Allen-Bradley 1397 Pulse Encoder Interface Card

Cat. No. 1397-PE

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What This Option Provides

The Pulse Encoder Interface Card is a drive mounted board that provides terminals and an interface to differential encoder feedback signals for both regenerative and non-regenerative 1397 drives.

Where This Option Is Used

This option may be used with all 1397 drives.

What These Instructions Contain

These instructions contain the necessary information to install & configure a 1397 Pulse Encoder Interface Card. For additional information on encoder signal requirements, wire recommendations, encoder parameters and related function blocks, refer to the 1397 User Manual — Publication 1397-5.0.

Specifications

Pulse Encoder Requirements	Waveform:	Square Wave — Constant Amplitude Over Entire Speed Range, Including Zero Speed
	Differential Output:	Single-Channel or Quadrature (Dual-Channel)
	Duty Cycle:	50% Nominal
	Quadrature:	Required for All Regenerative Drives
	Line Drivers:	May Be Required to Satisfy the Pulse Encoder Interface Card's Voltage Limits
Wiring Requirements	Refer to the 1397 User Manual — Publication 1397-5.0	
Pulse Encoder Interface Card Requirements	Power Supply:	+15V DC, ±5%, 200mA Maximum
	Absolute: Max Frequency	100 kHz
	Min Frequency:	0 kHz
	Recommended: Max Frequency	73 kHz
	Differential Input Requirements	Voltage: +25V DC Maximum to Common +5V DC Minimum Differential +15V DC Maximum Differential Input Impedance: 11kΩ Line Termination: 100Ω in Series with (1) 3900 pf Capacitor

How to Select the PPR of a Pulse Encoder

A 120 PPR pulse encoder can maintain a minimum speed of 25 RPM at the accuracy listed in the **Specifications** above. The drive can operate below minimum motor speed but with degraded accuracy. If a lower motor speed is required, a pulse encoder with a higher PPR rating is required.

To select a pulse encoder —

Step 1 — Determine the pulse encoder's minimum PPR requirement.

$$PPR_1 = \frac{[1] \times [60]}{N_1 \times 0.02}$$

where:

PPR_1 = The Pulse Encoder's Minimum Pulses-per-Revolution

N_1 = The Required Minimum Motor Speed in RPM

How to Select the PPR of a Pulse Encoder (continued)

One pulse/scan is required to meet the specified drive speed regulation listed in the 1397 User Manual. For a drive scan time of 0.02 seconds, the card requires a minimum of (50) pulses-per-second from a pulse encoder. Using a minimum motor speed of 25 RPM:

$$\mathbf{PPR_1} = \frac{[1] \times [60]}{\mathbf{25} \times [0.02]} = \mathbf{120\ PPR}$$

Step 2 — Determine the maximum allowable pulse encoder PPR.

To leave adequate "head room" for possible motor over speeding at the motor's rated nameplate speed, the card's "head room" frequency should not exceed 73kHz, the card's maximum frequency.

$$\mathbf{PPR_2} = \frac{73{,}000 \times 60\ \text{Sec/Min}}{\mathbf{N_2}}$$

where:

$\mathbf{PPR_2}$ = The Maximum Allowable Pulse Encoder PPR

$\mathbf{N_2}$ = P.041 [Max Motor Speed]

Step 3 — Pick a PPR for the application.

Pick a PPR for the application between the values calculated in Steps 1 & 2.

$$\mathbf{PPR_1} \leq \mathbf{PPR_{req}} \leq \mathbf{PPR_2}$$

where $\mathbf{PPR_{req}}$ = The PPR Required for the Application

Step 4 — Calculate the pulse encoder's required frequency at P.041 [Max Motor Speed].

Using the value selected in Step 3, calculate the pulse encoder frequency at P.041 [Max Motor Speed].

$$\mathbf{Freq_{req}} = \frac{\mathbf{N_2} \times \mathbf{PPR_{req}}}{60}$$

where:

$\mathbf{Freq_{req}}$ = The Pulse Encoder's Required Frequency

$\mathbf{PPR_{req}}$ = The PPR Required for the Application

Step 5 — Confirm that the pulse encoder frequency ≤ 80% of the pulse encoder's maximum rated nameplate frequency.

To ensure that the pulse encoder has adequate "head room" for motor overspeeding, confirm that the pulse encoder's required frequency is ≤ 80% of the pulse encoder's maximum rated nameplate frequency.

$$\mathbf{Freq_{req}} \leq 80\% \times \mathbf{Freq_{PE}}$$

where $\mathbf{Freq_{PE}}$ = The Pulse Encoder's Maximum Rated Nameplate Frequency.

How to Select the PPR of a Pulse Encoder (continued)

Example

Using a 5,000 RPM motor with a requirement to run as low as 25 RPM —

Determine the Pulse Encoder's Minimum PPR Requirement —

$$\mathbf{PPR_1} = \frac{[1] \times [60]}{\mathbf{25} \times [0.02]} = 120 \text{ PPR}$$

Determine the Maximum Allowable Pulse Encoder PPR —

$$\mathbf{PPR_2} \leq \frac{73{,}000 \times 60}{5000} \leq 876 \text{ PPR}$$

Pick a PPR for the Application — In This Example 500

$$\mathbf{PPR_1} \leq 500 \leq \mathbf{PPR_2}$$

Calculate the Pulse Encoder's Required Frequency at P.041 [Max Motor Speed] —

$$\mathbf{Freq_{req}} = \frac{[5{,}000] \times [500]}{60} = 41.67\text{kHz}$$

Confirm That the Pulse Encoder Frequency ≤ 80% of the Pulse Encoder's Maximum Rated Nameplate Frequency — In This Example 120kHz

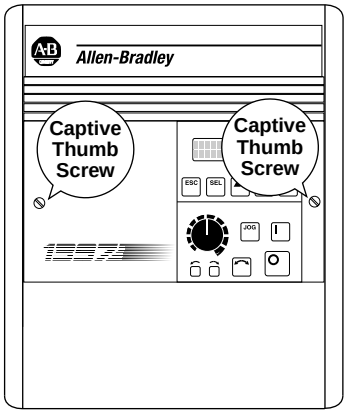
41.678k Hz ≤ .8 (120,000)

Installation

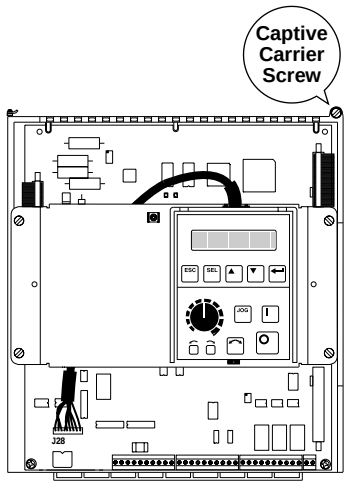
ATTENTION: This board contains ESD (Electrostatic Discharge) sensitive parts and assemblies. Static control precautions are required when installing, testing, servicing or repairing this assembly. Component damage may result if ESD control precautions are not followed. If you are not familiar with static 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, lockout and tag all incoming power to the drive. Verify with a voltmeter than no voltage exists at terminals L1, L2 and L3 on the drive input power terminal block.



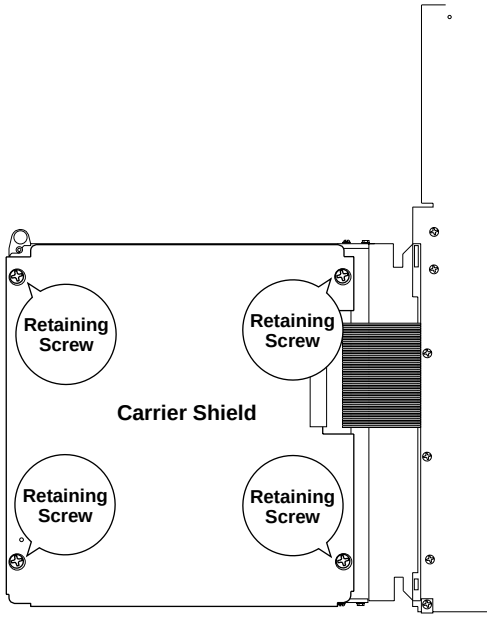
❒ **1** Remove and lock-out all incoming power to the drive. Loosen the (2) captive retaining screws and remove the drive cover.

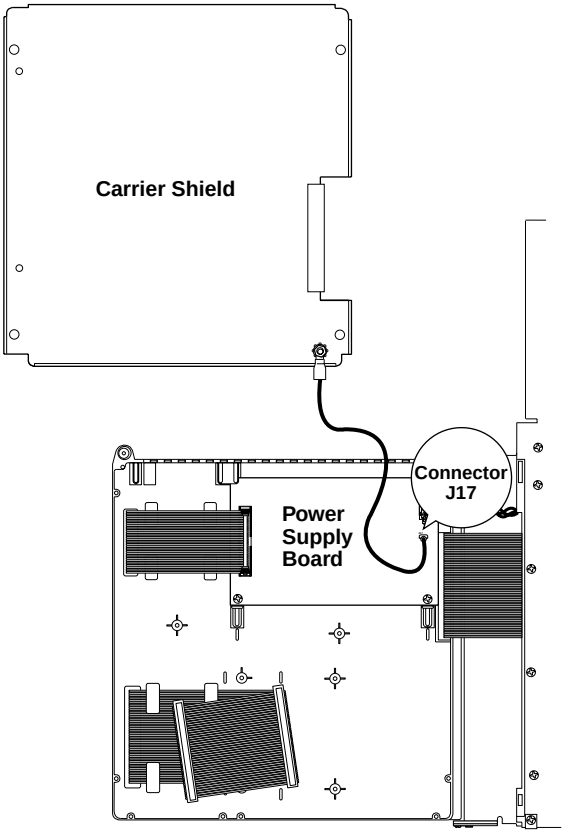


❒ **2** Loosen the captive carrier retaining screw and swing the carrier door open.

Installation
(continued)

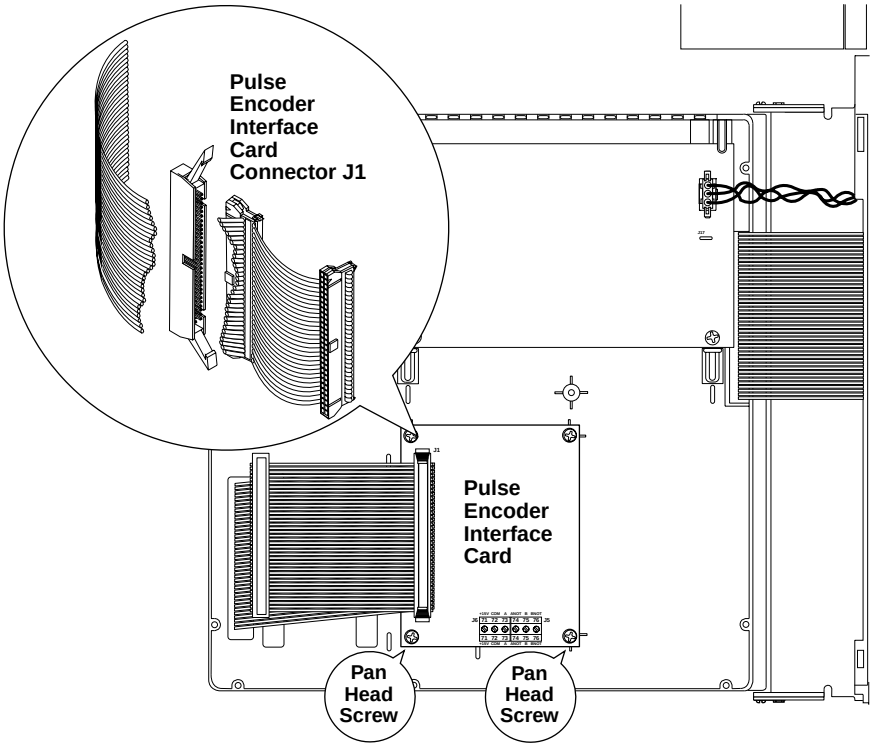
❒ **3** To remove the carrier shield, remove the (4) retaining screws and unplug the ground wire at the Power Supply Board.



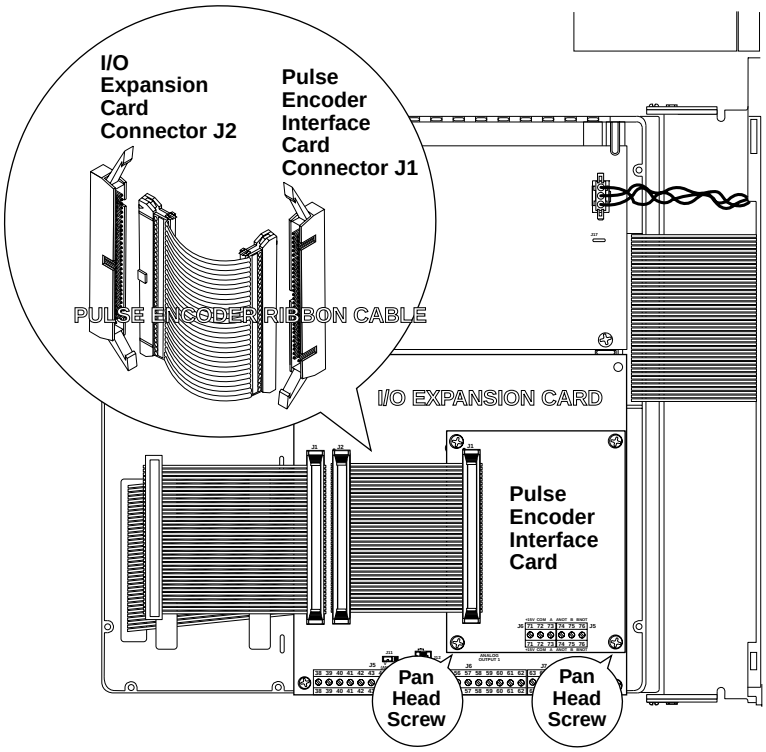


Installation
(continued)

If an I/O Expansion Card is also required, complete both Steps 4 and 5.



❒ **4** Install the Pulse Encoder Interface Card in the drive carrier using the (2) pan head screws provided, then plug the middle ribbon cable connector into **J1**.



❒ **5** If an I/O Expansion Card is used, the Pulse Encoder Interface Card is mounted piggy back on the I/O Expansion Board and connected using hardware included with the Pulse Encoder Interface Kit.

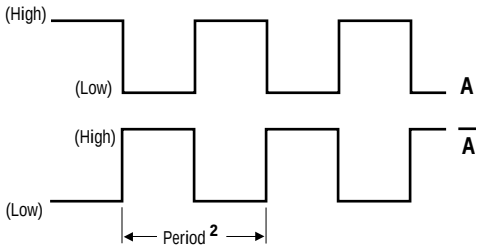
Wiring Specifications

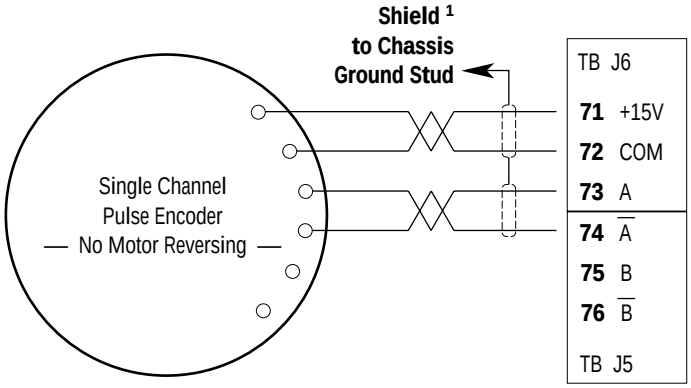
Terminal Blocks J5 and J6 are available for either regenerative or non-regenerative drive connection.

Note: Only regenerative drives allow motor reversing. Regenerative drives require that quadrature pulse encoders be used.

ATTENTION: The incorrect wiring of the pulse encoder and/or motor can cause an overspeed condition. Verify correct motor and pulse encoder polarity in the Start-Up and Adjustment section of the 1397 User Manual. Failure to observe this precaution could result in bodily injury.

Non-Regenerative Drives — Non-Reversing Motor Applications

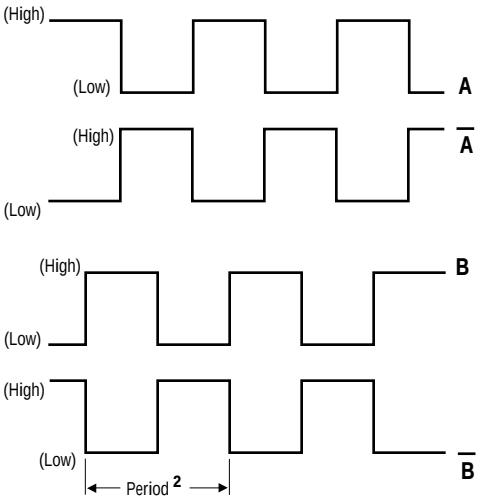


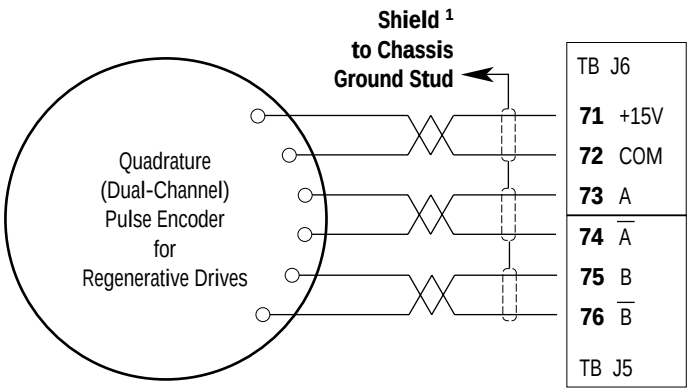


1 Belden 9728 or 9730 — (2) Conductor Twisted Shielded Cable Refer to the Cable and Wire Recommendations in the 1397 Use Manual for additional Wiring Specifications

2 Period = $\frac{1}{\text{frequency}}$

Regenerative Drives — Reversing and Non-Regenerative Motor Applications





1 Belden 9728 or 9730 — (2) conductor twisted shielded cable. Refer to the **Cable and Wire Recommendations** in the 1397 User Manual for additional wiring specifications.

2 Period = $\frac{1}{\text{frequency}}$

Setup

To configure the board for the selected pulse encoder, (4) parameters are set. An additional parameter may be checked for board status.

ATTENTION: The incorrect setting of parameters P.039 or P.048 can cause an overspeed condition. Both parameters must be set by a qualified person who understands the significance of setting them. Set the value of these parameters accurately per your application requirements. Failure to observe this precaution could result in bodily injury.

P.039 — Set **Feedback Type** to **Encoder**

This parameter is set to match the type of drive feedback signal used.

Default Value = Arm Volt

P.041 — Set **Max Motor Speed**

This parameter is set to match the motor's rated nameplate speed (N_2), the same value that was used in Step 2 on page 3.

Default Value = 500 RPM

P.048 — Set **Encoder PPR**

This parameter is set to the pulse encoder's rated PPR (PPR_{req}), the value that was selected in Step 3 on page 3.

Default Value = 18 PPR

P.049 — Set **Encoder Quad** to **Off** (Disabled) for a Single-Channel Encoder
Set **Encoder Quad** to **On** (Enabled) for a Quadrature (Dual-Channel) Encoder

This parameter is set to match the type of pulse encoder, either single-channel or quadrature (dual-channel).

Default Value = On

Notes

Notes

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