Allen-Bradley

PowerFlex® DC Drive Resolver Feedback Option Module

ATTENTION: Only qualified personnel familiar with DC drives and associated machinery should plan or implement the installation, start-up and subsequent maintenance of the system. Failure to comply may result in personal injury and/or equipment damage.

ATTENTION: To avoid an electric shock hazard, ensure that all power to the drive has been removed before performing the following.

ATTENTION: This drive 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 procedures are not followed. If you are not familiar with static control procedures, reference A-B publication 8000-4.5.2, "Guarding Against Electrostatic Damage" or any other applicable ESD protection handbook.

IMPORTANT The Resolver Feedback option module can only be used with PowerFlex DC drives with firmware version 5.002 or higher.

What This Kit Includes

- Resolver Feedback circuit board
- Resolver Interface circuit board
- Two stacker connectors
- Four 28 mm stand-offs and washers
- Three 14 mm stand-offs and washers
- Seven screws with captive lock washers
- Static strap

Tools That You Need

- Phillips® screwdriver (PH2)
- Hexalobular screwdriver
- Nut driver or wrench
- Flathead screwdriver

Phillips® is a registered trademark of Phillips Screw Company.

What You Need to Do

To install the resolver feedback option module:

- ❒ Step 1: Remove power from the drive
- ❒ Step 2: Open the drive
- ❒ Step 3: Install the resolver interface board
- ❒ Step 4: Install the resolver feedback board
- ❒ Step 5: Wire the resolver interface and feedback boards
- ❒ Step 6: Replace the protective covers and configure the resolver feedback option module

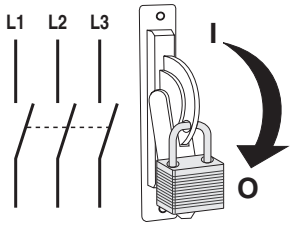
Step 1: Remove Power from the Drive

ATTENTION: Remove power before making or breaking cable connections. When you remove or insert a cable connector with power applied, an electrical arc may occur. An electrical arc can cause personal injury or property damage by:

- sending an erroneous signal to your system's field devices, causing unintended machine motion
- causing an explosion in a hazardous environment

Electrical arcing causes excessive wear to contacts on both the module and its mating connector. Worn contacts may create electrical resistance.

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

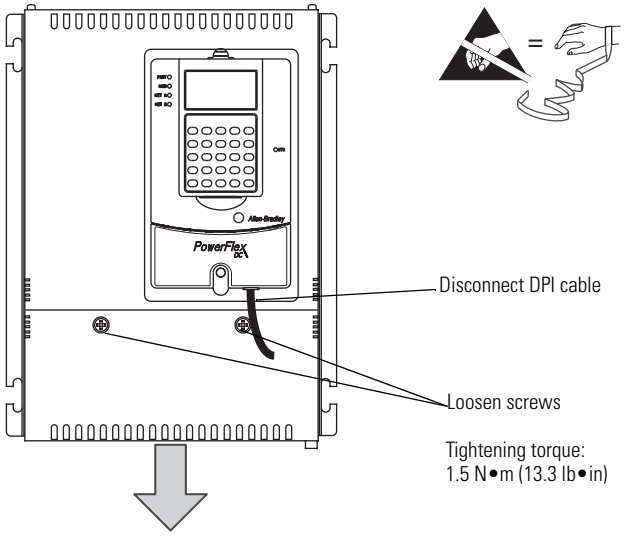


Step 2: Open the Drive

- To open frame A drives see Frame A Drives on page 3.
- To open frame B and C drives see Frame B and C Drives on page 4.
- To open frame D drives see Frame D Drives on page 4.

Frame A Drives

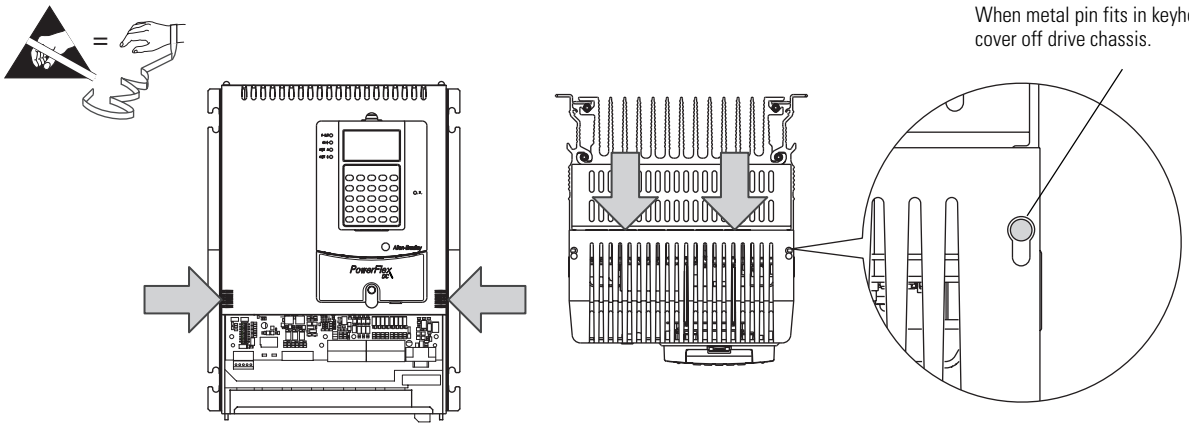
1. Disconnect the DPI cable from the HIM (if installed).
2. Loosen the captive screws that secure the bottom front cover to the drive, then slide the cover down and off the drive chassis.



3. Press in on the sides at the bottom edge of the cover and at the same time pull the cover toward you to pull it partially off the drive chassis. Next, at the top of the drive, pull the cover forward, away from the drive, until the pins fit in the keyhole in the top of the cover, then carefully lift the cover off of the drive chassis.

IMPORTANT The HIM assembly is connected via a cable to the control board and therefore will not pull free from the drive until disconnected.

Continue with Disconnect the HIM Communication Cable on page 5.

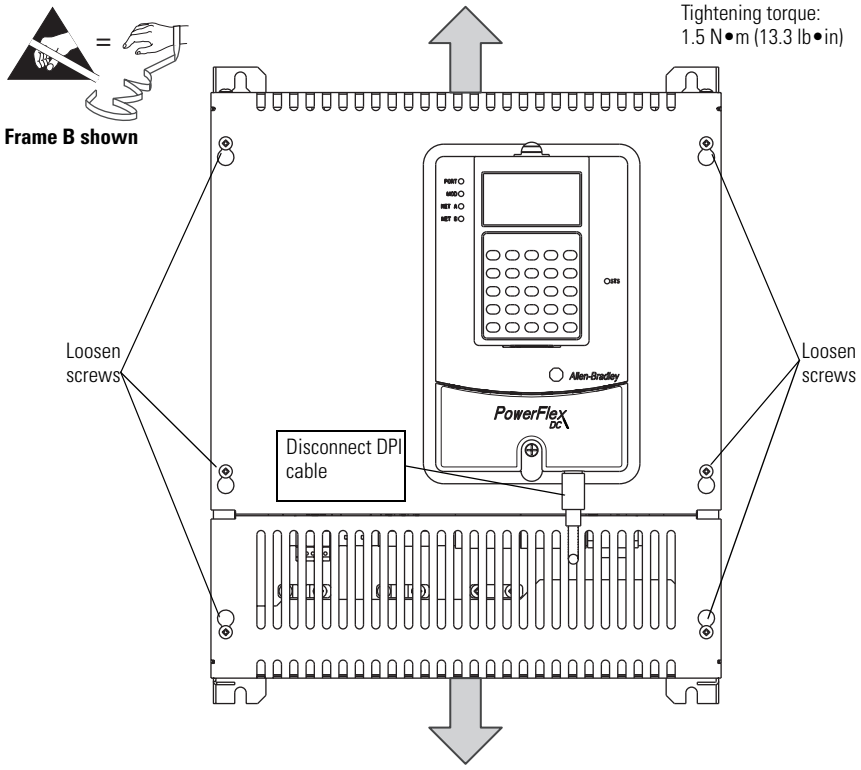


Frame B and C Drives

1. Disconnect the DPI cable from the HIM (if installed).
2. Loosen, but do not remove, the screws that secure the top and bottom front cover to the drive, then slide the covers off the drive chassis.

IMPORTANT The HIM assembly is connected via a cable to the control board and therefore will not pull free from the drive until disconnected.

Continue with Disconnect the HIM Communication Cable on page 5.



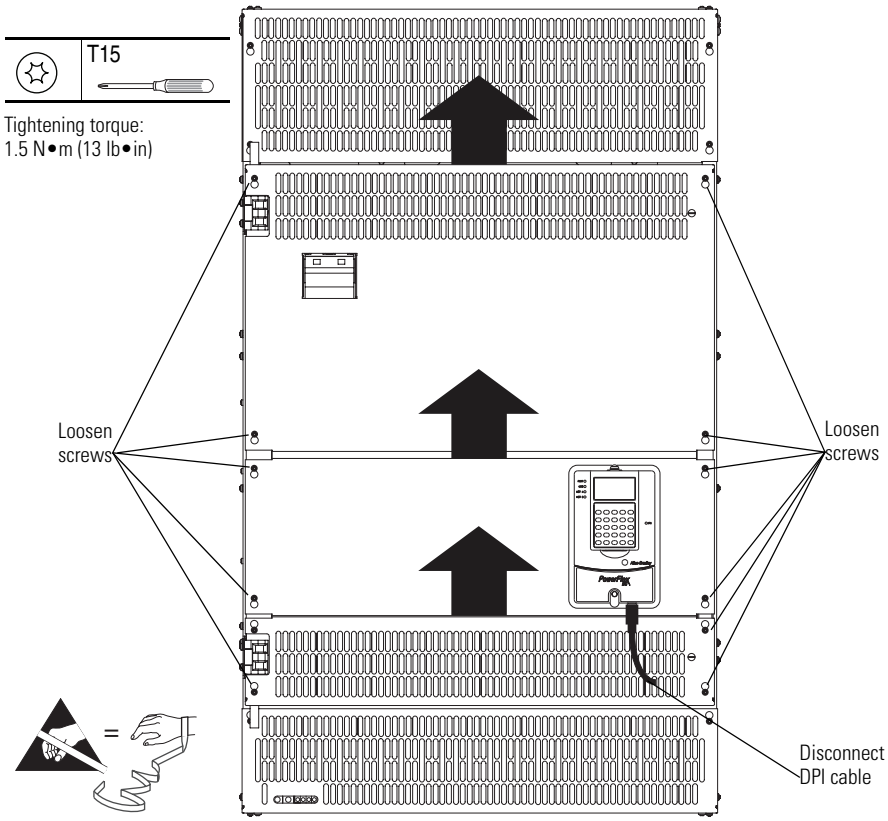
Frame D Drives

1. Disconnect the DPI cable from the HIM assembly (if installed) (see Figure 1 on page 5).
2. Loosen, but do not remove, the four hexalobular screws that secure each of the three covers to the control pan on the drive, then slide the covers up and off the drive chassis (see Figure 1 on page 5). Tightening torque is noted in the illustration for reassembly.

IMPORTANT A communication cable connects the HIM assembly to the control board mounted on the control pan. Therefore, the middle control pan cover and HIM assembly cannot be fully removed from the drive until the cable is disconnected.

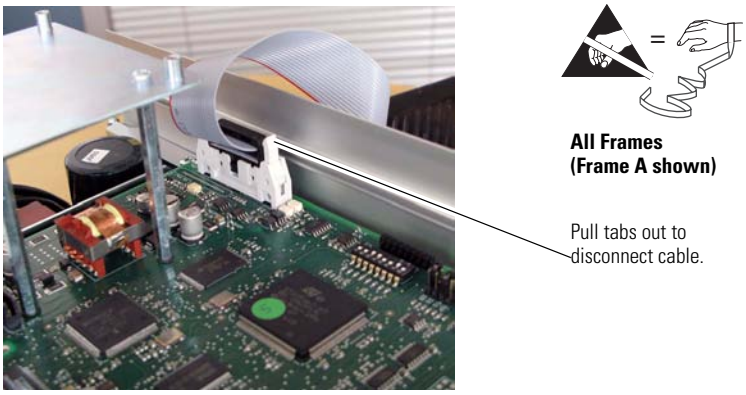
Continue with Disconnect the HIM Communication Cable on page 5.

Figure 1 - Frame D Cover Removal



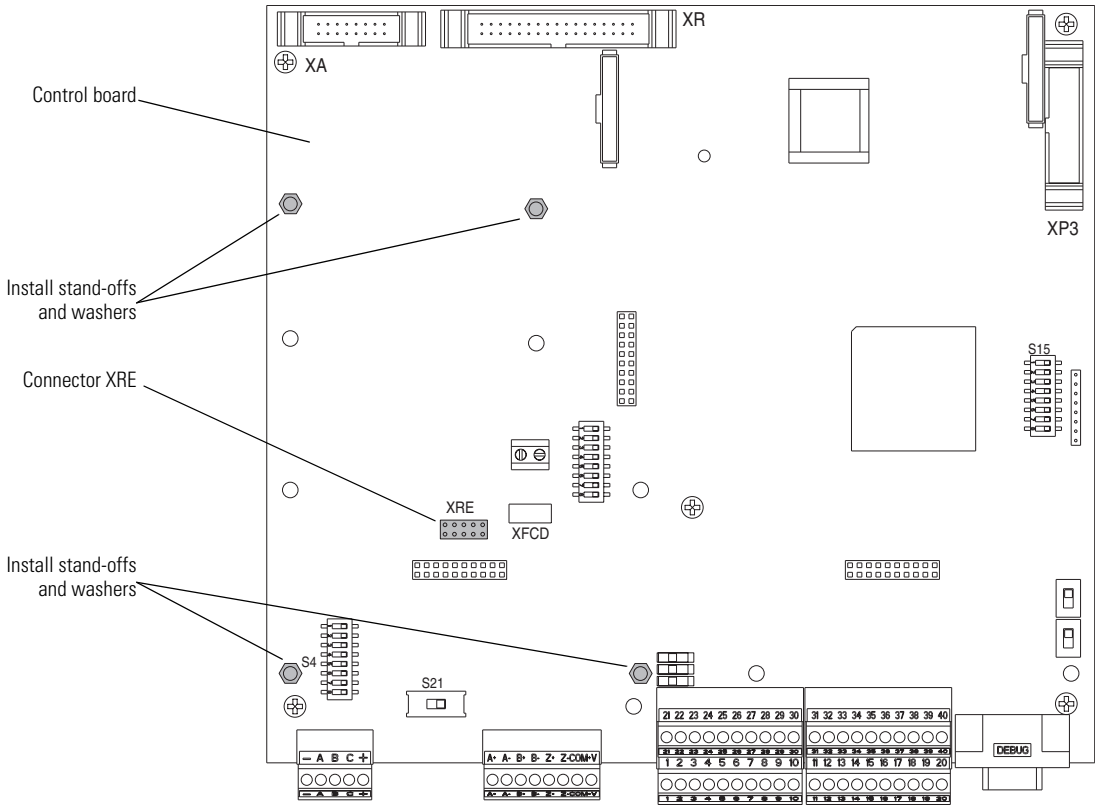
Disconnect the HIM Communication Cable

- Disconnect the HIM communication cable from the connector on the upper right corner of the Control board and remove the bottom cover.



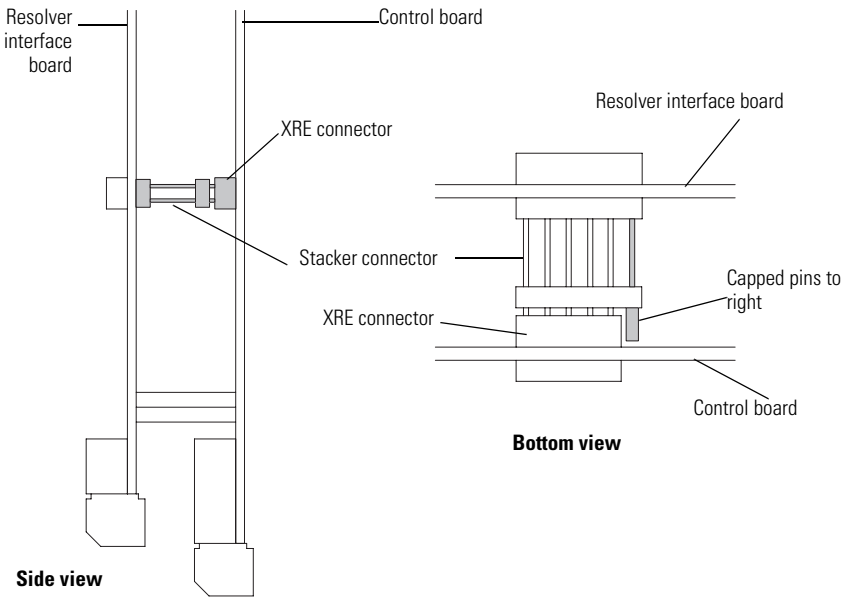
Step 3: Install the Resolver Interface Board

1. Secure the four 28 mm (1.1 in.) (longer) stand-offs and washers to the control board. Tightening torque is 0.7 N•m (6.2 lb•in).

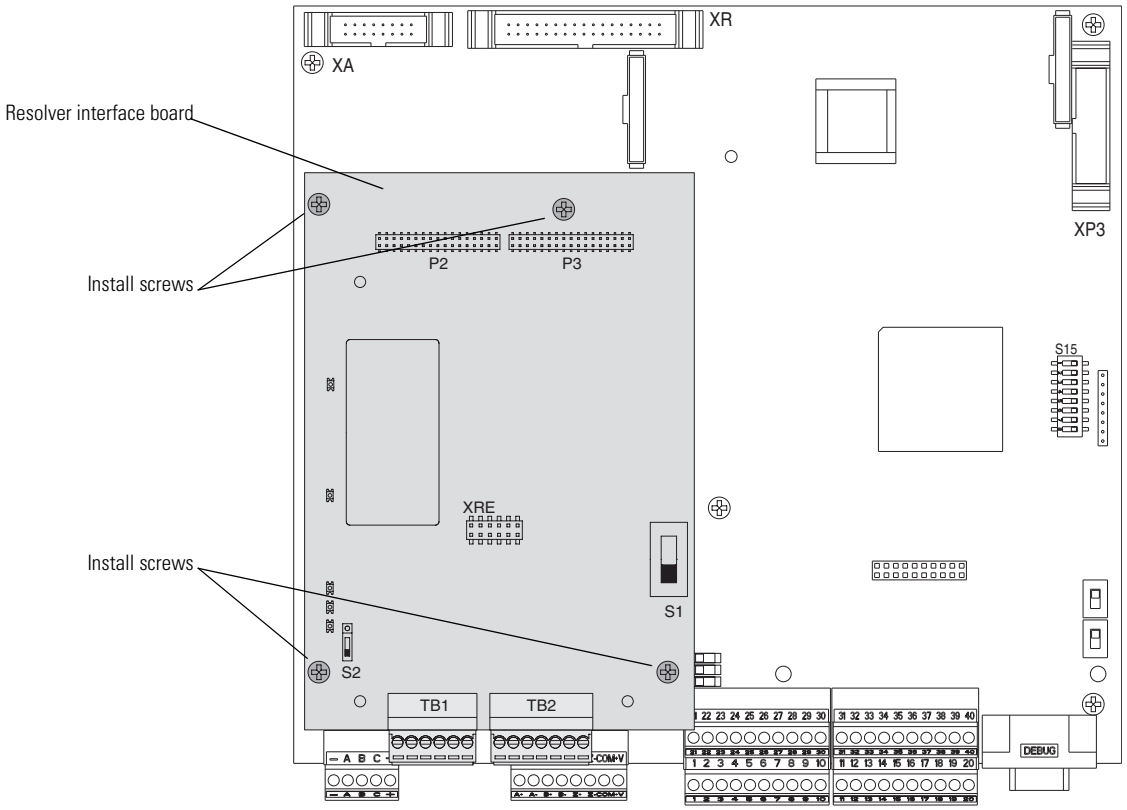


2. Carefully insert the stacker connector on the back of the resolver interface board into connector XRE on the control board (identified in the previous illustration).

IMPORTANT	The two pins of the stacker connector that are capped should be to the right of connector XRE when installed on the control board.

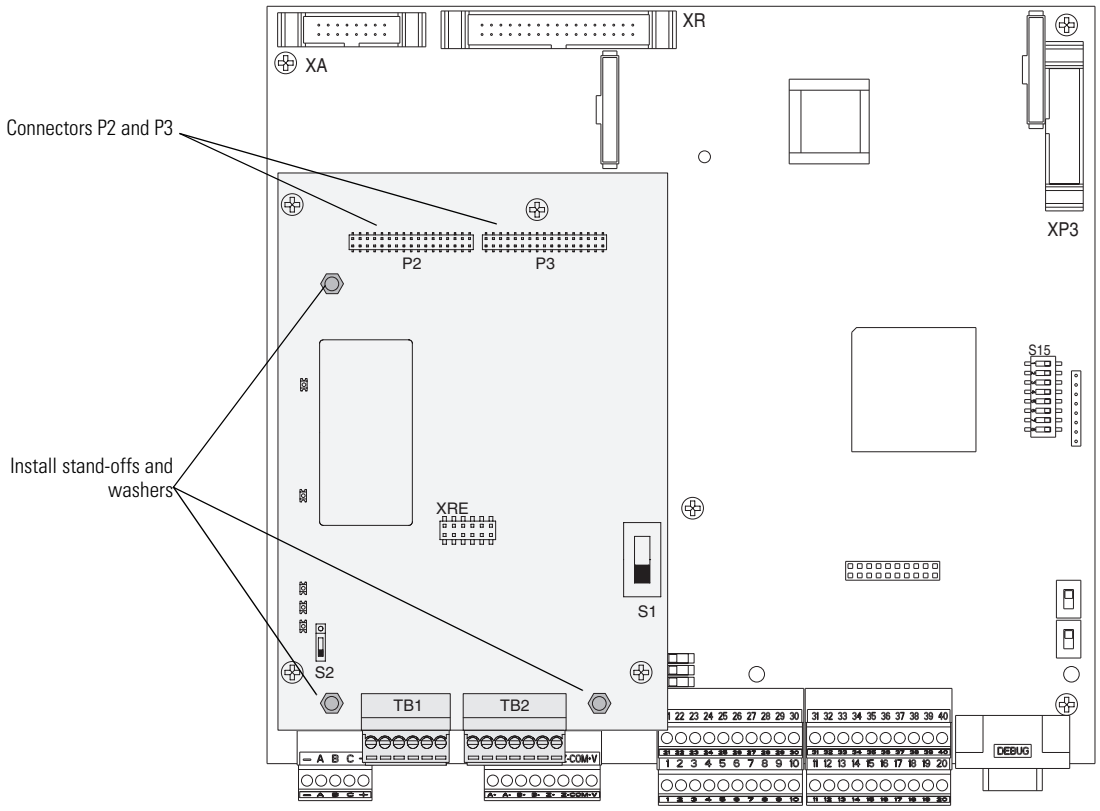


3. Secure the resolver interface board to the stand-offs using four screws with captive washers. Tightening torque is 0.7 N•m (6.2 lb•in).



Step 4: Install the Resolver Feedback Board

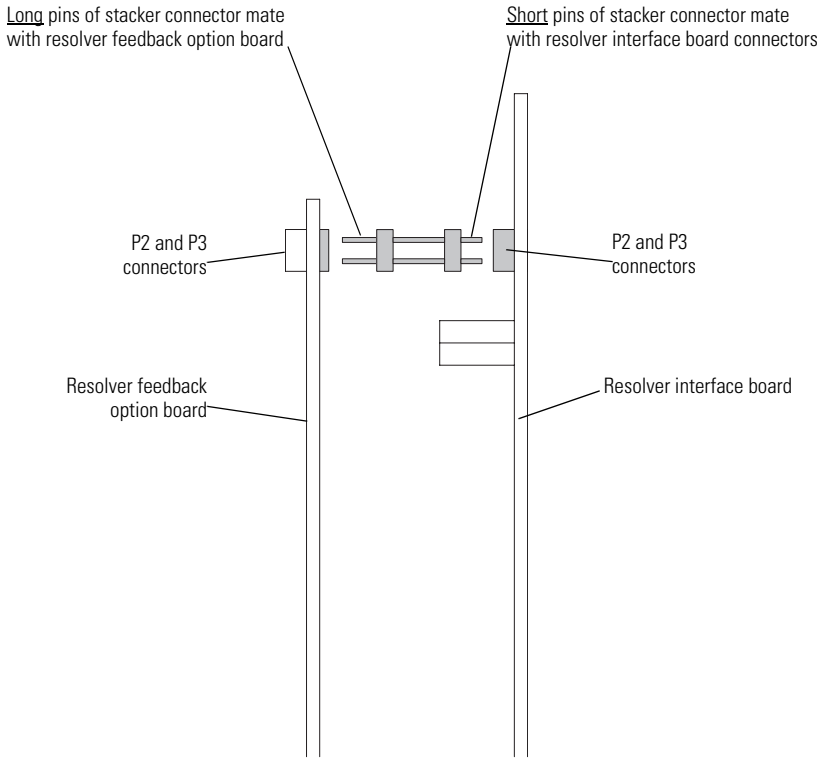
1. Secure the three 14 mm (0.6 in.) (shorter) stand-offs and washers to the resolver interface board. Tightening torque is 0.7 N•m (6.2 lb•in).



2. Carefully insert the long pins of the stacker connectors into connectors P2 and P3 on the back of the resolver feedback option board.

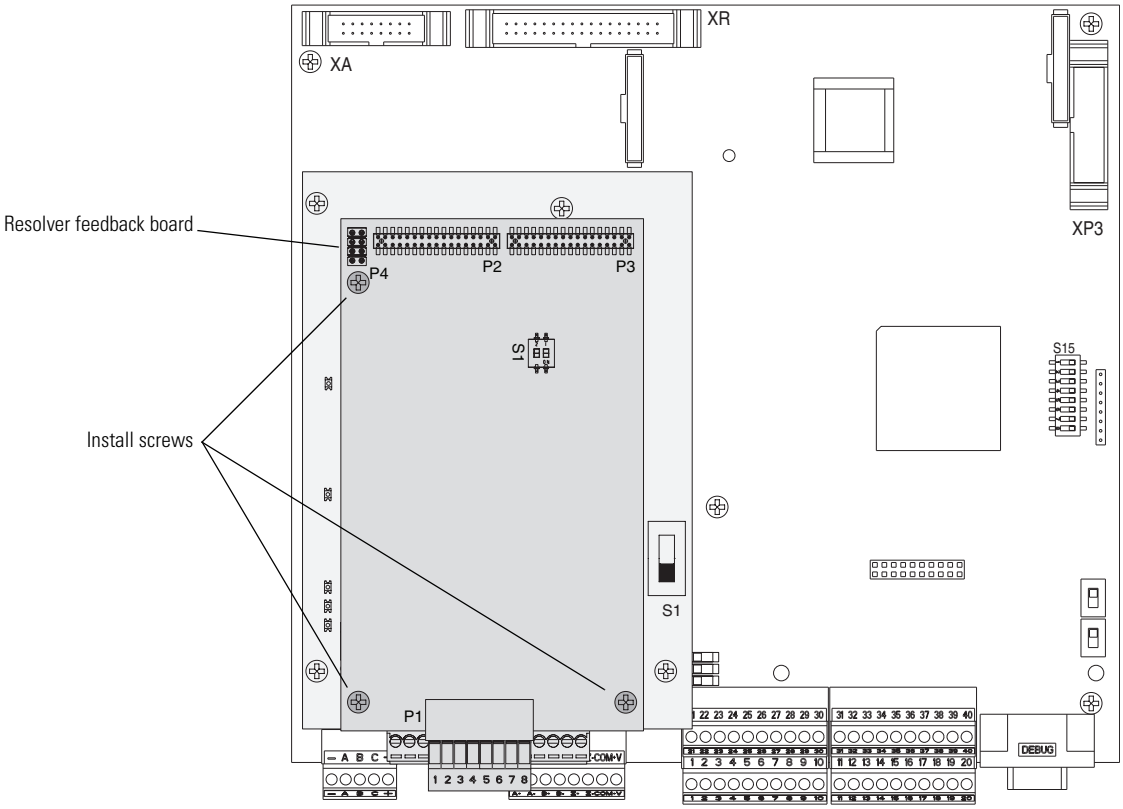
IMPORTANT The end of the stacker connectors with the long pins must connect to the mating connectors (P2 and P3) on the resolver feedback option board. The end of the stacker connectors with the short pins must connect to the mating connectors (P2 and P3) on the resolver interface board.

3. Carefully insert the stacker connectors on the back of the resolver feedback option board into connectors P2 and P3 (identified in the previous illustration) on the resolver interface board.



Side view

4. Secure the resolver feedback board to the stand-offs using three screws with captive washers. Tightening torque is 0.7 N•m (6.2 lb•in).



Step 5: Wire the Resolver Interface and Feedback Boards

Wiring the Resolver Interface Board

Table 1 - Resolver Interface Board TB1 Wire Size and Tightening Torque

Wire Size and Type			
Flexible (mm^2)	**Multi-core (mm^2)**	**AWG**	**Tightening Torque N•m (lb•in)**
0.140…1.500	0.140…1.500	26…16	0.4 (3.5)

Terminal block TB1 on the resolver interface (bottom) board provides connection points for an external 24V DC power supply input, resolver feedback board voltage status output and resolver feedback board reset input. Table 2 on page 12 details the connections.

The resolver feedback module can be powered via an internal or external (customer-supplied) 24V supply. The voltage source is selected by switch S2 on the resolver interface board. See Figure 3 on page 13 for the location of switch S2. The customer-supplied, external 24V power supply is only needed when using the resolver interface board with a PowerFlex DC frame A drive or Stand-Alone Regulator under the following conditions.

- A resolver is wired to the resolver feedback board (terminal block P1)
- A digital encoder is wired to the control board
- The frame A drive has a fan(s)

Switch S2 on the resolver interface board must be set to the "Ext" position when using an external 24V DC power supply for the resolver feedback option module.

Table 2 - Resolver Interface Board TB1 Terminal Descriptions

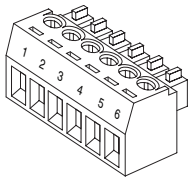
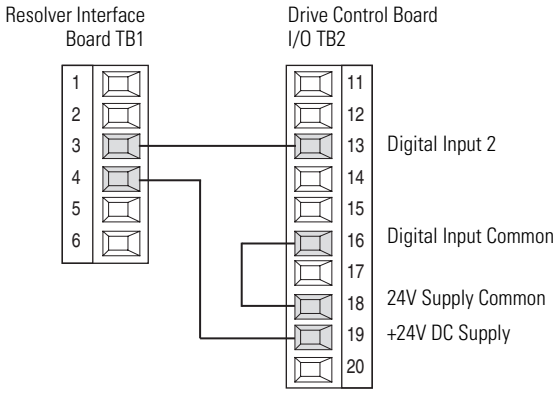
	Terminal	Signal	Description
	1	0V	External power supply input common
	2	+24V	External +24V DC power supply input
	3	OK-	Resolver feedback board voltage status output common
	4	OK+	+5…24V Resolver feedback board voltage status output Vcc OK = voltage present and within +5…24V range when connected to a digital input. Vcc not OK = voltage not present or below +5V when connected to a digital input. See Figure 2 below for wiring example.
	5	R-	Resolver feedback board reset input common
	6	R+	+24V Resolver feedback board reset input

Figure 2 - Resolver Feedback Board Voltage Status Wiring Example

In this example digital input 2, on drive I/O TB2, is configured as an Enable input. When the signal from terminals 3 and 4 on TB1 of the Resolver Interface board = "VCC not OK," the drive is disabled.



Terminal block TB2 on the resolver interface board is used to send the signals from the primary digital encoder installed and wired to the encoder terminal block on the control board to a second "follower" drive/regulator. When the outputs on TB2 are used, switch S1 on the resolver interface board must be set to match the encoder power supply voltage set for the primary encoder on the follower drive's control board (set via switch S21). See the PowerFlex Digital DC Drive User Manual, publication 20P-UM001, for details on installing a primary digital encoder and using switch S21 on the control board.

The S1 switch settings correspond to each of the three LEDs on the left side of the resolver interface board and indicate the selected supply voltage as follows:

- Green LED indicates a 5V supply when lit (on)
- Yellow LED indicates a 12V supply when lit (on)
- Blue LED indicates a 24V supply when lit (on)

See Figure 3 on page 13 for the location of switch S1 and corresponding LEDs on the resolver interface board.

See "Cable and Wiring Recommendations" in the PowerFlex Digital DC Drive User Manual, publication 20P-UM001, for encoder wiring recommendations.

Table 3 - Resolver Interface Board TB2 Terminal Descriptions

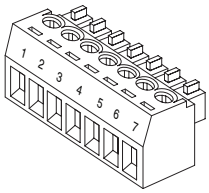
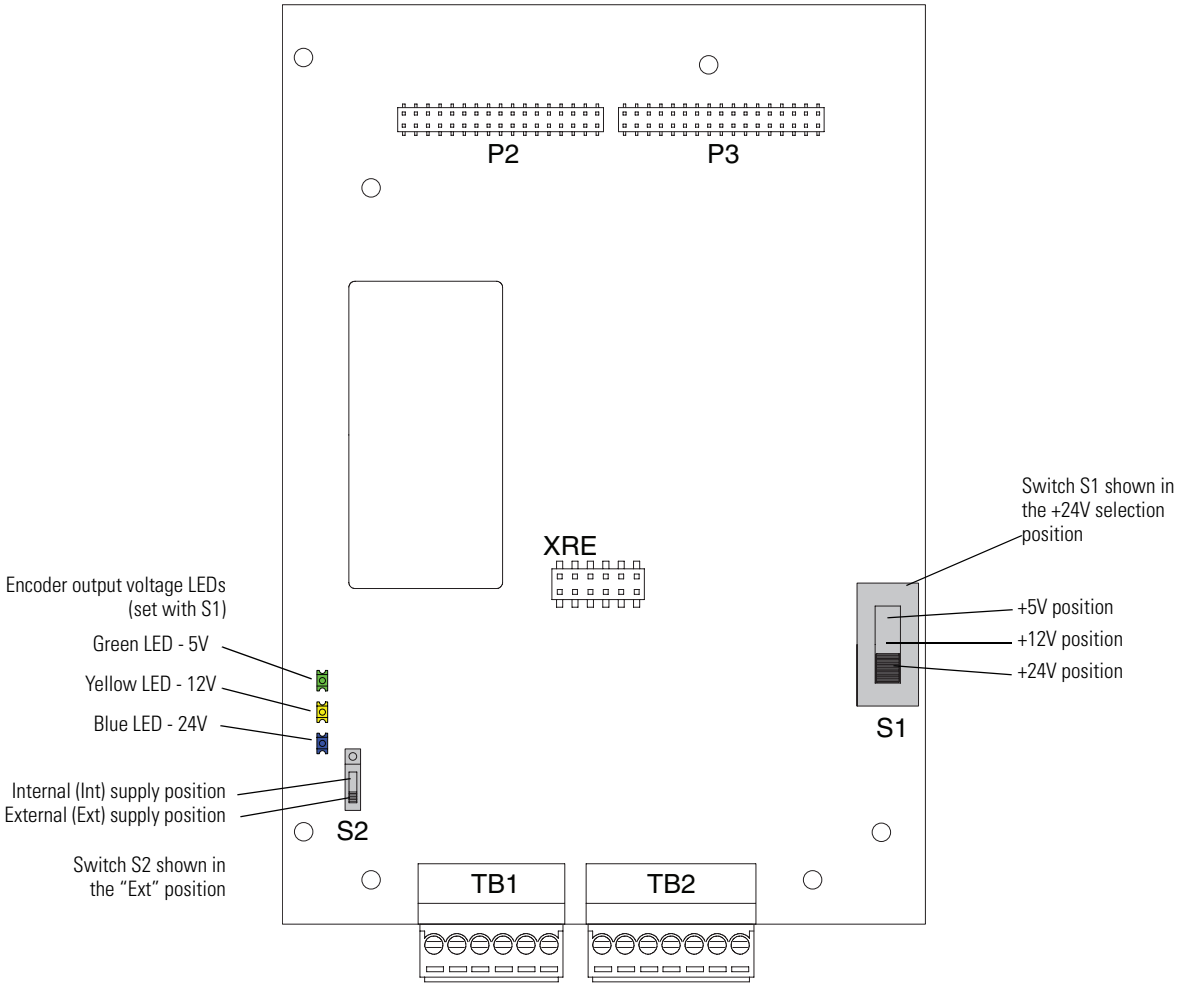
	Terminal	Signal	Description
	1	A+	Encoder A
	2	A-	Encoder A (NOT)
	3	B+	Encoder B
	4	B-	Encoder B (NOT)
	5	Z+	Encoder Z
	6	Z-	Encoder Z (NOT)
	7	Shield	Connection point for encoder cable shield

Table 4 - TB2 Encoder Output Specifications

Max. Output Current	20 mA
Max. Output Low Voltage	0.5V @ 20 mA
Min. Output High Voltage	Vcc - 2.6V @ 20 mA (where Vcc = 5V or 30V)

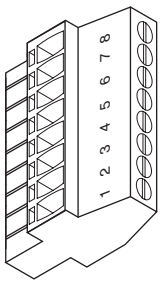
Figure 3 - Resolver Interface Board Switch and LED Locations



Wiring the Resolver Feedback Board

Terminal block P1 on the resolver feedback option (top) board provides the connection points for a single resolver. Table 5 details the connections.

Table 5 - Resolver Feedback Board P1 Terminal Descriptions

	Terminal	Signal	Description
	8	REF HIGH	Positive Reference signal
	7	SHIELD	Connection point for resolver cable shield
	6	REF LOW	Negative Reference signal
	5	SIN HIGH	Positive Sine signal
	4	SHIELD	Connection point for resolver cable shield
	3	SIN LOW	Negative Sine signal
	2	COS HIGH	Positive Cosine signal
	1	COS LOW	Negative Cosine signal

- P1 terminal block part number: 1639300000
- P1 terminal block material number: BL 3.50/08/90F SN BK BX

Recommended Resolver Cable

For the best results, Belden® 9730 (or equivalent) cable is recommended. For retro-fit applications where Reliance Electric™ resolvers (800123-xxx), wiring (417900-207CG) or Automax™ systems were used, existing wiring may be used (assuming it is in good working condition).

Belden 9730 (or Equivalent) Cable Attributes

- 3 twisted pairs, 24 AWG, shielded, -20 to +80 °C, 300V
- Inductance = 0.23 µH/ft
- Capacitance = 12.5 pF/ft
- Resistance = 24 Ω/1000 ft
- See Table 6 for maximum cable lengths

Reliance Electric 417900-207CG Cable Attributes

- 3 Twisted Pairs, 18 AWG, unshielded, 80°C, 300V
- Chrome FPR Jacket, Plenum Rated
- Twists Per Inch: 2-3 twists per inch of wire lay per pair
- Inductance per 1000 Feet: 0.13 µH ±10% as read on a GEN_RAD Model 1658 RLC Digibridge or equivalent
- Capacitance Per Pair: not to exceed 30 pF/ft ±0.3 pF as read on a GEN_RAD Model 1658 RLC Digibridge or equivalent
- Capacitance Difference Pair to Pair: not to exceed 0.6 pF/foot as read on a GEN_RAD Model 1658 RLC Digibridge or equivalent
- Resistance per 1000 Feet: 17.15Ω ±10%
- Insulation Thickness: 0.008 in.
- Conductor Stranding 16/30
- Jacket Thickness: 0.018 in.
- See Table 6 for maximum cable lengths

Table 6 - Maximum Resolver Cable Length

Cable	Maximum Cable Length	
	x1 and x2 Resolver Speed Ratio	x5 Resolver Speed Ratio
Belden 9730	305 m (1000 ft)	183 m (600 ft)
417900-207CG	240 m (800 ft)	150 m (500 ft)

Resolver Feedback Option Board Specifications

Consideration	Description
Excitation Frequency	2381…9300 Hz
Excitation Voltage	8…26 Vrms
Resolver Feedback Voltage	2 Vrms +/- 300 mV

Compatible Resolvers

The table below specifies which resolvers are compatible with the PowerFlex DC resolver feedback option module.

Manufacturer	Manufacturer Model/Catalog Number
Advanced Micro Controls Inc.	R11X-C10/7
Reliance Electric	800123-R 800123-1R 800123-2R 800123-S 800123-1S 800123-2S 800123-T 800123-1T 800123-2T (flange mounted)
Tamagawa	TS-2014N181E32 TS-2014N182E32 TS-2014N185E32 TS-2087N1E9 TS-2087N2E9 TS-2087N5E9 TS-2087N11E9 TS-2087N12E9

Resolver Wiring Diagrams

IMPORTANT The shield connections must only be made at the drive end of the cable (resolver end of cable shield is unattached) as shown in the diagrams below. Grounding both ends of the shielded cable can result in ground loops that could damage the resolver and/or drive.

Also, the resolver connections are considered signal level wiring and MUST be run separate from control and power wiring (and at least 12 inches apart).

Figure 4 - Resolver Interface Connection Example for Clockwise Rotation - Count Up

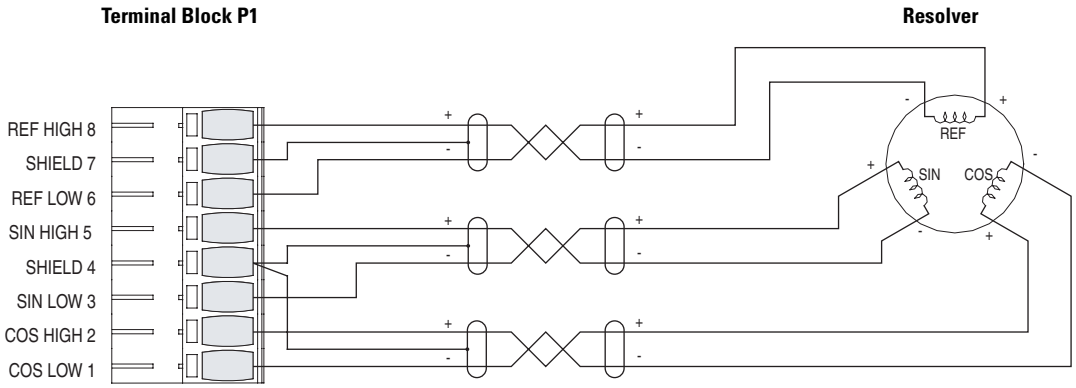
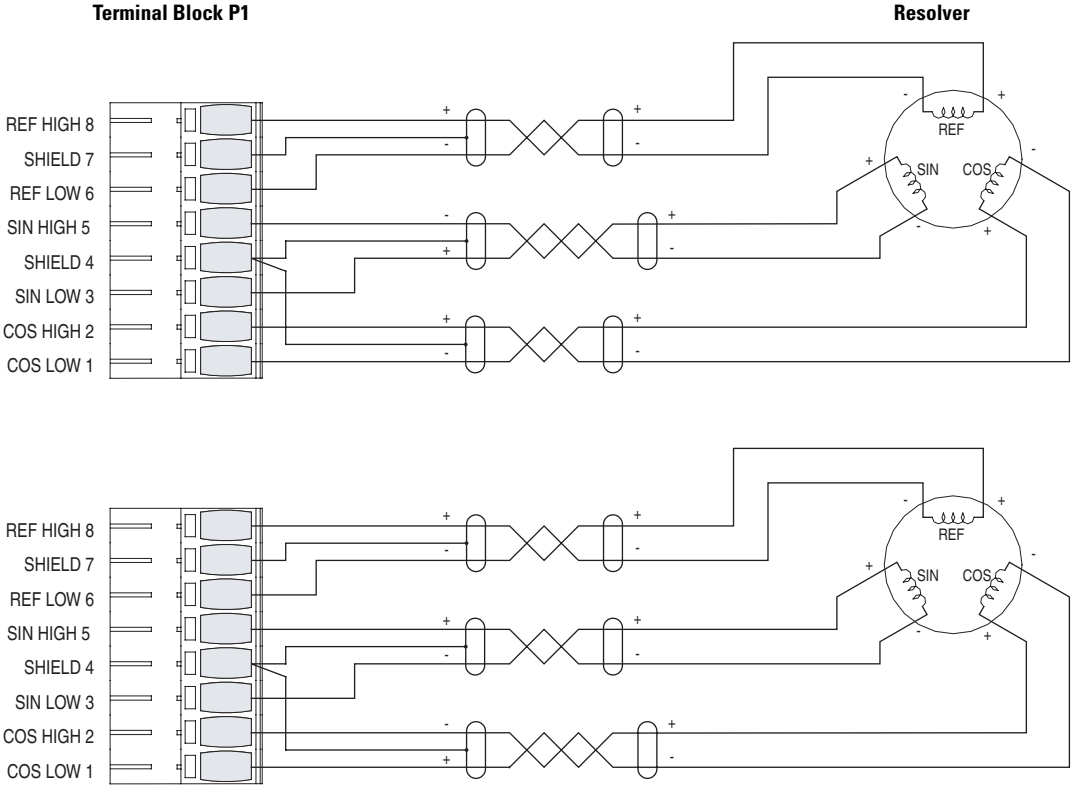


Figure 5 - Resolver Interface Connection Examples for Clockwise Rotation - Count Down

Reverse Polarity of Sine or Cosine Signals



Step 6: Replace the Protective Covers and Configure the Resolver Feedback Option Module

1. Close the drive covers in the reverse order as described in Step 2: Open the Drive on page 2.
2. Configure the resolver feedback option module. See the PowerFlex Digital DC Drive User Manual, publication 20P-UM001.



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