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Part # **MA3400A Rev 1.0**
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MA3400A

PC3400A Family Hardware Reference Manual

Single axis digital servo amplifier

The **PC34xxA** Series is a new generation of digital servo amplifiers for controlling ***Brushless DC*** and ***Brush DC*** servomotors in position, velocity, or torque (current) modes, feedback dependent. Units are available in current ratings of 3, 6, 10 and 20 amps RMS continuous.

PREFACE

You've just purchased the finest Servo Controller(s) in its class. The PC34xxA Series servo amplifiers are designed to provide reliable long-term and economical operation in demanding field environments. Without exception the PC34xxA Series Digital Servo Drives outperform every other competitor in the critical areas of size, performance, integration via its extensive I/O, ease of field service, and the versatility of its all-digital design. The PC34xxA Series is an OEM product where the Ship-Kits (connectors), manuals are included with each unit. Please review the section on Accessories 7.3.1 when ordering optional system components (motor-to-drive or I/O cable assemblies, regeneration resistor kits, etc.).

The **PC34xxA** Series is a new fourth-generation of digital servo amplifiers for controlling ***Brushless DC*** and ***Brush DC*** servomotors in position, velocity, or current (torque) modes, feedback dependent. Units are available in current ratings of 3, 6, 10 and 20 amps RMS continuous. The product series includes four product families: the **PC34xxAd**, a **Digital** servo drive, the **Intelligent** servo drives **PC34xxAi** and **PC34xxAi-001-xI** with extended I/O, the high performance DSP model is a **PC34xxAc Centennial** servo drive. See section 1.2 Model Designations and Specifications for additional detail. Depending on the model purchased, the **PC34xxA** product series supports Hall only (Trapezoidal Commutation), Resolver, Comcoder or Hall/Encoder for (Sinusoidal Commutation) or Tach feedback. Each model of the PC34xxA Series utilizes a space vector control algorithm. All modes of operation offer a PID loop-tuning feature to optimize the performance of the selected servomotor.

Each PC34xxA unit is a power supply, amplifier, controller and heatsink integrated into a single standalone package. The compact size and integrated design of the PC34xxA amplifier simplifies the installation process and reduces down time should the need for replacement arise. The unit is hardware configured for RS-232 (factory default), RS-422 or RS-485 serial communications with **ToolPAC**© software for configuration, debugging and trouble shooting of the unit. **ToolPAC** software allows complete configuration and diagnostics of all features in the unit.

Fundamentally, a **PC34xxA** amplifier is a computer that is dedicated to motion control. Like every other computer it has its own operating system, data storage capabilities, data manipulation capabilities. The unit also includes a serial interface for data communications. In addition, its built-in inputs/outputs allow for hard-wired connections for motor feedback and to sensor switches to ensure motion that is "in sync" with a user's environment. All PC34xxA Series servo controllers provide the user with the same basic components, including:

- Serial communications port for use with **ToolPAC**© for purposes of trouble shooting and initial drive configuration.

- A graphical user interface program, **ToolPAC**, provides the user with the tools to quickly and easily configure the PC34xxA to a specific motor and application. **ToolPAC** provides Wizards for **Axis Setup, I/O Configuration**, **Tuning** and is compatible with WIN95/WIN98/NT operating systems.

- System software including commands and parameters that allow you to configure the servo controller to your application, to enter and manipulate data, and to tune the performance of the unit to your application.

- Methods of control include Position, Velocity, and Current (torque) with the ability to accept Step/Dir, Step+/step- and Encoder quadrature in Following mode whereby you are commanding the servo system in a position following mode. Master/slave relationships can be developed from the secondary encoder inputs, providing motion output.

- Distributed Feedback; A mode of operation where a secondary encoder is used to close the Position loop in an application. When using Distributed Feedback you will loose the ability to provide Step/Dir, Step+/Step- or Encoder following as the secondary encoder is wired to these HSI inputs. Thus CAM and Master/Slave relationships are likewise not available.

- The **I/O Configuration Wizard** provides the user with the tools to configure Hardware interfaces for High-Speed Encoder inputs, CW, CCW, Home inputs, Brake output that allow you to interface to your machinery/equipment.

The **PC34xxAi** (Intelligent) Series Controllers accept high level commands directly, eliminating the need for a motion controller and can be operated standalone or networked. Each unit has the ability to store and execute motion programs. Additional features available are:

- Stored program mode refers to a method of control where you create and store "motion programs" on the servo controller system and execute the programs when required. Motion programs provide the user with the ability to perform complex, repetitive functions without having to type each individual command line every time you wish to perform the same function. In this mode you may choose to initiate a program through your communications port or establish a monitor program to allow an input to "trigger" or begin execution of a particular sequence of commands.

- Networked configuration allows for up to 31 axis from a single PC serial port or similar host device. Multi-axis start and stop, along with on-the-fly speed change, are only a few of the networked features available on these units. The user must request additional documentation to gain a better understanding of the network requirements. The documents listed below, you may log onto ftp site at the address shown below.

ToolPAC Software Reference Guide, for additional information on Advanced commands (Gearing, Macros, Links, PLS)	MAToolPAC.zip
Intelligent Servo Protocol (**MA-ISP.pdf**)	Below
Intelligent Servo ASCII Protocol (**MA-ISAP.pdf**)	Below
Intelligent Motion Language (**MA-IML.pdf**)	Below
Dynamic Link Library (DLL)	ISPDLL.zip

- http://www.pacsci.com.

- On the **PC34xxAi series**, up to 100 data points can be entered to define complex SPLINE tables as a function of time or complex CAM tables as a function of the master encoder input. Master/slave (Electronic Gearing) relationships can be developed from the secondary encoder inputs, providing motion output as a RATIO, CAM, or SPLINE.

- The **PC34xxAi-001-xI** has an additional 16 general-purpose digital inputs and 8 general purpose outputs.

The **PC34xxAc** (Centennial) Series Servo Controllers are one of the most advanced DSP motion controllers available. It can accept high level commands directly, eliminating the need for a motion controller and can be operated standalone or networked. Each unit has the ability to store and execute motion programs. Additional features available are:

- All modes of operation offer a Real-time Adaptive Tuning feature to optimize the performance of the selected servomotor. This Real-time Adaptive Tuning feature is bi-directional and includes load and inertia estimation and compensation. It also provides an Active Current Loop Compensation gain and phase. Optimal performance can be obtained on systems with varying inertial loads up to 50:1.

- Real-time clock, date and time stamp of fault history.

- Two additional 16-bit analog inputs and two 12-bit analog outputs can be utilized to interface to the user's environment.

- Advanced mathematical capabilities, 40 bit floating point, LOG functions, and trigonometric functions are available to simplify programming of complex motions.

- Advanced Electronic Gearing functions are available to meet the most demanding applications. Typical applications are conveyors, packaging and folding, labeling and printing, flying knife, shears and too many others to be mentioned.

- Complex SPLINE tables of up to 3000 data points can be entered to define custom motion profiles as a function of time.
  Complex CAM tables of up to 3000 data points can be entered to define custom motion profiles as a function of the master encoder input or as a function of the Auxiliary PID loop.

- Master/slave relationships can be developed from the secondary encoder inputs, providing motion output as a RATIO or CAM.

- Auxiliary PID loop with 100 microsecond update rate can be utilized in conjunction with the analog inputs, SPLINE, CAM, and master/slave capabilities. Applications such as web-tensioning, pump, and motion profiling can be addressed with ease. **PATENT US5357178**

PC3400A Family Hardware Reference Manual

Revision 1.0 - Initial documentation release.

SUMMARY OF SAFETY CONSIDERATIONS

This section contains duplications of each NOTE, CAUTION, and WARNING presented in the body of this document. These safety considerations are grouped according to the section that they appear in. It is highly recommended that the safety considerations contained in this section be reviewed prior to equipment installation or operation.

NOTES, **CAUTIONS**, and **WARNINGS** contained in the text provide important information.

	NOTE
	*A **NOTE** provides additional or special information to assist operation/maintenance personnel. Disregarding a **NOTE** may cause inconvenience but will not result in personal injury or equipment damage.*

	CAUTION
	*A **CAUTION** is provided in a procedure whenever electrical or mechanical damage may occur. Failure to heed a **CAUTION** will result in some form of damage to the equipment; however, personal injury is unlikely.*

	WARNING
	*A **WARNING** is provided in a procedure where personal injury may occur if the **WARNING** is not heeded. Electrical or mechanical damage may also occur.*

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1. Introduction

This section provides a summary of model designation and specifications, basic warranty policies, and customer service information.

1.1 About This Hardware Reference Manual

This Hardware Reference Manual contains the information necessary to install, wire, startup, operate, and service a **PC34xxA** Series Digital Servo Drives.

The product series includes units of 3, 6, 10 and 20 amp RMS continuous ratings. To simplify the use of this Installation User's Guide, we have organized the information into logical sections. In addition, we have created individual sub-sections on each of the **PC34xxA** models for information specific to that model. When configuration information is specific to a model of the **PC34xxA**, it will be noted at the beginning of the section. The sections common to all modes of control and configuration are also covered.

1.2 Model Designations and Specifications

Table 1.1 Model Designations and Specifications

PC34xxAy-001-zz

PC34xxA = Servo Drive Family Designation

xx = Power Level

- 03 = 3 A_{RMS} cont. @ 40 °C, 6 A_{RMS} peak.
- 06 = 6 A_{RMS} cont. @ 40 °C, 12 A_{RMS} peak.
- 10 = 10 A_{RMS} cont. @ 40 °C, 20 A_{RMS} peak.
- 20 = 20 A_{RMS} cont. @ 40 °C, 40 A_{RMS} peak.

A = AC input Designation

- 80-253VAC 1/3 Phase, 47-63Hz
  Catalog ratings are based on 230 VAC, 3 Phase power.

y = Drive configuration

- d = Digital Servo Drive
- i = Intelligent Servo Drive
- c = Centennial Servo Drive

- 001 = Customization Code

- 001 = Standard Unit

zz = Factory Assigned Hardware Customization

- R = Resolver Feedback
- E = Encoder Feedback
- RI = Resolver Feedback with extended I/O (Intelligent only)
- EI = Encoder Feedback with extended I/O (Intelligent only)

Table 1.2 PC34xxA drive specifications

Servo Loop Update			
Model	Current	Velocity	Position
PC34xxAd	102.4µs	408µs	2.0ms
PC34xxAi	102.4µs	408µs	2.0ms
PC34xxAc	100µs	100µs	100µs

Model	Processor	Clock	COMM	Serial	Ram	Flash
PC34xxAd PC34xxAi	Thompson F168	20 MHz	RS-232 RS-422 RS-485	19200	256K	256K
PC34xxAc Centennial	Thompson F168, TI VC33	75 MHz	RS-232 RS-422 RS-485	19200	512K 128K High Speed	256K

Figure 1-1 Multi-Tasking Operation

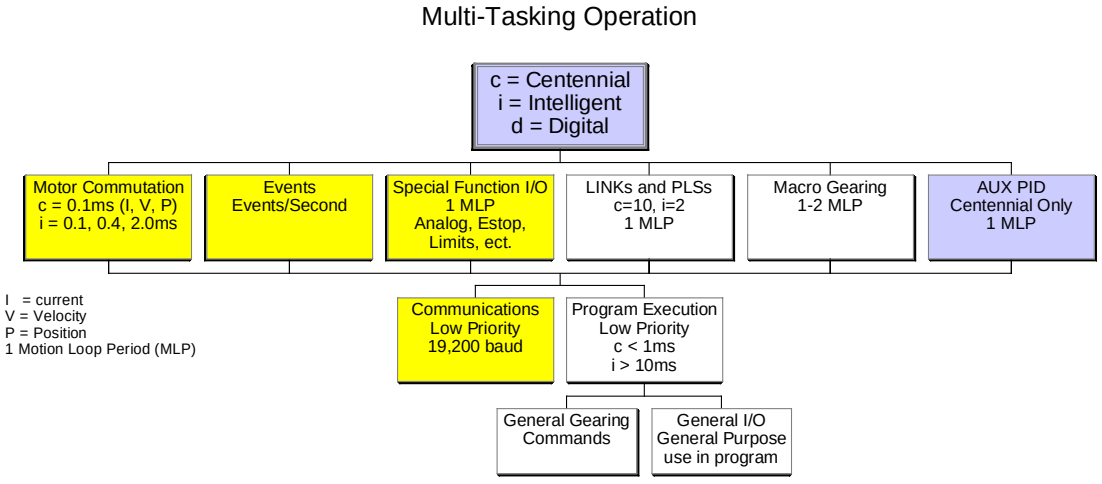


Table 1.3 PC34xxAd-001-x (Digital Drive)

Features @ 40C Ambient

Model [1] [2] Digital	Current (RMS)	Voltage AC	Bus Voltage	Regen External	Cabinet Watts (max)[3]	Inputs Analog [4]	Inputs Digital	Secondary Encoder Input	Outputs Digital	Encoder Outputs	Control Methods	Motor Types	Cont. kW
PC3403Ad-001-E	3/6	80-253VAC 1/3 Phase, 47-63Hz	1.4xVAC nominal, no-load	47 Ohm 150 Watt	60	**Total 2:** (Cmd and tach), +/- 10 VDC, 14 Bit	**Total 5:** ENABLE, CW, CCW, plus 2 HSI [5]	Utilize HSI1 and HSI2 inputs [5] (2MHz Quadrature)	**Total 2:** Drive-OK/Brake, Foldback, Isolated, 5-30 VDC, 50 mA Max	**Total 3:** Buffered A, B, Z Differential (26LS31)	Analog Current (torque), Velocity or Step/Dir, Step+/-, Quadrature Encoder	Brushless DC, Brush DC	1.1
PC3403Ad-001-R													
PC3406Ad-001-E	6/12				75								2.3
PC3406Ad-001-R													
PC3410Ad-001-E	10/20				100								3.8
PC3410Ad-001-R													
PC3420Ad-001-E	20/40			10 Ohm 200 Watt	200								7.6
PC3420Ad-001-R													

Additional Features to all models:

[1] ***ToolPAC*** *Configuration Software. Communication via RS-232/422/485*
7 segment diagnostic display and Fault History (cleared on power cycle).
I square t, Over-Voltage and Over-Current, PC3410/20 includes Over-Temp protection

[2] *Encoder Models - Hall Only, Encoder Only (diff), Comcoder (hall and diff encoder), Primary encoder up to 14MHz post-quadrature, Tachometer*
Resolver Models - accepts Transformation Ratio 0.5, accuracy >14-bit, excitation 5kHz. Buffered encoder outputs, 10-bit pre-quadrature.

[3] *Does not include regen resistor dissipation.*

[4] *Second analog input may be used for motor Over-Temp input*

[5] ***High Speed Inputs, 1.0-5.0VDC.(NON-ISOLATED) (software programmable low-pass filter)***
General Purpose digital inputs are 5-30 VDC. (ISOLATED)

Table 1.4 PC34xxAi-001-x (Intelligent Drives)

Features @ 40C Ambient

Model [1][2] Intelligent	Current (RMS)	Voltage AC	Bus Voltage	Regen External	Cabinet Watts (max)[3]	Inputs Analog [4]	Inputs Digital	Secondary Encoder Input	Outputs Digital	Encoder Outputs	Control Methods	Motor Types	Cont. kW
PC3403Ai-001-E	3/6	80-253VAC 1/3 Phase, 47-63Hz	1.4xVAC nominal, no-load	47 Ohm 150 Watt	60	**Total 2:** (Cmd and tach), +/- 10 VDC, 14 Bit	**Total 9:** ENABLE, 6 General purpose, plus 3 HSI [5]	Utilize HSI1 and HSI2 inputs [5] (2MHz Quadrature)	**Total 4:** Drive-OK/Brake, plus 3 general purpose, Isolated, 5-30 VDC, 50 mA Max	**Total 3:** Buffered A, B, Z Differential (26LS31)	Current (torque), Velocity and Step/Dir, Step+/-, Quadrature Encoder and Program	Brushless DC, Brush DC	1.1
PC3403Ai-001-R													
PC3406Ai-001-E	6/12				75								2.3
PC3406Ai-001-R													
PC3410Ai-001-E	10/20				100								3.8
PC3410Ai-001-R													
PC3420Ai-001-E	20/40			10 Ohm 200 Watt	200								7.6
PC3420Ai-001-R													

Additional Features to all models:

[1] ***ToolPAC*** *Configuration Software. Communication via RS-232/422/485*
7 segment diagnostic display and Fault History.
I square t, Over-Voltage and Over-Current, PC3410/20 includes Over-Temp protection

[2] *Encoder Models - Hall Only, Encoder Only (diff), Comcoder (hall and diff encoder), Primary encoder up to 14MHz post-quadrature, Tachometer*
Resolver Models - accepts Transformation Ratio 0.5, accuracy >14-bit, excitation 5kHz. Buffered encoder outputs, 10-bit pre-quadrature.

[3] *Does not include regen resistor dissipation.*

[4] *Second analog input may be used for motor Over-Temp input*

[5] ***High Speed Inputs, 1.0-5.0VDC.(NON-ISOLATED) (software programmable low-pass filter)***
General Purpose digital inputs are 5-30 VDC. (ISOLATED)

Table 1.5 PC34xxAi-001-xI (Intelligent Drives/Extended I/O)

Features @ 40C Ambient

Model [1][2] Extended IO	Current (RMS) [3]	Voltage AC	Bus Voltage	Regen External	Cabinet Watts (max)[4]	Inputs Analog [5]	Inputs Digital	Secondary Encoder Input	Outputs Digital	Encoder Outputs	Control Methods	Motor Types	Cont. kW
PC3403Ai-001-EI	3/6	80-253VAC 1/3 Phase, 47-63Hz	1.4xVAC nominal, no-load	47 Ohm 150 Watt	60	**Total 2:** (Cmd and tach), +/- 10 VDC, 14 Bit	**Total 25:** ENABLE, 22 General purpose, plus 3 HSI [6]	Utilize HSI1 and HSI2 inputs [6] (20MHz Quadrature)	**Total 12:** Drive-OK/Brake, plus 11 general purpose, Isolated, 5-30 VDC, 50 mA Max	**Total 3:** Buffered A, B, Z Differential (26LS31)	Torque (current), Velocity and Step/Dir, Step+/-, Quadrature Encoder and Program	Brushless DC, Brush DC	1.1
PC3403Ai-001-RI													
PC3406Ai-001-EI	6/12				75								2.3
PC3406Ai-001-RI													
PC3410Ai-001-EI	10/20				100								3.8
PC3410Ai-001-RI													
PC3420Ai-001-EI	20/40			10 Ohm 200 Watt	200								7.6
PC3420Ai-001-RI													

Additional Features to all models:

[1] ***ToolPAC*** *Configuration Software. Communication via RS-232/422/485*
7 segment diagnostic display and Fault History.
I square t, Over-Voltage and Over-Current, PC3410/20 includes Over-Temp protection

[2] *Encoder Models - Hall Only, Encoder Only (diff), Comcoder (hall and diff encoder), Primary encoder up to 14MHz post-quadrature, Tachometer*
Resolver Models - accepts Transformation Ratio 0.5, accuracy >14-bit, excitation 5kHz. Buffered encoder outputs, 10-bit pre-quadrature.

[3] ***For single phase AC derate current, 33% at 115 AC and 50% at 230 AC.***

[4] *Does not include regen resistor dissipation.*

[5] *Second analog input may be used for motor Over-Temp input*

[6] ***High Speed Inputs, 1.0-5.0VDC.(NON-ISOLATED) (software programmable low-pass filter)***
General Purpose digital inputs are 5-30 VDC. (ISOLATED)

Table 1.6 PC34xxAc-001-x (Centennial)

Features @ 40C Ambient

Model [1][2] Centennial	Current (RMS)	Voltage AC	Bus Voltage	Regen External	Cabinet Watts (max)[3]	Analog I/O [4]	Inputs Digital	Secondary Encoder Input	Outputs Digital	Encoder Outputs	Control Methods	Motor Types	Cont. kW
PC3403Ac-001-E	3/6	80-253VAC 1/3 Phase, 47-63Hz	1.4xVAC nominal, no-load	47 Ohm 150 Watt	60	**Inputs Total 4:** +/- 10 VDC, two-14 Bit, two-16 Bit **Outputs Total 2:** +/- 3.3 VDC 12 Bit	**Total 25:** ENABLE, 22 General purpose, plus 3 HSI [5]	Utilize HSI1 and HSI2 inputs [5] (2MHz Quadrature)	**Total 12:** Drive-OK/Brake, plus 11 general purpose, Isolated, 5-30 VDC, 50 mA Max	**Total 3:** Buffered A, B, Z Differential (26LS31)	Current (torque), Velocity and Step/Dir, Step+/-, Quadrature Encoder and Program	Brushless DC, Brush DC	1.1
PC3403Ac-001-R													
PC3406Ac-001-E	6/12				75								2.3
PC3406Ac-001-R													
PC3410Ac-001-E	10/20				100								3.8
PC3410Ac-001-R													
PC3420Ac-001-E	20/40			10 Ohm 200 Watt	200								7.6
PC3420Ac-001-R													

Additional Features to all models:

[1] ***ToolPAC*** *Configuration Software. Communication via RS-232/422/485*
7 segment diagnostic display and Fault History.
I square t, Over-Voltage and Over-Current, PC3410/20 includes Over-Temp protection

[2] *Encoder Models - Hall Only, Encoder Only (diff), Comcoder (hall and diff encoder), Primary encoder up to 14MHz post-quadrature, Tachometer*
Resolver Models - accepts Transformation Ratio 0.5, accuracy >14-bit, excitation 5kHz. Buffered encoder outputs, 10-bit pre-quadrature.

[3] *Does not include regen resistor dissipation.*

[4] *Second analog input may be used for motor Over-Temp input*

[5] ***High Speed Inputs, 1.0-5.0VDC.(NON-ISOLATED) (software programmable low-pass filter)***
General Purpose digital inputs are 5-30 VDC. (ISOLATED)

1.3 Warranty and Limitation of Liability

Includes software provided by Pacific Scientific

Pacific Scientific warrants its motors and controllers ("Product(s)") to the original purchaser (the "Customer"), and in the case of original equipment manufacturers or distributors, to their original consumer (the "Customer") to be free from defects in material and workmanship and to be made in accordance with Customer's specifications which have been accepted in writing by Pacific Scientific. In no event, however, shall Pacific Scientific be liable or have any responsibility under such warranty if the Products have been improperly stored, installed, used or maintained, or if customer has permitted any unauthorized modifications, adjustments, and/or repairs to such Products. Pacific Scientific's obligation hereunder is limited solely to repairing or replacing (at its option), at its factory any Products, or parts thereof, which prove to Pacific Scientific's satisfaction to be defective as a result of defective materials or workmanship, in accordance with Pacific Scientific's stated warranty, provided, however, that written notice of claimed defects shall have been given to Pacific Scientific within two (2) years after the date of the product date code that is affixed to the product, and within thirty (30) days from the date any such defect is first discovered. The products or parts claimed to be defective must be returned to Pacific Scientific, transportation prepaid by Customer, with written specifications of the claimed defect. Evidence acceptable to Pacific Scientific must be furnished that the claimed defects were not caused by misuse, abuse, or neglect by anyone other than Pacific Scientific. Pacific Scientific also warrants that each of the Pacific Scientific Motion Control Software Programs ("Program(s)") will, when delivered, conform to the specifications therefore set forth in Pacific Scientific's specifications manual. Customer, however, acknowledges that these Programs are of such complexity and that the Programs are used in such diverse equipment and operating environments that defects unknown to Pacific Scientific may be discovered only after the Programs have been used by Customer. Customer agrees that as Pacific Scientific's sole liability, and as Customer's sole remedy, Pacific Scientific will correct documented failures of the Programs to conform to Pacific Scientific's specifications manual. PACIFIC SCIENTIFIC DOES NOT SEPARATELY WARRANT THE RESULTS OF ANY SUCH CORRECTION OR WARRANT THAT ANY OR ALL FAILURES OR ERRORS WILL BE CORRECTED OR WARRANT THAT THE FUNCTIONS CONTAINED IN PACIFIC SCIENTIFIC'S PROGRAMS WILL MEET CUSTOMER'S REQUIREMENTS OR WILL OPERATE IN THE COMBINATIONS SELECTED BY CUSTOMER. This warranty for Programs is contingent upon proper use of the Programs and shall not apply to defects or failure due to: (I) accident, neglect, or misuse; (ii) failure of Customer's equipment; (iii) the use of software or hardware not provided by Pacific Scientific; (iv) unusual stress caused by Customer's equipment; or (v) any party other than Pacific Scientific who modifies, adjusts, repairs, adds to, deletes from or services the Programs. This warranty for Programs is valid for a period of ninety (90) days from the date Pacific Scientific first delivers the Programs to Customer.

THE FOREGOING WARRANTIES ARE IN LIEU OF ALL OTHER WARRANTIES (EXCEPT AS TO TITLE), WHETHER EXPRESSED OR IMPLIED, INCLUDING WITHOUT LIMITATION, ANY WARRANTY OF MERCHANTABILITY OR OF FITNESS FOR ANY PARTICULAR PURPOSE, AND ARE IN LIEU OF ALL OTHER OBLIGATIONS OR LIABILITIES ON THE PART OF PACIFIC SCIENTIFIC. PACIFIC SCIENTIFIC'S MAXIMUM LIABILITY WITH RESPECT TO THESE WARRANTIES, ARISING FROM ANY CAUSE WHATSOEVER, INCLUDING WITHOUT LIMITATION, BREACH OF CONTRACT, NEGLIGENCE, STRICT LIABILITY, TORT, WARRANTY, PATENT OR COPYRIGHT INFRINGEMENT, SHALL NOT EXCEED THE PRICE SPECIFIED OF THE PRODUCTS OR PROGRAMS GIVING RISE TO THE CLAIM, AND IN NO EVENT SHALL PACIFIC SCIENTIFIC BE LIABLE UNDER THESE WARRANTIES OR OTHERWISE, EVEN IF PACIFIC SCIENTIFIC HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES, FOR SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, INCLUDING WITHOUT LIMITATION, DAMAGE OR LOSS RESULTING FROM INABILITY TO USE THE PRODUCTS OR PROGRAMS, INCREASED OPERATING COSTS RESULTING FROM A LOSS OF THE PRODUCTS OR PROGRAMS, LOSS OF ANTICIPATED PROFITS, OR OTHER SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, WHETHER SIMILAR OR DISSIMILAR, OF ANY NATURE ARISING OR RESULTING FROM THE PURCHASE, INSTALLATION, REMOVAL, REPAIR, OPERATION, USE OR BREAKDOWN OF THE PRODUCTS OR PROGRAMS, OR ANY OTHER CAUSE WHATSOEVER, INCLUDING NEGLIGENCE.

The foregoing shall also apply to Products, Programs, or parts for the same which have been repaired or replaced pursuant to such warranty, and within the period of time, in accordance with Pacific Scientific's date of warranty. No person, including any agent, distributor, or representative of Pacific Scientific, is authorized to make any representation or warranty on behalf of Pacific Scientific concerning any Products or Programs manufactured by Pacific Scientific, except to refer purchasers to this warranty.

1.4 Customer Service

1.4.1 Factory Service

Pacific Scientific is committed to quality customer service. We maintain a staff of experienced engineers dedicated to providing quick and accurate responses to our customers' application and installation questions at (815) 226-3100.

1.4.2 On-Site Field Service

On-site field service, installation, and startup assistance are offered on an hourly basis. Please contact our Applications Department at (815)-226-3100 for current rates and applicable information.

1.4.3 Training

We have found that properly trained support personnel are an important factor in successful and efficient equipment operation. Consequently, we provide formal training seminars aimed specifically at maintenance and operating personnel. These seminars can be conducted at our facility or at your site. Please visit our web site www.pacsci.com for additional information.

2. Unpacking, Inspection, and Storage

This section provides information concerning unpacking and inspection of equipment, proper handling procedures, and storage considerations.

2.1 Unpacking and Inspection

Although every precaution is taken to ensure the equipment is delivered in good condition, it is essential that a careful inspection be made upon arrival at your plant. While we make every effort at the factory to fully inspect, test, and package our products so that they reach you defect and damage free, we cannot be responsible for handling by the shipper.

Remove the contents of the carton in which the unit was shipped. Inspect the carton and all components for possible physical damage or discrepancies. If there is any discrepancy in the order or if any damage is discovered, it should be reported immediately to both the carrier and the factory, and a damage claim should be filed immediately with the carrier. This is your responsibility; shipping damage and unreported shortages are not covered by the product warranty.

2.2 Handling

Electronic components in the control equipment are static sensitive. Use proper procedures and common sense when handling the modules to prevent possible inadvertent damage.

In the unlikely event that a unit needs to be returned to the factory, call our customer service number described in section 1.4 Customer Service to obtain a **Return Material Authorization.** Be sure to suitably pack the unit to endure the rigors of shipping.

2.3 Storage

It is often necessary to store the control equipment for some period of time before it is actually installed. Since electrical components are delicate and easily damaged, proper storage is very important to the future performance of the equipment. Store the equipment in a clean, dry, non-corrosive location protected from sudden temperature changes, high levels of moisture, shock, and vibration. **Ambient temperature should not exceed 85°C; room temperature is recommended. The minimum temperature must remain above 0°C and also above the dew point of the ambient air.**

When placing the equipment in storage, cover it to protect it against dust and/or dirt. However, the cover must not be airtight in order to allow air circulation and prevent moisture from being trapped inside.

3. Installation and Wiring

This section summarizes the recommended practices for installation of the servo equipment. These practices are based on and consistent with IEEE Standard 518-1982, "IEEE Guide for Installation of Electrical Equipment to Minimize Electrical Noise Inputs to Controllers from External Sources", particularly Section 6, "Installation, Recommendations and Wiring Practices". This standard must be followed. During assembly of our product in a machine, startup (that is, normal operation) is prohibited until the end-product complies with Directive 89/392/EEC (Machine Directive) and directive 89/336/EEC (EMC Directive). The machine manufacturer must prove that the complete system conforms to all relevant European Directives. All equipment grounding should also be in conformance with applicable National and Local electrical codes. Failure to follow recommended procedures might result in incorrect system operation and void the product warranty.

Review 7.1 Electrical Procedures for additional information.

	WARNING
	*When wiring the servo system, proper wiring procedures must be followed. The wiring is to be performed only by qualified electrical personnel familiar with the construction and operation of this equipment, the hazards involved, and the National Electrical Code (NEC) and local electrical codes. Equipment damage and/or injury could result if these procedures are not observed.* ***The user is responsible for conforming to all applicable local, national and international codes.***

3.1 Shielding and Grounding of Electrical Panels

Motion control servo systems contain digital and microprocessor circuitry that can be affected by Electro-Magnetic Interference (EMI). They also contain switching amplifiers that can generate significant EMI at frequencies from 10 kHz to 300 MHz.

The potential exists for this switching noise to interfere with the correct operation of both the servo system and any other electrical equipment in the vicinity.

While most manufacturers, including Pacific Scientific, design their products to minimize susceptibility to EMI, immunity is greatly affected by installation techniques. Some responsibility for avoiding EMI related problems must fall to the system integrator. This section describes panel layout, wiring, grounding, and shielding techniques effective in designing and integrating a servo system into your application.

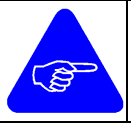
	WARNING
	*If there is a conflict between recommendations in this manual and safety codes, safety requirements must be followed.* ***The user is responsible for conforming to all applicable local, national and international codes.***

As in all engineering designs, a trade-off between the perfect solution and what is practical is unavoidable. You may not be able to apply all the suggestions we make, but careful attention to EMI reduction will minimize startup costs and future operating problems in any installation.

3.1.1 Panel Layout - General Placement

How parts are placed on the sub-panel and on the enclosure door will play an important role in reducing the effects of EMI. When designing a control panel for the servo system, the panel builder must recognize a system's two worst enemies: heat generation and electrical noise.

The importance of proper control panel layout cannot be overemphasized. First, it will set the stage for good noise-free wiring practices described later in this section. Second, it will minimize the effects of heat generation.

	NOTE
	**Mount unit to a vertical-mounting surface and provide a minimum of 1.0 inch of clearance on all sides to allow for adequate airflow.**

Proper control panel layout can be achieved by following the simple rules listed below. Review additional information on electrical procedures in this section.

- Do not mix power and control signal wiring in the same conduit, duct, or wire tray without 1.0 inches (26 mm) of separation.

- Provide separate wire ways for main DC, low power AC, high power DC, and low power DC.

- Restrict all high voltage power wiring and power devices such as circuit breakers, contactors, fuses, etc., to an area separate from the low-level control wiring as stated above.

- The area above the amplifiers is to be used for the wiring of low level (noise sensitive) control signals, such as analog input and output signals and motor feedback signals.

- When mounting any unit, be sure to remove paint from the mounting surfaces to obtain metal-to-metal contact. Use a serrated washer (star washer) to improve the connection. If in doubt use a ground strap to ensure good connection between the unit and the enclosure.

- Use ground straps made of 1 inch (25 mm) silver tinned flat copper braid to connect cabinet doors to enclosures, the first sub-panel to the enclosure, and each sub-panel to the next.

- Where electrical codes call for the typical green safety ground wires, use them *in addition* to any ground strap suggested in this guide.

- Follow the electrical codes for grounding of the main three-phase power transformer.

- It is recommended that all heat-generating resistors be mounted outside the cabinet with a protective enclosure.

- Allow a minimum distance of 1.0 inches (26 mm) above and below each drive and a minimum of 1.0 inches (26 mm) on each side of the drive to eliminate the potential problems of heat generation and electrical noise.

- No heat generating devices, such as transformers, inductors, braking resistors, etc., should be mounted directly below the mounting assembly.

- The motor wiring must be properly strain relieved to ensure interconnects, wiring and terminal connections do not become damaged.

3.1.2 Amplifier Placement and Installation

The user will install the amplifier(s) into a ventilated, metal industrial cabinet. Dimensions for the amplifier modules are given in Figure 3-4. Figure 3-1 shows a typical panel layout for four PC34xxA Series modules.

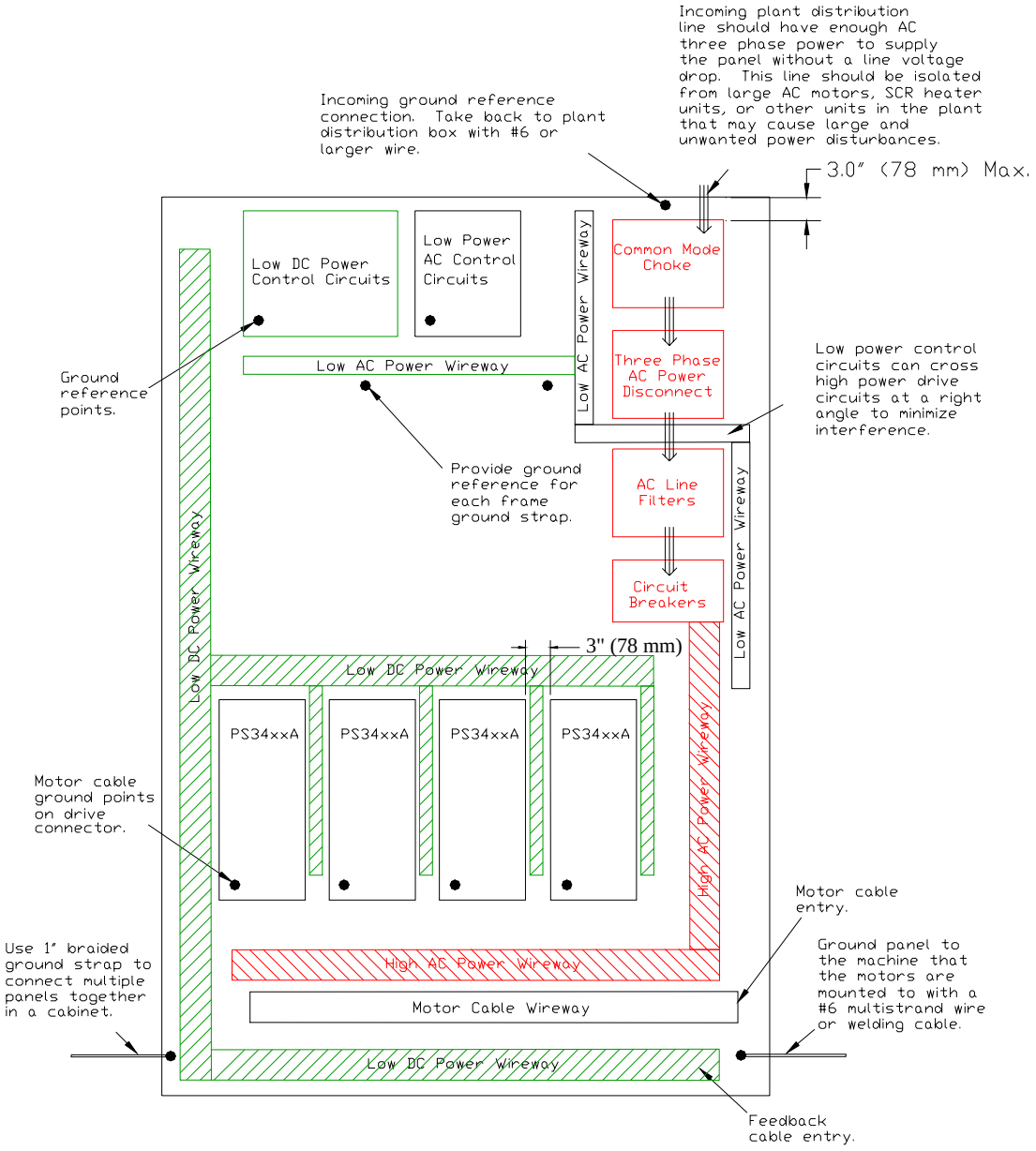
	NOTE
	*Allow a minimum distance of 1.0 inches (26 mm) above and below each drive and on each side of the drive to eliminate a servo system's two worst enemies: heat generation and electrical noise.*

	NOTE
	*Use ground straps made of 1 inch (25 mm) silver tinned flat copper braid to connect cabinet doors to enclosures, the first sub-panel to the enclosure, and each sub-panel to the next.*

	NOTE
	*Where electrical codes call for the typical green safety ground wires, use them **in addition** to any ground strap suggested in this guide.*

	NOTE
	*To obtain rated output current from all amplifiers, the ambient air temperature below the amplifiers must be between 0°C and +40°C. No heat generating devices, such as transformers, power supplies, or power resistors, should be mounted directly beneath the modules.*

Figure 3-1 Typical Panel Layout



3.1.3 Mounting Dimensions

The PC34xxA is designed for easy installation into an electrical cabinet or sub-panel. The integral heatsink and mounting surface heat-plate design increases the heat dissipation path and the product reliability. The user must attach the **PC34xxA** to a suitable ***vertical-mounting surface*** to optimize heat dissipation and provide a ***minimum of 1.0 inch of clearance*** on all sides to allow for adequate airflow.

Figure 3-2 PS-340x/PC34xxA

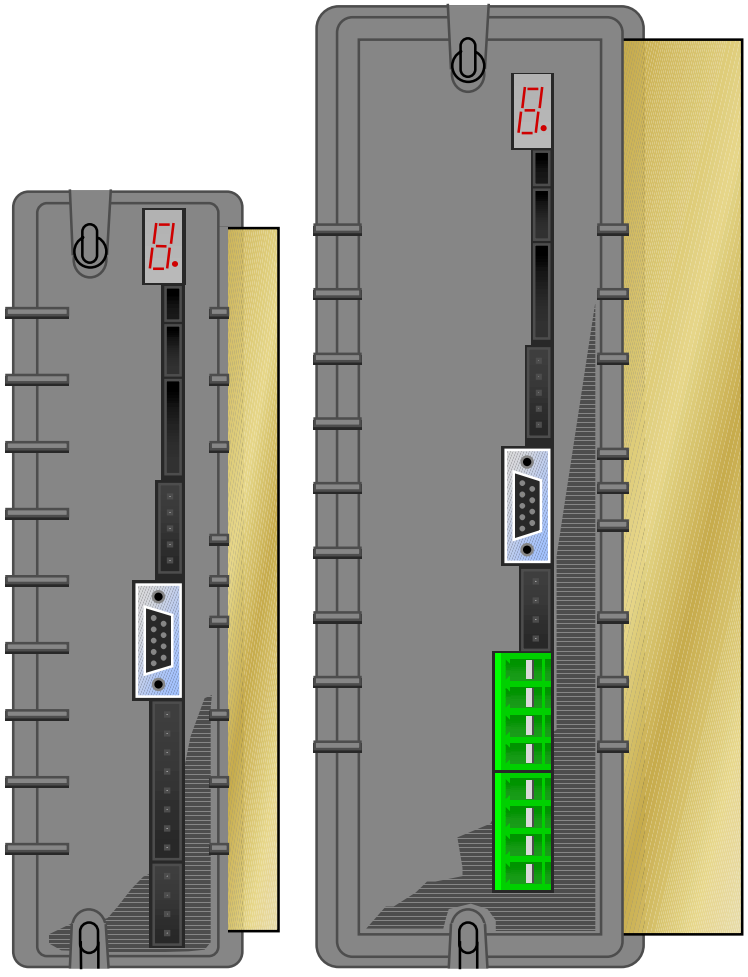
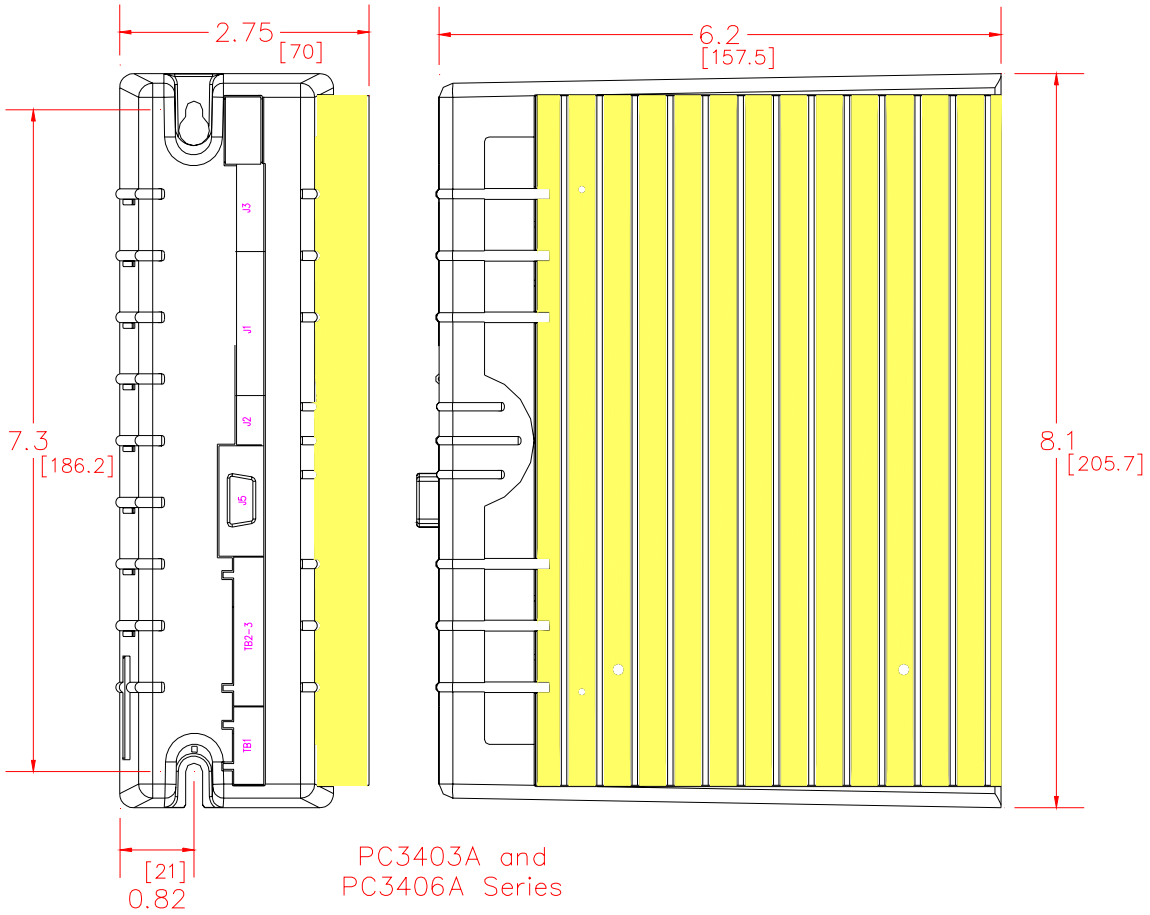


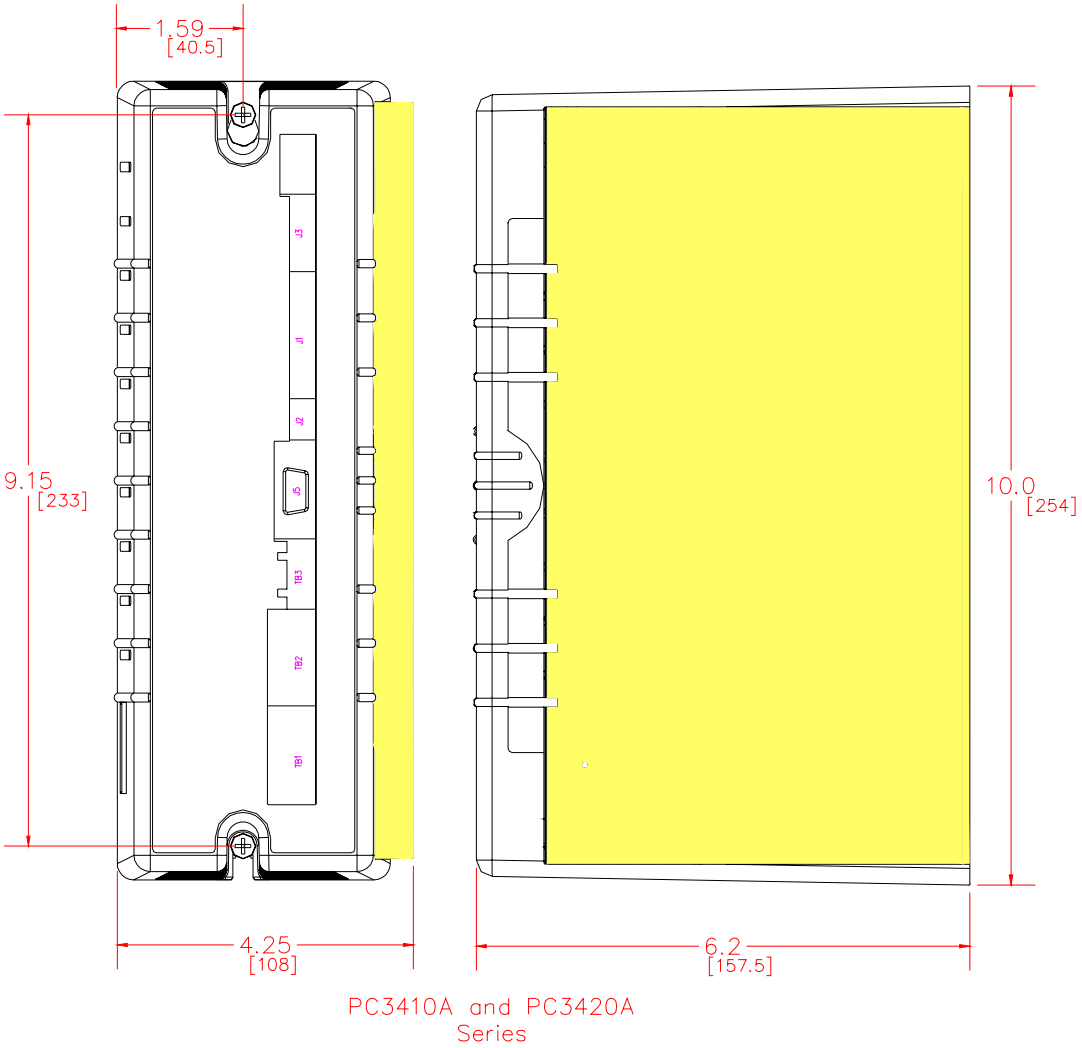
Figure 3-3 PC3403A and PC3406A Series Mounting Dimensions



Dimensions: inches [mm]

	NOTE
	*Mount unit to a **vertical-mounting surface** and provide a **minimum of 1.0 inch of clearance** on all sides to allow for adequate airflow.*

Figure 3-4 PC3410A and PC3420A Series Mounting Dimensions



Dimensions: inches [mm]

	NOTE
	*Mount unit to a **vertical-mounting surface** and provide a **minimum of 1.0 inch of clearance** on all sides to allow for adequate airflow.*

3.2 Communications (J5)

3.2.1 Serial Communication Hardware Configuration

The only hardware configuration that must be configured by the user prior to mounting is the method of communication and the serial node ID. ***The factory settings are RS232, Node#1.***

All models of the **PC34xx** Series Digital Servos have identical communications (Comm Port **J5**), thus making it possible to install a mixed combination of units for the most demanding applications.

	NOTE
	*Set the unit's axis id and method of communications prior to proceeding with mounting. Once configured,* ***we suggest that the front of each unit be marked with its unique Axis ID to facilitate installation and startup.***

The user must configure the PC34xxA Series Digital Servo prior to mounting the unit. To accomplish this task, the cover of the PC34xxA must be removed (no tools are required).

1. Grasp the heatsink in one hand and the enclosure in the other. Gently squeeze the center semi-circle feature of the enclosure to disengage the locking mechanism and slide it off the front of the drive.

2. Locate the 10-position dip-switch and set the unit's AXIS ID and COMMUNICATIONS METHOD per Table 3.1.

3. After the switches are configured we suggest that the user indicate the axis number on the front of each unit for later identification.

4. To reinstall the cover, gently slide the cover into position until the locking mechanism is engaged.

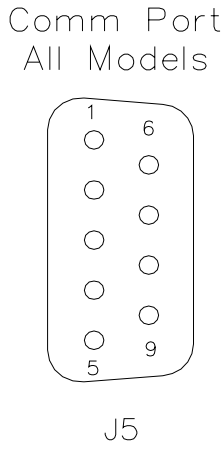
3.2.1.1 Serial Comm Port (J5)

The communications port is only required to allow **ToolPAC** to communicate to the controller for purposes of configuration for a specific motor and programming of the intelligent series. This port does not need to be wired during normal usage of the unit, (for configuration and diagnostics only).

Networked configuration of the intelligent series allows for up to 31 axis from a single PC serial port or similar host device (RS-485 full duplex). Multi-axis start and stop, along with on-the-fly speed change, are only a few of the networked features available on these units. The user must request additional documentation to gain a better understanding of the network requirements. The documents listed below may be accessed via our Internet site.

ToolPAC Software Reference Guide, for additional information on Advanced commands (Gearing, Macros, Links, PLS)	MAToolPAC.zip
Intelligent Servo Protocol (**MA-ISP.pdf**)	Below
Intelligent Servo **ASCII** Protocol (**MA-ISAP.pdf**)	Below
Intelligent Motion Language (**MA-IML.pdf**)	Below
Dynamic Link Library (DLL)	ISPDLL.zip

Figure 3-5 Comm Port Pin Definition (J5)

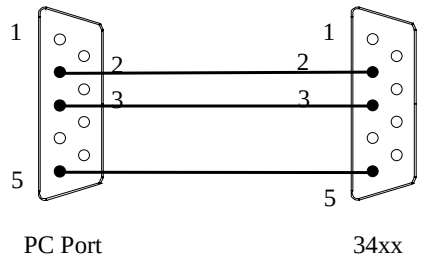


J5 - Comm Port (DB9-F)			
Pin #	**RS-232**	**RS-422 RS-485**	**RS-485 two wire**
1	NC	Tx+	Rx+/Tx+
2	Tx	Tx-	Rx-/Tx-
3	Rx	Rx-	Rx-/Tx-
4	NC	Rx+	Rx+/Tx+
5	COM	COM	COM
6	-	-	-
7	-	-	-
8	-	-	-
9	-	-	-

RS-232 Three Wire Configuration

This is the factory default configuration. This communication method is used for applications requiring less than 25 feet of communications cable.

Figure 3-6 Schematic of RS-232 Wiring



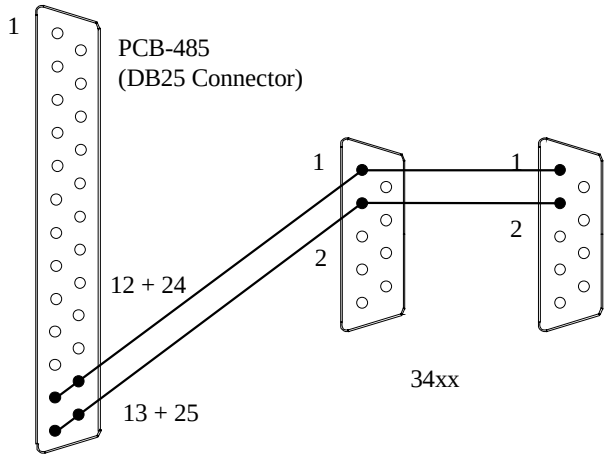
	NOTE
	Use shielded cabling for all communication needs. *Do not use ribbon cable to provide communications interconnect.*

RS-422/485 Two Wire Configuration

This communication method is used for applications requiring less than 5000 feet of communications cable. An **RS-485** communications card is required. ***An RS-485 communications card that supports "Automatic Data Send Control" which only enables the transmitter when a character is ready to be transferred is required.*** This method is cost-effective and provides increased noise immunity.

	NOTE
	Utilizing RS-422/485 communications cards by other manufacturers than those recommended by Pacific Scientific may result in erratic behavior and reduced noise immunity. *Use shielded cabling for all communication needs.* *Do not use ribbon cable to provide communications interconnect.*

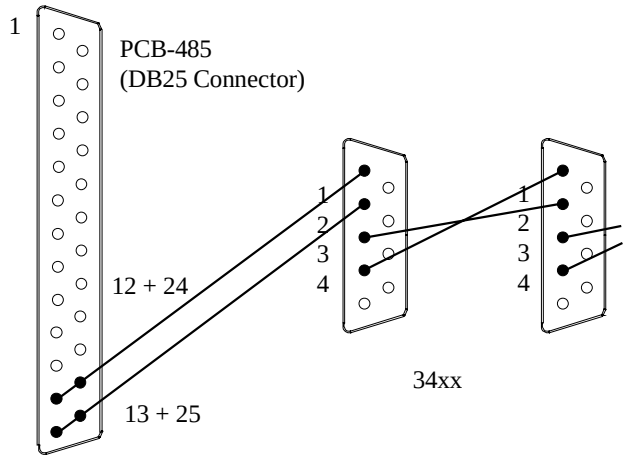
Figure 3-7 Schematic of RS-422/485 Wiring (Two Wire)



This is an alternate method of wiring the inter-axis cable and is used for applications requiring less than 5000 feet of communications cable. An **RS-485** communications card is required. ***An RS-485 communications card that supports "Automatic Data Send Control" which only enables the transmitter when a character is ready to be transferred is required.*** This method provides additional noise immunity.

	NOTE
	*Utilizing RS-422/485 communications cards by other manufacturers than those recommended by Pacific Scientific may result in erratic behavior and reduced noise immunity.* *Use shielded cabling for all communication needs.* *Do not use ribbon cable to provide communications interconnect.*

Figure 3-8 Schematic of RS-422/485 Wiring (Alternate Two Wire Method)

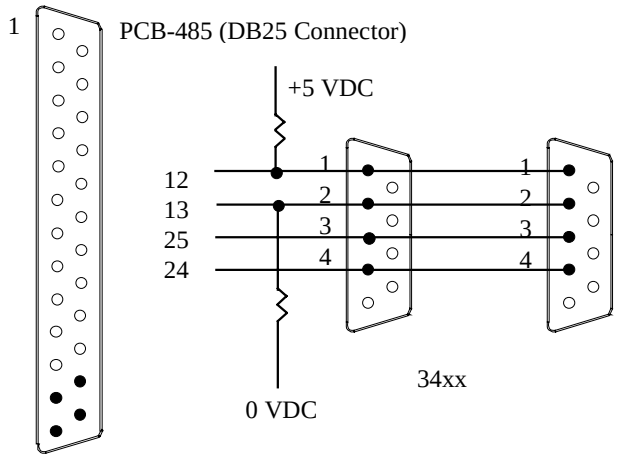


RS-422/485 Four Wire Configuration

This method is used for applications requiring less than 5000 feet of communications cable. An **RS-485** communications card is required. *The RS-485 communications card must support "Automatic Data Send Control" which only enables the transmitter when a character is ready to be transferred is required.* This method provides the highest noise immunity.

	NOTE
	Utilizing RS-422/485 communications cards by other manufacturers than those recommended by Pacific Scientific may result in erratic behavior and reduced noise immunity. (Use 10k resistors if not in PC Card, install at PC end of communications cable). *Use shielded cabling for all communication needs.* *Do not use ribbon cable to provide communications interconnect.*

Figure 3-9 Schematic of RS-422/485 Wiring (Four Wire Method)



Preferred Method (full duplex)

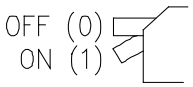
3.2.1.2 Serial Node Selection

The user must configure the axis selection switches to define the communications method and axis address of the unit. A unique axis address (from 1 through 31) must be selected for each unit when multiple axes will be on the same communications link. The default factory setting is node 1.

Table 3.1 Axis ID and Communication Method - Switch Selection

Node ID *				
Axis ID	**Switch 12345**		**Axis ID**	**Switch 12345**
0	00000		16	00001
1	10000		17	10001
2	01000		18	01001
3	11000		19	11001
4	00100		20	00101
5	10100		21	10101
6	01100		22	01101
7	11100		23	11101
8	00010		24	00011
9	10010		25	10011
10	01010		26	01011
11	11010		27	11011
12	00110		28	00111
13	10110		29	10111
14	01110		30	01111
15	11110		31	11111

**Node 1 is factory default.*
Node 0 is reserved.



Communication Methods	
Switch 678910	**Communication**
0010 0	RS-232 Three Wire
1100 1	RS-422/485 Two Wire *
0000 1	RS-422/485 Four Wire *
xxx1 x	* Switch 9 is ON for termination resistor on last unit

3.3 High Power Connections (TB1, TB2 and TB3)

Consult Table 7.2 System Accessories for engineering data on the selection of cables and related information on the specific model being installed. System interconnect diagrams are provided in Section 7.2 Relevant Engineering Prints. Be certain to use the diagram that refers to your system. Review Section 3.1, Shielding and Grounding of Electrical Panels, for information on placement of components.

	NOTE
	*High power wiring and low power DC signal wiring within the panel or enclosure should not share wire raceways and should be separated by a minimum of 6 inches (152 mm) for parallel runs. If wire paths should cross and touch, they should do so only at right angles to each other.*

- Provide separate wire ways for main AC, low power AC, high power DC, and low power DC.
- Restrict all high voltage power wiring and power devices; such as circuit breakers, contactors, fuses, etc., to an area separate from the low-level control wiring.
- Constant voltage power supplies can be installed if the DC power tends to drop below the specified minimum voltages required to keep the controllers from resetting.
- Where loss of control power is critical or an orderly shutdown in the event of a power loss is required, consider wiring the Control Power from a separate feed. Consult the following section for wiring and specifications.

	WARNING
	*Use care to ensure the correct pinout is used for the main power connections. Improper wiring will result in damage to the amplifier.*

3.3.1 AC Power (TB1)

The main AC power wiring is made to the keyed terminal block TB1. Use care to ensure the correct pinout is used for the main power. Ensure that the amplifier's PE ground, pin #1, is taken directly to the panel's single point ground (SPG).

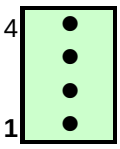
When operating off single phase AC, the L1 and L2 connections should be utilized.

The preferred AC line over-current protective device, one for each unit, is a three-phase magnetic circuit breaker with a 5-8x instantaneous trip point.

	WARNING
	When operating off single-phase VAC, ensure that you have taken into account the amplifiers current de-rating. ***For single phase AC derate current 33% at 115 VAC and 50% at 230 VAC.*** Failure to do so will result in damage to the amplifier and is not covered under the manufacturer warranty.

.

Table 3.2 AC Power



TB1 - AC Power	
Pin #	**AC IN**
4	L1
3	L2
2	L3
1	**GND (PE)**

Line Filters

AC power brought into the panel can allow EMI to enter the panel. This is especially true in facilities that have a large number of SCR controlled devices, such as variable speed drives and heating or welding devices. Line filters should be placed in the incoming power lines immediately after the safety circuits and before any critical control components.

The PC34xxA Series controllers have built-in suppressors to protect them from line-induced noise and transients. However, these internal devices cannot prevent such noise from affecting other parts of the system, such as high-speed sensor inputs and analog circuits. Line filters will be necessary to achieve conducted noise levels to meet requirements for the CE Mark. Refer to Table 7.3 Suggested Line Filters.

- Mount filters as close as possible to incoming power feed as practical.
- The incoming power feed should be as short and direct as possible.
- Do not bundle clean wiring from filtered sources with dirty unfiltered wiring.

3.3.2 Control Power (TB3) (Optional)

Wiring a separate Control Power should be considered where loss of control power is critical or an orderly shutdown in the event of a power loss is required. The ISOLATED control power supply is wired to terminals C+ and C- on TB3 of the unit. Warning! This power supply MUST NOT BE UTILIZED FOR ANY OTHER MACHINE FUNCTION, when energized from AC power the C- connection may measure greater than -90 VDC relative to PE ground.

	WARNING
	*The Control power supply must **NOT be common to chassis ground**; otherwise, equipment damage and/or injury could result. **This ISOLATED control power supply must not be utilized for any other function(s) in the application***

Table 3.3 Control Power Specifications

Model	Control Power Requirements
PC34xxA (all models)	**24 - 48 VDC, 1 A maximum. This ISOLATED power supply (NOT common to chassis ground).**

3.3.3 External Regen (TB3)

The PC34xxA can dissipate regeneration energy internally. Less than 10% of common installations require external regeneration resistors. When applications require hard deceleration that exceeds the unit's ability, an external regen resistor must be added to the system at the two terminals labeled **R+** and **R-** on TB3. A fuse should be placed in series with the regen resistor to protect the resistor. Specifications of the regeneration circuits are summarized in **Table 3.4** and **Table 3.5**.

	WARNING
	***External regen resistors are connected to the drive dc bus voltage that can reach 400 VDC. Connections to external regen resistors must be electrically insulated and mechanically shielded for safety. High voltage warning stickers are also recommended.*** It is recommended that all heat-generating resistors be mounted outside the cabinet with a protective enclosure.

Table 3.4 Regeneration Circuit Specifications

Regen active at	377 VDC
Bus fault /Over-Voltage/ active above	400 VDC
Bus fault /Under-Voltage/ active below	90 VDC

Table 3.5 External Regeneration Resistor Specifications

Model	External Continuous	External Peak	External Regen Resistor Kit
PC34**03**A	47 Ohm, 150 W	3 kW	PRK-0160-47
PC34**06**A	47 Ohm, 150 W	3 kW	PRK-0160-47
PC34**10**A	47 Ohm, 150 W	3 kW	PRK-0160-47
PC34**20**A	10 Ohm, 200 W	14 kW	PRK-0200-10

Resistor Kits include: resistor, fuse, fuse holder, and 1 meter of wire.

High Power DC Bus

The PC34xxA's protection circuitry monitors the DC bus, software parameter **VDC**, to determine if an under-voltage condition exists, parameter **BUSU** or if excessive regeneration is occurring. Exceeding the regeneration transistor's power rating, I^2t will cause the regen circuit to be disabled, which will result in a bus fault, shutting down the amplifier to safeguard the system, and displaying a fault. When external Regen is used, the circuit must be fused for **UL** certification. When a Bus Fault condition exists the motor will become "free-wheeling" and protective measures should be employed to prevent personal injury or damage to the system. **This fault condition can be cleared by toggling the Enable input OFF-to-ON or through cycling power to the unit.** When a Bus Fault occurs, the user should examine the application to determine if an external regeneration resistor is required, the motion can be slowed, or that the proper equipment has been selected for the application.

During the deceleration phase of motion the motor will regenerate energy into the amplifier. This regeneration will cause the voltage of the DC bus to rise. The regeneration resistor will turn on when the bus voltage exceeds 377 VDC. The peak power dissipation is calculated by the following formula:

$$PeakPower = \frac{V^2}{R} = \frac{(377)^2}{10} = 14kW$$

Peak power dissipation occurs the moment the circuit is enabled. As soon as regen is enabled, the regeneration power begins to be dissipated in the resistor and unless the system is generating peak regen power greater than the regen circuit peak-power capability, the bus voltage decreases.

(notes page)

3.3.4 Motor Wiring (TB2)

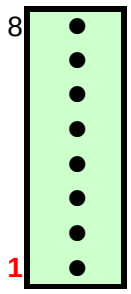
The motor is the prime mover in any installation. Special care should be taken to ensure that the motor is not damaged due to improper wiring and installation. Follow the general procedures listed below to ensure proper installation.

- Do not mix power and control signal wiring in the same conduit, duct, or wire tray without 6 inches (152 mm) of separation.
- Utilize shielded four (4) conductor wiring with drain for motor power cabling. Follow electrical codes to ensure the proper wire gauge for the motor and amplifier being installed into your application.
- Provide separate a wire way for the high power DC cables to the motor.
- **The motor wiring must be properly strain relieved to ensure that interconnect wiring and connections do not become damaged.**
- **Do not use excessive force, (hammer) to install power transmission components to the motors shaft as this may result in damage to the bearings or feedback device.**
- If your motor is provided with an internal thermal Over Temperature (OT) switch, it should be wired to the appropriate connections on the amplifier, see section Motor OT Sensor input (ADC2). Make this mode ACTIVE via ToolPAC parameter **COT** *Check motor OT input. (Not available when a tachometer is being utilized as a feedback device.)*

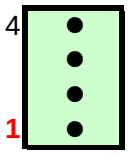
3.3.4.1 Brushless DC Motors

All of the PC34xxA series of controllers can run **Brushless DC** motors (BLDC), some times referred to as **Brushless AC** motors. The following is a guide to setting up BLDC motors with the PC34xxA controllers. (Table 5.13 Brushless DC Motor Parameters)

Table 3.6 BLDC Motor Connections



TB2-3 - BLDC	
Pin #	**Name**
8	Ctrl +
7	Ctrl -
6	Regen +
5	Regen -
4	Gnd
3	Phase U (A)
2	Phase V (B)
1	Phase W (C)



TB2 - BLDC	
Pin #	**Name**
4	Gnd
3	Phase U
2	Phase V
1	Phase W

The following motor types and control modes are supported:

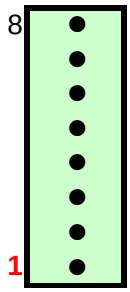
Table 3.7 BLDC Motor Configurations

Feedback Type (BLDC Motor)	Control modes	Command source *
Hall/Encoder feedback (PC34xxAx-001-E) Note: * Program = Intelligent series only	Current mode	Analog, Digital or Program
	Velocity mode	Analog, Digital or Program
	Position mode	Program
		Step/Dir
		Step Up/ Step Down
		Secondary Encoder Following
	Distributed-Feedback (encoder)	Analog or Digital Current
		Analog or Digital Velocity
		Program/Position
Resolver (PC34xxAx-001-R)	Current mode	Analog, Digital or Program
	Velocity mode	Analog, Digital or Program
	Position mode	Program
		Step/Dir
		Step Up/ Step Down
		Secondary Encoder Following
	Distributed-Feedback (encoder)	Analog or Digital Current
		Analog or Digital Velocity
		Program/Position
Hall Only (PC34xxAx-001-E)	Current mode	Analog or Digital
	Velocity mode	Analog or Digital
Encoder only (PC34xxAx-001-E) (motor must be manually rotated through the Z-channel to initiate motor commutation)	Current mode	Analog, Digital or Program
	Velocity mode	Analog, Digital or Program
	Position mode	Program
		Step/Dir
		Step Up/ Step Down
		Secondary Encoder Following
	Distributed-Feedback (encoder)	Analog or Digital Current
		Analog or Digital Velocity
		Program/Position

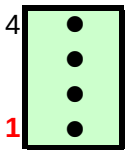
3.3.4.2 Brush DC Motors

All of the PC34xxA series of controllers can run **Brush DC** motors. The following is a guide to setting up Brush motors with the PC34xxA controllers. (Table 5.12 Brush DC Motor Parameters)

Table 3.8 Brush DC Motor Connections



TB2-3 - Brush DC	
Pin #	**Name**
8	**Ctrl +**
7	**Ctrl -**
6	Regen +
5	Regen -
4	Gnd
3	Motor DC + (U)
2	Motor DC - (V)
1	N/C (W)



TB2 - Brush DC	
Pin #	**Name**
4	Gnd
3	Motor DC + (U)
2	Motor DC - (V)
1	N/C (W)

The following motor types and control modes are supported:

Table 3.9 Brush DC Motor Configurations

Feedback Type (Brush Motor)	Control modes	Command source *
Encoder Only (PC34xxAx-001-E) Note: * Program = Intelligent series only	Velocity mode	Digital Velocity Command
		Analog Velocity Command
	Position mode	Program
		Step/Dir
		Step Up/ Step Down
		Secondary Encoder Following
Resolver (PC34xxAx-001-R)	Velocity mode	Digital Velocity Command
		Analog Velocity Command
	Position mode	Program
		Step/Dir
		Step Up/ Step Down
		Secondary Encoder Following
Tachometer Feedback (PC34xxA all models)	Velocity mode	Digital Velocity Command
		Analog Velocity Command
No Feedback (PC34xxA all models)	Current mode	Digital Current Command
		Analog Current Command
	Open Loop Speed mode	Digital Velocity Command
		Analog Velocity Command
Distributed-Feedback (encoder) motor feedback is not utilized (PC34xxA all models)	Distributed-Feedback (encoder)	Analog or Digital Current
		Analog or Digital Velocity
		Program/Position

3.4 Logic (low) Power DC Connections

Special care must be taken to ensure that the proper wiring is employed for the model being installed into your application. Please review Section 7.1 on Electrical Procedures before proceeding.

	NOTE
	*High power wiring and low power DC signal wiring within the panel or enclosure should not share wire raceways and should be separated by a minimum of 6 inches (152 mm) for parallel runs. If wire paths should cross and touch, they should do so only at right angles to each other.*

All control signals interfacing to the system must be wired with twisted cable, with at least one twist per inch, to minimize inductive noise coupling. **Encoder wiring must be wired with three (3) individual twisted shielded pairs, using cable equivalent to those listed in** Figure 7-3 Suggested Wire**.**

3.5 Motor Feedback (J3)

The PC34xxA Motor Feedback connector J3 is a 14 pin dual-row connector. The J3 connections also include a non-isolated +5 VDC supply, **250mA maximum**, for the hall effect device (HED), Encoder power, and motor over-temperature sensor (OT).

The **PC34xxA-001-E** Series is a digital amplifier that will only accept an **encoder with Hall** or an **encoder with Commutation Tracks encoded on the Z-Channel** or **Tachometer** as a feedback device.

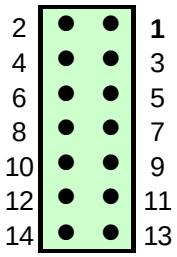
	NOTE
	***The PC34xxA-001-E Series accepts differential A/A', B/B' and Z/Z' encoder signals. It will NOT accept single-ended encoder signals.***

The **PC34xxA-001-R** Series is a digital amplifier that will only accept a resolver as the feedback device, (Transformation Ratios of 0.5 to 1.0). Buffered, Differential A, B and Z channel encoder-outputs are provided as 1024 LPR (4096 quadrature count) for a two-pole resolver.

Figure 3-10 PC34xxA Feedback Connector J3

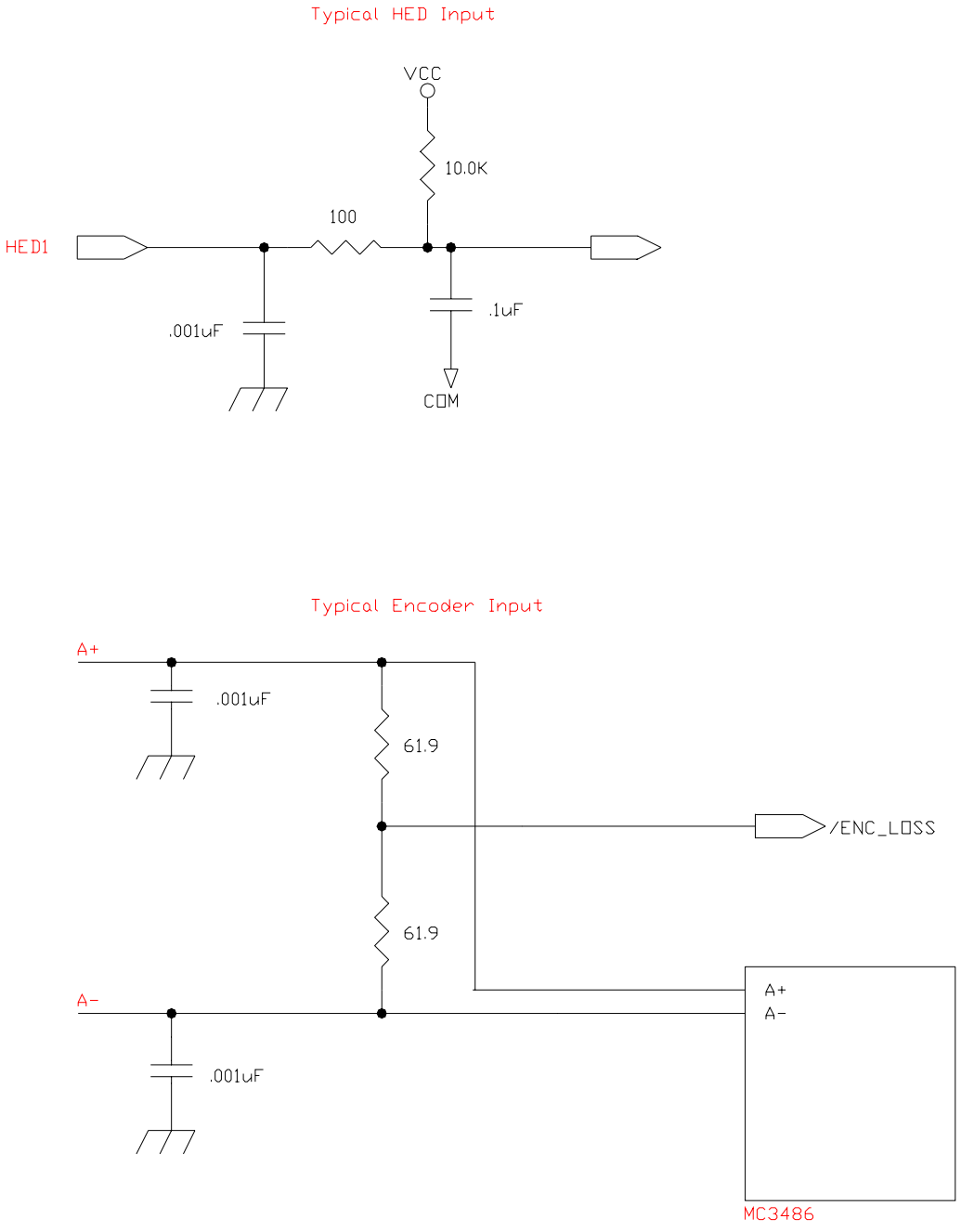
J3 - Encoder Feedback			
Pin #	**Signal**	**Pin #**	**Signal**
2	A -	**1**	A +
4	B -	3	B +
6	Z -	5	Z +
8	HED 1	7	Gnd
10	HED 3	9	HED 2
12	+5 VDC	11	+5 Return(com)
14	ADC2 - /OT -	13	ADC2 + / OT +

J3 - Resolver Feedback			
Pin #	**Signal**	**Pin #**	**Signal**
2	Sin - (S4)	**1**	Sin + (S2)
4	Cos - (S3)	3	Cos + (S1)
6	Ref - (R2)	5	Ref + (R1)
8	Spare	7	Gnd
10	Spare	9	Spare
12	+5 VDC	11	+5 Return(com)
14	ADC2 - /OT -	13	ADC2 + / OT +



A cable assembly, **PFC-000502-010**, may be purchased to facilitate wiring the J3 connector. This shielded cable assembly is pre-wired to the mating connector, ten feet in length (also available in 025 and 050 foot lengths).

Figure 3-11 Hall and Encoder Feedback Schematic J3



3.5.1.1 PC34xxAx-001-E Series

The **PC34xxAx-001-E** Series is a digital amplifier that will accept;

3.5.1.1.1 Hall Only (BLDC, 6-Step - Trap)

If you are utilizing a Brushless DC motor with Hall Effect Devices, only the HALL1, HALL2 and HALL3 inputs need be wired. Power for the Hall Effect Devices is supplied from the +5VDC and COM on the J3 connector.

If utilizing a motor with HALL ONLY feedback, the encoder channels need not be wired. Operation is limited to Current or Velocity commands.

Position mode operation can be accomplished via a secondary encoder. Read section Selecting Operation Mode for additional information.

	NOTE
	*To ensure proper configuration when using "HALL Only" mode, be sure to set the EPPR to 3X Motor Poles.*

3.5.1.1.2 Encoder Only (Brush DC)

If utilizing an encoder for feedback, the A+, A-, B+, B-, Z+ and Z- connections must be wired. Power for the Encoder is supplied from the +5VDC and COM on the J3 connector.

If utilizing a motor with this type of feedback, only the Encoder channels need to be wired. The unit can be operated in Velocity or Position mode (Brush DC Motor) with Step/Dir, Step+/Step- or Quadrature Encoder Following modes

Position mode operation can also be accomplished via a secondary encoder. Read section Selecting Operation Mode for additional information.

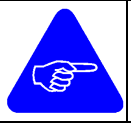
	NOTE
	***The PC34xxAx-001-E Series accepts differential A/A', B/B' and Z/Z' encoder signals. It will NOT accept single-ended encoder signals.***

3.5.1.1.3 Encoder with Halls or (Comcoder)

If utilizing an encoder/halls or a comcoder for feedback, the A+, A-, B+, B-, Z+ and Z- connections, and the HALL1, HALL2 and HALL3 inputs must be wired. Power for the Hall Effect Devices and the Encoder is supplied from the +5VDC and COM on the J3 connector.

The unit can be operated in Analog, Current, Velocity or Position mode with Step/Dir, Step+/Step- or Quadrature Encoder Following modes. Refer to section for Commutating Encoder, Hall/Encoder Specification compatible with encoder based controllers.

Position mode operation can also be accomplished via a secondary encoder. Read section Selecting Operation Mode for additional information.

	NOTE
	***The PC34xxAx-001-E Series accepts differential A/A', B/B' and Z/Z' encoder signals. It will NOT accept single-ended encoder signals.***

3.5.1.1.4 Encoder with Commutation Tracks encoded on the Z-Channel.

If utilizing a Brushless DC motor and an incremental Encoder with Commutation Tracks encoded on the Z-Channel, the HALL signals need not be wired. The unit can be operated in Analog, Current, Velocity or Position mode with Step/Dir, Step+/Step- or Quadrature Encoder Following modes.

Position mode operation can also be accomplished via a secondary encoder. Read section Selecting Operation Mode for additional information.

3.5.1.1.5 Tachometer (ADC2)

The ADC2 input can be used as a second analog input. Brush-DC motors with tachometer feedback can be operated in Velocity command mode. The encoder and hall channels need not be wired when utilizing this type of feedback device.

When utilizing a Brush DC Motor with differential tachometer feedback the user must confirm configuration the PC34xxA hardware to receive an analog feedback signal. The cover must be removed from the PC34xxA to access the internal components. *The jumper JP3 must be removed from the PCB*, thus converting to an analog input for the tachometer.

If a tachometer is to be utilized in an application, then parameter Check Motor OT input (COT) must be set to **Inactive** in ToolPAC for the PC34xxA to monitor this input.

Position mode operation can also be accomplished via a secondary encoder. Read section Selecting Operation Mode for additional information.

	NOTE
	*The ADC2+ and ADC2- inputs (pins J3-14 and J3-13) are factory configured as a motor OT input.* ***If utilizing a Tachometer feedback device, you must ensure that JP3 jumper is removed.*** *You will not have the ability to use a motor thermal OT.*

	CAUTION
	*The tachometer's analog input is ±10 VDC input.* ***Maximum feedback velocity is determined when the tachometer output voltage equals ±10 VDC.*** *Please use care in selecting the proper tachometer voltage for your application. Failure to heed this* ***CAUTION*** *will result in damage to the PC34xxA.*

3.5.1.1.6 Auxiliary Analog Input (ADC2)

If you have chosen to use the **ADC2/OT** input as a motor thermal Over Temperature (OT) switch, then you do not have access to this additional analog input. If you application should require use of the **ADC2** analog inputs on the amplifier J3 connector and disable this feature in the software configuration. Make this mode **INACTIVE** via parameter **COT** *Check motor OT input.* For additional information see sections Tachometer (ADC2) and Analog Input (J1).

	NOTE
	***To utilize the ADC2+ and ADC2- inputs as a motor Over Temperature (OT) input,(factory installed across JP3 internal to the drive) and enable this feature in the software configuration. Make this mode ACTIVE via parameter COT Check motor OT input.***

3.5.1.1.7 Motor OT Sensor input (ADC2)

If your motor is provided with an internal thermal Over Temperature (OT) switch, it should be wired to the **ADC2/OT** analog inputs on the amplifier. This input is wired to a N.C thermal switch internal to the motor (Z < 1k means motor is OK).

3.5.1.2 PC34xxAx-001-R Series

The **PC34xxAx-001-R** Series is a digital amplifier that will only accept a resolver as the feedback device.

3.5.1.2.1 Resolver Feedback

If you are utilizing a Brush or Brushless DC motor with Resolver feedback device, only the R1, R2 and S1 – S4 inputs need be wired.

The unit can be operated in Analog, Current, Velocity or Position mode with Step/Dir, Step+/Step- or Quadrature Encoder Following modes.

The **PC34xxAx-001-R** Series is a digital amplifier that will only accept a resolver as the feedback device, (Transformation Ratio of 0.5 to 1.0). The internal feedback resolution is 14 bits of position, (16,384 count). The motor feedback connector J3 is a 14-pin dual-row connector that contains connections for resolver feedback, (Figure 3-10 PC34xxA Feedback Connector J3). Refer to section Motor Feedback Specification for Commutating Resolver Specifications compatible with resolver based controllers.

The connections also include a non-isolated +5 VDC supply and a motor over-temperature sensor (OT). If a motor over temperature sensor is being utilized, see section Motor OT Sensor input (ADC2), you must enable this feature in the software configuration.

3.5.1.2.2 Motor OT Sensor input (ADC2)

If your motor is provided with an internal thermal Over Temperature (OT) switch, it should be wired to the **ADC2/OT** analog inputs on the amplifier. This input is wired to a N.C thermal switch internal to the motor (Z < 1k means motor is OK).

If a motor over temperature sensor is being utilized, you must enable this feature in the software configuration. Make this mode **ACTIVE** via parameter **COT** *Check motor OT input.*

	NOTE
	***To utilize the ADC2+ and ADC2- inputs as a motor Over Temperature (OT) input, functionality must be enabled through software.***

3.5.1.2.3 Auxiliary Analog Input (ADC2)

If you have chosen to use the **ADC2/OT** input as a motor thermal Over Temperature (OT) switch, then you do not have access to this additional analog input. If you application should require use of the **ADC2** analog inputs on the amplifier J3 connector, remove the jumper JP3 internal to the drive and disable this feature in the software configuration. Make this mode **INACTIVE** via parameter **COT** *Check motor OT input.*

For additional information see sections Tachometer (ADC2) and Analog Input (J1).

3.5.2 Motor Feedback Specification

If the customer is utilizing a motor not supplied by Pacific Scientific then specific care must be taken to ensure that the motor feedback is compatible and able to interface to the PC34xxA series controllers. **It is the responsibility of the user to ensure compatibility.**

Table 3.10 Commutating Encoder, Hall/Encoder Specification

Encoder/Hall	Value	Units
Encoder		
Input Voltage	5	volts
Input Current (max)	135	mamp
Operating Frequency	200	kHz max
Output Device	26LS31	
load (Z=2K)		
Sink/Source, (Minimum)	2	mamp
Suggested Interface	26LS32	
Alignment (Z-Channel)	N/A	
HALL		
Input Voltage	5	volts
Input Current (max)	80	mamp
Output Device	LM339	
Sink (max)	16	mamp
HALL pull up (R=1K)		
Alignment (HALL1)	See Note 1	

[1] Low-to-High transition of HALL1 aligns with positive going zero-crossing of motor Phase-A to Phase-C BEMF waveform.

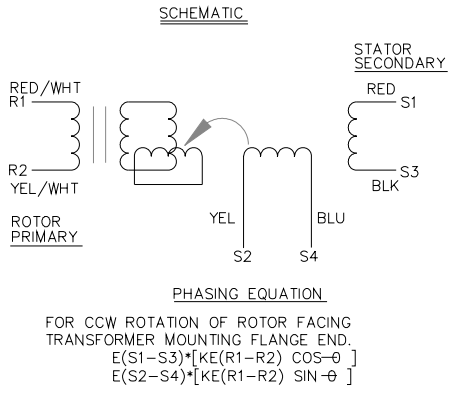
The **PC34xxAx-001-R** will accept resolver with a transformation ration between 0.5 to 1.0. A specification for typical units is shown below.

Table 3.11 Commutating Resolver Specification(s)

Resolver	Value	Units
Transformation Ratio	**0.500**	+/-10%
Input Voltage	7.0	volts rms
Input Frequency	4.3	kHz
Input Current (max)	100	mamp
Input Power	0.26	watts
Impedance Z-r0	33+j81	ohm
Impedance Z Sine	150+j200	ohm
Impedance Z-Cos	140+j175	ohm
Output Voltage, +/- 10%	3.5	volts
D.C. Rotor Resistance, +/- 10%	17	ohm
D.C. Stator Resistance, +/- 10%	94	ohm
Phase Shift (open circuit)	+10	degrees
Null Voltage (total)	30	RMS mv
Phase shift with Temp Drift	0.4	%/C
Temperature Range	-55 to +155	C

PC34xxAx-001-R has buffered differential A, B and Z channel encoder-outputs are provided as 1024 LPR (4096 quadrature count) for a two-pole resolver.

Figure 3-12 Resolver Schematic



3.6 I/O connector (J1) - all models

The PC34xxA's I/O connector J1 is a 24 pin dual-row connector that contains connections for an Analog command, Digital Inputs, Digital Outputs, High-Speed-Inputs (HSI) and Encoder Output signals. The various methods of wiring I/O common to all models are described in this section.

Please be sure to review this entire section prior to making connections. In addition, please read the sections specific to the models being installed; PC34xxAd**,** PC34xxAi**,** PC34xxAi-001-xI /Extended I/O or PC34xxAc Centennial.

A cable assembly, **PCA-MM24-006**, may be purchased to facilitate wiring the J1 connector, see Table 7.2 System Accessories. This shielded cable assembly is pre-wired to the mating connector, six feet in length.

3.6.1.1 Enable Input (J1)

A clear understanding of the ENABLE input (J1-5) and the Drive-OK/Brake Relay Output (J1) (J1-23 and J1-24) as Drive-OK or Brake control is necessary for developing the proper hardware interconnect. Some of the questions that the user MUST answer PRIOR to developing a system interconnect wiring for installations are;

- **Where does the systems motion controller reside?**

  1) In the PC34xxAi.
  2) Via network connection.
  3) Multi-axis motion control card.

- **What will be providing the servo Enable signal?**

  1) Opto input (ENABLE), factory default (preferred)
  2) Opto input (ENABLE) and'd with Software Enable (SWE)
  3) Opto input (ENABLE) or'd Software Enable (SWE)
  4) Software Enable (SWE)

- **If not utilizing a Brake, how will be Drive-OK output be utilized?**

- **If utilizing a Brake, what will control the brake release?**

  1) PC34xxA directly wired to the brake coil.
  2) PLC/ Multi-axis motion control card controls the brake function.

3.6.1.2 Analog Input (J1)

If you are using the **HSI** inputs for command input, you may skip this section.

The PC34xxA contains connections for a single analog input for use as a command reference. This differential analog input is intended to provide ±10 VDC control signal to the amplifier. The differential input should be driven via the users differential output and should be connected with individually shielded twisted pairs to provide the best possible noise immunity. Depending on the software configuration, the analog signal (software name **ADC1**) can be utilized to provide a "velocity" or "current" commands.

Single-ended analog command signals may be utilized by connecting the signal command to ADC1+ and the ADC1- to signal reference.

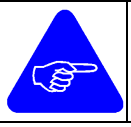
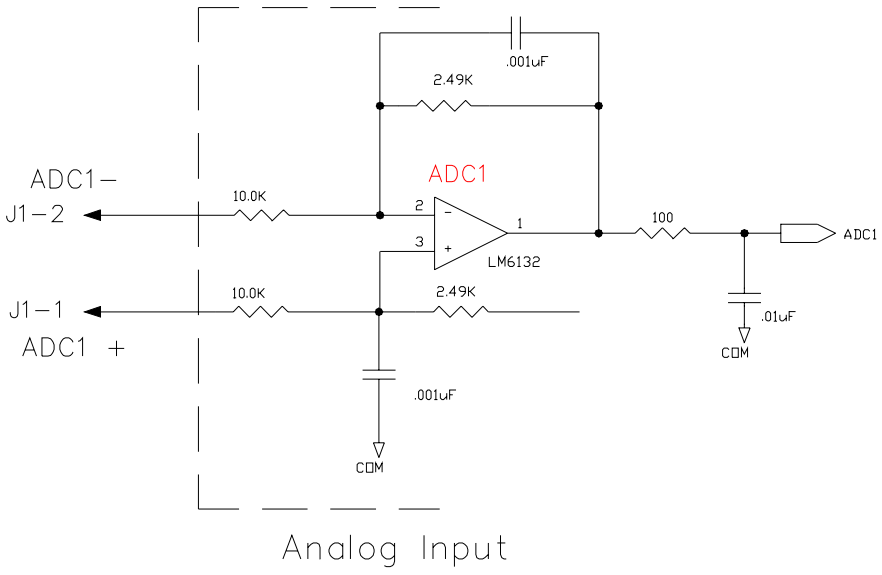
	NOTE
	***All models are 14-bit analog resolution.***

Figure 3-13 Schematic of PC34xxA Analog Inputs



3.6.1.3 Digital HSI inputs (J1)

If you are using the **Analog** input for command input, you may skip this section.

Inputs 5 and 6 are 2Mhz High Speed Inputs (HSI1 and HSI2) that can be utilized for the purpose of Distributed Feedback, following a master encoder (Quad), Step/Direction or Step+/Step- signal. ***An additional High Speed Input (Input 7) is available as registration input on the PC34xxAi and PC34xxAc models.***

When utilizing **Distributed Feedback** mode of operation HSI1 and HSI2 are wired as a master encoder (Quad) to a secondary encoder. Read section Distributed Feedback (J1) and Selecting Operation Mode for additional information.

The HSI inputs are intended for use with a differential output driver such as a 23LS31 line driver Figure 3-15 Wiring HSI Inputs as Differential Inputs. However since this is not always possible, single-ended Open collector or TTL outputs may be wired to these inputs. Please review the Figure 3-16 Wiring HSI Inputs as Single-ended inputs to the PC34xxA.

Relationships of the HSI inputs are shown in Figure 3-17 Relationship of HSI Signals. Please review for applications requiring Step/Dir, Step+/Step- or quadrature inputs for commanded motion.

Signal timing for the HSI inputs is shown in Figure 3-18 HSI Signal Timing. In applications where the user is not able to provide the required transition timing, open collector or TTL type, it should be noted that an ToolPAC command parameter, High Speed Input Filter (**HSIF**) is provided for applying a low-pass filter to all of the HSI input signals. ***HSIF may be set for 30kHz, 250kHz or 2MHz.***

	CAUTION
	*The High Speed Inputs (HSI) require a signal level of 0-5VDC relative to J1-3 (Shield).* *The voltage difference between HSI+ and HSI- must be greater than ±0.25 volts.* *Exceeding this voltage specification will result in damage to the equipment.* **NON-ISOLATED**

Figure 3-14 Schematic of PC34xxA HSI Inputs

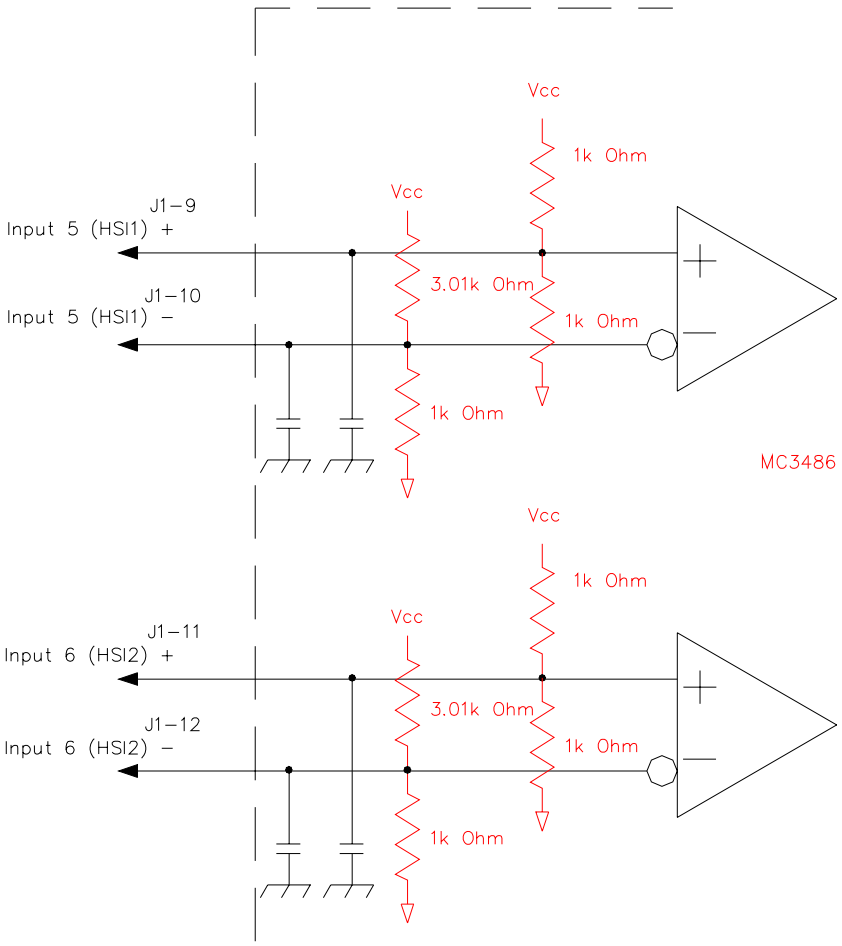


Figure 3-15 Wiring HSI Inputs as Differential Inputs

Note the measured voltages below.

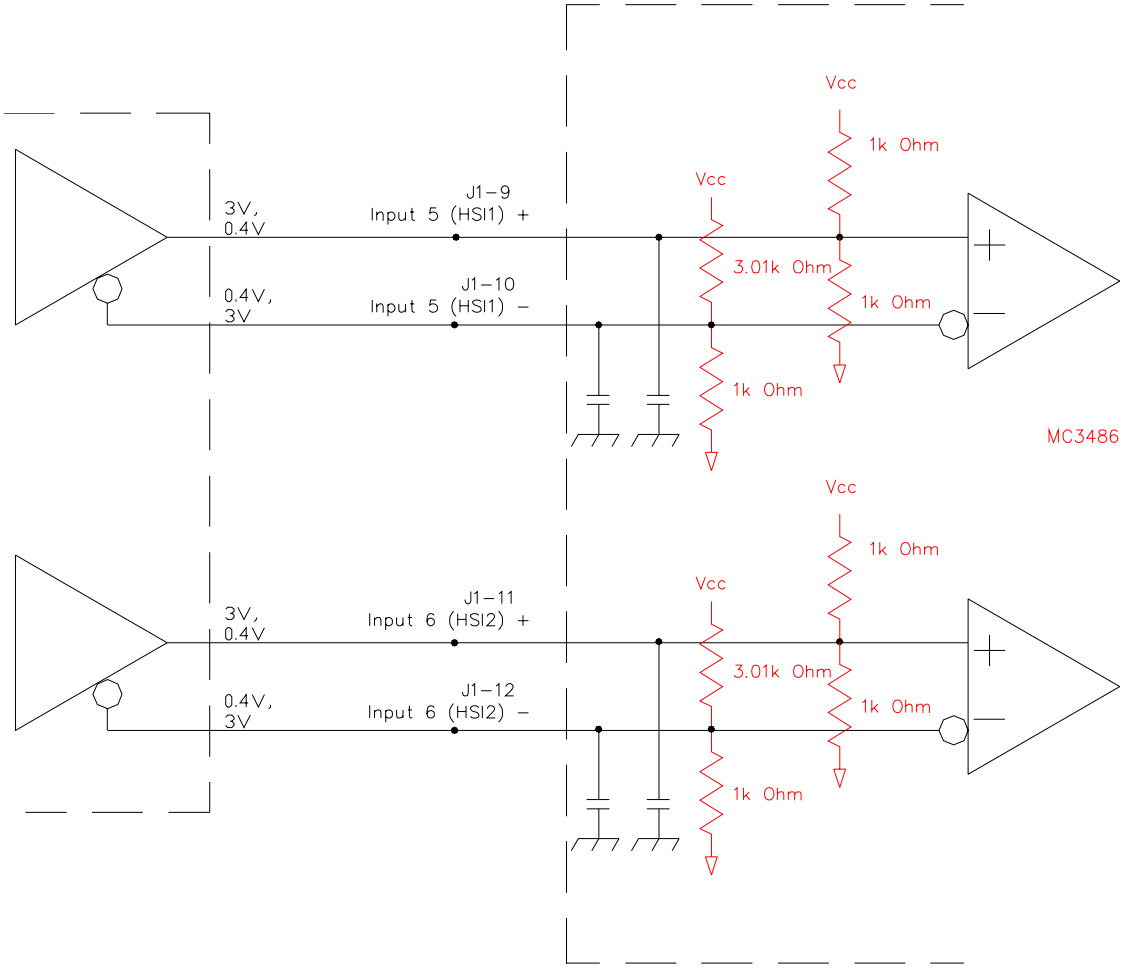


Figure 3-16 Wiring HSI Inputs as Single-ended

Open collector or TTL inputs must have the ability to sink 5ma and may be wired as shown below.

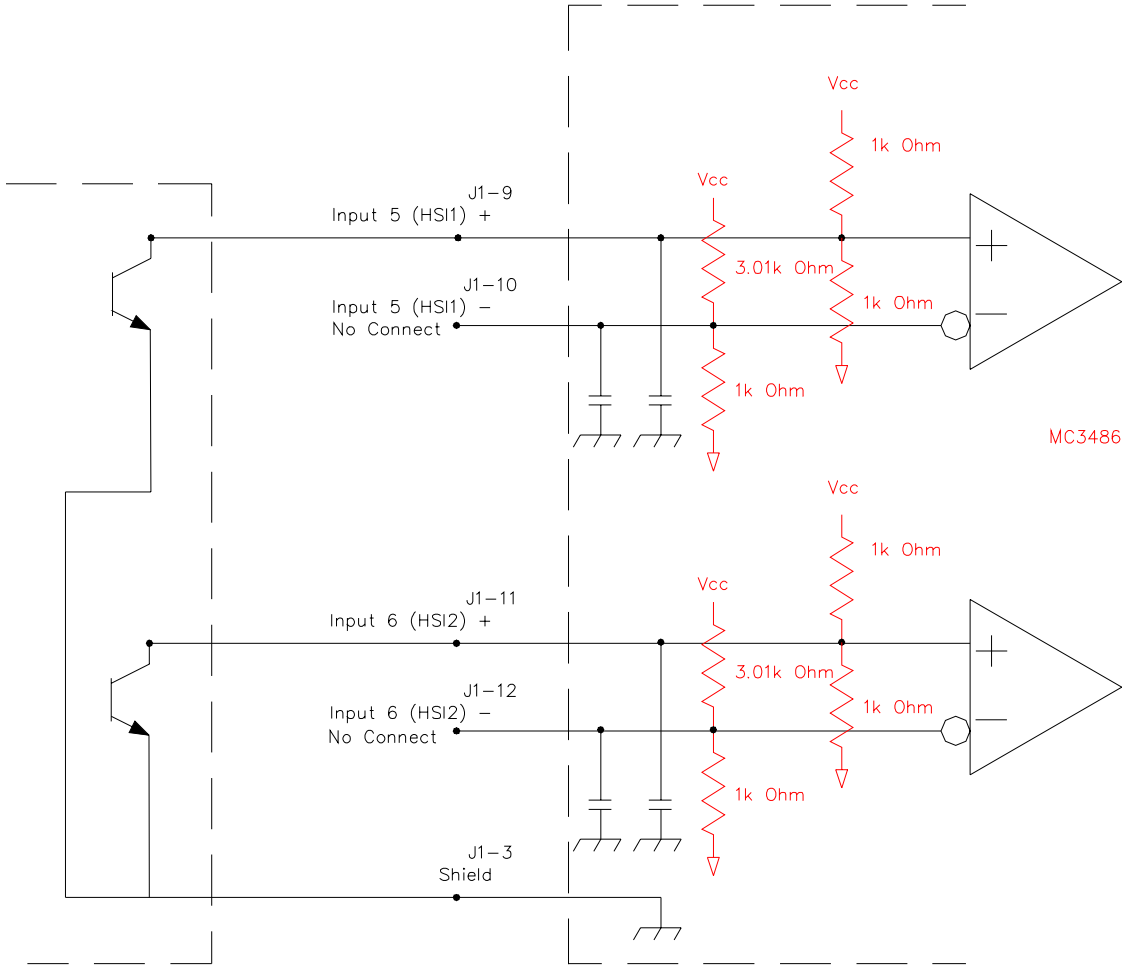


Figure 3-17 Relationship of HSI Signals

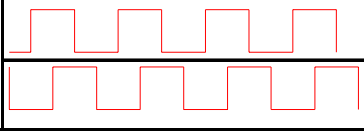
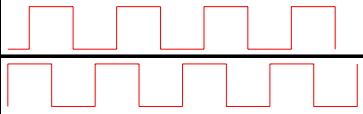
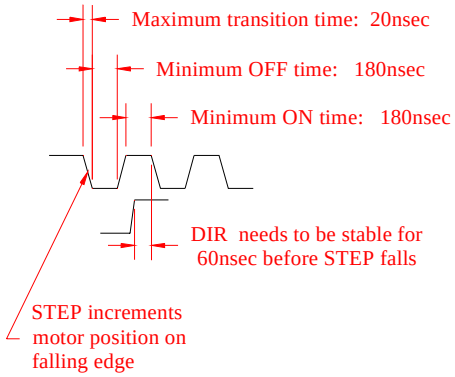
Signals for High Speed Inputs		
Mode	**HSI5**	**HSI6**
Step/Dir	**Direction** 0 = CCW, 1 = CW	**Step** when falling
		
Step+/Step-	**Step CCW** when HSI6 = 0	**Step CW** when HSI5 = 0
	 	 
Quadrature	**Phase A Quadrature**	**Phase B Quadrature**
	CCW on A (HSI5) rising with B (HSI6) low	
		

Figure 3-18 HSI Signal Timing



3.6.1.4 Distributed Feedback (J1)

If you are NOT using the Distributed Feedback mode of operation, you may skip this section.

All models of the PC3400 have Inputs 5 and 6 as High Speed Inputs (HSI1 and HSI2) that can be utilized for the purpose of Distributed Feedback. When utilizing **Distributed Feedback** mode of operation HSI1 and HSI2 are wired as a secondary encoder (Quad).

	NOTE
	*When utilizing Distributed Feedback you will **NOT** have the ability of performing Electronic Gearing, CAM, Step/Dir, Step+/Step- or Quadrature encoder following.* *The maximum motor velocity is limited to the capability of the encoder output or a 2Mhz-count rate whichever is less.* *Encoder z-channel is not supported, thus the software command Move to the Feedback Null (+/-) is **NOT** available.*

- When utilizing **Distributed Feedback** with a **Brushless DC (BLDC)** motor, the motors feedback is utilized for commutation purposes only! The secondary feedback device, an encoder, is wired to HSI1 and HSI2 inputs.

- When utilizing **Distributed Feedback** with a **Brush DC** motor, the motors feedback is NOT utilized nor required! The secondary feedback device, an encoder, is wired to HSI1 and HSI2 inputs.

- Velocity and Position loop tuning is performed utilizing the encoder signals wired to the **HSI1** and **HSI2** inputs. Thus it is important in an application utilizing Distributed Feedback to have a "rigid mechanical transmission" with minimal backlash and compliance. ***A system with backlash or compliance may be nearly impossible to tune!***

Please read sections Digital HSI inputs (J1) and Selecting Operation Mode for additional information.

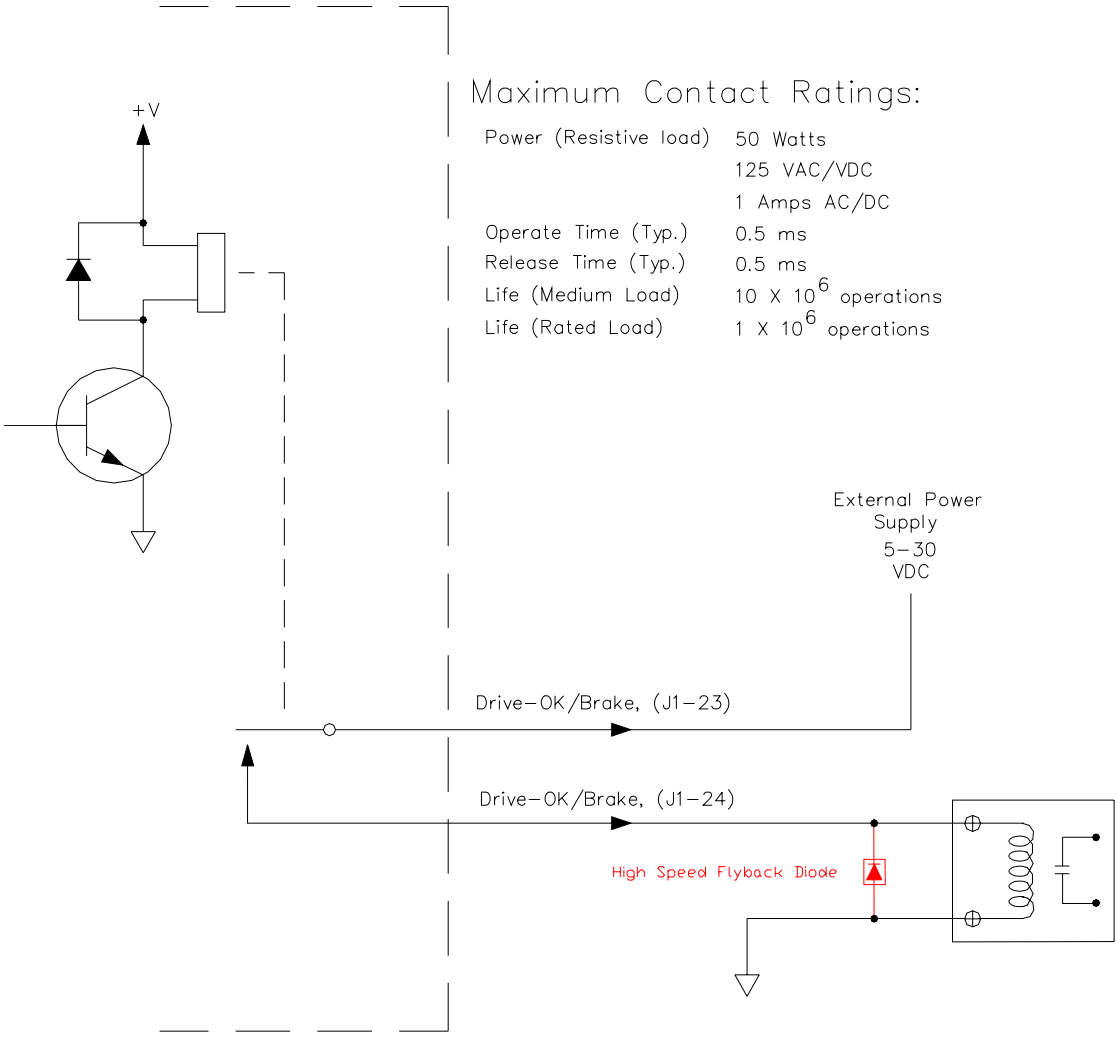
3.6.1.5 Drive-OK/Brake Relay Output (J1)

This relay output can be wired into the customers' hardware e-stop chain and/or utilized to directly energize the coil of the motor's safety power-off brake. The software default configuration of this output is as a Drive-OK. The ToolPAC **I/O Configuration Wizard** is utilized to configure this relay output as a Brake Output, Figure 5-4 ToolPAC Wizards.

When software configured as a Drive-OK output, the output will be active as long as there are no faults present. **(This does not imply that the controller is Enabled!)**

When software configured as a BRAKE output, the output is only active when main power is applied, the unit is enabled and no fault conditions exist. The relay output becomes active 200ms after the leading edge of the Enable signal. This output is inactive immediately if a fault conditions exists or the drive becomes disabled.

Figure 3-19 PC34xxA Drive-OK/Brake Relay Output



	CAUTION
	If utilizing this output to control a brake, the user must ensure that proper coil suppression is installed to prevent premature damage to relay contacts. Review Figure 7-4 Suppression - DC Relay for proper coil suppression.

3.6.1.6 Encoder Outputs (J1)

All models have buffered encoder outputs that may be used as a position or velocity signal. The encoder outputs are available for use in all modes of operation except when utilizing tachometer feedback.

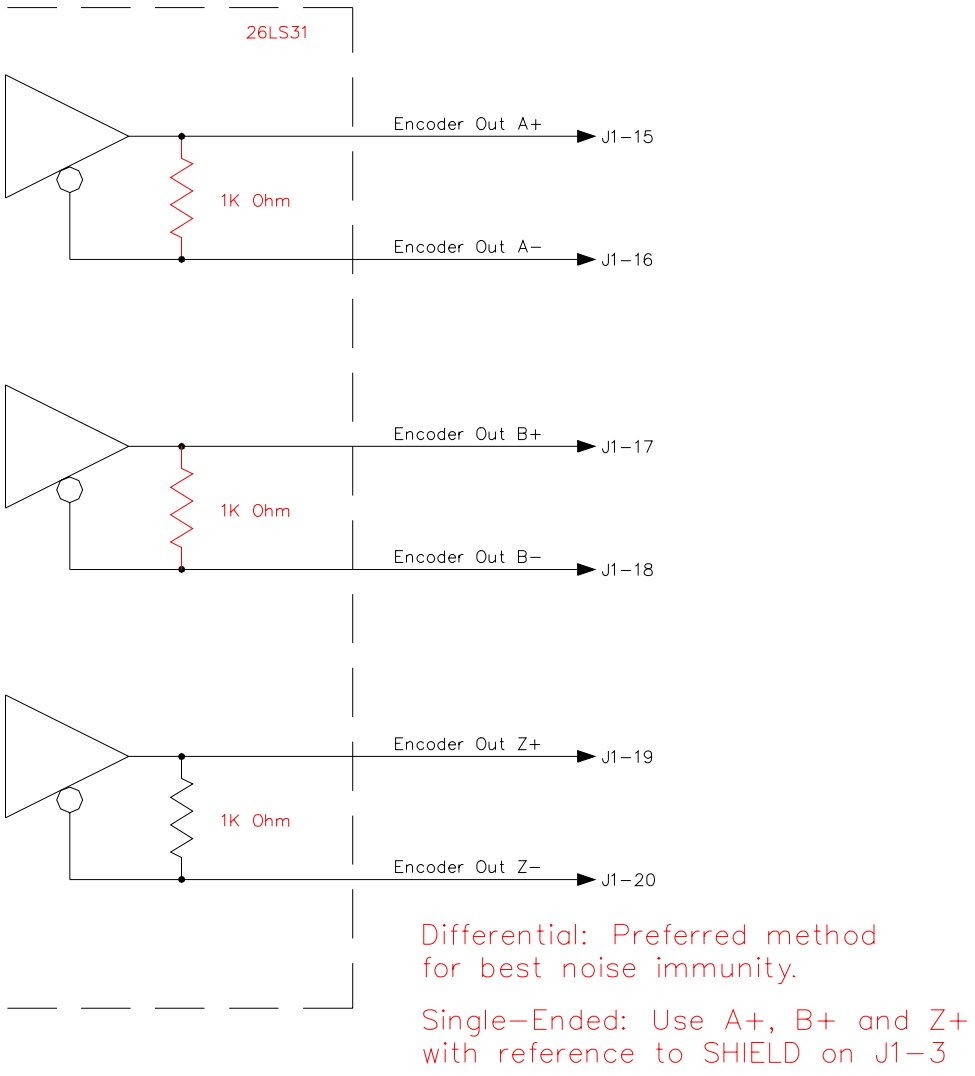
The A/B outputs are clocked at a frequency with respect to the Halls (hall only mode) or Encoder (encoder only, hall/encoder, Comcoder or encoder/encoded z-channel). This output is not user scalable, it is the user responsibility to purchase the proper motor/feedback to meet the system requirements.

- All models of the **PC34xxA** version drives have A, B and Z channels outputs.

The buffered encoder output(s) can be wired to a users differential or single-ended encoder input(s), refer to Figure 3-20 Encoder outputs for wiring information on your specific model and interface.

The encoder outputs may be wired to the HSI inputs of other controller(s) so that Master/Slave relationships can be developed to synchronize multiple axis of motion as a function of position or velocity.

Figure 3-20 Encoder outputs



3.7 PC34xxAd

Each **PC34xxAd** Series unit is an amplifier and heatsink integrated into a single standalone package.

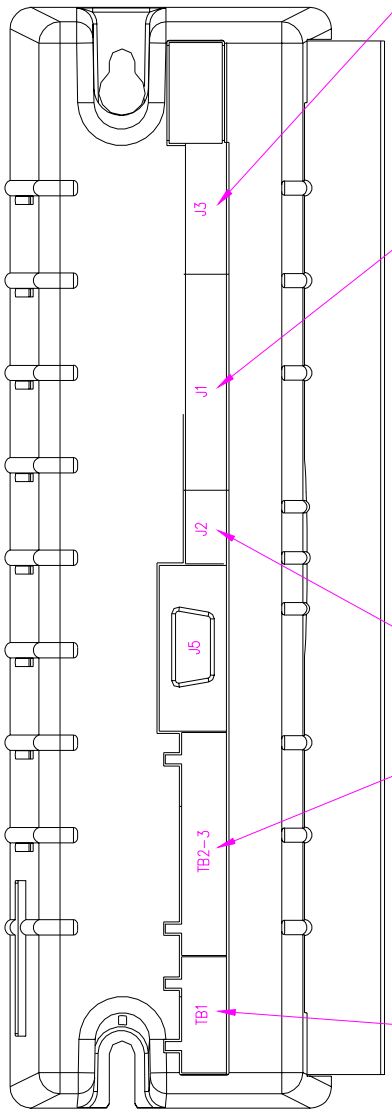
The **PC34xxAd-001-E** Series is a digital amplifier that will accept the following feedback devices; **Hall-only**, an **Encoder with Hall, Comcoder** an **encoder with Commutation Tracks encoded on the Z-Channel** or **Tachometer**. See section PC34xxAx-001-E Series.

The **PC34xxAd-001-R** Series is a digital amplifier that will accept a Commutating resolver as a feedback device, PC34xxAx-001-R Series. Buffered, Differential A, B and Z channel encoder-outputs are provided as 1024 LPR (4096 quadrature count) for a two-pole resolver, Encoder Outputs (J1).

All **PC34xxAd** Series servo controllers provide the user with the same basic components:

- A graphical user interface program, **ToolPAC**, provides the user with the tools to easily configure the PC34xxA to the specific application. **ToolPAC** is a Windows/NT-based program that provides Wizards for axis setup, tuning and I/O Configurations.
- A method of control is Analog input for Current (torque) or Velocity mode, Step/Dir, Step+/Step- or Following of a master quadrature encoder signal. Determine your required configuration, then review the appropriate section.
- A fixed ratio Master/slave relationships can be developed from the master encoder HSI inputs when used in Follow mode.
- Distributed Feedback is not available on this series.
- Hardware interfaces for Enable, Motor OT, Resolver or Digital HSI inputs (J1), CW, CCW inputs, Drive-OK/Brake Relay Output (J1) that allow you to interface to your machinery/equipment.

Figure 3-21 PC340xAd Connector Placement



J3 - Encoder Feedback			
Pin #	Signal	Pin #	Signal
2	A -	1	A +
4	B -	3	B +
6	Z -	5	Z +
8	HED 1	7	Gnd
10	HED 3	9	HED 2
12	+5 VDC	11	+5 Return(com)
14	ADC2 - /OT -	13	ADC2 + / OT +

J3 - Resolver Feedback			
Pin #	Signal	Pin #	Signal
2	Sin - (S4)	1	Sin + (S2)
4	Cos - (S3)	3	Cos + (S1)
6	Ref - (R2)	5	Ref + (R1)
8	Spare	7	Gnd
10	Spare	9	Spare
12	+5 VDC	11	+5 Return(com)
14	ADC2 - /OT -	13	ADC2 + / OT +

J1 - I/O			
Pin #	Isolated IO	Pin #	Isolated IO
2	ADC1 -	1	ADC1 +
4	IN_COM	3	Gnd
6	Input 2	5	**ENABLE**
8	**CW**/Input 4	7	**CCW**/Input 3
10	**Input 5 (HSI) -**	9	**Input 5 (HSI) +**
12	**Input 6 (HSI) -**	11	**Input 6 (HSI) +**
14	Spare	13	Spare
16	Out A -	15	Out A +
18	Out B -	17	Out B +
20	Out Z -	19	Out Z +
22	Spare	21	Spare
24	**OK/Brake -**	23	**OK/Brake +**

N/A

TB2-3 - BLDC	
Pin #	Name
8	**Ctrl +**
7	**Ctrl -**
6	Regen +
5	Regen -
4	Gnd
3	Phase U (A)
2	Phase V (B)
1	Phase W (C)

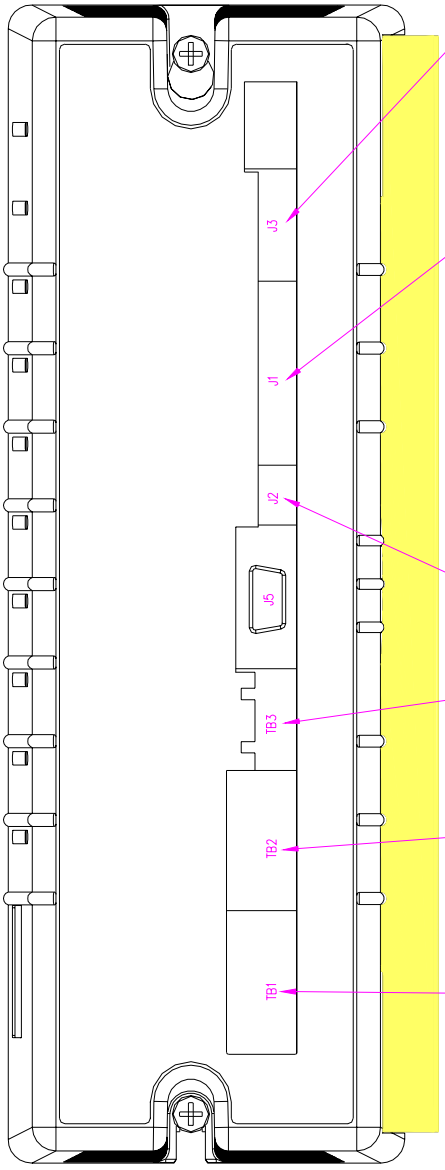
TB2-3 - Brush DC	
Pin #	Name
8	**Ctrl +**
7	**Ctrl -**
6	Regen +
5	Regen -
4	Gnd
3	Motor DC + (U)
2	Motor DC - (V)
1	N/C (W)

TB1 - AC Power	
Pin #	AC IN
4	L1
3	L2
2	L3
1	**GND (PE)**

J5 - Comm Port (DB9-F)			
Pin #	RS-232	RS-422 RS-485	RS-485 two wire
1	NC	Tx+	Rx+/Tx+
2	Tx	Tx-	Rx-/Tx-
3	Rx	Rx-	Rx-/Tx-
4	NC	Rx+	Rx+/Tx+
5	COM	COM	COM
6	-	-	-
7	-	-	-
8	-	-	-
9	-	-	-

PC3403Ad-001-x and
PC3406Ad-001-x

Figure 3-22 PC34xxAd Connector Placement



J3 - Encoder Feedback			
Pin #	Signal	Pin #	Signal
2	A -	1	A +
4	B -	3	B +
6	Z -	5	Z +
8	HED 1	7	Gnd
10	HED 3	9	HED 2
12	+5 VDC	11	+5 Return(com)
14	ADC2 - /OT -	13	ADC2 + / OT +

J3 - Resolver Feedback			
Pin #	Signal	Pin #	Signal
2	Sin - (S4)	1	Sin + (S2)
4	Cos - (S3)	3	Cos + (S1)
6	Ref - (R2)	5	Ref + (R1)
8	Spare	7	Gnd
10	Spare	9	Spare
12	+5 VDC	11	+5 Return(com)
14	ADC2 - /OT -	13	ADC2 + / OT +

J1 - I/O			
Pin #	Isolated IO	Pin #	Isolated IO
2	ADC1 -	1	ADC1 +
4	IN_COM	3	Gnd
6	Input 2	5	**ENABLE**
8	**CW**/Input 4	7	**CCW**/Input 3
10	**Input 5 (HSI) -**	9	**Input 5 (HSI) +**
12	**Input 6 (HSI) -**	11	**Input 6 (HSI) +**
14	Spare	13	Spare
16	Out A -	15	Out A +
18	Out B -	17	Out B +
20	Out Z -	19	Out Z +
22	Spare	21	Spare
24	**OK/Brake -**	23	**OK/Brake +**

TB3 - Ctrl/Regen	
Pin #	Name
4	**Ctrl +**
3	**Ctrl -**
2	Regen +
1	Regen -

TB2 - BLDC	
Pin #	Name
4	Gnd
3	Phase U
2	Phase V
1	Phase W

TB2 - Brush DC	
Pin #	Name
4	Gnd
3	Motor DC + (U)
2	Motor DC - (V)
1	N/C (W)

TB1 - AC Power	
Pin #	AC IN
4	L1
3	L2
2	L3
1	**GND (PE)**

J5 - Comm Port (DB9-F)			
Pin #	RS-232	RS-422 RS-485	RS-485 two wire
1	NC	Tx+	Rx+/Tx+
2	Tx	Tx-	Rx-/Tx-
3	Rx	Rx-	Rx-/Tx-
4	NC	Rx+	Rx+/Tx+
5	COM	COM	COM
6	-	-	-
7	-	-	-
8	-	-	-
9	-	-	-

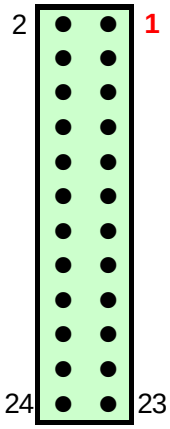
PC3410Ad–001–x and
PC3420Ad–001–x Series

3.7.1.1 Digital I/O (J1)

The PC34xxAd-001-E digital I/O connector J1 contains all of the connections for the unit; 14-bit Analog input, 3 inputs (Enable and CCW/CW limits), plus 2 HSI inputs, buffered encoder outputs and a relay for Output-1 as Drive-OK or Brake control. The various methods of wiring I/O are described in this section.

The optically isolated inputs, (Enable, CW Limit and CCW limit) are current activated, 10 mA minimum. The user must supply a 5-30 VDC voltage to utilize the optically isolated I/O. Since the digital inputs are current activated, the user may utilize PNP or NPN outputs to the drive.

Figure 3-23 PC34xxAd Connector J1

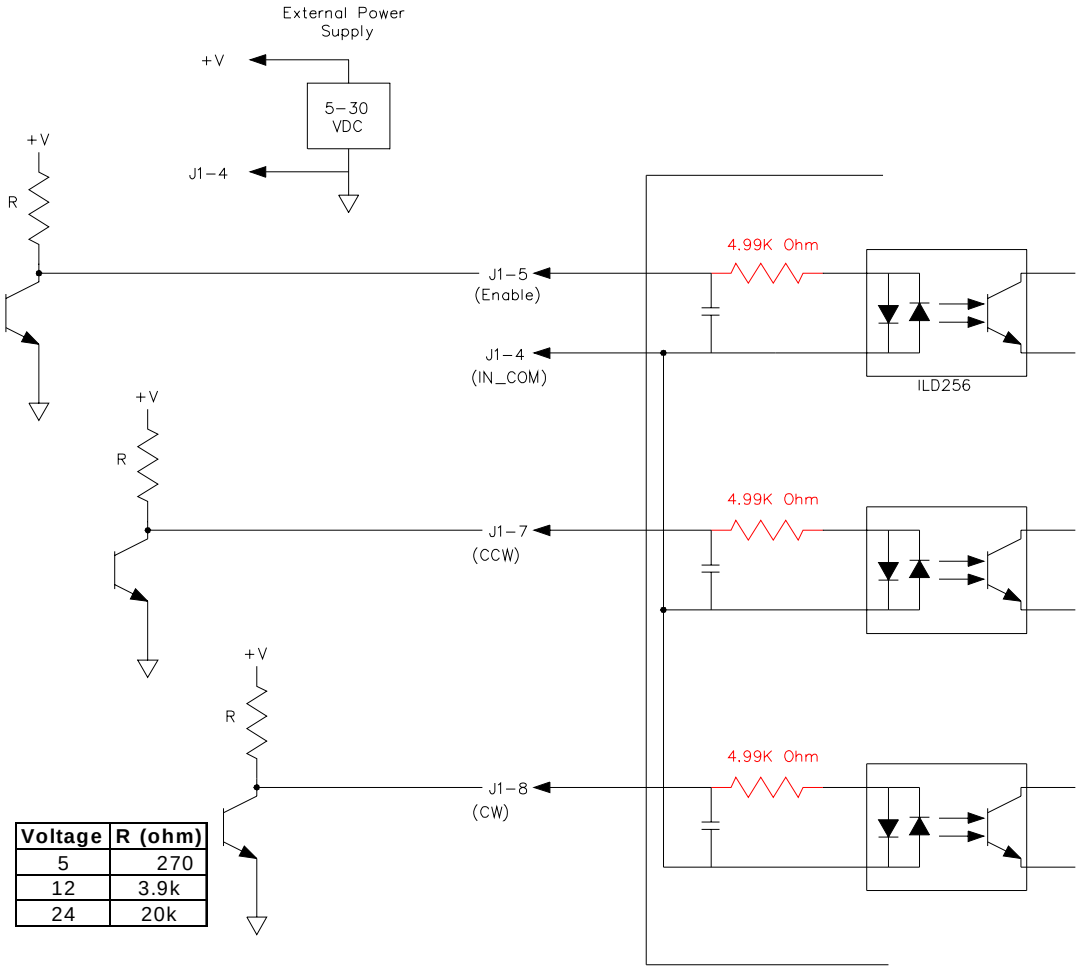


J1 - I/O			
Pin #	**Isolated IO**	**Pin #**	**Isolated IO**
2	ADC1 -	**1**	ADC1 +
4	IN_COM	3	Gnd
6	Input 2	5	**ENABLE**
8	**CW**/Input 4	7	**CCW**/Input 3
10	**Input 5 (HSI) -**	9	**Input 5 (HSI) +**
12	**Input 6 (HSI) -**	11	**Input 6 (HSI) +**
14	Spare	13	Spare
16	Out A -	15	Out A +
18	Out B -	17	Out B +
20	Out Z -	19	Out Z +
22	Spare	21	Spare
24	**OK/Brake -**	23	**OK/Brake +**

	CAUTION
	*The High Speed Inputs (HSI) require a signal level of 0-5VDC relative to J1-3 (Shield). The voltage difference between HSI+ and HSI- must be greater than ±0.25 volts. Exceeding this voltage specification will result in damage to the equipment.* ***NON-ISOLATED***

A cable assembly, **PCA-MM24-006**, may be purchased to facilitate wiring the J1 connector. This shielded cable assembly is pre-wired to the mating connector, six feet in length.

Figure 3-24 PC34xxAd Digital Input (Sourcing configuration A)



Voltage	R (ohm)
5	270
12	3.9k
24	20k

Figure 3-25 PC34xxAd Digital Input (Sourcing configuration B)

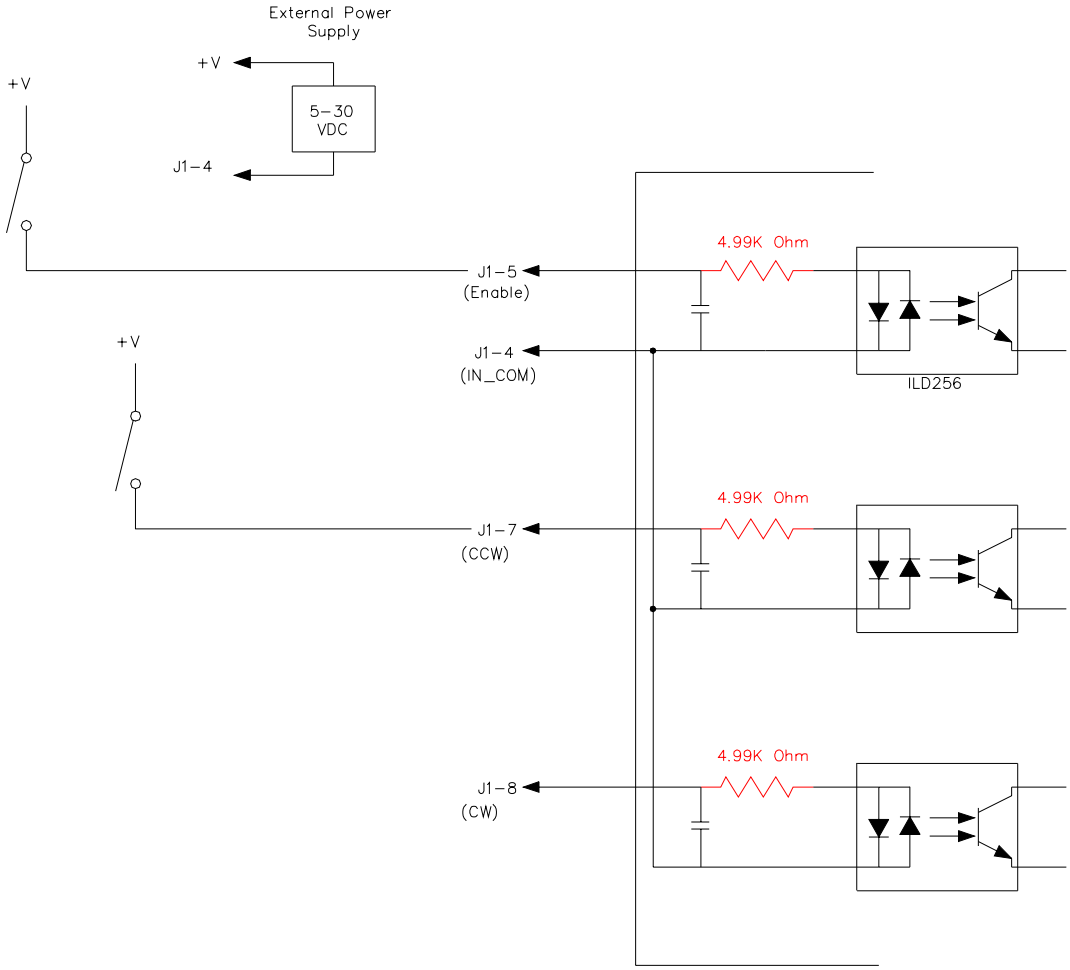


Figure 3-26 PC34xxAd Digital Input (Sinking configuration A)

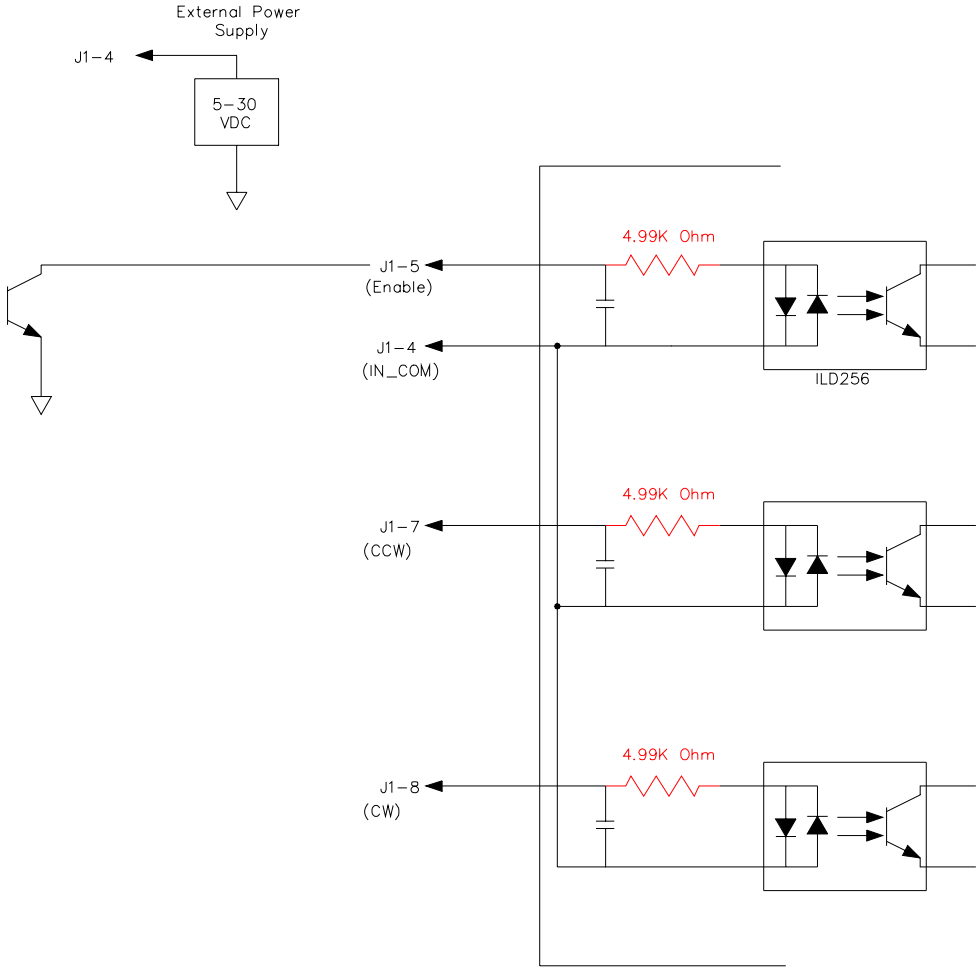
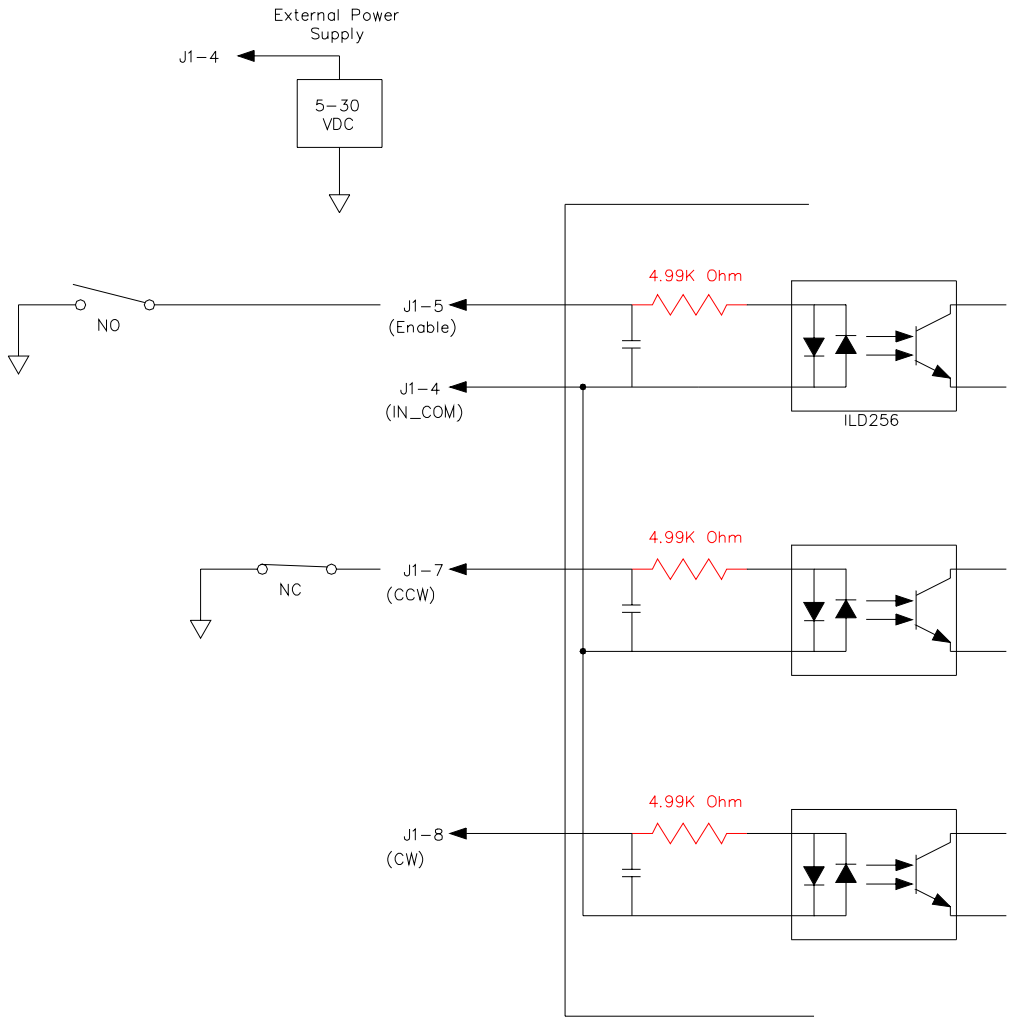


Figure 3-27 PC34xxAd Digital Input (Sinking configuration B)



3.8 PC34xxAi

Each **PC34xxAi** Series unit is an amplifier, intelligent controller and heatsink integrated into a single standalone package.

The **PC34xxAi-001-E** Series is an Intelligent Series digital amplifier that will accept the following feedback devices; **Hall-only**, an **Encoder with Hall, Comcoder** an **encoder with Commutation Tracks encoded on the Z-Channel** or **Tachometer**. See section PC34xxAx-001-E Series.

The **PC34xxAi-001-R** Series is an Intelligent Series digital amplifier that will accept a Commutating resolver as a feedback device, PC34xxAx-001-R Series. Buffered, Differential A, B and Z channel encoder-outputs are provided as 1024 LPR (4096 quadrature count) for a two-pole resolver, Encoder Outputs (J1).

All **PC34xxAi** Series servo controllers provide the user with the same basic components:

- A graphical user interface program, **ToolPAC**, provides the user with the tools to easily configure and program the PC34xxA to the specific application. **ToolPAC** is a Windows/NT-based program that provides Wizards for axis setup, tuning and I/O Configurations.

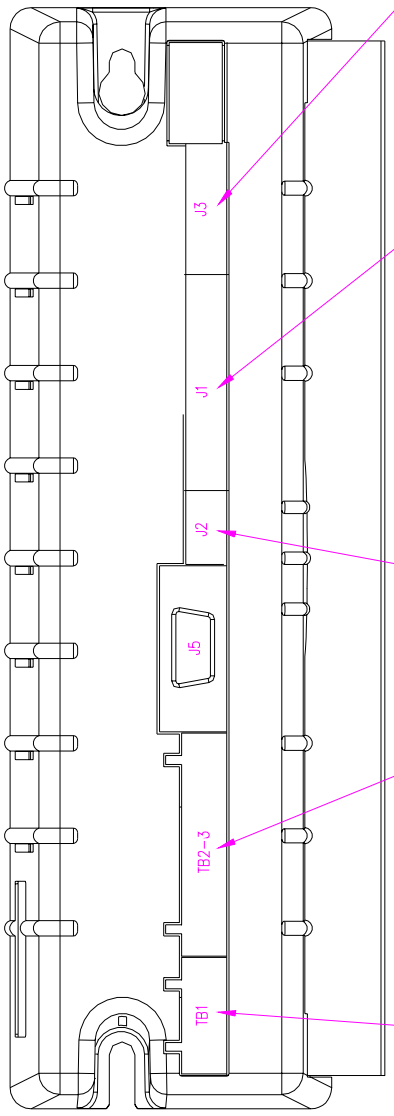
- A method of control may be Stand-alone program mode, Analog input for Current (torque) or Velocity mode, Step/Dir, Step+/Step- or Following of a master quadrature encoder signal. Determine your required configuration, then review the appropriate section.

- Master/slave relationships can be developed from the master encoder HSI inputs when used in Follow mode. Advanced ToolPAC programming features are available for performing complex Electronic Gearing and CAM motion.

- Distributed Feedback; A mode of operation where a secondary encoder is used to close the Position loop in an application. When using Distributed Feedback you will loose the ability to provide Step/Dir, Step+/Step- or Encoder following as the secondary encoder is wired to these HSI inputs. Thus, CAM and Master/Slave relationships are likewise not available.

- Hardware interfaces for Enable, Motor OT, Digital HSI inputs (J1), CW, CCW inputs, Drive-OK/Brake Relay Output (J1) that allows you to interface to your machinery/equipment.

Figure 3-28 PC340xAi Connector Placement



PC3403Ai–001–x and
PC3406Ai–001–x
Series

J3 - Encoder Feedback			
Pin #	Signal	Pin #	Signal
2	A -	1	A +
4	B -	3	B +
6	Z -	5	Z +
8	HED 1	7	Gnd
10	HED 3	9	HED 2
12	+5 VDC	11	+5 Return(com)
14	ADC2 - /OT -	13	ADC2 + / OT +

J3 - Resolver Feedback			
Pin #	Signal	Pin #	Signal
2	Sin - (S4)	1	Sin + (S2)
4	Cos - (S3)	3	Cos + (S1)
6	Ref - (R2)	5	Ref + (R1)
8	Spare	7	Gnd
10	Spare	9	Spare
12	+5 VDC	11	+5 Return(com)
14	ADC2 - /OT -	13	ADC2 + / OT +

J1 - I/O (Intelligent/Centennial Only)			
Pin #	Isolated IO	Pin #	Isolated IO
2	ADC1 -	1	ADC1 +
4	IN_COM	3	Gnd
6	Input 2	5	**ENABLE**/Input 1
8	**CW**/Input 4	7	**CCW**/Input 3
10	**Input 5 (HSI) -**	9	**Input 5 (HSI) +**
12	**Input 6 (HSI) -**	11	**Input 6 (HSI) +**
14	**Reg/(HSI-7) -**	13	**Reg/(HSI-7) +**
16	Out A -	15	Out A +
18	Out B -	17	Out B +
20	Out Z -	19	Out Z +
22	Output 2 -	21	Output 2 +
24	**OK/Brake -**	23	**OK/Brake +**

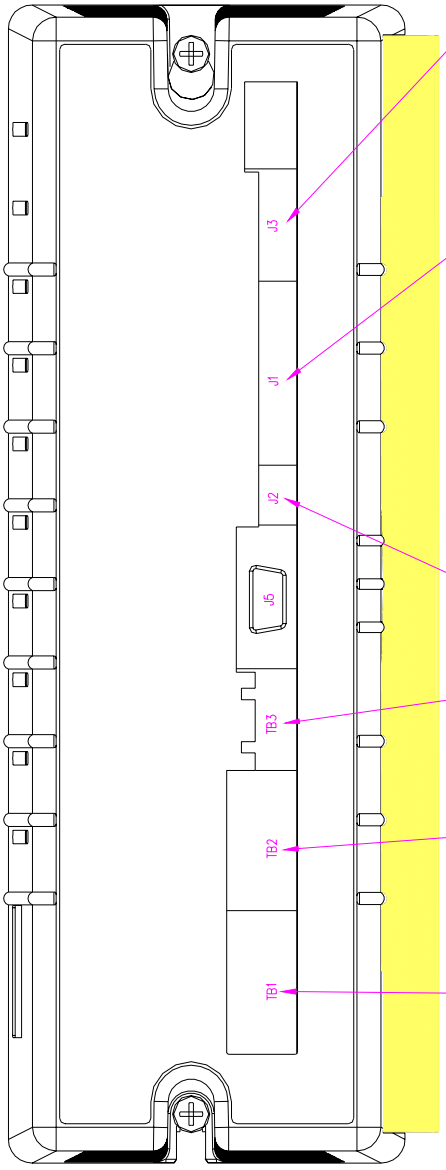
J2 - I/O (Intelligent/Centennial Only)			
Pin #	Isolated IO	Pin #	Isolated IO
2	Output 3 -	1	Output 3 +
4	Output 4 -	3	Output 4 +
6	Input 9	5	Input 8

TB2-3 - BLDC		TB2-3 - Brush DC	
Pin #	Name	Pin #	Name
8	**Ctrl +**	8	**Ctrl +**
7	**Ctrl -**	7	**Ctrl -**
6	Regen +	6	Regen +
5	Regen -	5	Regen -
4	Gnd	4	Gnd
3	Phase U (A)	3	Motor DC + (U)
2	Phase V (B)	2	Motor DC - (V)
1	Phase W (C)	1	N/C (W)

TB1 - AC Power	
Pin #	AC IN
4	L1
3	L2
2	L3
1	**GND (PE)**

J5 - Comm Port (DB9-F)			
Pin #	RS-232	RS-422 RS-485	RS-485 two wire
1	NC	Tx+	Rx+/Tx+
2	Tx	Tx-	Rx-/Tx-
3	Rx	Rx-	Rx-/Tx-
4	NC	Rx+	Rx+/Tx+
5	COM	COM	COM
6	-	-	-
7	-	-	-
8	-	-	-
9	-	-	-

Figure 3-29 PC34xxAi Connector Placement



J3 - Encoder Feedback			
Pin #	Signal	Pin #	Signal
2	A -	1	A +
4	B -	3	B +
6	Z -	5	Z +
8	HED 1	7	Gnd
10	HED 3	9	HED 2
12	+5 VDC	11	+5 Return(com)
14	ADC2 - /OT -	13	ADC2 + / OT +

J3 - Resolver Feedback			
Pin #	Signal	Pin #	Signal
2	Sin - (S4)	1	Sin + (S2)
4	Cos - (S3)	3	Cos + (S1)
6	Ref - (R2)	5	Ref + (R1)
8	Spare	7	Gnd
10	Spare	9	Spare
12	+5 VDC	11	+5 Return(com)
14	ADC2 - /OT -	13	ADC2 + / OT +

J1 - I/O (Intelligent/Centennial Only)			
Pin #	Isolated IO	Pin #	Isolated IO
2	ADC1 -	1	ADC1 +
4	IN_COM	3	Gnd
6	Input 2	5	**ENABLE**/Input 1
8	**CW**/Input 4	7	**CCW**/Input 3
10	**Input 5 (HSI) -**	9	**Input 5 (HSI) +**
12	**Input 6 (HSI) -**	11	**Input 6 (HSI) +**
14	**Reg/(HSI-7) -**	13	**Reg/(HSI-7) +**
16	Out A -	15	Out A +
18	Out B -	17	Out B +
20	Out Z -	19	Out Z +
22	Output 2 -	21	Output 2 +
24	**OK/Brake -**	23	**OK/Brake +**

J2 - I/O (Intelligent/Centennial Only)			
Pin #	Isolated IO	Pin #	Isolated IO
2	Output 3 -	1	Output 3 +
4	Output 4 -	3	Output 4 +
6	Input 9	5	Input 8

TB3 - Ctrl/Regen	
Pin #	Name
4	**Ctrl +**
3	**Ctrl -**
2	Regen +
1	Regen -

TB2 - BLDC	
Pin #	Name
4	Gnd
3	Phase U
2	Phase V
1	Phase W

TB2 - Brush DC	
Pin #	Name
4	Gnd
3	Motor DC + (U)
2	Motor DC - (V)
1	N/C (W)

TB1 - AC Power	
Pin #	AC IN
4	L1
3	L2
2	L3
1	**GND (PE)**

J5 - Comm Port (DB9-F)			
Pin #	RS-232	RS-422 RS-485	RS-485 two wire
1	NC	Tx+	Rx+/Tx+
2	Tx	Tx-	Rx-/Tx-
3	Rx	Rx-	Rx-/Tx-
4	NC	Rx+	Rx+/Tx+
5	COM	COM	COM
6	-	-	-
7	-	-	-
8	-	-	-
9	-	-	-

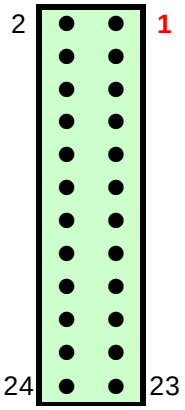
PC3410Ai–001–x and
PC3420Ai–001–x Series

3.8.1.1 Digital I/O (J1)

The **PC34xxAi** Series is an intelligent amplifier with I/O capability. The digital I/O connector J1 contains most of the connections for the unit; a 14-bit Analog Input (J1), 4 isolated inputs (Enable and 3 general purpose), plus 3 Digital HSI inputs (J1), buffered Encoder Outputs (J1) ABZ channels, 1 output plus a relay output for Drive-OK/Brake Relay Output (J1) control. The various methods of wiring I/O are described in this section.

The optically isolated inputs are current activated, 10 mA minimum. The user must supply a 5-30 VDC voltage to utilize the optically isolated I/O. Since the digital inputs are current activated, the user may utilize PNP or NPN outputs to the drive. Outputs are 5-30 VDC, 50 ma maximum.

Figure 3-30 PC34xxAi Connector J1



J1 - I/O (Intelligent/Centennial Only)			
Pin #	**Isolated IO**	**Pin #**	**Isolated IO**
2	ADC1 -	**1**	ADC1 +
4	IN_COM	3	Gnd
6	Input 2	5	**ENABLE**/Input 1
8	**CW**/Input 4	7	**CCW**/Input 3
10	**Input 5 (HSI) -**	9	**Input 5 (HSI) +**
12	**Input 6 (HSI) -**	11	**Input 6 (HSI) +**
14	**Reg/(HSI-7) -**	13	**Reg/(HSI-7) +**
16	Out A -	15	Out A +
18	Out B -	17	Out B +
20	Out Z -	19	Out Z +
22	Output 2 -	21	Output 2 +
24	**OK/Brake -**	23	**OK/Brake +**

	CAUTION
	*The High Speed Inputs (HSI) require a signal level of 0-5VDC relative to J1-3 (Shield). The voltage difference between HSI+ and HSI- must be greater than ±0.25 volts. Exceeding this voltage specification will result in damage to the equipment.* ***NON-ISOLATED***

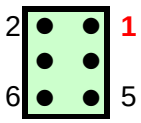
A cable assembly, **PCA-MM24-006**, may be purchased to facilitate wiring the J1 connector. This shielded cable assembly is pre-wired to the mating connector, six feet in length.

3.8.1.2 Digital I/O (J2)

The **PC34xxAi** Series has additional I/O capability located on connector J2 contains and additional two general-purpose outputs and two general-purpose inputs. The various methods of wiring I/O are described in this section.

The optically isolated inputs are current activated, 10 mA minimum. The user must supply a 5-30 VDC voltage to utilize the optically isolated I/O. Since the digital inputs are current activated, the user may utilize PNP or NPN outputs to the drive. Outputs are 5-30 VDC, 50 ma maximum.

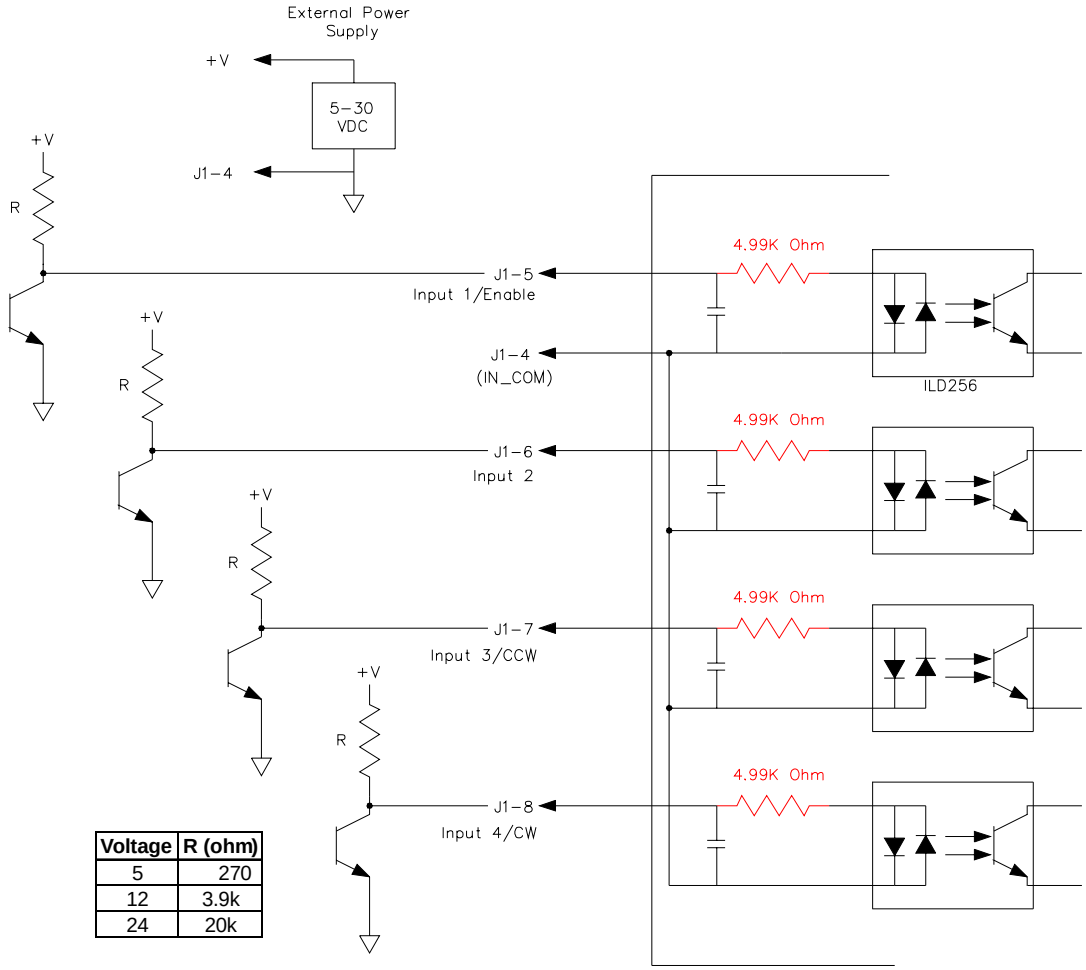
Figure 3-31 PC34xxAi Connector J2



J2 - I/O (Intelligent/Centennial Only)			
Pin #	**Isolated IO**	**Pin #**	**Isolated IO**
2	Output 3 -	1	Output 3 +
4	Output 4 -	3	Output 4 +
6	Input 9	5	Input 8

A cable assembly, **PCA-MC6-006**, may be purchased to facilitate wiring the J2 connector. This shielded cable assembly is pre-wired to the mating connector, six feet in length.

Figure 3-32 PC34xxAi Digital Input (Sourcing configuration A)



Voltage	R (ohm)
5	270
12	3.9k
24	20k

Figure 3-33 PC34xxAi Digital Input (Sourcing configuration B)

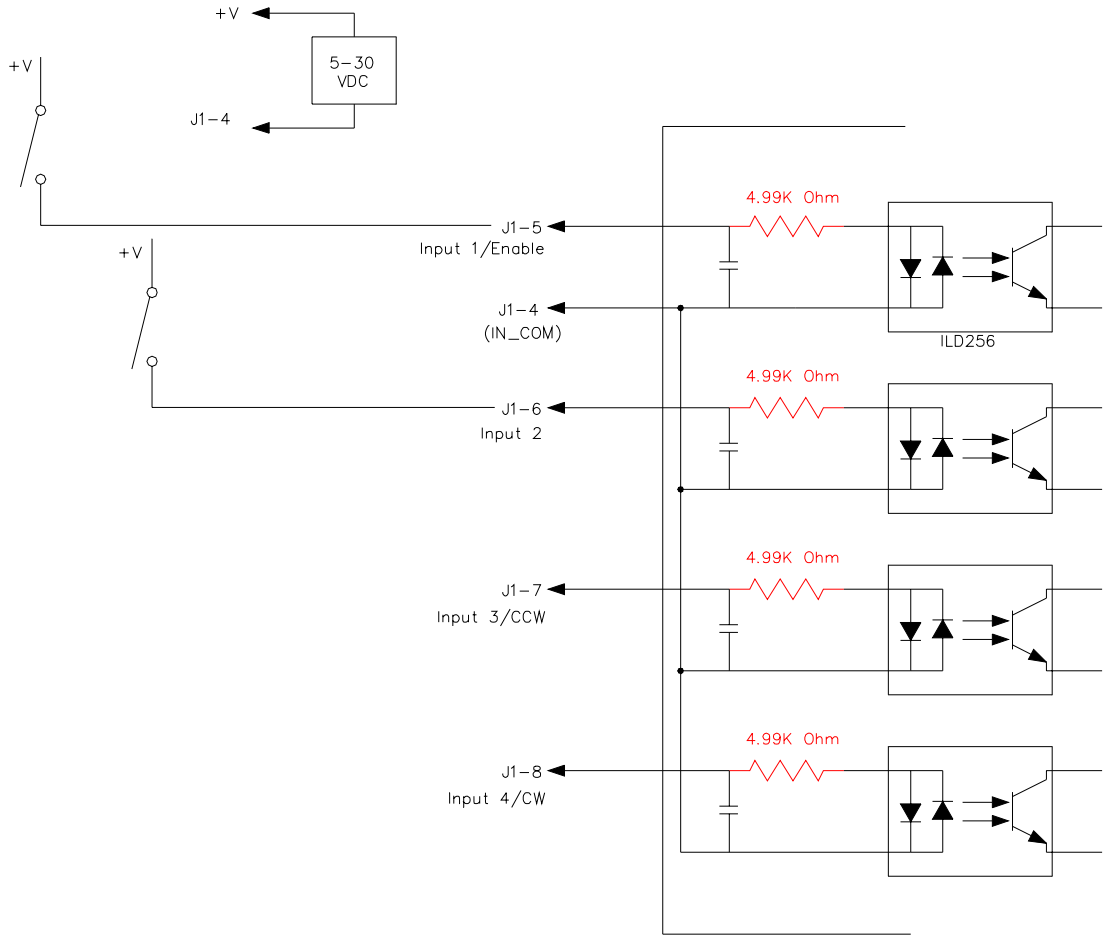


Figure 3-34 PC34xxAi Digital Input (Sinking configuration A)

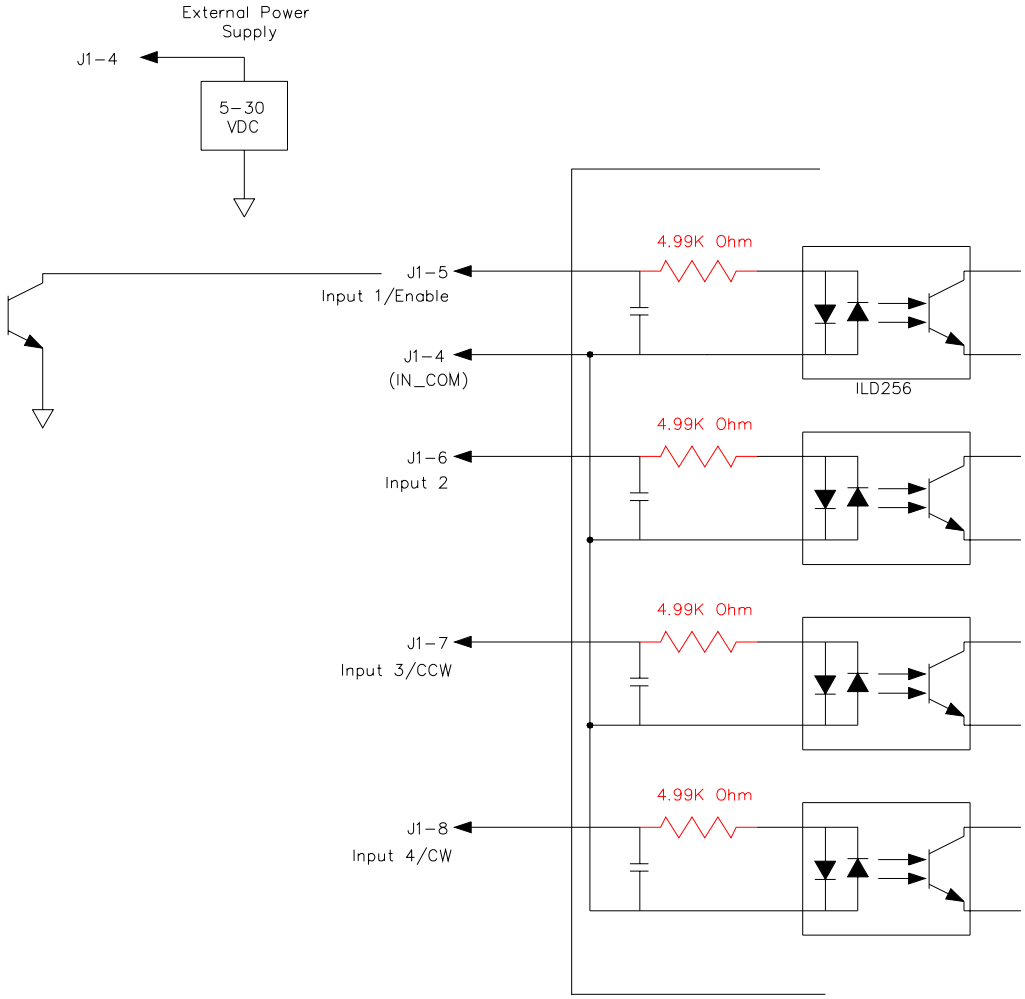


Figure 3-35 PC34xxAi Digital Input (Sinking configuration B)

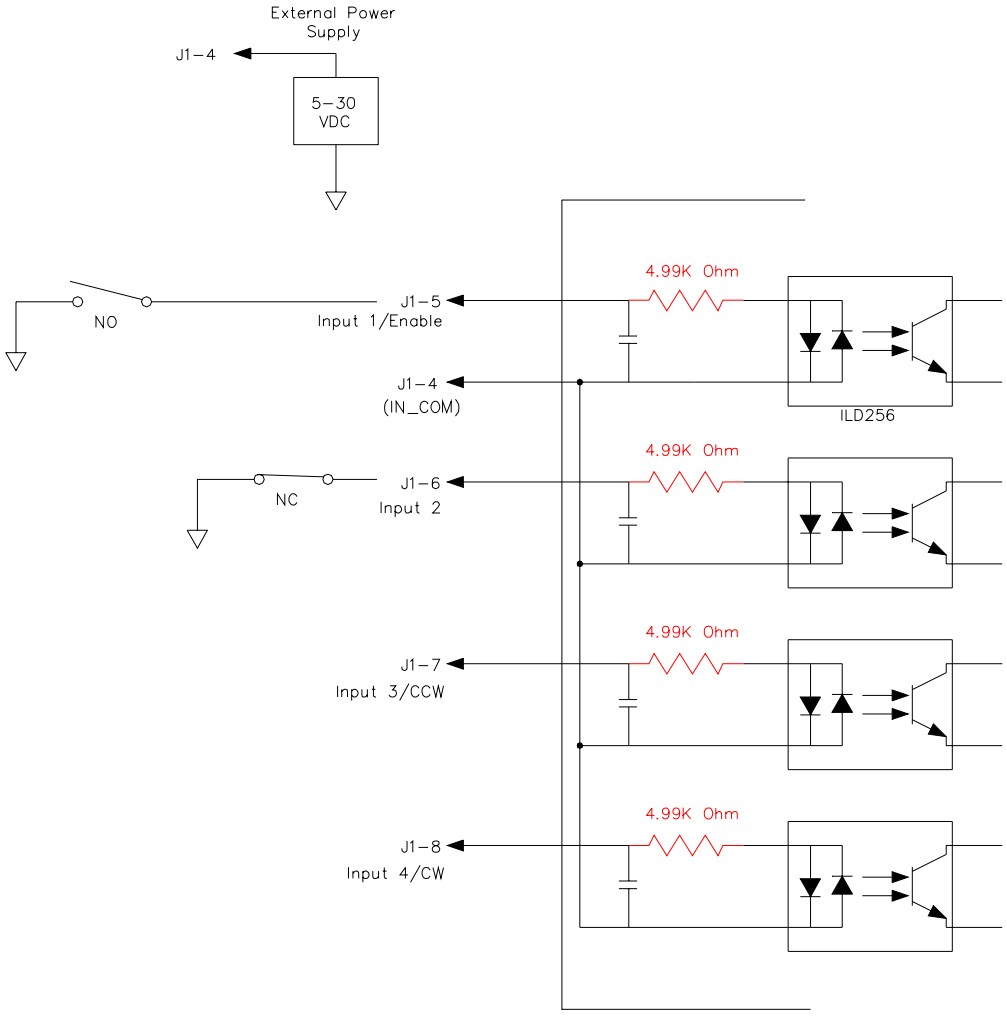
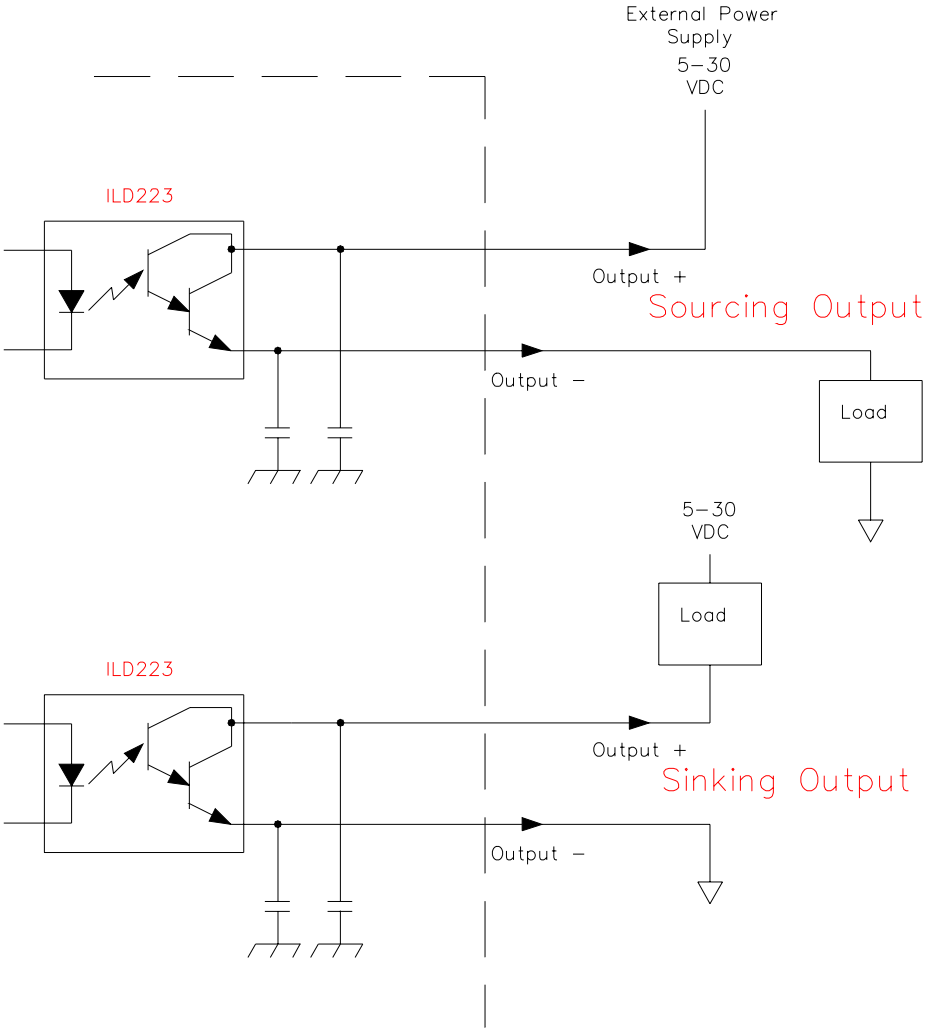


Figure 3-36 PC34xxAi Digital Outputs



The optically isolated outputs are 5-30 VDC, 50 ma maximum.

3.9 PC34xxAi-001-xI /Extended I/O

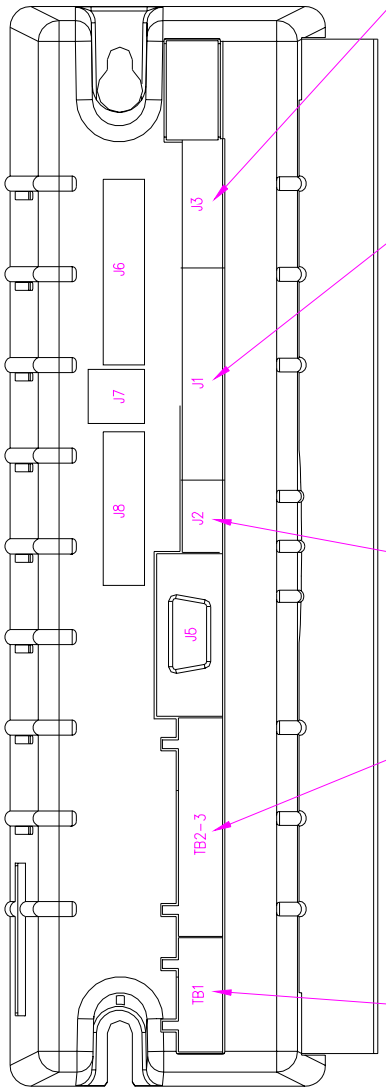
Models with extended I/O are **PC34xxAi-001-EI** and **PC34xxAi-001-RI**.

Each model of the **PC34xxAi** Series may be purchased with extended I/O, an additional 16 general purpose inputs on the J6 connector and 8 general purpose outputs on the J8 connector. *Units must be purchased with this option, they cannot be field upgraded.*

The **PC34xxAi-001-EI** Series is an Intelligent Series digital amplifier with extended I/O that will accept the following feedback devices; **Hall-only**, an **Encoder with Hall, Comcoder** an **encoder with Commutation Tracks encoded on the Z-Channel** or **Tachometer**. See section PC34xxAx-001-E Series.

The **PC34xxAi-001-RI** Series is an Intelligent Series digital amplifier with extended I/O that will accept a Commutating resolver as a feedback device, PC34xxAx-001-R Series. Buffered, Differential A, B and Z channel encoder-outputs are provided as 1024 LPR (4096 quadrature count) for a two-pole resolver, Encoder Outputs (J1).

Figure 3-37 PC340xAi-xl Connector Placement



PC3403Ai-001-xl and
PC3406Ai-001-xl
Series

J3 - Encoder Feedback			
Pin #	Signal	Pin #	Signal
2	A -	1	A +
4	B -	3	B +
6	Z -	5	Z +
8	HED 1	7	Gnd
10	HED 3	9	HED 2
12	+5 VDC	11	+5 Return(com)
14	ADC2 - /OT -	13	ADC2 + / OT +

J3 - Resolver Feedback			
Pin #	Signal	Pin #	Signal
2	Sin - (S4)	1	Sin + (S2)
4	Cos - (S3)	3	Cos + (S1)
6	Ref - (R2)	5	Ref + (R1)
8	Spare	7	Gnd
10	Spare	9	Spare
12	+5 VDC	11	+5 Return(com)
14	ADC2 - /OT -	13	ADC2 + / OT +

J1 - I/O (Intelligent/Centennial Only)			
Pin #	Isolated IO	Pin #	Isolated IO
2	ADC1 -	1	ADC1 +
4	IN_COM	3	Gnd
6	Input 2	5	**ENABLE**/Input 1
8	**CW**/Input 4	7	**CCW**/Input 3
10	**Input 5 (HSI) -**	9	**Input 5 (HSI) +**
12	**Input 6 (HSI) -**	11	**Input 6 (HSI) +**
14	**Reg/(HSI-7) -**	13	**Reg/(HSI-7) +**
16	Out A -	15	Out A +
18	Out B -	17	Out B +
20	Out Z -	19	Out Z +
22	Output 2 -	21	Output 2 +
24	**OK/Brake -**	23	**OK/Brake +**

J6 - Extended Inputs			
Pin #	Isolated IO	Pin #	Isolated IO
2	Input 18	1	Input 17
4	Input 20	3	Input 19
6	Input 22	5	Input 21
8	Input 24	7	Input 23
10	Shield	9	Input-Com
12	Input 26	11	Input 25
14	Input 28	13	Input 27
16	Input 30	15	Input 29
18	Input 32	17	Input 31
20	Ground	19	Input-Com

J2 - I/O (Intelligent/Centennial Only)			
Pin #	Isolated IO	Pin #	Isolated IO
2	Output 3 -	1	Output 3 +
4	Output 4 -	3	Output 4 +
6	Input 9	5	Input 8

J8 - Extended Outputs			
Pin #	Isolated IO	Pin #	Isolated IO
2	Output 17 -	1	Output 17 +
4	Output 18 -	3	Output 18 +
6	Output 19 -	5	Output 19 +
8	Output 20 -	7	Output 20 +
10	Output 21 -	9	Output 21 +
12	Output 22 -	11	Output 22 +
14	Output 23 -	13	Output 23 +
16	Output 24 -	15	Output 24 +
18	Gnd	17	Gnd

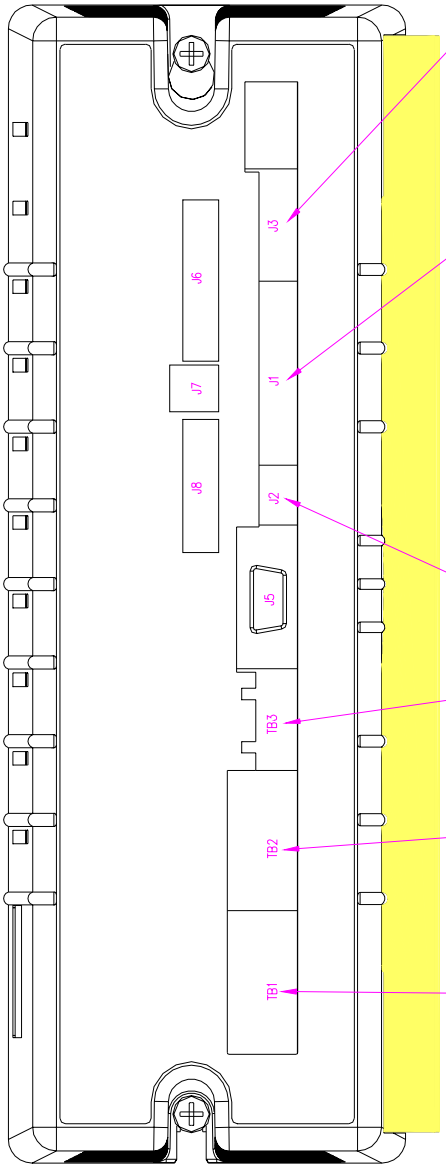
TB2-3 - BLDC	
Pin #	Name
8	**Ctrl +**
7	**Ctrl -**
6	Regen +
5	Regen -
4	Gnd
3	Phase U (A)
2	Phase V (B)
1	Phase W (C)

TB2-3 - Brush DC	
Pin #	Name
8	**Ctrl +**
7	**Ctrl -**
6	Regen +
5	Regen -
4	Gnd
3	Motor DC + (U)
2	Motor DC - (V)
1	N/C (W)

TB1 - AC Power	
Pin #	AC IN
4	L1
3	L2
2	L3
1	**GND (PE)**

J5 - Comm Port (DB9-F)			
Pin #	RS-232	RS-422 RS-485	RS-485 two wire
1	NC	Tx+	Rx+/Tx+
2	Tx	Tx-	Rx-/Tx-
3	Rx	Rx-	Rx-/Tx-
4	NC	Rx+	Rx+/Tx+
5	COM	COM	COM
6	-	-	-
7	-	-	-
8	-	-	-
9	-	-	-

Figure 3-38 PC34xxAi-xl Connector Placement



J3 - Encoder Feedback			
Pin #	Signal	Pin #	Signal
2	A -	1	A +
4	B -	3	B +
6	Z -	5	Z +
8	HED 1	7	Gnd
10	HED 3	9	HED 2
12	+5 VDC	11	+5 Return(com)
14	ADC2 - /OT -	13	ADC2 + / OT +

J3 - Resolver Feedback			
Pin #	Signal	Pin #	Signal
2	Sin - (S4)	1	Sin + (S2)
4	Cos - (S3)	3	Cos + (S1)
6	Ref - (R2)	5	Ref + (R1)
8	Spare	7	Gnd
10	Spare	9	Spare
12	+5 VDC	11	+5 Return(com)
14	ADC2 - /OT -	13	ADC2 + / OT +

J1 - I/O (Intelligent/Centennial Only)			
Pin #	Isolated IO	Pin #	Isolated IO
2	ADC1 -	1	ADC1 +
4	IN_COM	3	Gnd
6	Input 2	5	**ENABLE**/Input 1
8	**CW**/Input 4	7	**CCW**/Input 3
10	**Input 5 (HSI) -**	9	**Input 5 (HSI) +**
12	**Input 6 (HSI) -**	11	**Input 6 (HSI) +**
14	**Reg/(HSI-7) -**	13	**Reg/(HSI-7) +**
16	Out A -	15	Out A +
18	Out B -	17	Out B +
20	Out Z -	19	Out Z +
22	Output 2 -	21	Output 2 +
24	**OK/Brake -**	23	**OK/Brake +**

J6 - Extended Inputs			
Pin #	Isolated IO	Pin #	Isolated IO
2	Input 18	1	Input 17
4	Input 20	3	Input 19
6	Input 22	5	Input 21
8	Input 24	7	Input 23
10	Shield	9	Input-Com
12	Input 26	11	Input 25
14	Input 28	13	Input 27
16	Input 30	15	Input 29
18	Input 32	17	Input 31
20	Ground	19	Input-Com

J2 - I/O (Intelligent/Centennial Only)			
Pin #	Isolated IO	Pin #	Isolated IO
2	Output 3 -	1	Output 3 +
4	Output 4 -	3	Output 4 +
6	Input 9	5	Input 8

J8 - Extended Outputs			
Pin #	Isolated IO	Pin #	Isolated IO
2	Output 17 -	1	Output 17 +
4	Output 18 -	3	Output 18 +
6	Output 19 -	5	Output 19 +
8	Output 20 -	7	Output 20 +
10	Output 21 -	9	Output 21 +
12	Output 22 -	11	Output 22 +
14	Output 23 -	13	Output 23 +
16	Output 24 -	15	Output 24 +
18	Gnd	17	Gnd

TB3 - Ctrl/Regen	
Pin #	Name
4	**Ctrl +**
3	**Ctrl -**
2	Regen +
1	Regen -

J5 - Comm Port (DB9-F)			
Pin #	RS-232	RS-422 RS-485	RS-485 two wire
1	NC	Tx+	Rx+/Tx+
2	Tx	Tx-	Rx-/Tx-
3	Rx	Rx-	Rx-/Tx-
4	NC	Rx+	Rx+/Tx+
5	COM	COM	COM
6	-	-	-
7	-	-	-
8	-	-	-
9	-	-	-

TB2 - BLDC	
Pin #	Name
4	Gnd
3	Phase U
2	Phase V
1	Phase W

TB2 - Brush DC	
Pin #	Name
4	Gnd
3	Motor DC + (U)
2	Motor DC - (V)
1	N/C (W)

TB1 - AC Power	
Pin #	AC IN
4	L1
3	L2
2	L3
1	**GND (PE)**

PC3410Ai-001-xl and
PC3420Ai-001-xl Series

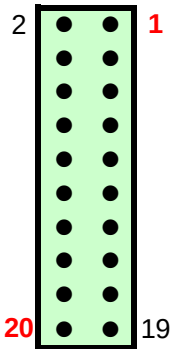
3.9.1.1.1 Digital Inputs (J6)

The **PC34xxAi-001-xI** Series has 16 additional general-purpose inputs located on the J6 connector, the inputs are software numbered 17 through 32. The various methods of wiring I/O are described in this section.

The optically isolated inputs are current activated, 10 mA minimum. The user must supply a 5-30 VDC voltage to utilize the optically isolated I/O. Since the digital inputs are current activated, the user may utilize PNP or NPN outputs to the drive.

Refer to Figure 3-32 PC34xxAi Digital Input (Sourcing configuration A), Figure 3-33 PC34xxAi Digital Input (Sourcing configuration B), Figure 3-34 PC34xxAi Digital Input (Sinking configuration A) or Figure 3-35 PC34xxAi Digital Input (Sinking configuration B) for additional information on wiring of digital inputs.

Figure 3-39 PC34xxAi Connector (J6)



J6 - Extended Inputs			
Pin #	**Isolated IO**	**Pin #**	**Isolated IO**
2	Input 18	**1**	Input 17
4	Input 20	3	Input 19
6	Input 22	5	Input 21
8	Input 24	7	Input 23
10	Shield	9	Input-Com
12	Input 26	11	Input 25
14	Input 28	13	Input 27
16	Input 30	15	Input 29
18	Input 32	17	Input 31
20	Ground	19	Input-Com

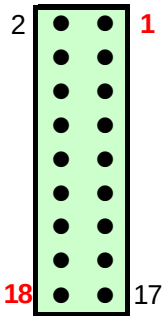
A cable assembly, **PCA-MM20-006**, may be purchased to facilitate wiring the J6 connector. This shielded cable assembly is pre-wired to the mating connector, six feet in length.

3.9.1.1.2 Digital Outputs (J8)

The **PC34xxAi-001-xI** Series has eight additional general-purpose outputs located on the J8 connector, the outputs are software numbered 17 through 24. The various methods of wiring I/O are described in this section.

The optically isolated outputs are 5-30 VDC, 50 ma maximum.

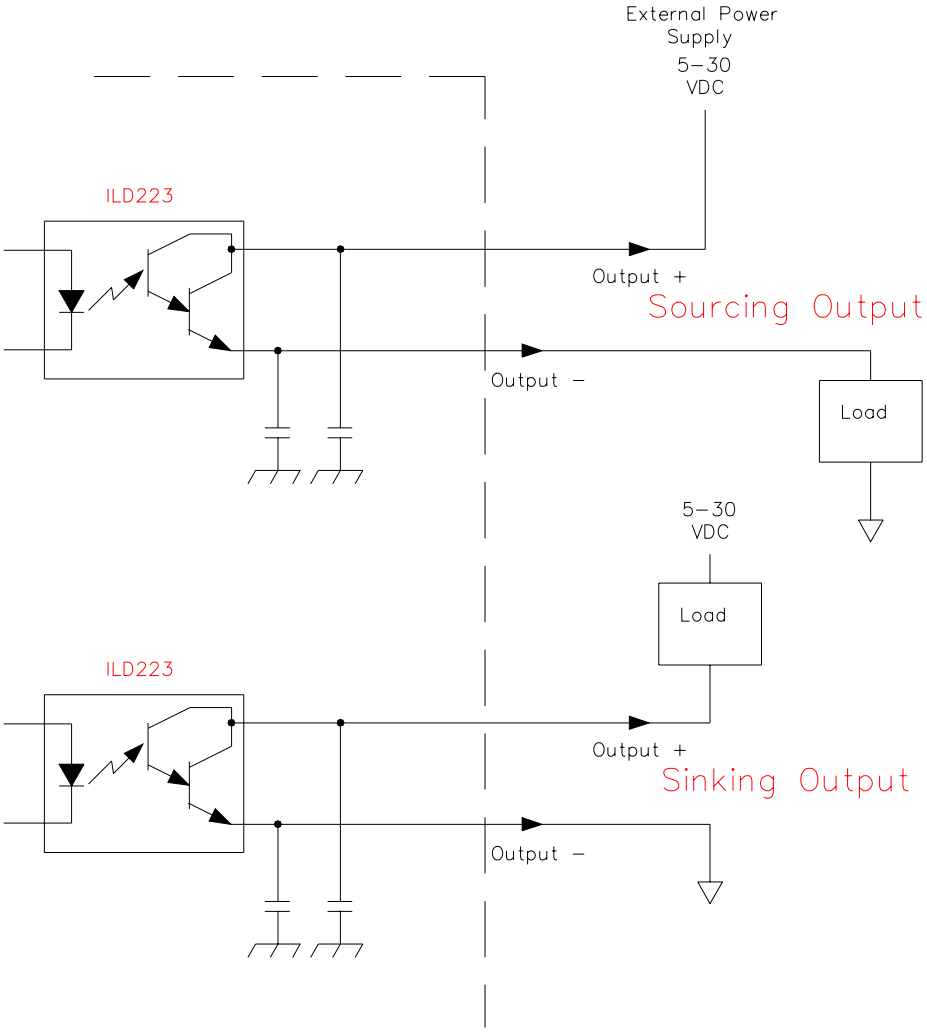
Figure 3-40 PC34xxAi Connector (J8)



J8 - Extended Outputs			
Pin #	Isolated IO	Pin #	Isolated IO
2	Output 17 -	1	Output 17 +
4	Output 18 -	3	Output 18 +
6	Output 19 -	5	Output 19 +
8	Output 20 -	7	Output 20 +
10	Output 21 -	9	Output 21 +
12	Output 22 -	11	Output 22 +
14	Output 23 -	13	Output 23 +
16	Output 24 -	15	Output 24 +
18	Gnd	17	Gnd

A cable assembly, **PCA-MM18-006**, may be purchased to facilitate wiring the J8 connector. This shielded cable assembly is pre-wired to the mating connector, six feet in length.

Figure 3-41 PC34xxAi Digital Outputs



3.10 PC34xxAc

Each PC34xxAc Series unit is an amplifier, centennial controller and heatsink integrated into a single standalone package.

The **PC34xxAc-001-E** Series is an Centennial Series digital amplifier that will accept the following feedback devices; **Hall-only**, an **Encoder with Hall, Comcoder** an **encoder with Commutation Tracks encoded on the Z-Channel** or **Tachometer**. See section PC34xxAx-001-E Series.

The **PC34xxAc-001-R** Series is an Centennial Series digital amplifier that will accept a Commutating resolver as a feedback device, PC34xxAx-001-R Series. Buffered, Differential A, B and Z channel encoder-outputs are provided as 1024 LPR (4096 quadrature count) for a two-pole resolver, Encoder Outputs (J1).

All **PC34xxAc** Series servo controllers provide the user with the same basic components:

- A graphical user interface program, **ToolPAC**, provides the user with the tools to easily configure and program the PC34xxA to the specific application. **ToolPAC** is a Windows/NT-based program that provides Wizards for axis setup, tuning and I/O Configurations.

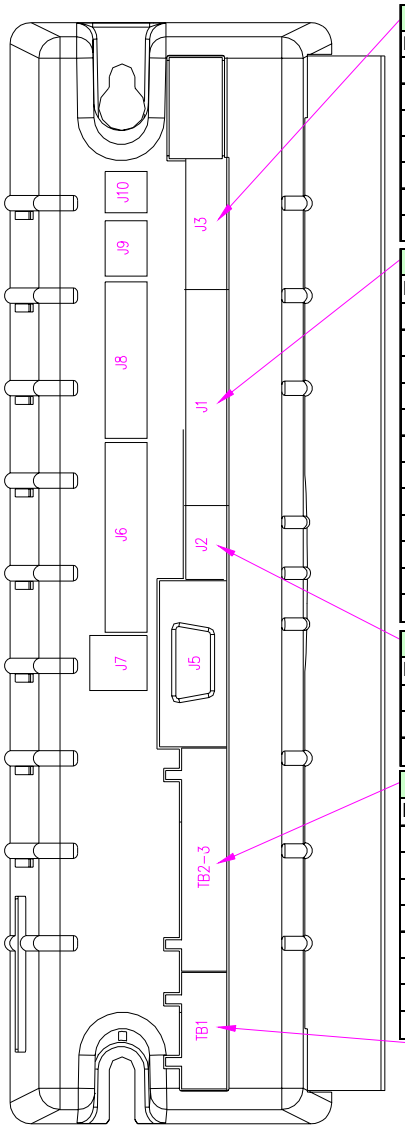
- A method of control may be Stand-alone program mode, Analog input for Current (torque) or Velocity mode, Step/Dir, Step+/Step- or Following of a master quadrature encoder signal. Determine your required configuration, then review the appropriate section.

- Master/slave relationships can be developed from the master encoder HSI inputs when used in Follow mode. Advanced ToolPAC programming features are available for performing complex Electronic Gearing and CAM motion.

- Distributed Feedback; A mode of operation where a secondary encoder is used to close the Position loop in an application. When using Distributed Feedback you will loose the ability to provide Step/Dir, Step+/Step- or Encoder following as the secondary encoder is wired to these HSI inputs. Thus, CAM and Master/Slave relationships are likewise not available.

- Hardware interfaces for Enable, Motor OT, Digital HSI inputs (J1), CW, CCW inputs, Drive-OK/Brake Relay Output (J1) that allows you to interface to your machinery/equipment.

Figure 3-42 PC340xAc Connector Placement



PC3403Ac-001-x and
PC3406Ac-001-x

J3 - Encoder Feedback			
Pin #	Signal	Pin #	Signal
2	A -	1	A +
4	B -	3	B +
6	Z -	5	Z +
8	HED 1	7	Gnd
10	HED 3	9	HED 2
12	+5 VDC	11	+5 Return(com)
14	ADC2 - /OT -	13	ADC2 + / OT +

J3 - Resolver Feedback			
Pin #	Signal	Pin #	Signal
2	Sin - (S4)	1	Sin + (S2)
4	Cos - (S3)	3	Cos + (S1)
6	Ref - (R2)	5	Ref + (R1)
8	Spare	7	Gnd
10	Spare	9	Spare
12	+5 VDC	11	+5 Return(com)
14	ADC2 - /OT -	13	ADC2 + / OT +

J1 - I/O (Intelligent/Centennial Only)			
Pin #	Isolated IO	Pin #	Isolated IO
2	ADC1 -	1	ADC1 +
4	IN_COM	3	Gnd
6	Input 2	5	**ENABLE**/Input 1
8	**CW**/Input 4	7	**CCW**/Input 3
10	**Input 5 (HSI) -**	9	**Input 5 (HSI) +**
12	**Input 6 (HSI) -**	11	**Input 6 (HSI) +**
14	**Reg/(HSI-7) -**	13	**Reg/(HSI-7) +**
16	Out A -	15	Out A +
18	Out B -	17	Out B +
20	Out Z -	19	Out Z +
22	Output 2 -	21	Output 2 +
24	**OK/Brake -**	23	**OK/Brake +**

J6 - Extended Inputs			
Pin #	Isolated IO	Pin #	Isolated IO
2	Input 18	1	Input 17
4	Input 20	3	Input 19
6	Input 22	5	Input 21
8	Input 24	7	Input 23
10	Shield	9	Input-Com
12	Input 26	11	Input 25
14	Input 28	13	Input 27
16	Input 30	15	Input 29
18	Input 32	17	Input 31
20	Ground	19	Input-Com

J2 - I/O (Intelligent/Centennial Only)			
Pin #	Isolated IO	Pin #	Isolated IO
2	Output 3 -	1	Output 3 +
4	Output 4 -	3	Output 4 +
6	Input 9	5	Input 8

J8 - Extended Outputs			
Pin #	Isolated IO	Pin #	Isolated IO
2	Output 17 -	1	Output 17 +
4	Output 18 -	3	Output 18 +
6	Output 19 -	5	Output 19 +
8	Output 20 -	7	Output 20 +
10	Output 21 -	9	Output 21 +
12	Output 22 -	11	Output 22 +
14	Output 23 -	13	Output 23 +
16	Output 24 -	15	Output 24 +
18	Gnd	17	Gnd

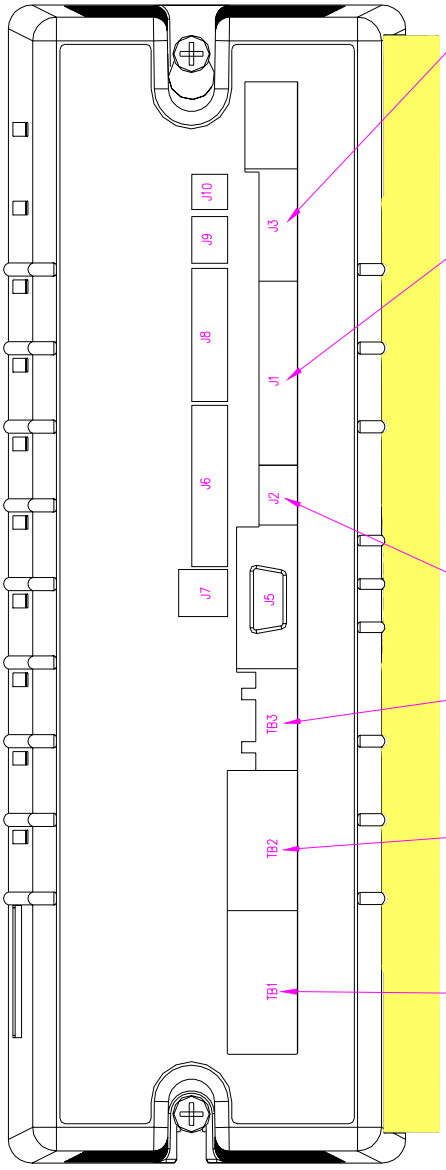
TB2-3 - BLDC	
Pin #	Name
8	Ctrl +
7	Ctrl -
6	Regen +
5	Regen -
4	Gnd
3	Phase U (A)
2	Phase V (B)
1	Phase W (C)

TB2-3 - Brush DC	
Pin #	Name
8	Ctrl +
7	Ctrl -
6	Regen +
5	Regen -
4	Gnd
3	Motor DC + (U)
2	Motor DC - (V)
1	N/C (W)

TB1 - AC Power	
Pin #	AC IN
4	L1
3	L2
2	L3
1	GND (PE)

J5 - Comm Port (DB9-F)			
Pin #	RS-232	RS-422 RS-485	RS-485 two wire
1	NC	Tx+	Rx+/Tx+
2	Tx	Tx-	Rx-/Tx-
3	Rx	Rx-	Rx-/Tx-
4	NC	Rx+	Rx+/Tx+
5	COM	COM	COM
6	-	-	-
7	-	-	-
8	-	-	-
9	-	-	-

Figure 3-43 PC34xxAc Connector Placement



J3 - Encoder Feedback

Pin #	Signal	Pin #	Signal
2	A -	1	A +
4	B -	3	B +
6	Z -	5	Z +
8	HED 1	7	Gnd
10	HED 3	9	HED 2
12	+5 VDC	11	+5 Return(com)
14	ADC2 - /OT -	13	ADC2 + / OT +

J3 - Resolver Feedback

Pin #	Signal	Pin #	Signal
2	Sin - (S4)	1	Sin + (S2)
4	Cos - (S3)	3	Cos + (S1)
6	Ref - (R2)	5	Ref + (R1)
8	Spare	7	Gnd
10	Spare	9	Spare
12	+5 VDC	11	+5 Return(com)
14	ADC2 - /OT -	13	ADC2 + / OT +

J1 - I/O (Intelligent/Centennial Only)

Pin #	Isolated IO	Pin #	Isolated IO
2	ADC1 -	1	ADC1 +
4	IN_COM	3	Gnd
6	Input 2	5	**ENABLE**/Input 1
8	**CW**/Input 4	7	**CCW**/Input 3
10	**Input 5 (HSI) -**	9	**Input 5 (HSI) +**
12	**Input 6 (HSI) -**	11	**Input 6 (HSI) +**
14	**Reg/(HSI-7) -**	13	**Reg/(HSI-7) +**
16	Out A -	15	Out A +
18	Out B -	17	Out B +
20	Out Z -	19	Out Z +
22	Output 2 -	21	Output 2 +
24	**OK/Brake -**	23	**OK/Brake +**

J6 - Extended Inputs

Pin #	Isolated IO	Pin #	Isolated IO
2	Input 18	1	Input 17
4	Input 20	3	Input 19
6	Input 22	5	Input 21
8	Input 24	7	Input 23
10	Shield	9	Input-Com
12	Input 26	11	Input 25
14	Input 28	13	Input 27
16	Input 30	15	Input 29
18	Input 32	17	Input 31
20	Ground	19	Input-Com

J2 - I/O (Intelligent/Centennial Only)

Pin #	Isolated IO	Pin #	Isolated IO
2	Output 3 -	1	Output 3 +
4	Output 4 -	3	Output 4 +
6	Input 9	5	Input 8

J8 - Extended Outputs

Pin #	Isolated IO	Pin #	Isolated IO
2	Output 17 -	1	Output 17 +
4	Output 18 -	3	Output 18 +
6	Output 19 -	5	Output 19 +
8	Output 20 -	7	Output 20 +
10	Output 21 -	9	Output 21 +
12	Output 22 -	11	Output 22 +
14	Output 23 -	13	Output 23 +
16	Output 24 -	15	Output 24 +
18	Gnd	17	Gnd

TB3 - Ctrl/Regen

Pin #	Name
4	**Ctrl +**
3	**Ctrl -**
2	Regen +
1	Regen -

J5 - Comm Port (DB9-F)

Pin #	RS-232	RS-422 RS-485	RS-485 two wire
1	NC	Tx+	Rx+/Tx+
2	Tx	Tx-	Rx-/Tx-
3	Rx	Rx-	Rx-/Tx-
4	NC	Rx+	Rx+/Tx+
5	COM	COM	COM
6	-	-	-
7	-	-	-
8	-	-	-
9	-	-	-

TB2 - BLDC

Pin #	Name
4	Gnd
3	Phase U
2	Phase V
1	Phase W

TB2 - Brush DC

Pin #	Name
4	Gnd
3	Motor DC + (U)
2	Motor DC - (V)
1	N/C (W)

TB1 - AC Power

Pin #	AC IN
4	L1
3	L2
2	L3
1	**GND (PE)**

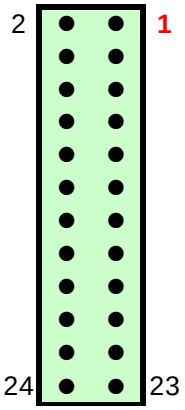
PC3410Ac-001-x and
PC3420Ac-001-x Series

3.10.1.1 Digital I/O (J1)

The **PC34xxAc** Series is an centennial amplifier with I/O capability. The digital I/O connector J1 contains most of the connections for the unit; a 14-bit Analog Input (J1), 4 isolated inputs (Enable and 3 general purpose), plus 3 Digital HSI inputs (J1), buffered Encoder Outputs (J1) ABZ channels, 1 output plus a relay output for Drive-OK/Brake Relay Output (J1) control. The various methods of wiring I/O are described in this section.

The optically isolated inputs are current activated, 10 mA minimum. The user must supply a 5-30 VDC voltage to utilize the optically isolated I/O. Since the digital inputs are current activated, the user may utilize PNP or NPN outputs to the drive. Outputs are 5-30 VDC, 50 ma maximum.

Figure 3-44 PC34xxAc Connector J1



J1 - I/O (Intelligent/Centennial Only)			
Pin #	**Isolated IO**	**Pin #**	**Isolated IO**
2	ADC1 -	**1**	ADC1 +
4	IN_COM	3	Gnd
6	Input 2	5	**ENABLE**/Input 1
8	**CW**/Input 4	7	**CCW**/Input 3
10	**Input 5 (HSI) -**	9	**Input 5 (HSI) +**
12	**Input 6 (HSI) -**	11	**Input 6 (HSI) +**
14	**Reg/(HSI-7) -**	13	**Reg/(HSI-7) +**
16	Out A -	15	Out A +
18	Out B -	17	Out B +
20	Out Z -	19	Out Z +
22	Output 2 -	21	Output 2 +
24	**OK/Brake -**	23	**OK/Brake +**

	CAUTION
	*The High Speed Inputs (HSI) require a signal level of 0-5VDC relative to J1-3 (Shield). The voltage difference between HSI+ and HSI- must be greater than ±0.25 volts. Exceeding this voltage specification will result in damage to the equipment.* ***NON-ISOLATED***

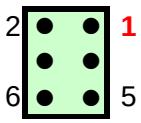
A cable assembly, **PCA-MM24-006**, may be purchased to facilitate wiring the J1 connector. This shielded cable assembly is pre-wired to the mating connector, six feet in length.

3.10.1.2 Digital I/O (J2)

The **PC34xxAc** Series has additional I/O capability located on connector J2 contains and additional two general-purpose outputs and two general-purpose inputs. The various methods of wiring I/O are described in this section.

The optically isolated inputs are current activated, 10 mA minimum. The user must supply a 5-30 VDC voltage to utilize the optically isolated I/O. Since the digital inputs are current activated, the user may utilize PNP or NPN outputs to the drive. Outputs are 5-30 VDC, 50 ma maximum.

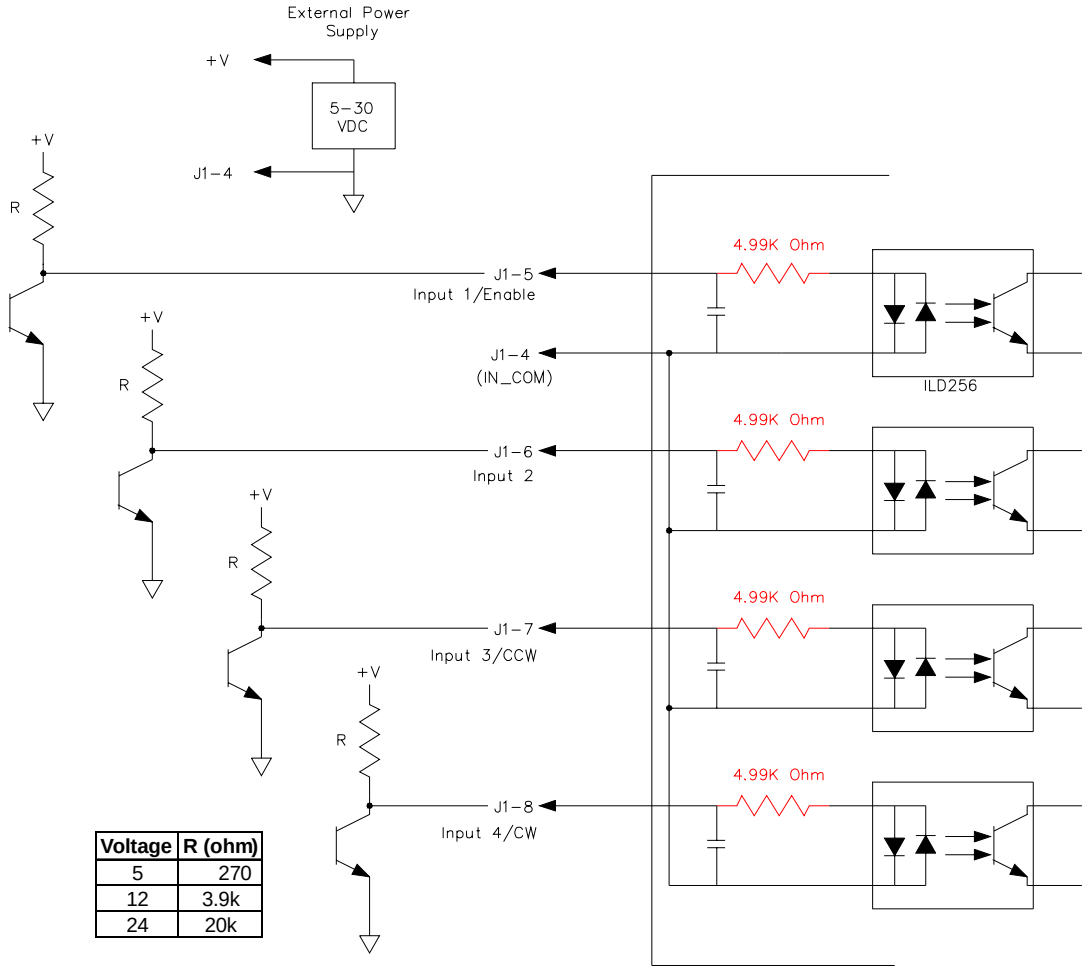
Figure 3-45 PC34xxAc Connector J2



J2 - I/O (Intelligent/Centennial Only)			
Pin #	**Isolated IO**	**Pin #**	**Isolated IO**
2	Output 3 -	1	Output 3 +
4	Output 4 -	3	Output 4 +
6	Input 9	5	Input 8

A cable assembly, **PCA-MC6-006**, may be purchased to facilitate wiring the J2 connector. This shielded cable assembly is pre-wired to the mating connector, six feet in length.

Figure 3-46 PC34xxAc Digital Input (Sourcing configuration A)



Voltage	R (ohm)
5	270
12	3.9k
24	20k

Figure 3-47 PC34xxAc Digital Input (Sourcing configuration B)

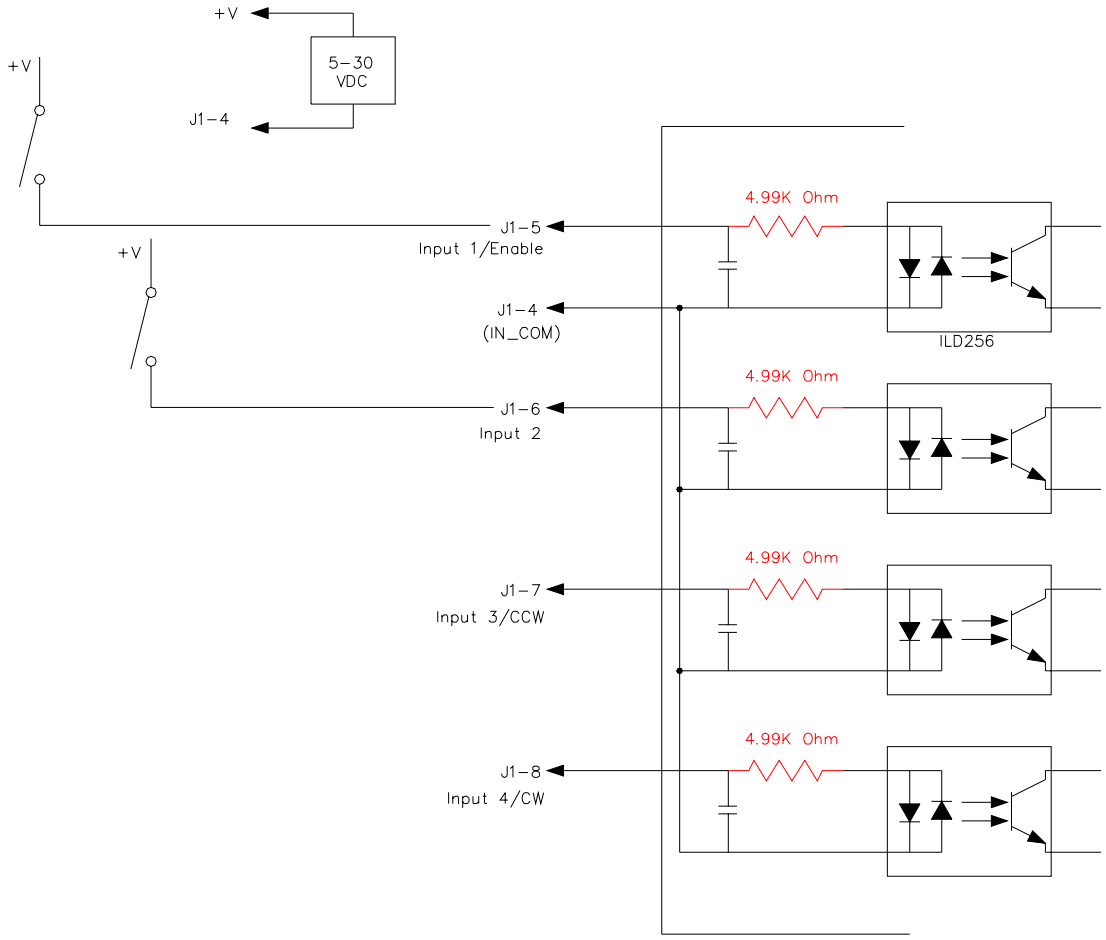


Figure 3-48 PC34xxAc Digital Input (Sinking configuration A)

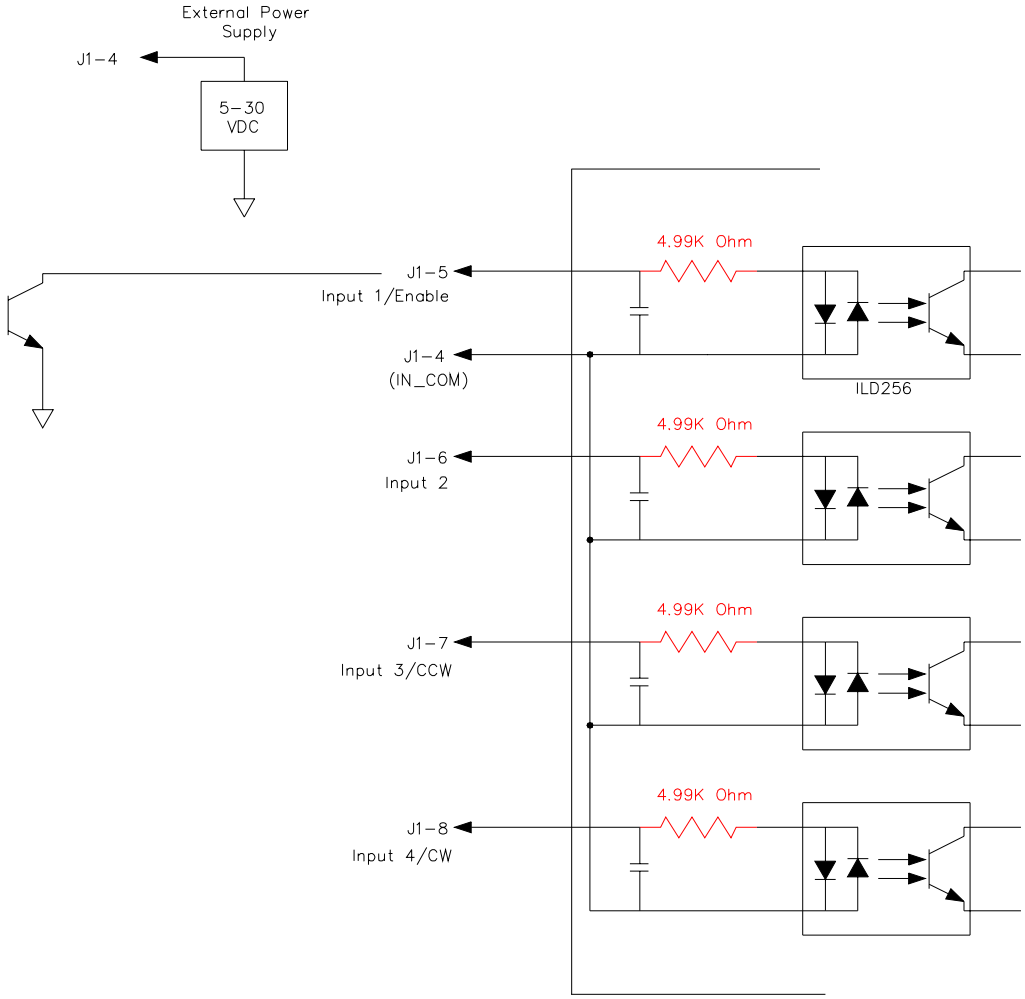


Figure 3-49 PC34xxAc Digital Input (Sinking configuration B)

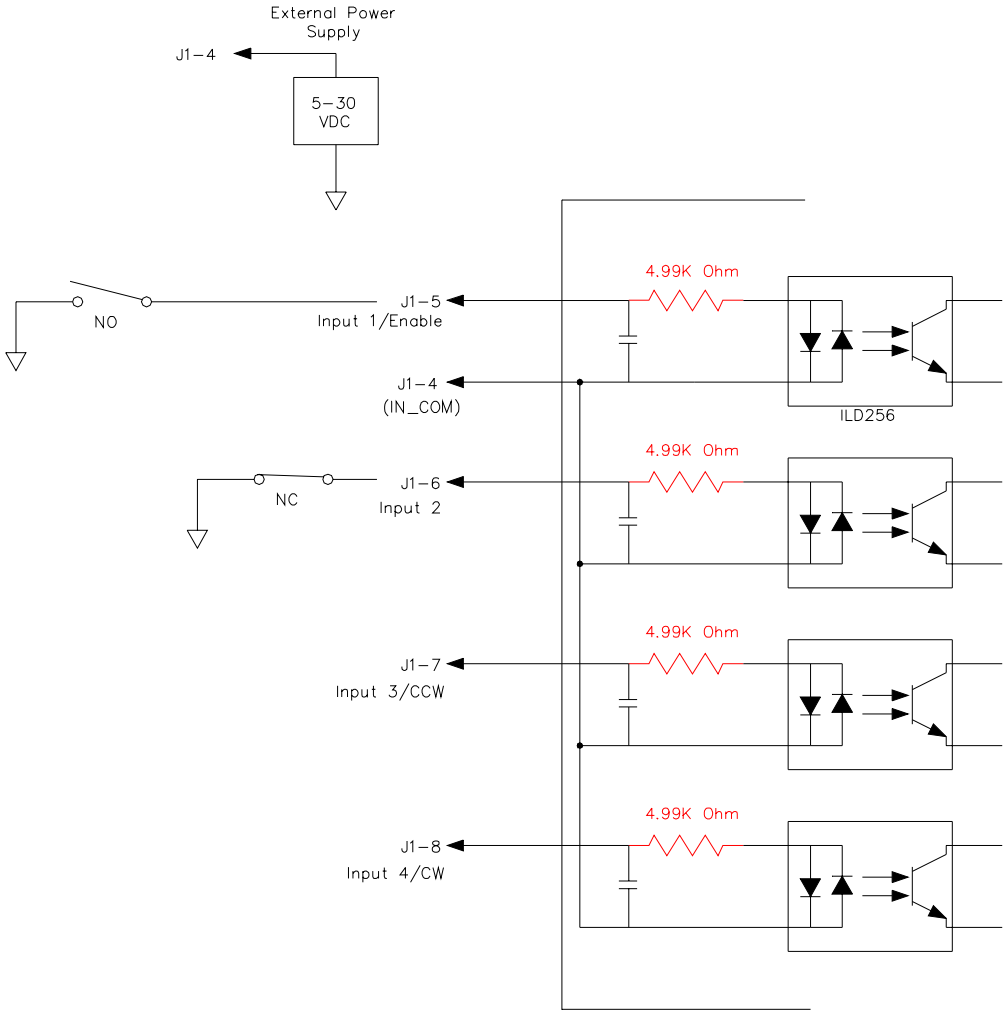
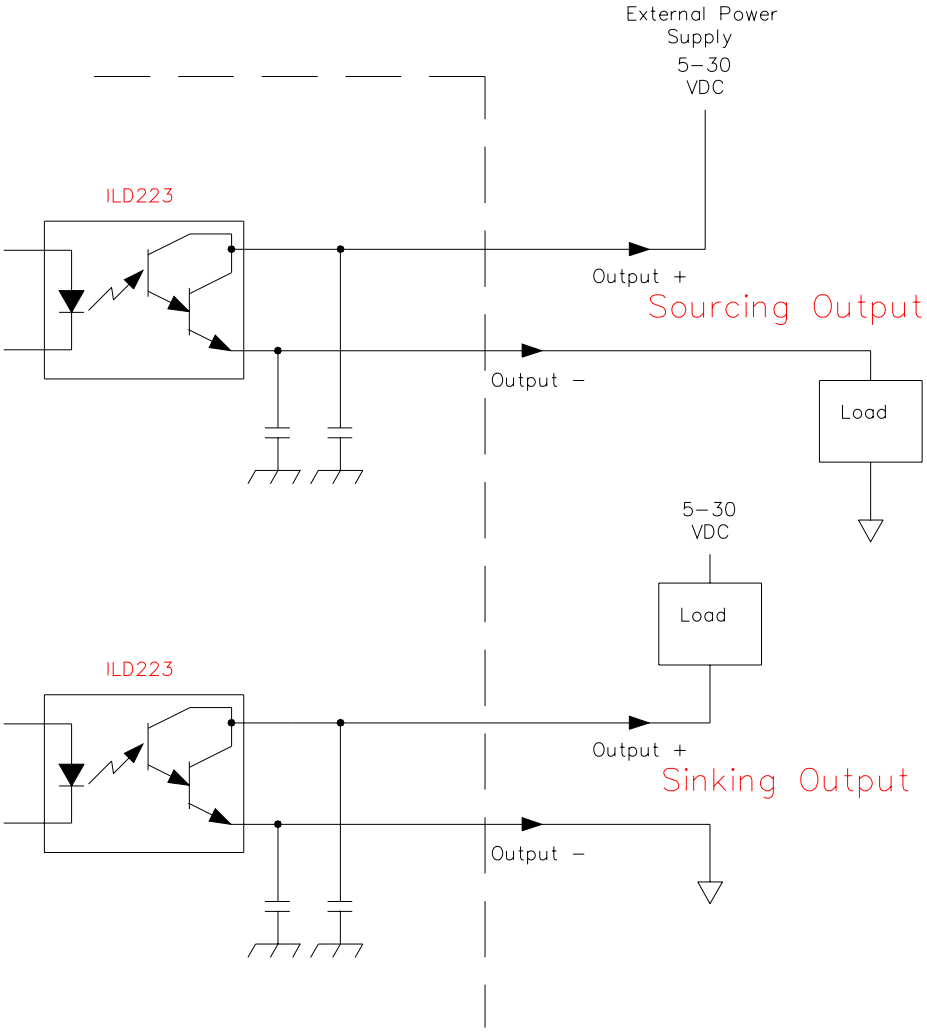


Figure 3-50 PC34xxAc Digital Outputs



The optically isolated outputs are 5-30 VDC, 50 ma maximum.

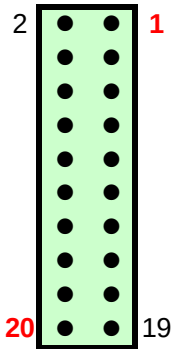
3.10.1.3 Digital Inputs (J6)

The **PC34xxAc** has 16 additional general-purpose inputs located on the J6 connector, the inputs are software numbered 17 through 32. The various methods of wiring I/O are described in this section.

The optically isolated inputs are current activated, 10 mA minimum. The user must supply a 5-30 VDC voltage to utilize the optically isolated I/O. Since the digital inputs are current activated, the user may utilize PNP or NPN outputs to the drive.

Refer to Figure 3-32 PC34xxAi Digital Input (Sourcing configuration A), Figure 3-33 PC34xxAi Digital Input (Sourcing configuration B), Figure 3-34 PC34xxAi Digital Input (Sinking configuration A) or Figure 3-35 PC34xxAi Digital Input (Sinking configuration B) for additional information on wiring of digital inputs.

Figure 3-51 PC34xxAc Connector (J6)



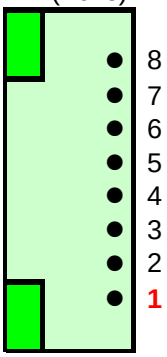
J6 - Extended Inputs			
Pin #	**Isolated IO**	**Pin #**	**Isolated IO**
2	Input 18	1	Input 17
4	Input 20	3	Input 19
6	Input 22	5	Input 21
8	Input 24	7	Input 23
10	Shield	9	Input-Com
12	Input 26	11	Input 25
14	Input 28	13	Input 27
16	Input 30	15	Input 29
18	Input 32	17	Input 31
20	Ground	19	Input-Com

A cable assembly, **PCA-MM20-006**, may be purchased to facilitate wiring the J6 connector. This shielded cable assembly is pre-wired to the mating connector, six feet in length.

3.10.1.4 Ethernet Port (J7)

The **PC34xxAc** Series has an Ethernet communications port as J7 connection. This Communications port is reserved for future firmware releases and should not be wired by the user at this time.

Figure 3-52 PC34xxAc Connector J7



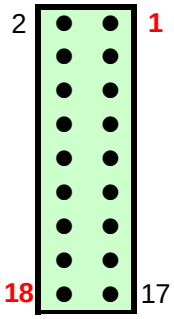
J7 - EtherNet	
Pin #	Description
8	
7	
6	Rx -
5	
4	
3	Rx +
2	Tx -
1	Tx +

3.10.1.5 Digital Outputs (J8)

The **PC34xxAc** Series has eight additional general purpose outputs located on the J8 connector, the outputs are software numbered 17 through 24. The various methods of wiring I/O are described in this section.

The optically isolated outputs are 5-30 VDC, 50 ma maximum.

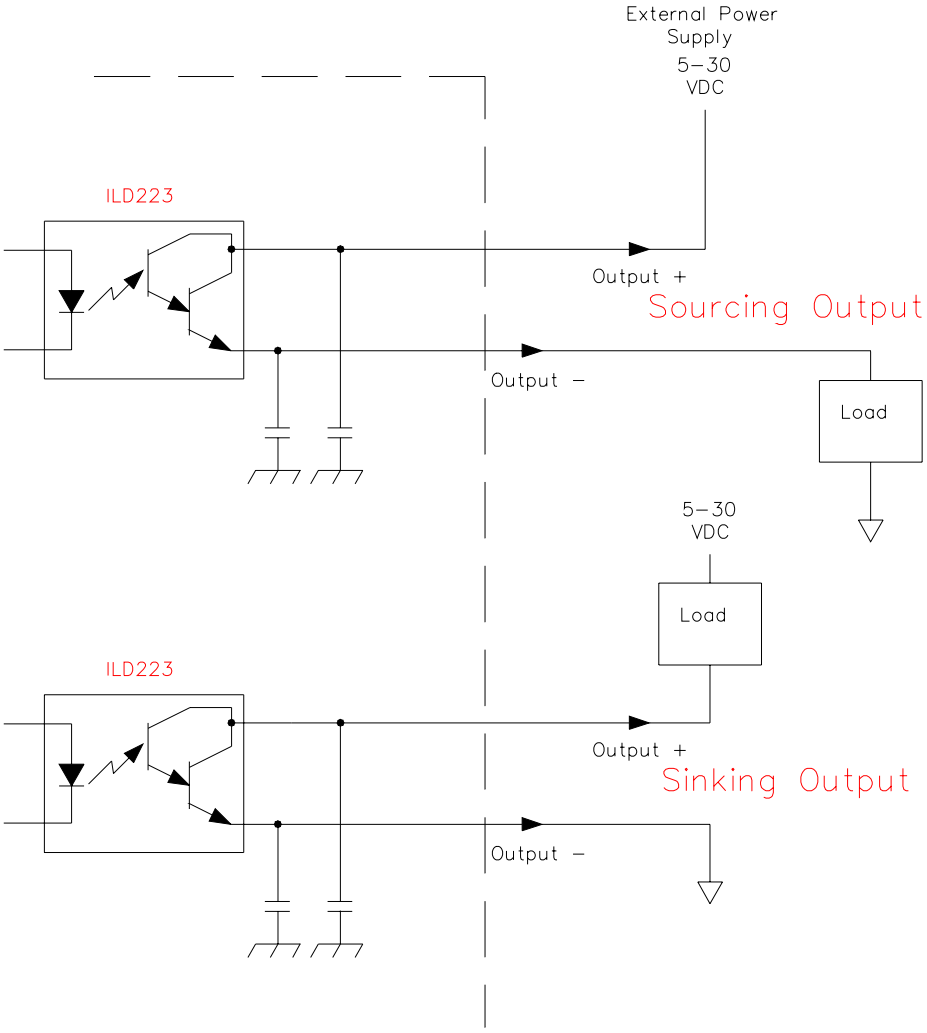
Figure 3-53 PC34xxci Connector (J8)



J8 - Extended Outputs			
Pin #	Isolated IO	Pin #	Isolated IO
2	Output 17 -	1	Output 17 +
4	Output 18 -	3	Output 18 +
6	Output 19 -	5	Output 19 +
8	Output 20 -	7	Output 20 +
10	Output 21 -	9	Output 21 +
12	Output 22 -	11	Output 22 +
14	Output 23 -	13	Output 23 +
16	Output 24 -	15	Output 24 +
18	Gnd	17	Gnd

A cable assembly, **PCA-MM18-006**, may be purchased to facilitate wiring the J8 connector. This shielded cable assembly is pre-wired to the mating connector, six feet in length.

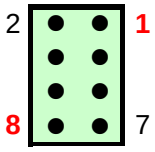
Figure 3-54 PC34xxAi Digital Outputs



3.10.1.6 Analog I/O (J9)

The **PC34xxAc** Series has additional analog I/O capability located on connector J9 contains an additional two **16-bit analog ±10 volt** inputs and two **12-bit analog, ±3.3 volt** outputs. The various methods of wiring the analog I/O are described in this section.

Figure 3-55 PC34xxAc Connector J9



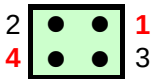
J9 - Analog I/O			
Pin #	**Isolated IO**	**Pin #**	**Isolated IO**
2	ADC3 -	1	ADC3 +
4	ADC4 -	3	ADC4 +
6	DAC1	5	Gnd
8	DAC COM	7	DAC2

A cable assembly, **PCA-MC8-006**, may be purchased to facilitate wiring the J9 connector. This shielded cable assembly is pre-wired to the mating connector, six feet in length.

3.10.1.7 Comm Port #2 (J10)

The **PC34xxAc** Series has an additional RS-232 serial port. This Communications port is reserved for future firmware releases and should not be wired by the user. Used for factory diagnostics only.

Figure 3-56 PC34xxAc Connector J10



J10 - Comm Port #2			
Pin #	**Isolated IO**	**Pin #**	**Isolated IO**
2	Tx	1	COM
4	Gnd	3	Rx

.

4. ToolPAC Software Setup and Installation

This section will guide the user through the ToolPAC© **software installation.** ToolPAC© **is a Win95/Win98/NT based program that provides Wizards for axis setup, tuning and programming of the 2400 and 3400 Series Intelligent Drives. The graphical user interface of the** ToolPAC **provides the user with the tools to easily configure the 3400 to his specific application.**

4.1 Hardware Requirements

To take full advantage of the tools available within **ToolPAC**, the system integrator must have a PC with Win95/Win98/NT, a hard disk with a minimum of 10M free space, a communications port, a mouse, and a CD-ROM drive.

4.2 Software Installation

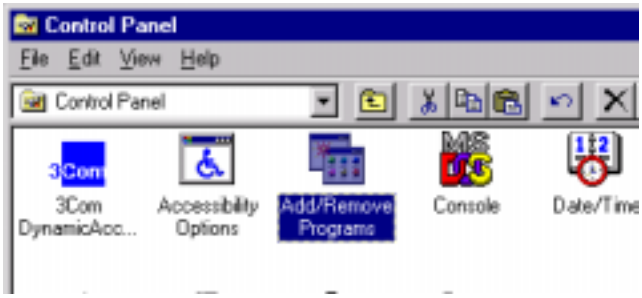
4.2.1 Preliminary Steps

The **ToolPAC** user interface program is provided on a CD-ROM. The purchased copy is considered a site license. The end user may make backup copies for multiple installations of this software. When available, software and firmware upgrades may be made available to end users with purchased copies. To obtain upgrades, you may log onto Pacific Scientific's web site at http://www.pacsci.com.

It is recommended that the OEM or system integrator purchase a copy of the **ToolPAC** software for each installation and their end user for additional tuning and maintenance of the equipment.

4.2.2 Installation Procedure

The **ToolPAC** user interface program is supplied on a read/write CD ROM disk. Install this disk in the CD ROM drive of your PC, select the Add/Remove Programs icon, and follow the instructions for adding a program.



An Install Shield is provided to guide you through the installation process. Follow the instructions presented in the Install Shield.

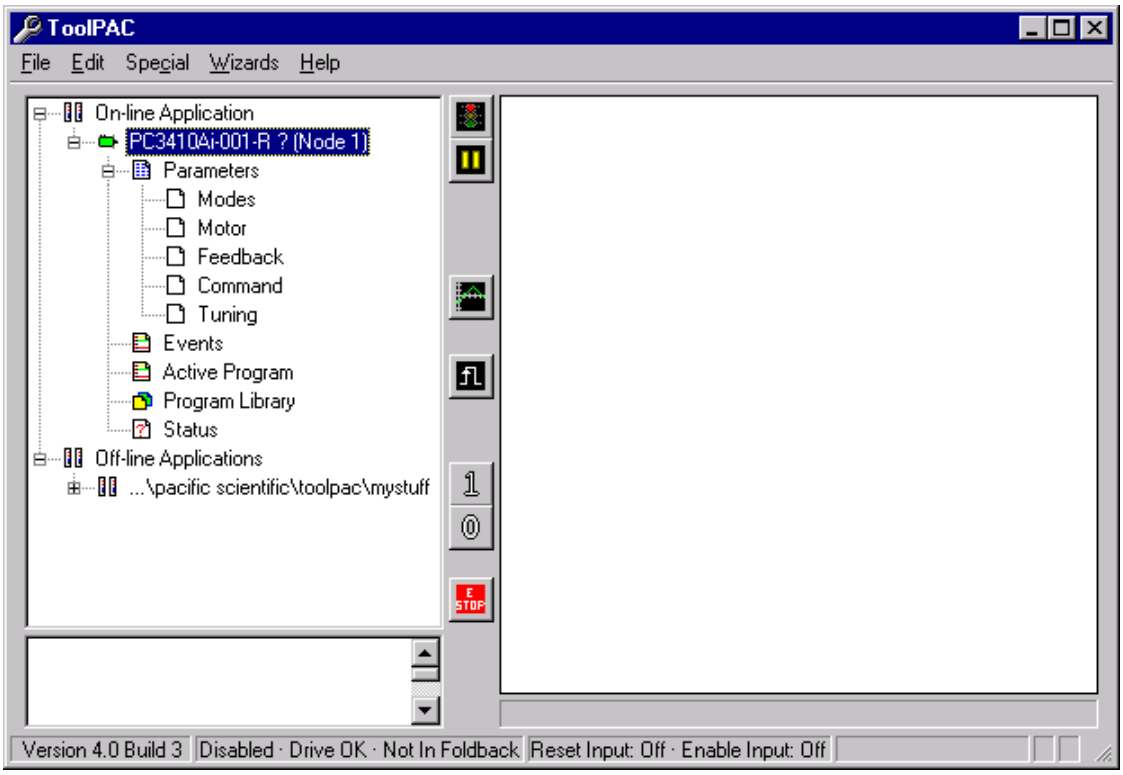
Note that extensive help menus are available with ToolPAC to assist the user in determining the function of each command, parameter, or feature. Help screens for commands and parameters are accessed by first highlighting the item and then performing a right-mouse click.

4.2.3 ToolPAC Configuration

To take full advantage of the ToolPAC software features, the user must first configure the software for his computer. Launch the ToolPAC software from your program menu. Below is an example of the file functions available from the main screen, Figure 4-1 ToolPAC Main Screen.

The user should take this time to configure the software for the printer. The user should also confirm the communications port being utilized by the software to communicate to the amplifiers. When ever ToolPAC is loaded, a check is completed of the PC's ports to select the proper location of your communications port. *Shared IRQs for the selected communications port and LAN, MODEM, IR ports or MOUSE will result in erratic operation of the software.*

Figure 4-1 *ToolPAC* ***Main Screen***

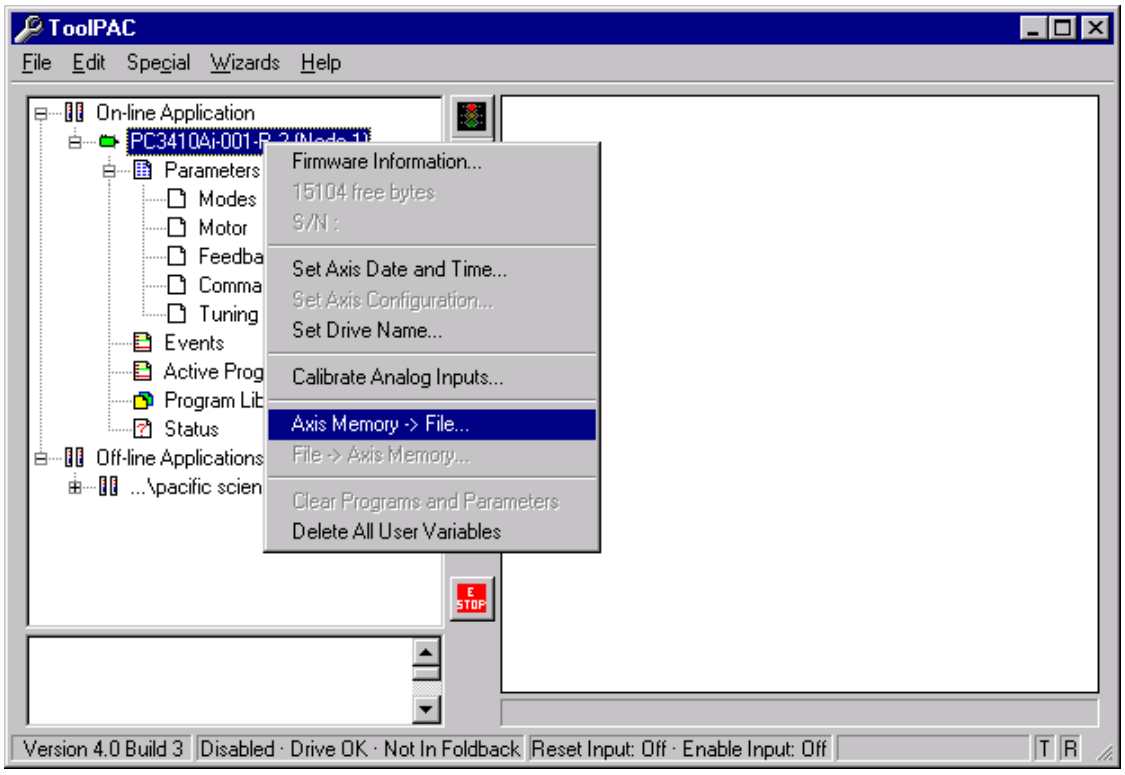


A green icon of a motor under the connected application lets you know which axes model is currently connected to the PC. The Axis Menu can be accessed via a right-mouse click.

The feature Axis Memory-> File will make a snapshot or backup copy of the existing unit. This snapshot is saved as a file type SNA and includes all the information necessary to completely duplicate the function of an amplifier.

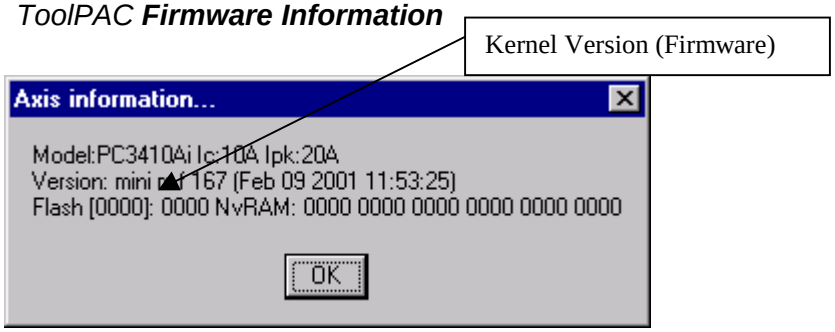
When requesting applications assistance, this file may be sent via e-mail to assist in prompt response to your application needs. Call 815-226-3100 for customer service or to obtain our current e-mail address. Be sure to supply additional application information that may be useful in determining your wiring, configuration and desired function.

Figure 4-2 *ToolPAC* ***Axis Menu***



The firmware information presented here must be available when calling for applications assistance. This information will provide you with the Model and Kernel Version of the firmware currently installed in flash.

Figure 4-3 *ToolPAC* ***Firmware Information***



You are now ready to proceed with the configuration of the amplifier.

	WARNING
	Before proceeding, make sure that the ENABLE input is INACTIVE to prevent accidental motion during the amplifier configuration process.

5. System Startup

After the system has been installed and wired, it is ready for startup. This section will detail the startup procedure of the servo system and verify proper wiring and operation. Parameter settings and tuning adjustments to the amplifier will be accomplished for your particular application.

To assist you in starting up the servo system, a step-by-step Startup procedure has been included. This procedure should always be followed to ensure proper operation of the servo system. This procedure assumes that the correct interconnect diagrams have been followed and International, National and Local electrical wiring codes have been carefully adhered to.

The 3400 is a digital motion controller that will process commands within the hardware and software limits dictated by the user (wiring, configuration, parameters, events, etc.). The output of the system is the motion(s) created in response to the command(s) input. Be sure to review all software commands and hardware prior to installing the system.

5.1 Preparation for Startup

5.1.1 Selecting Operation Mode

Before the Startup procedure can proceed, the user must determine the motor parameters and type of motor being used.

The **PC34xxA** series amplifiers can operate **Brush** and **Brushless DC** servomotors.

All models of the **PC34xxA** series are easily configured as a servo amplifier in a Torque mode for direct input to the current (torque) loop, in Velocity (speed) mode, Position or Follow mode. All modes of operation offer a PID-loop tuning feature to properly control Brush or Brushless DC servomotors.

5.1.2 Modes of Operation

This section is to briefly describe possible modes of operation that the user may adopt for their application. For additional information on parameters and function, please refer to Figure 7-7 Function Block Diagram.

Current Mode (torque)

In Current (torque) mode, the amplifier will accept a current command via analog input #1 (**ADC1**) or a Digital current command via the serial port or program, (parameter **DCC**).

Velocity Mode

In Velocity mode, the amplifier will accept an analog velocity command via analog input #1 (**ADC1**). The maximum acceleration and deceleration rates are limited via parameters **ACC** and **DEC** respectively. In this mode of operation the position loop is closed within an external motion controller and the **PC34xxA** controls the inner velocity and current loops. Additionally the user may command a Digital velocity via the serial port or program, (parameter **DCV**).

Position-Following mode

In Position-Following Mode the amplifier will accept a Step/Dir, Step+/Step- or Quadrature Encoder signal for Following. In Position-Following mode, the amplifiers High Speed Inputs (HSI) are utilized to accept encoder quadrature A and B channels respectively. The amplifier utilizes the parameters similar to position mode to control the number of encoder quadrature signals, **SPPR** equivalent to one revolution of the motor shaft. These ratio numbers should NOT be changed on-the-fly as the change is instantaneous and will result in abrupt changes in velocity.

	CAUTION
	*The High Speed Inputs (HSI) require a signal level of 0-5VDC relative to J1-3 (Shield).* *The voltage difference between HSI+ and HSI- must be greater than ±0.25 volts.* *Exceeding this voltage specification will result in damage to the equipment.* **NON-ISOLATED**

Electronic Gearing

Electronic Gearing is a special form of Position-Following Mode that utilizes a master Quadrature Encoder signal for Following. Electronic Gearing is ONLY available on the intelligent series controllers. The amplifiers High Speed Inputs (HSI) are utilized to accept a Master encoder quadrature A and B channels respectively. A program is required to control the Slave motor with-respect to the Master encoder. For additional information on Electronic Gearing, please refer to MAToolPAC, available on our web site, http://www.pacsci.com.

The amplifier utilizes the parameters similar to position mode to control the number of encoder quadrature signals. Since the HSI1 and HSI2 inputs are utilized for applications requiring Electronic Gearing, you cannot operate in Step/Dir, Step+/Step- or Distributed Feedback - Position mode.

Distributed Feedback - Position Mode

When utilizing **Distributed Feedback - Position mode** of operation HSI1 and HSI2 are wired as a master encoder (Quad) to a secondary encoder to close the systems position loop. The motor's feedback is utilized for purposes of motor commutation and velocity control. Since the HSI1 and HSI2 inputs are utilized for applications requiring Distributed Feedback, you cannot operate in Electronic Gearing, CAM, Step/Dir, Step+/Step- or Quadrature Encoder mode.

The amplifier utilizes the parameters similar to position mode to control the number of encoder quadrature signals, **SPPR** equivalent to one revolution of the Master Encoder. The IO Configuration Wizard is utilized to set the amplifier into the Distributed Feedback mode. Motion is commanded via Program Control.

Program Control

Under Program Control the Intelligent servo amplifier will execute Motion, Torque or Velocity commands and accept a Quadrature Encoder signal for Electronic Gearing. Possible methods of commanding motion are so varied that it not practical to document them all here. For additional information on motion commands, Gearing, Macros, Links and PLS functions, download **ToolPAC Software Reference Guide** from our ftp site, www.pacsci.com.

Digital/Serial mode

The user may elect to command Current, Velocity or Position commands via the serial communications port. Please review the following documents, available on the ToolPAC CD ROM, if you are intending on utilizing this method of control.

- **ToolPAC Software Reference Guide**, for additional information on Advanced commands (Gearing, Macros, Links, PLS) (MAToolPAC.zip)
- **Dynamic Link Library (DLL) (**ISPDLL.zip**)**
  - **MSVB and C++ DLL's are provided**
  - **Intelligent Servo Protocol (MA-ISP.pdf)**
  - **Intelligent Servo ASCII Protocol (MA-ISAP.pdf)**
  - **Intelligent Motion Language (MA-IML.pdf)**

5.1.3 Summary of Functions

5.1.3.1 Enable Input (Reset)

The Enable input to the drive is **Leading-Edge** triggered only. Any reset-able faults will be cleared on the rising-edge of the Enable input.

5.1.3.2 Motor Over Temperature (OT) Input

Motor over-temperature inputs are provided on the feedback connector, J3 of the PC34xxA drives. This input is wired to a N.C thermal switch internal to the motor (Z < 1k means motor is OK). If a motor **OT** sensor is to be utilized in an application, then ToolPAC parameter Check Motor OT must be set to **Active** for the firmware to monitor this input.

	NOTE
	*The ADC2+ and ADC2- inputs (pins J3-14 and J3-13) is factory configured as a motor OT input. If utilizing a Tachometer feedback device, you will not have the ability to use a motor thermal OT.*

5.1.3.3 Tachometer Input

When utilizing a Brush DC Motor with tachometer feedback the user must configure the PC34xxA hardware to receive an analog feedback signal. The cover must be removed from the PC34xxA to access the internal components. *The jumper JP3 must be removed from the PCB*, thus disabling the motor thermal OT and converting it to an analog input for the tachometer.

If a tachometer is to be utilized in an application, then parameter Check Motor OT input (COT) must be set to **Inactive** for the firmware to monitor this input.

	NOTE
	*The ADC2+ and ADC2- inputs (pins J3-14 and J3-13) is factory configured as a motor OT input. If utilizing a Tachometer feedback device, you must remove the JP3 jumper, (will not have the ability to use a motor thermal OT.)*

5.1.3.4 Drive-OK/Brake Relay Output

This relay output can be wired into the customers' hardware e-stop chain and/or utilized to directly energize the coil of the motor's safety power-off brake. The software default configuration of this output is as a Drive-OK. The ToolPAC **I/O Configuration Wizard** is utilized to configure this relay output as a Brake Output, Figure 5-4 ToolPAC Wizards.

- When software configured as a Drive-OK output, the output will be active as long as there are no faults present. (This does not imply that the controller is enabled!)
- When software configured as a BRAKE output, the output is only active when main power is applied, the unit is enabled and no fault conditions exist. The Brake output is only wired in applications where a brake is being utilized to maintain the motor's position when the motor is not enabled. The relay output becomes active 200ms after the leading edge of the Enable signal. This output is inactive immediately if a fault conditions exists or the drive becomes disabled.
- The user has NO software control over this output.

5.1.3.5 High Speed Inputs

The HSI1 and HSI2 inputs are utilized for applications requiring Follow Mode or the Advanced Electronic Gearing Capabilities of the 3400. Please review the section on Digital HSI inputs (J1).

5.2 Applying Power

5.3 Amplifier Configuration

5.3.1 General Description

ToolPAC supplies the tools necessary to configure the amplifier to your application. The screen images and descriptions provided in this section are intended to highlight some of the major features available within the software.

ToolPAC Wizards for Setup, Tuning and **I/O Configuration** are provided to step the user through the basic configuration of the system.

A **dual trace scope** is provided to allow the user to capture data on the commanded and actual motor motion.

ToolPAC provides **HELP** on commands, parameters, features and functions available within the 3400 Series product line.

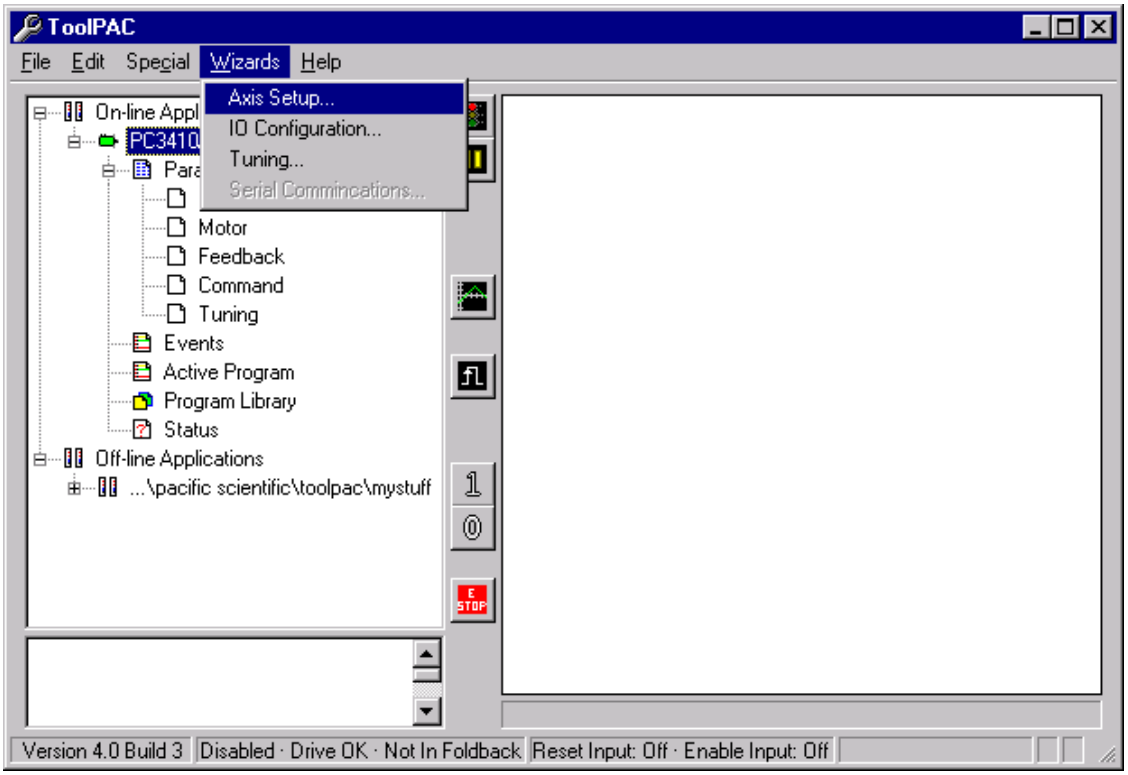
Review this section to familiarize yourself with the features available prior to programming the unit. This will save time in the startup of a new application.

5.3.2 Wizard: Axis Setup

The amplifier configuration is done primarily via the Axis Setup Wizard. The Setup Wizard will configure all of the system parameters necessary to allow you to generate motion within your selected application. **The Setup Wizard should be the first screen accessed when configuring a new amplifier.** This wizard will utilize the information provided to create stable tuning parameters Kf, Kp, Ki and PPG.

The customer is required to have the minimal information about the motor type: Kt, Jmotor, Icont, feedback type, etc. Examples of these screens are shown below.

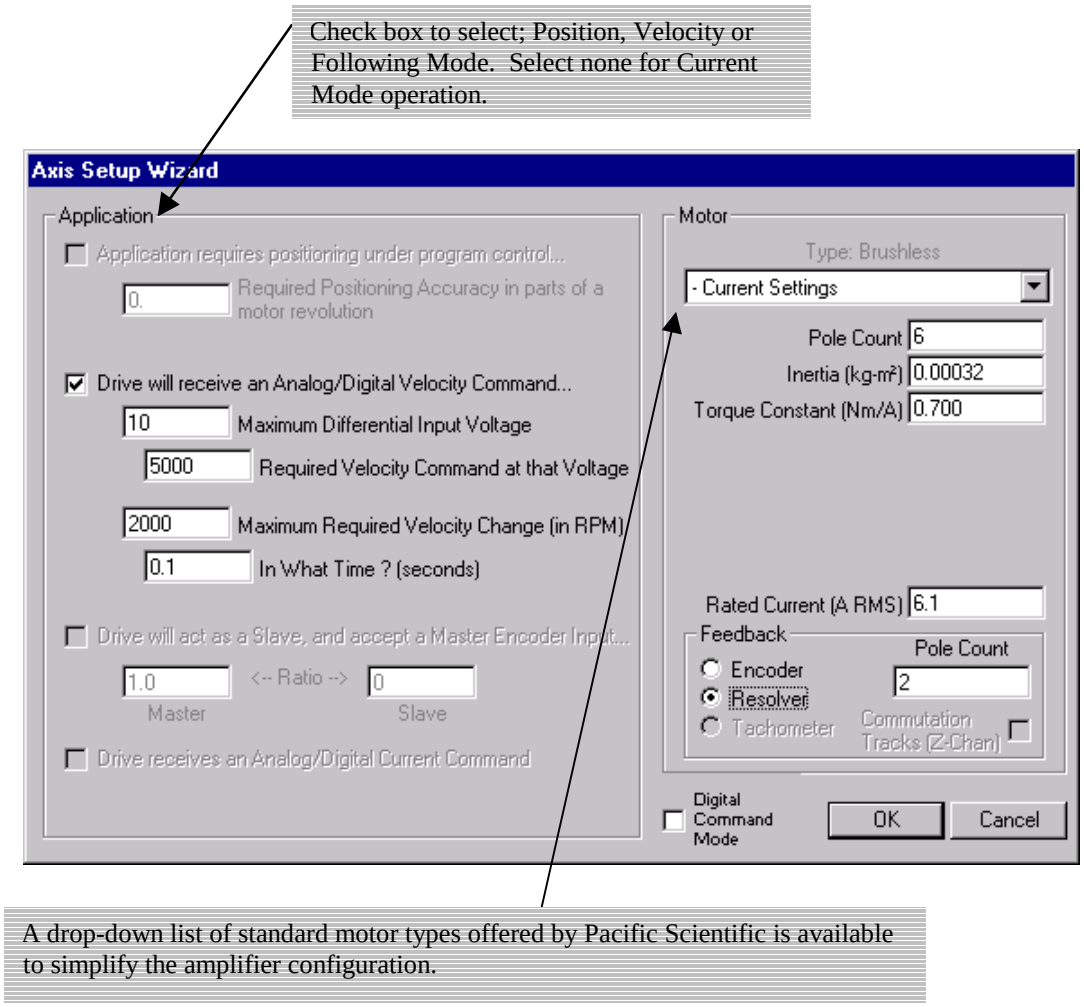
Figure 5-4 *ToolPAC* ***Wizards***



All versions of the 3400 Series can be configured for a **Brush** or **Brushless DC** motors.

The user is required to provide minimal information about the motor type, the application mode, and the command source.

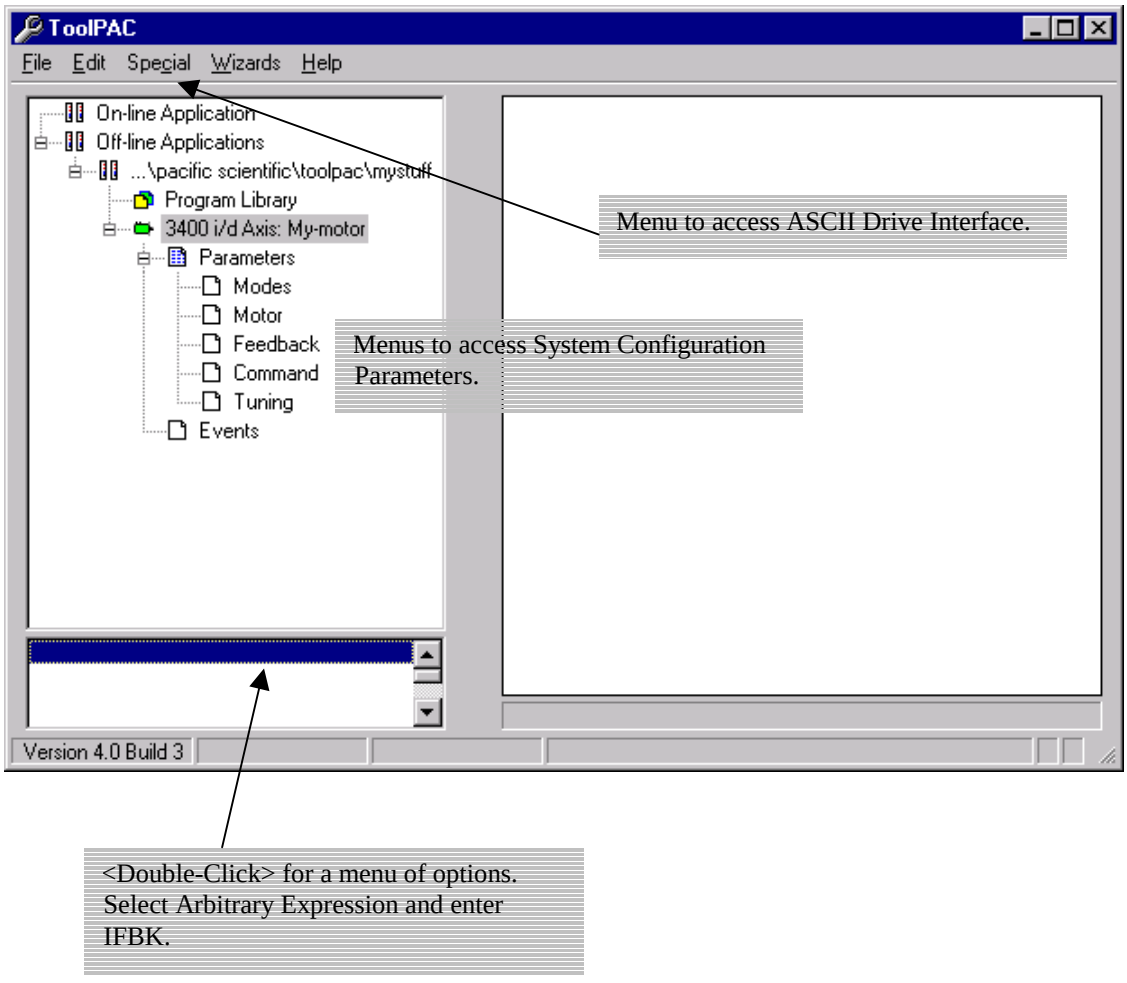
Figure 5-5 *ToolPAC* ***Wizard - Brushless Motor***



5.3.3 Digital Current loop tuning procedure

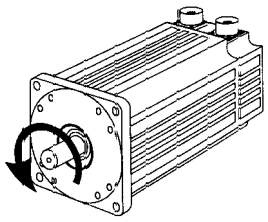
The 3400 Series is a 100% digital servo drive, (the exception are two analog sensors for voltage and current) thus it is necessary for the user to "Tune the Current loop" prior to operating the system. This procedure MUST be followed when operating a motor that is not listed in the Axis Setup Wizard, to prevent damage to the motor and to provide optimal performance.

Current loops must be tuned in a similar way to tuning a Brush or Brushless motor. The systems tuning parameters **IKPD** and **IKPQ** must be set (to the same value, i.e. IKPD = IKPQ). The tuning of the current loops will have to be done with a locked motor shaft and in current mode, since when the motor is running unloaded the feedback currents are much lower than the command.



The tuning procedure is as follows:

1) Put drive in current mode, digital command. (Menu: Parameters/Modes)
2) If using a Brush DC motor, ensure that the Drive Mode is set to **Brush DC**. If using a Brushless DC motor, ensure that the Drive Mode is changed to **Variable-Frequency** for this configuration procedure. (Menu: Parameters/Modes)
3) When using a Brush motor; lock motor shaft. Set current command **DCC** to a value of between 50% and 100% of **IRMS**. (Menu: Parameters/Command)
4) When using Brushless motor; Set the Variable Frequency Current command **VFI** to a value of between 50% and 100% of **IRMS** and Variable Frequency Frequency command VFF to 0.0 (Menu: Parameters/Command)
5) Set **IKPD**, **IKPQ** to low value (~1000) (Menu: Parameters/Tuning)
6) Put variable **IFBK** up in ToolPAC Monitor Window
7) Enable drive. Incrementally increase **IKPD** and **IKPQ** until **IFBK** is between 50% and 66% of **DCC** or **VFI** At this point, the current loop gains are set properly.
8) Disable drive.
9) Unlock motor shaft.
10) Complete the current loop tuning by setting the current loop integral gains **IKID** and **IKIP**. **IKID=IKPd*0.1** and **IKIQ=IKPD*0.1**. *Be sure to record values for future reference*
11) Enable drive and verify the direction of rotation to be **CCW** as viewed from the motor shaft end. You will need to set **VFI=1.0** to command a velocity when utilizing a BLDC motor. Disable and correct motor wiring if the direction of motor rotation is not **CCW**. You have now verified that the motor wiring is correct. ***Note that feedback is not being utilized at this time, thus the motors rotation may be rough. Be sure to record wiring for future reference.***



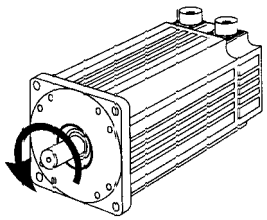
12) Disable drive.
13) Change the Drive Mode back to the proper setting for the test motor. See item #2 above.
14) Proceed with verification of feedback wiring

5.3.4 Feedback device and wiring verification

If using a Brush DC motor with IR compensation (open-loop, no feedback) then you may skip this section.

Please follow steps #1, #2, #10 and #12 under Digital Current loop tuning procedure to verify motor wiring is correct before proceeding.

1) Put the Motor Velocity and Feedback position in the ToolPAC Monitor Window.
2) Manually rotate the Motor CCW and verify that the motor velocity is positive.



- Hall Only (Brushless 6-Step (trap): Put the parameter **HED** in the Monitor Window (Arbitrary Expression). Slowly turn the motor counter-clockwise, CCW while observing the Hall Effect Device (HED) variable. Ensure that (HED) changes in the following order: Verify that the value **HED** for CCW roation is in the following pattern. *If not,, then the halls are wired backwards, swap HALL2 and HALL3 wires or you may change the direction for counting the Hall states via parameter* **HINV=1**.

- Tachometer Feedback: Put the parameter **ADC2** in the Monitor Window (Arbitrary Expression). Verify that the value is positive for CCW roation. *If not, then the tachometer is wired backwards.*

HED Status	H3	H2	H1	CCW	CW
1	0	0	1		
5	1	0	1		
4	1	0	0		
6	1	1	0		
2	0	1	0		
3	0	1	1		
1	0	0	1		

- Encoder Only (Brush DC) (Brushless Ignore halls) or Encoder/Hall (Brushless): *If not positive velocity, then the Encoder is wired backwards, swap the B+/B- wires or or you may change the direction for counting the feedback signals states via parameter* **FINV=1**.
- Encoder/Hall: Follow the steps above for Hall Only and Encoder Only.
- *HED counts in REVERSE order for motors with ENCODER/Z-channel encoded commutation.*

3) Set current command **DCC** to a value of between 50% and 100% of **IRMS**. (Menu: Parameters/Command)

4) Enable the drive.

5) Verify that in current mode the motor rotates **CCW** with a positive current command.

- If Brush DC motor and direction is not CCW, repeate steps above to isolate improper wiring. Verify that motor velocity is positive for CCW motor rotation if using encoder or tachometer feedback. You are now finished with your configuration.
- If Brushless DC motor you may need to adjust the value of the Commutation Offset **COFF** to account for manufacturers location of the feedback devices relitive to the motor poles. In this next series of steps we will determine the angular offset between the motor phasing and the feedback to determine the Commutation Offset (COFF). Proceed with the following steps

6) Enable the drive.

7) Set current command **DCC** to a value of between 50% and 100% of **IRMS**. (Menu: Parameters/Command)

8) Adjust the Commutation Offset (**COFF**) from –180 to 180 degrees to obtain CCW motion. (To set COFF >180 enter a negative value. IE. 190>COFF = -170 and 200>COFF = -160) (Menu: Parameters/Motor)

9) Note the Motor Velocity in the Monitor Window. The Motor Velocity is positive for CCW motion. The motor should spin **CCW** with a positive current command.

10) Incrementally adjust **COFF** to achieve the highest "positive" motor velocity.

11) Set current command **DCC** to a negative of its current value. (Menu: Parameters/Command)

12) With a negative Current Command (**DCC**), the motor spins **CW**. Note the Motor Velocity in the Monitor Window. *The Motor Velocity is negative for **CW** motion.*

13) Repeat steps 7, through 12 (with the exception of 10) and continue to adjust **COFF** until the Motor Velocity is within 10% of the same speed in the **CCW** and **CW** directions.

14) The Commutation Offset (**COFF**) is now properly set.

At this point you have completed the procedures for determining the proper motor wiring, feedback wiring and drive configurations. You may now complete configuration of the unit for your chosen application; Current, Velocity, Position, Step/Dir, etc. We suggest that you document the motor and feedback wiring and print out a record of the parameter settings for future reference.

5.3.5 Relevant Motor Parameters

Below is a listing of relevant motor parameters necessary for a proper configuration of a servo system. You may also wish to review Figure 7-7 Function Block Diagram for additional details on system parameters.

Table 5.12 Brush DC Motor Parameters

Brush DC Motor		
Relevant Motor Parameters		
	MRES	motor line-to-line resistance
	KT	motor torque constant
	INER	motor inertia
	IRMS	motor continuous current limit
	IMAX	motor peak current limit
Feedback Parameters		
	EPPR	encoder pulses (edges) per motor revolution
	FBF	feedback filter frequency (usually 100 to 500Hz)
Tachometer Feedback Parameters		
	FBS	motor feedback scaling (volts per kRPM)
	FBF	feedback filter frequency (usually 100 to 500Hz)
	COT	check motor OT input (must be inactive) (remove jumper J3 on the PCB)

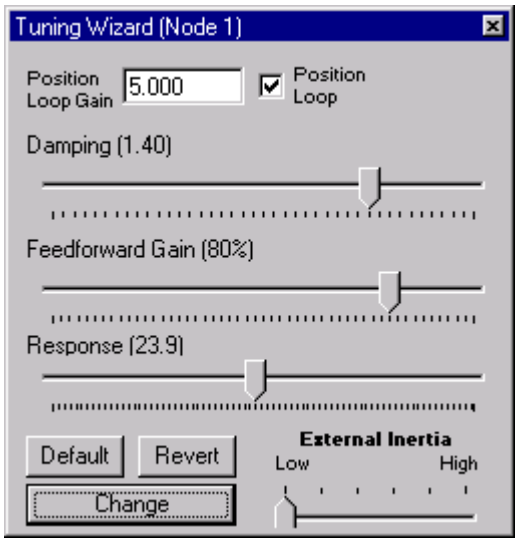
Table 5.13 Brushless DC Motor Parameters

BLDC Motor		
Relevant Motor Parameters		
	COFF	commutation offset
	KT	motor torque constant
	MPOL	Motor poles
	INER	motor inertia
	IRMS	motor continuous current limit
	IMAX	motor peak current limit
	IMAX	motor peak current limit
Feedback Parameters (encoder)		
	FEED	encoder, commutating encoder
	EPPR	encoder pulses (edges) per motor revolution
	FBF	feedback filter frequency (usually 100 to 500Hz)
Feedback Parameters (resolver)		
	FEED	resolver
	RPOL	resolver poles
	FBF	feedback filter frequency (usually 100 to 500Hz)

5.3.6 Wizard: Tuning

The Tuning Wizard is typically utilized in conjunction with the ToolPAC Scope to monitor the commanded motion versus the motion output. The slider bars are provided to assist with making adjustments. The slider bars are arranged in the order of importance, the most important is displayed at the top of this Tuning Wizard screen. During the adjustment process the software will automatically adjust the Kp, Ki, and Kf parameters. If the system becomes unstable during this process, select DEFAULT or REVERT, then select CHANGE.

Figure 5-6 *ToolPAC* ***Wizard - Tuning***



5.3.7 Update New Firmware

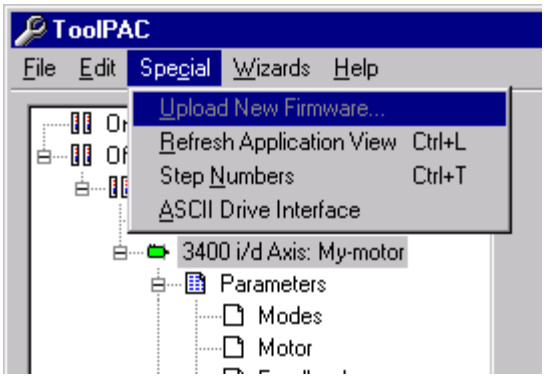
A special feature of the 3400 series drive is the ability of the user to upgrade the FLASH Memory with new firmware. This feature is useful for performing field upgrades to units as software enhancements or custom commands are made available.

ToolPAC will prevent you from accidentally loading the improper firmware to your unit.

Functions are available when the mouse is placed on the green motor icon. When in the connected application view, the user may refresh the connected application view (reread the data from the connected application from the amplifier) or Upload New Firmware.

	WARNING
	***When uploading new firmware, the user is prompted to observe safety precautions to prevent accidental damage to the application. The amplifier will be disabled while the firmware is being copied into flash memory. POWER MUST NOT BE INTERRUPTED DURING FIRMWARE UPLOAD!***

Figure 5-7 Upload New Firmware



6. Maintenance/Troubleshooting

This section summarizes the status and error codes that may be displayed on the PC3400A Series Servos. It also makes recommendations for troubleshooting and fault recovery procedures.

LOOK at the Fault history available in the ToolPAC STATUS screen!

6.1 Status LED (seven segment)

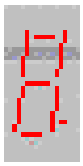
A seven-segment display is located on the front of the 34xx Series amplifier to provide the user with information on the current status of the amplifier. If a fault condition exists that prevents the unit from performing its function, the seven-segment display will indicate the error code(s).

If multiple errors are present, the codes will scroll to allow you to determine the type of errors present.

Table 6.1 below shows the meaning of each code combination.

Table 6.1 Seven Segment Display

Display Segment	Status Description
idnn	Logon display that occurs on power-up. The number nn indicates the unit's ID.
At	Amplifier over-temp fault, disabled. Verify condition exists, provide additional cooling, reduce motion requirements.
bF	Bus fault. The output is disabled due to an under voltage or over voltage condition.
CF	Configuration fault, disabled. Important system configuration parameters are missing.
d	Disabled, bus voltage not present. Enable input is not active.
E	Enabled, bus voltage is present.
ES	E-Stop fault, disabled. Drive needs to be reset.
FE	Following Error, stopped. Verify the motor's ability to meet the load requirements. Verify tuning parameters.
FL	Feedback Loss, disabled. Check wiring and function of feedback device.
HL	Hall Effect Loss, disabled. Check wiring and function of Hall device.
L	Limit inputs for CCW and/or CW are active. Check wiring for N.C. limit switches and parameter IOCW.
OS	Over-Speed fault, disabled. Verify control signal and load coupling.
Ot	Over-Temp motor fault, disabled. Verify condition exists, reduce motion requirements.
P	Pause input is active, program execution is paused. Check wiring for N.O. limit switch and parameter IOCW.
SF	Software Fault condition exists, disabled. Check Fault History type and Program for errors. See ToolPAC Software Reference Manual for possible causes.
SC	Short Circuit Fault. The output is disabled. Check for shorts in motor and power leads to the motor.
.	Blinking when processor is functional. If non-blinking, unit requires factory service.



6.2 Fault Recovery

Software faults are cleared on the leading-edge of the ENABLE input. Hardware faults are cleared ONLY after the condition has been cleared and the ENABLE input is activated.

6.3 Trouble Shooting

Motor does not move

- Configure the drive for your selected motor type and feedback type.
- Check to see if drive is powered-up or if the module's Seven-Segment Status shows a current fault or is "E" for ENABLED. LOOK at the Fault history available in the ToolPAC STATUS screen!
- Configure the drive for your selected motor type and feedback type.
- Verify that the motor current is set properly, (refer to Installation Manual) and that an acceleration and velocity command other than zero was executed prior to the move command.
- Verify that the Motor and Feedback parameters are set properly.
- Verify that Current loop and velocity loop parameters are set properly.
- Verify that hard-limit input is not active.
- Verify load is not jammed and that the brake is released.
- Verify motor is connected. Check parameter **IFBK** in the monitor window.
- Bus-Fault; Verify that you are supplying the correct AC voltage to the drive. Check parameter **VDC** in the monitor window.
- Verify motor Check wiring for loose connections, possible shorts and verify module and I/O is correctly wired.

Communicate errors

- Check communication cable for proper wiring or a loose connection.
- Confirm that switch setting for communication match the communication type. (RS-232, RS-485, etc. Refer to Installation Manual)
- Verify that the correct PC communication port is selected in Axis Configuration.

7. Appendices

The information contained in the following appendices is provided for reference purposes for the proper selection of system components.

7.1 Electrical Procedures

	NOTE
	***Read this section before proceeding with any system wiring!***

Grounding

To minimize the effects of electrical noise, a systematic rack, panel, and system grounding procedure should be followed. Review Section 3.1, Shielding and Grounding of Electrical Panels, for pertinent information.

The panel or rack in which the equipment is installed should provide a Single-Point Ground, hereafter referred to as SPG, stud, or bar. The SPG should be welded or bolted inside the enclosure and be electrically continuous with the mounting assembly. The panel's SPG should, in turn, be tied by a 1-inch (25mm) braided strap to a good Physical Earth (PE) ground, to which other panels, cabinets, and the controlled machinery are similarly grounded.

	NOTE
	*Use ground straps made of 1 inch (25 mm) silver tinned flat copper braid to connect cabinet doors to enclosures, the first sub-panel to the enclosure, and each sub-panel to the next.*

The PE ground could consist of a copper rod driven into the earth (a grounding electrode), a building column which is embedded in the earth, or another mass which has been determined to be at a true earth ground potential. A copper rod driven into the earth is the recommended method.

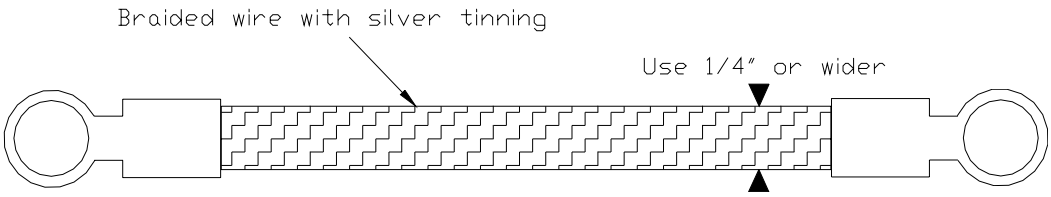
	CAUTION
	*Use Star grounding arrangement. Chain grounding or daisy-chain arrangements should not be used.*

The system ground and equipment grounds for other units on the panel, if any, should be *individually* wired to the SPG, utilizing 10 AWG (5.5 mm^2) stranded copper wire.

In any system connection to a physically separated piece of equipment or another part of the control system, careful attention should be given to the avoidance of ground loops. Ground loops can cause erratic system operation.

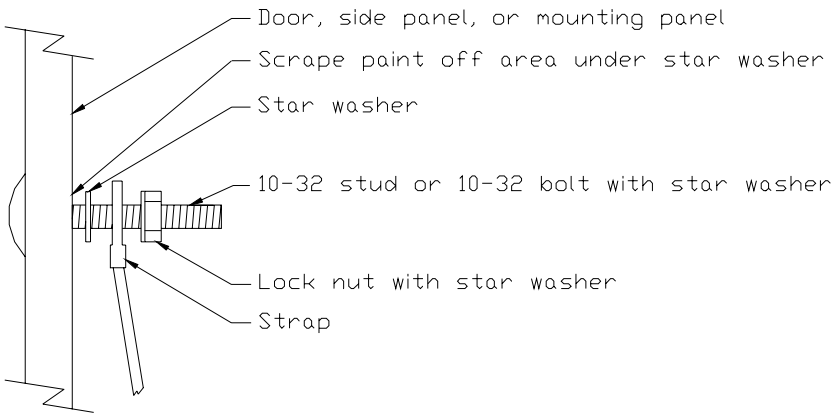
	NOTE
	*Where electrical codes call for the typical green safety ground wires, use them **in addition** to any ground strap suggested in this guide.*

Figure 7-1 Recommended Ground Strap



When mounting any unit, be sure to remove paint from the unit and the mounting surface to obtain metal-to-metal contact. Use a serrated washer (star washer) to improve the connection. If in doubt use a ground strap to ensure good connection between the unit and the panel.

Figure 7-2 Recommended Ground Strap Mounting Technique



Wiring and shielding

Wired connections to the system are of two categories: high power wiring and low power control signal wiring.

	NOTE
	*High power wiring and low power DC signal wiring within the panel or enclosure should not share wire raceways and should be separated by a minimum of 12 inches (305 mm) for parallel runs. If wire paths should cross and touch, they should do so only at right angles to each other.*

	NOTE
	*Provide separate wire ways for main AC, low power AC, high power DC, and low power DC.*

Low power DC signal level wiring (logic and analog signals) leaving the panel/enclosure on which the system is mounted should run in separate metallic conduits or channels from AC power, motor power conductors, or other power equipment circuits.

The analog and High Speed Inputs of the **34xx** Series Amplifiers are differential inputs. These differential inputs should be driven via the user's differential outputs and should be connected with individually shielded twisted pairs to provide the best possible noise immunity.

All control signals interfacing to the system must be wired with twisted cable, with at least one twist per inch, to minimize inductive noise coupling. Encoder and resolver wiring must be wired with individual twisted shielded pairs, using cable equivalent to those listed in Figure 7-3 Suggested Wire below.

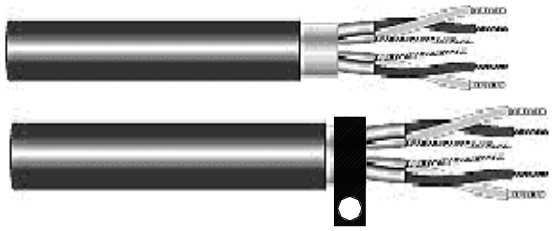


Figure 7-3 Suggested Wire

Wire Selection Table		
Purpose	**Description**	**Manufacturer**
Signal	22 AWG, 2 Pair, Shield & Drain	Alpha 5482C
Signal	22 AWG, 3 Pair, Shield & Drain	Alpha 5484C
Signal	24 AWG, 2 Pair, Shield & Drain, Low Capacitance	Belden 8102
Signal	24 AWG, 4 Pair, Shield & Drain, Low Capacitance	Belden 8104
Signal	24 AWG, 8 Pair, Shield & Drain, Low Capacitance	Belden 8108
Signal	28 AWG, 2 Pair, Shield & Drain, Low Capacitance	Alpha 3492C/Belden 8132
Signal	28 AWG, 4 Pair, Shield & Drain, Low Capacitance	Alpha 3494C
Signal	28 AWG, 8 Pair, Shield & Drain, Low Capacitance	Alpha 3498C
Ground Strap		

Unused conductor pairs should be grounded to the SPG at *one end only* to avoid a ground loop. Ensure that any interface cable shield is individually wired to the appropriate cable shield termination point. Shields should be insulated from ground and all other electrostatic shields along the length of the run. *The ungrounded end should have the shield cut back and taped to prevent contact with other conductors or conduits.* If a twisted shielded pair must be broken (at terminal boards or connector pairs), the unshielded length is not to exceed 2 inches (50 mm) and carry the shield through the connection on a separate pin or terminal.

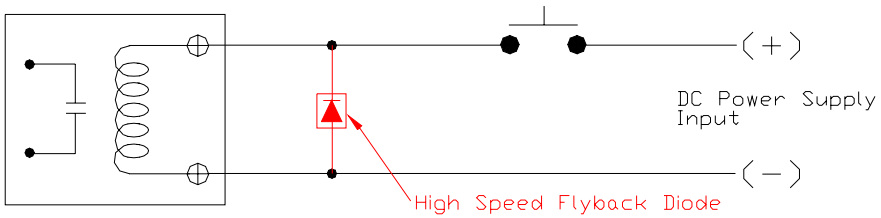
Secondary power (logic commons), if provided by individual equipment, should be directly wired from their source to the SPG utilizing 12 AWG (3.5 mm^2) wire.

Noise Source Suppression

It is necessary to suppress all relay and contactor coils, both AC and DC. Noise suppressors can be purchased locally and are an effective, inexpensive method of eliminating potential noise problems in the system.

Any connection to an inductive load (such as a DC coil) should be terminated with a high-speed flyback diode to absorb the high-energy spikes caused when the coil is switched off and its magnetic field collapses. Such diodes should be connected close to the inductive load to provide suppression at its source, across the coil with the reverse polarity to the voltage that powers the coil. The amount of energy absorbed is considerable and the diode must be rated accordingly.

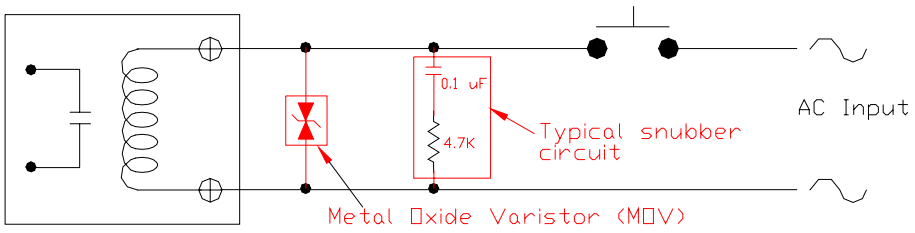
Figure 7-4 Suppression - DC Relay



Any connection to an inductive load (such as an AC coil) should be terminated with an RC snubber circuit or metal oxide varistor (MOV) to absorb the high energy spikes caused when the coil is switched off and its magnetic field collapses. An RC snubber (4.7k ohm resistor in series with a 0.1 µf capacitor) placed across an AC coil will effectively suppress noise generation. Such suppression devices should be connected close to the inductive load to provide suppression at its source. The amount of energy absorbed is considerable and the suppressor must be rated accordingly.

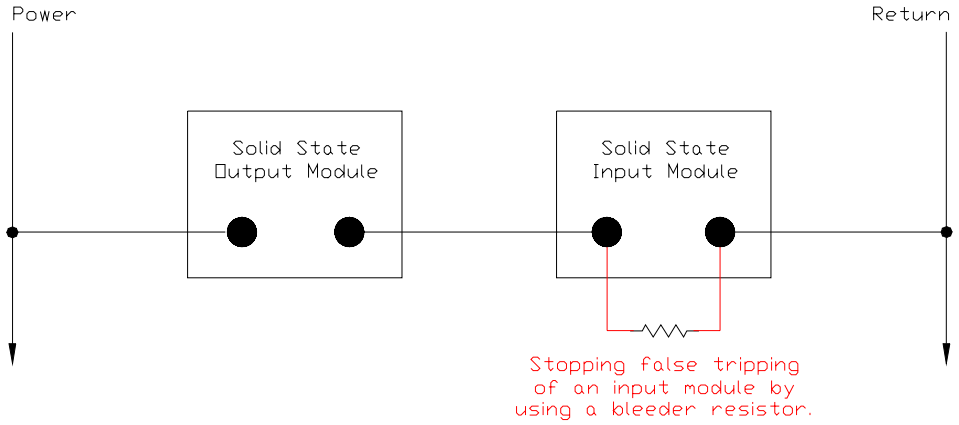
Metal Oxide Varistors (MOV) are less effective than an RC Snubber for noise suppression and tend to degrade over time.

Figure 7-5 Suppression - AC Relay



Solid state inputs that are driven from solid state outputs should have a bleeder resistor across the input to provide a path for the output's leakage current when the output is off. This will help prevent false tripping on the input when the output is off. This is extremely important when utilizing the high-speed inputs or when utilizing Solid State Devices on the outputs of the 34xx. The resistor's rating depends on the output device's leakage current and the input device's OFF voltage.

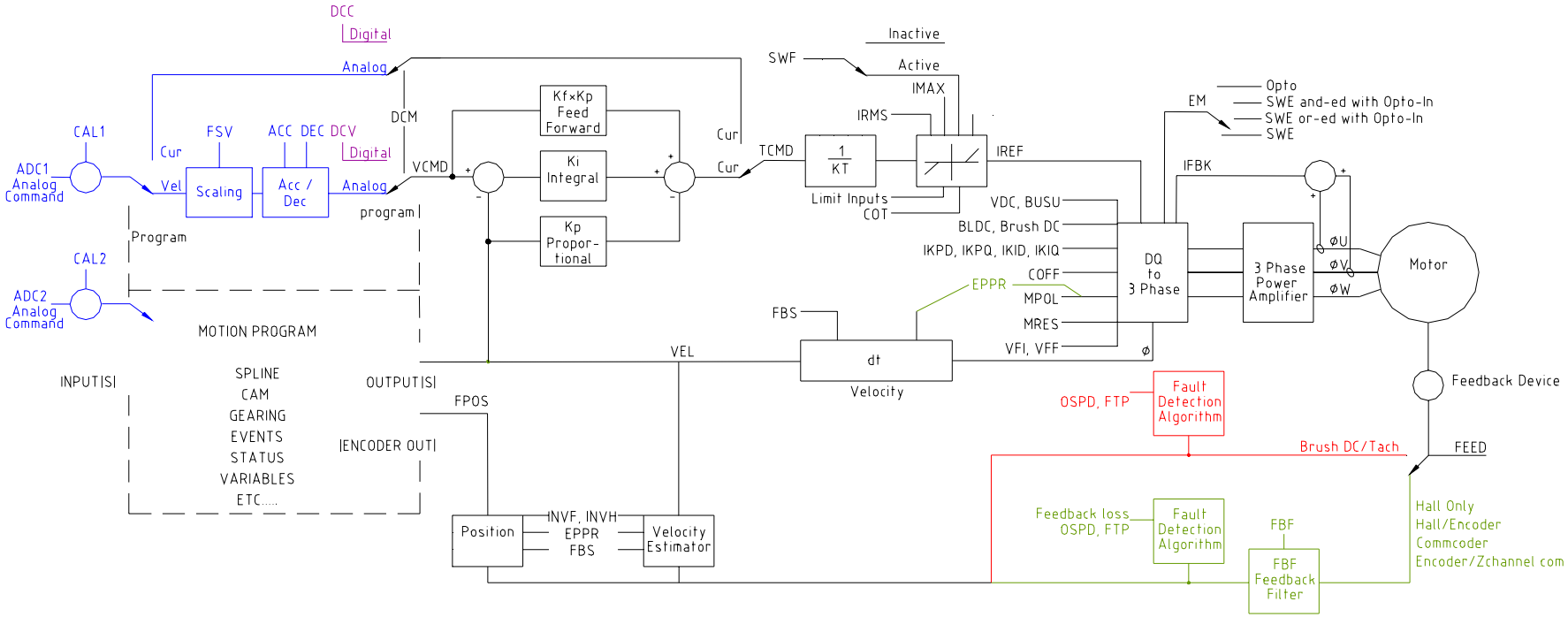
Figure 7-6 De-coupling - SS Relay



7.2 Relevant Engineering Prints

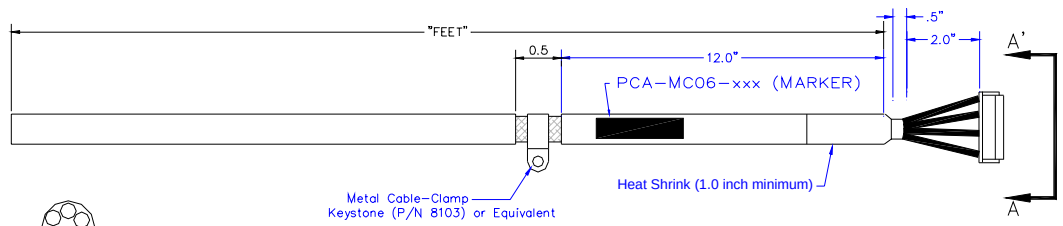
In this section we present a number of system interconnect drawings to be utilized as guidelines for a generic installation.

Figure 7-7 Function Block Diagram

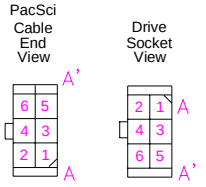


PC34xxAi – AUX I/O (J2)
PD24xxD – Motor Power (TB2)

DATE	SYM	REVISION RECORD	AUTH	DWN	CHK



20AWG x 6C
ALPHA 45156
XTRA Guard 4 - Gray PVC



Cap:43025-0600 (MOLEX)
Socket:43030-0008

PD2400D PC3400A

	TB2	J2	
PacSci	Function	Function	Conductor
1	A+	O3 +	Black
2	A–	O3 –	Red
3	Shield	O4 +	Green
4	Shield	O4 –	White
5	B+	Input 8	Blue
6	B–	Input 9	Orange

PCA–MC06–xxx (xxx = feet, +1.5/–0.0 inch)

Cable Assembly includes one each of the above cable packaged in a plastic bag.
Plastic bag is marked with the PCA-MC06-xxx part number.

Strain Relief as required

Reference sheet "Molex Contact Installation" for proper crimp technique and pin orientation.

Do NOT pre-soldered wire ends.

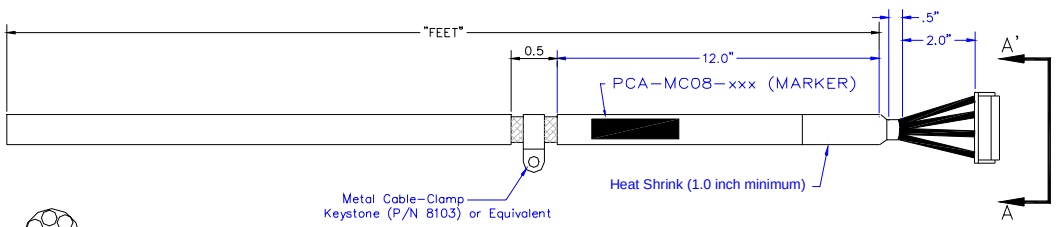
Trim unused wires to sheath.

PACIFIC SCIENTIFIC
HIGH PERFORMANCE MOTORS AND DRIVES
110 FORDHAM ROAD WILMINGTON, MA 01887

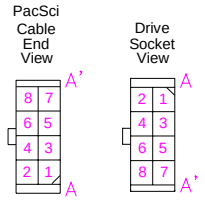
Cable	SCALE CAD	DWN: RMF APPR: –
TITLE: PCA–MC06–xxx Cable Assembly		
DATE: 2/13/01 SHT 1 OF	SIZE B	DRAWING NO: PCA–MC06–xxx REV 1

PC34xxD – DC Power (TB1)
PD24xxD – DC Power (TB1)
PC34xxAc – Analog I/O (J9)

DATE	SYM	REVISION RECORD	AUTH	DWN	CHK



20AWG x 8C
ALPHA 45158
XTRA Guard 4 - Gray PVC



Cap:43025-0800 (MOLEX)
Socket:43030-0008

	PC3400D (TB1)	PC2400D (TB1)	PC3400Ac (J9)	
PacSci	Function	Function	Function	Conductor Pair
1	GND	GND	AN_IN3+	Green
2	GND	GND	AN_IN3–	White
3	Regen +	Regen +	AN_IN4+	Blue
4	Regen –	Regen –	AN_IN4–	Yellow
5	CTL –	CTL –	GND	Brown
6	CTL +	CTL +	DAC1	Orange
7	DC Com	DC Com	DAC2	Black
8	DC PWR +	DC PWR +	COM	Red

PCA–MC08–xxx (xxx = feet, +1.5/–0.0 inch)

Cable Assembly includes one each of the above cable packaged in a plastic bag.
Plastic bag is marked with the PCA-MM08-xxx part number.

Strain Relief as required

Reference sheet "Molex Contact Installation" for proper crimp technique and pin orientation.

Do NOT pre-soldered wire ends.

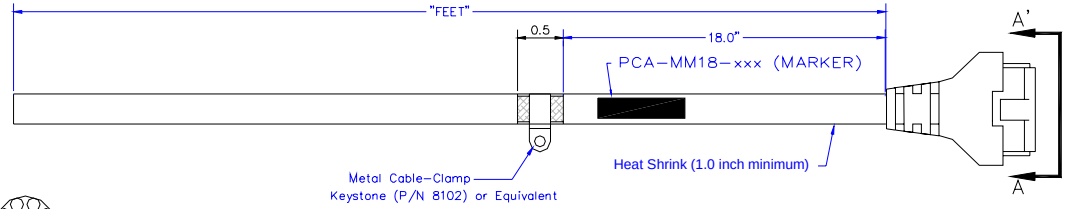
Trim unused wires to sheath.

PACIFIC SCIENTIFIC
HIGH PERFORMANCE MOTORS AND DRIVES
110 FORDHAM ROAD WILMINGTON, MA 01887

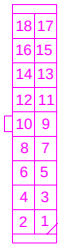
Cable	SCALE CAD	DWN: RMF APPR: –
TITLE: PCA–MC08–xxx Cable Assembly		
DATE: 2/13/01 SHT 1 OF	SIZE B	DRAWING NO: PCA–MC08–xxx REV 1

PC3400 Extended Digital Output (J8)

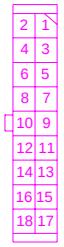
DATE	SYM	REVISION RECORD	AUTH	DWN	CHK



PacSci Cable End View



Drive View



24AWG x 8P
Belden 8108
Low C, Gray PVC

Cap:43025-1800 (MOLEX)
Socket:43030-0008

	OUTPUT (Ref. J8)	
PacSci	Function	Conductor Pair
1	+01	Blue/White Stripe
2	–01	White/Blue Stripe
3	+02	Orange/White Stripe
4	–02	White/Orange Stripe
5	+03	Green/White Stripe
6	–03	White/Green Stripe
7	+04	Brown/White Stripe
8	–04	White/Brown Stripe
9	+05	Gray/White Stripe
10	–05	White/Gray Stripe
11	+06	Blue/Red Stripe
12	–06	Red/Blue Stripe
13	+07	Orange/Red Stripe
14	–07	Red/Orange Stripe
15	+08	Green/Red Stripe
16	–08	Red/Green Stripe
17	GND	Drain
18	Not Used	

PCA–MM18–xxx (xxx = feet, +1.5/–0.0 inch)

Cable Assembly includes one each of the above cable packaged in a plastic bag.
Plastic bag is marked with the PCS-MM18-xxx part number.

Strain Relief as required

Reference sheet "Molex Contact Installation" for proper crimp technique and pin orientation.

Do NOT pre-soldered wire ends.

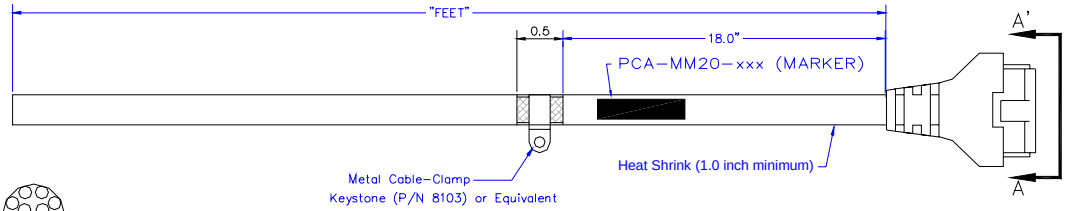
Trim unused wires to sheath.

PACIFIC SCIENTIFIC
HIGH PERFORMANCE MOTORS AND DRIVES
110 FORDHAM ROAD WILMINGTON, MA 01887

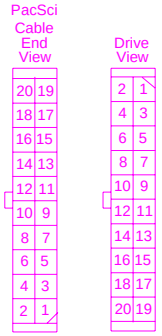
3400 Cable	SCALE CAD	DWN: RMF APPR: –
TITLE: PCA–MM18–xxx Extended Digital Output (J8)		
DATE: 2/13/01 SHT 1 OF	SIZE B	DRAWING NO: PCA–MM18–xxx REV 1

PC3400/PD2400 Extended Digital Input (J6)

DATE	SYM	REVISION RECORD	AUTH	DWN	CHK



24AWG x 10P
Belden 8110
Low C, Gray PVC



Cap:43025-2000 (MOLEX)
Socket:43030-0008

	INPUT (Ref. J6)	
PacSci	Function	Conductor Pair
1	IN1	Blue/White Stripe
2	IN2	White/Blue Stripe
3	IN3	Orange/White Stripe
4	IN4	White/Orange Stripe
5	IN5	Green/White Stripe
6	IN6	White/Green Stripe
7	IN7	Brown/White Stripe
8	IN8	White/Brown Stripe
9	1IN_COM	Gray/White Stripe
10	2IN_COM	White/Gray Stripe
11	IN9	Blue/Red Stripe
12	IN10	Red/Blue Stripe
13	IN11	Orange/Red Stripe
14	IN12	Red/Orange Stripe
15	IN13	Green/Red Stripe
16	IN14	Red/Green Stripe
17	IN15	Brown/Red Stripe
18	IN16	Red/Brown Stripe
19	GND	DRAIN
20	Not Used	
	Not Used	Gray/Red Stripe
	Not Used	Red/Gray Stripe

PCA-MM20-xxx (xxx = feet, +1.5/-0.0 inch)

Cable Assembly includes one each of the above cable packaged in a plastic bag.
Plastic bag is marked with the PCS-MM20-xxx part number.

Strain Relief as required

Reference sheet "Molex Contact Installation" for proper crimp technique and pin orientation.

Do NOT pre-soldered wire ends.

Trim unused wires to sheath.

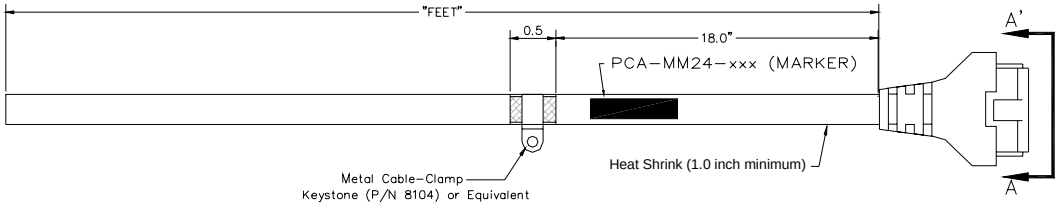
PACIFIC SCIENTIFIC
HIGH PERFORMANCE MOTORS AND DRIVES
110 FORDHAM ROAD WILMINGTON, MA 01887

3400 Cable	SCALE CAD	DWN: RMF APPR: –
TITLE: PCA-MM20-xxx Extended Digital Input (J6)		
DATE: 2/13/01 SHT 1 OF	SIZE B	DRAWING NO: PCA-MM20-xxx REV 1

Standard I/O CABLE (J1)

DATE	SYM	REVISION RECORD	AUTH	DWN	CHK

24AWG x 12P
Belden 8112
Low C, Gray PVC



PacSci Cable End View

24	23
22	21
20	19
18	17
16	15
14	13
12	11
10	9
8	7
6	5
4	3
2	1

Drive View

2	1
4	3
6	5
8	7
10	9
12	11
14	13
16	15
18	17
20	19
22	21
24	23

STANDARD I/O (Ref. J1)

PacSci	Function	Conductor Pair
1	ADC1 +	Blue/White Stripe
2	ADC1 -	White/Blue Stripe
3	Shield	Shield (Drain)
4	IN_COM	White/Orange Stripe
5	Input 1	Green/White Stripe
6	Input 2	White/Green Stripe
7	Input 3	Brown/White Stripe
8	Input 4	White/Brown Stripe
9	Input 5 (HSI) +	Gray/White Stripe
10	Input 5 (HSI) -	White/Gray Stripe
11	Input 6 (HSI) +	Blue/Red Stripe
12	Input 6 (HSI) -	Red/Blue Stripe
13	Input 7 (HSI) +	Orange/Red Stripe
14	Input 7 (HSI) -	Red/Orange Stripe
15	Out A +	Green/Red Stripe
16	Out A -	Red/Green Stripe
17	Out B +	Brown/Red Stripe
18	Out B -	Red/Brown Stripe
19	Out Z +	Gray/Red Stripe
20	Out Z -	Red/Gray Stripe
21	Output 2 +	Blue/Black Stripe
22	Output 2 -	Black/Blue Stripe
23	Brake +	Orange/Black Stripe
24	Brake -	Black/Orange Stripe

Cap:43025-2400 (MOLEX)
Socket:43030-0008

PCA-MM24-xxx (xxx = feet, +1.5/-0.0 inch)

Cable Assembly includes one each of the above cable packaged in a plastic bag.
Plastic bag is marked with the PCS-MM24-xxx part number.

Strain Relief as required

Reference sheet "Molex Contact Installation" for proper crimp technique and pin orientation.

Do NOT pre-soldered wire ends.

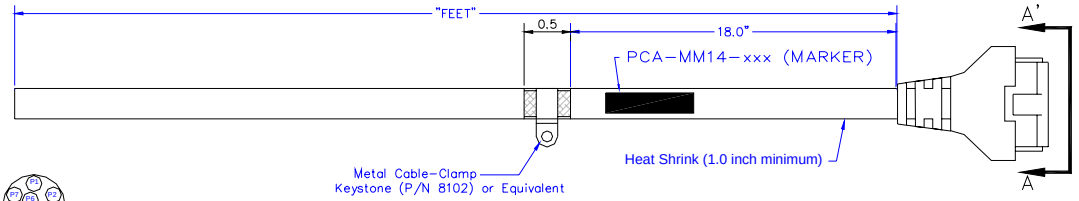
Trim unused wires to sheath.

PACIFIC SCIENTIFIC
HIGH PERFORMANCE MOTORS AND DRIVES
110 FORDHAM ROAD WILMINGTON, MA 01887

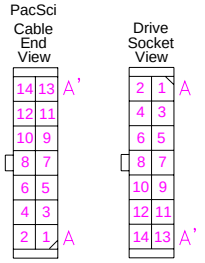
3400 Cable	SCALE CAD	DWN: RMF APPR: -
TITLE: PCA-MM24-xxx Standard I/O Cable (J1)		
DATE: 2/13/01 SHT 1 OF	SIZE B	DRAWING NO: PCA-MM24-xxx REV 1

PC3400 Servo Motor Feedback (J3)

DATE	SYM	REVISION RECORD	AUTH	DWN	CHK



24AWG x 8P
Belden 8108
Low C, Gray PVC



Cap:43025-1400 (MOLEX)
Socket:43030-0008

	Feedback (Ref. J3)		
PacSci	Function	Pair	Conductor Color
1	A+/SIN+	P1	Blue/White Stripe
2	A-/SIN-	P1	White/Blue Stripe
3	B+/COS+	P3	Green/White Stripe
4	B-/COS-	P3	White/Green Stripe
5	Z+/REF+	P2	Orange/White Stripe
6	Z-/REF-	P2	White/Orange Stripe
11	+5 Ret	P6	Blue/Red Stripe
12	+5 Vdc	P6	Red/Blue Stripe
*	BRK+	P4	Brown/White Stripe
*	BRK-	P4	White/Brown Stripe
13	ADC2+/OT+	P5	Gray/White Stripe
14	ADC2-/OT-	P5	White/Gray Stripe
7	SHIELD		Shield (Drain)
n/c	n/c		
8	HALL 1	P7	Red/Orange Stripe
9	HALL 2	P7	Orange/Red Stripe
10	HALL 3	P8	Green/Red Stripe
Cut Flush	Cut Flush	P8	Red/Green Stripe

PFC-0005002-xxx (xxx = feet, +1.5/-0.0 inch)

Cable Assembly includes one each of the above cable packaged in a plastic bag.
Plastic bag is marked with the PCA-MM14-xxx part number.

Strain Relief as required

Reference sheet "Molex Contact Installation" for proper crimp technique and pin orientation.

Do NOT pre-soldered wire ends.

Trim unused wires to sheath.

* BRK-
* BRK+

WIRES TRIMMED INTERNALLY, IF REQUIRED
CUSTOMER TO CUT BACK JACKET NEAR P-CLAMP
TO EXPOSE BROWN/WHITE PAIR FOR CUSTOMER"S USE

PACIFIC SCIENTIFIC
HIGH PERFORMANCE MOTORS AND DRIVES
110 FORDHAM ROAD WILMINGTON, MA 01887

3400 Cable	SCALE CAD	DWN: RMF
		APPR: -

TITLE: PFC-0005002-xxx
Feedback Cable Assembly (J3)

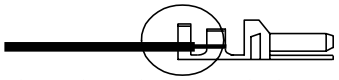
DATE: 2/13/01	SIZE	DRAWING NO:	REV
SHT 1 OF	B	PFC-0005002-xxx	1

ACCEPTED METHOD

LAY WIRE ONTO THE CONTACT ALLOWING THE INSULATION TO EXTEND BEYOND THE CONTACT. USING THE TERMINAL CRIMPER (11-03-0043), PRESS CONTACT INTO THE WIRE. THE INSULATION WILL BE PIERCED AND THE WIRE TRIMMED PROPERLY. REMOVE EXCESS WIRE.

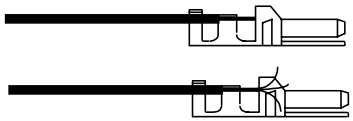
OPTIONAL METHOD

RIGHT

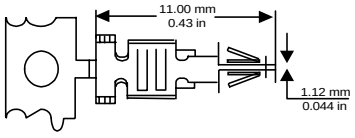


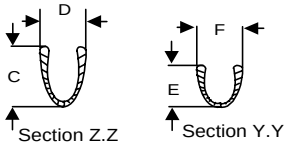
INSULATION MUST BE PART OF CRIMP

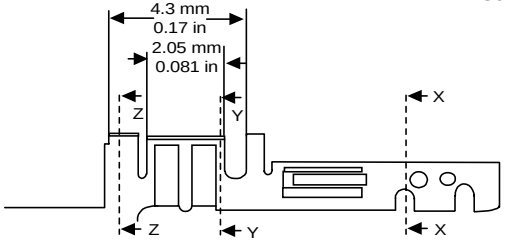
WRONG

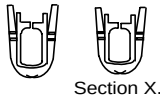


STRANDS OF WIRE DO NOT EXTEND IN CONTACT AREA









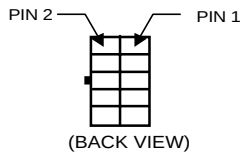
MOLEX SOCKET MOLEX P/N 43030-0008

TERMINAL SPECIFICATION

	WIRE SIZE AWG		INSULATION DIA INCH		STRIP LENGTH INCH	
	MIN	MAX	MIN	MAX	MIN	MAX
43030-0008	24	20	--	0.073	0.100	0.115

REQUIRED TOOLS:

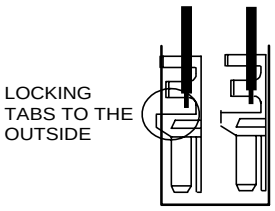
TERMINAL CRIMPER	11-01-0200
CRIMP TERMINAL EXTRACTOR	11-03-0043



(BACK VIEW)

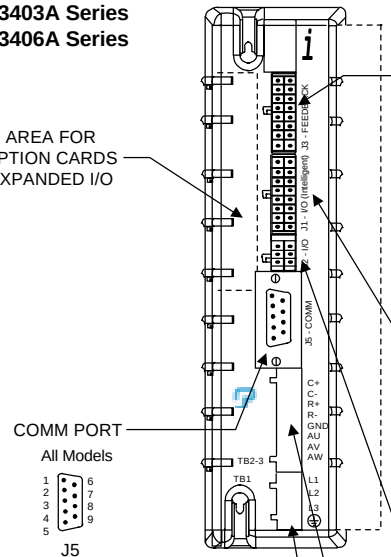
RECEPTACLE
MOLEX P/N: 43025-XXXX

(TOP VIEW)

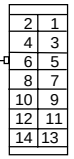


(SIDE VIEW)

PC3403A Series
PC3406A Series



DRIVE SOCKET

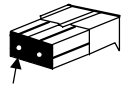


WIRING TABLE

J3 ENCODER FEEDBACK			
Pin #	Signal	Pin #	Signal
2	A -	1	A +
4	B -	3	B +
6	Z -	5	Z +
8	HED 1	7	Shield
10	HED 3	9	HED 2
12	+5 VDC	11	+5 Return (com)
14	ADC2 - /OT -	13	ADC2+ /OT +

J3 RESOLVER FEEDBACK			
Pin #	Signal	Pin #	Signal
2	Sin - (S4)	1	Sin + (S2)
4	Cos - (S3)	3	Cos + (S1)
6	Ref - (R2)	5	Ref + (R1)
8	Spare	7	Shield
10	Spare	9	Spare
12	+5 VDC	11	+5 Return (com)
14	ADC2 - /OT -	13	ADC2+ /OT +

Plug Reverence



PIN 1

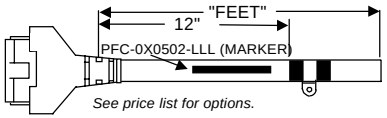
Cable P/N *

PCA-XXnn-xxx

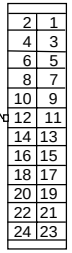
XX = Connector Style
nn = Number of Pins
xxx = FEET, +1.5 - 0.0 inch

* SK-PC340xxA includes all connectors and pins for customers to build their own cables **(included with drive)**.

COLOR CODED
FLYING LEADS



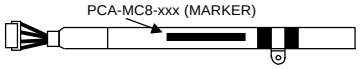
See price list for options.



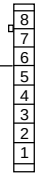
J1 I/O (Intelligent Only)			
Pin #	Isolated I/O	Pin #	Isolated I/O
2	ADC1-	1	ADC1+
4	IN_COMM	3	Shield
6	INPUT2	5	Enable (Input1)
8	CW/INPUT4	7	CCW/INPUT3
10	INPUT5 (HS1)-	9	INPUT5 (HS1)+
12	INPUT6 (HS1)-	11	INPUT6 (HS1)+
14	Reg/(HS1-7)-	13	Reg/(HS1-7) +
16	OUTA-	15	OUTA+
18	OUTB-	17	OUTB+
20	OUTZ-	19	OUTZ+
22	Output 2 -	21	Output 2 +
24	OK/BRAKE-	23	OK/BRAKE+

Customer Wiring Required Plug Supplied with Ship Kit

J2 - I/O (Intelligent Centennial Only)			
Pin #	Isolated I/O	Pin #	Isolated I/O
2	Output 3 -	1	Output 3 +
4	Output 4 -	3	Output 4 +
6	Input 9	5	Input 8



J6 COMM PORT (DB9-F)			
Pin #	RS-232	RS-422 RS-485	RS-485 TWO-WIRE
1	NC	TX+	RX +/ TX +
2	TX	TX -	RX -/ TX -
3	RX	RX -	RX -/ TX -
4	NC	RX +	RX +/ TX +
5	COM	COM	COM
6	--	--	--
7	--	--	--
8	--	--	--
9	+5 VDC	+5 VDC	+5 VDC



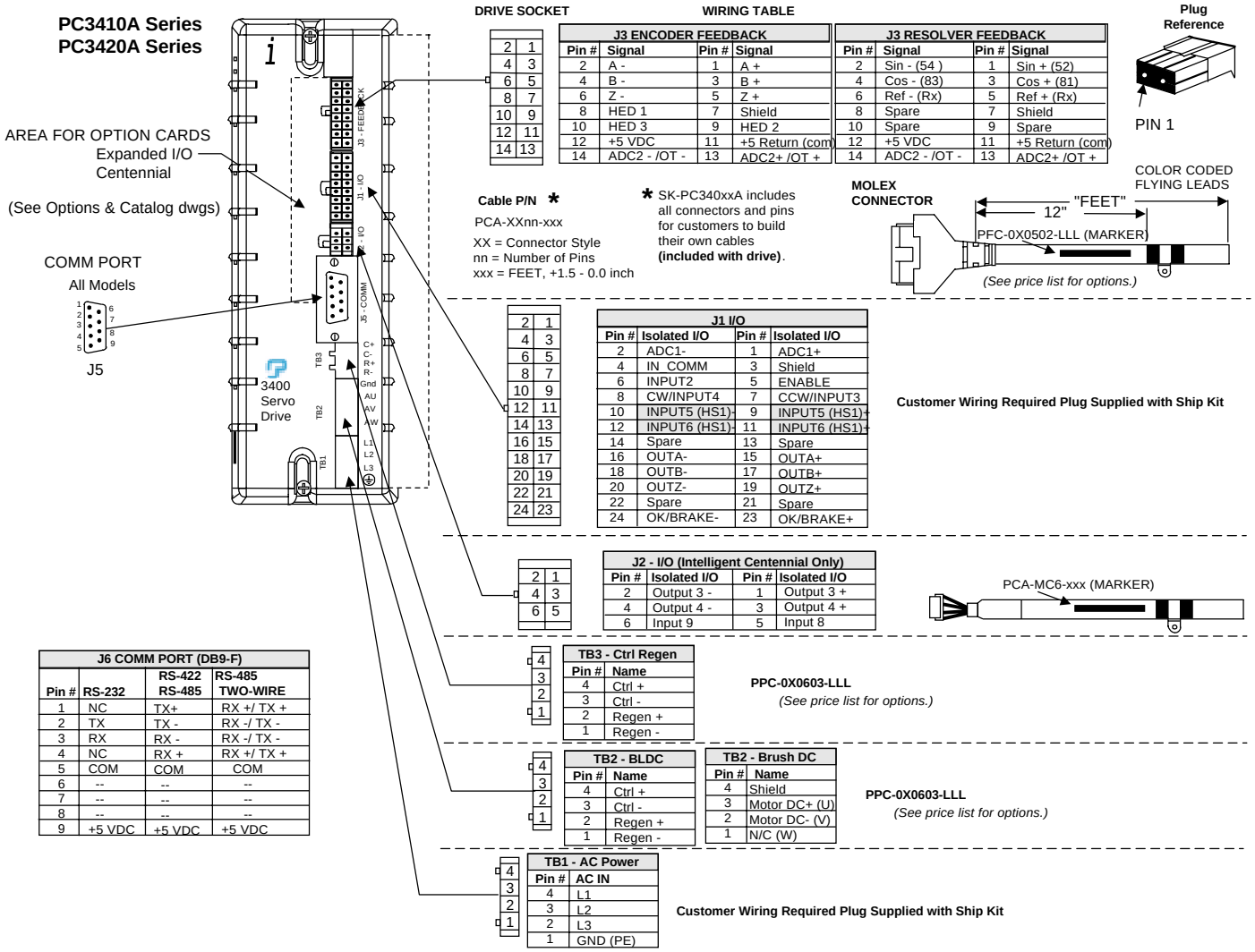
TB2-3 - BLDC	
Pin #	Name
8	Ctrl +
7	Ctrl -
6	Regen +
5	Regen -
4	Shield
3	Phase U (A)
2	Phase V (B)
1	Phase W (C)

TB2-3 - Brush DC	
Pin #	Name
8	Ctrl +
7	Ctrl -
6	Regen +
5	Regen -
4	Shield
3	Motor DC + (U)
2	Motor DC - (V)
1	N/C (W)

PPC-0X0Y0Z-LLL
Where X=1, 3, 7
Y=1, 6, 7
Z=4, 5
(*See price list for options*)

TB1 - AC Power	
Pin #	AC IN
4	L1
3	L2
2	L3
1	GND (PE)

Customer Wiring Required Plug Supplied with Ship Kit



J3 ENCODER FEEDBACK			
Pin #	Signal	Pin #	Signal
2	A -	1	A +
4	B -	3	B +
6	Z -	5	Z +
8	HED 1	7	Shield
10	HED 3	9	HED 2
12	+5 VDC	11	+5 Return (com)
14	ADC2 - /OT -	13	ADC2+ /OT +

J3 RESOLVER FEEDBACK			
Pin #	Signal	Pin #	Signal
2	Sin - (54)	1	Sin + (52)
4	Cos - (83)	3	Cos + (81)
6	Ref - (Rx)	5	Ref + (Rx)
8	Spare	7	Shield
10	Spare	9	Spare
12	+5 VDC	11	+5 Return (com)
14	ADC2 - /OT -	13	ADC2+ /OT +

J1 I/O			
Pin #	Isolated I/O	Pin #	Isolated I/O
2	ADC1-	1	ADC1+
4	IN_COMM	3	Shield
6	INPUT2	5	ENABLE
8	CW/INPUT4	7	CCW/INPUT3
10	INPUT5 (HS1)-	9	INPUT5 (HS1)+
12	INPUT6 (HS1)-	11	INPUT6 (HS1)+
14	Spare	13	Spare
16	OUTA-	15	OUTA+
18	OUTB-	17	OUTB+
20	OUTZ-	19	OUTZ+
22	Spare	21	Spare
24	OK/BRAKE-	23	OK/BRAKE+

J2 - I/O (Intelligent Centennial Only)			
Pin #	Isolated I/O	Pin #	Isolated I/O
2	Output 3 -	1	Output 3 +
4	Output 4 -	3	Output 4 +
6	Input 9	5	Input 8

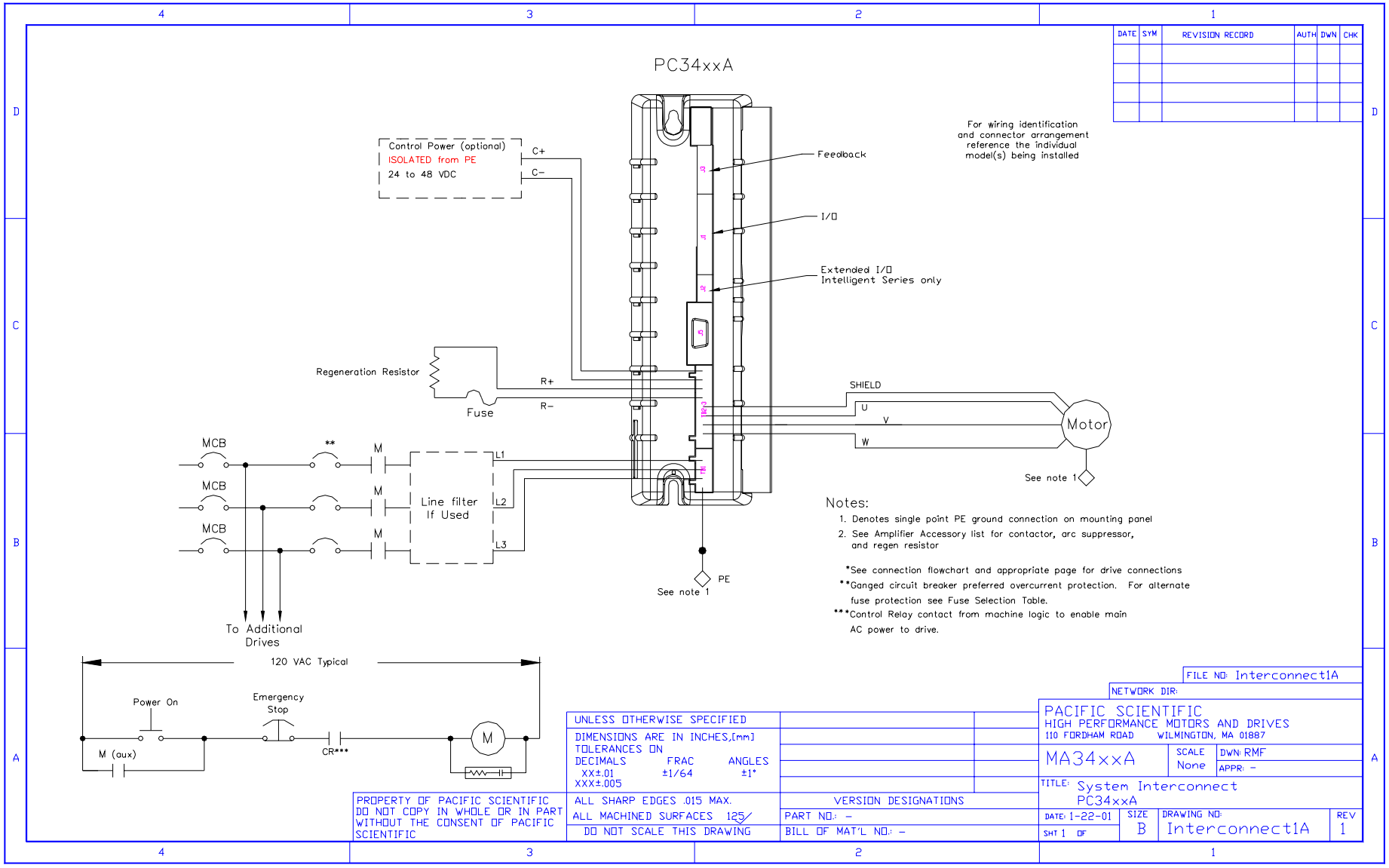
J6 COMM PORT (DB9-F)			
Pin #	RS-232	RS-422 RS-485	RS-485 TWO-WIRE
1	NC	TX+	RX +/ TX +
2	TX	TX -	RX -/ TX -
3	RX	RX -	RX -/ TX -
4	NC	RX +	RX +/ TX +
5	COM	COM	COM
6	--	--	--
7	--	--	--
8	--	--	--
9	+5 VDC	+5 VDC	+5 VDC

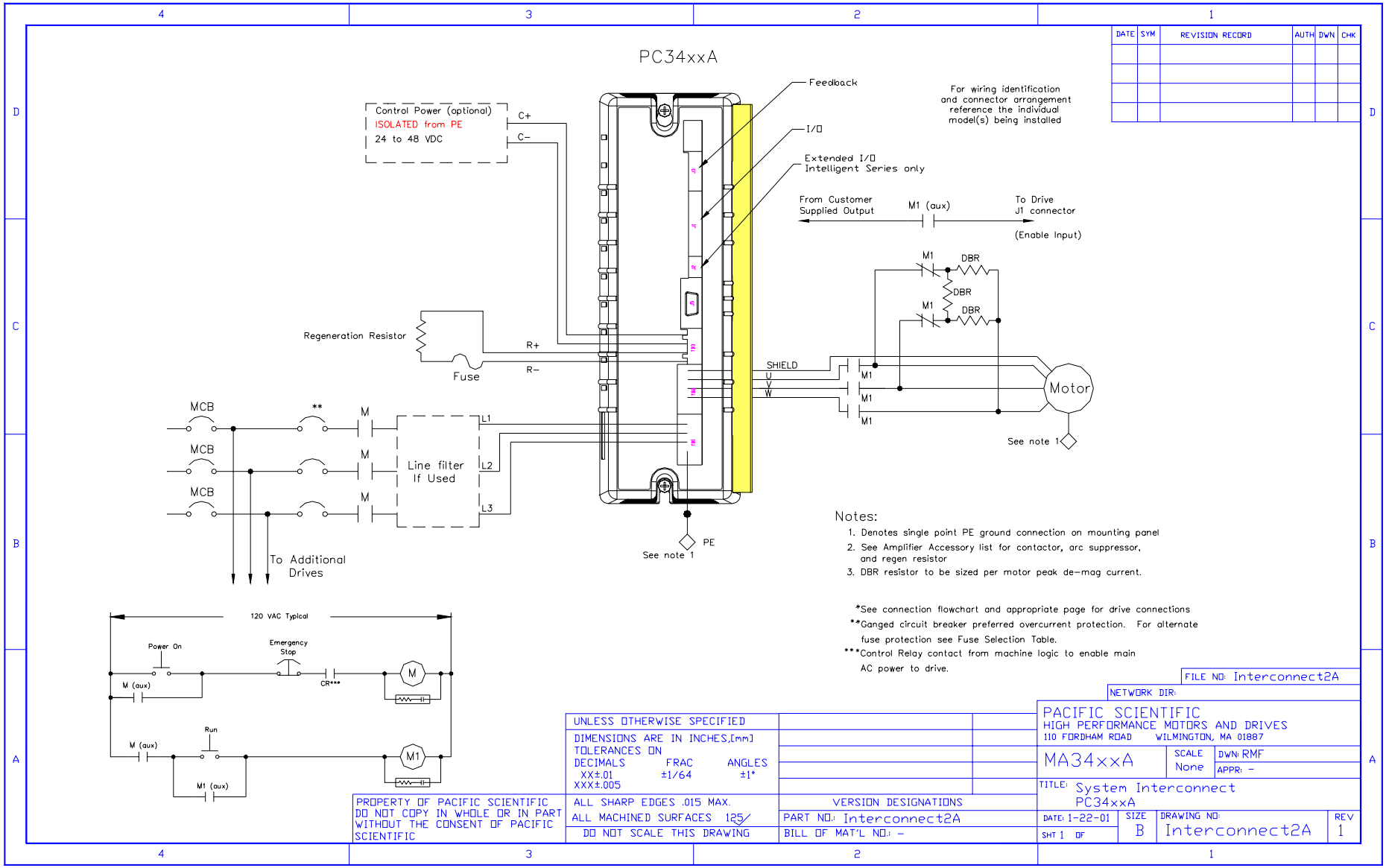
TB3 - Ctrl Regen	
Pin #	Name
4	Ctrl +
3	Ctrl -
2	Regen +
1	Regen -

TB2 - BLDC	
Pin #	Name
4	Ctrl +
3	Ctrl -
2	Regen +
1	Regen -

TB2 - Brush DC	
Pin #	Name
4	Shield
3	Motor DC+ (U)
2	Motor DC- (V)
1	N/C (W)

TB1 - AC Power	
Pin #	AC IN
4	L1
3	L2
2	L3
1	GND (PE)

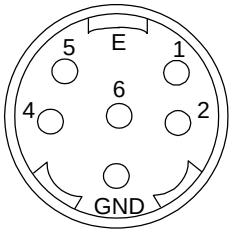

PC34xxA
Control Power (optional)
ISOLATED from PE
24 to 48 VDC
C+
C–
Feedback
I/O
Extended I/O
Intelligent Series only
For wiring identification and connector arrangement reference the individual model(s) being installed
Regeneration Resistor
Fuse
R+
R–
SHIELD
U
V
W
Motor
See note 1
MCB
**
M
L1
L2
L3
Line filter
If Used
PE
See note 1
To Additional Drives
120 VAC Typical
Power On
Emergency Stop
M (aux)
CR***
M
Notes:
1. Denotes single point PE ground connection on mounting panel
2. See Amplifier Accessory list for contactor, arc suppressor, and regen resistor
*See connection flowchart and appropriate page for drive connections
**Ganged circuit breaker preferred overcurrent protection. For alternate fuse protection see Fuse Selection Table.
***Control Relay contact from machine logic to enable main AC power to drive.
DATE SYM REVISION RECORD AUTH DWN CHK
UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES,[mm]
TOLERANCES ON
DECIMALS FRAC ANGLES
XX±.01 ±1/64 ±1°
XXX±.005
ALL SHARP EDGES .015 MAX.
ALL MACHINED SURFACES 125
DO NOT SCALE THIS DRAWING
VERSION DESIGNATIONS
PART NO.: –
BILL OF MAT'L NO.: –
PROPERTY OF PACIFIC SCIENTIFIC
DO NOT COPY IN WHOLE OR IN PART
WITHOUT THE CONSENT OF PACIFIC
SCIENTIFIC
FILE NO: Interconnect1A
NETWORK DIR:
PACIFIC SCIENTIFIC
HIGH PERFORMANCE MOTORS AND DRIVES
110 FORDHAM ROAD WILMINGTON, MA 01887
MA34xxA
SCALE None
DWN: RMF
APPR: –
TITLE: System Interconnect PC34xxA
DATE: 1-22-01
SIZE B
DRAWING NO: Interconnect1A
REV 1
SHT 1 OF


PC34xxA
Control Power (optional)
ISOLATED from PE
24 to 48 VDC
C+
C–
Feedback
I/O
Extended I/O
Intelligent Series only
For wiring identification
and connector arrangement
reference the individual
model(s) being installed
From Customer
Supplied Output
M1 (aux)
To Drive
J1 connector
(Enable Input)
Regeneration Resistor
R+
R–
Fuse
M1
DBR
SHIELD
U
V
W
Motor
See note 1
MCB
**
M
L1
L2
L3
Line filter
If Used
To Additional
Drives
PE
See note 1
Notes:
1. Denotes single point PE ground connection on mounting panel
2. See Amplifier Accessory list for contactor, arc suppressor, and regen resistor
3. DBR resistor to be sized per motor peak de-mag current.
*See connection flowchart and appropriate page for drive connections
**Ganged circuit breaker preferred overcurrent protection. For alternate fuse protection see Fuse Selection Table.
***Control Relay contact from machine logic to enable main AC power to drive.
120 VAC Typical
Power On
Emergency Stop
M (aux)
CR***
Run
M1 (aux)
DATE SYM REVISION RECORD AUTH DWN CHK
UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES,[mm]
TOLERANCES ON
DECIMALS FRAC ANGLES
XX±.01 ±1/64 ±1°
XXX±.005
ALL SHARP EDGES .015 MAX.
ALL MACHINED SURFACES 125
DO NOT SCALE THIS DRAWING
PROPERTY OF PACIFIC SCIENTIFIC
DO NOT COPY IN WHOLE OR IN PART
WITHOUT THE CONSENT OF PACIFIC
SCIENTIFIC
VERSION DESIGNATIONS
PART NO: Interconnect2A
BILL OF MAT'L NO: –
FILE NO: Interconnect2A
NETWORK DIR:
PACIFIC SCIENTIFIC
HIGH PERFORMANCE MOTORS AND DRIVES
110 FORDHAM ROAD WILMINGTON, MA 01887
MA34xxA
SCALE None
DWN: RMF
APPR: –
TITLE: System Interconnect
PC34xxA
DATE: 1-22-01
SHT 1 OF
SIZE B
DRAWING NO: Interconnect2A
REV 1

7.2.1 Motor connectors

Figure 7-8 Interconnectron (6-Pin and 12-Pin)

Connector "E" Option
Power Connector
PMA Series, S Series

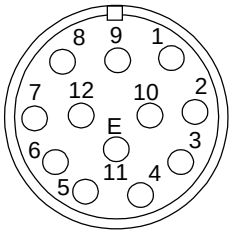


Motor Pin	Motor	PC3400	Drive Pin
1	U	V	TB2-2
2	W	W	TB2-1
GND	Earth case	GND	TB2-4
4	Brake -		
5	V	U	TB2-3
E	Brake +		

SUGGESTED MATING CONNECTOR

Connector
LPLA 06D FRRN 213 00 A5
PACIFIC SCIENTIFIC
769-004916-00

Interconnection "E" Option
Resolver Feedback 12-Pin
PMA Series, S Series with Resolver



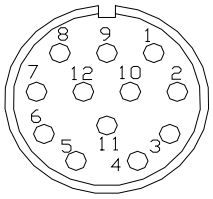
Motor Pin	Motor	PC3400	Drive Pin
1	S1	Cos + (S1)	J3-3
2	S3	Cos - (S3)	J3-4
3	S4	Sin - (S4)	J3-2
4	S2	Sin + (S2)	J3-1
5	R1	Ref + (R1)	J3-5
6	R2	Ref - (R2)	J3-6
7	OT+	ADC2 + /OT +	J3-13
8	OT-	ADC2 - /OT -	J3-14
9	not used		
10	not used		
11	not used		
12	not used		

SUGGESTED MATING CONNECTOR

Connector
SPNA 12T FRON 1609 00 D9
PACIFIC SCIENTIFIC
769-004915-00

Figure 7-9 Interconnectron (12-Pin and 17-Pin)

Interconnectron "E" Option
Hall Feedback 12-Pin
PMA Series, S series with Hall only

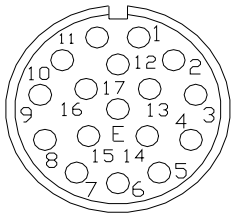


Motor Pin	Motor	PC3400	Drive Pin
1	+ 5 VDC	**+5 VDC**	**J3-12**
2	0V supply	**+5 Return(com)**	**J3-11**
3	Hall 3	**Hall 3**	**J3-10**
4	Hall 1	**Hall 1**	**J3-8**
5	Hall 2	**Hall 2**	**J3-9**
6	not used		
7	OT +	**ADC2 + / OT +**	**J3-13**
8	OT -	**ADC2 - /OT -**	**J3-14**
9	not used		
10	not used		
11	not used		
12	not used		

SUGGESTED MATING CONNECTOR

CONNECTOR
SPNA 12T FRON 169 00 D9
PACIFIC SCIENTIFIC
769-004915-00

Interconnectron "E" Option
Feedback Connector 17-Pin
PMA Series, Commutating Encoder



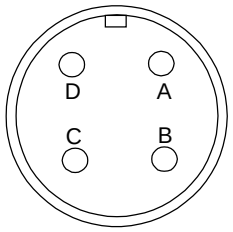
SUGGESTED MATING CONNECTOR

CONNECTOR
SPNA 17H FRON 169 00 E3
PACIFIC SCIENTIFIC
769-004917-00

Motor Pin	PMA Series	PC3400	Drive Pin
1	5V +	**+5 VDC**	**J3-12**
2	PTC	**ADC2 + / OT +**	**J3-13**
3	0V supply	**+5 Return(com)**	**J3-11**
4	Hall Sensor W +		
5	Hall Sensor W -		
6	Hall Sensor U +		
7	Hall Sensor U -		
8	Hall Sensor V +		
9	Hall Sensor V -		
10	A +	**A+**	**J3-1**
11	A -	**A-**	**J3-2**
12	B +	**B+**	**J3-3**
13	B -	**B-**	**J3-4**
14	Z +	**Z+**	**J3-5**
15	Z -	**Z-**	**J3-6**
16	not used		
17	PTC rtn	**ADC2 - /OT -**	**J3-14**

Figure 7-10 MS Connector (4-Pin and 8-Pin)

Connector "C" Option
Power Connector
S30/R30/R40/R60 Series



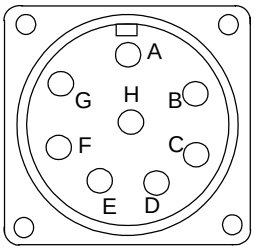
Motor Pin	Motor	PC3400A	Drive Pin
A	R	V	TB2-2
B	S	U	TB2-3
C	T	W	TB2-1
D	Ground	GND	TB2-4

SUGGESTED MATING CONNECTOR AND CLAMP

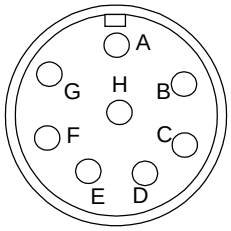
Series	Mating Connector	Clamp
R20, R30 R40, R50	M53106A20-4S Pacific Scientific P/N CZ00007	MS3057-12A-1 Pacific Scientific P/N CE00001
R80	M53106A24-229 Pacific Scientific P/N CZ00010	MS3057-16A-1 Pacific Scientific P/N CE00004

Connector "C" Option
Resolver Feedback 12-Pin
PMA Series, S Series with Resolver

All Series Except MS3102E20-7P



R20 Series Only MS3101A20-7P



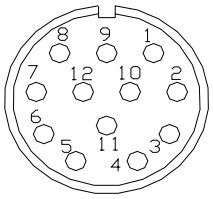
Motor Pin	Motor	PC3400	Drive Pin
A	S4	Sin - (S4)	J3-2
B	S3	Cos - (S3)	J3-4
C	S2	Sin + (S2)	J3-1
D	S1	Cos + (S1)	J3-3
E	R1	Ref + (R1)	J3-5
F	R2	Ref - (R2)	J3-6
G	OT +	ACD2 + /OT +	J3-13
H	OT -	ACD2 - /OT -	J3-14

SUGGESTED MATING CONNECTOR AND CLAMP

Connector	Clamp
MS3106A20-7S Pacific Scientific P/N CZ00008	MS3057-12A-1 Pacific Scientific P/N CE00003

Figure 7-11 MS Connector (12-Pin and 17-Pin)

Connector "C" Option
Hall Feedback 12-Pin
PMA Series, S series with Hall only

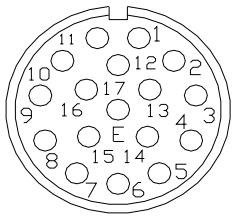


Motor Pin	Motor	PC3400	Drive Pin
1	+ 5 VDC	**+5 VDC**	**J3-12**
2	0V supply	**+5 Return(com)**	**J3-11**
3	Hall 3	**Hall 3**	**J3-10**
4	Hall 1	**Hall 1**	**J3-8**
5	Hall 2	**Hall 2**	**J3-9**
6	not used		
7	OT +	**ADC2 + / OT +**	**J3-13**
8	OT -	**ADC2 - /OT -**	**J3-14**
9	not used		
10	not used		
11	not used		
12	not used		

SUGGESTED MATING CONNECTOR

CONNECTOR
SPNA 12T FRON 169 00 D9
PACIFIC SCIENTIFIC
769-004915-00

Interconnectron "E" Option
Feedback Connector 17-Pin
PMA Series, Commutating Encoder



Motor Pin	PMA Series	PC3400	Drive Pin
1	5V +	**+5 VDC**	**J3-12**
2	PTC	**ADC2 + / OT +**	**J3-13**
3	0V supply	**+5 Return(com)**	**J3-11**
4	Hall Sensor W +		
5	Hall Sensor W -		
6	Hall Sensor U +		
7	Hall Sensor U -		
8	Hall Sensor V +		
9	Hall Sensor V -		
10	A +	**A+**	**J3-1**
11	A -	**A-**	**J3-2**
12	B +	**B+**	**J3-3**
13	B -	**B-**	**J3-4**
14	Z +	**Z+**	**J3-5**
15	Z -	**Z-**	**J3-6**
16	not used		
17	PTC rtn	**ADC2 - /OT -**	**J3-14**

SUGGESTED MATING CONNECTOR

CONNECTOR
SPNA 17H FRON 169 00 E3
PACIFIC SCIENTIFIC
769-004917-00

7.3 Options and Accessories

7.3.1 Accessories

Table 7.2 System Accessories

ToolPAC	ToolPAC SOFTWARE, CD ROM (includes manuals)
MA34xxA	PC34xxA Family Hardware Reference Manual
MAToolPAC	ToolPAC Software Reference Manual
PCA-MM4c-006	CABLE ASSEMBLY, Centennial serial cable, 4 POS, 6 FT (J10)
PCA-MC6-006	CABLE ASSEMBLY, EXTENDED I/O, 6 POS, 6 FT (J2)
PCA-MC8-006	CABLE ASSEMBLY, Centennial Analog, 8 POS, 6 FT (J9)
PCA-MM18-006	CABLE ASSEMBLY,EXTENDED OUTPUTS, 18 POS, 6 FT (J8)
PCA-MM20-006	CABLE ASSEMBLY, EXTENDED INPUTS, 20 POS, 6 FT (J6)
PCA-MM24-006	CABLE ASSEMBLY, I/O, 24 POS, 6 FT (J1)
PFC-000502-010	CABLE ASSEMBLY, FEEDBACK, 14 POS, 10 FT (J3)
PRK-0160-47	REGEN RESISTOR KIT (3403/06/10)
PRK-0200-10	REGEN RESISTOR KIT (3420)
RS-232-5600	CABLE ASSEMBLY, DB9, RS-232, 6 FT
PTK-3MD-001	HAND CRIMP TOOL, MOLEX 3mm/EXTRACTOR
	HAND CRIMP TOOL, MOLEX 3MM (Molex 11-01-0200)
SK-340xA	SHIP KIT FOR PC3403A/PC3406A SERVO (includes the following)
102-3MD-0008	Pins, Gold, Loose, 20-24 AWG (Molex 43030-0008)
102-3MD-06	Receptacle, 4 pos, 3mm, Dual Row (Molex 43025-0600)
102-3MD-14	Receptacle, 14 pos, 3mm, Dual Row (Molex 43025-1400)
102-3MD-24	Receptacle, 24 pos, 3mm, Dual Row (Molex 43025-2400)
100-042	Receptacle, 4 pos, 5mm
100-004	Receptical, 8 pos, 5mm
SK-34xxA	SHIP KIT FOR PC3410A/PC3420A SERVO (includes the following)
102-3MD-0008	Pins, Gold, Loose, 20-24 AWG (Molex 43030-0008)
102-3MD-06	Receptacle, 4 pos, 3mm, Dual Row (Molex 43025-0600)
102-3MD-14	Receptacle, 14 pos, 3mm, Dual Row (Molex 43025-1400)
102-3MD-24	Receptacle, 24 pos, 3mm, Dual Row (Molex 43025-2400)
100-120-1	Receptacle, 4 pos, 7.62mm (1 qty)
100-120-2	Receptacle, 4 pos, 7.62mm (1 qty)
100-042	Receptical, 4 pos, 5mm, Control Power/Regen
SK-340xA-1	SHIP KIT FOR PC3403A/PC3406Ai-001-xI SERVO
SK-34xxA-1	SHIP KIT FOR PC3410A/PC3420Ai-001-xI SERVO
SK-340xA-2	SHIP KIT FOR PC3403A/PC3406Ac CENTENNIAL SERVO
SK-34xxA-2	SHIP KIT FOR PC3410A/PC3420Ac CENTENNIAL SERVO

7.3.1.1 Suggested Line Filters

Table 7.3 Suggested Line Filters

Filter Selection Table (AC Line In)	
Description	**Schaffner P/N**
Line Filter, Single Phase, 8 A	FN350-8/29
Line Filter, Single Phase, 12 A	FN350-12/29
Line Filter, Single Phase, 20 A	FN350-20/29
Line Filter, Single Phase, 30 A	FN350-30/33
Line Filter, Three Phase, 8 A	FN351-8/29
Line Filter, Three Phase, 16 A	FN351-16/29
Line Filter, Three Phase, 25 A	FN351-25/33
Line Filter, Three Phase, 50 A	FN2351-50/33
Line Filter, Three Phase, 80 A	FN351-80/34
Line Filter, Three Phase, 110 A	FN351-110/35

Required to comply with EC directive 89/336/EEC.
Schaffner EMC Inc. USA 201-379-7778

7.3.1.2 AC Fuse Selection

Table 7.4 AC Fuse Selection

AC Fuse Selection Table		
Drive Model	**Fuse Rating**	**Fuse**
PC3403A	5 A RMS, 250V	Bussman ABC-5
PC3406A	10 A RMS, 250V	Bussman ABC-10
PC3410A	15 A RMS, 500V	Bussman FNQ-15
PC3420A	30 A RMS, 500V	Bussman FNQ-30

The preferred AC line over-current protective device, one for each unit, is a three-phase magnetic circuit breaker with a 5-8x instantaneous trip point.

The listed AC line fuses are required to meet UL/cUL. It is the user's responsibility to ensure compliance with applicable electrical safety codes.

7.3.1.3 External Regen Fuse Selection

Table 7.5 External Regen Fuse Selection

Regen Fuse Selection Table		
Drive Model	**Fuse Rating**	**Fuse**
PC34**03**A	4.0 A RMS, 500VDC	Bussman KLM-4
PC34**06**A	4.0 A RMS, 500VDC	Bussman KLM-4
PC34**10**A	10.0 A RMS, 500VDC	Bussman KLM-10
PC34**20**A	10.0 A RMS, 500VDC	Bussman KLM-10

7.3.1.4 External Regeneration Resistors

Table 7.6 External Regeneration Resistors

Model	External Continuous	External Peak	External Regen Resistor Kit
PC34**03**A	47 Ohm, 150 W	3 kW	PRK-0160-47
PC34**06**A	47 Ohm, 150 W	3 kW	PRK-0160-47
PC34**10**A	47 Ohm, 150 W	3 kW	PRK-0160-47
PC34**20**A	10 Ohm, 200 W	14 kW	PRK-0200-10

Resistor Kits include: resistor, fuse, fuse holder, and 1 meter of wire.

7.3.1.5 Suggested Contactors DIN Mount

Table 7.7 Suggested Contactors DIN Mount

Suggested Contactor with MOL Mounting (Telemecanique)		
Rating (A)	**Description**	**MOL Relay**
9	3 N.O., aux: 3 N.O. 2 N.C., 120 V coil	LC1D0910F7 & LA1DN22
12	3 N.O., aux: 3 N.O. 2 N.C., 120 V coil	LC1D1210F7 & LA1DN22
25	3 N.O., aux: 3 N.O. 2 N.C., 120 V coil	LC1D2510F7 & LA1DN22
32	3 N.O., aux: 3 N.O. 2 N.C., 120 V coil	LC1D3210F7 & LA1DN22
50	3 N.O., aux: 3 N.O. 2 N.C., 120 V coil	LC1D5010F7 & LA1DN22
80	3 N.O., aux: 3 N.O. 2 N.C., 120 V coil	LC1D8010F7 & LA1DN22

Use arc suppressor for relay coil (Telemecanique LA4DA1U)

The contactor is a “BREAK-BEFORE-MAKE” type to prevent damaging the amplifiers power section.

7.4 Standards and Environmental Specifications

7.4.1 Environmental Specifications

Operating Ambient Temperature Range	0 to 40 °C
Storage Ambient Temperature Range	-25 °C to 70 °C
Humidity	5% to 95% non-condensing
Altitude (*Derate output 2% per 1000 feet above 3300 feet.)*	3300 feet
Vibration	According to IEC 68, Parts 2-6
Frequency	10 to 55 Hz
Amplitude	0,075 mm
Cycles per axis (xyz)	10
Frequency sweep	1 octave/minute

7.4.2 Agency Listings / Certifications

North America - UL and UL-C (Canada)

UL and UL-C (Canada) Listing under UL 508 *Industrial Control Equipment*
File E183999

European Community - CE Mark

In our Declaration of Conformity, we affirm our compliance with Directive 73/23/EEC (Low voltage Directive) and with Directive 89/336/EEC (EMC Directive).

During assembly of our product in a machine, startup (that is, normal operation) is prohibited until the end-product complies with Directive 89/392/EEC (Machine Directive) and directive 89/336/EEC (EMC Directive).

The machine manufacturer must prove that the complete system conforms with all relevant European Directives. Safety (Low Voltage Directive)

prEN50178 Electronic Equipment for Use in Power Installations

EMC Standards

EN50081-1 Emissions standard for residential, commercial and light industrial environments.
EN50081-2 Emissions standard for industrial environments
EN50082-2 Immunity standard for industrial environments

The chart below shows the EMI/EMC standards to which the PC34xxA servo family of drives have been tested and passed.

EMI/EMC STANDARD		PC34xxA	PC340xA
CISPR11-A	Emissions (radiated & conducted)	X	X
1000-4-2	Electrostatic Discharge (ESD)	X	X
1000-4-3	Radiated Immunity (Mag Field)	X	X
1000-4-4	Fast Transient burst	X	X
1000-4-6	RF Conducted Immunity (CW)	X	X
1000-4-8	50Hz Radiated Susc.	X	X
1000-4-11	Power Sag & Dip		X

7.4.2.1 CE Installation - 3/6 amp models

The CE initials confirm that the PC34xxA drives satisfy all requirements of CE Directives. The equipment is not ready to operate without additional installations (cable, motor, etc.). The following requirements must be met to ensure compliance with the Low Voltage Directive:

- Drive and Line Filter are to be mounted in an appropriate sized, ventilated metal enclosure. The enclosure was grounded with a 3' piece of 3/4" braid. (CISPR)
- Add line filter **(Schaffner P/N FN351-8/29)** is to be placed as close to where the AC line enters the enclosure as possible. The line filter(s) are placed immediately after the enclosures main disconnect. One line filter is required per PC340x series controller. (CISPR)
- Add both common mode chokes **(Fair-Rite P/N 2643803802)** and **(Fair-Rite P/N 5977011101)** to the main AC lines within 3 inch (75 mm) after the entrance to the enclosure. **All of the main power lines including ground must make a minimum of five passes through both of the common mode chokes, chokes may be "stacked" for ease of mounting.** These chokes are placed prior to the enclosures main disconnects. (CISPR)
- All of the shield cables (Communications, I/O and feedback) must be terminated directly to the base of the enclosure using a metal cable **P-Clamp** around the shield, screwed into the base within 2" of the enclosure opening. (Immunity)
- Add ferrite **(Fair-Rite P/N 0431164181)** with one pass to each of the following cables; digital I/O, analog I/O, feedback and serial communications. The ferrite is to be placed on each cable just before the cables exit the enclosure (required if cables/signals exit enclosure). (CISPR)
- The motors power cable shield must be grounded via a **P-Clamp** to the distribution panel. The motors power cable shield and motor body must also be grounded to PE at the motor end.
- Add common mode choke **(Fair-Rite P/N 5977011101)** with three pass to the motors power cable at the drive. (CISPR)

Required components					
Vendor	**Part Number**	**Description**	**Outside Diameter**	**Inside Diameter**	**Length**
Fair-Rite	2643803802	Toroid, common mode choke	2.4 inch (61mm)	1.4 inch (36 mm)	0.5 inch (12.7 mm)
Fair-Rite	5977011101	Toroid, common mode choke	2.9 inch (75mm)	1.5 inch (39 mm)	0.5 inch (12.7 mm)
Schaffner	FN351-8/29	Line Filter, Three Phase, 8 A	-	-	-
Fair-Rite	2643101902	Ferrite, Shield Bead	1.12 inch (28.5mm)	0.54 inch (13.8 mm)	1.125 inch (29 mm)

Fair-Rite Products Corporation USA 914-895-2055
Schaffner EMC Inc. USA 201-379-7778

7.4.2.2 CE Installation - 10/20 amp models

The CE initials confirm that the PC34xxA drives satisfy all requirements of CE Directives. The equipment is not ready to operate without additional installations (cable, motor, etc.). The following requirements must be met to ensure compliance with the Low Voltage Directive:

- Drive and Line Filter are to be mounted in an appropriate sized, ventilated metal enclosure. The enclosure was grounded with a 3' piece of 3/4" braid. (CISPR)
- Add line filter (**Schaffner P/N FN351-25/33**) is to be placed as close to where the AC line enters the enclosure as possible. The line filter(s) are placed immediately after the enclosures main disconnect. One line filter is required per PC34xx series controller.
- Add both common mode chokes (**Fair-Rite P/N 2643803802**) and (**Fair-Rite P/N 5977011101**) to the main AC lines within 3 inch (75 mm) after the entrance to the enclosure. **All of the main power lines including ground must make a minimum of five passes through both of the common mode chokes, chokes may be "stacked" for ease of mounting.** These chokes are placed prior to the enclosures main disconnects. (CISPR)
- All of the shield cables (Communications, I/O and feedback) must be terminated directly to the base of the enclosure using a metal cable P-Clamp around the shield, screwed into the base within 2" of the enclosure opening. (Immunity)
- Add ferrite (**Fair-Rite P/N 0443167251**) with one pass to each of the following cables; digital I/O, analog I/O, feedback and serial communications. The ferrite is to be placed on each cable just before the cables exit the enclosure (required if cables/signals exit enclosure). (CISPR)
- Add non-polarized capacitors from each AC line to ground. Capacitors are to be located at the line side of the line filter; **4700 pF "Y" caps** to the AC line at the filter input, one from each phase to ground. (CISPR)
- Add common mode choke (**Fair-Rite P/N 5977011101**) with three pass to the motors power cable at the drive. (CISPR)
- The motors power cable shield must be grounded via a P-Clamp to the distribution panel. The motors power cable shield and motor body must also be grounded to PE at the motor end.

Required components					
Vendor	**Part Number**	**Description**	**Outside Diameter**	**Inside Diameter**	**Length**
Fair-Rite	5977011101	Toroid, common mode choke	2.9 inch (75mm)	1.5 inch (39 mm)	0.5 inch (12.7 mm)
Evox Rifa	PHE830MD6330M	Cap, EMI supressor	-	-	-
Schaffner	FN351-25/33	Line Filter, Three Phase, 25 A	-	-	-
Fair-Rite	2643803802	Ferrite, Shield Bead	2.4 inch (61mm)	1.4 inch (36 mm)	0.5 inch (12.7 mm)
Fair-Rite	443167251	Ferrite	0.87 inch (22 mm)	0.4 inch (10.2 mm)	1.27 inch (32.3 mm)

Fair-Rite Products Corporation USA 914-895-2055
Schaffner EMC Inc. USA 201-379-7778

CE Declaration of Conformity

This is to certify that:

Pacific Scientific
110 Fordham Road
Wilmington, MA 01887 USA

Declares that the product(s):

Designation *DIGITAL SERVO DRIVE*

Type PC3400xxAy-001-z,

Where:		
	xx	= 03, 06, 10, 20
	001	= factory customization code
	y	= d or I
	z	= E, EI, R, RI

comply with the following relevant regulation:

CE Guideline	*73/23/EEC*	*Low Voltage Directive*
Applied harmonized standards:		pr EN 50178
CE Guideline	*89/336/EEC*	*EMC Directive*
Applied harmonized standards:	EN 50081-2: 1993, EN 50082-1: 1991	

Issued By: Pacific Scientific
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