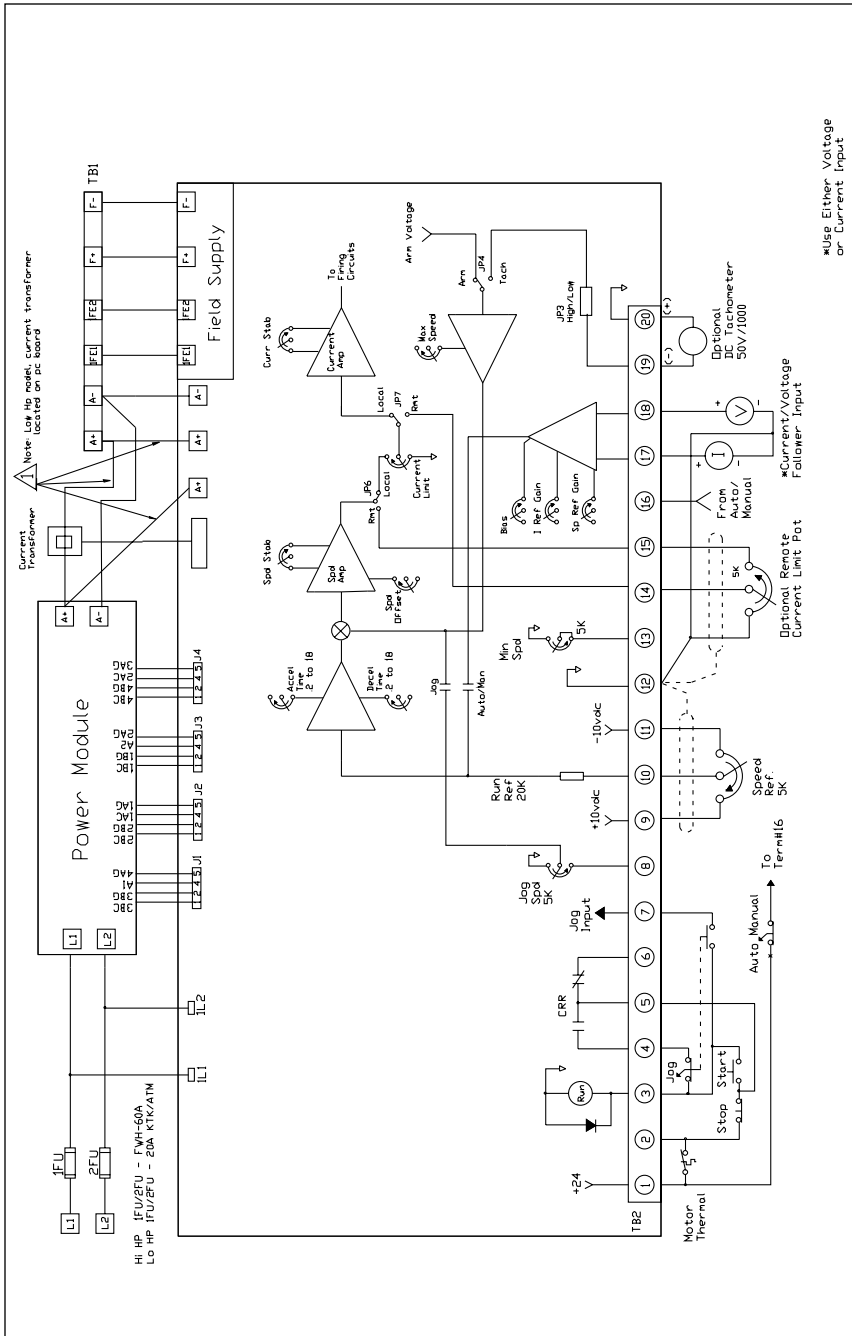
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Regen: F3R2C, F3R2E, F3R5C, F3R5E

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Introduction

The purpose of this manual is to provide the user with the information needed to install, start-up, and maintain the Focus 3 drive. This instruction manual should be read in its entirety, paying special attention to the warning and caution notices, before installation and before performing any start-up or drive maintenance.

General Description

The Focus 3 is a single phase analog drive for DC motors with power ranges from .25 to 5HP. It is available as either non-regenerative or regenerative and as either panel mounted or enclosed. The drive incorporates many features which are standard on high performance system drives, such as dynamic stability and signal follower adjustments. The major difference between the non-regen and regen drives is that the regen drive is isolated (control circuit can be grounded) while the non-regen is not isolated (control circuit can not be grounded). Signal isolation is available as an option for the non-regen drive.

Receiving

The user is responsible for inspecting the equipment thoroughly before accepting the shipment from the freight company. Check the items received against the purchase order. If any items are obviously damaged, do not accept delivery until the damage has been noted on the freight bill.

Inspection

Before installation and start-up of the drive, inspect the unit for mechanical integrity (i.e. loose parts, wires, etc). If physical damage was sustained during shipment, leave the shipping container intact and notify the freight agent. After unpacking, check the drive's nameplate catalog number against the purchase order. See page 2 for nameplate location.

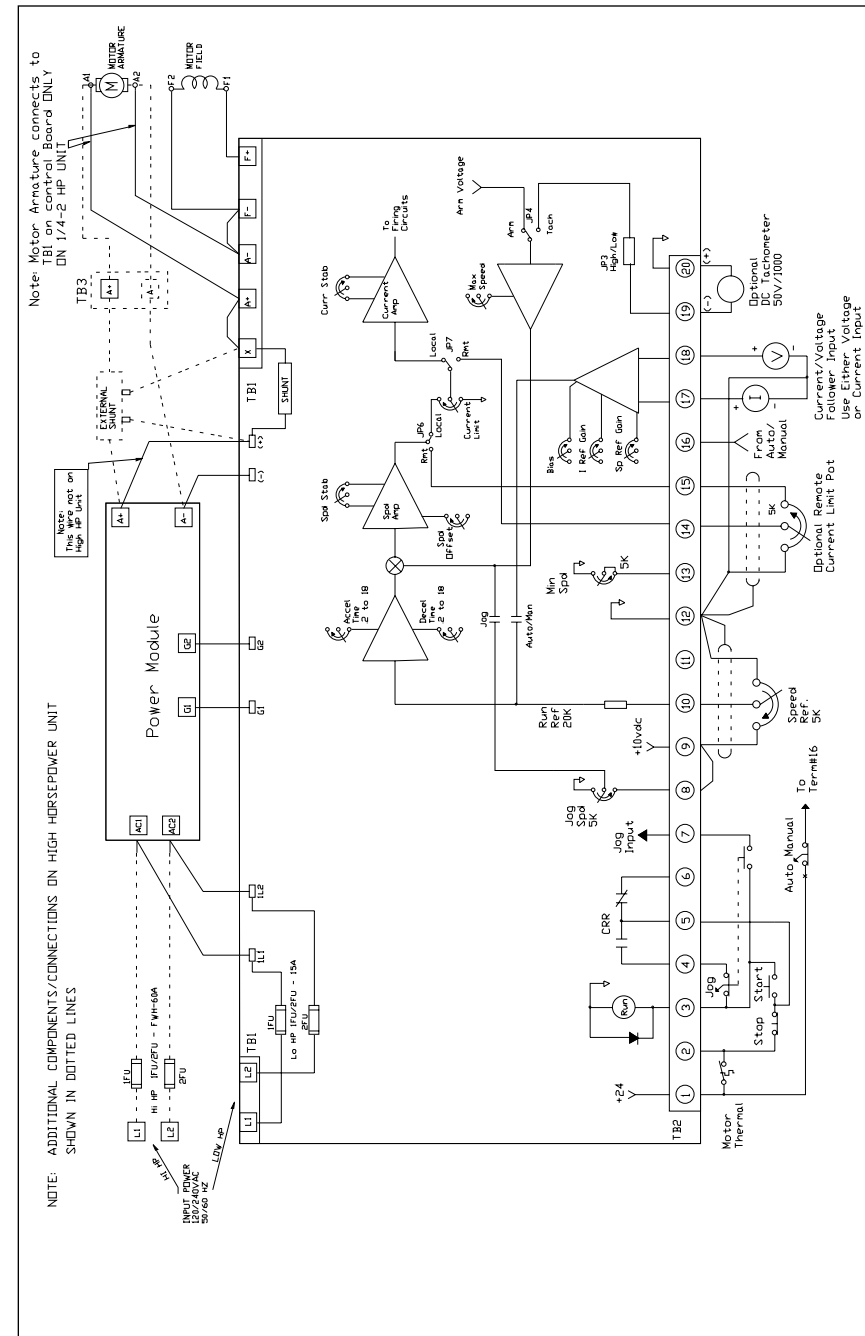
Storing

Store the drive in its shipping container prior to installation. If the drive isn't used for a period of time, store according to the following instructions in order to maintain warranty coverage:

- Clean, dry location
- Ambient Temperature Range: -40°C to 70°C
- Humidity: 95%, Non-condensing

WARNING!

Improper procedures can result in personal injury or equipment damage. Only qualified electrical maintenance technicians familiar with electronic drives and their standard safety precautions should be permitted to install, start-up, or maintain this apparatus.



Non-Regen: F3N2C, F3N2E, F3N5C, F3N5E

Signal Follower Zero Bias (BIAS) used with Voltage Input (TB2-18)

The BIAS pot prevents "creep" in the motor speed by eliminating any unwanted offset voltage levels in the voltage source. It may also be used to add a slight offset to the voltage signal.

Signal Follower Zero Bias (BIAS) used with Current Input (TB2-17)

Non-regen drives: Adjust the BIAS pot so the drive is at zero speed when the minimum current signal follower reference (4-20 or 1-5mA) is applied.

Regen drives: Adjust the BIAS pot to eliminate motor "creep" at zero speed when the current signal follower reference (0-5 or 0-20mA*) is set at its minimum value.

* If a 4-20mA reference is required, use the optional signal isolation board (F3ISOB). If a regen drive with a 4-20mA signal that was "biased out" at 4mA lost its connection, the drive would run in reverse when restarting.

Voltage / Speed Signal Follower Gain (SP REF GAIN)

The SP REF GAIN pot calibrates the user supplied Voltage Signal Follower reference (0 - 200VDC) so the motor reaches its rated voltage/speed when the voltage signal is set to its maximum value. It is factory preset to its full counterclockwise position.

Current Signal Follower Gain (IREF GAIN)

The IREF GAIN pot calibrates the user supplied Current Signal Follower reference (1-5 or 4-20mA non-regen or 0-5 or 0-20mA regen) so the motor reaches its rated voltage/speed when the current signal is set to its maximum value. It is factory preset to its full clockwise position.

PERFORMANCE FEATURES

Solid State Full Wave Power Bridge - Uses generously rated power semiconductors for maximum reliability and long life.

Full Four Quadrant Operation (regen only) - Allows operation of the drive motor in both the forward and reverse directions while producing torque in either the clockwise or counterclockwise direction.

Inner Current Loop Regulator - Inherent high band width capability for fast response.

Rectilinear Phase Control (regen only) - Improves performance at low speeds and near zero load.

SCR Trigger Circuits (regen only) - Pulse transformer isolated, hard firing, high frequency burst type pulse train output from individually gated oscillators insures SCR conduction regardless of the effects of line notching or incoming AC power line.

Semiconductor Fusing - Both AC lines fused for maximum protection in case of short circuit.

AC Line Filter and Transient Voltage Suppressor Network - Eliminates interaction between other drives or AC equipment.

Field Economy (regen only) - Insures longer life for wound field DC motors. May be easily bypassed.

Current Limit Ranges - Selectable current limit ranges to match the drive to the motor being used. Provides overload protection and smooth acceleration of high inertia loads.

Speed Regulator - 1% accuracy armature voltage feedback with IR compensation or 1% accuracy with DC tachometer feedback. Regulation accuracy may be affected by the tachometer selected.

Current (Torque) Regulator - 2% accuracy armature current regulator allows the user to control motor torque instead of speed.

Circuit Board Indicators - Light emitting diodes (LEDs) on the control board indicate when the drive is in Run Mode or the Current Limit is enabled.

Isolated Control Circuitry (regen only) - Provides isolation of the control and regulator circuitry from the AC power bus for operator and equipment protection in the event of a ground fault. The speed potentiometer and tachometer are not at line potential. System compatibility is possible without additional isolation accessories.

Remote Current Limit - Available by the simple addition of a potentiometer.

Current Signal Follower Input* - Allows the motor speed to be controlled by a current signal from a commercially available transducer. The signal may be one of the following:

Non-regen - 1-5mA or 4-20mA
Regen - 0-5mA or 0-20mA

Voltage Signal Follower Input* - Allows the motor speed to be controlled by a voltage signal from a DC tachometer generator or a process voltage signal. It accepts an input with a range of 0-200VDC.

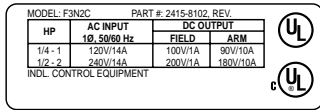
Negative IR Compensation (regen only) - Used in load sharing applications.

Auto/Manual Operation - Standard circuitry allows the drive to be controlled by the operator controls or by the current/voltage signal inputs.

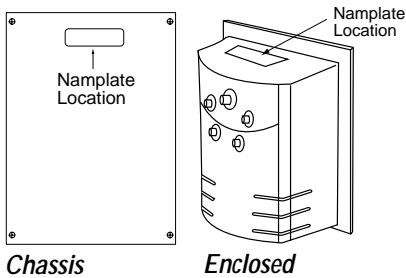
UL/cUL - All Focus 3 Drives are UL/cUL listed.

**In non-regen drives, the current/voltage signal must be ungrounded and isolated from the AC power source and other controls which use the signal. If the signal is not isolated, an isolator (such as #F3NSBD) must be used or drive failure will occur.*

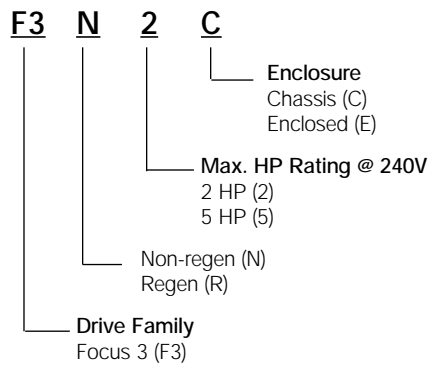
Nameplate Information



Nameplate Location



Catalog Number Definition



Specifications

DRIVE RATINGS TABLE

	CATALOG NUMBER	ENCLOSURE	HP RANGE	AC INPUT		DC OUTPUT		
				1Ø VOLTS	MAX AMPS	ARMATURE		FIELD VOLTS
						VOLTS	MAX AMPS	
Non-Regen	F3N2C	Chassis	1/4 -1	120	14	90	10	100
			1/2 -2	240	14	180	10	200
	F3N2E	NEMA 4/12	1/4 -1	120	14	90	10	100
			1/2 -2	240	14	180	10	200
Regen	F3N5C	Chassis	3-5	240	35	180	25	200
			F3N5E	NEMA 4/12	3-5	240	35	180
	F3R2C	Chassis			1/4 -1	120	16	90
			1/2 -2	240	16	180	10	200
	F3R2E	NEMA 4/12	1/4 -1	120	16	90	10	100
			1/2 -2	240	16	180	10	200
F3R5C	Chassis	3-5	240	40	180	25	200	
		F3R5E	NEMA 4/12	3-5	240	40	180	25

STANDARD FEATURES

Horsepower Range	1/4 - 1HP @ 120VAC, 1/2 - 2HP@240VAC 3-5HP @ 240VAC
Input Voltage	120/240VAC ±10%
Input Frequency	60/50Hz ±2Hz
Field Supply	1Amp
AC Line Fuses: 2HP 5HP	15Amp (non-regen), 20Amp (regen) 40Amp (non-regen), 60Amp (regen)
Pull Apart Terminal Block TB2 (Control Wiring)	
Run and Current Limit LEDs	

Jog Speed (JOG SPD)

Adjust the JOG SPD pot clockwise to increase the speed (0-30% of full speed reference) at which the motor will run when in jog mode. It is factory preset to its full counterclockwise position.

Velocity Stability (VEL STAB)

The VEL STAB and SPD RATE FDB pots match the dynamic characteristics of the drive to the dynamic characteristics of the DC motor and its load. The drive's outer velocity loop includes an electrical "lead" circuit to compensate for the mechanical "lags" that exist in both the DC motor and its driven mechanical system. The VEL STAB pot adjusts the time constant of this lead circuit.

Clockwise rotation causes the drive to respond more quickly to speed reference/speed feedback changes but increases the overshoot experienced by the drive. Counterclockwise adjustment of this pot dampens the drive response. It is factory preset at the midway position.

Speed Rate Feedback (SPD RATE FDB)

Used with the VEL STAB pot, the SPD RATE FDB pot controls the relative magnitude of the "lead" circuit in the velocity loop. Clockwise rotation reduces the drive's velocity rate of change and decreases the overshoot experienced by the drive. Normally used in tachometer feedback applications, this pot is factory preset to its full counterclockwise position. Note: It is available with the regen drive only.

Speed Loop Offset (SPD OFFSET)

This pot is used to zero out any offsets in the speed loop amplifier. With the speed pot set to zero (as well as the min. speed pot, if used), adjust the SPD OFFSET so any "creep" in the motor speed is eliminated with zero speed reference. It is factory preset to its mid-way position.

Current Stability (ISTAB)

The ISTAB pot matches the dynamic characteristics of the drive to the dynamic characteristics of the DC motor armature. The drive's inner current loop includes an electrical "lead" circuit to compensate for the electrical "lag" that exists in the DC motor armature current. The ISTAB pot adjusts the time constant of this lead circuit.

In torque (current) control applications, the velocity loop is bypassed and the current loop is used. For speed (velocity) control applications, the current loop is fed from the output of the velocity loop.

The current loop responds to current changes quickly. Therefore, the ISTAB pot is very sensitive and harder to adjust properly. Clockwise rotation causes the drive to respond more quickly to current changes, but the factory shipped setting is adequate for most applications.

POTENTIOMETER ADJUSTMENTS

Maximum Speed (MAX SPD)

The MAX SPD pot sets the maximum motor speed (70-120% of motor base speed) allowed. It is factory preset to the midway position. Note: Do not exceed motor nameplate maximum speed rating. With the motor running, turn the speed pot on the drive enclosure cover/operator control panel fully clockwise. Then, adjust the MAX SPD pot on the control board to set the desired maximum motor speed.

Minimum Speed (MIN SPD)

The MIN SPD pot sets the minimum speed (0-30% of maximum speed setting) at which the motor will run. It is factory preset at its full counterclockwise position. With the motor running, turn the speed pot on the drive enclosure cover/operator control panel fully counterclockwise. Adjust the MIN SPD pot clockwise until the desired lowest motor speed is reached.

Internal Resistance Compensation (IR COMP)

The IR Compensation pot is used to overcome the motor's natural tendency to slow down as the load increases. If the motor slows down excessively as it is loaded, adjust the IR COMP pot clockwise. The motor will oscillate in speed or "hunt" if the IR COMP pot is adjusted too far clockwise. If this pulsing of speed occurs, adjust the IR COMP pot counterclockwise until the motor speed stabilizes. Note: If the drive is using the voltage or current signal follower, perform these adjustments with the Auto/Manual switch in the Manual position.

Acceleration and Deceleration Times (ACCEL / DECEL)

Adjust the ACCEL and DECEL pots clockwise to increase the linear acceleration and deceleration times (.2-30 seconds). These adjustments are independent from each other. Note: Controlled deceleration time occurs when the speed pot is turned down, but not when the start/stop switch is placed in the STOP position. Note: The roles of ACCEL and DECEL pots are reversed when reverse rotation is applied to the motor. Note: When the drive is used in torque (current) control mode, the ACCEL/DECEL pots adjust how quickly the motor torque level changes as the main torque pot is varied.

Local Current Limit (LOC ILMT)

Set the LOC ILMT pot to limit the motor armature current to 150% or less of the motor nameplate rating. It should represent the lowest level consistent with satisfactory operation. The pot is factory preset at 150% of the range selected by jumper JP9 (A-D).

The yellow Current Limit LED indicator light on the drive control board illuminates when the armature current reaches 95-100% of the current limit setting.

PERFORMANCE SPECIFICATIONS

Service Factor	1.0
Speed Regulation (95% Load Change):	
Armature Voltage	1% of Max. Speed with IR Compensation
All other variables (voltage regulated)	15% of Base Speed
Tachometer Feedback	.5% of Base Speed
Overload Capacity	150% of Max. Rating for one minute
Efficiency:	
Control Only	98%
Drive System (motor and control)	86%

DRIVE OPERATING CONDITIONS

Altitude (without derating)	3300Ft.
Ambient Temperature:	
Chassis	0-55°C
Enclosed (NEMA 4/12)	0-40°C

INTERNAL ADJUSTMENTS (POTENTIOMETERS)

Potentiometer Function	Range
Maximum Speed	80-120% of Rated Speed
Minimum Speed	0-30% of Maximum Speed
IR Compensation	0-20% of Rated Voltage
Current Limit	0-150% of Selected Range
Acceleration Time	.3-20 seconds (linear)
Deceleration Time	.3-20 seconds (linear)
Jog Speed	0-30% of Full Speed Reference
Speed Loop Offset	Adjustable
Speed Rate (regen only)	Adjustable
Velocity Loop Stability	Adjustable
Current Loop Stability	Adjustable
Current Signal Follower Gain	Adjustable
Velocity Signal Follower Gain	Adjustable
Signal Follower Zero Bias	Adjustable

CUSTOMER SELECTIONS (JUMPERS)

Function	Range
Input Voltage	120/240VAC (2HP)
Control Mode	Speed/Torque
Current Feedback range	High/Medium/Low/Xlow
Current Limit Pot Selector	Local/Remote
Armature Voltage level	90/180V
Optional "M" Contactor	Yes/No
Tachometer Feedback	High/Low
Speed Feedback Selector	Armature/Tachometer
Line Frequency	60/50Hz
IR Compensation	Positive/Negative (regen only)

OPERATOR FUNCTIONS

	Chassis	Enclosed
Speed Adjustment(Speed Pot)	Standard	Standard
Start/Stop	Customer Supplied	Standard
Forward/Reverse(regen only)	Customer Supplied	Optional
Auto/Manual	Customer Supplied	Optional
Run/Jog	Customer Supplied	Optional

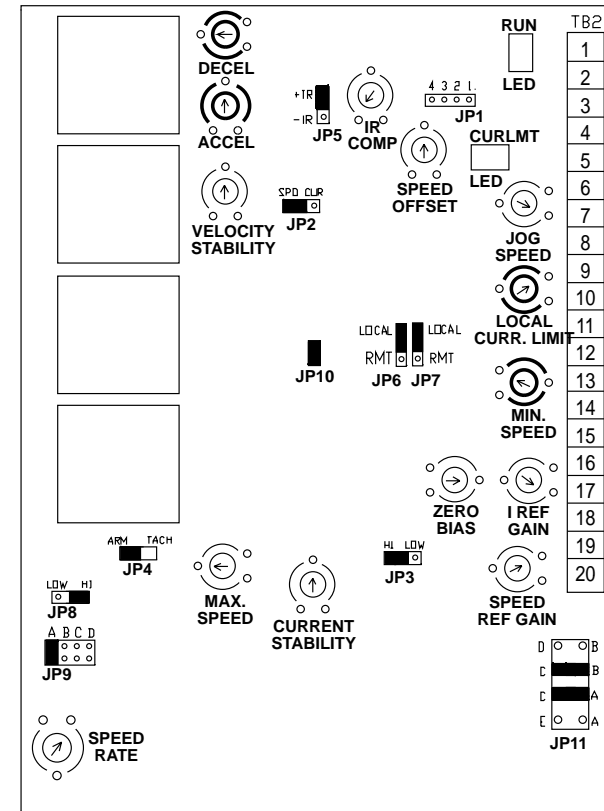
CONTROL CIRCUIT SPECIFICATIONS

Logic Control Power	24VDC
Speed Potentiometer	5000ohms, 2watts
Input Signal Requirement	10VDC @ .5mAmps (Regen is ±10VDC @ .5mAmps)
Control Circuit Isolation	Optional with non-regen, Standard with regen drive
Current Signal Follower	1-5mA or 4-20mA (non-regen), 0-5mA or 0-20mA (regen)
Voltage Signal Follower	0-200VDC

FOCUS 3 OPTIONS

CATALOG NUMBER	DESCRIPTION	
F3SE	Enclosure	Small (2HP), NEMA 4/12
F3LE	Kits	Large (5HP), NEMA 4/12
F3M112	*M*	1/4 - 1HP @ 120V
F3M224	Contactor	1/2 - 2HP @ 240V
F3M524	Kits	3 - 5HP @ 240V
F3DB224	Dynamic Braking Kits	.5HP @ 120V, 2HP @ 240V
F3DB1524		.25 - .33HP @ 120V, 1.5HP @ 240V
F3DB124		.75 - 1HP @ 240V
F3DB0524		.5HP @ 240V
F3DB112		.75 - 1HP @ 120V
F3DB324		3HP @ 240V
F3DB524		5HP @ 240V
F3TS	Toggle Switch, NEMA 4/12	
F3NSBD	Signal Isolation Board	
2450-9024	Remote Percent Speed Meter Kit	
2450-9021	Remote RPM Speed Meter Kit	
0895-8000	Remote Operator Station	
6160-9001	Ten-Turn Potentiometer	

Jumpers and Pots shown in default position.



Regen PC Board: F3R2C, F3R2E, F3R5C, F3R5E

Internal Adjustments / Potentiometers

* Acceleration Time (.3-20 seconds)
* Deceleration Time (.3-20 seconds)
Velocity Loop Stability
IR Compensation (0-20% of rated voltage)
Speed Loop Offset
Jog Speed (0-30% of full speed reference)
* Local Current Limit (0-150% of selected range)
* Minimum Speed (0-30% of maximum speed)
Current Signal Follower Gain
Signal Follower Zero Bias
Voltage/Speed Signal Follower Gain
Current Loop Stability
Maximum Speed (80-120% of rated speed)
Speed Rate

* Frequently used pots. Most applications do not require additional pots to be adjusted.

Jumper Programming

WARNING!

Equipment damage and/or personal injury may result if jumper programming is attempted while control is operational. Always lock out power at the remote disconnect before changing jumper positions.

If using the Focus drive as a torque regulator, make the following adjustments:

- JP2: Select current (CUR) control
- JP4: Select tachometer (TACH) feedback, but do not use a tachometer.
- JP9: Select the appropriate current feedback range.
- ACCEL and DECEL pots: Set to full counterclockwise position.
- LOCAL CURRENT LIMIT pot: Set to full clockwise position.

Prior to installing the control, jumpers must be programmed for the following:

JUMPER	DESCRIPTION	RANGE	DEFAULT
JP1	Optional "M" Contactor Sequencing Module	Yes or No	No contactor
JP2*	Speed or Current Control Mode	Speed or Current (SPD) (CUR)	Speed
JP3	Tachometer Feedback Range (at max. speed)	Low (6.5-17.4VDC) or HI (60-160VDC)	HI
JP4	Speed Feedback Selector	Tachometer (TACH) or Armature (ARM)	Armature
JP5	Positive or Negative IR Compensation	Positive or Negative (+IR) (-IR)	Positive
JP6	Local or Remote Current Limit Pot	Local or Remote (RMT)	Local
JP7	Local or Remote Current Limit Pot	Local or Remote (RMT)	Local
JP8	Armature Voltage Level	LOW (90VDC) or HI (180VDC)	HI(180VDC)
JP9	Current Feedback Range	A thru D (see Table below)	A
JP10	Line Frequency	50 or 60Hz (w/ jumper)	60Hz
JP11	Input Voltage	120 or 240VAC (see Table below)	240VAC

* When Current Control (JP2) is selected, set Jumper JP4 to the TACH position but do not use a tachometer.

(JP9) CURRENT FEEDBACK RANGE

CATALOG NUMBER	OUTPUT CURRENT (AMPS)	JP9 JUMPER POSITION
F3R2C F3R2E (1/4 - 2HP)	2.6	No Jumper
	5.5	A
	7.5	B
	10	C
F3R5C F3R5E (3 - 5HP)	6.6	No Jumper
	13.8	A
	16	B
	18.75	C
	25	D

(JP11) INPUT VOLTAGE

INPUT VOLTAGE	JP11 JUMPER POSITIONS
120VAC	A to E and B to D
240VAC	A to C and B to C

FOCUS 3 OPTIONS DESCRIPTION

Enclosure Kits (F3SE & F3LE)

The NEMA 4/12 enclosure kits are designed for use with the Focus 3 chassis drives. The start/stop toggle switch and speed pot are factory installed in the cover and wired to the terminal block. All necessary mounting hardware is included in the kit.

Toggle Switch (F3TS)

The F3TS toggle switch is designed for use with the Focus 3 Drives and Enclosure Kits. This NEMA 4/12, 2-position, maintained contact toggle switch may be used as the customer operator for Auto/Manual, Forward/Reverse (regen only), and Run/Jog functions.

"M" Contactor Kits

These kits Include a magnetic contactor, interface pc board, and mounting bracket which can be installed directly on the heatsink of the chassis mount unit and inside the enclosed control. It provides a positive disconnect of the motor armature when the control is stopped, preventing motor turnover in case the SCRs should false fire. In addition, an auxiliary form C contact is included for customer use. (This kit may be required by local and/or national electrical codes.)

Dynamic Braking Kits

These kits are designed for use with the "M" Contactor Kits. Dynamic braking provides rapid motor stopping by automatically connecting a resistor across the armature of the motor to absorb the energy produced by the coasting motor (now acting as a generator) and bring it to a stop quickly. Note that the dynamic brake is not a holding (fail-safe) brake. The standard dynamic brake resistors have been sized for use with DC motors that have no appreciable load inertia connected to the shaft and have start/stop cycles no more frequent than 3 quick stops with 7 minutes before the next stop.

Signal Isolation Board (F3NSBD)

The F3NSBD board provides isolation of the speed reference and start signal to the Focus non-regen drive. In non-regen drives, the signal common connection (term. TB2-12) is connected internally to the drive power terminal A+. Grounding the signal common is equivalent to earth grounding the incoming power supply through the control board and will result in drive failure. This board is necessary when the drive is remotely controlled by a PLC or some other form of process control which is ground referenced.

Inputs:

Voltage Ranges 5, 12, 26, 52, 98, 208VDC
Current Ranges 0-5, 1-5, 0-20, 4-20mA

Output: 0 to +10VDC (uni-polar)

Input Power: 17-30VDC @ 50mA max. (for control circuitry)

Control Relay (CRR):

Input 24VDC @ 12.1mA, 120VAC @ 20mA
Contacts 2-Form A, 1A @ 250VAC

Speed Pot: 5Kohms, 2W

Isolation Voltage: 240VAC Power Systems
2000VAC Hi-Pot for one minute

Remote Speed Meter Kits

Provide a visual indication of the motor speed by monitoring the output voltage of a motor mounted DC tachometer or the motor armature voltage (which is directly proportional to the speed). A PC board is included and mounted on the back of the meter to allow calibration of the meter for use with a range of inputs. The meter kits are supplied in a NEMA 1 enclosure suitable for wall mounting, but may be easily removed if panel mounting is preferred. When used with a tachometer, the motor speed indicated is within a +/-2% accuracy. Using the armature voltage input, the accuracy is +/-5%.

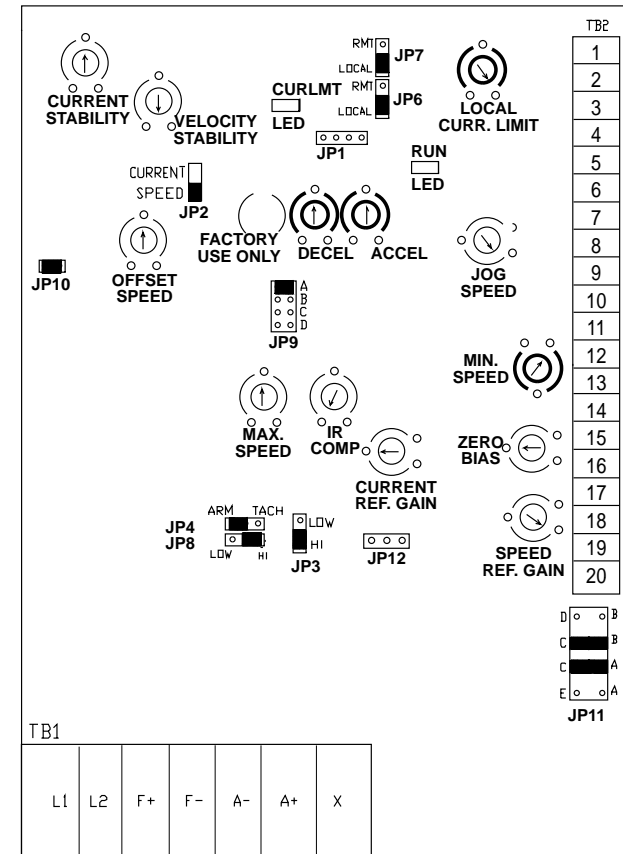
Remote Operator Station

This kit includes Start and Stop momentary pushbuttons, a speed potentiometer, and provisions for adding a jog selector switch. This NEMA 1 kit can operate the Focus drives from a remote location.

Ten-Turn Potentiometer

This kit may be used to replace the standard single-turn potentiometer in the control to provide a much finer adjustment of the speed or torque. Included in the kit are the ten-turn pot and the digital turns-indicating knob suitable for mounting in the control cover or in a remote operator station. When using this ten-turn pot in an enclosed control, the enclosure rating is NEMA 1.

Jumpers and Pots shown in default position.



Non-Regen PC Board: F3N2C, F3N2E, F3N5C, F3N5E

Internal Adjustments / Potentiometers

* Acceleration Time (.3-20 seconds)

* Deceleration Time (.3-20 seconds)

Velocity Loop Stability

IR Compensation (0-20% of rated voltage)

Speed Loop Offset

Jog Speed (0-30% of full speed reference)

* Local Current Limit (0-150% of selected range)

* Minimum Speed (0-30% of maximum speed)

Current Signal Follower Gain

Signal Follower Zero Bias

Voltage/Speed Signal Follower Gain

Current Loop Stability

Maximum Speed (80-120% of rated speed)

* Frequently used pots. Most applications do not require additional pots to be adjusted.

Jumper Programming

WARNING!

Equipment damage and/or personal injury may result if jumper programming is attempted while control is operational. Always lock out power at the remote disconnect before changing jumper positions.

If using the Focus drive as a torque regulator, make the following adjustments:

- JP2: Select current (CUR) control
- JP4: Select tachometer (TACH) feedback, but do not use a tachometer.
- JP9: Select the appropriate current feedback range.
- ACCEL and DECEL pots: Set to full counterclockwise position.
- LOCAL CURRENT LIMIT pot: Set to full clockwise position.

Prior to installing the control, jumpers must be programmed for the following:

JUMPER	DESCRIPTION	RANGE	DEFAULT
JP1	Optional "M" Contactor Sequencing Module	Yes or No (NO JUMPER)	No contactor
JP2*	Speed or Current Control Mode	Speed or Current (SPD) (CUR)	Speed
JP3	Tachometer Feedback Range (at max. speed)	Low(6.5-17.4VDC) or HI(60-160VDC)	HI
JP4	Speed Feedback Selector	Tachometer (TACH) or Armature (ARM)	Armature
JP6	Local or Remote Current Limit Pot Selector	Local or Remote(RMT)	Local
JP7	Local or Remote Current Limit Pot	Local or Remote(RMT)	Local
JP8	Armature Voltage Level Selector	LOW(90VDC) or HI(180VDC)	HI(180VDC)
JP9	Current Feedback Range	A thru D (see Table below)	A
JP10	Line Frequency Selector	50 or 60Hz (w/ jumper)	60Hz
JP11	Input Voltage Selector	120 or 240VAC (see Table below)	240VAC

* When Current Control (JP2) is selected, set Jumper JP4 to the TACH position but do not use a tachometer.

(JP9) CURRENT FEEDBACK RANGE

CATALOG NUMBER	OUTPUT CURRENT (AMPS)	JP9 JUMPER POSITION
F3N2C F3N2E (1/4 - 2HP)	2.7	No Jumper
	5.5	A
	6.4	B
	7.5	C
	10	D
F3N5C F3N5E (3 - 5HP)	6.6	No Jumper
	13.8	A
	16	B
	18.75	C
	25	D

(JP11) INPUT VOLTAGE

INPUT VOLTAGE	JP11 JUMPER POSITIONS
120VAC	A to E and B to D
240VAC	A to C and B to C

WARNING!

Installation of this equipment must be done in accordance with the National Electrical Code and all other applicable regional or local codes. Proper grounding, conductor sizing, and short circuit protection must be installed for safe operation. Improper installation or operation of this control may cause injury to personnel or damage to equipment.

WARNING!

Hazardous voltages may be present on external surfaces of ungrounded controls. This can result in personal injury or equipment damage.

- Check nameplate data for conformance with AC power source and motor.

WARNING!

When performing visual inspections and maintenance, the incoming AC power must be turned off and locked out. Hazardous voltages will be present until the AC power is turned off. The drive contactor does not remove hazardous voltages when opened.

- During normal operation, keep all covers in place and cabinet doors shut.

CAUTION!

Never operate the control for an extended time on its back. Heat from the heatsink may penetrate control logic wiring.

**Environment
NEMA 4/12**

Suitable for most well-ventilated factory areas where industrial equipment is installed. Locations subject to steam vapors, oil vapors, flammable or combustible vapors, chemical fumes, and corrosive gases or liquids should be avoided unless an appropriate enclosure has been supplied. Ambient temperature is not to exceed 40°C.

Chassis

Suitable for mounting in a user's enclosure where internal temperatures will not exceed 55°C.

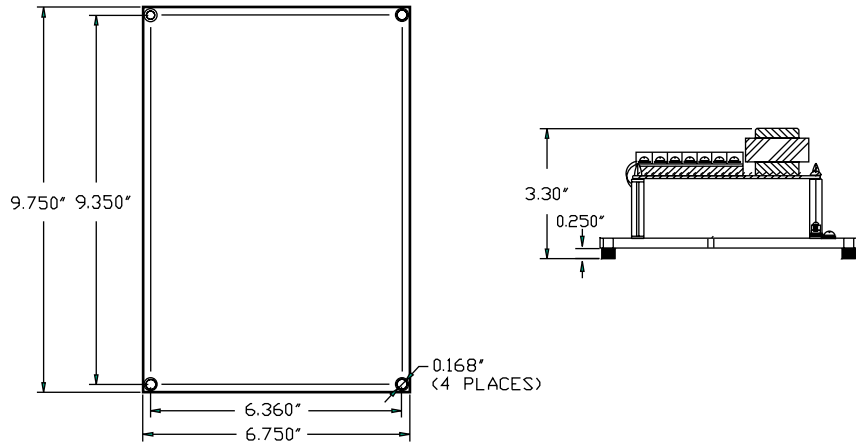
Jumper Selection

Prior to applying power, the control jumpers location must be selected (see Start-up, pages 14-17). Some of the parameters determined by the jumper location are:

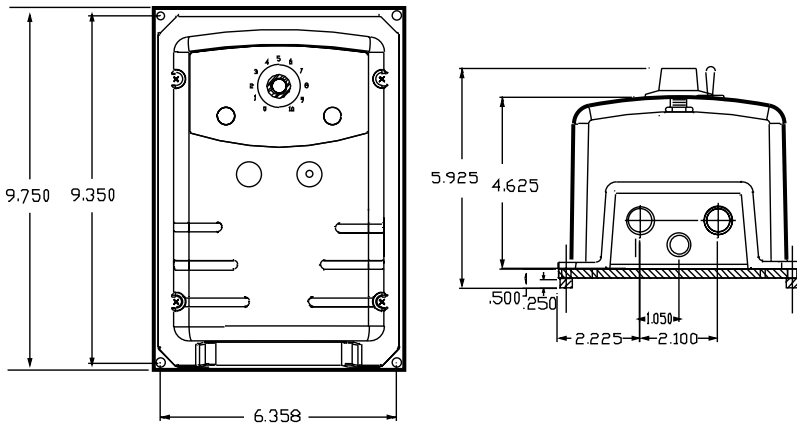
- Input AC Line Voltage (120/240VAC)
- Input Line Frequency (60/50Hz)
- Speed or Current Control
- Tach or Current Feedback Range
- Armature Voltage

WARNING!

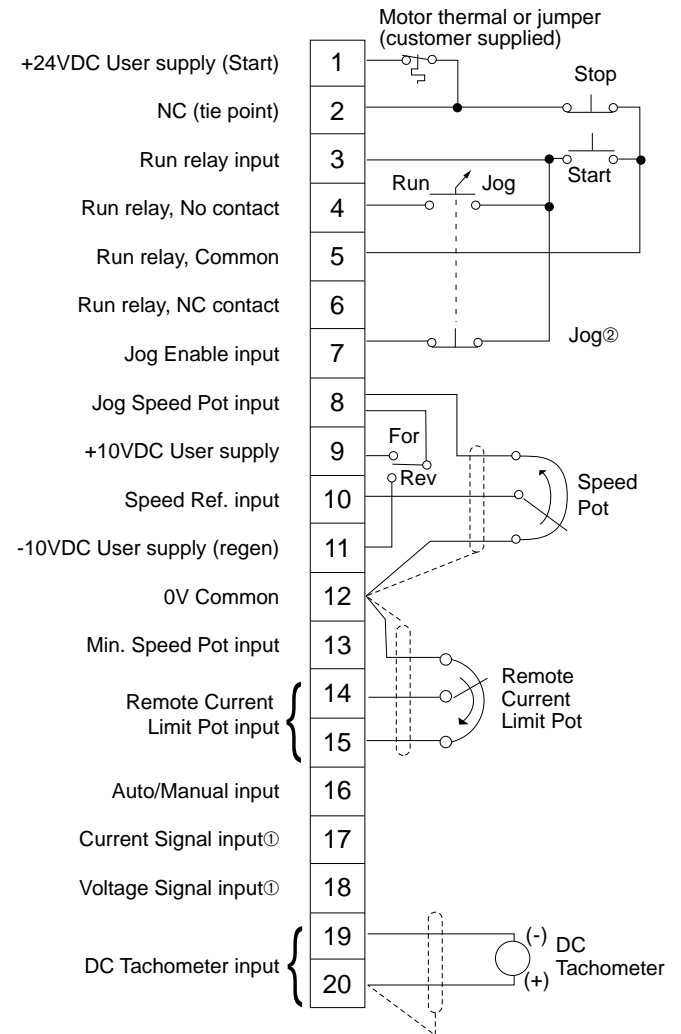
Equipment damage and/or personal injury may result if jumper programming is attempted while the control is operational. Always lock out power at the remote disconnect before changing any jumper positions.



F3N2C, F3R2C



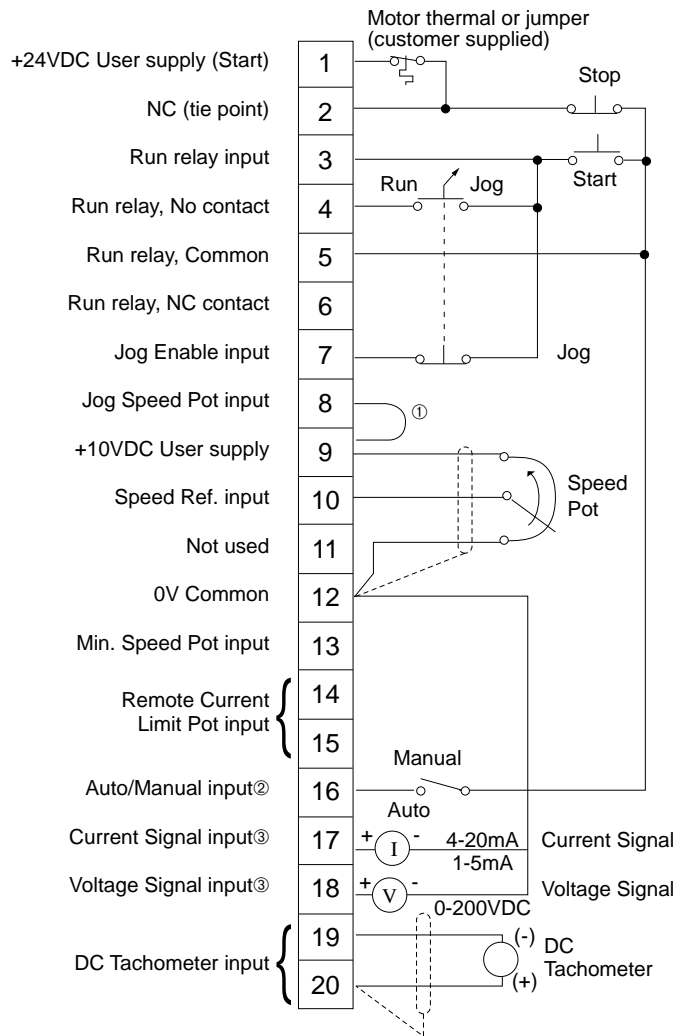
F3N2E, F3R2E



① Use either Current (term. 17) or Voltage (term. 18) Input.

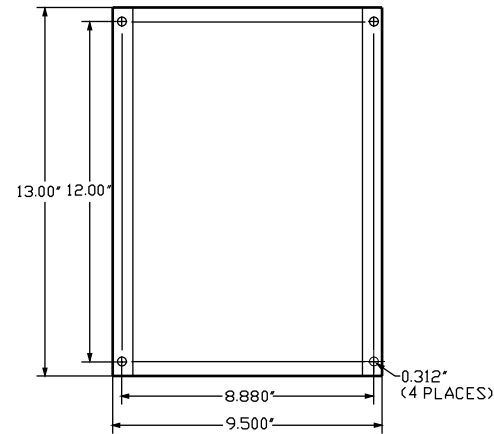
② When using Jog and Forward/Reverse functions, remove jumper from terms. 3 & 4.

Regen 3 wire:
Start/Stop, Forward/Reverse, Jog, and Speed Potentiometer

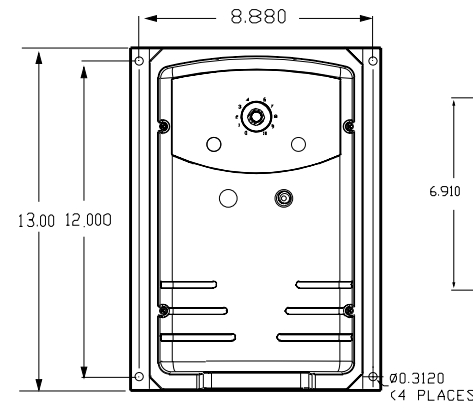
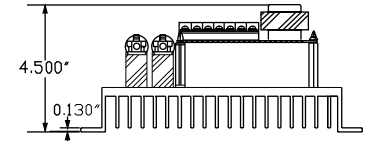


- ① When using Jog function, remove factory installed the jumper from terms. 3 & 4 and add to terms 8 & 9.
- ② Auto/Manual switch is required to select between the speed pot and the voltage/current signal input. If current or voltage signal is used without the speed pot, jumper terms. 2 & 16.
- ③ Use either Current (term. 17) or Voltage (term. 18) Input.

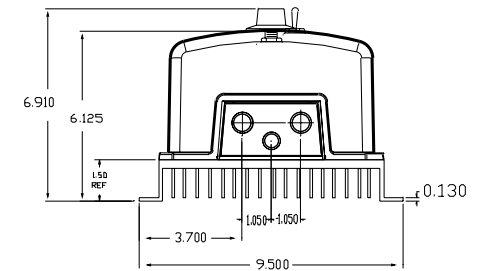
**Non-regen 3 wire:
Start/Stop, Jog, Auto/Manual with
Speed Pot or Current/Voltage Signal**



F3N5C, F3R5C



F3N5E, F3R5E



0.3120 (4 PLACES)

Start-up Guidelines

- STEP 1:**
Receiving & InspectionPage 1
- STEP 2:**
Jumper Selection ...Pages 20-23
- STEP 3:**
Drive Installation...Pages 9-11
- STEP 4:**
Power WiringPages 12-13
- STEP 5:**
Control WiringPages 14-19
- STEP 6:**
Potentiometer Adjustments
Pages 23-26

NOTE

Read this manual in its entirety, paying particular attention to the *Warnings* and *Cautions* in each section before installing, starting, or maintaining this drive.

CAUTION!

Improper procedures can result in personal injury or equipment damage. Only qualified electrical maintenance technicians familiar with electronic drives and their standard safety precautions should be permitted to install, start-up, or maintain this apparatus.

Incoming Power Requirements

A remote fused AC line disconnect or circuit breaker installed ahead of the control is required by the NEC (National Electrical Code). The control is designed to accept single phase AC line voltage.

Grounding

The control must be connected to earth ground, provided by an enclosure or chassis-installed screw, for safety of operating personnel. If the drive cabinet or chassis unit is mounted such that it is not grounded, a ground wire must be connected to the panel or enclosure frame for personal safety.

Motor Wiring

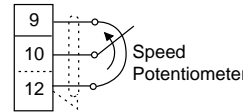
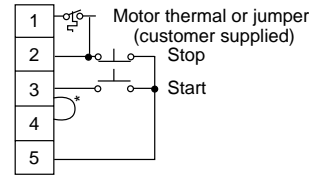
For motor thermal wiring, see the "Control Wiring" section.

If the motor rotates in the wrong direction, one of the following changes may correct it:

1. Exchange A1 and A2 output motor armature leads.
2. Exchange F1 and F2 Motor Shunt field leads.
3. Change position of Forward/Reverse switch, if being used.

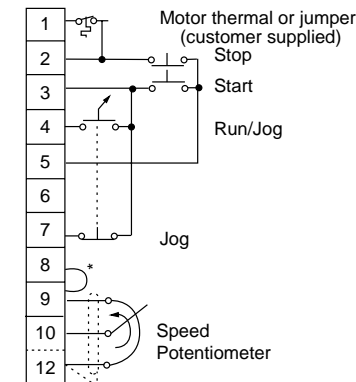
Power Wiring Terminals Description

TERM. #	DESCRIPTION
L1	AC Line Voltage Input
L2	AC Line Voltage Input
GND	Earth Ground
F+	Motor Field (+) (shunt wound motors only)
F-	Motor Field (-) (shunt wound motors only)
A+	Motor Armature (+)
A-	Motor Armature (-)
FE1	Field Economy (regen only)
FE2	Field Economy (regen only)



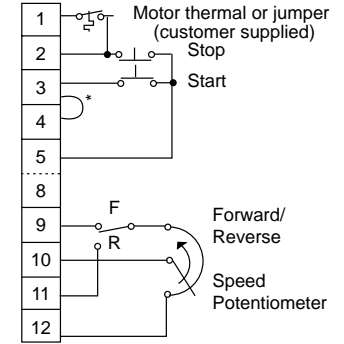
* Jumper installed at factory.

3 Wire: Start/Stop and Speed Potentiometer



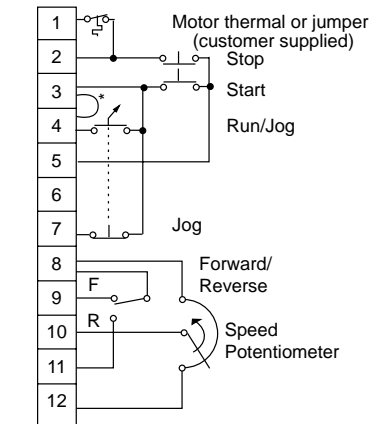
* When using Jog function, remove factory installed jumper from terms. 3 & 4 and add to terms. 8 & 9.

3 Wire: Start/Stop, Jog and Speed Potentiometer



* Jumper installed at factory.

3 Wire (regen only): Start/Stop, Forward/Reverse and Speed Potentiometer



* When using the Jog and For/Rev functions, remove the factory installed jumper from terms. 3 & 4.

3 Wire (regen only): Start/Stop, Jog, Forward/Reverse and Speed Potentiometer

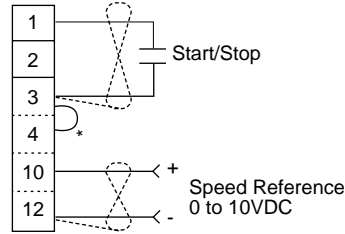
NOTE

Shielded wire (2 or 3 conductor) is recommended for reference and other signal wire connections. Shields should be taped off at the remote end. At the drive, connect shields to the circuit common, route wire away from high current lines (i.e. AC lines and armature wiring).

CAUTION!

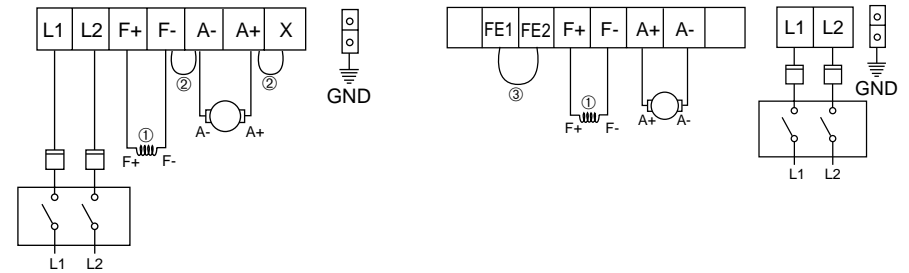
The non-regen drive control circuitry is not isolated.* No points in the control circuitry, including common, should be connected to earth ground unless specifically shown on the supplied wiring diagrams. No grounding connections should be made on the terminal block. Improper connections to ground, including speed potentiometer connections, will result in control failure.

* If using the optional signal isolation board, use the wiring diagrams supplied with the board. The regen drive does have circuit isolation as standard and the control circuitry can be connected to ground.



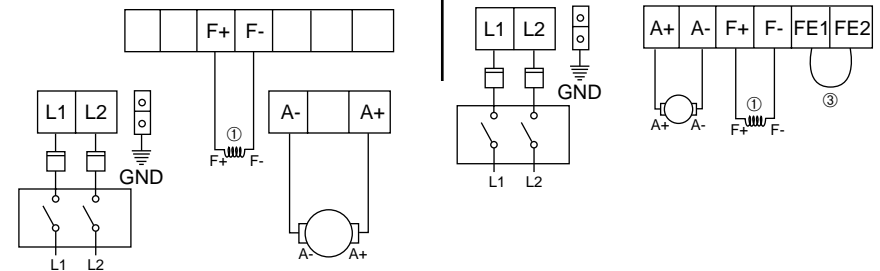
* Jumper installed at factory.

2 Wire: PLC Control



F3N2C, F3N2E

F3R2C, F3R2E



F3N5C, F3N5E

F3R5C, F3R5E

- ① Terminals F1 and F2 are used only with shunt wound motors.
- ② Jumpers installed at factory. If "M" contactor is used, jumpers must be removed.
- ③ Jumper installed at factory. If field economy is desired, remove jumper and add auxiliary contact connections.

TERMINAL CONNECTIONS (TB2) DESCRIPTION

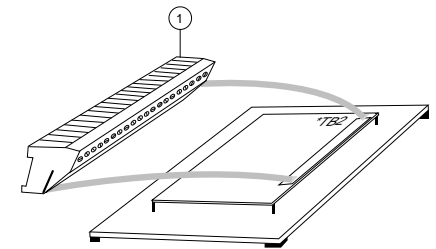
1	+24VDC supply. Powers the logic inputs to the drive. It is not intended to be used to power external circuits.
2	Tie point. It has no internal connections and is used as a tie point for the Motor thermal/Stop button connection.
3	Run input. When +24VDC is applied to this terminal, the Run relay picks up, the Speed loop and the Current loop are enabled, and the clamp on the SCR firing circuits is released.
4	Run relay contact, normally open connection. Rated: .5amps, 125VAC. It can be used as the seal-in contact in a three-wire run circuit or as the run contact feedback in a two-wire system.
5	Run relay contact, common connection.
6	Run relay contact, normally closed connection.
7	Jog input. When +24VDC is applied to this input, the output of the accel/decel circuit is electronically disconnected from the speed loop and the jog speed reference (from the jog speed pot) is electronically switched in. This jog speed reference can be configured as a Thread speed (maintained jog speed) by jumpering terminals TB2-3 & 4 in addition to the Run/Jog connections already shown on page 12.
8	Jog potentiometer supply voltage input. This terminal is typically connected to the +10VDC (TB2-9) speed pot supply for non-regen drives and for regen drives when jog is required in one direction only. For applications using the regen drive with the Forward/Reverse function, this terminal is switched between the +10VDC (TB2-9) and -10VDC (TB2-11) supply through the Forward/Reverse switch shown on page 11. This input may also be used as a direct speed reference input since it bypasses the accel/decel circuit; the 10VDC reference will produce only 30% max. motor speed.
9	+10VDC Speed pot/Jog supply voltage. Maximum load is 5mamp, min. 2Kohm.
10	Standard Speed reference input, speed pot wiper. Input impedance: 20Kohm.
11	-10VDC Speed pot/Jog supply voltage (regen only). Maximum load is 5mamp, min. 2Kohm. This terminal is not used with the non-regen drive.
12	Drive signal common connection, drive circuit common connection. <i>Non-regen drives only: never connect this terminal to earth ground.</i> Since this terminal is connected internally to the drive power terminal A+, earth grounding this connection is equivalent to earth grounding the incoming power supply through the control board and will result in drive failure. This connection may be grounded on regen drives only.
13	Minimum Speed potentiometer connection. This terminal is used in conjunction with the speed pot to provide a minimum speed setting. It is compatible with the Forward/Reverse switch option.
14	Remote Current Limit potentiometer, wiper connection. Jumpers JP6 & JP7 must be set to Rmt position. Shielded cable should be used for wiring purposes if the pot is not mounted on the drive front cover. A standard pot (5Kohm, 2W) may be used.
15	Remote Current Limit potentiometer, clockwise connection. Jumpers JP6 & JP7 must be set to Rmt position. Shielded cable should be used for wiring purposes if the pot is not mounted on the drive front cover. A standard pot (5Kohm, 2W) may be used. Note: counter clockwise connection and shield should be connected to terminal TB2-12.
16	Auto/Manual input. When +24VDC is applied to this terminal, the speed reference input to the accel/decel circuit is switched from the standard speed pot input to the follower (current or voltage) reference derived from terminal TB2-17 or 18. If the current/voltage follower is the only signal used, terminals TB2-2 & 16 must be jumpered.

TERMINAL CONNECTIONS (TB2) DESCRIPTION

Note:	The Current (TB2-17) or Voltage (TB2-18) source input to the non-regen drive must be isolated from earth ground. If it is not, an isolator (such as signal isolator board #F3NSBD or equivalent) must be used to prevent drive failure. The return line of the signal (current or voltage) source and the shield should be connected to terminal TB2-12 or 20.
17	Current signal follower input, positive input for current source. Input impedance: 100ohms. Range: 1-5 or 4-20 mamps for the non-regen drive and 0-5 or 0-20 mamp for the regen drive.
18	Voltage signal follower input, positive input for voltage source. Input impedance: 1Kohm/volt. Range: 0-200VDC.
19	DC Tachometer input, negative input from motor mounted DC tachometer. Input impedance: 120Kohm in the high position and 13.5Kohm in the low position. Range at maximum speed: 6.5 to 17.4VDC in the low position and 60-160VDC in the high position. Note: virtually any tachometer voltage can be used with the addition of an external resistor in series with the lead (consult factory if required).
20	DC Tachometer input, positive input from motor mounted DC tachometer. Note: wire shield should also be connected to this terminal.

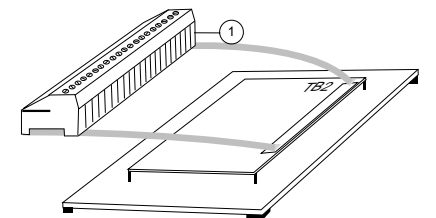
Terminal Block (TB2) Installation

On chassis drives, the terminal block (TB2) is installed so that control wires are inserted into the terminal point from the right side of the block. For enclosed drives, the terminal block must be installed so wires extend up (90° angle) from the drive PC board. If the control wires extend out to the side, there is not sufficient clearance space for the enclosure cover.



Enclosed
F3N2C, F3N5C, F3R2C, F3R5C

- ① If the customer supplied motor thermal is not used, terms. 1 & 2 must be jumpered or drive will not start.



Chassis
F3N2C, F3N5C, F3R2C, F3R5C