

Allen-Bradley
1397
Regulated Field Supply Card
Cat. Nos. 1397-FS2004
1397-FS2010
1397-FS2015

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What This Option Provides

When installed, the Regulated Field Supply Card enables the drive's software field control loop, allowing field control functions to be adjusted by the user.

Where This Option Is Used

This option may be used with all 1397 Drives.

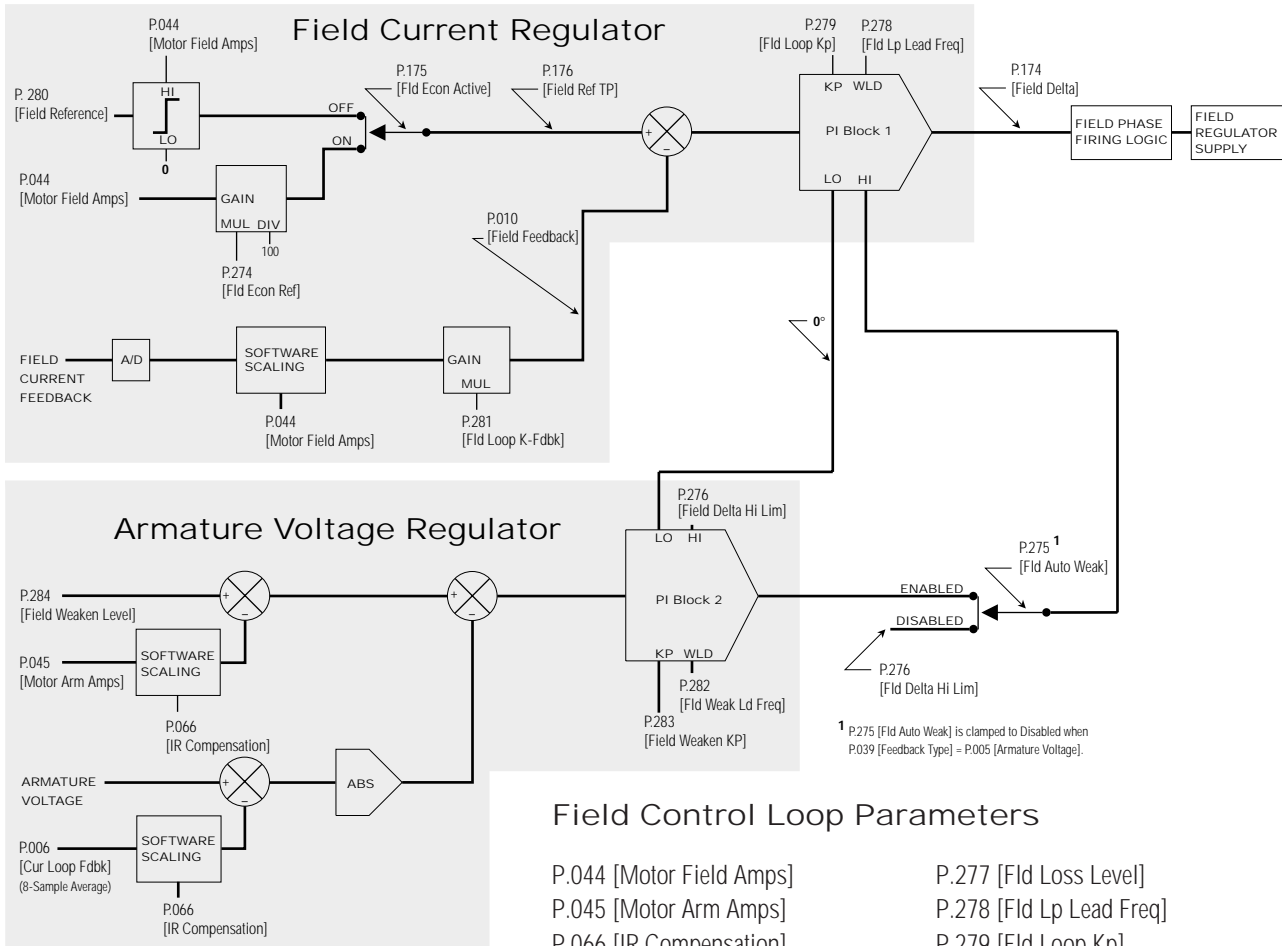
Catalog Number	Regulated Field Supply Amp Rating
1397-FS2004	4A
1397-FS2010	10A
1397-FS2015	15A

What These Instructions Contain

These instructions contain the necessary information to install and configure a 1397 Regulated Field Supply Card. For additional information on parameter programming, field supply operation and function block diagrams, refer to the 1397 User Manual — Publication 1397-5.0.

Allen-Bradley Drives

How This Option Works



Field Control Loop Parameters

- | | |
|--------------------------|--------------------------|
| P.044 [Motor Field Amps] | P.277 [Fld Loss Level] |
| P.045 [Motor Arm Amps] | P.278 [Fld Lp Lead Freq] |
| P.066 [IR Compensation] | P.279 [Fld Loop Kp] |
| P.273 [Fld Econ Delay] | P.280 [Field Reference] |
| P.274 [Fld Econ Ref] | P.281 [Fld Loop K-Fdbk] |
| P.275 [Fld Auto Weak] | P.283 [Fld Weaken Kp] |
| P.276 [Fld Delta Hi Lim] | P.284 [Fld Weaken Level] |

For the drive to operate, one of the following field supply options must be present.

- A Fixed Field Supply
- A Regulated Field Supply
- An Enhanced Field Supply

At power-up if the Regulated Field Supply Card is installed:

1. P.177 [Field Regulator] will detect it's presence and display either 4, 10 or 20A — the Regulated Field Supply Card's rating.
2. The field current control loop shown above operates and drive parameters P.184 [J20 Fld Loss Det], P.185 [J21 Field Supply] and P.272 [E-Fld Volts Adj] are ignored.
3. The Regulated Field Loss and Field Economy circuits become active in place of those used by the Fixed and Enhanced Field Supply options.

How This Option Works

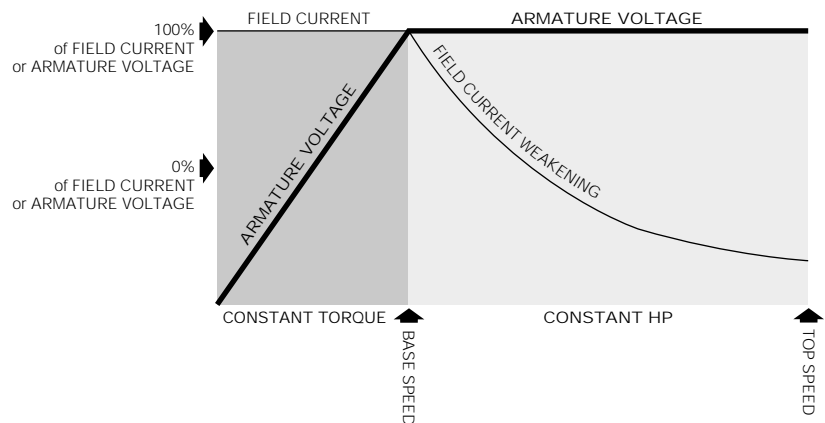
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The field control loop can operate in one of two ranges — A Constant Torque (armature control) Range or a Constant HP (field control) Range.

If the Regulated Field Supply Card's factory defaults are set, it will operate in a fixed voltage mode by firing the field SCRs at a fixed angle of 117°. This will produce a motor field voltage of 150VDC with a 230V AC line input, or 300VDC with a 460V AC line input. To produce other motor field voltages, parameter P.044 [Motor Field Amps] must be set as described in the Setup section of this publication before motor startup. Even though the Regulated Field Supply will be producing fixed voltage, the value of parameter P.044 will be set to 0.01 Amps. After a valid value is entered for P.044, the user-assigned value for parameter P.277 [Fld Loss Level] becomes effective.

Important: The Regulated Field Supply Card will not regulate field current until a valid value for parameter P.044 is entered. The drive can be operated however, when the Regulated Field Supply Card is operating in the fixed voltage mode. Field loss detection will only occur if there is a complete loss of field current. This is similar to having the Fixed or Enhanced Field Supply installed.

The Field Control Loop contains (2) regulators — A Field Current Regulator and an Armature Voltage (or counter-EMF) Regulator.



As shown above, in the Constant Torque (armature control) range, the Field Control Loop can be configured to decrease Armature Voltage¹ when the motor's armature is greater than P.284 [Fld Weaken Level] and the field begins to weaken. As motor speed increases beyond base speed, Armature Voltage will increase above rated voltage. PI (proportional plus integral) Block 2 monitors armature voltage and will reduce the HI limit of PI Block 1 that controls field current. As field current decreases, field flux and Armature Voltage also decreases. Field current continues to decrease until Armature Voltage is equal to the value set in P.284 [Fld Weaken Level].

¹ The armature IR drop can be compensated for by resetting parameter P.066 [IR Compensation].

How This Option Works

(continued)

Control of Armature Voltage during field weakening can only occur when a tachometer or encoder is used and P.039 [Feedback Type] is not set to Arm Volt. Field weakening can also be disabled by setting P.275 [Fld Auto Weak] to Disabled. The drive can also be operated in the Constant HP (field control) Range, controlling parameter P.280 [Field Reference] exclusively.

Both the Field Current Regulator and the Armature Voltage Regulator contain Proportional plus Integral (PI) control. There is no user configurable low limit parameter setting to these PI blocks. The low limit is always fixed at 0°. The high limit however, can be set up to 180° delta using parameter P.276 [Fld Delta Hi Lim]. This input allows a full-on field voltage of 207V DC with a 230V AC line input, or 414V DC with a 460V AC line input. To regulate higher field voltages, a step-up transformer must be used to supply the AC side of the field supply bridge. The output of the Field Current Regulator is an angle to the regulated field supply gate firing circuit represented in degrees by parameter P.174 [Field Delta].

How to Select a Regulated Field Supply

There are (3) Regulated Field Supply Cards to select from — 4, 10 or 15 Amps. Each Regulated Field Supply Card provides (3) different gains for field current feedback — 1, 2 or 5.

When the Regulated Field Supply Card is installed, at Drive Setup, the 1397 User Manual instructs the user to enter the rated hot field amps from the motor's nameplate into parameter P.044 [Motor Field Amps]. Once this value has been entered, the software will automatically select the feedback gain from the board to produce the largest full scale digital value in the A/D converter. P.044 will be limited to a value based on the Regulated Field Supply Card installed.

Important: Select the kit that provides the motor's nameplate hot field current — Including any current necessary for field forcing — Required by your application.

Catalog Number	Regulator Rating	P.044 Value	Gain	Rated Output Amps	Field Current Resolution
1397-FS2004	4A	0.11-0.8A	5	0.8A	4mA
		0.81-2.00A	2	2A	10mA
		2.01-4.00A	1	4A	20mA
1397-FS2010	10A	0.28-2.00A	5	2A	10mA
		2.01-5.00A	2	5A	25mA
		5.01-10.00A	1	10A	50mA
1397-FS2015	15A	0.55-4.00A	5	4A	20mA
		4.01-10.00A	2	10A	50mA
		10.01-20.00A	1	15A	100mA

Installation



ATTENTION: This board contains ESD (Electrostatic Discharge) sensitive parts and assemblies. Static control precautions are required when installing, testing, servicing or repairing this assembly. Component damage may result if ESD control precautions are not followed. If you are not familiar with static control procedures, reference publication 8000-4.5.2, "Guarding against Electrostatic Damage" or any other applicable ESD protection handbook.

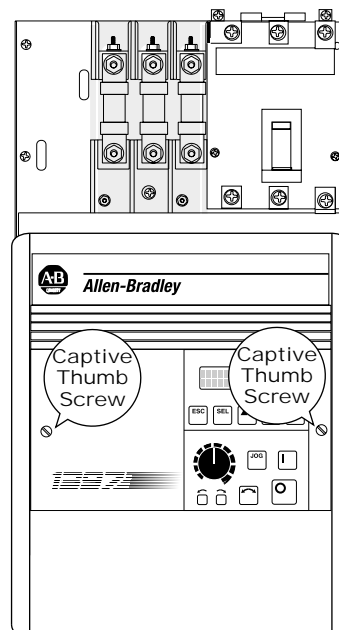


ATTENTION: Electric Shock can cause injury or death. Remove all power before working on this product.

The drive is at line voltage when connected to incoming AC power. Before proceeding with any installation or troubleshooting activity, disconnect, lock out, and tag all incoming power to the drive. Verify with a voltmeter that no voltage exists at terminals L1, L2 and L3 on the drive input power terminal block.

- ❑ 1 Remove and lock-out all incoming power to the drive.

- ❑ 2 For 1.5-30HP/230V and 3-60HP/460V Drives, loosen the (2) captive thumb screws to remove the drive cover.

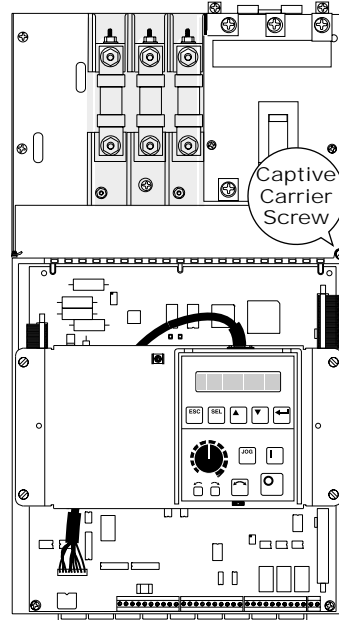


Allen-Bradley Drives
1.5-30HP/230V and 3-60HP/460V Drives
with Drive Cover in Place

Installation

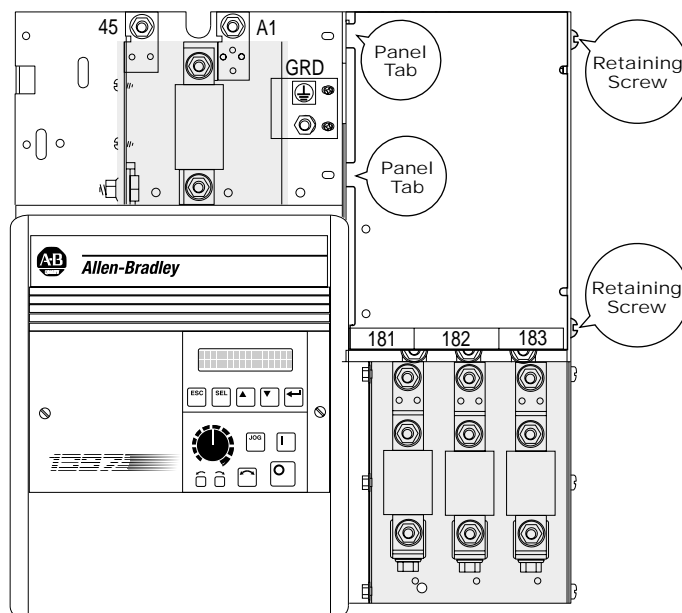
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- **3** For 1.5-30HP/230V and 3-60HP/460V Drives, loosen the captive carrier retaining screw to swing the carrier door open.



1.5-30HP/230V and 3-60HP/460V Drives
with Carrier Door Closed

- **4a** For 40-60HP/230V and 75-125HP/460V Drives without an AC line disconnect, loosen the (2) auxiliary panel cover retaining screws. To lift out the auxiliary panel, loosen the screws only enough to allow the panel tabs to slide out.



40-60HP/230V and 75-125HP/460V Drives
with Auxiliary Panel Cover

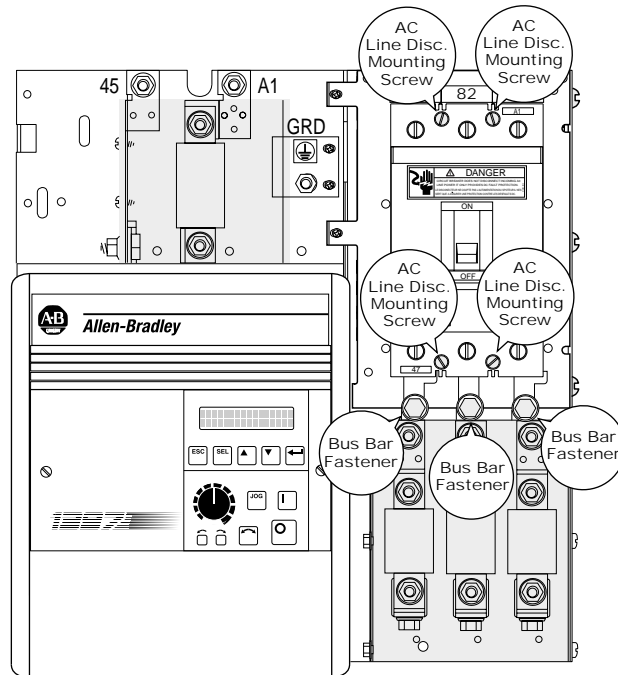
Installation

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- ❑ **4b** For 40-60HP/230V and 75-125HP/460V Drives with an AC line disconnect, both the disconnect switch and disconnect panel must be removed.

To remove the disconnect switch from the disconnect panel:

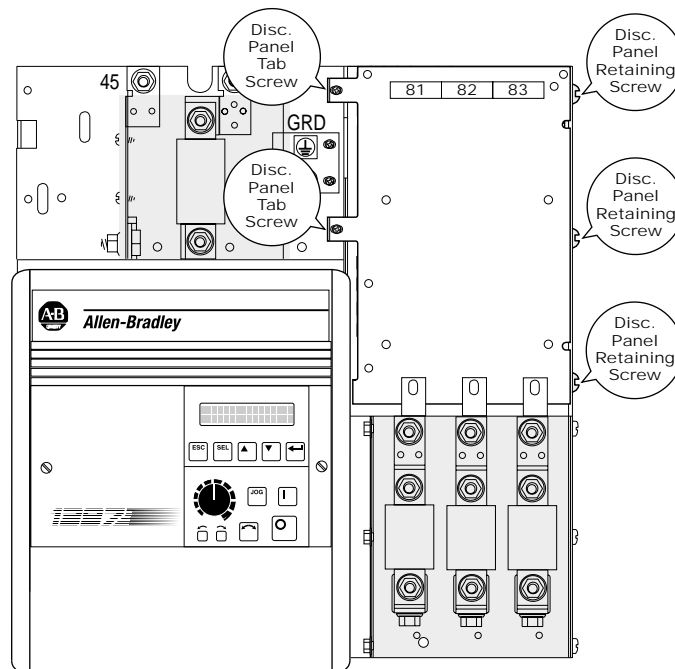
- Remove the (3) bus bar $\frac{1}{4}$ " (250A disconnect) or $\frac{3}{8}$ " (400A disconnect) fasteners.
- Remove the (4) AC line disconnect mounting screws.



40-60HP/230V and 75-125HP/460V Drives with AC Line Disconnect

To remove the disconnect panel:

- Remove the (2) disconnect panel tab screws to free the tabs.
- Remove the top and bottom disconnect panel retaining screws.
- Loosen the middle disconnect panel retaining screw to slide out the disconnect panel for removal.



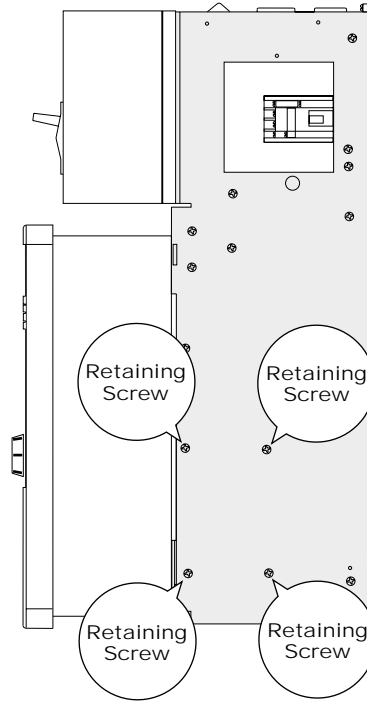
40-60HP/230V and 75-125HP/460V Drives with AC Line Disconnect Removed

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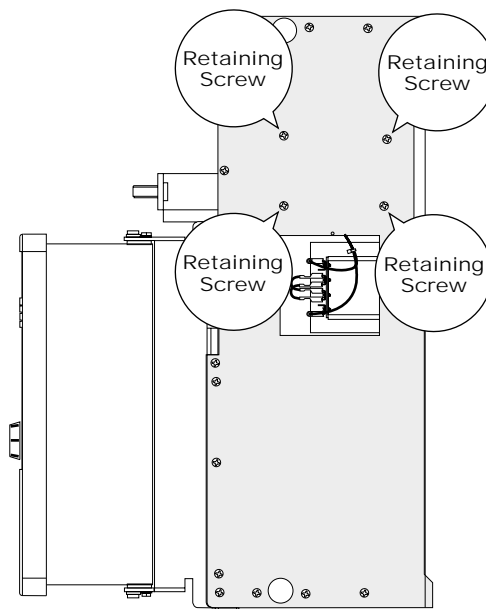
Installation

(continued)

- ❑ 5 To remove either the Fixed or Enhanced Field Supply, remove the (4) retaining screws from the outside right side panel.



1.5-30HP/230V and 3-60HP/460V Drives
— Outside Right Side Panel —



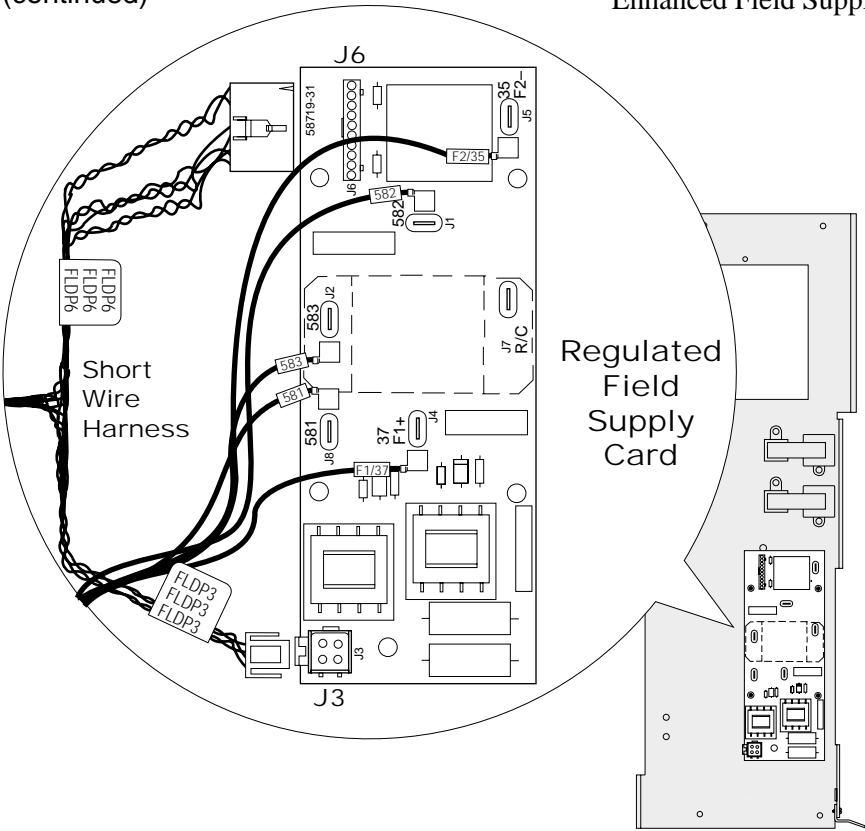
40-60HP/230V and 75-125HP/460V Drives
— Outside Right Side Panel —

Installation

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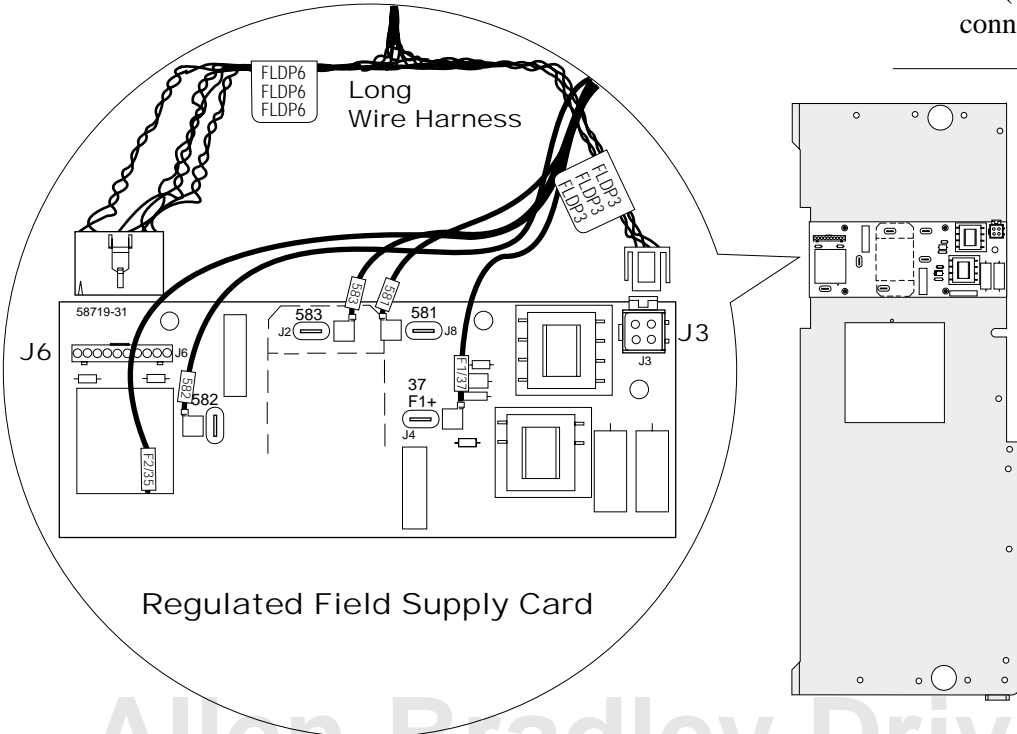
❑ 6 Unplug the (5) blue fast-on connectors from the Fixed or Enhanced Field Supply Card.

- For 1.5-30HP/230V and 3-60HP/460V Drives, unplug the red P4 connector from the Power Interface Board to free the card.
- For 40-60HP/230V and 75-125HP/460V Drives, unplug the red P4 connector from Power Interface Board connector S4 to free the card.



1.5-30HP/230V and 3-60HP/460V Drives
— Inside Right Side Panel —

❑ 7 Remove the (4) retaining screws from the back of the Regulated Field Supply Card. Use these same (4) screws to install the Regulated Field Supply card in the Fixed or Enhanced Field Supply Card's old location. Plug either the shorter or longer wire harness included with the kit into the Regulated Field Supply Card and reattach the (5) blue fast-on connectors as shown.



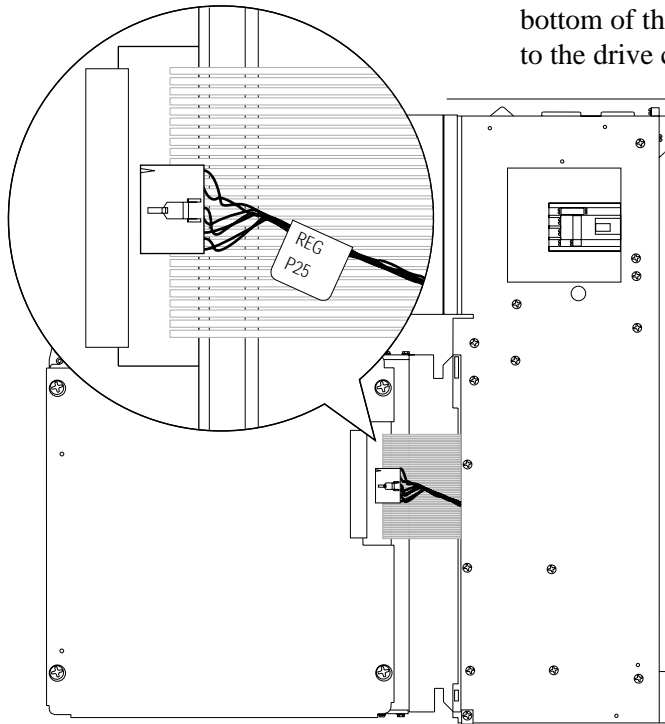
40-60HP/230V and 75-125HP/460V Drives
— Inside Right Side Panel —

Allen-Bradley Drives

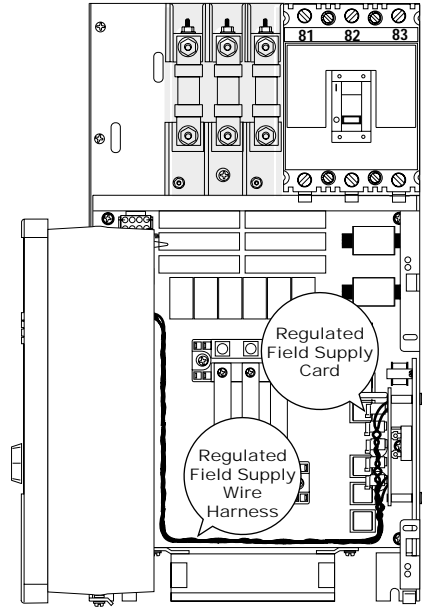
Installation

(continued)

- **8a** For 1.5-30HP/230V and 3-60HP/460V Drives, route the other end of the wire harness through the drive carrier along the bottom of the drive chassis as shown. Secure the wire harness to the drive chassis using cable ties included with the kit.



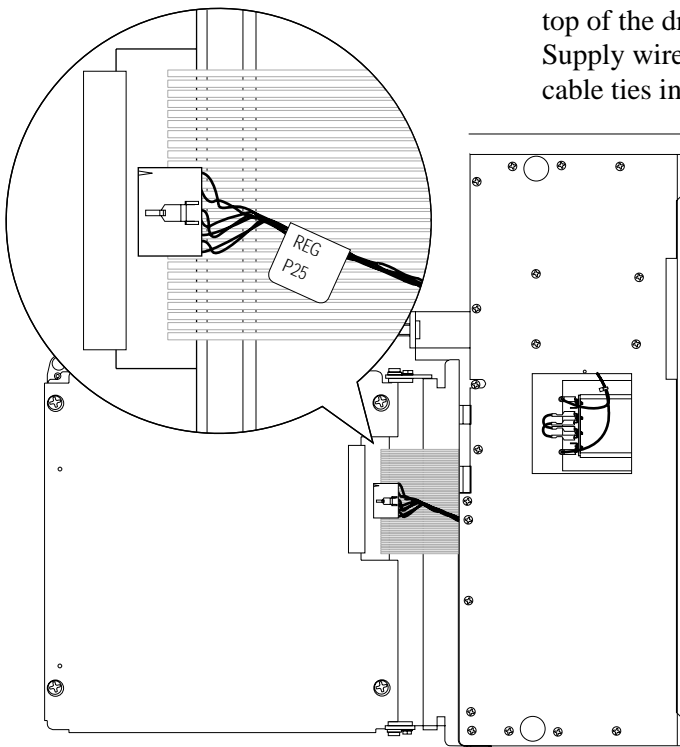
— Carrier Door Open —



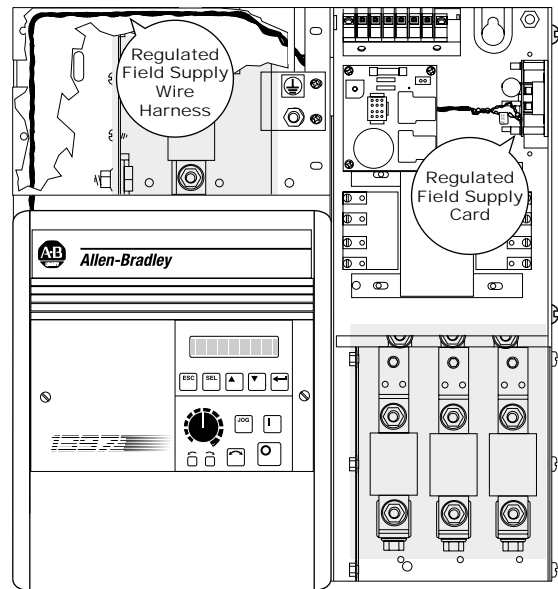
— Carrier Door Open —

1.5-30HP/230V and 3-60HP/460V Drives

- **8b** For 40-60HP/230V and 75-125HP/460V Drives, route the other end of the wire harness through the drive carrier along the top of the drive chassis as shown. Secure the Regulated Field Supply wire harness to the existing drive wire harness using cable ties included with the kit.



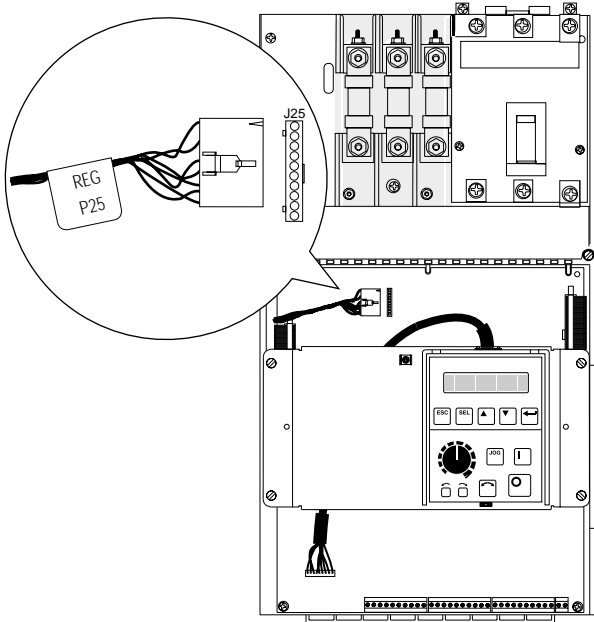
— Carrier Door Open —



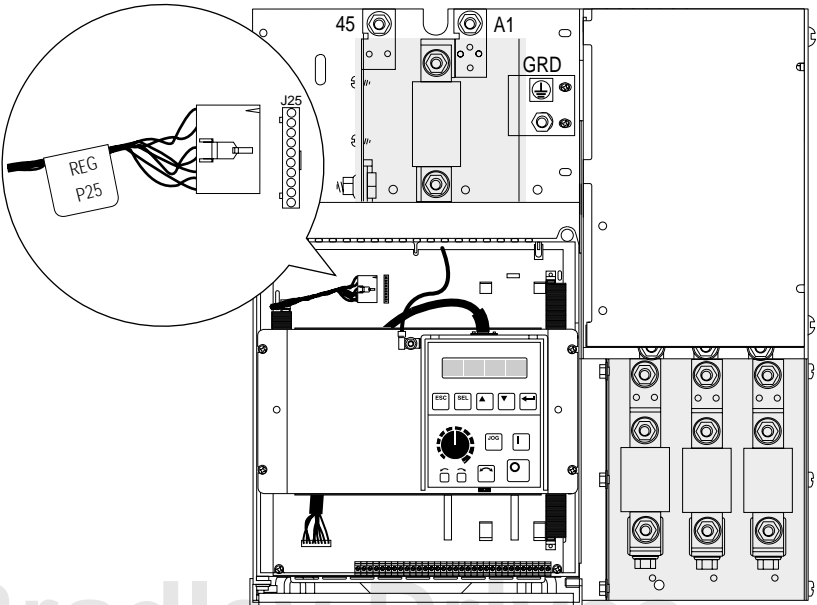
— Carrier Door Closed —

Installation
(continued)

- ❑ 9 Plug the other end of the Regulated Field Supply wire harness into Regulator Board connector J25.



1.5-30HP/230V and 3-60HP/460V Drives
— Carrier Door Closed —



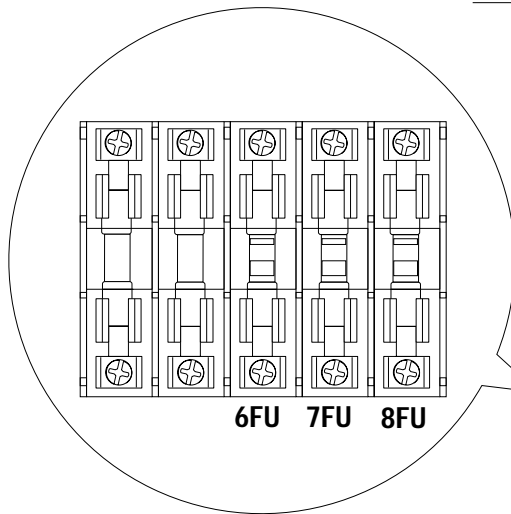
40-60HP/230V and 75-125HP/460V Drives
— Carrier Door Closed —

Allen-Bradley Drives

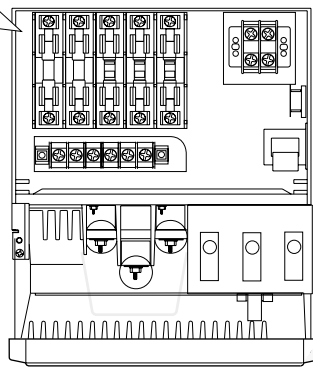
Installation

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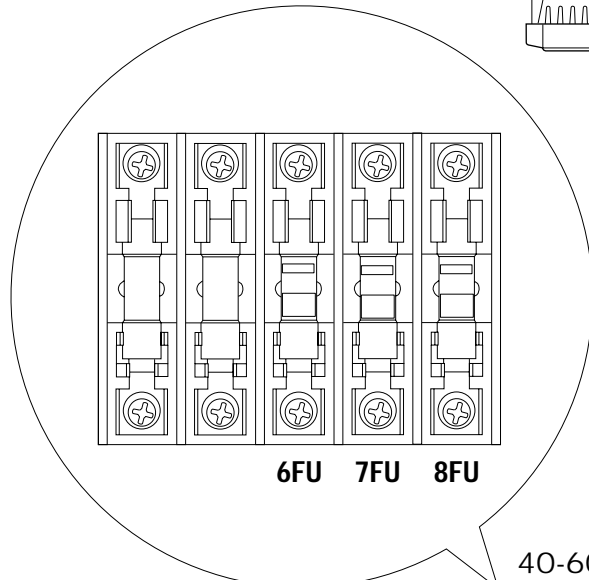
- ❑ 9 Replace fuses 6FU, 7FU & 8FU with the (3) UL Class CC/600V/25A fuses included with the kit.



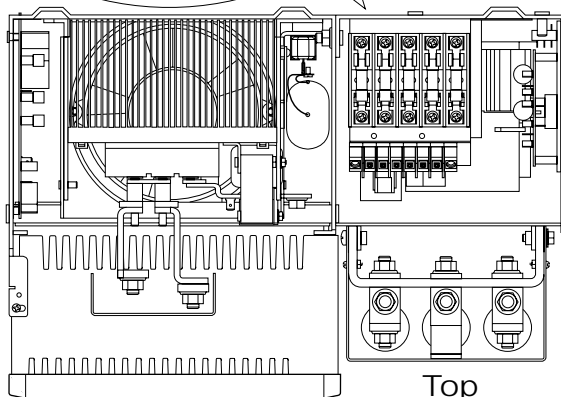
1.5-30HP/230V and 3-60HP/460V Drives



Top



40-60HP/230V and 75-125HP/460V Drives



Top

Installation

(continued)

- ❑ **10** If required, reinstall the auxiliary panel cover or AC line disconnect removed in steps 4a & 4b. Torque the (3) bus bar fasteners to the values listed below.

Fastener Size	Maximum Torque
1/4"	7.46 N-m (66 lb.-in.)
3/8"	26.66 N-m (236 lb.-in.)

Setup

The following parameters are grouped by Regulated Field Supply Card function. Depending upon the application, not all parameters must be changed from the parameters' default settings. Parameter P.044 [Motor Field Amps] however, must always be reset to accommodate the Regulated Field Supply Card.

Field Loss Parameters

P.044 [Motor Field Amps]

P.274 [Fld Econ Ref]

P.277 [Fld Loss Level]

When the Regulated Field Supply is operating in the fixed voltage mode, field loss detection will only occur if there is a complete loss of field current.

When the field current regulator is controlling field current, and the Regulated Field Supply Card is not operating in the fixed voltage mode, a field current loss fault will be generated when the field current drops below the value set for parameter P.277 [Fld Loss Level].

The same field feedback signal used by the Regulated Field Supply Card is used by the field loss detection circuit. Field current feedback is compared against the value entered in parameter P.277 [Fld Loss Level]. If feedback < P.277, a fault will be generated. P.277 is entered as a percentage of parameter P.044 [Motor Field Amps]. P.274 [Fld Econ Ref] must be set > P.277 [Fld Loss Level] to avoid field loss faults.

A field loss fault will also occur if the digital value on the A/D converter reaches full scale — Approximately 28% above the rated field output.

Important: Regulator Board Jumper J20 is designed to allow the motor field winding to be separately excited. Jumper J20 is ignored if the Regulated Field Supply Card is installed. Placing J20 in the Disable position will not disable field loss detection.

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Setup

(continued)

Overvoltage Protection Parameters

P.046 [Motor Arm Volts]

Armature overvoltage protection is always active regardless of the type of feedback. This reduces the chance of overvolutaging the armature due to a weakened field. An overvoltage fault occurs when the armature terminal voltage exceeds 130% of parameter P.046 [Motor Arm Volts].

Overspeed Protection Parameters

P.039 [Feedback Type]

P.044 [Motor Field Amps]

Overspeed detection is active only when a tachometer or encoder is being used and parameter P.039 [Feedback Type] is set to DC Tach, Encoder or AC Tach. Because of this, field weakening is limited when P.039 [Feedback Type] is set to Arm Volt and the drive is configured as a voltage regulator. P.277 [Fld Loss Level] is limited to a low value — 50% of P.044 [Motor Field Amps] if P.039 [Feedback Type] is set to Arm Volt.

Field Economy Parameters

P.044 [Motor Field Amps]

P.175 [Fld Econ Active]

P.273 [Fld Econ Delay]

P.274 [Fld Econ Ref]

Parameter P.175 [Fld Econ Active] indicates that field economy is active. Field economy is active from the time the motor stops or the the drive is powered up and after the time delay set in parameter P.273 [Fld Econ Delay] expires. When the Regulated Field Supply Card is operating in the fixed voltage mode, a constant field voltage is generated regardless of the state of P.175.

To provide field economy for the Regulated Field Supply Card, parameter P.274 [Fld Econ Ref] is set as a reference. The value of P.274 is entered as a % of P.044 [Motor Field Amps]. To avoid nuisance field loss faults, the value of P.274 must also be set > P.277 [Fld Loss Level].



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