Focus 3N

¼ to 5HP Single Phase, Uni-Directional
Non-Regenerative DC Drive

User Guide

P/N: FOCUS3N-UG
Revision: A2
Date: November 22 2005

General Information

The manufacturer accepts no liability for any consequences resulting from inappropriate, negligent or incorrect installation or adjustment of the optional operating parameters of the equipment or from mismatching the variable speed drive with the motor.

The contents of this User Guide are believed to be correct at the time of printing. In the interests of a commitment to a policy of continuous development and improvement, the manufacturer reserves the right to change the specifications of the product or its performance, or the contents of the User Guide, without notice.

Customer Support

Control Techniques
359 Lang Boulevard, Building B
Grand Island, New York 14072
U.S.A. Telephone: (716) 774-1193

It is Control Techniques' goal to ensure your greatest possible satisfaction with the operation of our products. We are dedicated to providing fast, friendly, and accurate assistance. That is why we offer you so many ways to get the support you need. Whether it's by phone, fax or modem, you can access Control Techniques support information 24 hours a day, seven days a week. Our wide range of services include:

Fax **(716) 774-8327**

You can FAX questions and comments to Control Techniques Just send a FAX to the number listed above.

Website and Email **www.emersonct.com**

Website: www.emersonct.com

Email: info@emersonct.com

If you have Internet capabilities, you also have access to technical support using our website. The website includes technical notes, frequently asked questions, release notes and other technical documentation. This direct technical support connection lets you request assistance and exchange software files electronically.

Technical Support **(716) 774-1193 or (800) 893-2321**

Email: pdtechsupport@emersonct.com

Control Techniques' products are backed by a team of professionals who will service your installation. Our technical support center in Grand Island New York is ready to help you solve those occasional problems over the telephone. Our technical support center is available 24 hours a day for emergency service to help speed any problem solving. Also, all hardware replacement parts, if needed, are available through our customer service organization.
When you call, please be prepared to provide the following information:

The type of controller or product you are using
What you were doing when the problem occurred
How you tried to solve the problem

Need on-site help? Control Techniques provides service, in most cases, the next day. Just call Control Techniques' technical support center when on-site service or maintenance is required.

Customer Service **(716) 774-1193 or (800) 367-8067**

Email: customer.service@emersonct.com

Authorized Control Techniques distributors may place orders directly with our Customer Service department. Contact the Customer Service department at this number for the distributor nearest you.

⚠WARNING **“Warning” indicates a potentially hazardous situation that, if not avoided, could result in death or serious injury.**

⚠ CAUTION **“Caution” indicates a potentially hazardous situation that, if not avoided, may result in minor or moderate injury.**

CAUTION **“Caution” used without the safety alert symbol indicates a potentially hazardous situation that, if not avoided, may result in property damage.**

Safety Considerations

Safety Precautions

This product is intended for professional incorporation into a complete system. If you install the product incorrectly, it may present a safety hazard. The product and system may use high voltages and currents, carry a high level of stored electrical energy, or are used to control mechanical equipment that can cause injury.

You should give close attention to the electrical installation and system design to avoid hazards either in normal operation or in the event of equipment malfunction. System design, installation, commissioning and maintenance must be carried out by personnel who have the necessary training and experience. Read and follow this safety information and instruction manual carefully.

Enclosure

This product is intended to be mounted in an enclosure that prevents access except by trained and authorized personnel and prevents the ingress of contamination. This product is designed for use in an environment classified as pollution degree 2 in accordance with IEC664-1. This means that only dry, non-conducting contamination is acceptable.

Setup, Commissioning and Maintenance

It is essential that you give careful consideration to changes to drive settings. Depending on the application, a change could have an impact on safety. You must take appropriate precautions against inadvertent changes or tampering. Restoring default parameters in certain applications may cause unpredictable or hazardous operation.

Safety of Machinery

Within the European Union all machinery in which this product is used must comply with Directive 89/392/EEC, Safety of Machinery.

The product has been designed and tested to a high standard, and failures are very unlikely. However the level of integrity offered by the product’s control function – for example stop/ start, forward/reverse and maximum speed – is not sufficient for use in safety-critical applications without additional independent channels of protection. All applications where malfunction could cause injury or loss of life must be subject to a risk assessment, and further protection must be provided where needed.

General warning
Failure to follow safe installation guidelines can cause death or serious injury. The voltages used in this unit can cause severe electric shock and/or burns, and could be lethal. Extreme care is necessary at all times when working with or adjacent to this equipment. The installation must comply with all relevant safety legislation in the country of use.

AC supply isolation device
The AC supply must be removed from the drive using an approved isolation device or disconnect before any servicing work is performed, other than adjustments to the settings or parameters specified in the manual. The drive contains capacitors, which remain charged to a potentially lethal voltage after the supply has been removed.

Grounding (Earthing, equipotential bonding)
The drive must be grounded by a conductor sufficient to carry all possible fault current in the event of a fault. The ground connections shown in the manual must be followed.

Fuses
Fuses or over-current protection must be provided at the input in accordance with the instructions in the manual.

Isolation of control circuits
The installer must ensure that the external control circuits are isolated from human contact by at least one layer of insulation rated for use at the applied AC supply voltage.

Table of Contents

When viewing this document electronically, the Table of Content items are active and will direct you to that topic by clicking on that item.

Table of Contents

When viewing this document electronically, the Table of Content items are active and will direct you to that topic by clicking on that item.

Introduction

This is the User's Guide for Focus 3N (Non-regenerative) series of DC Drives. The Focus 3 is a 3rd generation product of the long-standing Focus series. The Focus 1 was introduced back in 1980 and the Focus 2 later in 1982. The Focus 2 was retired when the Focus 3 was introduced as it took advantage of many technological advances in power electronics. The Focus 3 Non-regen is a single-phase, uni-directional analog drive for DC motors with power ranges from ¼ to 5HP.

Your Focus 3N is a general purpose non-regenerative DC motor speed controller that is powered from either 115Vac or 230Vac single phase power. A non-regenerative (single quadrant) drive is one that can provide motoring torque for acceleration and to overcome rated loads. There are a great many applications where non-regenerative drives provide the most economical solution. A non-regenerative drive however cannot slow down a motor faster than the motors normal coasting rate (unless a Dynamic Braking stop is commanded) nor can it stop overhauling load situations. For more demanding applications, a sister drive- the Focus 3 Regen (regenerative model), offers full four quadrant operation for bi-directional motor control and controlled deceleration as well as opposition to overhauling loads.

Both drives incorporate many features that are standard on high performance system drives, such as dynamic stability and built-in signal follower adjustments. Focus 3 drives come in two basic model variations- with and without enclosure.

Chassis Model

The model without an enclosure is denoted as a chassis model. The chassis model is intended for mounting within a User supplied cabinet and where the User intends to provide remote Start/Stop and Speed control signals.

Enclosed Model

The Enclosed version comes to you already in a NEMA 4/12 enclosure that would allow the User to mount the Focus on a wall or machine surface. The Enclosed version has Start/Stop and the Speed Control adjustment on the front cover for convenient operation.

For a complete overview of the Focus 3 product line and available options, visit our website at: www.emersonct.com or click the link below:

Focus 3 Catalog Section

Motor Compatibility

The Focus 3 was designed to run standard 90 Vdc or 180 Vdc Shunt Wound or Permanent Magnet DC motors in one direction. The Focus 3 can run motors with other characteristics (such as Universal motors) but one must review those requirements to insure compatibility. Universal motors have commutator brushes but typically plug into the AC power line. Universal motors are often used in tools such as Drills, Saws, Shop VAC's, Routers, etc and typically cannot be run in reverse.

Shunt Wound Motors that are controlled by single phase DC drives typically have 4 power wires. Two of these are the Armature leads typically designated A1 & A2 or A+ & A-. The other two power wires are the shunt field leads and typically designated F1 & F2 or F+ & F-. The Focus 3 can supply up to ***1 Amp*** for shunt field excitation (field current requirements beyond 1A may damage field rectifier diodes). If your motor does not have Field Current information on the nameplate, you can determine compatibility by measuring your motors Field resistance using a calibrated ohmmeter.

Motors with:

90v Armatures typically require 100 Vdc for field excitation. In these cases, the Focus 3 requires 120vac input power and must be internally set for this input level. The motor Field resistance should not be less than 100 ohms when cold.

180v Armatures typically require 200 Vdc for field excitation. In these cases, the Focus 3 requires 240vac input power and must be internally set for this input level. The motor Field resistance should not be less than 200ohms when cold.

240v Armatures typically require 150 Vdc for field excitation. In these cases, the Focus 3 requires 240vac input power and must be internally set for this input level. The motor field resistance should not be less than 150 ohms when cold and will require a series resistor to drop the additional field supply voltage. Consult Control Techniques Technical Support for additional information.

Motors with:

Permanent Magnet Motors typically have only 2 power wires. These are the Armature leads and typically designated A1 and A2 or A+ and A-.

Eddy Current Clutch Controls

Focus 3 Non-Regenerative Drives have been used to replace many of our old Eddy Current Clutch Drive units. To regulate speed the clutch output shaft typically employed a tachometer (typically AC but DC could also be used)

A Replacement Solution
for 1235 / 367 Eddy Current Controllers
F3N2C-EC

The Eddy Current controls were a very popular means of providing variable speed control of a machine back in the 1970's. A simple 10-amp eddy current controller could actually control the speed/torque of a 900 HP motor. The F3N2C-EC can provide coil current up to 10 amps dc in 5 ranges starting at 2.7amps by setting a programming jumper. This current level can be "fine tuned" to the exact coil current of the clutch being controlled. For more specific information, refer to CTAN213 via the Internet at our website: www.emersonct.com or click the link below:

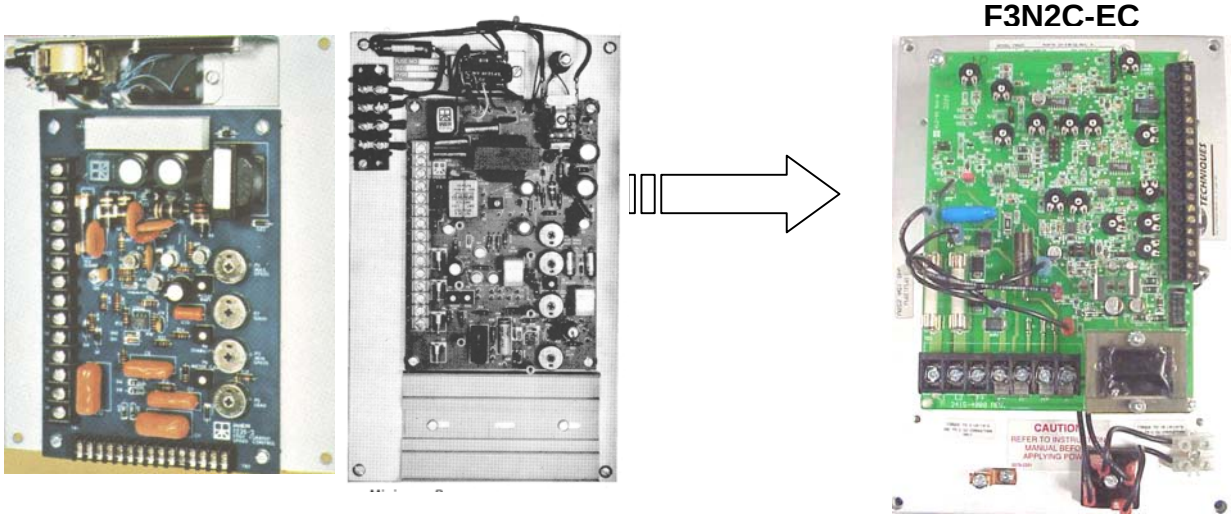
CTAN213

WER Eddy Current 367 Controller

Emerson Eddy Current 1235 Controller

Control Techniques Focus Eddy Current Controller

F3N2C-EC



Speed Control

Armature Voltage Feedback

The Focus 3 can vary the speed of the motors mentioned above as a function of the Speed potentiometer setting (or external speed command signal) by simply varying the output Armature voltage (field excitation if used typically remains constant). A great many motor applications do not require ultra precise speed control. Because of this, the Focus 3 is factory set for Armature Voltage Feedback. Armature Voltage Feedback (or simply Armature Feedback) does not require any special motor mounted speed feedback device and is therefore inherently quite reliable and is capable of providing up to 1% speed regulation.

Speed Feedback- Tachometer

Should more precise speed control be required, the Focus 3 can accommodate those motors equipped with DC Tachometers (AC tachometers require an option kit). DC tachometers output a linear voltage proportional to their RPM and can provide the Focus 3 with exact motor speed feedback information. With good DC tachometers up to 0.5% speed accuracy can be achieved. AC tach's are not as accurate as DC tach's but DC tach's require brush maintenance whereas the AC tach has no brushes.

Tach failure will typically result in motor speed runaway. One who designs systems with Speed Feedback devices such as DC tachometers should be cognizant of this fault condition and must take machine design precautions should this event occur.

We would recommend that all DC Drives be initially run using Armature Voltage Feedback to verify operation even if Tach Feedback is the ultimate goal.

Quick Stops

A non-regenerative drive cannot stop a motor faster than the motors normal coasting rate unless a Dynamic Braking resistor is employed. The DB option provides a rather quick stopping action and provides motor turning resistance when the drive is not in the RUN condition. The Focus 3N can be outfitted with a Dynamic Braking resistor should this requirement be desired.

Note: DB Resistors require Contactor Option - See **Options**

Power Outages

Shunt Wound Motors

Should a power outage occur, the drive would turn off and the motor would coast to rest. If a Dynamic Braking resistor were employed there would typically be enough decaying field strength to enable some faster stopping action.

Permanent Magnet Motors

Should a power outage occur, the drive would turn off and the motor would coast to rest. If a Dynamic Braking resistor were employed, full Dynamic Braking force would be exerted because the field is maintained by the motors internal permanent magnets. Therefore, there would be motor turning resistance during power outages as well.

General Information

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.

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 paperwork.

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 nameplate catalog number against the purchase order. See page 10 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: -40^0C to 70^0C
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.

PERFORMANCE FEATURES

- **Solid State Full Wave Power Bridge** -Uses generously rated power semiconductors for Maximum reliability and long life.
- **Inner Current Loop Regulator -** Inherent high bandwidth capability for fast response.

- **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.
- **Current Limit Ranges -** Selectable current limit ranges to match the drive to the motor being used. Provides smooth acceleration of high inertia loads.
- **Speed Regulator -** 1 % accuracy armature voltage feedback with IR compensation or 0.5 % 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.
- **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: 1 -5mA or 4-20mA
- **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 0-200 Vdc.
- **Auto/Manual Operation** - Standard circuitry allows the drive to be controlled by the operator speed potentiometer or by the current/voltage signal inputs.
- **UL/cUL -** All Focus 3 Drives are UL/cUL listed.

***Use voltage or current input**

⚠WARNING

- ***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 damage will occur.***

- ***One cannot make a connection to ground or a grounded device to any terminal or connection point to the Focus 3 Non-Regenerative Drive without causing drive damage. Such failures unfortunately cannot be warranted.***

- ***See Ways of Achieving Isolation on page 69 of this manual***

The Focus 3 comes in two basic model variations- with and without enclosure.

Chassis Model

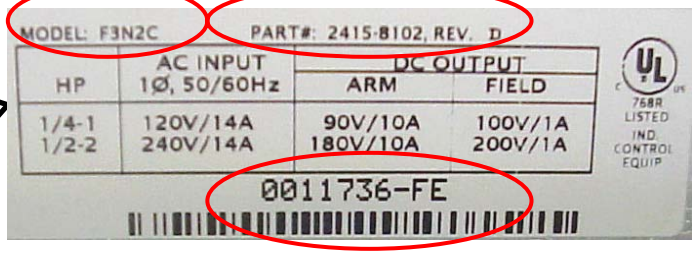
The model without an enclosure is denoted as a chassis model. The chassis model is intended for mounting within a User supplied cabinet and where the User intends to provide remote Start/Stop and Speed control signals.

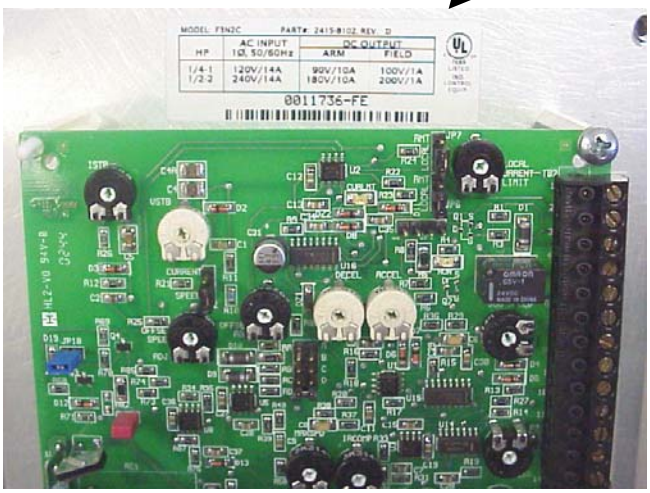
Enclosed Model

The Enclosed version comes to you already in a NEMA 4/12 enclosure that would allow the User to mount the Focus on a wall or machine surface. The Enclosed version has Start/Stop and the Speed Control adjustment on the front cover for convenient operation.

Nameplate Information

Enclosed Unit





Chassis Unit

Model Number Definition

F3 N 2 C

Enclosure
Chassis (C)
Enclosed (E)

Max HP Rating @240vac
2 HP (2)
5 HP (5)

Non-Regen (N)
Regen (R)

Drive Family
Focus 3 (F3)

Always record the drive ***Model Number***, ***Part Number*** and ***Serial Number*** for future warranty situations and spare parts. A good location to record these is on the **Start-up Guide Worksheet** on page #49.

F3N2C

F3N2E

Enclosed Models

Chassis Models

F3N5E

F3N5C

Specifications

Ratings

			AC Input		DC Output			
Catalog Part #	**Enclosure**	**HP**	**1Ø** **Volts**	**Max** **Amps**	**Armature** **Volts**	**Armature** **Amps**	**Field** **Volts**	**Field** **Amps**
F3N2C	Chassis	¼ -1	120	14	90	10	100	1
		½-2	240	14	180	10	200	1
F3N2E	NEMA 4/12	¼ -1	120	14	90	10	100	1
		½-2	240	14	180	10	200	1
F3N5C	Chassis	3-5	240	35	180	25	200	1
F3N5E	NEMA 4/12	3-5	240	35	180	25	200	1

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 (DC)	0. 5% of Base Speed
Speed Range:	30:1
Efficiency:	
Control Only	98%
Drive System (motor and control)	86% typically

DRIVE OPERATING CONDITIONS

Altitude (without derating)	3300Ft.
Ambient Temperature:	
Chassis Models	0-55^{0}C (130° F)
Enclosed (NEMA 4/12)	0-40^{0}C (104° F)

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	0.3-20 seconds (linear)
Deceleration Time	0.3-20 seconds (linear)
Jog Speed	0-30% of Full Speed command
Speed Loop Offset	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
Control Mode	Speed / Torque
Current Feedback range	High / Medium / Low / Xlow
Current Limit Pot Selector	Local / Remote
Armature Voltage level	90 Vdc/180 Vdc
Optional “M” Contactor	Yes/No
Tachometer Feedback	High/Low
Speed Feedback Selector	Armature / Tachometer
Line Frequency	50/ 60Hz

OPERATOR FUNCTIONS

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

CONTROL CIRCUIT SPECIFICATIONS

Logic Control Power	24 Vdc
Speed Potentiometer	5000 ohms
Input Signal Requirement	10 Vdc @ 0.5mA
Control Circuit Isolation	Optional with non-regen F3N models Standard with regen F3R models
Current Signal Follower	1-5mA or 4 - 20mA
Voltage Signal Follower	10 – 200 Vdc (at Maximum Speed)

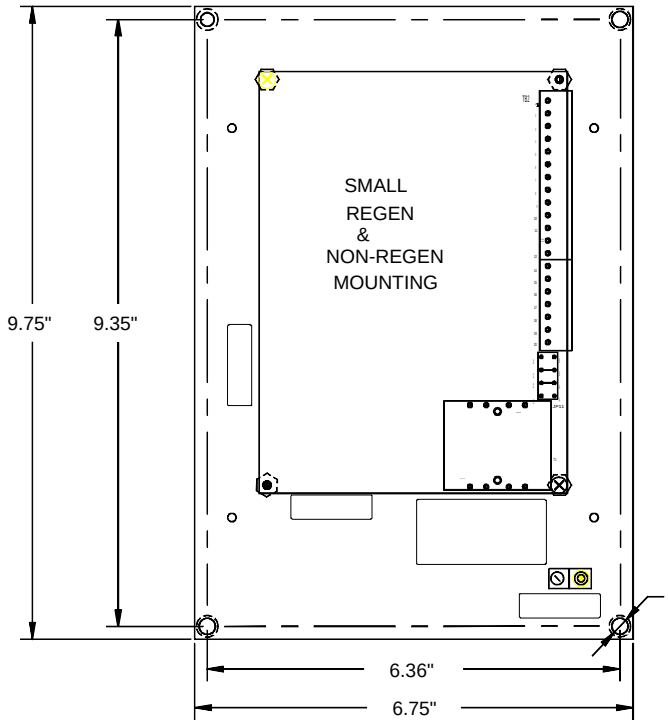
FOCUS 3 OPTIONS

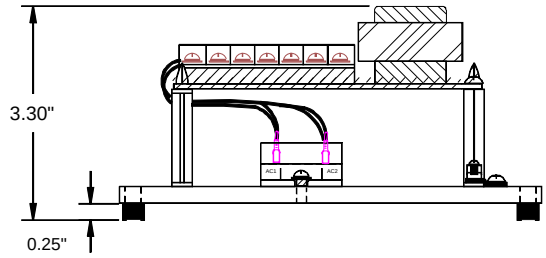
CATALOG NUMBER	DESCRIPTION	
F3SE	Enclosure Kits	Small (2HP), NEMA 4/12
F3LE		Large (5HP), NEMA 4/12
F3M112	"M" Contactor Kits	¼ - 1HP @ 120V
F3M224		½ - 2HP @ 240V
F3M524		3 - 5HP @ 240V
F3DB224		½ HP @ 120V, 2HP @ 240V
F3DB1524		¼ - 1/3 HP @ 120V, I .5HP @ 240V
F3DB124	Dynamic Braking Kits	¾ -1HP @ 240V
F3DB0524		½ HP @ 240V
F3DB112		¾ -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	
2950-9066	Remote Operator Station (3 Function)	
2950-9068	Remote Operator Station (5 Function)	
6160-9001	Ten-Turn Precision Potentiometer	

Focus 3 Chassis Dimensions

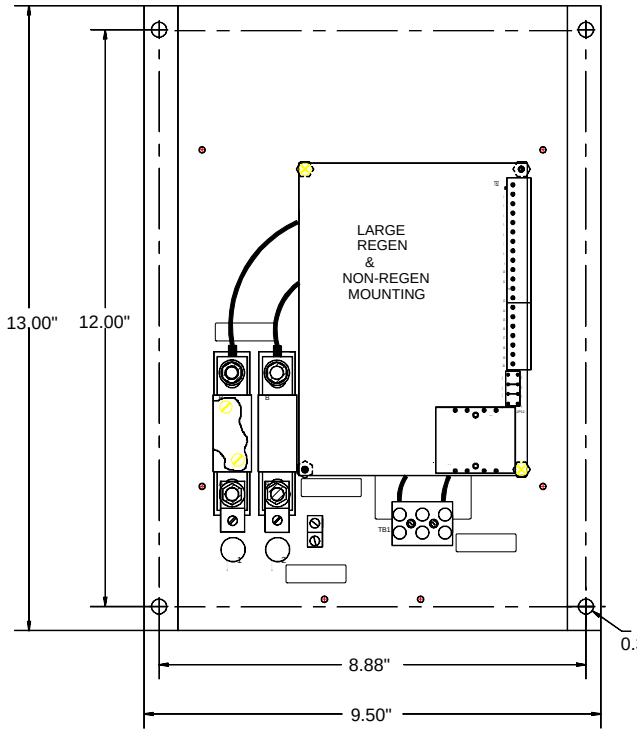
Chassis

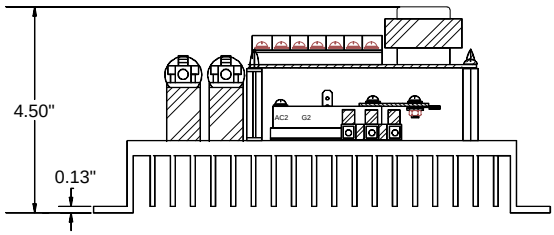
Suitable for mounting in a user's enclosure where internal temperatures will not exceed 55^0C.





F3N2C



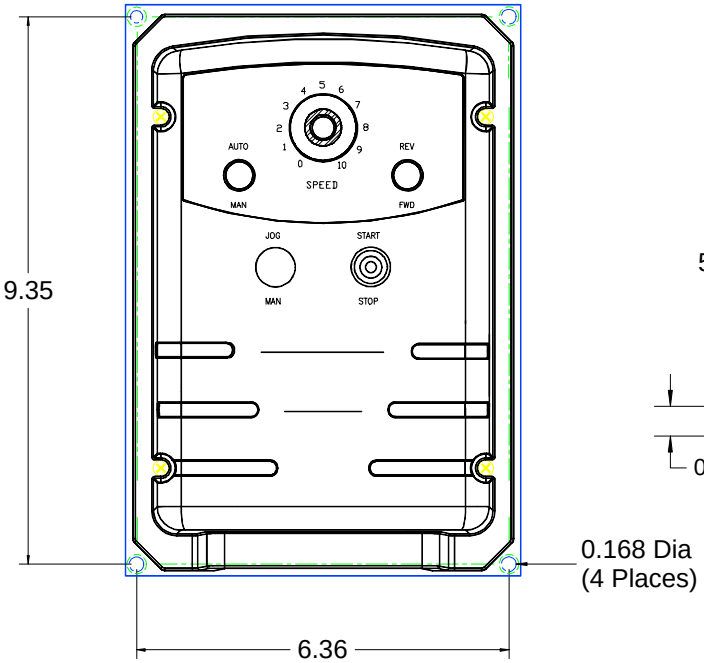


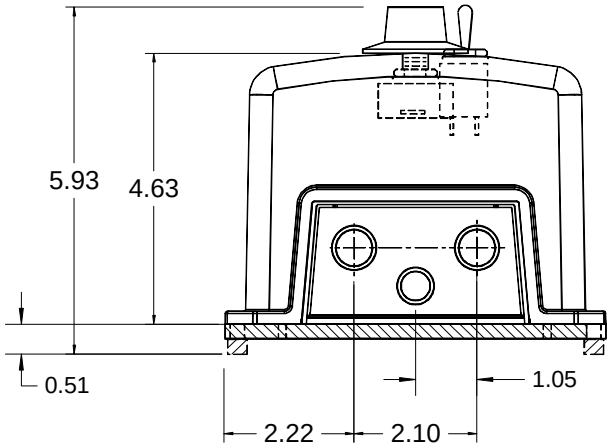
F3N5C

Focus 3 Enclosed Dimensions

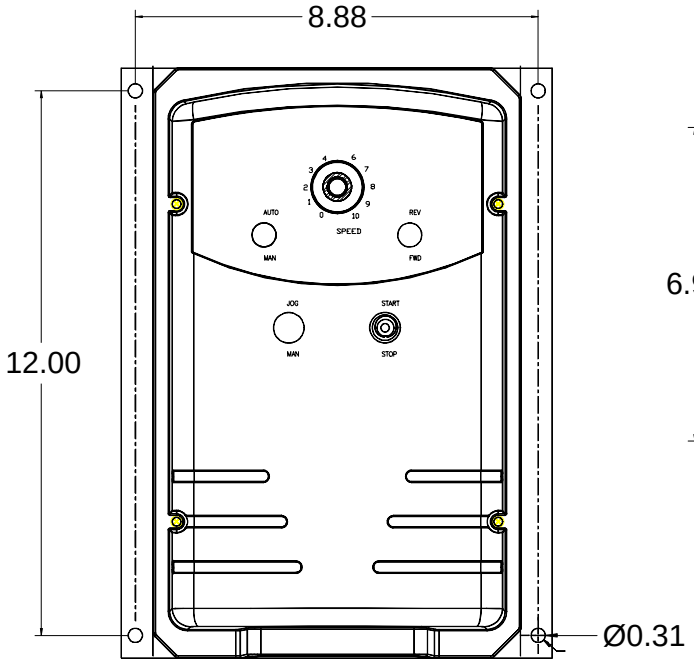
NEMA 4/12

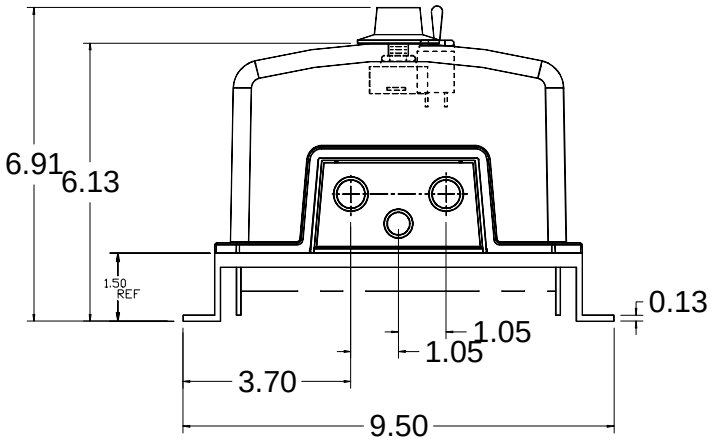
Suitable for most well ventilated factory areas where industrial equipment is installed. Locations subject to steam vapors, oil vapors, flammable or combustible vapors, chemical fumes, and corrosive gases or liquids should be avoided unless an appropriate enclosure has been supplied. Ambient temperature is not to exceed 40^0C.





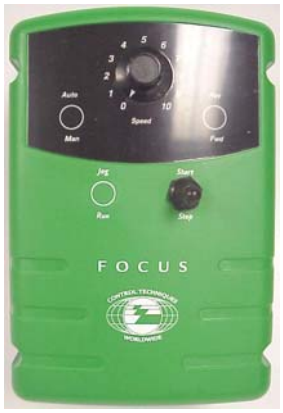
F3N2E





F3N5E

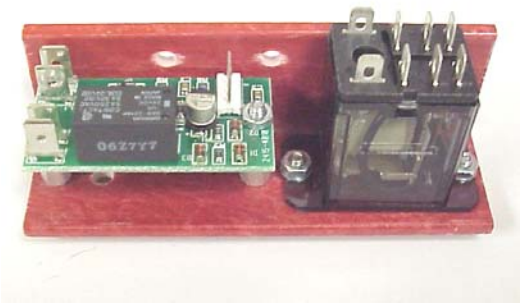
Focus 3 Option Kits



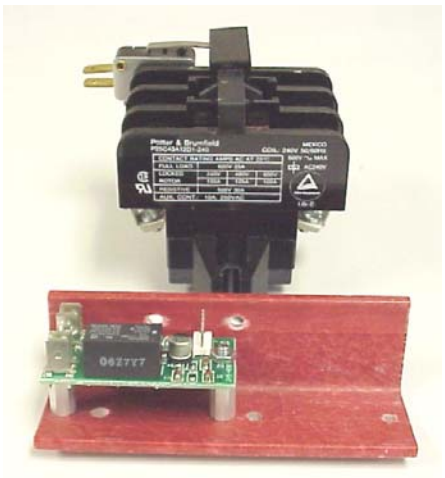
Focus 3 Enclosure Option – F3SE (small) up to 2HP
F3LE (large) 3-5HP

This kit provides the flexibility of stocking only Chassis drives and adding the enclosure when required. It reduces the number of stocked items to 6 (four chassis drives and two covers) as opposed to eight (four enclosed drives and four chassis drives). It includes the speed adjustment potentiometer and the start/stop switch pre-wired to a plug-on terminal strip and all seals to provide a NEMA 4/12-enclosure rating.

Focus 3 Contactor Kit – P/N F3M112 (1 HP,120vac)
P/N F3M224 (2 HP, 240vac)



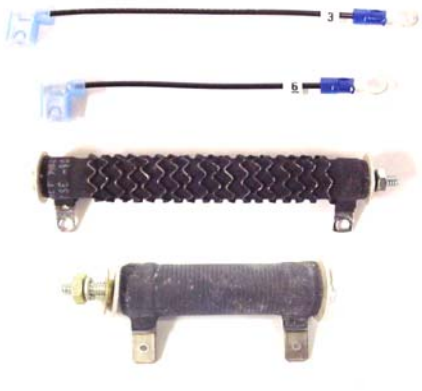
This Kit includes a magnetic contactor that can be mounted either in the Focus 3 enclosed unit or on the chassis mount unit. It provides a positive disconnect of the motor armature when the controller is stopped, preventing motor rotation in the event of SCR mis-fire due to line noise. This kit may also be required by local and/or National Electrical Codes. This kit also includes the DB (dynamic braking) poles, an auxiliary normally open contact and all connection wires.



Focus 3 Contactor Kit– P/N F3M524 (3-5 HP, 240vac)

This Kit includes a magnetic contactor that can be mounted either in the Focus 3 enclosed unit or on the chassis mount unit. It provides a positive disconnect of the motor armature when the controller is stopped, preventing motor rotation in the event of SCR mis-fire due to line noise. This kit may also be required by local and/or National Electrical Codes. This kit also includes the DB (dynamic braking) poles, an auxiliary normally open contact and all connection wires.

Focus 3 Option Kits



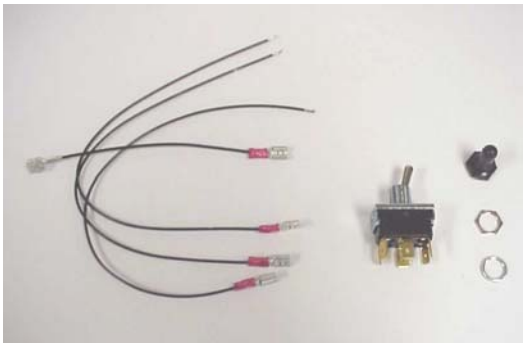
Focus 3 Dynamic Braking Kit
PN– See Table Below

For use with Focus 3 Contactor Kits. Dynamic braking provides rapid motor stopping by quickly dissipating the stored energy in the rotating motor and load. These resistors have been sized in accordance with Nema specifications for dynamic braking.

"Providing 3 stops in rapid succession with the load inertia equal to the motor inertia, then cooling forever."

Note: Large and small dynamic braking resistors shown, ¼-2 HP use small and the 3-5 HP use the large resistor.

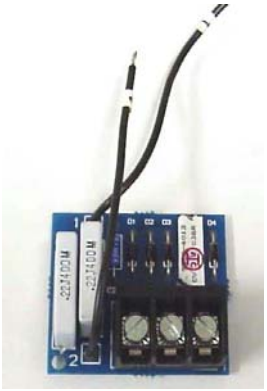
AC Input	HP (Typical)	Part Number
120 Vac	1/4-1/3	F3DB1524
	1/2	F3DB224
	3/4-1	F3DB112
240 Vac	1/2	F3DB0524
	3/4-1	F3DB224
	1.5	F3DB1524
	2	F3DB224
	3	F3DB324
	5	F3DB524



Focus 3 Toggle Switch – P/N F3TS

This kit can be mounted in the drive enclosure cover or remote mounted when used with chassis drives. The kit includes the switch, NEMA 4/12 switch boot and the connection wires for enclosure use. It is used to provide one of the following functions: Fwd/Rev, Run/Jog, or Auto/Manual. Up to 3 of these kits may be used with the Drive cover.

Focus 3 Option Kits



AC Tachometer Input Board – P/N F3ACT

This option kit allows the Focus 3 to accept AC tachometer feedback. It mounts directly to the focus pc board and accommodates a range from 45 to 110vac at maximum speed.

Signal Isolator Board – P/N F3NSBD

This option is used in applications where isolation is required between an external control signal and the motor controller (which may or may not be at earth ground potential). It can be utilized to isolate a variety of voltage or current signals (see specifications below). It may also be used simply to isolate the speed adjustment pot, and the pot power supply is included. This option can be mounted in the enclosure or in a piece of plastic track (included with kit).

Specifications:

Input Power:	17- 30 Vdc @ 50mA Max. (for control circuitry)
Control Relay (CRR):	24 Vdc @ 12.1 mA (JP5 = 24 Vdc) 120 Vac @ 20 mA (JP5 = 120 Vac) Contact Type/Rating – 2 Form A / 1A @ 250 Vac
Isolation Voltage:	240 Vac Power Systems 2000 Vac Hi-Pot for 1 Minute
Inputs:	
Voltage Ranges:	5,12,26,52,98 & 208 Vdc, 180 Ohms/volt
Current Ranges:	0-5 mA, 1-5 mA, 910 Ohms input impedance
	0-20 mA, 4-20 mA, 250 Ohms input impedance
Speed Pot:	5Kohms, 2W (Includes +10 Vdc power supply for potentiometer)
Output:	0 to +10 Vdc (Uni-polar)

Focus Family Options

<u>Remote Operator Station</u> – P/N 2950-9068 /2950-9066

These NEMA 1 operator stations can be used to remotely control Focus 1 and Focus 3 Motor Controllers. Two models are available as shown. Both units include a Speed Potentiometer, a green normally open start button and a red normally closed stop button. The 2450-9068 also includes two two- position switches with two contacts, 1 normally open, 1 normally closed.

<u>Remote Percent Speed Meter</u> – P/N 2450-9024

This meter may be used to remotely display the motor speed in percent of maximum speed. Included is a universal calibration board. The 4 1/2-inch meter is mounted in a NEMA 1 wall mountable steel enclosure.

<u>Remote RPM Speed Meter</u> – P/N 2450-9021

This meter may be used to remotely display the motor RPM (up to 2000rpm). Included is a universal calibration board. The 4-1/2inch meter is mounted in a NEMA 1 wall mountable steel enclosure.

<u>Ten-Turn Precision Speed Potentiometer</u> – P/N 6160-9001

This is a multi-turn speed potentiometer. It provides a vernier scale for precise and repeatable speed setting. A locking tab is provided to prevent in advertent speed changes. It may be mounted in either of the Focus 1 and Focus 3 enclosures or the Remote Operator Station described above.

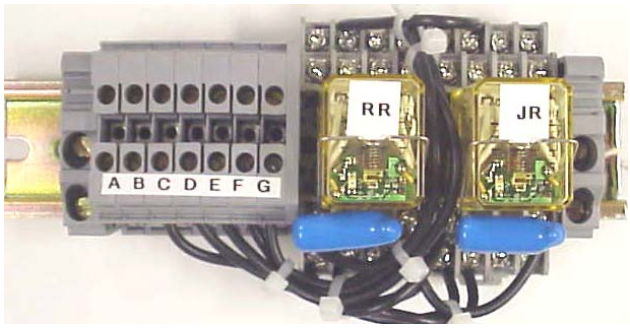
<u>Speed Potentiometer</u> – P/N SpdPot

This potentiometer can be used for either a remote speed command potentiometer or a remote current limit potentiometer.

These options are used with the chassis mount controls and include Din rail for panel mounting in the customer's enclosure.

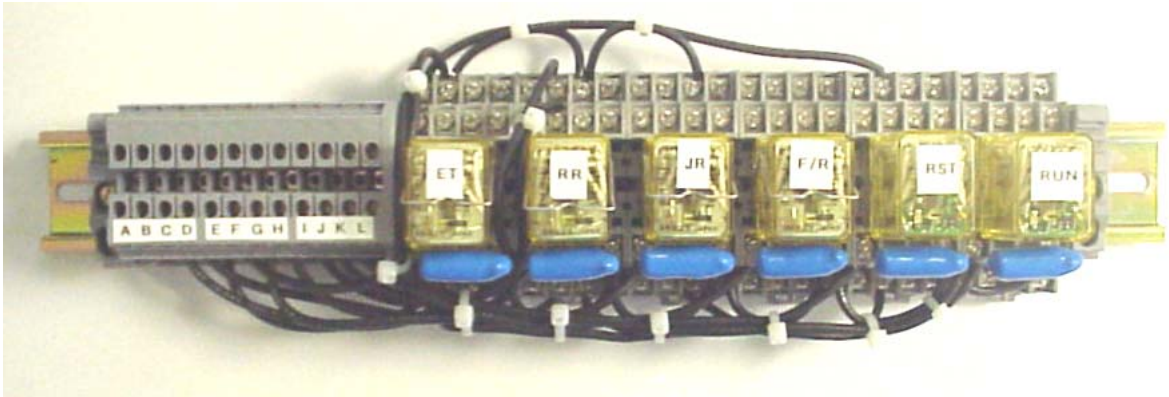
<u>120Vac Interface</u> – P/N ACIF-2R-Focus – Run/Stop & Jog

This kit is available for the Focus series of drives. It is designed to provide a 120-Vac interface for applications requiring remotely mounted industrial operator devices (i.e. Operator Stations shown on previous page).



<u>120Vac Interface</u> – P/N ACIF-6R-Focus – Run/Stop Forward/Reverse, Jog and Auto/Manual

This kit is available for the Focus series of drives. It is designed to provide a 120-Vac interface for applications requiring remotely mounted Industrial operator devices (i.e. Operator Stations shown on previous page).



Customer Connections & Start-Up

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.

Start-up Guidelines

⚠ 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.

⚠ 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.

Incoming Power Requirements

A remote fused AC line disconnects 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 either via mounting screws provided by an enclosure or chassis-installed screw or by using the Earth Ground lug provided on the drive heatsink, for safety of operating personnel. The ground wire should be of the same gauge as the AC Input wires and must be connected to the panel or enclosure frame for personal safety.

Wiring Guidelines for Focus DC Drives

Check drive nameplate data for conformance with AC power source and motor

		AC Input				DC Output			Shunt Field		
Catalog	**HP**	**Fusing**		**Max**	**Wire**	**Armature**	**Armature**	**Wire**	**Field**	**Field**	**Wire**
Part #			**Volts**	**Amps**	**AWG**	**Volts**	**Amps**	**AWG**	**Volts**	**Amps**	**AWG**
F3N2C	¼ -1 ½-2	15 Amp 250Vac	120 240	14 14	#14	90 180	10 10	#14	100 200	1 1	#14
F3N2E	¼ -1 ½-2	15 Amp 250Vac	120 240	14 14	#14	90 180	10 10	#14	100 200	1 1	#14
F3N5C F3N5E	3	40 Amp 500Vac	240	21	#10	180	15	#10	200	1	#14
F3N5C F3N5E	5	40 Amp 500Vac	240	35	#8	180	25	#8	200	1	#14

Notes:

All wiring based on 75° C copper wire, types FEPW, RH, RHW, THHW, THW, THWN, XHHW, USE, ZW

Wire gauge size based on 30° C maximum ambient and no more than three conductors in a raceway or cable and 1.25 service factor.

Please refer to National Electric Code Table 310-16 for additional information.

Wiring must also meet *any* Local Codes.

Do not place knife switches, polarity reversing switches, reversing contacts in the armature or field circuits.

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

Motor Thermal Switch

For Motor Thermostat wiring, see the “Control Wiring” section.

Wrong Motor Rotation

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

Exchange Al and A2 output Motor Armature leads.

Or

Exchange Fl and F2 Motor Shunt field leads.

If DC Tachometer Feedback is being used, Tach wires will also need to be swapped.

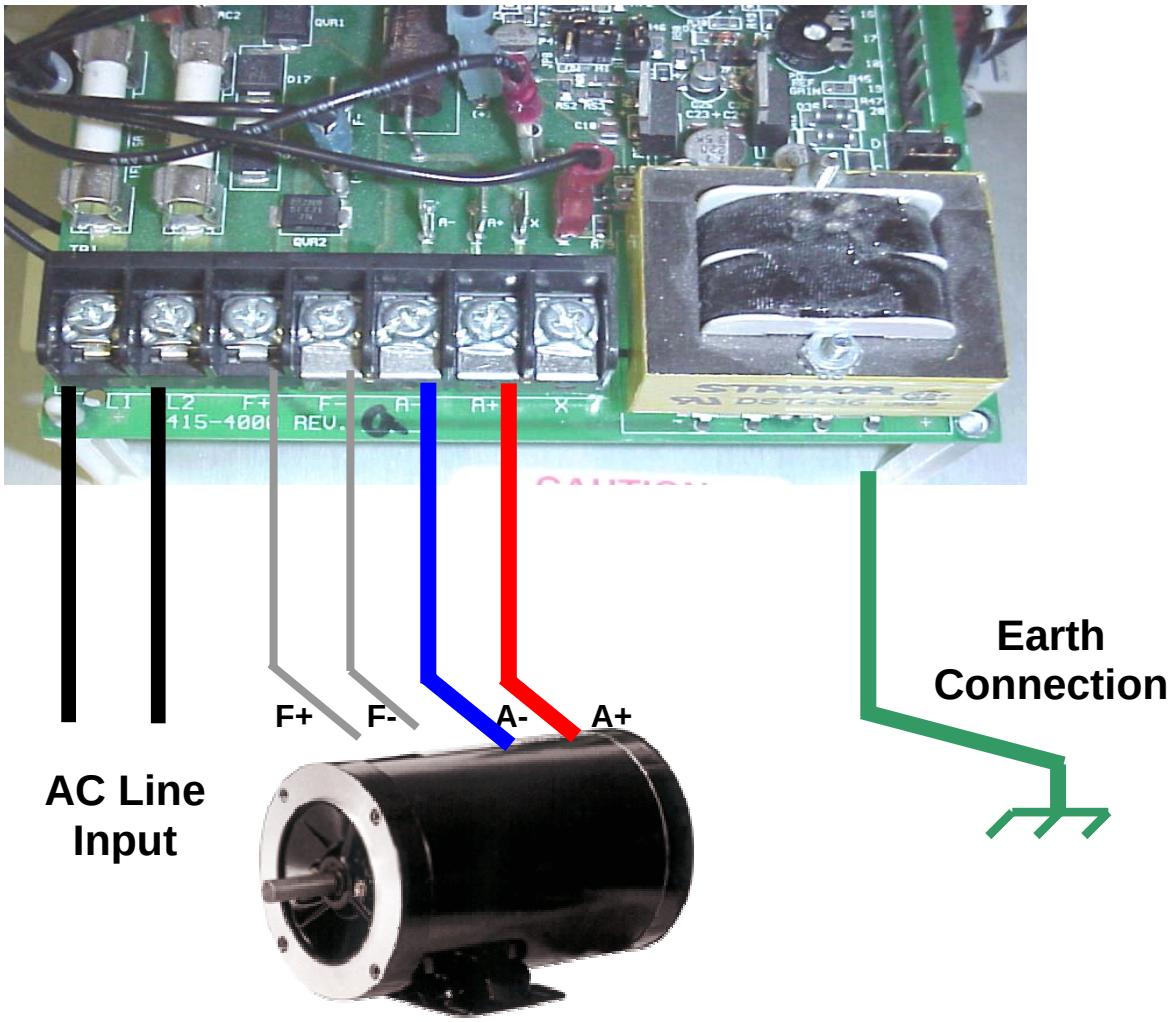
Installation of Option Kits

Do not install option kits until you have verified the basic operation as outlined in the Start-Up section.

Pre-installation of option kits before verification of basic drive operation will make troubleshooting much more difficult. Option kits are often installed incorrectly and one cannot determine if the drive was functional before kits were installed.

Drive Power Wiring

¼ - 2 HP Focus 3 Models
F3N2E & F3N2C

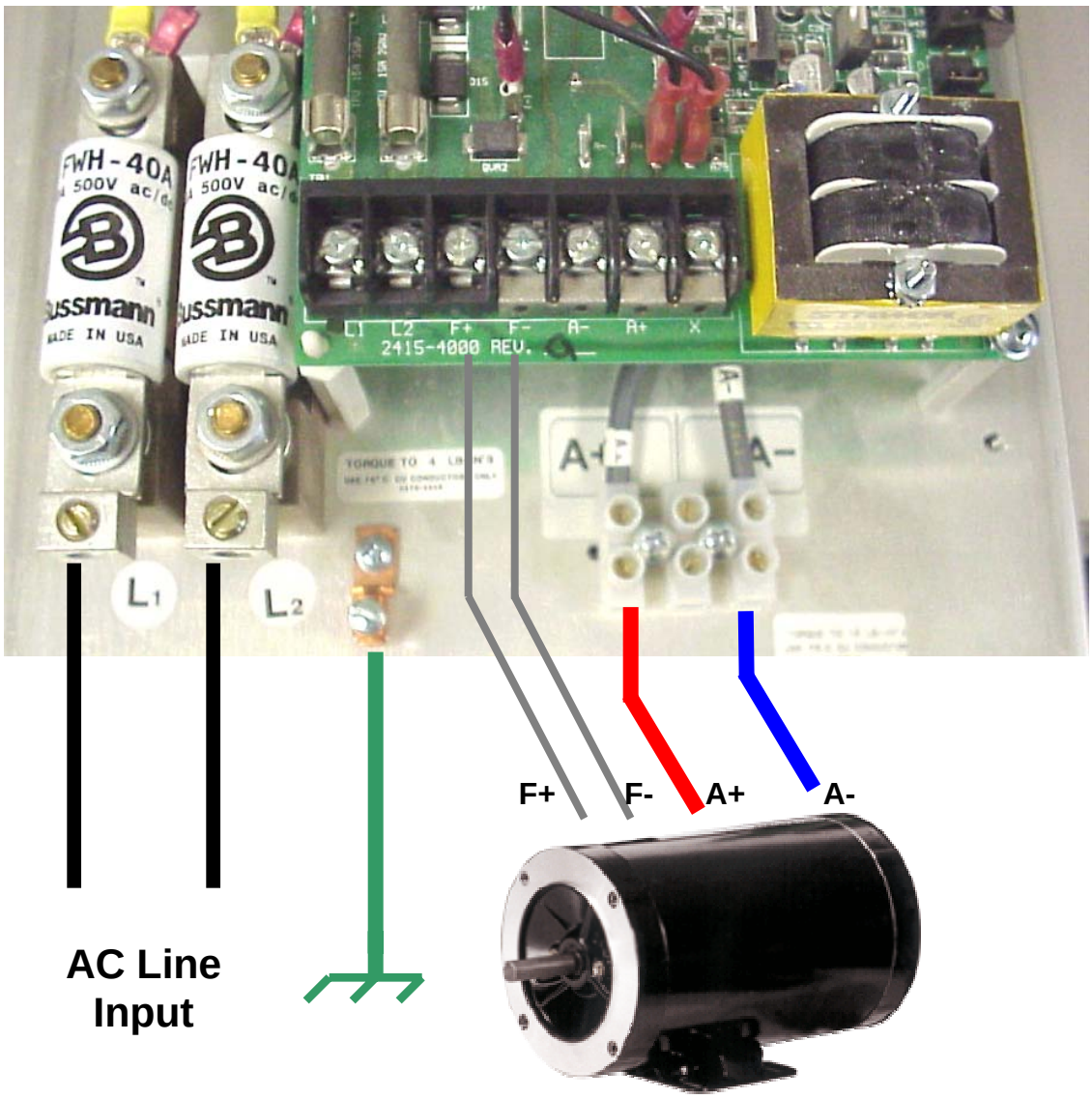


A+ & A- are the motor Armature leads

F+ & F- are a shunt wound motors Field leads (they will not be present on Permanent Magnet or Universal Motors)

Drive Power Wiring

3 - 5 HP Focus 3 Models
F3N5E & F3N5C



A+ & A- are the motor Armature leads

F+ & F- are a shunt wound motors Field leads (they will not be present on Permanent Magnet or Universal Motors)

Control Wiring

TERMINAL CONNECTIONS (TB2) & DESCRIPTIONS

Pin Number

1 **+24 Vdc Supply:** Powers the logic inputs to the drive. It is not intended for it to be used to power external circuits. External use will void warranty.

2 **Tie Point:** It has no internal connections and is used as a tie point for the Motor Thermal or Stop button connection.

3 **Run Input:** When +24 Vdc 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 Output:** Normally Open connection. Rated: 0.5amps @ 120VAC for non-inductive loads. 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:** Relay common connection.

6 **Run Relay Contact:** Normally Closed connection. Rated: 0.5amps @ 120VAC for non-inductive loads.

7 **Jog Input:** When +24 Vdc is applied to this input, the output of the accel / decel circuit is electronically disconnected from the speed loop and the jog speed command (from the jog speed pot) is electronically switched in. This jog speed command 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 30.

8 **Jog Potentiometer Supply voltage input:** This terminal is typically connected to the +10 Vdc (TB2-9) speed pot supply when jog is required.

9 **+10 Vdc Speed pot / Jog supply voltage:** Maximum load is 5ma therefore the recommended Jog Pot value would be 5K ohms

10 **Standard Speed command input:** Typically this input is connected to the wiper of the speed pot wiper. Input impedance: 20Kohm.

11 **Unused**: This terminal is not used with the non-regen F3N drives.

TERMINAL CONNECTIONS (TB2) & DESCRIPTIONS

12 **Drive Signal Common Connection:** Drive circuit common connection. **Never connect this terminal to Earth Ground**. 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**.

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) may be used – see **Accessories/Options**

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 5Kohm potentiometer should be used, see **Accessories/Options** Note: Counter clockwise connection and shield should be connected to terminal TB2 pin 12.

16 **Auto/Manual Input:** When +24 Vdc is applied to this terminal, the speed command input to the accel/decel circuit is switched from the standard speed pot input to the follower (current or voltage) speed command derived from terminal TB2- pins 17 or 18. If the current/voltage follower is the only signal used, terminals TB2- pins 2 & 16 must be jumpered.

Note: The Current (TB2 pin 17) or Voltage (TB2 pin 18) source input to drive must be isolated from earth ground. If it is not or if uncertain, an isolator (such as Signal Isolator Board P/N 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 pins 12 or 20.

17 **Current Signal Follower Input:** positive input for external mA current source. Input impedance: 100 ohms. Range: 1-5mA or 4-20 mA

18 **Voltage Signal Follower Input:** positive input for external voltage source. Input impedance: 1 Kohm/volt. Range: 0-200 Vdc.

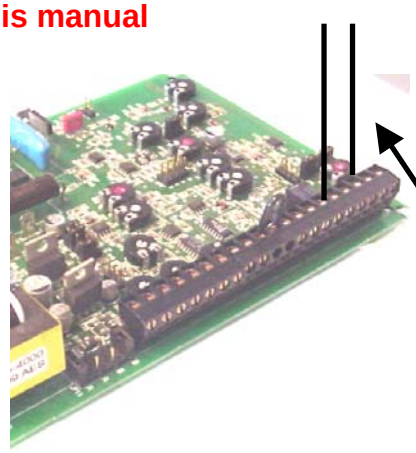
19 **DC Tachometer Input:** negative input from motor mounted DC tachometer. Input impedance: 120 Kohm in the high position and 13.5K ohm in the low position. Range at maximum speed: 6.5 to 17.4 Vdc in the low position and 60 –160 Vdc in the high position. Note: virtually any tachometer voltage can be used with the addition of an external resistor in series with the tach lead (consult factory it required).

20 **DC Tachometer Input:** positive input from motor mounted DC tachometer. Note: Cable shield should also be connected to this terminal.

⚠ CAUTION

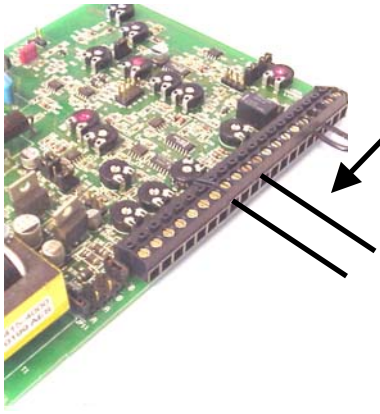
The F3N drive control circuitry is not isolated *. No points in the control circuitry, including common, should be connected to earth ground unless specifically shown on the supplied wiring diagrams. No grounding connections should be made on the terminal block. Improper connections to ground, including speed potentiometer connections, will result in immediate control failure and will void the factory warranty.

*** See How to Achieve Isolation on page 68 of this manual**

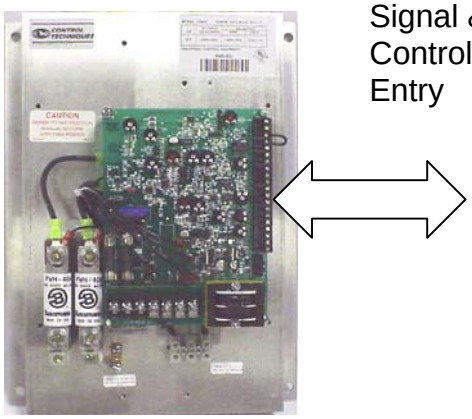


Enclosed Units Wire Entry

Chassis Units Wire Entry



Signal & Control Wiring Entry



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 (90^0 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.***

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

NOTE:

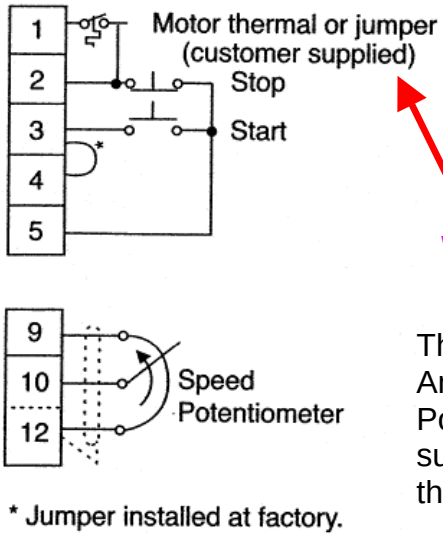
Shielded wire (2 or 3 conductor) is recommended for speed command and other signal wire connections. Shields should be taped off at the remote end. At the drive, connect shields to the circuit common, route wire away from high current lines (i.e. AC lines and armature wiring).

Recommended Cables and pots are available from :
Control Techniques Service Center
@ 1-800-367-8067

Terminal Strip Connections

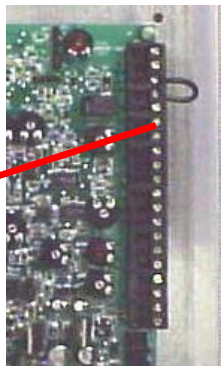
Enclosed Model

Standard Start / Stop & Speed Potentiometer Connections



The Start/Stop Switch And the Speed Potentiometer are supplied as shown on the drive cover

Chassis Model



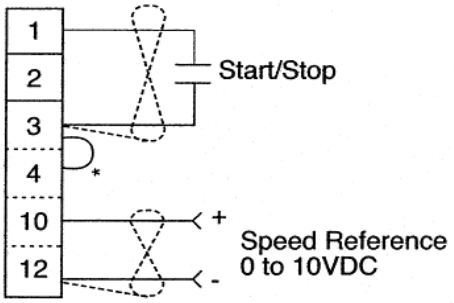
The Chassis Model has no operator devices connected to the drive control terminal strip. The only connections made are connections from terminal #3 to #4 which is required for three wire Start/Stop controls.

The Speed Potentiometer is supplied “loose” with the drive.

The next three pages show various configurations of operator control devices and speed (or current) adjustment potentiometers. These can be used on Chassis models, which is typically the case, or the Enclosed models, which would require possible enclosure and internal wiring changes. The two wire configuration (top of next page) is commonly used for remote contol of the drive (i.e. PLC control). These connections must be isolated from earth ground.

Optional Terminal Strip Connections

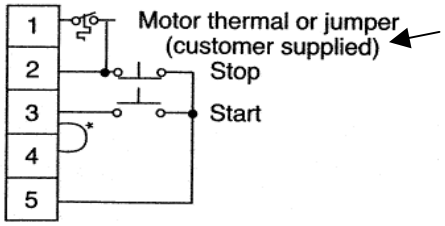
Note: It is strongly recommended that all remote control connections to the drive (i.e. speed pot, start / stop etc.) are wired with shielded cable for noise immumity. These are all low voltage signals. No connections are to be tied to earth ground.



* Jumper installed at factory.

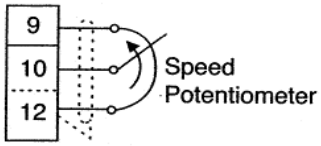
Two Wire ON / OFF

with remote 0 to +10Vdc Speed command (this signal must be isolated !)



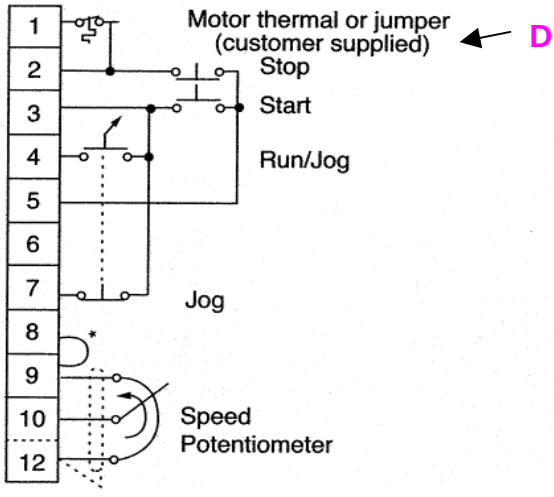
Drive will not Start without this!

Three Wire Start / Stop



* Jumper installed at factory.

With Uni-polar Speed Potentiometer (DO NOT Connect Shield to Earth Ground !)



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

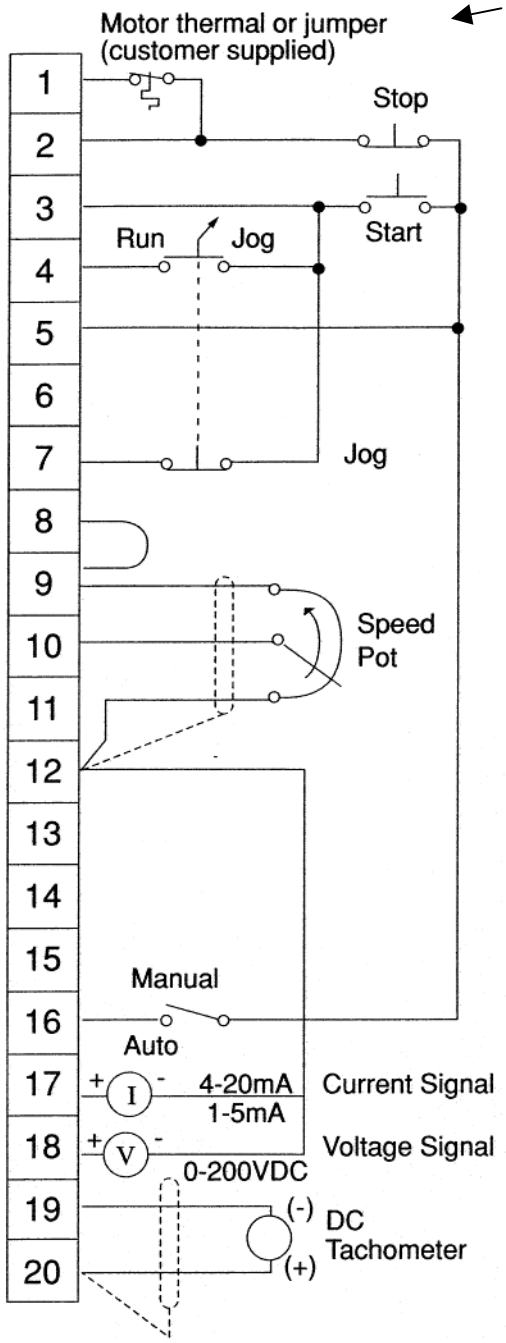
Drive will not Start without this!

Three Wire Start / Stop with Run / Jog Selector Switch

With Uni-polar Speed Potentiometer (DO NOT Connect Shield to Earth Ground !)

Typical Terminal Strip Connections

Note: It is strongly recommended that all remote control connections to the drive (i.e. speed pot, start / stop etc.) are wired with shielded cable for noise immumity. These are all low voltage signals. No connections are to be tied to earth ground.



Drive will not Start without this!

Three Wire Start / Stop
with Run / Jog Selector Switch

With Uni-polar Speed Potentiometer
(DO NOT Connect Shield to Earth Ground !)

With
Manual / Auto Speed command Selector Switch
(Manual – Speed Pot)
(Auto – Either Current Signal
or
Voltage Signal)

With
DC Tachometer Feedback

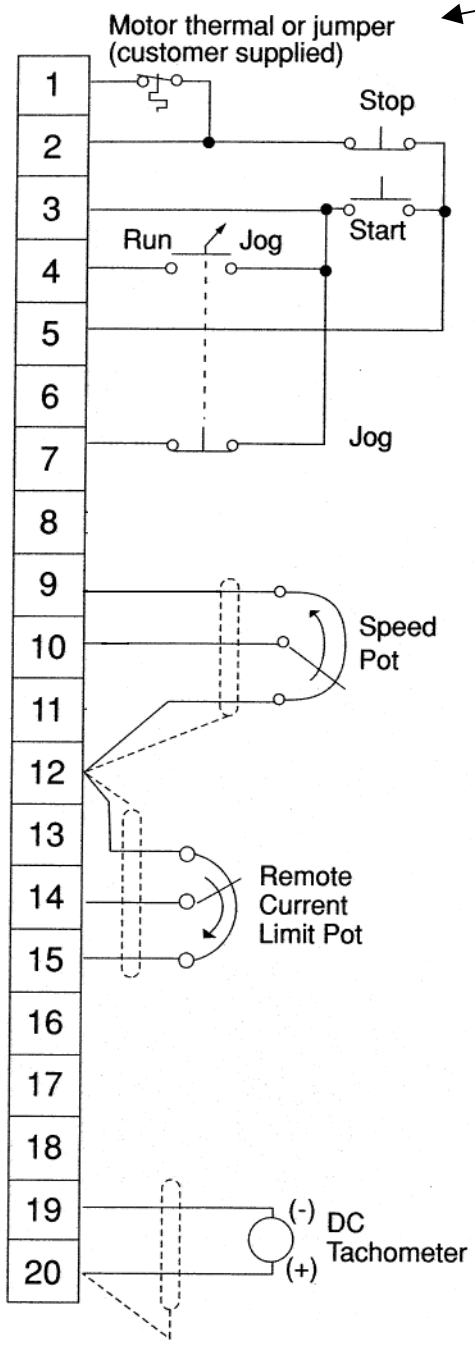
DO NOT Connect Shield to Earth Ground !

Shielded cable should be 3 conductor with overall shield w/pot end tied off and dressed.
Cable and pots are available from Control Techniques Service Center @ 1-800-367-8067

Cable P/N 3CONCBL-XXX (XXX in feet)

Typical Terminal Strip Connections

Note: It is strongly recommended that all remote control connections to the drive (i.e. speed pot, start / stop etc.) are wired with shielded cable for noise immumity. These are all low voltage signals. No connections are to be tied to earth ground.



Drive will not Start without this !

Three Wire Start / Stop
With Run / Jog Selector Switch

With
Uni-polar Speed Potentiometer

(DO NOT Connect Shields to Earth Ground !)

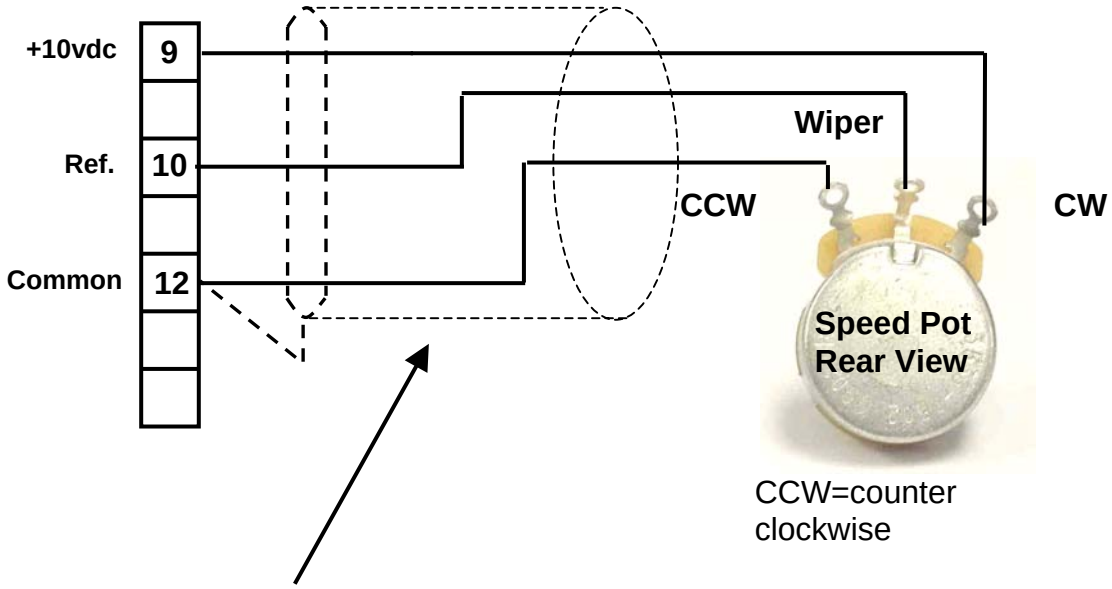
With
Remote Current Limit Potentiometer
This potentiometer is available from Control Techniques; see accessories section, page 20

With
DC Tachometer Feedback

DO NOT Connect Shield to Earth Ground !

Shielded cable should be 3 conductor with overall shield w/pot end tied off and dressed.
Cable and pots are available from:
Control Techniques Service Center @ 1-800-367-8067
Cable P/N 3CONCBL-XXX (XXX in feet)

Standard Unipolar Speed Potentiometer Wiring



CCW=counter clockwise

Cable should be 3 conductor with overall shield w/pot end tied off and dressed. Cable and pots are available from:
Control Techniques Service Center @ 1-800-367-8067

Cable P/N 3CONCBL-XXX (XXX in feet)

Speed Potentiometer P/N **SpdPot**

⚠WARNING

Do Not Connect shield to Earth. This will result in permanent damage to the Drive and **will not be covered** under WARRANTY

Customer Jumper Selections

Jumper Programming

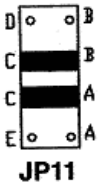
⚠WARNING

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.

See page 36 for jumper locations

JUMPER	DESCRIPTION	RANGE	FACTORY SETTING
JP1	Optional "M" Contactor Sequencing Module	Yes or No (**NO JUMPER**)	**No Contactor**
JP2*	Speed or Current Control Mode (see next page)	**Speed** or Current (**SPD**) (CUR)	**Speed**
JP3	Tachometer Feedback Range (at max. speed)	Low (6.5-17.4 Vdc) or **HI (60-160 Vdc)**	**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 (90 Vdc) or **HI (180 Vdc)**	**HI (180 Vdc)**
JP9	Current Feedback Range	**A** thru D (see next page)	**A**
JP10	Line Frequency Selector	50 or **60Hz** (w/ jumper)	**60Hz**
JP11	Input Voltage Selector	120 or **240Vac** (see Table below)	**240Vac**

Input Line Voltage	JP11 Jumper Positions
120Vac	A to E and B to D
240Vac	**A to C** and **B to C**



JP11

Items in **BOLD RED** are factory set positions

Current Feedback Range (JP9)

FOCUS Catalog Number	DC Output Current (Amps)	JP9 Jumper Position
(1/4 – 2 HP) F3N2C F3N2E	2.7	No Jumper
	5.5	A
	6.4	B
	7.5	C
	10	**D**
(3 – 5 HP) F3N5C F3N5E	6.6	No Jumper
	13.8	A
	16	B
	18.75	C
	25	**D**

Current Control Mode

Focus 3 Drives can be configured to operate in the Current Control Mode which is often referred to as making the drive a "**Current Regulator**". Since motor torque is directly proportional to the armature current, a drive configured as a Current Regulator is often referred to as a "**Torque Regulator**".

***If using the Focus drive as 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.

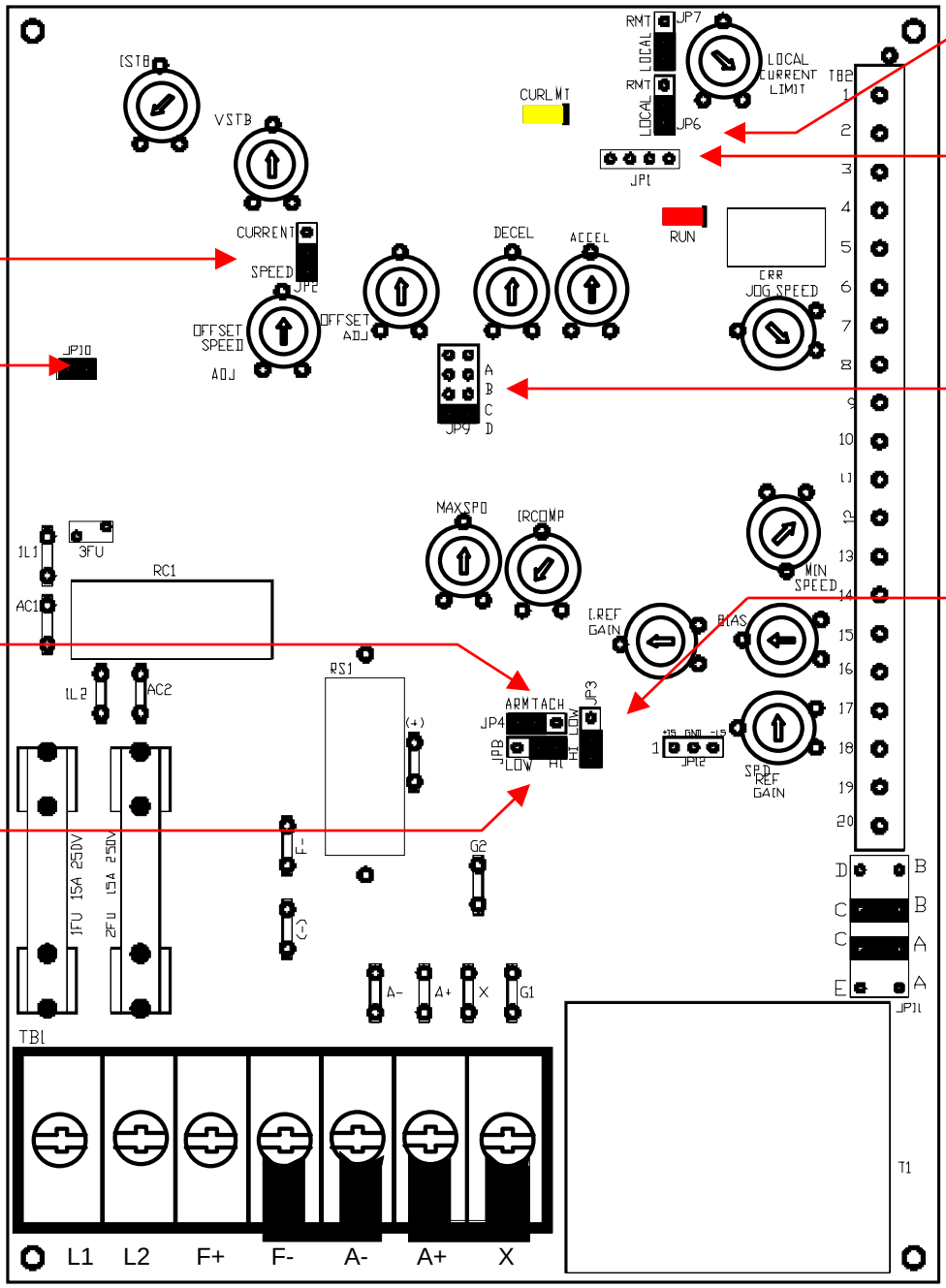
ACCEL and **DECEL** pots: Set to full counterclockwise position.
LOCAL CURRENT LIMIT pot: Set to full clockwise position.

⚠WARNING

In torque control mode, the motor speed is determined by how much load there is on the motor and the torque level set on the drive. If torque in the motor (as set by the Drive) is set to a level higher than what is required to move the load, the motor will accelerate in speed until either the load from the motor increases to the level set by the drive or the drive reaches its maximum output voltage (as set by the line voltage).
In the case of a lightly loaded motor,
the motor could accelerate to almost twice-base speed under these conditions.

In this mode the user be aware of this and MUST PROVIDE OVERSPEED PROTECTION.

Programming Jumper Locations



Regulation Mode Speed / Current
JP2

50 / 60 Hz Operation (in = 60Hz)
JP10

Armature / Tachometer Feedback Selector
JP4

Armature Voltage Range Selector
JP8

Current Limit Pot selection Local or Remote
JP6 / JP7

Optional Motor Contactor control connection
JP1

Maximum Output Current Selection
JP9

Tachometer Feedback Range Selector
JP3

JP11
AC Input Range Selection

Jumper Programming

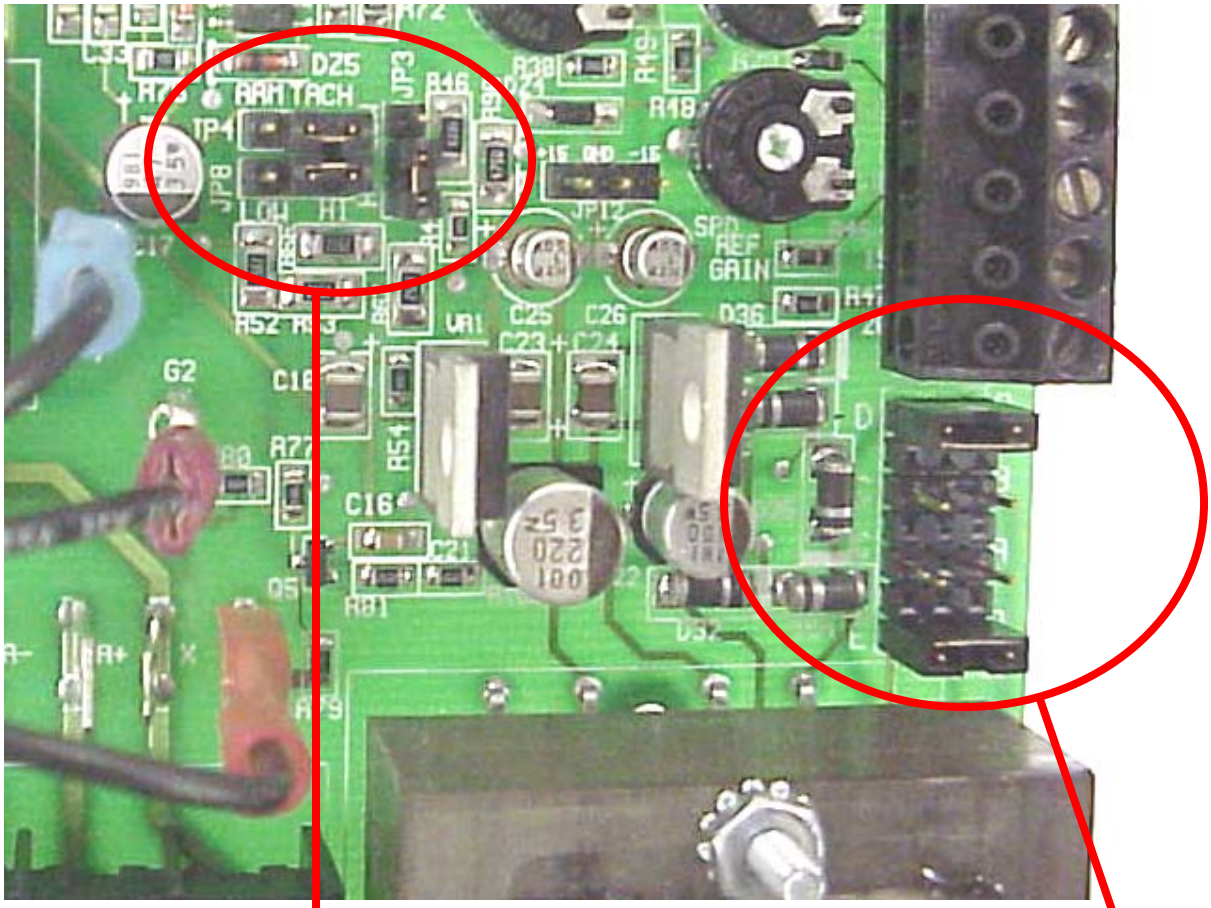


Photo shown jumpered for 120Vac input

JP3-Tach Feedback Range

Lo - 6.5 to 17.4 Vdc
Hi - 60 to 160 Vdc

JP4 -------- Feedback Selector

Tachometer (Tach)
Armature (Arm)

JP8 --------- Armature Voltage

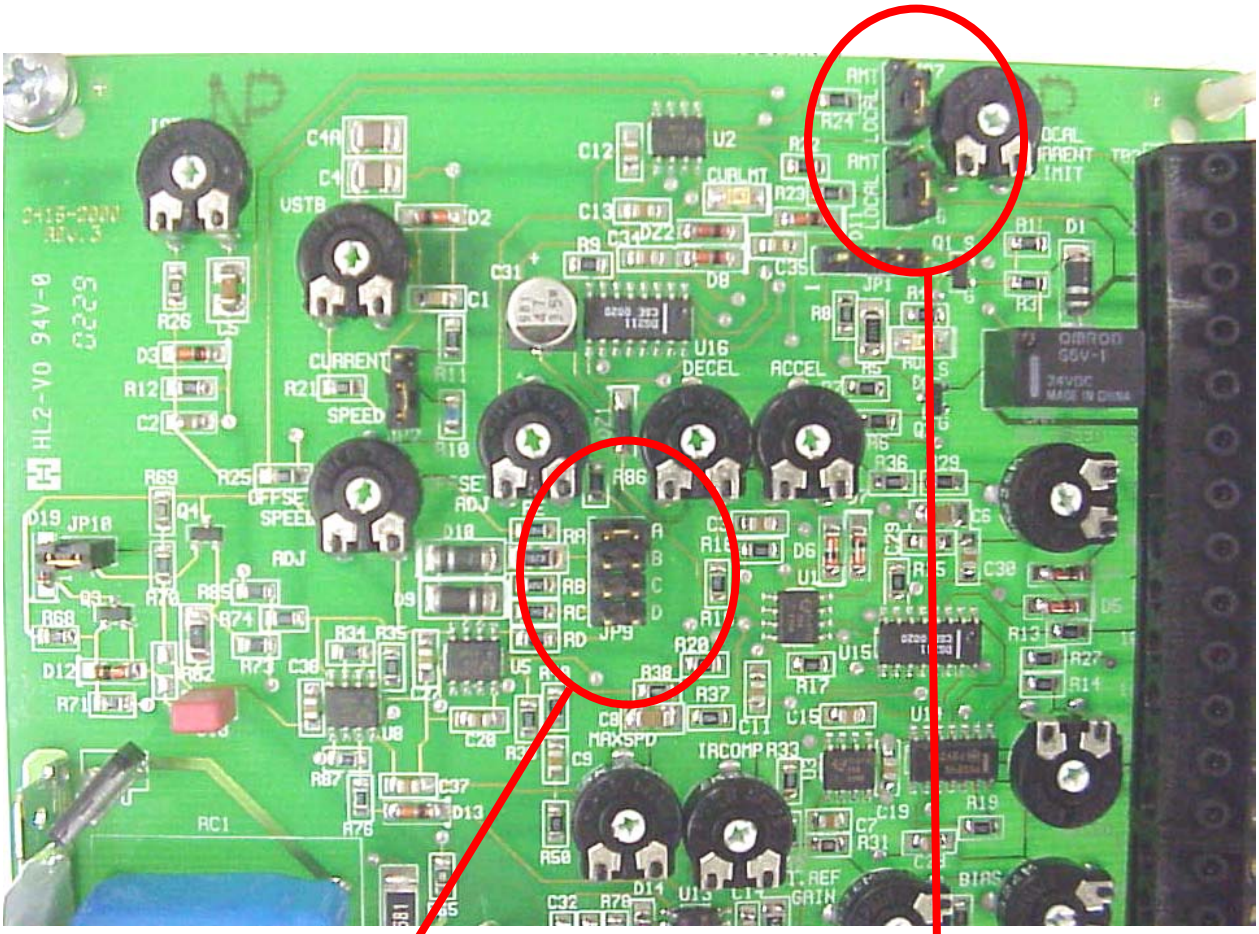
90 Vdc
180 Vdc

JP11 ---- Input Voltage

120 Vac A to E
&
B to D

240 Vac A to C
&
B to C

Bold Fonts indicate Factory Settings



JP9 -- Max Output Current
(100%)

Removed - 2.7 A
A – 5.5 A
B – 6.4 A
C – 7.5 A
D – 10A

Select based on Armature requirements

JP6 & JP7 --- Remote Current Limit
Pot Select

Local – Uses Current Limit pot on Control Board

Remote – Uses remote Current limit Potentiometer

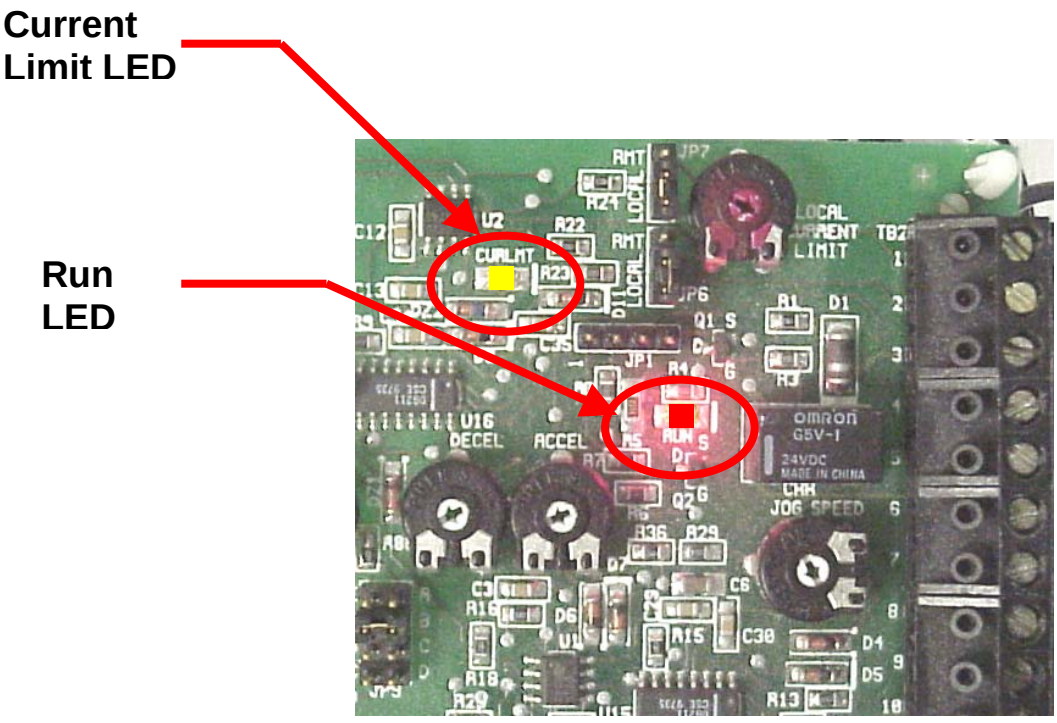
Bold Fonts indicate Factory Settings

LED Status Indicators

Run LED – This red led will illuminate any time the run relay is energised

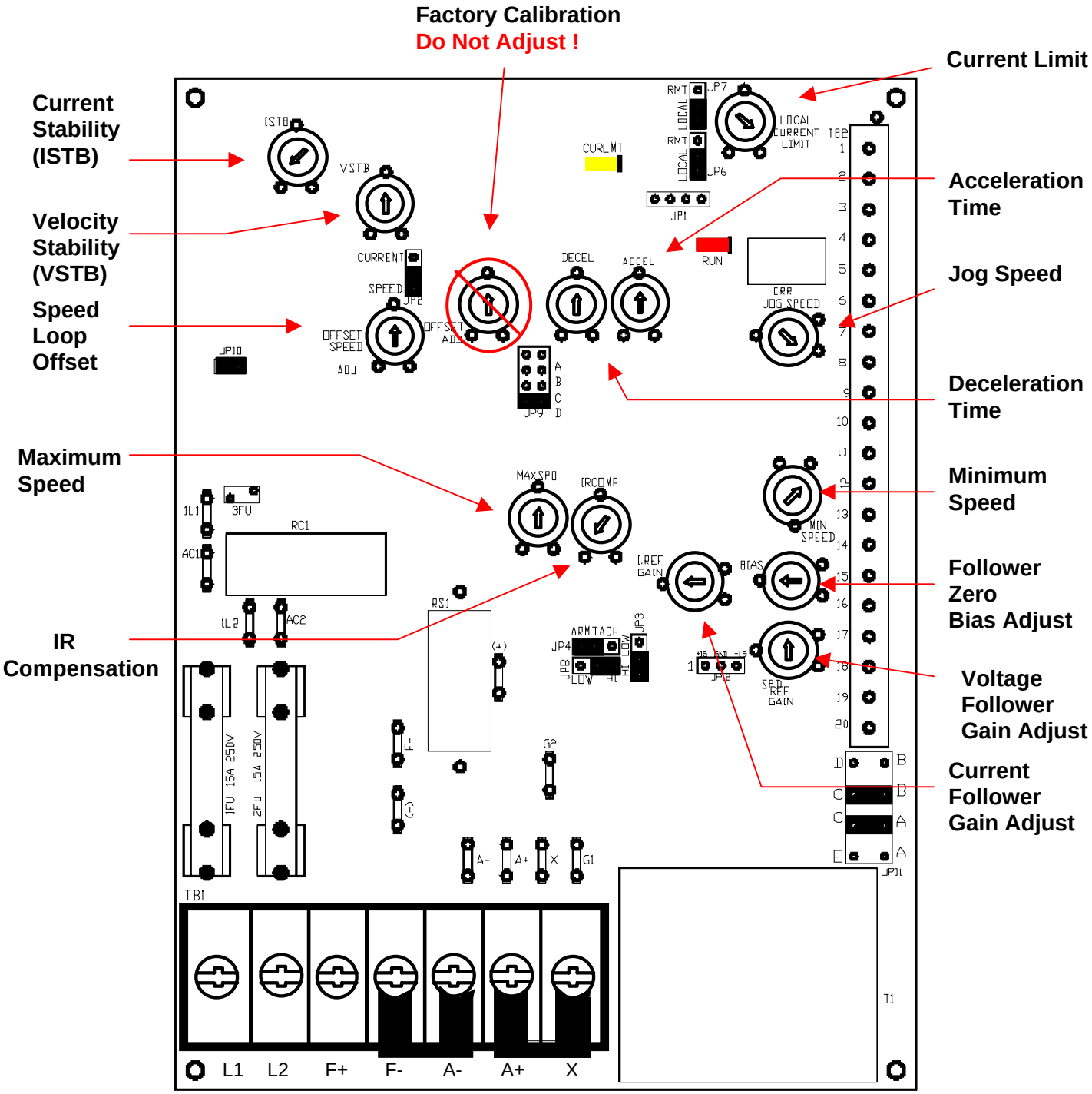
Curr Lmt (Current Limit) **LED** – This yellow led will illuminate any time one of the three conditions are met:

1. The drive is at the maximum output current as set by the current limit potentiometer and the selected position of JP9
2. The motor is at the maximum output voltage as possible based on the supply voltage.
3. The motor armature is open circuit (no motor connected)



Internal Adjustments / Potentiometers

Jumpers and pots shown in Factory positions



Basic Customer Adjustments

Maximum Speed (MAX SPD)

The MAX SPD pot sets the maximum motor speed (80-120% 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 while monitoring actual motor RPM or by measuring the Armature Voltage on A+ & A-. Then, adjust the MAX SPD pot on the control board to set the desired maximum motor speed. Do not exceed the motors Armature Voltage nameplate rating.

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.

Acceleration and Deceleration Times (ACCEL / DECEL)

Adjust the ACCEL and DECEL pots clockwise to increase the linear acceleration and deceleration times (0.3-30 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: 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.

Jog Speed (JOG SPD)

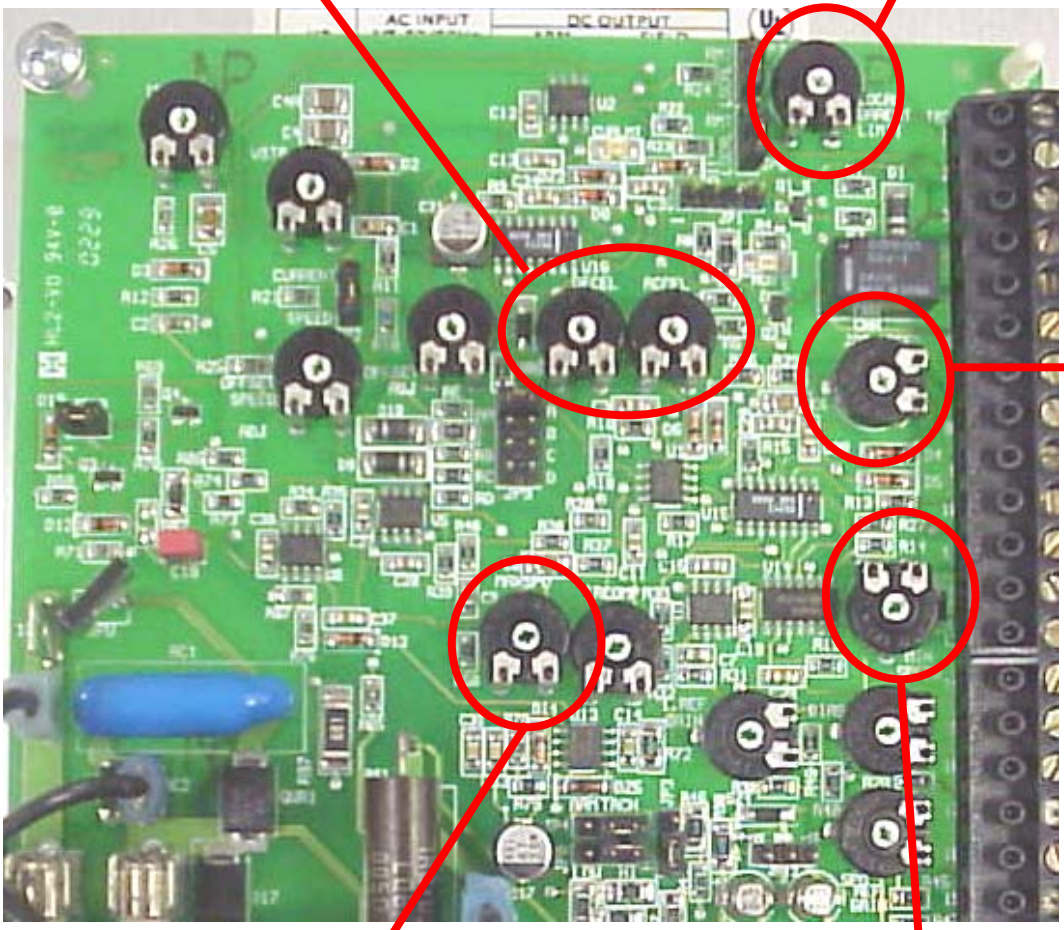
Adjust the JOG SPD pot clockwise to increase the speed (0-30% of full speed reference) at which the motor will run when in jog mode. It is factory preset to its full counterclockwise position.

Basic Customer Adjustments

Acceleration
and
Deceleration
Time adjustments

Local Current Limit

Limits maximum Output Current



JOG SPEED
Sets Jog
Speed

MAX SPD

Adjust for maximum Motor speed

MIN SPD

Adjust for minimum Motor speed

Additional Tuning Adjustments

Internal Resistance Compensation (IR COMP)

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 to recover speed lost during the loaded condition. 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 counter clockwise until the motor speed stabilizes.

If JP4 is set in the TACH position indicated tachometer feedback is being used, turn the IR COMP pot fully counter clockwise otherwise instability will occur.

Note: If the drive is using the voltage or current signal follower, perform these adjustments with the Auto/Manual switch in the Manual position.

Velocity Stability (VEL STAB)

The VEL STAB pot helps 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 command/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.

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 usually adequate for most applications.

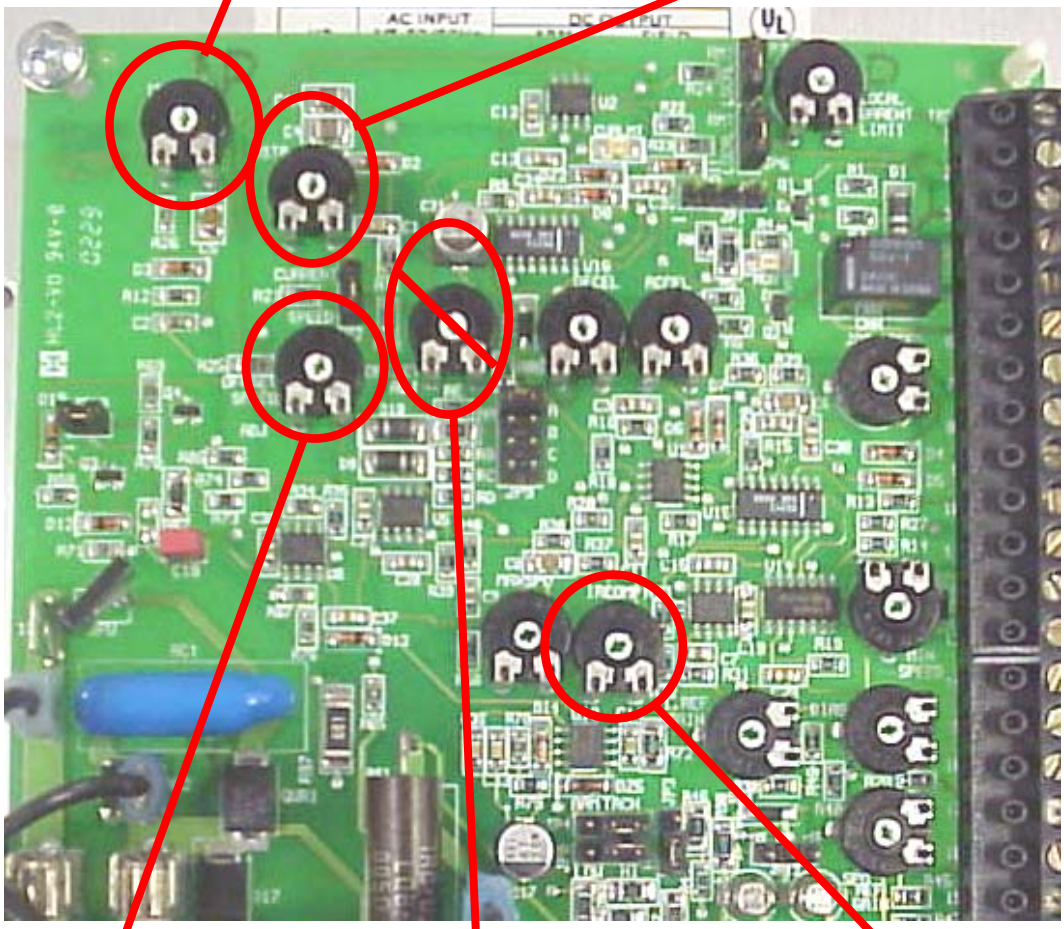
Speed Loop Offset (SPD OFFSET)

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 Spd pot, if used), adjust the SPD OFFSET so any "creep" in the motor speed is eliminated with zero speed command. It is factory preset to its midway position.

Additional Tuning Adjustments

Current Stability
(ISTB)
Adjust for current loop stability

Velocity Stability
(VSTB)
Adjust for speed loop stability



Speed Loop Offset

Adjust for zero creep speed

Factory Adjustment* only**
DO NOT ADJUST

IR Comp

Adjust for motor speed droop due to load

***** See page 74 for re-adjustment procedure.**

Optional Tuning Adjustments

The following adjustments **are only required** when either the current follower input (i.e. 4-20 mA input) or the voltage follower input (i.e. tachometer follower) is used. Only one of these inputs may be used. Terminal #16 must be tied to +24 Vdc (terminal #1) to activate the follower input speed command; typically this selection is made by the **Auto/Manual** selector switch (see page 31) .

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)

Adjust the BIAS pot so the drive is at zero speed when the minimum current signal follower speed command (4-20 or 1 –5 mA) is applied.

If a 4-20mA speed command is required, use the optional signal isolation board *(F3NSBD).*

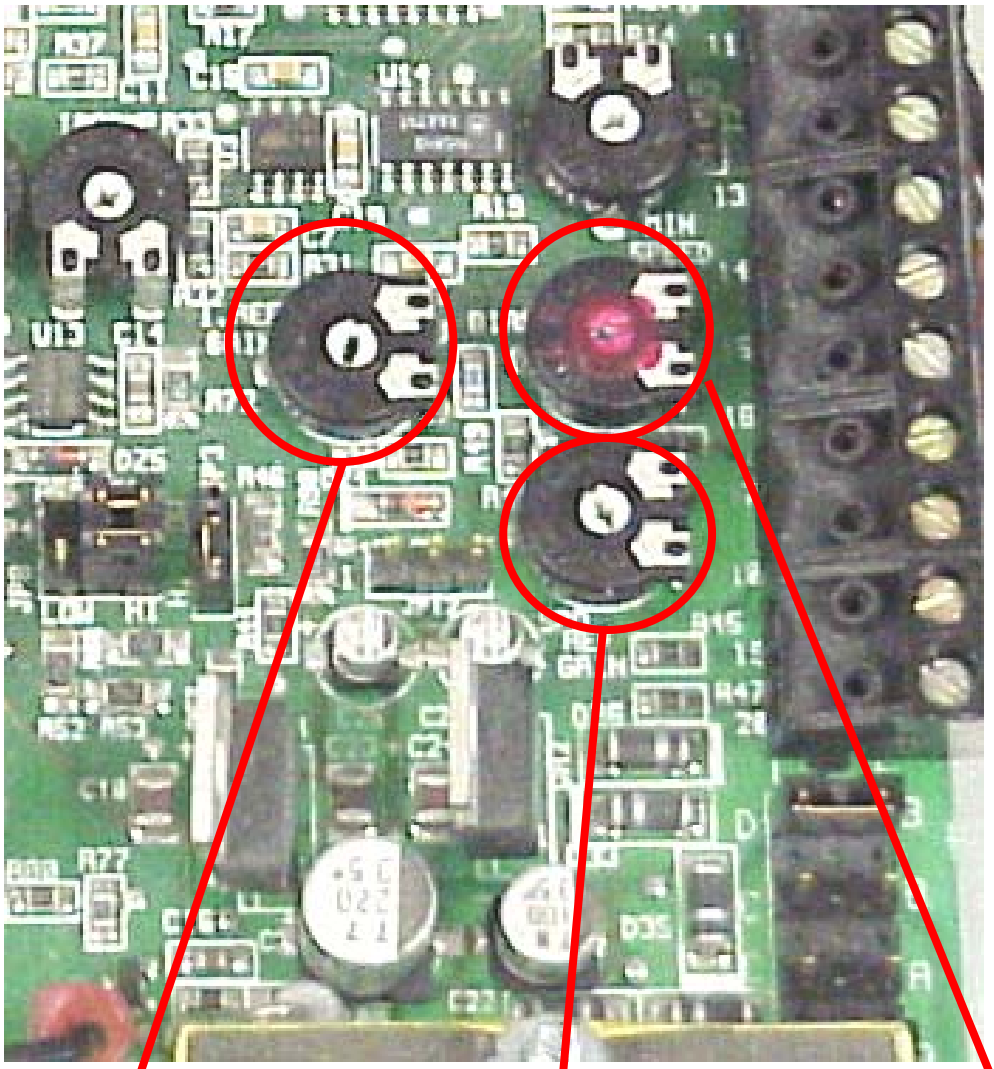
Voltage / Speed Signal Follower Gain (SP REF GAIN)

The SP REF GAIN pot calibrates the User supplied Voltage Signal Follower speed command (0 - 200 Vdc) so the motor reaches its rated voltage/speed when the input 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 speed command (1-5mA or 4-20mA) 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.

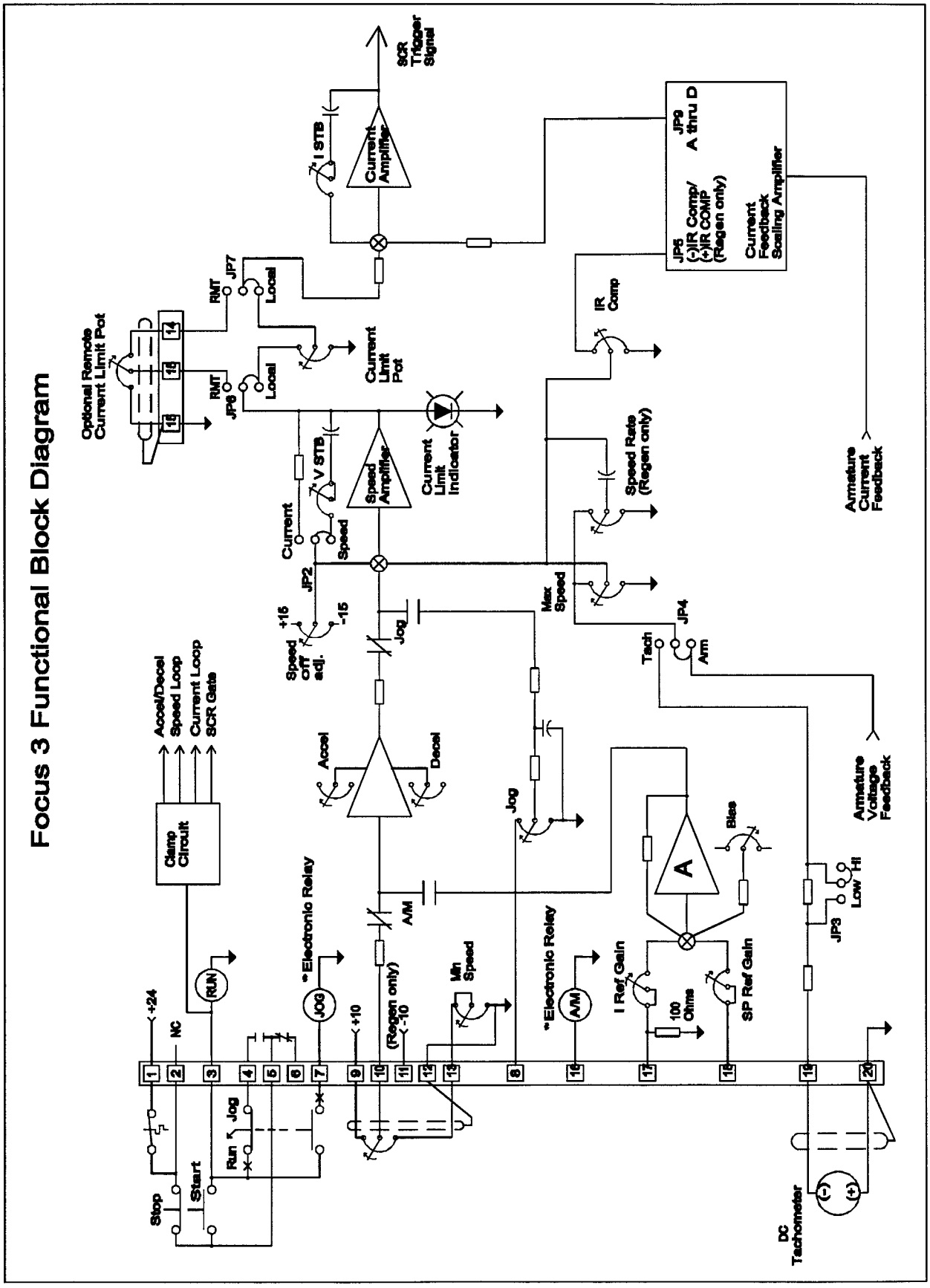
Optional Tuning Adjustments

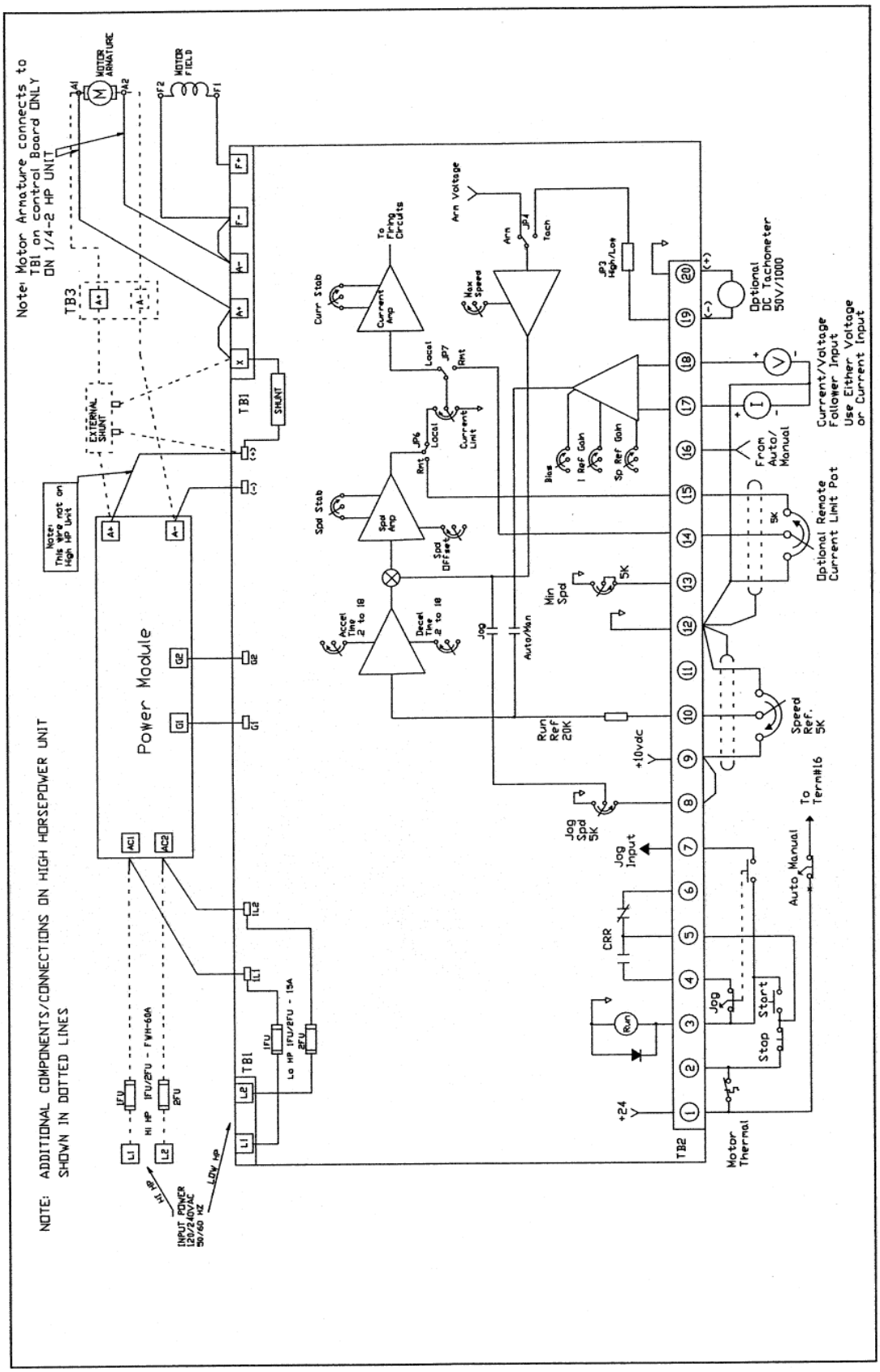


Current Ref Gain

Speed Ref Gain

Zero Bias


Focus 3 Functional Block Diagram
SCR Trigger Signal
I STB
Current Amplifier
JP9 A thru D
JP5 (-)IR Comp/ (+)IR COMP (Regen only)
Current Feedback Scaling Amplifier
RMT
JP7
Local
Optional Remote Current Limit Pot
14
15
16
RMT
JP6
Local
Current Limit Pot
IR Comp
V STB
Speed Amplifier
Current Limit Indicator
Speed Rate (Regen only)
Armature Current Feedback
Current
Speed
JP2
+15
-15
Speed Off adj.
Jog
Max Speed
JP4
Tach
Arm
Accel/Decel
Speed Loop
Current Loop
SCR Gate
Accel
Decel
Clamp Circuit
Jog
Armature Voltage Feedback
A
Bias
*Electronic Relay
A/M
Low
Hi
JP3
RUN
JOG
+10
-10
(Regen only)
Min Speed
*Electronic Relay
A/M
I Ref Gain
100 Ohms
SP Ref Gain
+24
NC
1
2
3
4
5
6
7
8
9
10
11
12
13
8
16
17
18
19
20
Stop
Start
Run
Jog
DC Tachometer
(-)
(+)



Non-Regen: F3N2C, F3N2E, F3N5C, F3N5E

Start-up Guide Worksheet

⚠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.

At this point all INPUT POWER must be OFF !

Obtain the following information:

Focus Drive Model

☐ F3N2C or ☐ F3N2E
☐ F3N5C or ☐ F3N5E

Drive Serial Number_____
Drive Part Number _____

a) **AC Input Line Voltage**
☐ 240 Vac
☐ 120 Vac

b) **Motor Nameplate Information**:
Armature Voltage _____Vdc
Armature Current _____A
Field Voltage _____Vdc
Field Current _____A
Rated RPM _____ rpm

c) **Type of Speed Feedback**
☐ **Armature Voltage** (most common case)
☐ DC Tachometer
☐ AC Tachometer (Option Board Required)

Focus drives come to you factory set for Armature Voltage feedback. Even if your motor is equipped with Tachometer for Speed feedback, **we would strongly suggest** that you first run your motor using Armature Voltage initially. After you have set the motors maximum speed in Armature Voltage feedback, you can check your tachometers output to verify that it producing the correct output before actually using it.

d) **Regulation Mode**
☐ **Speed** (most common case)
☐ Torque

Focus drives come to you factory set for Speed Regulation mode which is the most common case. Even if your application requires Torque control, **we would strongly suggest** that you first run your motor Speed Control initially. After you have verified proper operation in the Speed mode, you could then switch over to Torque mode.

Focus 3 Jumper Setup Worksheet

Refer to the data recorded on the previous page for this worksheet

Refer to your motor nameplate data.

STEP 1 Does your motor have a shunt field winding?
If No go to STEP 5 otherwise go on.

STEP 2 Is your motor field current greater than 1.1A?
If No, go to STEP 3
If Yes **STOP** The Focus 3 Field Supply rectifier will be damaged!!!
Call Tech Support for a solution.

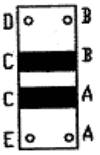
STEP 3 If your motor field voltage is 100 Vdc,
then you must use **120 Vac for Input Power** ----- Set **JP11** as shown
and **Set JP8 to Low**
then go to STEP 7

JP11

If you must use **240 Vac** ----- Call Tech Support for a solution
otherwise go to STEP 4

STEP 4 If your motor field voltage is 200 Vdc,
then you must use **230 Vac for Input Power** ---- Set JP11 as shown
and **Set JP8 to Hi**
then go to STEP 7

otherwise **STOP** ---- Call Tech Support for a solution

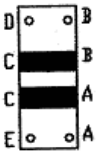


JP11

STEP 5 If your motor armature voltage is greater than 110 Vdc,
then you should use **230 Vac for Input Power** ---- Set JP11 as shown
and **Set JP8 to Hi**
then go to STEP 7

If you must use 120 Vac ---- Call Tech Support for a solution

otherwise go to STEP 7



JP11

STEP 6 If your motor armature voltage is less than 110 Vdc,
then you must use **115 Vac for Input Power** ----- Set JP11 as shown
and **Set JP8 to Lo**
then go to STEP 7

JP11

Armature Current Programming - (JP9) Current Feedback Range

STEP 7

Are you applying a Focus Model F3N2C or F3N2E ? If yes, then **set jumper JP9** to the letter that matches up most closely with your motors Armature Amp rating from the table below:

otherwise go to STEP 7a

FOCUS Catalog Number	DC Output Current (A)	JP9 Jumper Position
(1/4 – 2 HP) F3N2C F3N2E	2.7	No Jumper
	5.5	A
	6.4	B
	7.5	C
	10	D

then go to STEP 8

STEP 7a

Are you applying a Focus Model F3N5C or F3N5E? If yes, then **set jumper JP9** to the letter that matches up most closely with your motors Armature Amp rating from the table below:

otherwise go to STEP 7

FOCUS Catalog Number	DC Output Current (A)	JP9 Jumper Position
(3 – 5 HP) F3N5C F3N5E	6.6	No Jumper
	13.8	A
	16	B
	18.75	C
	25	D

Initial Start-Up

The following procedure is to verify proper operation of the drive in its simplest form as a basic speed regulator with no option kits installed. It is assumed that the drive is in its "*out of box*" condition with respect to jumper programming with the exception of what was just changed in the previous pages, jumper setup worksheet.

Installation of Option Kits

Do not install option kits until you have verified the basic operation as outlined in the Start-Up section.

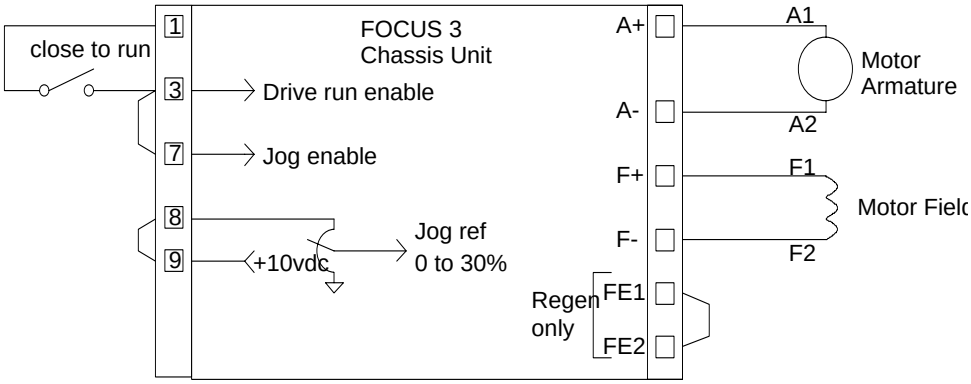
Pre-installation of option kits before verification of basic drive operation will make troubleshooting much more difficult. Option kits are often installed incorrectly and one cannot determine if the drive was functional before kits were installed.

Initial Start-Up con't

A minimal number of connections are made to the terminal strip (see diagrams below). If the drive is an enclosed unit with operator devices (start/stop and speed pot) only the jumper from terminal block TB2-1 to TB2-2 needs to be made.

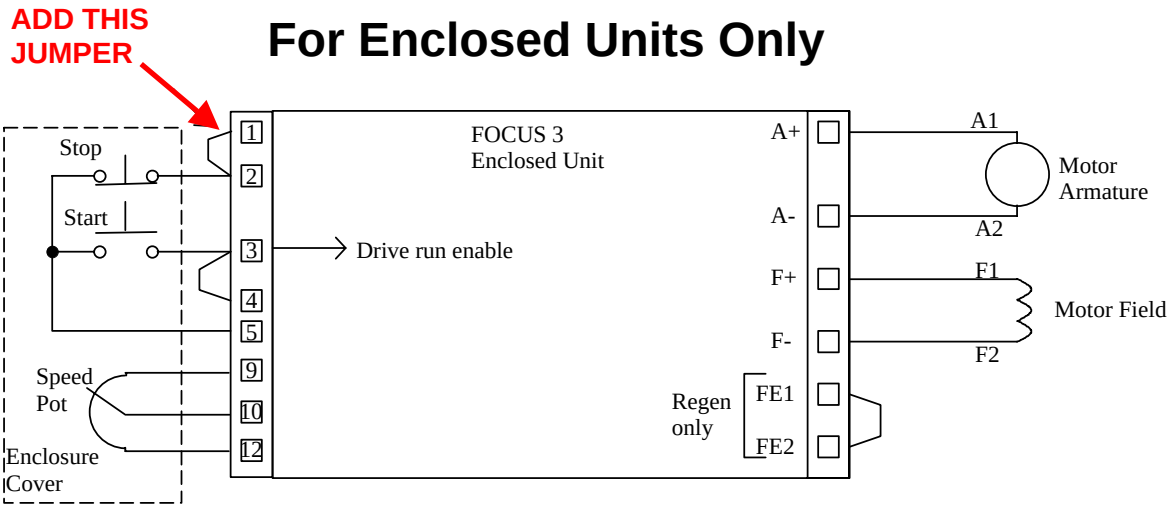
a) Type of Speed Feedback; In this procedure, **leave jumper in armature feedback** (JP4 = ARM).
b) Regulation Mode: In this procedure, **leave jumper in speed regulation** (JP2 = SPD).

For Chassis Units Only



Note: Permanent Magnet Motors do not have Field F1 & F2, connections

For Enclosed Units Only



Initial Start-Up con't

1. Adjust Current Limit Pot labeled LOC ILMT, fully counter-clockwise.
   Adjust Speed pot (enclosed unit) approximately 1/3 turn clockwise (from full CCW position)
   Adjust Jog pot (chassis unit) fully clockwise.

Power can now be Applied !

2. Start drive. Run light (red) and Current limit light (yellow) are illuminated.

3. ***Slowly*** adjust current limit pot clockwise (~1/4 turn) while watching motor shaft. Verify that the motor rotates in the desired direction and that the motor slowly accelerates to about 30% of rated speed (also note that current limit light goes out when motor is running steady). If the motor rotates in the wrong direction, stop drive, ***REMOVE AC POWER*** and then reverse the field leads, F1 and F2.
   Re-apply power and repeat this step.

4. Stop Drive and **Turn off AC Power**.

Basic Setup with Tachometer Feedback

(go to step #8 if NO tachometer)

5. The drive can now be set up for tachometer feedback if required.
   Set JP4 to "Tach" position
   Connect tachometer signal to drive (- to #19, + to #20)
   Set JP8 to "Hi" if the following calculated voltage is in the range 60 to 160 Vdc.
   Set JP8 to "Low" if the following calculated voltage is in the range 6.5 to 17.4 Vdc.
   Tach voltage at max speed = $\frac{\text{tach volts per 1000rpm X max motor rpm}}{1000}$
   If the calculated voltage is NOT in the ranges listed above, consult factory.

   Repeat steps 1 to 2 above then proceed to step 6.

6. ***Slowly*** adjust current limit pot clockwise (~1/4 turn) while watching motor shaft. Verify that the motor rotates in the desired direction and that the motor slowly accelerates to about 30% of rated speed (also note that current limit light goes out when motor is running steady). If the motor continues to accelerate past ~30% speed, tachometer is probably connected backwards. Stop drive, **Turn off *AC POWER*** and then reverse the tachometer leads, re-apply power and repeat this step. Stop Drive and **Turn off AC Power when complete**.

7. Drive can now be set-up for terminal strip connections as required by the particular application. Refer to pages 30-32 for typical **Terminal Strip Connections.**

8. Only do the next Step if the Drive is to be configuration as of Current or Torque Regulator. Otherwise Drive can now be set-up for terminal strip connections as required by the particular application. Refer to pages 30-32 for typical **Terminal Strip Connections.**

Basic Setup for Current (Torque) Regulator

9. If the drive is to be set-up as a Current (torque) Regulator, set jumper JP2 to "CURR" position and JP4 to "TACH" position but **DO NOT** connect a Tachometer.

The standard speed command input (TB2-#10) is now the drive current reference. The accel / decel adjustments on the control board will now control the rate of change of current.

Note that the drive is now controlling motor torque and **NOT** speed, therefore if the current reference is set to a higher level than the torque required by the load, the motor will run to speeds in excess of rated motor speed. In applications where this **over-speed** condition can occur (such as a web break in a simple re-winder) an external over-speed protection device must be added to the system.

Focus 3 Trouble Shooting Guide

IMPORTANT SAFEGUARDS

All work on the drive should be performed by personnel familiar with it and its application. Before performing any maintenance or troubleshooting, read the instructions and consult the system diagrams. Only minor adjustments should be necessary on initial start-up, depending on the application. In addition, some common sense maintenance needs to be followed.

⚠WARNING

MAKE SURE THAT ALL POWER SOURCES HAVE BEEN DISCONNECTED BEFORE MAKING CONNECTIONS OR TOUCHING INTERNAL PARTS. LETHAL VOLTAGES EXIST INSIDE THE CONTROL ANYTIME INPUT POWER IS APPLIED, EVEN IF THE DRIVE IS IN A STOP MODE. A TURNING MOTOR GENERATES VOLTAGE IN THE DRIVE EVEN IF THE AC LINE IS DISCONNECTED. EXERCISE CAUTION WHEN MAKING ADJUSTMENTS WITH THE CONTROL DRIVING A MOTOR. NEVER INSTALL OR REMOVE ANY PC BOARD WITH POWER APPLIED TO THE CONTROL

KEEP IT CLEAN: The control should be kept free of dust, dirt, oil, caustic atmosphere and excessive moisture.

KEEP IT COOL: The control should be located away from machines having a high ambient temperature. On panel mount controls, air flow across heatsinks must not be restricted by other equipment within the enclosure.

KEEP CONNECTIONS TIGHT: The equipment should be kept away from high vibration areas that could loosen connections or cause chafing of wires. All interconnections should be re-tightened at time of initial start-up and at least every six months.

⚠WARNING

THE DC MOTOR MAY BE AT LINE VOLTAGE EVEN WHEN IT IS NOT INOPERATION. THEREFORE, NEVER ATTEMPT TO INSPECT, TOUCH OR REMOVE ANY INTERNAL PART OF THE DC MOTOR (SUCH AS THE BRUSHES) WITHOUT FIRST MAKING SURE THAT ALL AC POWER TO THE CONTROL AS WELL AS THE DC POWER TO THE MOTOR HAS BEEN DISCONNECTED.

The motor should be inspected at regular intervals and the following checks must be made:

A. See that both the inside and outside of the motor are not excessively dirty. This can cause added motor heating, and therefore, can shorten motor life.

B. If a motor blower is used, make sure that the air passages are clean and the impeller is free to rotate. If air filters are used, they should be cleaned at regular intervals or replaced if they are disposable. Any reduction in cooling air will increase motor heating.

C. Inspect the commutator and brushes. Replace the brushes if needed. Make sure that the proper brush grade is used.

D. The motor bearing should be greased per the manufacturer's instructions as to type of grease and maintenance frequency. Over greasing can cause excessive bearing heating and failure. Consult the instructions supplied with the motor for more details.

TROUBLESHOOTING OVERVIEW

Fast and effective troubleshooting requires well-trained personnel supplied with the necessary test instruments as well as a sufficient stock of recommended spare parts. Capable electronic technicians who have received training in the control operation and who are familiar with the application are well qualified to service this equipment.

Suggested Training

A. Study the system instruction manual and control drawings.
B. Obtain practical experience during the system installation and in future servicing.
C. Train in the use of test instruments.

Maintenance Records

lt is strongly recommended that the user keeps records of downtime, symptoms, results of various checks, meter readings, etc. Such records will often help a service engineer locate the problem in the minimum time, should such services be required.

General Troubleshooting

The most frequent causes of drive failure are:

A. Loose or broken wire connections.

B. Circuit grounding within the interconnections or the power wiring.

C. Mechanical failure at the motor.

DO NOT make adjustments or replace components before checking all wiring. Also monitor all LED indicator lights before proceeding with troubleshooting checks, and check for blown fuses.

lt should be noted that modern solid state electronic circuitry is highly reliable. Often problems, which appear to be electrical, are actually mechanical. It is advised that the motor be checked in the event of any drive problems. Refer to the motor owner's manual for maintenance and repair procedures.

Notes for a Troubleshooting Technician

A minimum knowledge of system operation is required, but it is necessary to be able to read the system schematics and connection diagrams.

An oscilloscope may be needed to locate problem areas and to make adjustments. However, the majority of problems can be solved by using a multimeter and by parts substitution.

⚠WARNING

WHEN A TEST INSTRUMENT IS BEING USED, CARE MUST BE TAKEN TO INSURE THAT ITS CHASSIS IS NOT GROUNDED EITHER BY A GROUNDING PLUG CONNECTION OR BY ITS CASE BEING IN CONTACT WITH A GROUNDED SURFACE. EXTREME CARE MUST BE TAKEN WHEN USING THE OSCILLOSCOPE SINCE ITS CHASSIS WILL BE ELECTRICALLY HOT TO GROUND WHEN CONNECTED TO THE CONTROL SYSTEM.

BASIC TROUBLESHOOTING

This paragraph contains a basic list of symptoms of an improperly functioning control. Included in the list are possible causes and corrective measures for each symptom described.

⚠WARNING

BEFORE PROCEEDING WITH ANY MAINTENANCE OR TROUBLE-SHOOTING ACTIVITY, ALL POWER SOURCES MUST BE DISCONNECTED.

CONTROL APPEARS TO BE DEAD:

A. Terminals TB2-1 and –2 on the main PC board not jumpered together - install either a jumper or the Motor Thermostat between these terminals.
B. No AC power - apply AC power and measure L1 and L2 for correct voltage.
C. Blown line fuses - replace line fuses.
D. Loose connections -turn off AC power and tighten connections.
E. Control incorrectly wired - recheck all wiring.
F. Defective Start/Stop switch, component on main PC board, or rectifier cube - replace bad components as required. (See Critical Components)
G. Speed potentiometer set to zero - slowly advance from zero to begin motor rotation.

LINE FUSES BLOW OR MAIN CIRCUIT BREAKER TRIPS WHEN APPLYING AC POWER:

A. Control is wired to AC voltage exceeding control rating -rewire control to proper AC voltage or use step-down transformer.
B. Rectifier cube, field diodes on main PC board, motor winding or suppressor network shorted, or a short to ground is present - locate and remove short.
C. Improper wiring or jumper programming during installation.
D. Defective main PC board component - replace as required. (See Critical Components)
E. Motor shaft jammed - determine cause and correct.
F. Excessive carbon dust from brushes in motor - determine cause and correct.

FUSES BLOW WHEN SPEED POTENTIOMETER IS ADVANCED FROM ZERO:

A. Motor is overloaded - reduce load as required.
B. Motor is defective - consult motor instruction manual and repair or replace motor as required.
C. Current limit adjustment set too high - readjust

ACCEL TIME IS MUCH LONGER THAN EXPECTED:

A. Check Accel pot setting
B Motor overloaded – reduce or remove load and re-check

DECEL TIME IS MUCH LONGER THAN EXPECTED:

A. Check Decel pot setting
B. Motor is being overhauled by another motor in system or by inertia of the machine

MOTOR DOES NOT REACH FULL SPEED:

A. Motor is overloaded - correct overload condition.
B. Maximum Speed potentiometer (MAX) is set too low -adjust MAX potentiometer clockwise.
C. Low AC line voltage (more than 10% below nominal) -check AC line voltage and correct.
D. Current limit set too low – re-adjust.
E. Incorrect jumper programming of JP9 - follow programming procedure
F. Defective rectifier cube - replace as required. (See Critical Components)
G. Motor brushes worn - replace as specified in motor instruction manual.

MOTOR RUNS IN WRONG DIRECTION:

A. The Al and A2 output leads to the motor are incorrectly wired - exchange these leads.

B. On shunt wound motors only the shunt field Fl and F2 leads are incorrectly wired – exchange these leads.

MOTOR DOES NOT MAINTAIN SPEED UNDER LOAD:

A. IRCOMP potentiometer is set too low - adjust clockwise

H. Motor is overloaded - correct overload condition.

I. Incorrect jumper programming – check jumpers.

J. Defective component on main PC board – replace (See Critical Components)

K. Current limit set too low – readjust.

L. Motor brushes worn - replace as specified in motor instruction manual.

MOTOR DOES NOT COME TO FULL STOP:

A. Minimum Speed potentiometer (MIN) is set too high -readjust

B. Defective speed or torque potentiometer, component on regulator PC board, Start/Stop switch, or rectifier cube -replace as required. (See Critical Components)

NO SPEED CONTROL:

M. Defective rectifier cube - replace as required (See Critical Components)

N. Defective component on main PC board - replace as required. (See Critical Components)

O. Incorrectly wired or defective speed potentiometer - check the wiring.

P. Incorrect jumper programming - check jumper programming.

Q. If the control (after rechecking all the wiring for proper and secure connections) is still inoperative, make the following voltage checks. Double check to make sure that armature leads Al and A2 are not grounded.

F. High resistance ground on motor armature

VOLTAGE CHECK CHART

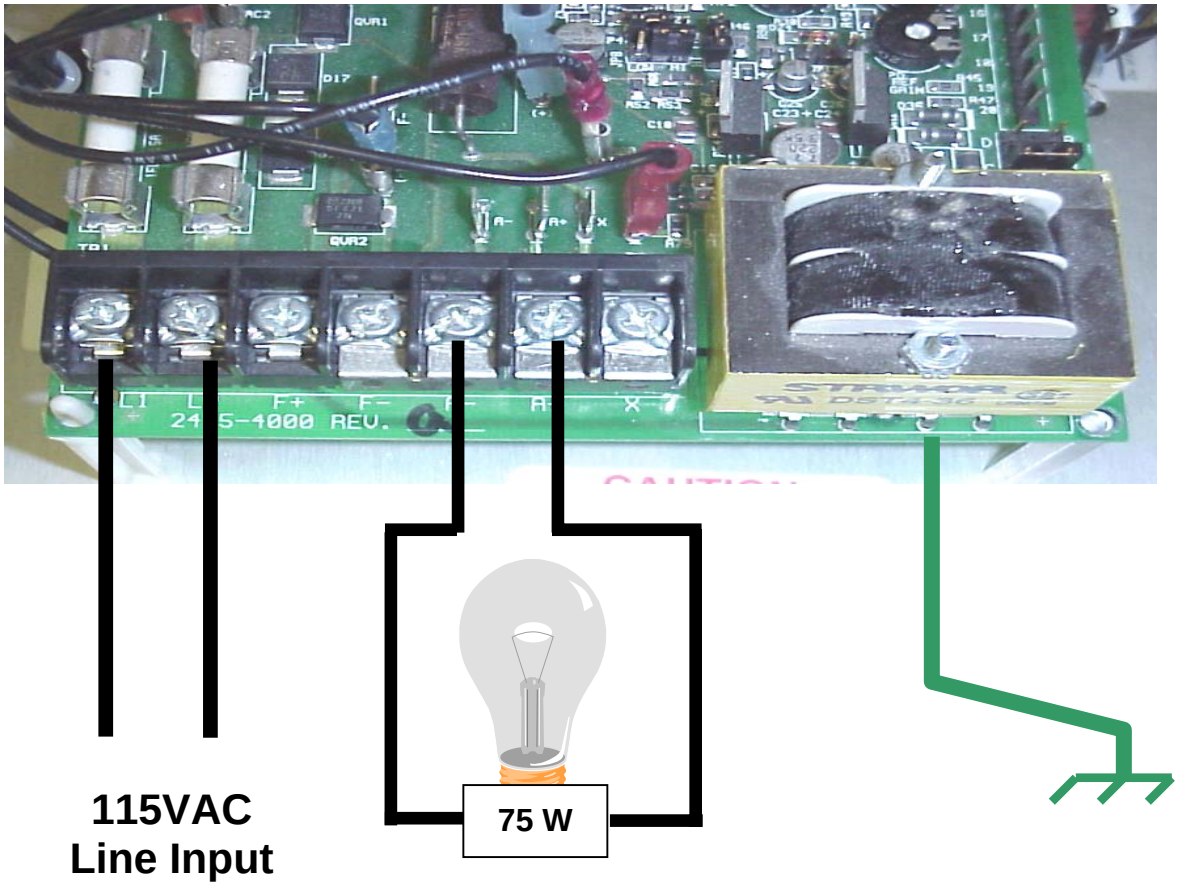
Step	Function	Normal Voltage Readings		Terminal or Point	Probable Cause
1 with AC Power "on"	Voltage to Rectifiers	120 Vac ±10%	240 Vac ± 10%	ACl AC2 On power cube	Blown Fuses
2*	Speed command	0 to +10 Vdc	0 to +10 Vdc	10-12	Defective speed adjustment potentiometer or circuit board assembly
3	Field Supply Voltage	100 Vdc	200 Vdc	+Fl -F2	Defective field diodes defective encapsulated bridge rectifier assembly
4*	Armature Voltage	0-90 Vdc	0-1 80 Vdc	+Al -A2	Defective encapsulated bridge rectifier ass'y, or circuit board assembly

*Depends on the setting of the speed adjustment knob

Basic Test Setup – Light Bulb Test

It is fairly easy to test Focus Drives on the bench. One does not have to use a motor to verify basic operation. When working properly, the Focus basically creates a variable voltage much like a light dimmer except the output is DC. The easiest way to check a Focus on the bench without a motor is to connect the Armature output to a resistive load. One could use a 75 watt light bulb screwed into a light bulb socket base as shown below.

Basic Test Power Wiring



In order to test the Focus, one would need to setup the input for 115 Vac operation and for basic Armature Voltage feedback. The drive should also be set for the lowest current setting. Therefore before testing, one should record the settings before test so that they could be reset back after the test.

Record Drive Set-up ***BEFORE*** performing Light bulb test

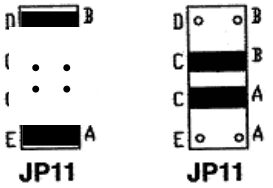
Before Test
Circle One

JP2 SPD CUR

JP4 ARM TACH

JP8 Hi Low

JP9 A B C D



115 Vac 230 Vac Operation

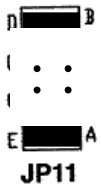
Test

JP2 SPD

JP4 ARM

JP8 Low

JP9 None



115 Vac Operation

Basic Armature Circuitry Checkout

After the Focus is wired as shown on the previous page and the jumper set as indicated above, 115 Vac power could be applied and the Focus should cause the light bulb to vary in brightness from nothing to full brightness. One could measure the voltage across the bulb and it should be about 90 Vdc at maximum brightness. This would verify the basic Start/Stop, Speed command, Power Supply, Regulator and Power Sections.

Field Supply Checkout

If one wants to check the Field Supply, power should be removed and the light bulb moved over to the F+ and F- terminals (use a 75 W bulb or less for the field. Use of greater than 75 W could permanently damage the Field rectifiers). Then upon application of power, the light bulb should light to full brightness and the voltage across the light bulb should measure about 100 Vdc.

If the Focus passes these basic tests, the drive should be OK and the drive should be able to run a good motor at least in Armature Voltage feedback (JP4 in ARM). Reset jumpers back to the "**Before Test Recorded Settings**" except for JP4 and re-check.

If the motor has a shunt field, it should measure at least:

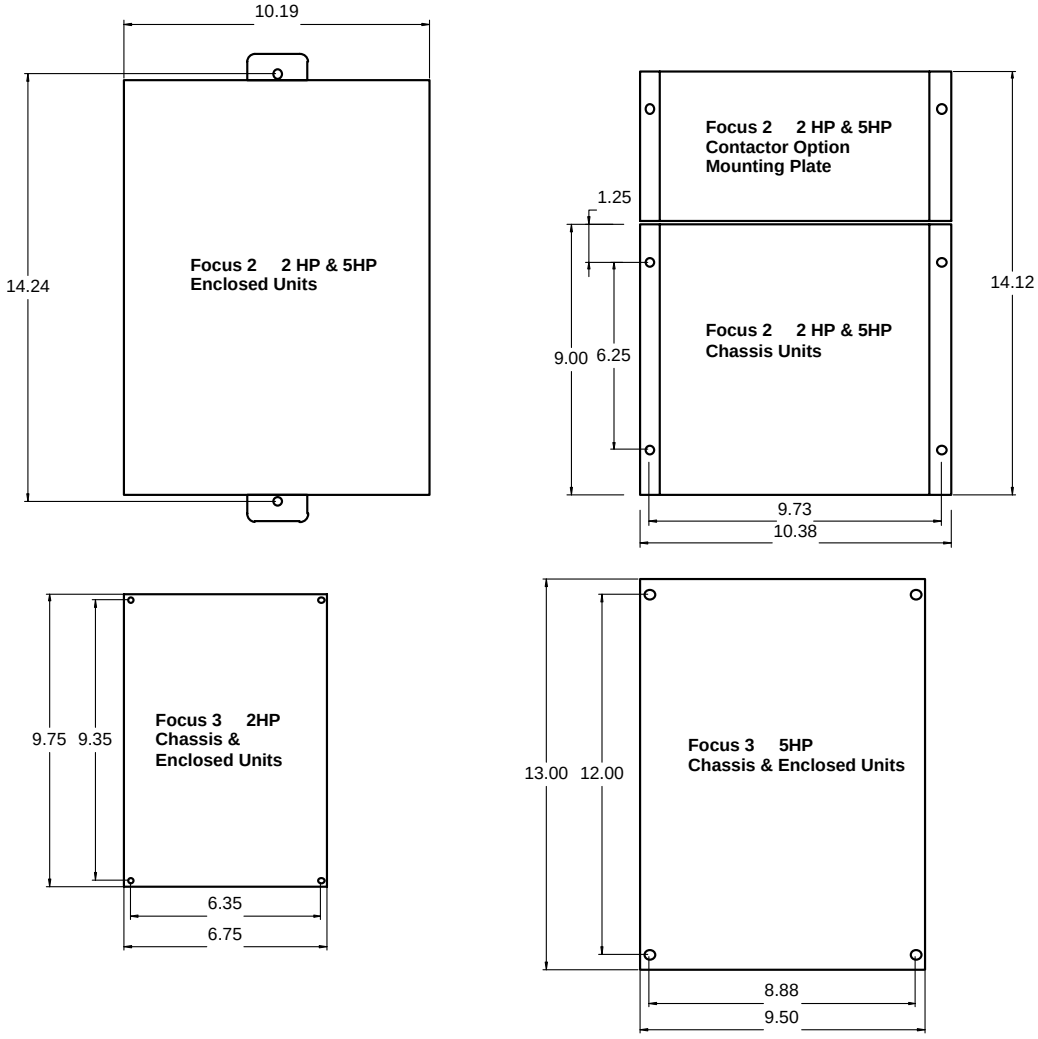
200 ohms if Nameplate indicates 200 Vdc Field
100 ohms if Nameplate indicates 100 Vdc Field

Retrofitting Focus 2 Drives with Focus 3 Drives

In retrofitting a Focus 2 with a Focus 3 drive there are four key issues to examine; physical size and mounting, location of power and signal connections, electrical compatibility and available options.

1. Physical size and mounting:

The enclosed Focus 3 drives are all slightly smaller in physical size than the Focus 2 drives, the mounting hole locations though are different.
The chassis versions of the Focus 3 drives are slightly larger the Focus 2 drives unless the Focus 2 drive was supplied with the contactor option where as they are equivalent in size.



2. Power and signal connections:

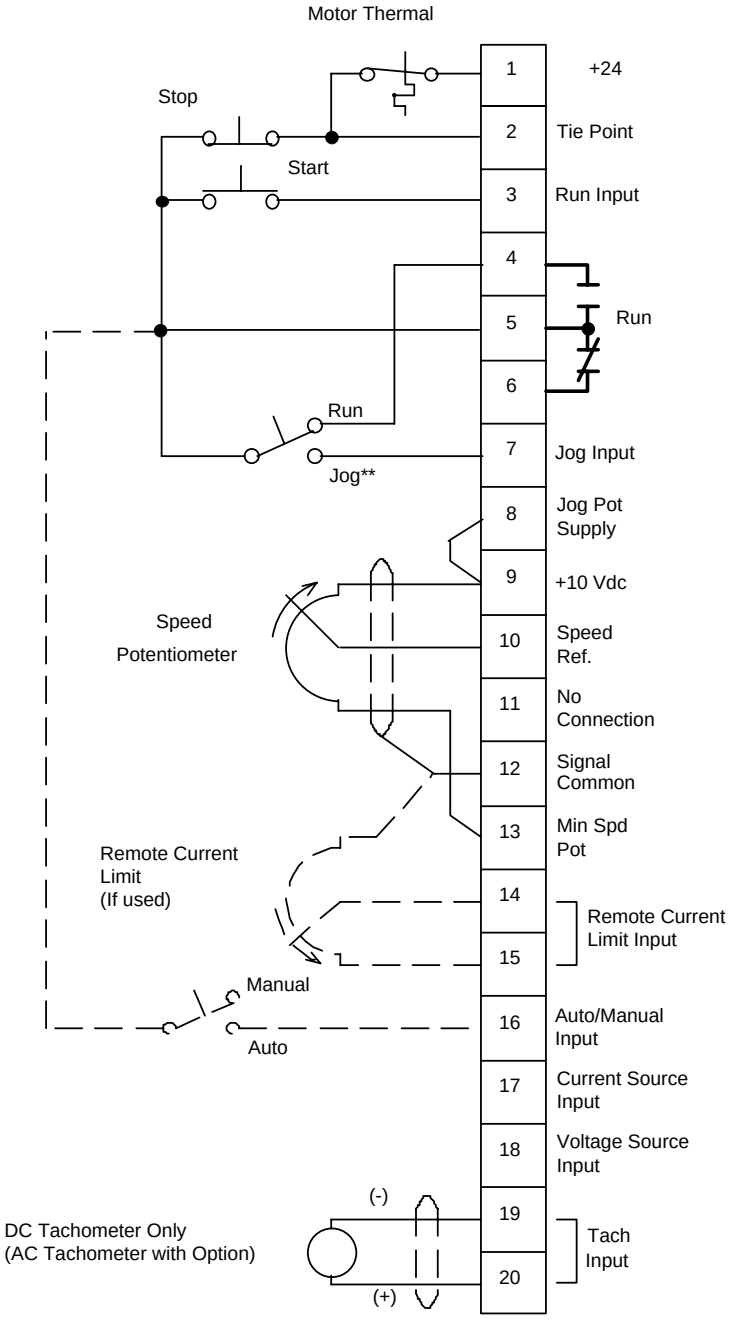
Focus 2 – Power and Motor Connections across the top
Signal Connections down the left side

Focus 3 - Power and Motor Connections across the bottom
Signal Connections down the right

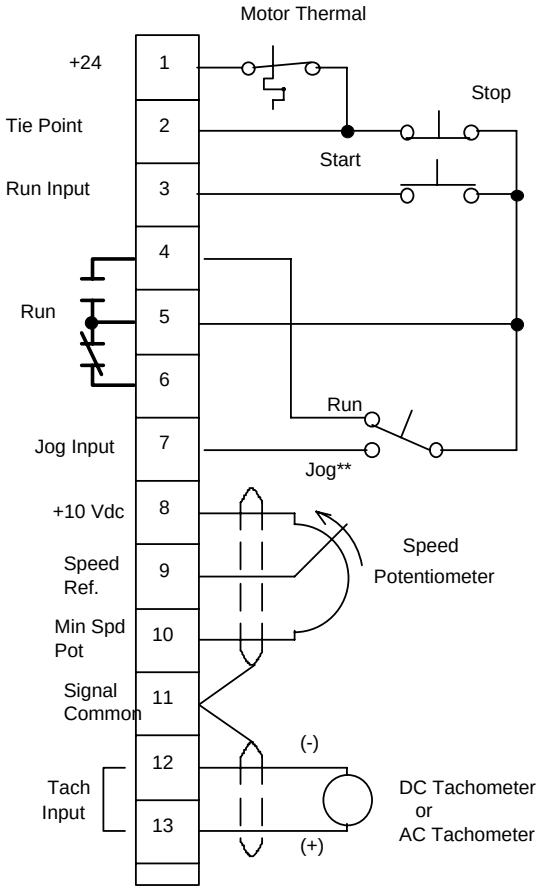
3. Electrical Compatibility:

The Focus 3 is electrically identical to the Focus 2 controller with the exception that the terminal strip connections are slightly different due to the addition of extra standard features. A comparison these two terminal strips are shown below.

Focus 3



Focus 2



4.	**Available options:**	**Focus 3**	**Focus 2**
	Jog at Jog Speed	Standard	Optional
	Current/Voltage follower	Standard	Optional
	Remote Current Limit	Standard	Optional
	Nema 4/12**	Standard	Optional
	AC Tach Feedback	Optional	Standard
	Reference Isolator	Available	Not Available
	Reversing	Focus 3 Regen Drive	Optional

** Enclosed Units

Application Notes

In order to provide continuing support for the Focus products (as well as all of our other products): (if this is being viewed electronically, click on any blue item for link)

Application Notes (CTANXXX)
Technical Notes (CTTNXXX)
Replacement Instructions (CTRIXXX)
and kit **Instruction Sheets** (CTISXXX) are posted on our web site

These documents provide a wide variety of information instantly available day or night. Below is a list of currently available **Application Notes** :

Click on DC Drives if on website

Application Note #	Rev	Drive Family	Topic
CTAN 125	A	Focus 3	Replacing Focus 2 with Focus 3 Drives
CTAN 130	1.1	Focus 3	Tach Follower Applications
CTAN 204	1.0	Focus 3	Power Wiring Guidelines
CTAN 213	1.1	Focus 3	Eddy Current Controller Retrofit
CTAN 215	1.0	Focus Family	Earth Grounding & Isolation
CTAN 216	1.0	Focus 3	Eddy Current Replacement Solution
CTAN 235	1.0	Focus 3	Adjustable Brake / Dynamometer App's
CTAN 240	1.0	Focus 3	Speed Master w/Torque Slave
CTAN 241	1.0	Focus 3	120vac Remote Control Pushbuttons
CTAN 243	1.0	Focus 3	Multiple Drives Running in Tandem
CTAN 244	1.0	Focus 3	Isolated Master Reference Board

Replacement Instruction for Control Board (CTRI1210) can be found at our website at: www.emersonct.com or click the link below:

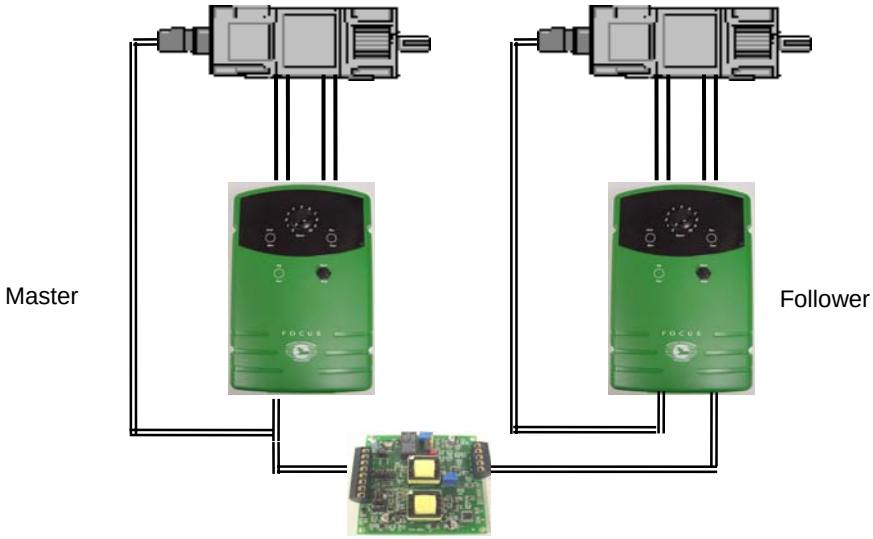
CTRI210

CTAN130 and CTAN 215 are given in the next few pages.

CTAN #130

Focus 3 Drives in Tachometer Follower Applications

There are many applications that require a second drive to follow the speed of the first (or primary) drive. There are two basic methods used, the first is a parallel method and the second is a cascaded method. In the parallel method the speed command of the first drive is sent directly to the second drive (as a speed command) while in the cascaded method, the speed feedback (tachometer) is directed to the second drive as a speed command. A disadvantage to the parallel method is that if for some reason the first drive slows down while in a current limit condition, for example, the second drive would no longer follow since it may not be in a current limit condition. This is not the case for the cascaded method since the drive is following the actual speed of the first drive.

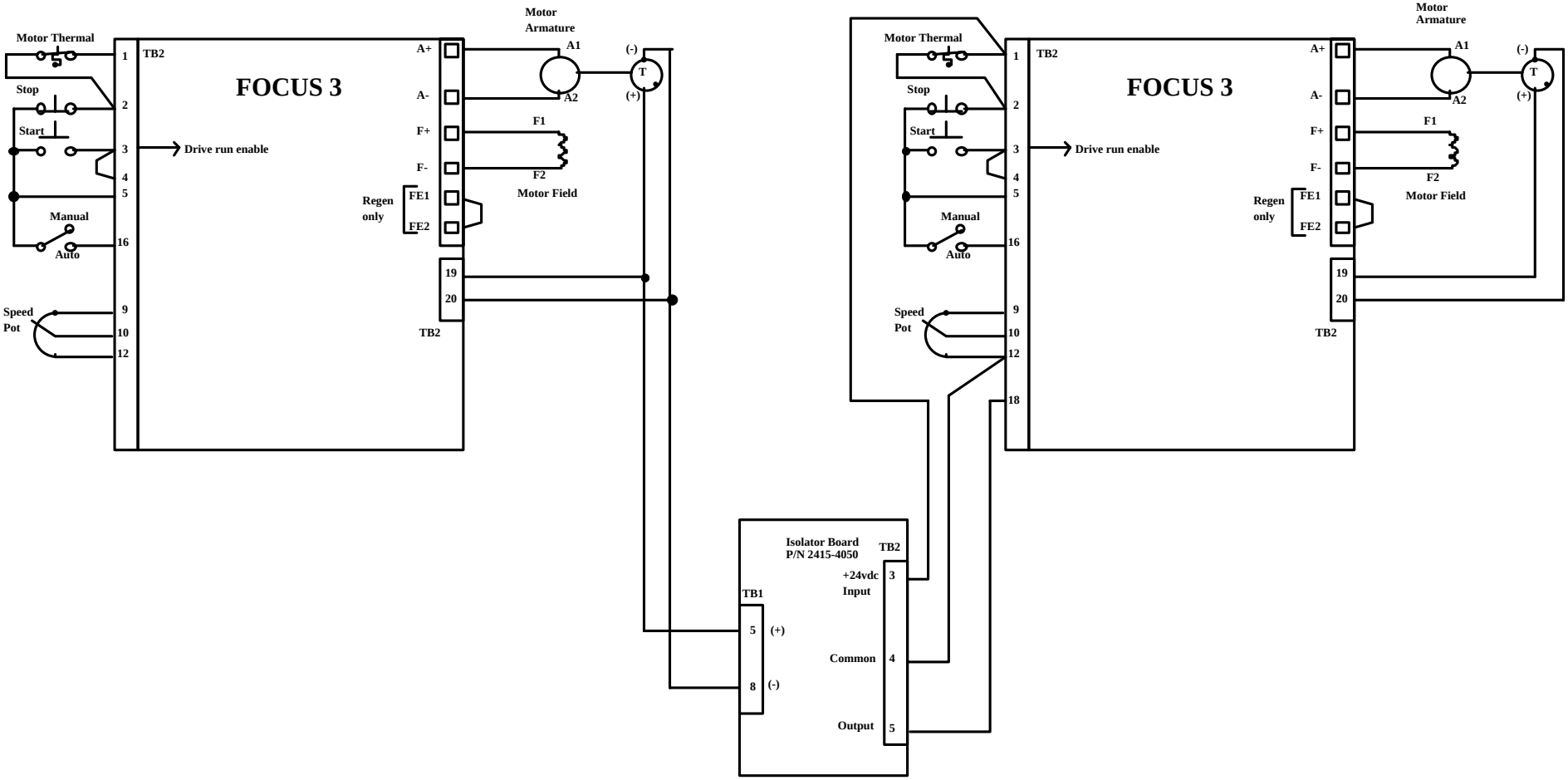


Focus Isolator (F3NSBD)

Focus 3 Non-Regen Drives

The **Focus 3 isolator option** (p/n F3NSBD) is ideally suited for this purpose since it is powered directly by the Follower drive and connections are minimal.

Focus 3 Non-Regen Master / Follower Application

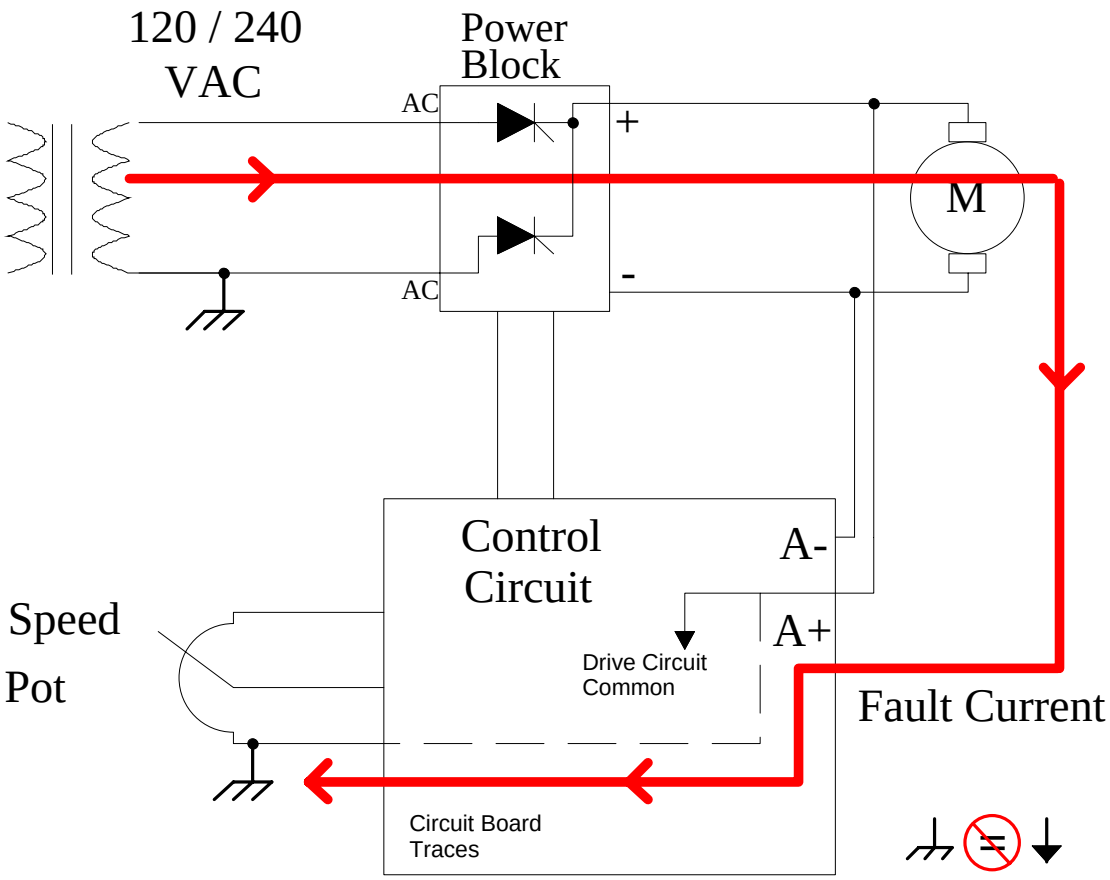


CTAN #215

Ways of Achieving Isolation

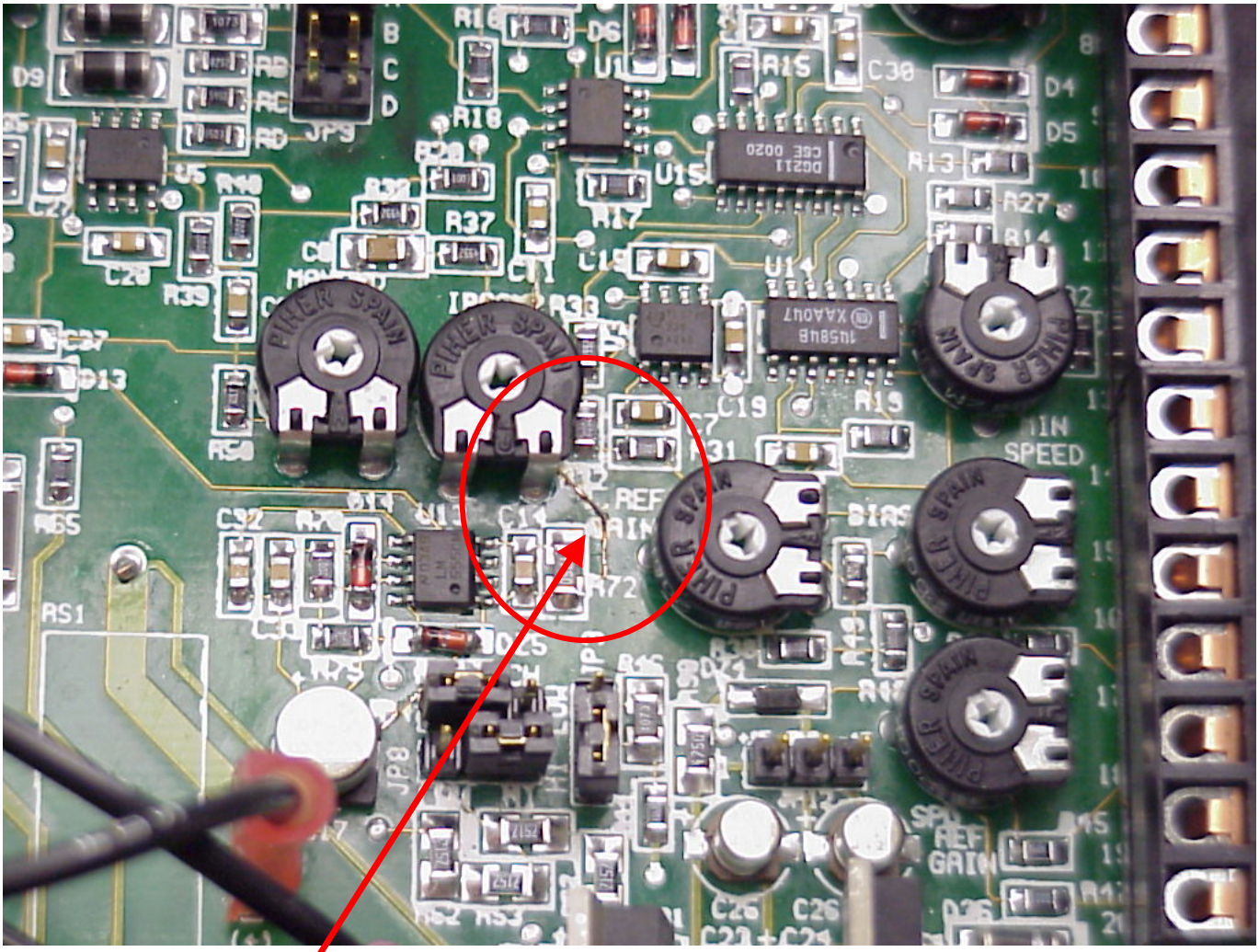
Non-Regenerative DC Drives
F3N2C / F3N2E / F3N5C / F3N5E

Focus F3N non-regenerative motor controllers are not isolated from the power circuit. Essentially, circuit common on the control card is connected directly to the A+ terminal of the motor. Therefore, **NO** terminal connection on the control terminal strip (TB2) can be connected to earth ground in any way, even momentarily. Any earth ground on



these terminals will effectively short out the power line through the circuit board traces. The Focus 3 Regenerative drives (**F3R**2C / **F3R**2E / **F3R**5C / **F3R**5E) are isolated from the power line and therefore, connections on TB2 can be tied to earth ground.

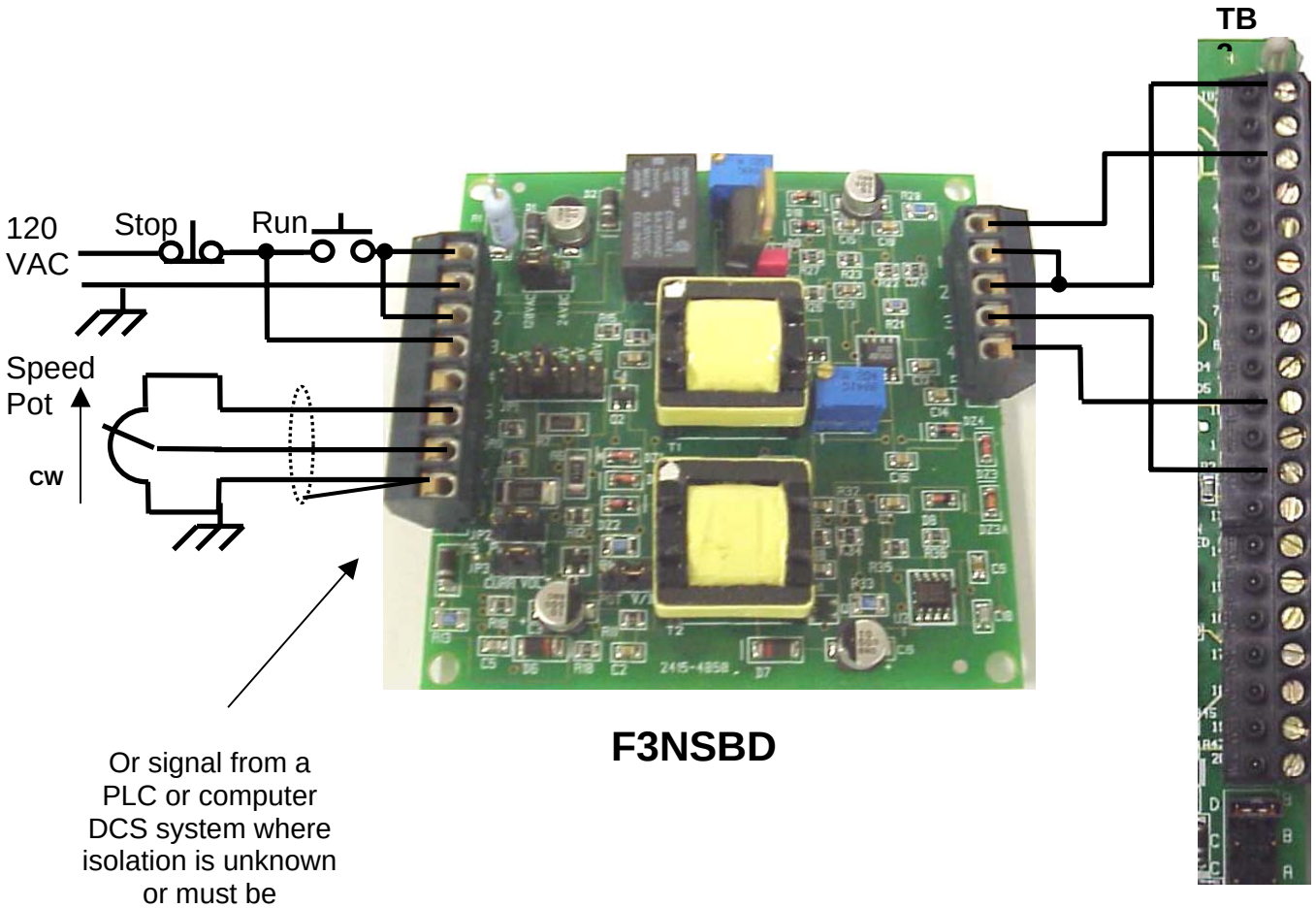
Damage to Focus 3 Circuit Board caused by connecting speed potentiometer to earth ground.



Typical Damaged circuit trace due To earth ground connection on Control terminal strip

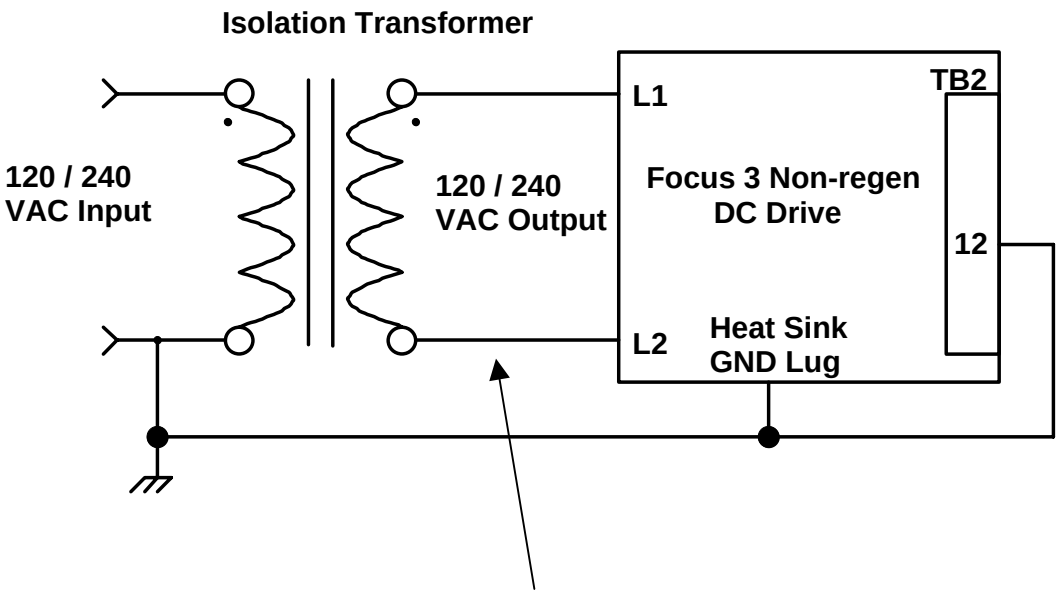
Solutions to Applications Requiring Control Inputs to be Earth Grounded

Solution #1 – Focus 3 Signal Isolator Board



This option is used in applications where isolation is required between an external control signal and the motor controller (which may or may not be at earth ground potential). It can be utilized to isolate a variety of voltage or current signals (see specifications below). It may also be used simply to isolate the speed adjustment pot, and the pot power supply is included! This option can be mounted in the enclosure or in a piece of plastic track (included with kit).

Solution #2 – Isolation Transformer



⚠ CAUTION

DO NOT CONNECT GROUND

TO TRANSFORMER SECONDARY

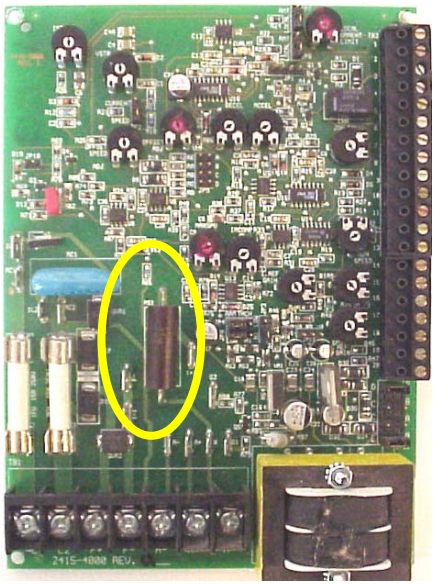
Transformer KVA = 1.5 x Rated Armature Current x 120 Vac (or 240)

Example: Your DC Motor has a 10 A armature

KVA = 1.5 x 10 A x 120 Vac = 2.4 KVA (use 2.5 KVA)

Critical Components and Replacement Parts

Main Control Board



2415-4000

This control board is used on both the all Focus 3 non-regen models:

F3N2C F3N2E F3N5C F3N5E

The low horsepower units, F3N2C and F3N2E use the board as it is shipped.

Replacement Instruction for Control Board (CTRI1210) can be found at our website at: www.emersonct.com or click the link below:

CTRI210

Speed Adjust Pot

3533-0502 – Potentiometer

3549-002 - Knob

Power Block

3720 – 004
F3N2C & F3N2E

Fuses

3705-032
15 A, 250 Vac

Power Block

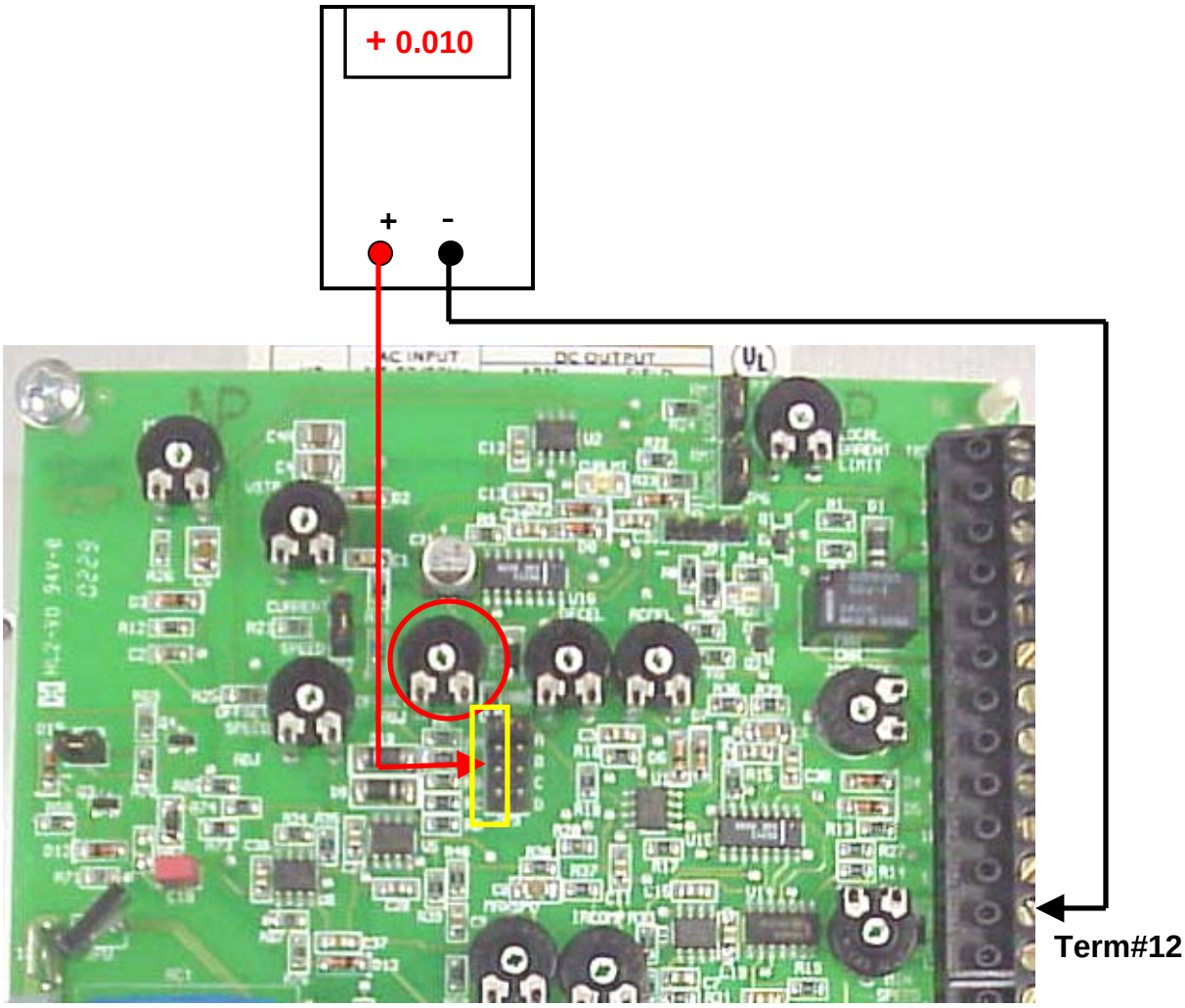
3720- 010A
F3N5C & F3N5E

Fuses

3701-504000
40 A, 500 Vac

These components are stocked and sold through the North American Service Center. To order please contact sales @ 1-800-367-8067

Calibration procedure for adjustment of current feedback offset adjustment potentiometer



With power applied to the drive but NOT in run. Measure the dc voltage at JP9 (any of the free pins on the left side) with respect to signal common (terminal #12).

Adjust the offset adj potentiometer so that the digital voltage meter (set for 2 volt scale) reads as close to 0.000 as possible but NOT negative (+0.010 is a reasonable value).

INDEX

S

T

W