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HIGH PERFORMANCE SERVO DRIVES



- PC800 Series Drives
  - CE Compliant
  - 90-264V ac Input Voltage
  - 5.3, 10.6, 21.2 A_{RMS} Peak, 2.7, 3.6, 7.1 A_{RMS} Continuous
  - Up to 3,000 Watts Continuous Shaft Power
- PC3400 Series Drives
  - CE ccompliant
  - AC and DC Models
  - 5-40 A_{RMS} Peak, 2.5-20 A_{RMS} Continuous
  - Up to 7,600 Watts Continuous Shaft Power
- SC900 Series Drives
  - 90-264V ac Input Voltage
  - 5.3-42.4 A_{RMS} Peak, 2.7-21.2 A_{RMS} Continuous
  - Up to 6,750 Watts Continuous Shaft Power
- SCE900 Series Drives
  - CE Compliant
  - 180-528V ac Input Voltage
  - 5.3-33.7 A_{RMS} Peak, 2.7-22.5 A_{RMS} Continuous
  - Up to 15,000 Watts Continuous Shaft Power

October, 2001

PACIFIC SCIENTIFIC

Danaher MOTION

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PACIFIC SCIENTIFIC BRUSHLESS SERVO DRIVE FAMILY



Introducing the PC3400 Family of Drives

The PC3400 Series brushless servo drives are the intelligent, easy-to-use cost-effective servos from the leaders in service and support. With both AC and DC powered models, covering five output power levels, these compact drives bring sophisticated and powerful motion control in a compact package. ToolPAC, the Windows®-based development software utility uses intuitive commands to point and click your way to a successful motion program. ToolPAC also works to program the PD2400 intelligent stepper drives, yielding more flexibility for solving your motion challenges.



The PC800 Family of Drives

The PC800 digital brushless servo drives are the drives you've been asking for — the cost-effective, small servos with the best lead time in the industry. 40% smaller than the 900 series, with three power levels and multiple command interfaces including preset motion indexing and SERCOS, the PC800 offers a great value for your drive investment — and all available for shipment within



days. Add rugged, PLC-like optically-isolated I/O and you'll see why this next generation of drives from the people who originated the all-digital servo drive is right for you.

Servo Systems with Powerful Modular Connectivity

The modular high performance systems from Pacific Scientific match drives selected from a range of power levels. Plug-in control option cards add exactly the functionality you need.

The Digital Solution

The SC900 Series is a family of all-digital servo drives that uses a single DSP, like the PC800, to close the current, velocity and position loops. All system and application parameters are set digitally to ensure repeatability and eliminate drift. The SC900 Series is available in four power levels, all with integral power supplies and shunt regulators.

The SCE900 Family of Drives

We've added the CE mark and the capability to operate at a range of voltages suitable for use anywhere on the globe to our SC900 family of high performance servo drives. No other drive offers higher performance. No other drive offers broader functionality.



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PC800, SC/SCE900 DRIVES FEATURES & BENEFITS

With five power levels you can choose the drive to suit your application — wherever it may wind up.

PacSci Motors Complete the Package

The PMA Series of brushless servomotors delivers a comprehensive line of rugged, cost-effective servomotors. Covering frame sizes from 55mm to 190mm square and a continuous rated torque range of 0.21 to 48.5 Nm, these motors offer an economic means to satisfy the requirements of your application.

The PMB Series of brushless servomotors introduces an IP40 construction motor in three frames; size 17 and NEMA 23 & 34 to address your need for a high-performance motor in higher volume applications. With a continuous rated torque range from 0.22 to 1.40 Nm, the cost-effective PMB motors complement our full line of servos.

The S Series brushless servomotors offer continuous torques from 0.5 to 6.6 Nm. Available in two frame sizes with both metric and NEMA 23 & 34 mounting faces, these compact motors squeeze a lot of torque into a small package.

Smart technology. Motion simplified.

These systems are a prime example of Pacific Scientific's commitment to offer you smart technology — the highest performance products available, customized to suit your applications and backed by unmatched customer support and quality. We want to help make your job easier. For more information contact our Customer Response Center at (815) 226-3100, or visit our website at www.pacsci.com.

FEATURES	BENEFITS
PC800, SC/SCE900 Drives	
Patented Digital Resolver to Digital Converter (DRDC) • 24-bit resolution	Delivers ultra smooth operation at low speeds
Signature Current Control • Matches drive commutation to motor Back EMF	Provides low torque ripple at all speeds
Fully Digital System • No manual adjustments	Configure drive in seconds via PC utility or option card
Advanced anti-resonance filters	Tune complicated mechanical systems easily
Resolver Feedback • Simple rugged magnetic structure	More reliable than encoders
PC3400 Drives	
DC and AC-powered units available	DC units more compact for the user who already has a power supply
ToolPAC software can be used to program PD2400 intelligent stepper drives as well	Cross-platform motion application flexibility
Optional extended I/O card adds more optically isolated I/O to an already generous complement	Heightened programming options
PC800 Drives	
Command interfaces include preset index moves by a standard, built-in profile generator	Enhanced application flexibility
Optically isolated, PLC-like I/O	Rugged construction minimizes drive damage
Digital oscilloscope within PC830 Tools,™ software utility	Set-up and tuning greatly simplified
SERCOS connectivity available with new SERCON816 ASIC	Noise-immune networking available at speeds up to 16 kHz
SC/SCE900 Drives	
Programmable single-axis controller • Electronic Cams • 21 Bi-directional I/O • Local Area Network • A-B DF1 Interface • Modbus Interface • Opto22 Interface	Replaces Mechanical Cams Replaces need for mini PLC High speed LAN to PCs Allen-Bradley PLC link Modicon PLC link Direct interface to industry accepted I/O
SERCOS Option Card • Distributed, noise immune architecture	Reduces wiring costs through fiber optic communications
PC connectivity • DLLs for Win95/98 & WinNT • DDE server for WinNT	Simplifies communication to PCs
SCE900	
CE compliant drives 180-528V ac Input Voltage	Global acceptance, eliminates cost for isolation transformer



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INDEX

How to use this selection guide

The table of contents to the right will help you find more information on each drive family. Use the selection overview on page 3 to identify motors available to fit your drive system voltage, torque and speed requirements. Detailed system combinations with ratings are shown on pages 30 - 35.

Information on the Pacific Scientific motors mentioned on the following pages can be found in the Pacific Scientific publication "High Performance Servo Motors." A copy of this publication can be obtained by calling Pacific Scientific, or you can get one by visiting our website at www.pacsci.com.

- If you are already familiar with these drives and their available options, refer to the Model Number Codes on pages 4, 10, 14 and 24 to verify coded information prior to ordering.
- If you are not familiar with these drives and their available options, refer to the index at the right. Note that each drive family is covered individually and the technical data applies to all drives. Construct a model number after all the technical parameters, including options, are determined.

Our sizing and selection program, Optimizer 3.0 can be helpful in determining the correct motor for your application. Input the parameters for your specific application and specify your drive voltage, current and output type and Optimizer will find the motors that fit the bill. Ask for your copy today.

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SELECTION OVERVIEW

Suitable System Drive Motor Combinations — See Performance Data beginning on page 31

Voltage, Drive, Architecture	Drive Model	Motor Model									
		PMA1	PMA2	PMA4	PMA5	PMA6	PMB1	PMB2	PMB3	S20	S30
18-74V dc bus, stand-alone intelligent drive with serial communications	PC3402D	—	—	—	—	—	●	—	—	—	—
	PC3405D	—	—	—	—	—	●	●	—	—	—
240V ac, 320V dc bus, stand-alone intelligent drive with serial communications	PC3403A	●	●	●	—	—	●	●	●	●	●
	PC3406A	—	●	●	●	—	—	—	●	●	●
	PC3410A	—	—	●	●	—	—	—	●	—	●
	PC3420A	—	—	—	●	●	—	—	—	—	—
240V ac, 320V dc bus, stand-alone drive with serial communications or SERCOS	PC8x2	●	●	●	—	—	●	●	●	●	●
	PC8x3	—	●	●	—	—	—	●	●	●	●
	PC8x4	—	●	●	●	—	—	—	●	●	●
240V ac, 320V dc bus, modular drive with removable option card upgrade path	SC/SCE9x2	●	●	●	—	—	●	●	●	●	●
	SC9x3	—	●	●	—	—	—	●	●	●	●
	SC9x4	—	—	●	●	—	—	—	●	—	●
	SC9x5	—	—	—	●	●	—	—	—	—	—
400V ac, 560V dc bus, modular drive with removable option card upgrade path	SCE9x3	—	—	●	—	—	—	—	—	—	●
	SCE9x4	—	—	●	●	—	—	—	—	—	—
	SCE9x5	—	—	—	●	●	—	—	—	—	—
	SCE9x6	—	—	—	—	●	—	—	—	—	—
480V ac, 640V dc bus, modular drive with removable option card upgrade path	SCE9x3	—	—	●	—	—	—	—	—	—	●
	SCE9x4	—	—	●	●	—	—	—	—	—	—
	SCE9x5	—	—	—	●	●	—	—	—	—	—
	SCE9x6	—	—	—	—	●	—	—	—	—	—

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P C 34XX D i - 0 0 1 - X X

Pacific Scientific

Servo Drives

Drive Family/RMS Current Rating

02 = 2.5A_{RMS} cont., 5A_{RMS} peak①
03 = 3.0A_{RMS} cont., 6A_{RMS} peak①
05 = 5.0A_{RMS} cont., 10A_{RMS} peak①
06 = 6.0A_{RMS} cont., 12A_{RMS} peak①
10 = 10.0A_{RMS} cont., 20A_{RMS} peak①
20 = 20.0A_{RMS} cont., 40A_{RMS} peak①

Input Voltage

D = DC Input Voltage
A = AC Input Voltage

Controller Type

d = Digital
i = Intelligent

Factory Preassigned

Standard Options

R = Resolver Feedback③
E = Encoder Feedback
RI = Resolver Feedback with extended I/O③
EI = Encoder Feedback with extended I/0

NOTES:
① DC Input drives only.
② AC Input drives only.
③ Resolver Feedback option on AC input voltage drives only.

Accessories

Part Number	Description
MA3400A	Hardware installation manual for PC34xxA drives
MA3400D	Hardware installation manual for PC34xxD drives
MAToolPac	ToolPac reference manual with ToolPAC CD
PRK-0160-47	Regen resistor kit for PC3403/06/10
PRK-0180-26	Regen resistor kit for PC3402/05
PRK-0200-10	Regen resistor kit for PC3420
SK-340xA	Connector ship kit for PC3403/06A drives
SK-340xA-1	Connector ship kit for PC3403/06A drives with extended I/O
SK-34xxA	Connector ship kit for PC3410/20A drives
SK-34xxA-1	Connector ship kit for PC3410/20A drives with extended I/O
SK-34xxD	Connector ship kit for PC3402/05D drives
SK-34xxD-1	Connector ship kit for PC3402/05D drives with extended I/O
PTK-3MD-001	Hand crimping tool set, MOLEX 3mm
PCA-MM24-006	Digital I/O cable — drive end-to-flying leads — 6 ft.
PCA-MM18-006	Extended digital output cable — drive end-to-flying leads — 6 ft.
PCA-MM20-006	Extended digital input cable — drive end-to-flying leads — 6 ft.
PCA-MM14-010	Feedback cable — drive end-to-flying leads — 10 ft.
PCA-MM14-025	Feedback cable — drive end-to-flying leads — 25 ft.
PCA-MM14-050	Feedback cable — drive end-to-flying leads — 50 ft.
PDK3400-120	120V ac demo kit for PC3400, PD2400 Series

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PC3400 SERIES OVERVIEW



0.21 kW to 6.8 kW continuous power

0.43 kW, 13.6 kW peak power

Performance Features

- All-digital operation for increased reliability, reduced cost.
- Space-Vector Modulation advanced algorithm for motor control
- Standard analog and digital interfaces
  - –Internal through multiple stored programs
  - –Digital through RS-232/485 interface
  - –Analog ±10V interface – velocity or torque control
  - –Step commands via step/direction, step up/down or encoder following, either single ended or differential
- Windows®-based ToolPAC configuration and programming software aids set-up
  - –Powerful digital oscilloscope feature displays drive function graphically
  - –Motion programming simplified to point and click commands
  - –Axis Set-up Wizard makes configuration process easy
  - –Tuning Wizard aids system tuning — parameters are intuitive and easy to adjust
- AC models contain on-board power supply
  - –Separate logic supply input keeps logic power working when bus power is disconnected
- Inaudible, high-frequency digital PWM sine wave current control
- Extensive protection circuitry
- Seven-segment display shows diagnostic and status information

Typical Applications

- Electronic assembly equipment
- Semiconductor wafer processing equipment
- Material handling
- Robotics
- X-Y tables and slides
- Packaging machinery
- Specialty machinery

Product Description

The PC3400 Series is the latest addition in next-generation all-digital servo drives for Pacific Scientific. Available in both AC-powered and DC versions, the drives are a cost-effective, easy-to-use, family of intelligent servo drives from the leaders in service and support. The intelligent model is a fully programmable drive that replaces a motion controller in applications using complex moves and electronic camming or gearing. The digital model accepts step and direction, analog or encoder signals. Both models feature our proprietary Space-Vector Modulation advanced algorithm for motor control. RS-232/485 communications allow easy programming using a PC or drop communication during operation for up to 32 drive nodes.

ToolPAC

ToolPAC is the Windows®-based configuration and development utility. The software works with both PC3400 family servo drives and PD2400 Series stepper drives. Powerful full motion programming is easy to achieve using point-and-click commands.

I/O

- Two analog inputs: programmable ±10V, differential, 14-bits, 20 kΩ
- Five digital inputs: programmable, 4.5 - 26.5V, 6.5 kΩ source or sink (optically-isolated)
- Two digital high-speed inputs: programmable, 5V, 499Ω (<1 µsec response)
- One digital registration input: programmable, 5V, 499Ω (<1 µsec response)
- Two digital outputs: programmable plus current feedback indicator, 26.5V dc maximum supply, 30 mA maximum source or sink (optically isolated)
- Drive OK/brake output: 100V dc maximum supply, 1A maximum (relay)
- Encoder output: A, B, Z channels

In addition, each PC3400 drive accepts the "I"-option extended I/O card, which adds 16 additional inputs and 8 additional outputs.

Protection/Diagnostics

- Short-circuit protection: phase-to-phase, phase-to-common
- Overvoltage protection
- Undervoltage protection
- Overtemperature protection
- Feedback loss indication
- Position error indication
- Overspeed indication
- Current foldback circuit
- Regen management circuit

Agency Approval

- UL recognized – 508C (Type R) – file #E183999
- DC models UL pending
- cUR
- CE Compliant

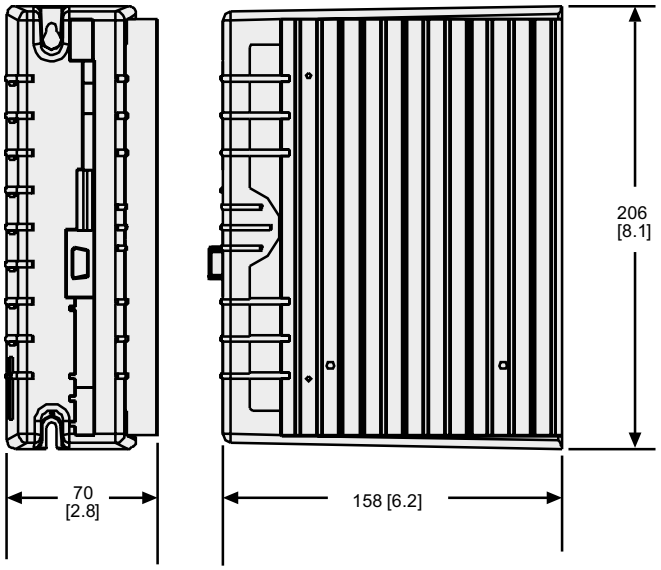
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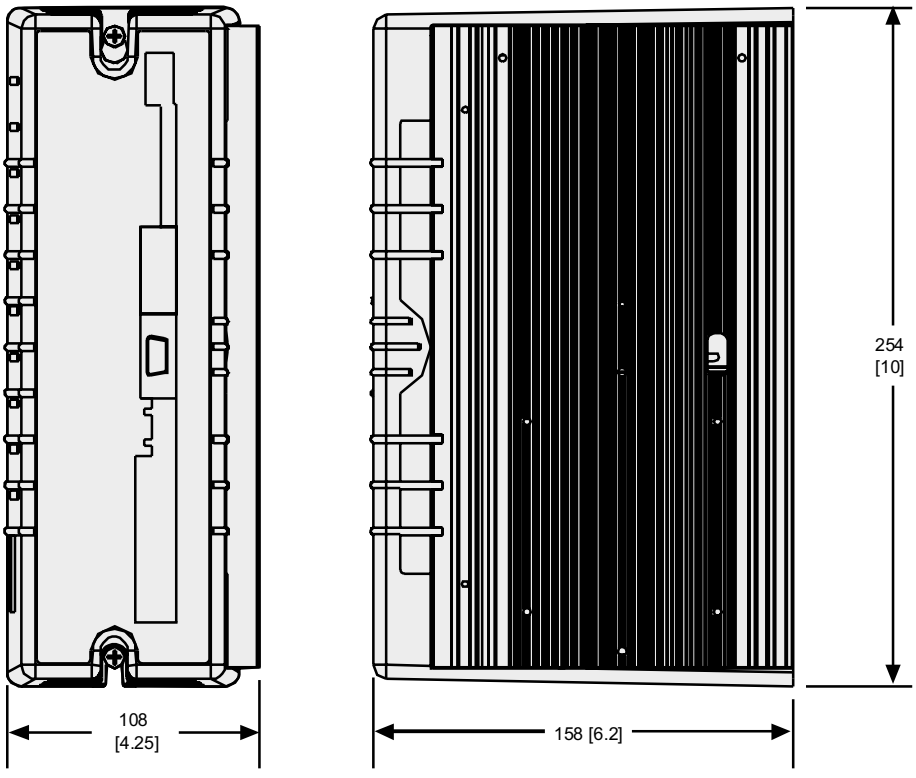
PC3400 SERIES DIGITAL DRIVES DIMENSIONS

PC3400 SERIES SERVO DRIVES dimensions mm (in.)

PC3403A, PC3406A

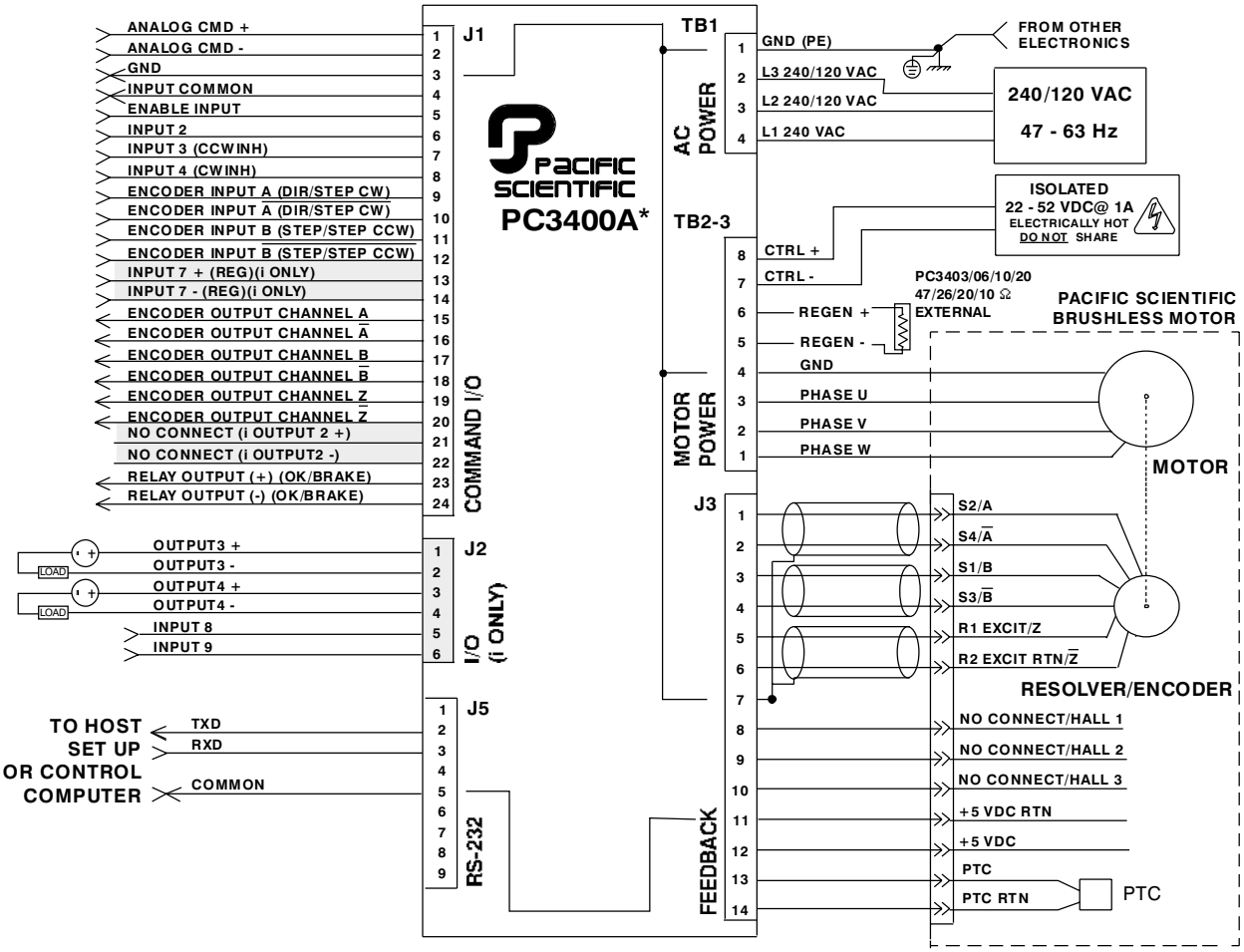


PC3410A, PC3420A



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Connection Diagram



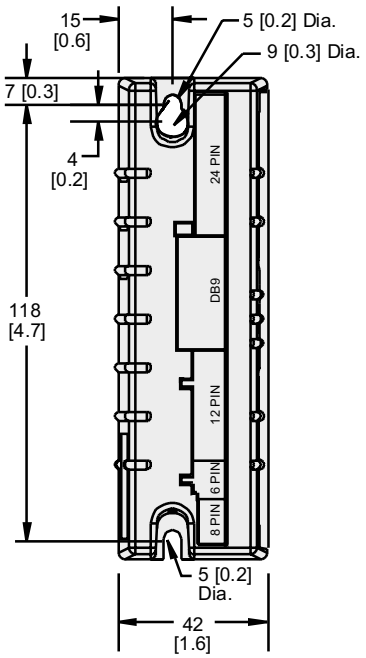
* Pinout for AC input drives shown for reference. Contact Pacific Scientific for DC model connections.

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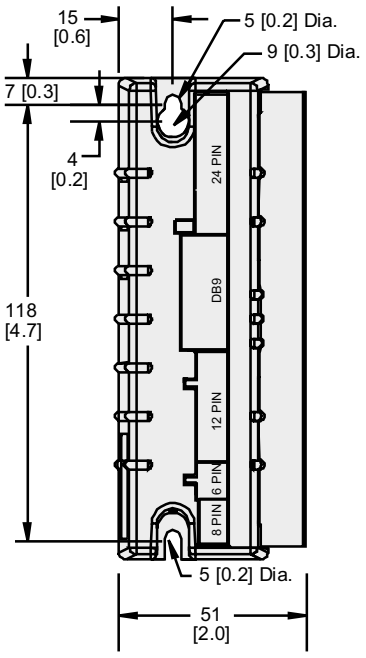
PC3400 SERIES DIGITAL DRIVES DIMENSIONS

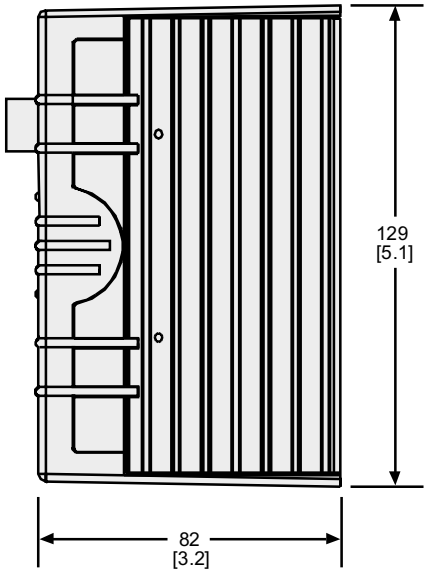
PC3400 SERIES SERVO DRIVES dimensions mm (in.)

PC3402D



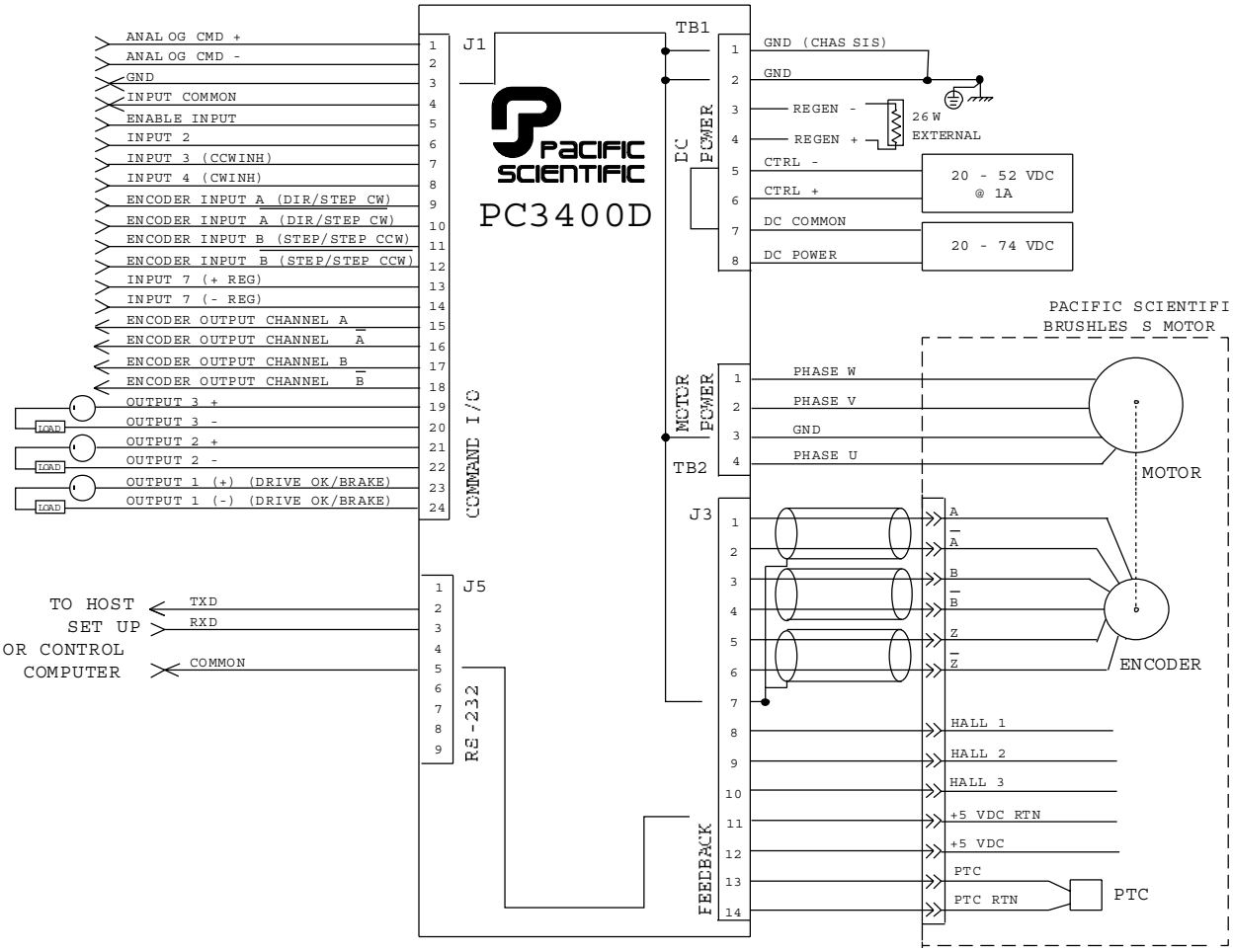
PC3405D





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Connection Diagram



Schematic shown for i (Intelligent) model drive. For information on d model (Digital) contact the factory or consult **www.pacsci.com.**

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PC800 SERIES



P C 8 X X - 0 0 1 - X

Pacific Scientific Servo Drive Family Designation

Interface Designation

3 = RS-232/485, ±10V dc Step/Dir. Preset Indexing
4 = SERCOS Interface

Power Level

2 = 2.7A_{RMS} cont. @ 25-40°C, 5.3A_{RMS} Peak
3 = 3.6A_{RMS} cont. @ 25-40°C, 10.6A_{RMS} Peak
4 = 7.1A_{RMS} cont. @ 25-40°C, 21.2A_{RMS} Peak

Accessories

N = No Accessories
A = D-sub Connector Kit
T = Terminal Board Adapter Connector Kit
F = Terminal Block Adapter and D-sub for Feedback①

Customization Code

001 = Standard Unit
XYZ = Factory Assigned Hardware Customization

NOTES:
① Available only with PC840 models.

Accesories

Part Number	Description
CA-800	D-sub connector kit
CA-800-FB	15-pin D-sub connector for feedback
CA-800-TB	Terminal block adapter connector kit
MA830②	User manual, PC830 models
MA840②	User manual, PC840 models
830Tools™ ②	830 configuration software on 3-1/2" diskettes
830Tools™ -CD②	830 configuration software on CD-ROM
PFK-120	120V ac fan kit (mounts remotely from drive, N/A for PC832)
PFK-240	240V ac fan kit (mounts remotely from drive, N/A for PC832)
PRK-200	Regen assembly (200W resistor with 2' cable)
PDK-833-120	Demo kit with 120V ac cord
PDK-833-240	Demo kit with 240V ac cord
PFW830-N	Firmware upgrade kit without insertion tool
PFW830-T	Firmware upgrade kit with insertion tool

② Available for download from Pacific Scientific web site at no charge.

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PC800 SERIES OVERVIEW



1.1 kW, 1.5 kW or 3.0 kW continuous power

2.25 kW, 4.5 kW or 9 kW peak power

Performance Features

- All-digital DSP–based
- Standard analog and digital interfaces
  - – Step/Direction Digital interface–position or velocity control
  - – Preset moves using an internal profile generator
  - – ±10V Analog interface–velocity or torque control
  - – Quadrature Encoder Digital interface–electronic gearing follower
- RS-232/485 serial interface
- Windows®-based PC830 Tools configuration software simplifies set-up
  - – Powerful digital oscilloscope feature quickly shows drive function graphically
  - – Intuitive parameter configuration — be up and running in minutes
  - – Digital auto-tuning — no pots to tweak
  - – All system and application parameters are set in software and can be saved in EEPROM
  - – Automated diagnostic routine greatly speeds troubleshooting
- Rugged, PLC-like digital and analog I/O
  - – Six optically-isolated, user-configurable inputs
  - – Three optically-isolated, user-configurable outputs
  - – One relay output
- Single resolver feedback survives hostile environments
- Hall/Encoder feedback allows application flexibility
- Advanced tuning for reduced settling time
- Quadrature encoder outputs up to 16,384 PPR
- All connections on front — easy access to clearly marked connectors
- Optional Terminal Block Adapter speeds connections even further
- Separate logic supply input keeps logic power working when bus power is disconnected
- Extensive protection circuits and diagnostics to ease set-up
- 400 Hz velocity loop bandwidth
- Inaudible, high-frequency, Digital PWM sine wave current control
- IGBT Power stage — more efficient, less audible noise

When combined with Pacific Scientific's brushless servo motors, the PC800 Series drives provide continuous torques ranging from 0.21 to 12.4 Nm and peak torques from 1.4 to 33.3 Nm. Standard motor power and resolver feedback cables are available to complete your motion control system and provide reliable, trouble-free start-up and operation.

Typical Applications

- Packaging machinery
- Electronic assembly equipment
- Semiconductor wafer processing equipment
- Material handling
- Robotics
- X-Y tables and slides
- Specialty machinery

Product Description

The PC800 Series is the next generation of Pacific Scientific's all-digital brushless servo drives. They provide a cost-effective, high-performance alternative to previous generation drives in a package 40% smaller than equivalent older servos.

These drives use a single DSP to close the current, velocity, and position loops. All system and application parameters are set in software to insure repeatability and eliminate drift. The PC800 Series is available in two power levels, both with integral power supplies. The drives comply with the CE low-voltage directive without requiring additional isolation.

All PC800 drives include several command interface features. A standard ±10V analog interface is available to command motor torque or velocity. A standard step and direction interface is available to command motor position or velocity. An internal profile generator allows preset moves for incremental, absolute, homing or registration motion profiles.The drive can also be used in electronic gear following mode by using either quadrature encoder or step and direction inputs. Incremental moves can also be superimposed on electronic gearing moves.

RS-232/485 Serial Interface

This allows the user to program the various PC800 set-up parameters using an IBM-compatible PC and PC830 Tools configuration software. It also allows the PC800 to be connected to any host computer containing RS-232/485 communications capability.

Digital Resolver-To-Digital Conversion

The PC800 drives use the proven DRDC (Digital Resolver-to-Digital Converter) to provide 24-bit-per-revolution resolution for smooth, precise control (U.S. Patent 5,162,798) The PC800 also supports Hall sensor inputs for commutation, making it suitable for use with many popular linear motors

SERCOS

The PC840 family of drives offers open SERCOS connectivity using the new SERCON816 ASIC. Noise-immune network speeds of up to 16 kHz make real-time distributed motion control a reality, using many popular SERCOS multi-axis control schemes. More information on SERCOS is available on pages 25 – 29.

I/O

- Six optically-isolated inputs
- Three optically-isolated outputs
- One relay output, 30V dc @ 1A
- Differential ±10V analog input
- Single-end analog input, ±5V dc
- Two analog outputs, ±5V dc
- Encoder quadrature output
- Encoder quadrature input (Step/Direction)
- Enable input
- +5V dc @ 200 mA user output
- +24V dc @ 100 mA power supply for optically-isolated inputs

Protection/Diagnostics

- Dual LED display
- In-rush current limiting
- Control power fuse
- Output short circuit protection
- Overtemperature protection, motor and drive
- IT protection
- Under voltage protection
- Excessive regeneration protection

Agency Approval

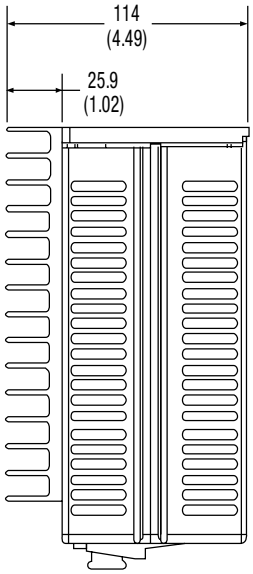
- UL recognized – 508C (Type R) – file #E137798
- cUL
- Meets IEC Vibration Standard, #68-2-6
- Models CE Compliant: EMC standard EB61800-3 and safety standard EN50178.

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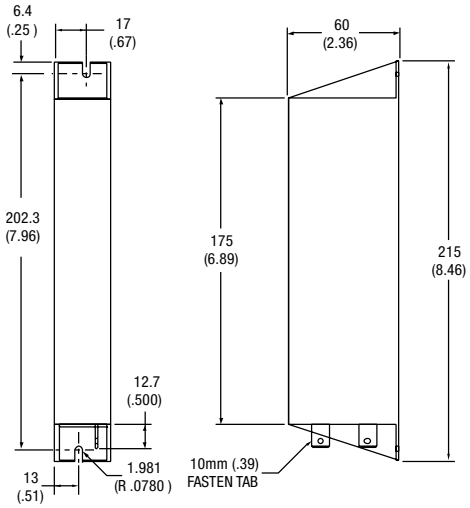
PC800 SERIES DIGITAL DRIVES DIMENSIONS

PC800 SERIES

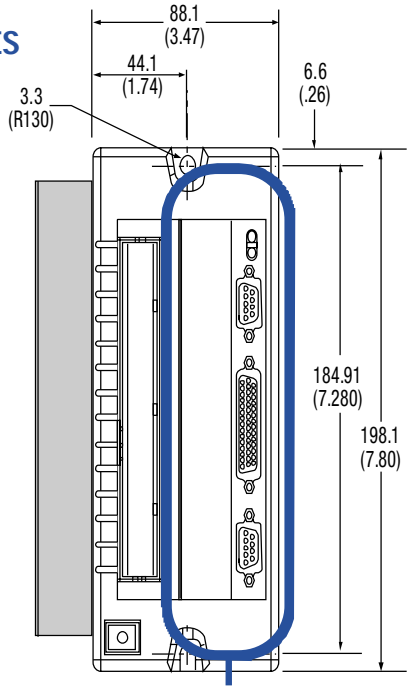
mm (in.)



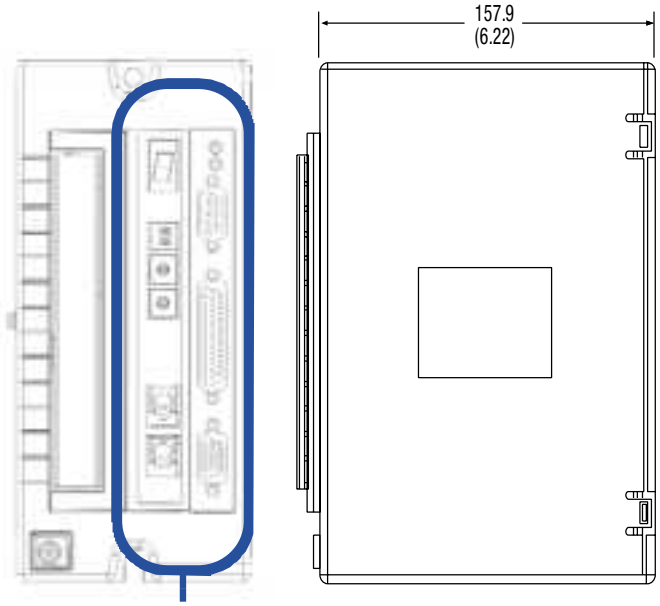
Regeneration Resistor*



PC830 SERIES

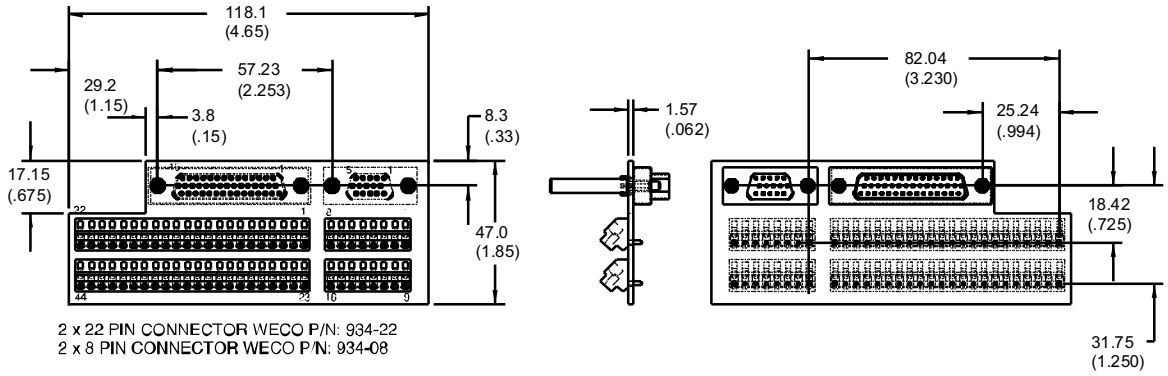


PC840 SERIES



Terminal Block Adaptor

mm (in.)

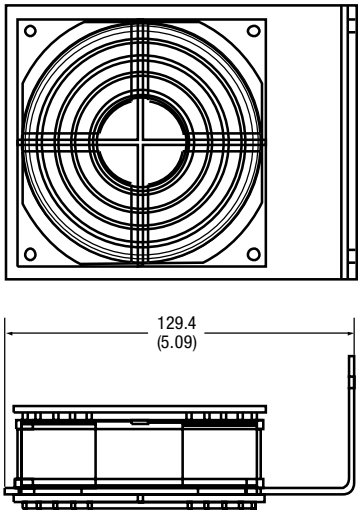


* Shown without electrical connection cable, see page 10 for more information.

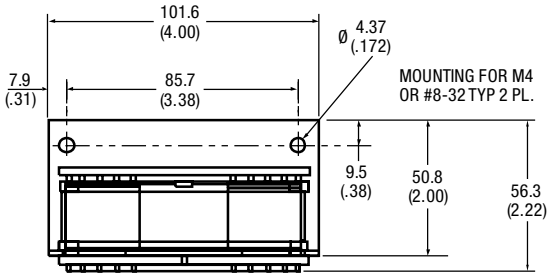
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PC800 SERIES

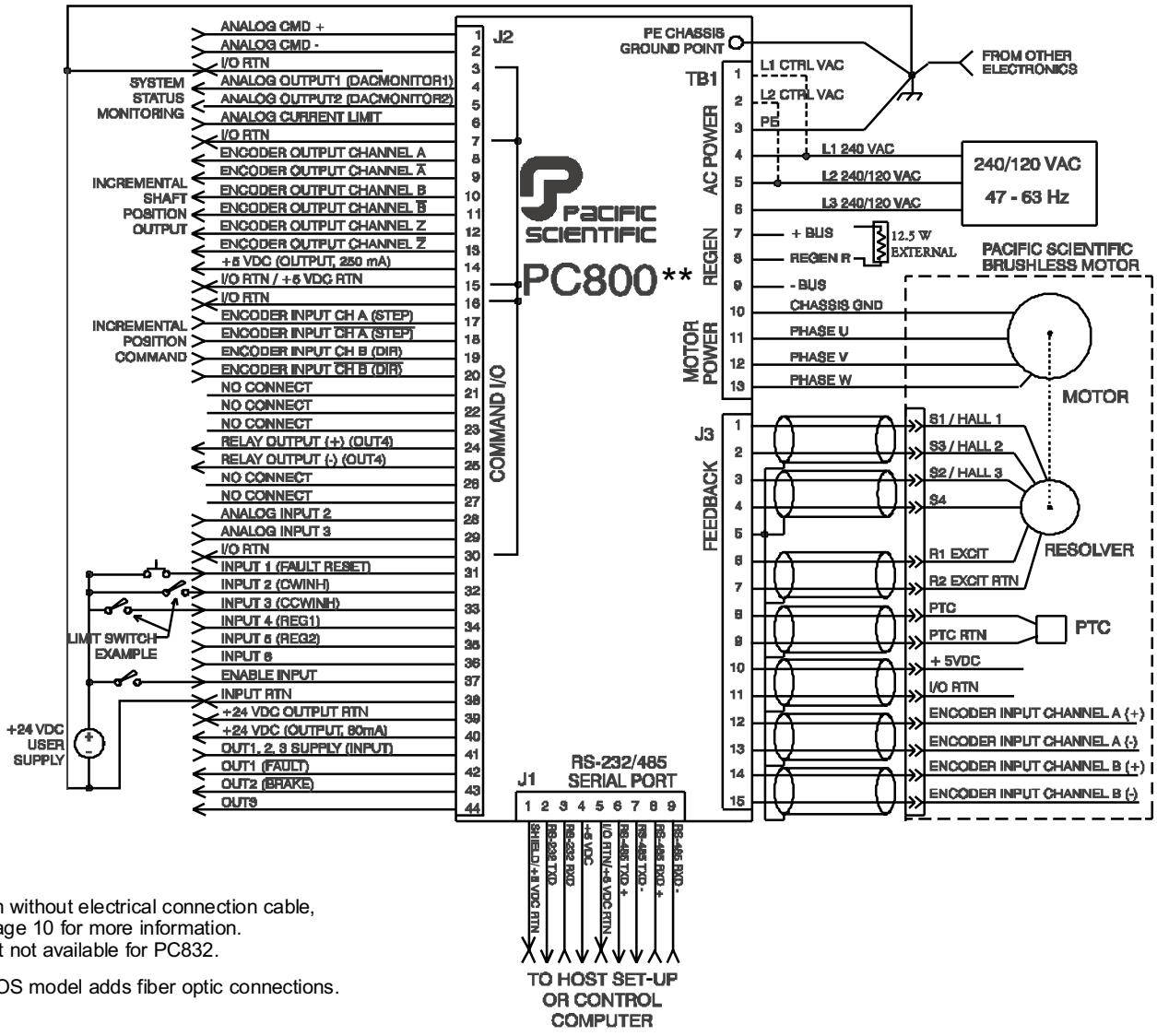
mm (in.)



Fan Kit Option*



Connection Diagram



* Shown without electrical connection cable, see page 10 for more information. Fan kit not available for PC832.

** SERCOS model adds fiber optic connections.

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SC9 0 3 N N - 001 - 01

Servo Drive Family Designation

Option Card Designator
- **0** = No option card installed
- **3** = OC930-001-00 Serial Port Option Card installed
- **4** = OC940-001-01 SERCOS Interface Option Card installed
- **5** = OC950-50X-01 Programmable Option Card installed
  (X – See Customization Code below)

Power Level②
- **2** = 5.3A peak, 2.7A continuous @ 25°C
- **3** = 10.6A peak, 5.3A continuous @ 25°C
- **4** = 21.2A peak, 10.6A continuous @ 25°C
- **5** = 42.4A peak, 21.2A continuous @ 50°C

Accessories Option
- **N** = No accessory kit
- **A** = Basic connector kit, manual(s)
- **T** = Terminal block adapter connector kit, manual(s)

Fan Kit Option
- **N** = No fan, convection cooled①
- **1** = 120V ac fan, forced air cooled①
- **2** = 240V ac fan, forced air cooled①

Customization Code, Factory assigned
- **001** = Standard Unit

NOTE: The following customization codes are only valid when ordering an SC950.
- **501** = OC950 32k×8 NV RAM, without PacLAN
- **502** = OC950 128k×8 NV RAM, without PacLAN
- **503** = OC950 32k×8 NV RAM, with PacLAN
- **504** = OC950 128k×8 NV RAM, with PacLAN

Firmware
- **01** = Standard base servo software

SCE9 0 3 N N - 001 - 01

Servo Drive Family Designation

Drive Type Digital Brushless Servo Drive (High Voltage, CE Compliant)③

Option Card Designator
- **0** = No option card installed
- **3** = OCE930-001-00 Serial Port Option Card installed
- **4** = OCE940-001-01 SERCOS Interface Option Card installed
- **5** = OCE950-50X-01 Programmable Option Card installed
  (X – See Customization Code below)

Power Level②
- **2** = 5.3A peak, 2.7A continuous @ 25°C①
- **3** = 7.5A peak, 3.8A continuous @ 25°C
- **4** = 15.0A peak, 7.5A continuous @ 25°C
- **5** = 22.5A peak, 11.3A continuous @ 25°C
- **6** = 33.8A peak, 22.5A continuous @ 25°C

Accessories Option
- **N** = No accessory kit
- **A** = Basic connector kit, manual(s)
- **T** = Terminal block adapter connector kit, manual(s)

Fan Kit Option
- **N** = No fan, convection cooled①
- **1** = 120V ac fan, forced air cooled①
- **2** = 240V ac fan, forced air cooled①

Customization Code, Factory assigned
- **001** = Standard Unit

NOTE: The following customization codes are only valid when ordering an SC950.
- **501** = OCE950 32k×8 NV RAM, without PacLAN
- **502** = OCE950 128k×8 NV RAM, without PacLAN
- **503** = OCE950 32k×8 NV RAM, with PacLAN
- **504** = OCE950 128k×8 NV RAM, with PacLAN
- **601** = OCE950 32k×8 NV RAM, without PacLAN
- **602** = OCE950 128k×8 NV RAM, without PacLAN
- **603** = OCE950 32k×8 NV RAM, with PacLAN③
- **604** = OCE950 128k×8 NV RAM, with PacLAN③

Firmware
- **01** = Standard base servo software

① "N" mandatory for SCE906, SC905 — fan built-in, not optional.
② SCE902 for operation at 240V ac max only.
③ Enhanced firmware version.
④ A_{RMS}.

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SC/SCE900 SERIES DIGITAL DRIVES

SC900 Controllers are UL Recognized (File E137798)

SCE900 Controllers are CE Compliant

0.85 kW to 18 kW continuous power

1.7 kW to 27 kW peak power

Performance Features

- All-digital DSP–based
- Standard analog and digital interfaces
  - ± 10V Analog interface–velocity or torque control
  - Step/Direction Digital interface–position or velocity control
  - Step Up/Step Down interface–position or velocity control
  - uadrature Encoder Digital interface–electronic gearing follower
- Removable option cards for flexibility
  - RS-232/485 serial interface
  - SERCOS multi-axis fiber optic interface
  - Expanded I/O
  - Field firmware upgrade
- Personality parameters in base drive or on removable option card (EEPROM)
- Digital auto-tuning for easy set-up–no pots to tweak
- All system and application parameters are set in software and can be saved in EEPROM
- Single resolver feedback survives hostile environments
- Optional incremental encoder available for position feedback and/or commutation
- Quadrature encoder outputs up to 16,384 PPR
- Digital and analog I/O
- All connections on front—easy access to clearly marked connectors
- Extensive protection circuits and diagnostics to ease set-up
- Inaudible, high frequency, Digital PWM sine wave current control
- Autotuning automatically sets system parameters - no instruments required
- IGBT Power stage - more efficient, less audible noise

When combined with Pacific Scientific's brushless servo motors, the SC/SCE900 Series drives provide continuous torques ranging from 0.21 to 48.5 Nm and peak torques from 1.4 to 103 Nm. Standard motor power and resolver feedback cables are available to complete your motion control system and provide reliable, trouble-free startup and operation.

Typical Applications

- Packaging machinery
- Electronic assembly equipment
- Material handling
- Robotics
- X-Y tables and slides
- Specialty machinery
- Multi-axis systems
- Semiconductor wafer processing equipment

Product Description

The Pacific Scientific SC/SCE900 Series is a family of advanced digital servo drives. These drives utilize a single DSP to close the current, velocity, and position loops. All system and application parameters are set in software to insure repeatability and eliminate drift. The SC/SCE900 Series is available in several power levels, all with integral power supplies and shunt regulators.

The base SC/SCE900 unit includes several command interface features. A standard ±10V analog interface is available to command motor torque or velocity. Two standard stepper interfaces, step/direction and Step Up/Step Down, are also available to command motor position or velocity. The drive can also be used in electronic gear following mode by using the quadrature encoder input.

Various option cards are available to increase the functionality of the base drive. The option card is required to set the base SC/SCE900 parameters, but can be removed once set-up is complete. All option cards have the capability to replace the base drive's personality parameter non-volatile storage and provide removable personality parameter storage. The option cards also allow SC/SCE900 firmware upgrades, which eliminate the need to disassemble equipment or the drive when upgrading.

RS-232/485 Serial Interface OC930 Option Card

This card allows the user to program the various SC/SCE900 set-up parameters using an IBM-compatible PC. It also allows the SC900 to be connected to any host computer containing RS-232/485 communications capability. See page 25 for more details.

SERCOS Interface OC940 Option Card

This card adds SERCOS (SErial Real-time COmmunications System) fiber optic communication capability to the SC/SCE900. See pages 25, 26 for more details.

Programmable single-axis Position Control OC950 Option Card

This card allows the user to program the option card to increase functionality of the base drive. See page 26 for more details.

Digital Resolver-To-Digital Conversion

A patented Digital Resolver-to-Digital Converter called DRDC provides industry leading 24-bit-per-revolution position resolution. This very high position resolution yields an all digital velocity control with smoothness indistinguishable from an all analog control. U.S. Patent 5,162,798.

Signature Current Control

The SC/SCE900 Series utilizes signature control, a proprietary form of brushless motor sinusoidal commutation. This current control technique significantly reduces ripple torques due to harmonics in the motor's back EMF wave form. By tailoring the sinusoidal current's wave shape or "signature" to match the motor's back EMF, electro-magnetic ripple torque is reduced to ±2% or less. In your application, this results in excellent machine precision and smoothness with high throughput capability. This proprietary commutation control also provides exceptional high-speed motor control.

Full Digital Control

The combination of DSP, DRDC, and ASICs (Application Specific Integrated Circuits) give the SC/SCE900 its all digital advantage. An all digital implementation reduces component count to increase reliability while reducing cost, eliminating analog drift, eliminating imprecise potentiometer adjustments, reducing size, and increasing flexibility.

I/O

- Differential ±10V analog input
- Two ±5V analog outputs
- Six Bi-directional input/outputs, TTL or 24V logic compatible
- Encoder quadrature output
- Encoder quadrature input (Step/Direction, Step Up/Step Down)
- Enable input
- +5V dc @ 200 mA user output

Protection/Diagnostics

- Seven-segment status display
- In-rush current limiting
- Control Power Fuse
- Output short circuit protection
- Overtemperature protection, motor and drive
- IT protection
- Under voltage protection
- Excessive regeneration protection

Agency Approval

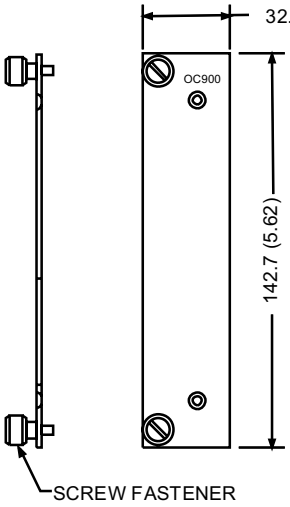
- UL recognized – 508C (Type R) – file #E137798
- Meets CSA Standard, C22.2 #142-M1987
- Meets IEC Vibration Standard, #68-2-6
- SCE900 Models CE Compliant

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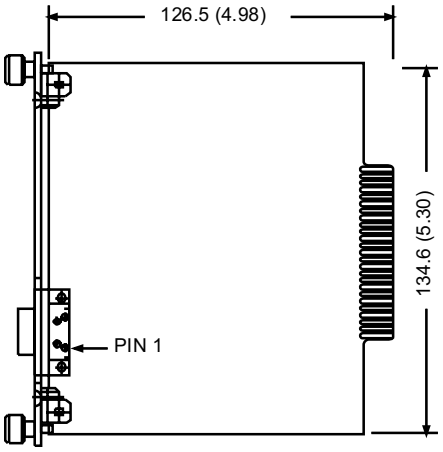
SC900 SERIES OPTIONS

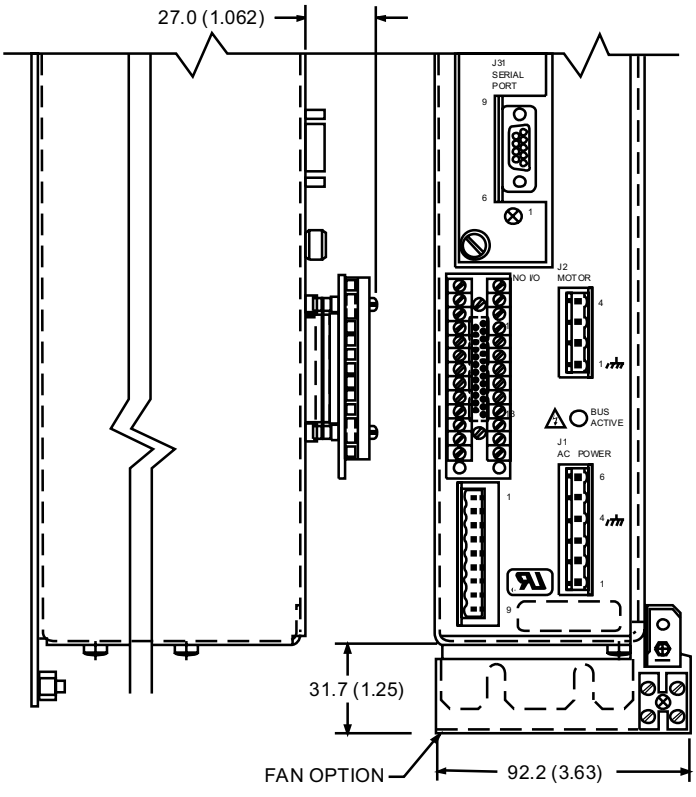
mm (in.)

OCE900 BLANK PANEL
*NOTE: All option cards share same dimensions

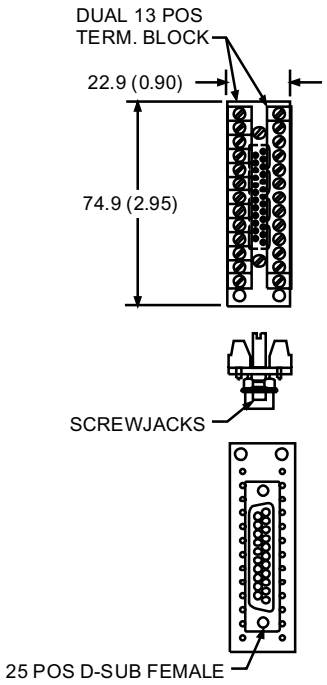


0CE930 OPTION CARD
*NOTE: All option cards share same dimensions





TERMINAL BLOCK ADAPTER



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SC/SCE900 SERIES DIGITAL DRIVES DIMENSIONS

SC902, 903 and 904 / SCE902, 903, 904 and 905

mm (in.)

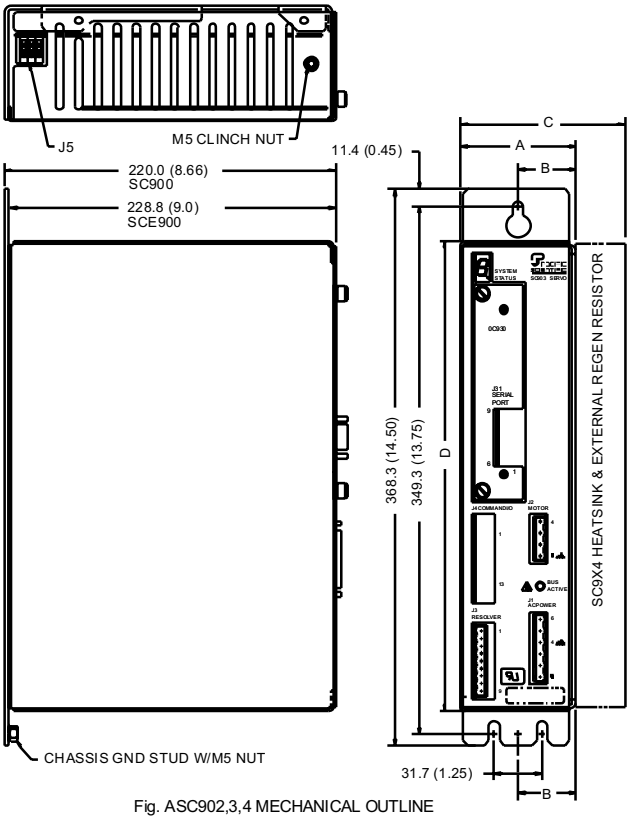
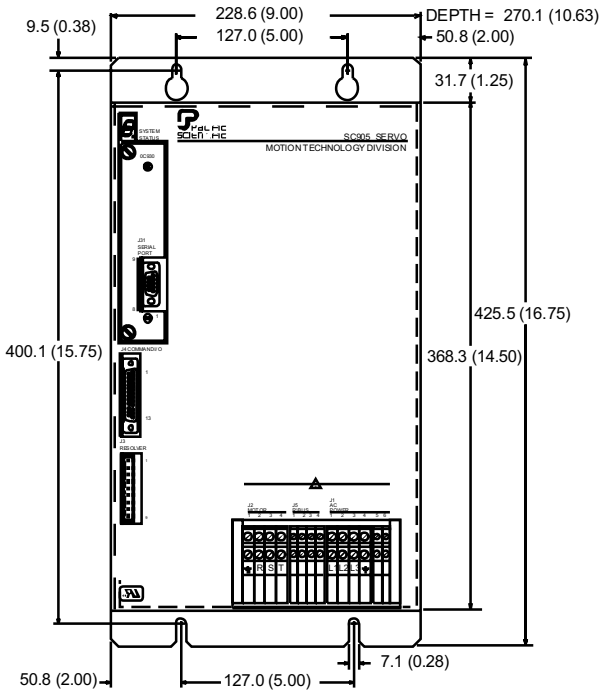


Fig. ASC902,3,4 MECHANICAL OUTLINE

DIMENSIONS LEGEND mm (in.)				
MODEL	A	B	C	D
SC9x2	57.2 (2.25)	28.6 (1.12)	N/A	312.0 (12.3)
SC9x3	82.67 (3.25)	44.45 (1.75)	N/A	312.0 (12.3)
SC9x4	81.4 (3.20)	40.6 (1.60)	114.8 (4.52)	312.0 (12.3)
SCE9x2	57.2 (2.25)	28.6 (1.12)	N/A	309.4 (12.2)
SCE9x3	84.0 (3.31)	45.5 (1.79)	85.0 (3.35)	309.4 (12.2)
SCE9x4	84.0 (3.31)	45.5 (1.79)	116.5 (4.6)	309.4 (12.2)
SCE9x5	84.0 (3.31)	45.5 (1.79)	159.5 (6.3)	309.4 (12.2)

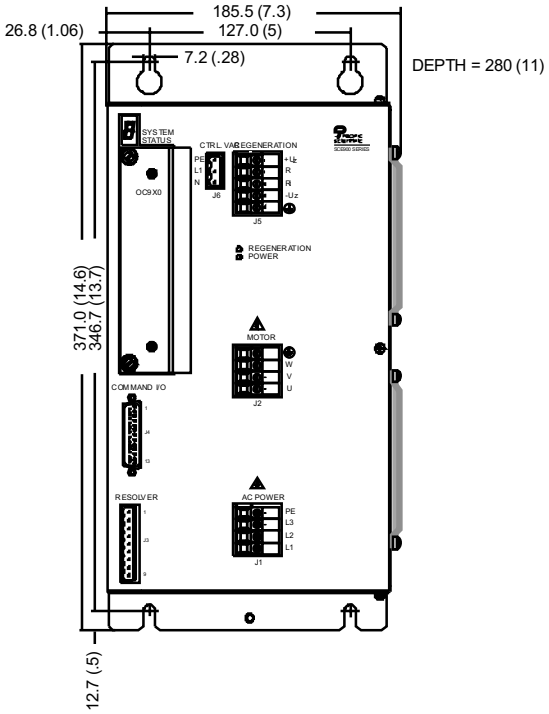
SC905

mm (inches)



SCE906

mm (inches)



SC/SCE900 SERIES

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PC3400 SERIES POWER DATA

	PC3403A	PC3406A	PC3410A	PC3420A	PC3402D	PC3405D
Continuous Output Current	$3A_{RMS}$	$6A_{RMS}$	$10A_{RMS}$	$20A_{RMS}$	$2.5A_{RMS}$	$5A_{RMS}$
Peak Output Current	$6A_{RMS}$	$12A_{RMS}$	$20A_{RMS}$	$40A_{RMS}$	$5A_{RMS}$	$10A_{RMS}$
Seconds at Peak Current	2	2	1	0.5	1	1
Power Input						
90-253V ac, 47-63 Hz (1 or 3 Phase)	Yes	Yes	Yes	Yes	n/a	n/a
Continuous @ 253V ac						
3 Phase	1.0 kW	2.0 kW	3.4 kW	6.8 kW	n/a	n/a
1 Phase	0.50 kW	1.0 kW	1.7 kW	3.4 kW	n/a	n/a
Peak @ 253V ac						
3 Phase	2.0 kW	4.0 kW	6.8 kW	13.6 kW	n/a	n/a
20-74V dc	n/a	n/a	n/a	n/a	Yes	Yes
Watt (cont) @ 74V dc	n/a	n/a	n/a	n/a	214	427
Watt (peak) @ 74V dc	n/a	n/a	n/a	n/a	427	854
Power Stage Efficiency @ PCONT	98%	98%	98%	98%	98%	98%
Maximum External Regen Duty Cycle	1.6%	1.6%	5%	5%	1.6%	1.6%
Peak Regen	3.2 kW	5.7 kW	7.4 kW	14.8 kW	230W	280W
Minimum Motor Inductance	1 mH	1 mH	1 mH	1 mH	0.1 mH	0.1 mH
Output Current Ripple Frequency	20 kHz	20 kHz	20 kHz	20 kHz	80 kHz	80 kHz
Maximum Cable Length	50m / 164 ft.	50m / 164 ft.	50m / 164 ft.	50m / 164 ft.	50m / 164 ft.	50m / 164 ft.

Control power to maintain logic while main power is removed (not required for normal operation):
AC powered drives – 22-52V dc, 500V isolation from chassis, 1 amp/drive, electrically hot (control wired to bus) DO NOT share.
DC powered drives – 18-48V dc NON-ISOLATED, 1 amp/drive.

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PC800, SC/SCE900 SERIES POWER DATA

	PC8x2		PC8x3		PC8x4		SC/SCE9x2		SC9x3		SC9x4		SC9x5	
Input Voltage														
Control logic power	90 - 264V ac, 47 - 63 Hz, single phase													
Bus power	90-264V ac, 1 or 3-phase (except SC905 - 3-phase only)													
Input Current														
Control logic power	500 mA maximum @ 120V ac, 250 mA maximum @240V ac													
	PC8x2		**PC8x3**		**PC8x4**		**SC/SCE9x2**		**SC9x3**		**SC9x4**		**SC9x5**	
	A_{RMS}	Equivalent $A_{0\text{-}PEAK}$	A_{RMS}	Equivalent $A_{0\text{-}PEAK}$	A_{RMS}	Equivalent $A_{0\text{-}PEAK}$	A_{RMS}	Equivalent $A_{0\text{-}PEAK}$	A_{RMS}	Equivalent $A_{0\text{-}PEAK}$	A_{RMS}	Equivalent $A_{0\text{-}PEAK}$	A_{RMS}	Equivalent $A_{0\text{-}PEAK}$
Bus power	4.5A	6.4A	9.0A	12.7A	18.0A	25.5A	4.5A	6.4A	9.0A	12.7A	18.0A	25.5A	29.0A	41.0A
Peak Output Current														
5 seconds	5.3A	7.5A	10.6A	15A	21.2A	30.0A	5.4A	7.6A	10.6A	15.0A	21.2A	30.0A	42.2A	59.7A
Continuous Output Current														
25°C convection cooling	N/A	N/A	N/A	N/A	N/A	N/A	2.75A	3.9A	5.3A	7.5A	10.6A	15.0A	21.2A	30.0A
50°C forced air cooling	N/A	N/A	N/A	N/A	N/A	N/A	2.75A	3.9A	5.3A	7.5A	10.6A	15.0A	21.2A	30.0A
50°C convection cooling	N/A	N/A	N/A	N/A	N/A	N/A	1.75A	2.5A	3.5A	5.0A	7.1A	10.0A	21.2A	30.0A
25 - 40°C convection cooling	2.7A	3.8A	3.6A	5.0A	7.1A	10.0A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
25 - 40°C forced air cooling	N/A	N/A	5.3A	7.5A	10.6A	15.0A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Peak Output Power @ 240V ac														
1 second	2.25 kW		4.5 kW		9.0 kW		2.2 kW		4.5 kW		9.0 kW		18.0 kW	
Continuous Output Power														
@240V ac three phase														
25°C convection cooling	N/A		N/A		N/A		1.1 kW		2.2 kW		4.5 kW		9.0 kW	
50°C forced air cooling	N/A		N/A		N/A		1.1 kW		2.2 kW		4.5 kW		9.0 kW	
50°C convection cooling	N/A		N/A		N/A		0.75 kW		1.5 kW		3.0 kW		9.0 kW	
25 - 40°C convection cooling	1.1 kW		1.5 kW		3.0 kW		N/A		N/A		N/A		N/A	
25 - 40°C forced air cooling	N/A		2.2 kW		4.5 kW		N/A		N/A		N/A		N/A	
@240V ac single phase														
25°C convection cooling	N/A		N/A		N/A		0.80 kW		1.6 kW		2.3 kW		N/A	
50°C forced air cooling	N/A		N/A		N/A		0.80 kW		1.6 kW		2.3 kW		N/A	
50°C convection cooling	N/A		N/A		N/A		0.55 kW		1.1 kW		1.5 kW		N/A	
25 - 40°C convection cooling	1.1 kW		1.1 kW		2.0 kW		N/A		N/A		N/A		N/A	
25 - 40°C forced air cooling	N/A		1.6 kW		2.0 kW		N/A		N/A		N/A		N/A	
Power Stage Efficiency @ PCONT	98%		98%		98%		95%		96%		97%		97%	
Shunt Regulator Power														
Peak power (300 mSec)	12.8 kW		12.8 kW		12.8 kW		3.0 kW		6.0 kW		12.0 kW		20.0 kW	
Continuous power														
25°C convection cooling	200W		200W		200W		20W		40W		100W		200W	
50°C forced air cooling	N/A		N/A		N/A		25W		50W		125W		200W	
50°C convection cooling	N/A		N/A		N/A		20W		40W		100W		200W	
Maximum external regen duty cycle	6%		6%		6%		16%		12%		6%		10%	
Bus capacitance energy absorption														
from 320V nominal bus (240V ac)	20 Joules		30 Joules		40 Joules		15 Joules		15 Joules		30 Joules		50 Joules	
Output Current Ripple Frequency fs	20kHz		20 kHz		16 kHz		20 kHz		20 kHz		20 kHz		20 kHz	
Minimum Motor Inductance l-l @ 240V ac	4 mH		2 mH		1.25 mH		4 mH		2 mH		1 mH		0.5 mH	
Maximum Motor Power Cable length	50m / 164 ft.		50m / 164 ft.		50m / 164 ft.		50m / 164 ft.		50m / 164 ft.		50m / 164 ft.		50m / 164 ft.	

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SCE900 SERIES HIGH VOLTAGE POWER DATA

	SCE9x3		SCE9x4		SCE9x5		SC9x6	
Input Voltage								
Control logic power	90 - 264V ac, 47 - 63 Hz, single phase							
Bus power	180 - 528V ac, 3-phase							
Input Current								
Control logic power	500 mA maximum @ 120V ac, 250 mA maximum @240V ac							
	SCE9x3		**SCE9x4**		**SCE9x5**		**SC9x6**	
	A_{RMS}	**Equivalent** $A_{0\text{-}PEAK0\text{-}PEAK}$	A_{RMS}	**Equivalent** $A_{0\text{-}PEAK}$	A_{RMS}	**Equivalent** $A_{0\text{-}PEAK}$	A_{RMS}	**Equivalent** $A_{0\text{-}PEAK}$
Bus power	5.0A	7.1A	10.0A	14.1A	15.0A	21.2A	30.0A	42.4AA
Peak Output Current								
5 seconds	7.5A	10.6A	15.0A	21.2A	22.5A	31.8A	33.8A	47.8A
Continuous Output Current								
25°C convection cooling	3.8A	5.4A	7.5A	10.6A	11.3A	16.0A	22.5A	31.8A
50°C forced air cooling	N/A	N/A	7.5A	10.6A	11.3A	16.0A	22.5A	31.8A
50°C convection cooling	2.5A	3.5A	5.0A	7.1A	7.5A	10.6A	22.5A	31.8A
Peak Output Power @ 400V ac								
1 second, up to full 50°C	5 kW		10 kW		15 kW		22.5 kW	
Peak Output Power @ 480V ac								
1 second, up to full 50°C	5 kW		12 kW		18 kW		27 kW	
Continuous Output Power								
@400V ac three phase								
25°C convection cooling	2.5 kW		5.0 kW		7.5 kW		15 kW	
50°C forced air cooling	N/A		5.0 kW		7.5 kW		15 kW	
50°C convection cooling	2.1 kW		3.9 kW		5.0 kW		15 kW	
@480V ac three phase								
25°C convection cooling	3.0 kW		6.0 kw		9.0 kW		18 kW	
50°C forced air cooling	N/A		6.0 kw		9.0 kW		18 kW	
50°C convection cooling	2.5 kW		3.9 kW		6.0 kW		18 kW	
Power Stage Efficiency @ PCONT	96%		97%		97%		97%	
Shunt Regulator Power								
Peak power (300 mSec)	8 kW		16 kW		16 kW		24 kW	
Continuous power								
25°C convection cooling	25W		100W		200W		250W	
50°C forced air cooling	N/A		125W		250W		250W	
50°C convection cooling	20W		100W		200W		250W	
Maximum external regen duty cycle	10%		10%		10%		10%	
Bus capacitance energy absorption								
from 640V nominal bus (480V ac)	27 Joules		50 Joules		80 Joules		144 Joules	
Output Current Ripple Frequency fs	20 kHz		20 kHz		20 kHz		16 kHz	
Minimum Motor Inductance l-l @ 240V ac	5.7 mH		2.8 mH		1.9 mH		1.6 mH	
Maximum Motor Power Cable length	50m / 164 ft.		50m / 164 ft.		50m / 164 ft.		50m / 164 ft.	

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PC3400 SERIES TECHNICAL OVERVIEW

Command Types	PC3403A	PC3406A	PC3410A	PC3420A	PC3402D	PC3405D
Internal	Multiple stored programs					
Digital	RS-232/485 Interface					
Analog	±10V analog (current or velocity)					
Step	Step/direction, step up/down or encoder following (single-ended or differential)					

Performance	PC3403A	PC3406A	PC3410A	PC3420A	PC3402D	PC3405D
Switching Frequency	10 kHz					
Servo Loop	Current 100 µsec; Velocity 400 µsec; Position 2msec					

Communication Loop	PC3403A	PC3406A	PC3410A	PC3420A	PC3402D	PC3405D
Serial	RS-232/RS-485 for digital commands,setup and diagnostics; 19.2 kBaud					

Feedback Types	PC3403A	PC3406A	PC3410A	PC3420A	PC3402D	PC3405D
	Resolver, Hall or tachometer only				Hall or tachometer only	
	Encoder with Hall (20 MHz post quadrature)					
	Encoder with z-channel encoded commutation tracks (20 MHz post quadrature)					
	Primary motor feedback: resolver or encoder; Secondary feedback: encoder					
	Primary motor feedback: resolver or encoder; Secondary feedback: encoder				Primary motor feedback: encoder; Secondary feedback: encoder	

Inputs	PC3403A	PC3406A	PC3410A	PC3420A	PC3402D	PC3405D
Analog (2)	Programmable ±10V, differential, 14 bits, 20kΩ					
Digital (5)	Programmable, 5-24V, 5kΩ, source or sink (optically isolated)					
Digital High Speed (5)	Programmable, 5V, 499Ω (<1 sec response)					
Digital Registration (1)	Programmable, 5V, 499Ω (<1 sec response)					
Enable*	5-30V, 5kΩ, source or sink (optically isolated)					

Outputs	PC3403A	PC3406A	PC3410A	PC3420A	PC3402D	PC3405D
Digital (2)	Programmable, 30V dc maximum supply, 35 mA maximum source or sink					
Drive OK/Brake	100V dc maximum supply, 1A maximum (relay)					
Foldback*	30V dc maximum supply, 35 mA maximum, source or sink					
Encoder	A, B, Z channels					

Protection	PC3403A	PC3406A	PC3410A	PC3420A	PC3402D	PC3405D
	Short circuit: phase-to-phase, phase-to-common					
	Overvoltage; undervoltage					
	Overtemperature					
	Feedback loss; position error; current foldback					

Input Power	PC3403A	PC3406A	PC3410A	PC3420A	PC3402D	PC3405D
Main	90-253V ac, 1ø or 3ø, 47-63 Hz				18-74V dc	
Back-up Control	24-48V dc (isolated)				18-48V dc (non-isolated)	

Environmental	PC3403A	PC3406A	PC3410A	PC3420A	PC3402D	PC3405D
Storage Temperature	-40°-70°C (recommended 25°C)					
Operating Temperature	0°-40°C ambient					
Humidity	0%-95%, non-condensing					

* May be used as programmable I/O.

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PC800, SC/SCE900 SERIES TECHNICAL OVERVIEW

Analog Input Command	PC800	SC900	SCE900
Range	±13.5V velocity or torque		
Resolution	>14 bits		
Offset	Adjustable to zero		
Offset drift	250 µV/°C typical		
Digital Input Command	**PC800**	**SC900**	**SCE900**
Modes	Step/Direction, Step Up/Step Down, Quadrature Encoder		
Maximum input frequency			
Step/Direction, Pulse Forward/Reverse	800kHz	1 MHz	800kHz
Quadrature Encoder	800kHz	833 kHz	800kHz
Current Loop	**PC800**	**SC900**	**SCE900**
Bandwidth	1500 Hz maximum		
Update period	62.5 µS		
Velocity Loop	**PC800**	**SC900**	**SCE900**
Bandwidth	400 Hz		
Update period	250 µS		
Command resolution	<0.001 rpm		
Feedback accuracy	0.05% worst case		
Feedback ripple	0.75% p-p at 1000 rpm (drive only) 3% p-p at 1000 rpm (with 20 arcmin resolver)		
Feedback Resolution	0.014 rpm		
Range	0 to 21,000 rpm	0 to 30,000 rpm	
Position Loop	**PC800**	**SC900**	**SCE900**
Bandwidth	100 Hz		
Update period	1 mS		
Command resolution	65,536 steps/rev (16 bits/rev)		
Feedback accuracy	±5.3 arcmin (drive only), ±25 arcmin (with 20 arcmin resolver)		
Feedback Resolution	16,777,216 (24 bits/rev)		
Encoder Output Signals	**PC800**	**SC900**	**SCE900**
Type	Quadrature with marker pulse, differential TTL line driver		
Resolution	128 to 16384 PPR by powers of 2, 125 to 16,000 PPR by powers of 2		
Maximum output frequency	833 kHz		
Marker pulse width	1 quadrature pulse nominal		
Serial Port	**PC800**	**SC900**	**SCE900**
Type	RS-232, RS-485		
Baud rate	19,200 baud	9600 baud	
Maximum RS-485 nodes	32		
Dedicated I/O	**PC800**	**SC900**	**SCE900**
	Enable 5V or 24V compatible		
Programmable I/O	**PC800**	**SC900**	**SCE900**
	Optically isolated, relay, analog	6 bi-directional 5V or 24V compatible, 2 analog outputs	
Mating Connectors	**PC800**	**SC900**	**SCE900**
	Power-screw terminal, signal-screw terminal or D-connectors Terminal block option	Power-screw terminal, signal-screw terminal or D-connectors	
Environmental	**PC800**	**SC900**	**SCE900**
Storage temperature	- 40°C to 70°C		
Operating temperature			
Full ratings	0°C to 40°C[4]	0°C to 50°C	
Derated convection[2]	N/A	25°C to 60°C	
Derated forced air [1] [3]	0°C to 40°C[3]	50°C to 60°C	
Altitude	**PC800**	**SC900**	**SCE900**
	1,500 m (5,000 ft.)		
Humidity	**PC800**	**SC900**	**SVE900**
	10% to 90%, non-condensing		

[1] Linearly derate output power and output current from full rating at 25°C to 53% at 60°C.
[2] Linearly derate output power and output current from full rating at 50°C to 66% at 60°C.
[3] Maximum heat sink temperature 70°C.
[4] Not applicable for the PC832.

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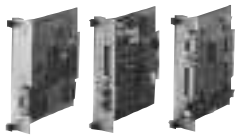
PC800, SC/SCE900 SERIES PARAMETERS

PARAMETER (PARTIAL LIST)	DESCRIPTION
Current Loop	
KIP	Current loop proportional gain (V/A)
ILMTPLUS	Plus current limit (%)
ILMTMINUS	Minus current limit (%)
COMMOFF	Commutation offset angle (Deg)
COMMSRC	Selects commutation feedback device
POLECOUNT	Motor pole count
ITTHRESH	Threshold for drive IT protection (%)
VBUSTHRESH	Threshold for low motor bus fault (V)
Velocity Loop	
KVP	Velocity loop proportional gain (A/rad/sec)
KVI	Velocity loop integral gain (Hz)
AFR0, ARF1	Anti-resonance filter break frequencies (Hz)
ARZ0, ARZ1	Anti-resonance zero frequencies (Hz)
Position Loop	
KPP	Position loop proportional gain (Hz)
KVFF	Velocity feed forward gain (%)
Block Type	
BLKTYPE = 0	Analog command torque block
BLKTYPE = 1	Analog command velocity block
BLKTYPE = 2	Incremental command position block
BLKTYPE = 4	Digital frequency command torque block
BLKTYPE = 5	Digital frequency command velocity block
With OC930, N/A PC800	
BLKTYPE = 2	Serial port command position block
BLKTYPE = 8	Serial port command velocity block
Feedback Source	
REMOTEFB = 0	Use motor shaft resolver for position feedback
REMOTEFB = 1	Use encoder input for position feedback
REMOTEFB = 2	Use encoder input for position and velocity feedback
Encoder Output	
ENCOUT	Encoder output resolution (PPR)
Encoder Input	
ENCIN	Encoder input resolution (PPR)
ENCMODE	Encoder input mode, quadrature/step, dir/Up, Dn
Digital I/O	
BDIOMap1-6	Selects input or output function for each BDIO
Analog Out	
DMxMAP	Selects signal for channel x
DMxGain	Set output volt per signal unit
DMxF0	Low pass filter in Hz for channel x

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SC/SCE 900 SERIES OPTION CARDS

OC/OCE 930, 940, 950



HOW TO ORDER — SC900 Digital Drive . . . Drive Accessories

Accessory	Description	Order Number
Option Cards:		
Blank panel	This is a blank panel to cover an unused option card slot.	OC900-001
Firmware upgrade	This option card allows easy plug-in upgrading of the SC900 firmware and allows removable personality.	OC900-002-01
Serial communications	This option card adds RS-232/485 serial communications to the base SC900. Suffix -00 is standard, -01 includes base unit firmware upgrade. Includes 3-1/2" floppy disk with PC communications utility.	OC930-001-0x
SERCOS interface	This option card adds SERCOS interface capability to the base SC900.	OC940-001-01
Programmable	This option card adds programmable functionality to the base SC900.	OC950-50X-01
Connector Kits:		
All mating connectors w/D-sub	Includes all mating connectors for base unit. Screw terminal blocks for power and D-sub for signal. X designates drive power level.	CA90x
All mating connectors w/D-sub to TB adapter	Includes all mating connectors for base unit. Screw terminal blocks for power and D-sub to screw terminal adapter modules for signal.	CA90x-TB
Fan Kits:		
Fan kit for SC9x2/3/4	Adds forced air cooling to the SC9x2, SC9x3, SC9x4. Suffix -002 is for 240V ac 50/60 Hz, -001 is for 120V ac 60 Hz.	OF902-00x OF903-00x OF904-00x
Manuals:		
SC900 base drive	Hardware reference manual for SC900 base drives.	MA900
OC930 option card	Hardware/software reference manuals for the serial communications option card.	MA930
OC940 option card	Hardware/software reference manuals for the SERCOS interface option card.	MA940
OC950 option card	Hardware/software reference manuals for the programmable single-axis option card.	MA950

HOW TO ORDER — SC900 Series Recommended Motor/Drive Systems

See Recommended Motor/Drives Systems table on page 3 for performance information and model numbers for servo motor/drive combinations. Order motors and drives as separate part numbers.



HOW TO ORDER — SCE900 Digital Drive . . . Drive Accessories

Accessory	Description	Order Number
Option Cards:		
Blank panel	This is a blank panel to cover an unused option card slot.	OCE900-001
Firmware upgrade	This option card allows easy plug-in upgrading of the SCE900 firmware and allows removable personality.	OCE900-002-01
Serial communications	This option card adds RS-232/485 serial communications to the base SCE900. Suffix -00 is standard, -01 includes base unit firmware upgrade. Includes 3-1/2" floppy disk with PC communications utility.	OCE930-001-0x
SERCOS interface	This option card adds SERCOS interface capability to the base SCE900.	OCE940-001-01
Programmable	This option card adds programmable functionality to the base SCE900.	OCE950-50X-01
Connector Kits:		
All mating connectors w/D-sub	Includes all mating connectors for base unit. Screw terminal blocks for power and D-sub for signal. X designates drive power level.	CAE90x
All mating connectors w/D-sub to TB adapter	Includes all mating connectors for base unit. Screw terminal blocks for power and D-sub to screw terminal adapter modules for signal.	CAE90x-TB
Fan Kits:		
Fan kit for SCE9x2, 9x3, 9x4, 9x5	Adds forced air cooling to the SCE9x2, 9x3, 9x4, 9x5. Suffix -002 is for 240V ac 50/60 Hz. Bottom mounting force air cooling fan and bracket accessory kit for the SCE9x2, 9x3, 9x4, 9x5. Option suffix -002 is the Standard 240V ac 50/60 Hz model and suffix -001 is a 120V ac 60 Hz model. **Note:** The SCE9x6 has an internal fan.	OF902-00x OF903-00x OF904-00x[1]
Manuals:		
SCE900 base drive	Hardware reference manual for SCE900 base drives.	MAE900
OCE930 option card	Hardware/software reference manuals for the serial communications option card.	MA930
OCE940 option card	Hardware/software reference manuals for the SERCOS interface option card.	MA940
OCE950 option card	Hardware/software reference manuals for the programmable single-axis option card.	MA950-IDE

HOW TO ORDER — SCE900 Series Recommended Motor/Drive Systems

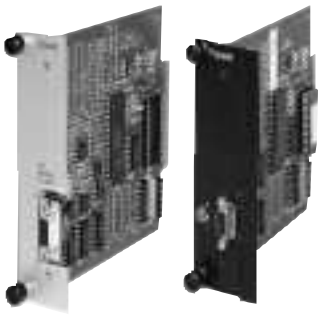
See Recommended Motor/Drives Systems table on pages 30-35 for performance information and model numbers for servo motor/drive combinations. Order motors and drives as separate part numbers.

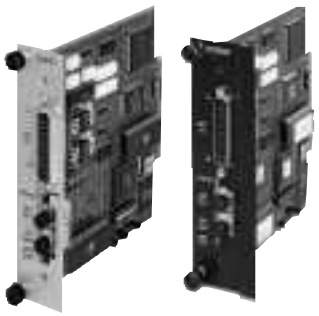
[1] OF904 is for SCE9x4 and 9x5 models.

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SC/SCE 900 SERIES OPTION CARDS

OC/OCE 930, 940, 950





OC/OCE930 Option Cards

SC/SCE900 Digital Servo Drives gain their application flexibility from three available option cards. The OC930 can be used simply as a RS-232/RS-485 serial communications interface, to serve as the programming module to set-up the SC/SCE900 drive for the first time. Or, it can be left to continually communicate instructions for changeovers, or monitor system parameters as needed.

Features

- All-digital set-up of current loop, velocity loop and (when used) position loop — no pots, DIP switches, jumpers or components to alter during servo loop set-up
- Serial communications using RS-232/485
- Parameters can be saved in non-volatile memory on either the SC/SCE900 or the OC/OCE930
- Automatic drive set-up using 930 Dialogue
- Automatic analog command offset using 930 Dialogue
- Simple uploading, downloading and disk storage of drive parameters for ease of cloning and backup documentation
- Precise readout of motor velocity, position and other variables using the serial link and 930 Dialogue

Serial Communications

The OC930 Serial Communications Option Card communicates over a 9600 baud serial link to a host IBM-compatible PC. The OC/OCE930 supports communications using either RS-232 or RS-485 protocols.

All-Digital Set-up

With all-digital set-up, you're not spending a lot of your precious time staring at a scope while tweaking pots — in most cases, you'll only need a PC to set-up, tune and get running. Drift is eliminated — automatically.

930 Dialogue Software

930 Dialogue is a simple-to-use software package that establishes communications between your PC and the OC/OCE930 during set-up and operation. Intuitive screens in a Windows environment make it easy to set-up, initiate auto-tuning, change and monitor operations.

Personality Module Use

You can leave the OC/OCE930 plugged into the SC/SCE900 drive after set-up and configure it to allow parameters stored in its non-volatile RAM to replace the personality parameters stored on the drive. This can greatly speed changeover time and increases the flexibility you have to apply the drive.

Operations Monitoring

With the OC/OCE930 plugged into the SC/SCE900 drive, you can monitor the operations of the drive using 930 Dialogue and a standard IBM-compatible PC.

OC/OCE940 Option Cards

DIGITAL FIBER OPTIC single-axis SERCOS Option Card

The OC/OCE940 SERCOS Interface Option Card allows any family drive to function in a multi-axis system with a minimum of wiring headaches. Simple fiber optic links give the OC940 blazing communications speed with either the host computer or multi-axis function block.

Features

- Fiber optic noise-free environment
- 32-bit performance
- SERCOS interface
- Intel™ MicroController inside
- 8 optically isolated inputs
- 8 optically isolated outputs
- Simplified interconnect
- Intelligent drive

When combined with the servo drive, the OC940 option card is designed for use in distributed, multi-axis motion control systems utilizing the SERCOS (Serial Realtime Communications System) digital interface international standard. SERCOS replaces the ±10V analog servo command interface with a high speed, digital, fiber optic link. The SERCOS standard allows bi-directional flow of information. The control sends position, velocity and torque commands and the drive reports actual data back.

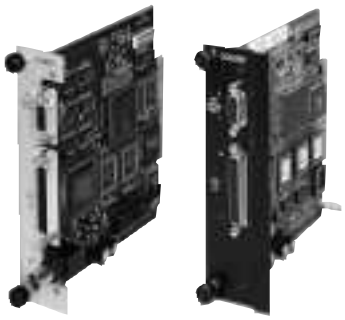
SERCOS

SERCOS is an open architecture, fiber-optic based controller to digital drive interface international standard. The SERCOS interface is designed to communicate closed loop data serially in real time for high performance motion control systems. The SC/SCE900 control is a digital drive incorporating low-cost digital signal processors (DSPs) that when combined with the OC/OCE940 option card exploit the most current innovations in motion control to date.

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SC/SCE 900 SERIES OPTION CARDS

OC/OCE 930, 940, 950



Noise Free Environment

A single fiber optic cable ring is the only connection necessary between the motion controller and the drives. Cable lengths of up to 100 meters can be achieved between controller and drive without any concern of signal corruption.

Simplified Interconnect

When compared to a conventional multi-axis motion system, the OC/OCE940 offers a much simpler approach. A typical analog system requires many low voltage interconnects between the drive and controller. The troublesome task of running numerous wires through conduit and debugging them is reduced to running a single fiber optic cable. The wiring between motor and drive can be done local to where the motor is being used.

Optically Isolated I/O

The OC/OCE940 comes standard with 8 configurable optically isolated inputs and 8 optically isolated outputs. The I/O is 5V dc to 30V dc compatible.

Intelligent Drive

The OC/OCE940 closes all its loops locally. The position, velocity and torque blocks are maintained within the drive. This allows the motion controller to be freed up to generate the motion profiles. Up to 16 axes of motion profiles can be updated every 2 mSeconds.

This 2 mSecond update rate should not be confused with the servo loop update rates. The servo loop update rates are controlled by the drives local processor. In traditional centralized systems, the profile generator update rate is typically not specified since this interface is buried within the controller.

OC/OCE950 Option Cards

Programmable single-axis Position Control Option Card

For superior motion control, the OC/OCE 950 give you maximum programmability using Pac Sci's ServoBASIC Plus™ programming language. This Windows® Development Environment programming package uses a powerful interactive debugger to speed set-up and diagnostics. OC/OCE950 gives you the power to control up to 21 separately configurable I/O points, and 8 programmable limit switches easily. PacLAN networking and Opto-22 I/O connectivity are popular options to the OC/OCE950.

Features

- New Windows® Development Environment
- Compiled ServoBASIC™ Software
- Powerful interactive debugger
- Intel™ microcontroller inside
- 21 programmable and configurable I/O
- Optional connection to Opto-22 I/O
- Optional connection to DF-1 or Modbus network
- Optional PacLAN™ local area network
- 32K NV memory w/optional 128K available
- 8 programmable limit switches w/module
- Fully adjustable motion profile parameters
- Electronic cam profiling
- Interrupts on motion & program variables

Basic Programming Language

Since first introducing a standard software programming tool like BASIC in a drive 1987, Pacific Scientific has continued to enhance the functionality and ease of use. The fourth generation OC/OCE950 and Windows® development package incorporates functions like `RunSpeed` and `IndexDist` integrated with standard `While:Wend` and `For:Next` statements to give you true motion programming flexibility. Why not use a language you already know?

Windows Development Environment

This development environment lets you program in modular blocks that can easily be re-used time and time again. The easy-to-use editor and powerful debugger with program variable watch windows make troubleshooting easy. Easy to use as a simple word processor, yet the structured text language controls the most complex machines.

Cinfigurable BI-Directional I/O

The OC/OCE950 has 21 digital I/O ports. These ports can be configured as either inputs or outputs. The ServoBASIC program also has access to the SC900 base drive's six I/O for a total of 27 ports. The days of not having the right mix of inputs and outputs are over. This I/O can be used to interface to your PLC, or control machine sensors and other control devices. For fully flexible industrial I/O the OC/OCE950 ports are Opto-22 compatible.

Features When Combined with the SC900 Family of Brushless Servo Drives

- Completely digital set-up and tuning
- DSP based servo control algorithms
- Encoder input and encoder output
- Analog input and two analog outputs
- Two high-speed registration inputs
- Digital fault code information
- Full protection and diagnostics
- Ability to run linear motors
- Exclusive Signature Current Control
- Patented DRDC resolver ASIC
- Full range of servo motors — up to 800 lb.-in.

Local Area Network Option

In addition to the standard RS-232/485 Serial interfaces the OC/OCE950 can be ordered with Pacific Scientific's PacLAN interface. This is ideal for networking single-axis drives together. It is a 2.5 Mbaud token passing communications port where all variables and real-time motor information can be passed from drive to drive. Connect up to 255 drives together with PacLAN and you still have serial ports left over to communicate with your Operator Interface!

Buy Only What You Need

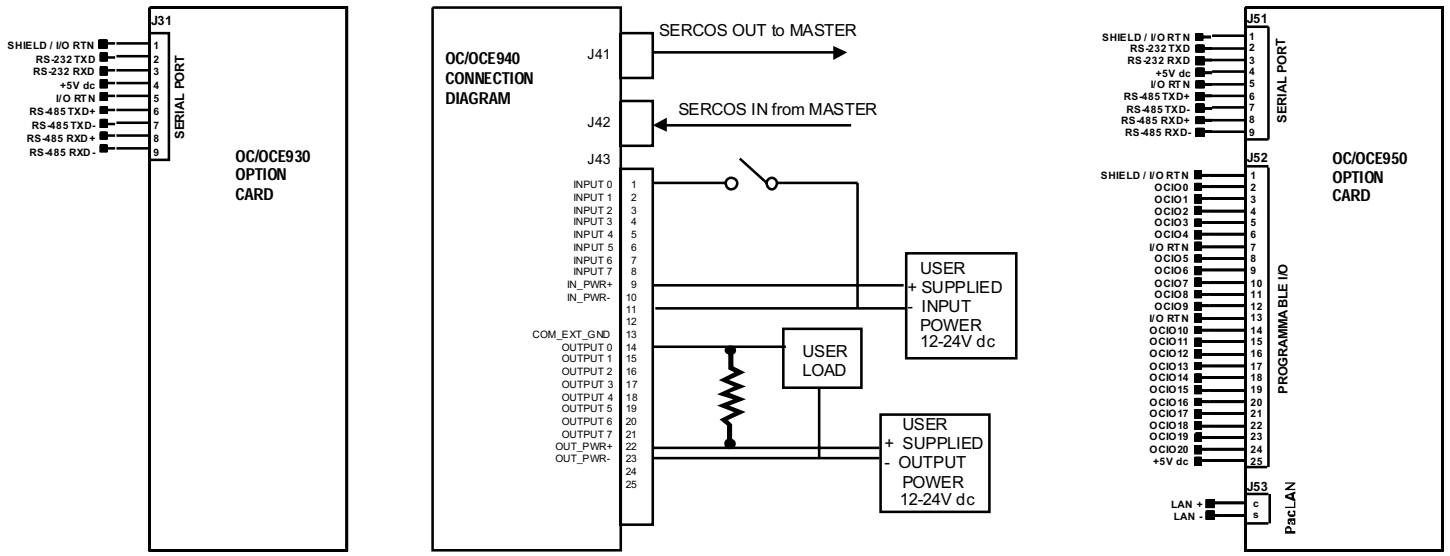
Like the rest of the SC/SCE900 Series products, the OC/OCE950 can be ordered with or without options. Modular ordering allows you to build up the options that suit your needs and not pay for extras you won't use. Even the Windows Development Environment is a one-time purchase item for the cost-conscious OEM.

How To Order

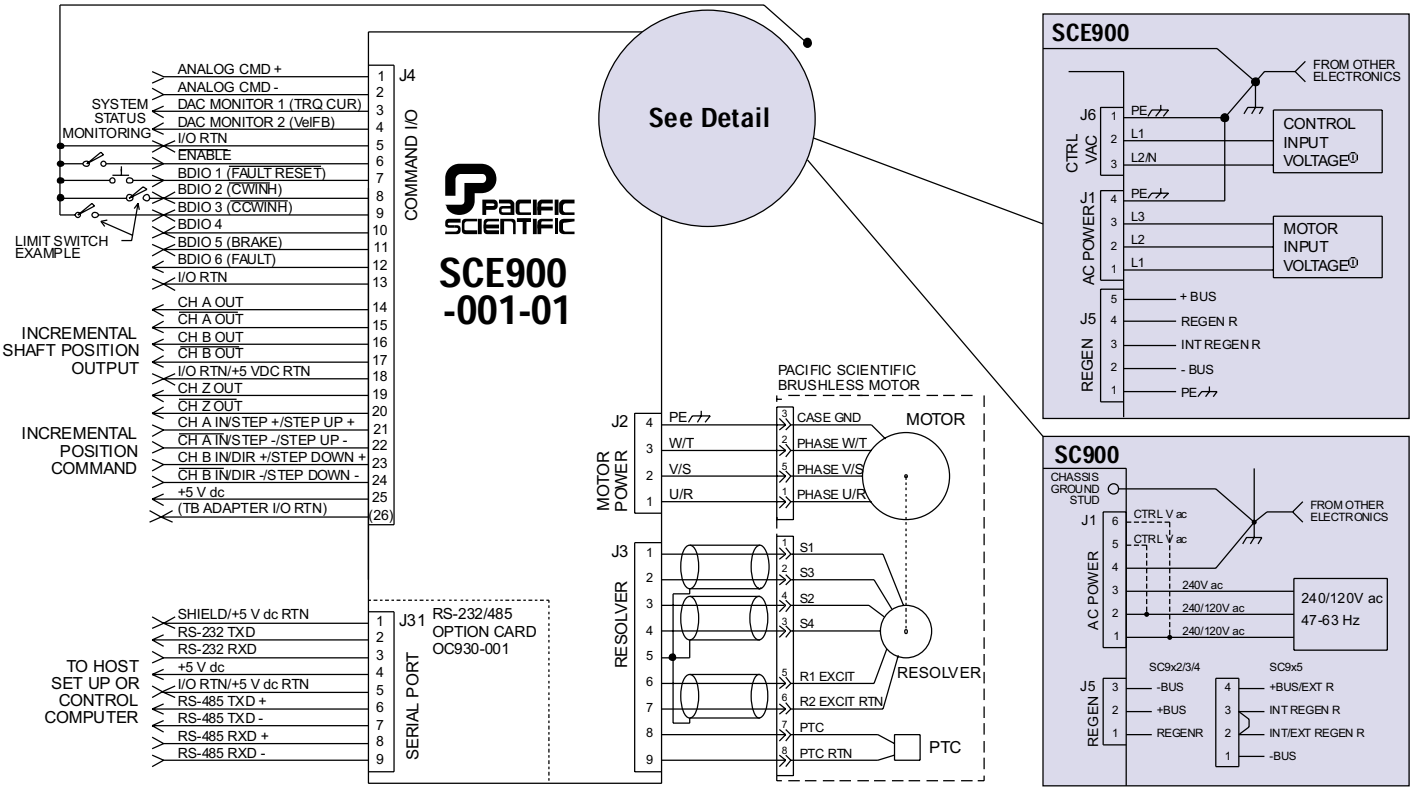
These option cards are designed to plug into any SC/SCE900 servo drive. See page 24 for more details.

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CONNECTION DIAGRAM . . . OC/OCE930, OC/OCE940, OC/OCE950 Option Cards



CONNECTION DIAGRAM . . . SC/SCE930



① See power specifications, pages 19 and 20.

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±10V analog interface - velocity or torque control

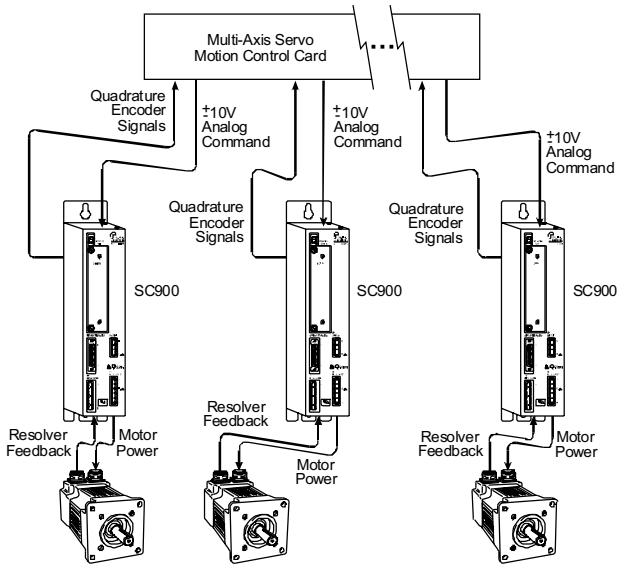


Figure 1

This multi-axis application utilizes a typical multi-axis motion control card. The motion control card generates ±10V analog commands for each axis drive. These analog commands control either motor torque or motor velocity. If the control card is commanding torque, the systems velocity loop is closed in the motion control card. If the control card is commanding velocity, the drive closes the velocity loop in the system. The drive generates quadrature encoder feedback signals from the motor's resolver. These quadrature encoder signals are used by the motion control card to close the system's position loop and to execute the motion profiles.

step/direction digital interface - velocity or position control

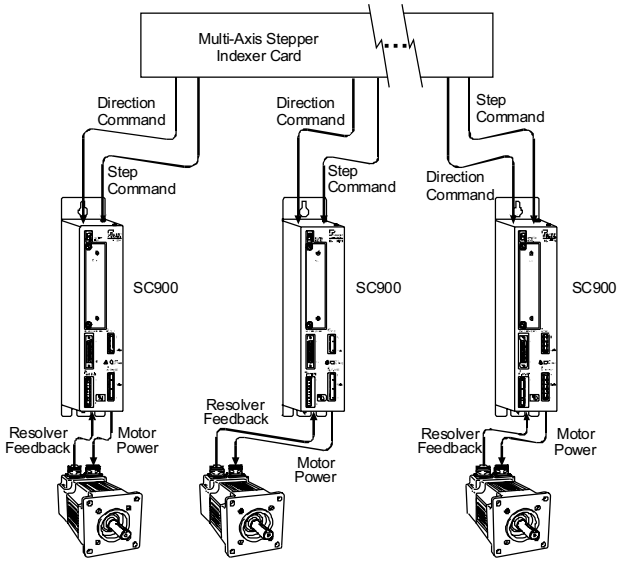


Figure 2

This multi-axis application utilizes a typical multi-axis stepper indexer card. The indexer generates step and direction commands for each axis drive. These commands control the velocity and position of the servo systems. The drive closes the current, velocity and position loops. Position commands are received via the step and direction interface.

host computer digital interface - velocity, torque or position control

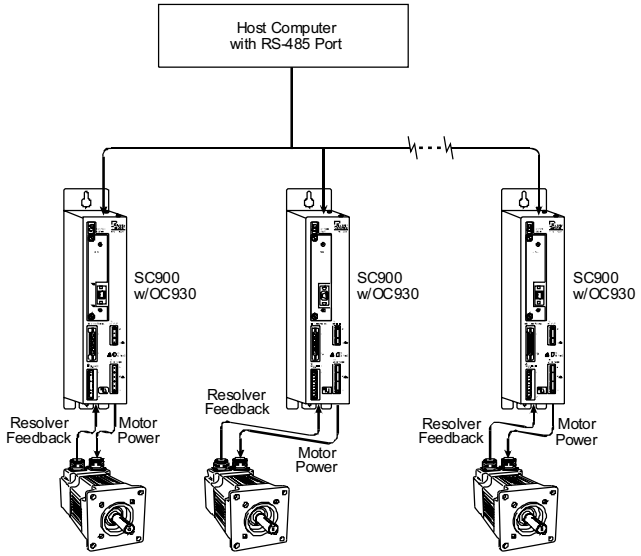


Figure 3

This multi-axis application utilizes a computer equipped with a serial port. The computer generates velocity, torque or position commands. Because 9600 Baud serial communications are not very fast, this configuration is best suited for slowly changing or "set and forget" types of applications. It is economical and easy to install. For fast changing applications referfuo figures 1 and 2 above and figure 4 on page 29.

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SERCOS distributed multi-axis control - velocity, torque or position control

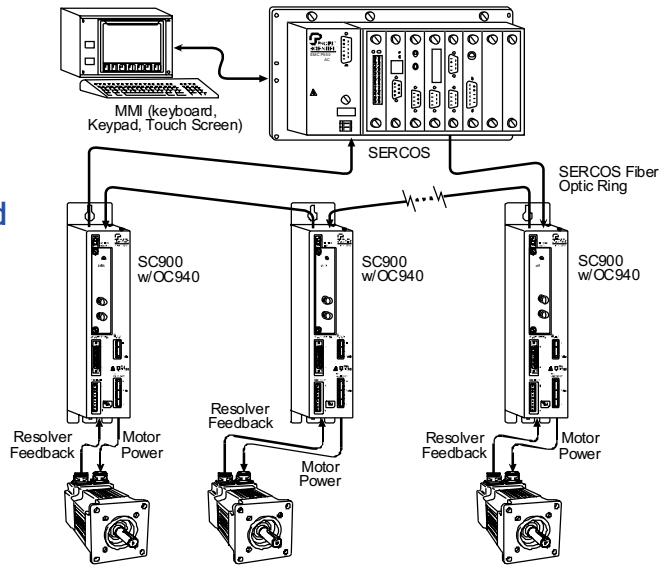


Figure 4

This multi-axis application utilizes a SERCOS control and SERCOS compatible drives (slaves). SERCOS (**SE**rial **R**ealtime **CO**mmunications **S**ystem) provides a **distributed** multi-axis control topology and is a digital interface international standard. The traditional multi-axis control topology is centralized as shown in Figure 1 (page 28). The distributed SERCOS topology is analogous to a network of PCs while the traditional centralized approach is analogous to a mainframe with dumb terminals.

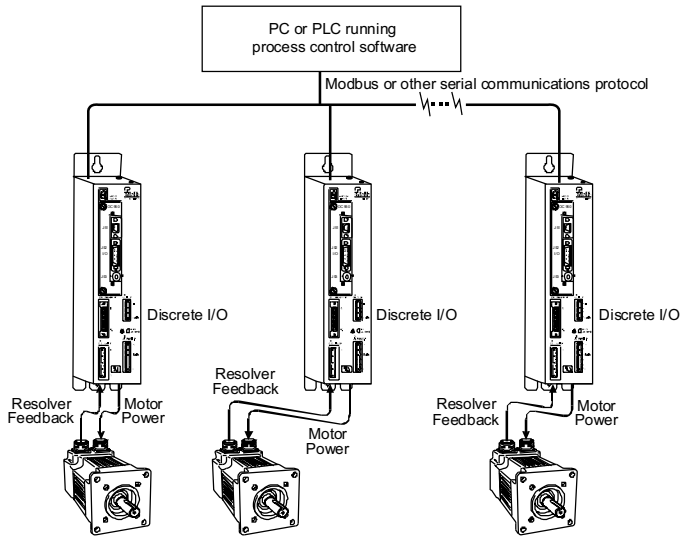
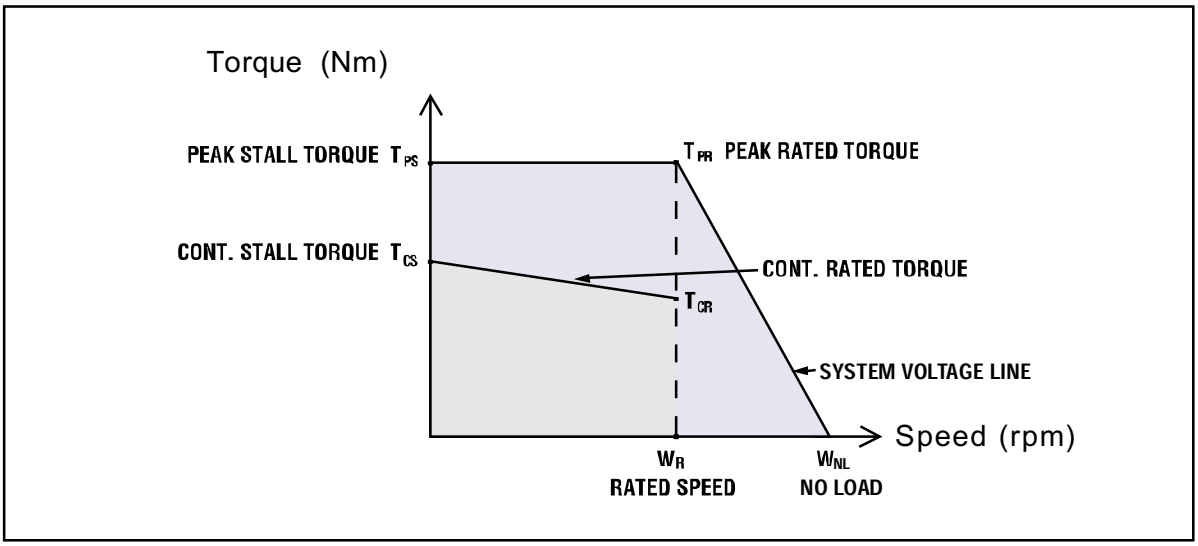


Figure 5

This multi-axis application uses a control signal sent by a PLC or PC running process control software via a serial communications protocol, such as Modbus or DF1. Each drive, equipped with an OC/OCE950 programmable option card, can communicate with its own discrete I/O. This distributed control scheme can support up to 255 separate drive nodes on the 2.5 Mbaud PacLAN network.

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HOW TO BUILD A SERVO DRIVE & MOTOR SYSTEM



System torque/speed information on the following pages are designed to help you select the optimum brushless servo motor/controller combination.

The nominal values in this data illustrate performance for the recommended motor/controller systems.

DRIVE & MOTOR PERFORMANCE CURVES

The performance characteristics of a brushless servo system (motor/controller combination) are described by a torque/speed operating envelope. As shown above, the shaded areas of the curve indicate the continuous duty and intermittent duty zones of the system.

Continuous Duty Zone

The continuous duty zone is bordered by the maximum continuous torque line up to the rated speed of the motor.

The continuous torque line is set by either the motor's maximum rated temperature, or the controller's rated continuous current output, whichever is less. The system voltage line is set by the voltage rating of the controller, the line voltage supplied, and the motor winding.

The system can operate on a continuous basis anywhere within this area, assuming the motor temperature is 40°C or less, ambient. Refer to the Test Conditions on the pages that follow.

Intermittent Duty Zone

The intermittent duty zone is bordered by the peak torque line and the system voltage line.

The peak torque line is set by either the controller's peak current rating, which the controller can produce for a limited time, or the maximum rated current for the motor, whichever is less. Refer to the Rating Data on the pages that follow.

NOTE: higher torque levels may be achievable at higher power levels. Consult Pacific Scientific for more details.

The system voltage line is set by the voltage rating of the controller, the line voltage applied and the motor winding.

Operation in the intermittent zone must be limited to a duty cycle that will produce an RMS system torque falling within the continuous duty area. The RMS torque value is defined by the magnitude of the intermittent torque and the percentage of the time spent at that torque.

Zero - Peak, or RMS?

Current brushless drive technology uses a sinusoidal output. Pacific Scientific rates its systems using RMS values to accurately reflect system performance operating with a sinusoidal waveform.

Older published ratings were based on 0 - peak values, using a trapezoidal waveform.

Optimizer 3.0

For more information on any motor on the following pages, or to take a closer look at detailed torque/speed information, take a look at our sizing and selection program, Optimizer™ 3.0. With Optimizer's sine/trapezoidal conversion algorithm, you can see how our motors pair up with a trapezoidal drive, too. Call Pacific Scientific at 815-226-3100 to get your free copy today, or visit our website at www.pacsci.com.

Additional References

On the pages that follow, each individual system has reference points in a table. In addition to rating points for peak (T_{PS}) and continuous torque (T_{CS}) ratings at stall, each system has:

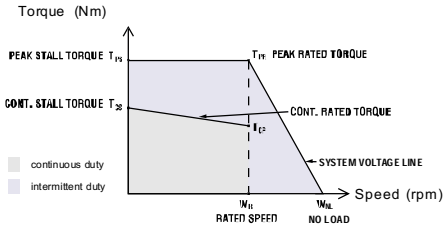
- Rated speed (W_R)
- Continuous torque at rated speed (T_{CR})
- Peak torque at rated speed (T_{PR})
- Motor unloaded speed (W_{NL})

To construct a curve, follow the guidelines presented in the generic curve above. System rated speeds and torques are based on the intersection of the system voltage line and the peak current line. Differing peak currents will impact rated system speeds.

The points are provided for reference for use in comparing and sizing systems.

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SYSTEMS PERFORMANCE DATA



RECOMMENDED MOTOR/DRIVE SYSTEMS, 48V dc bus[1] [2]

Servo Motor Model[5]	Servo Drive Model	Peak Stall Torque T_{PS}[1] Nm (lb.-in.)	Peak Rated Torque T_{PR}[2] Nm (lb.-in.)	Cont. Stall Torque T_{CS} Nm (lb.-in.)	Cont. Rated Torque T_{CR} Nm (lb.-in.)	Rated Speed W_R[3] rpm	No-Load Speed W_{NL} rpm	Cont. Stall Current I_{CS} A_{RMS}	Current at Peak Torque I_{PS} A_{RMS}	Inertia[4] J $kgm^2 \times 10^{-3}$ ($lb.-in.-S^2 \times 10^{-3}$)	Inductance Line-Line L mH
PMB Series motors with PC340XD Drives											
PMB11B	PC3402	0.48 (4.3)	0.48 (4.3)	0.22 (1.95)	0.22 (1.95)	700	5,200	2.3	5.0	0.0048 (0.042)	3.2
PMB11D	PC3405	0.48 (4.3)	0.47 (4.2)	0.22 (1.95)	0.20 (1.77)	5,800	10,400	4.6	10.0	0.0048 (0.042)	0.8
PMB12B	PC3402	0.83 (7.3)	0.83 (7.3)	0.40 (3.5)	0.40 (3.5)	600	3,000	2.4	5.0	0.0087 (0.077)	3.5
PMB12D	PC3405	0.87 (7.7)	0.86 (7.6)	0.40 (3.5)	0.38 (3.4)	3,300	5,700	4.6	10.0	0.0087 (0.077)	1.0
PMB13D	PC3405	1.18 (10.4)	1.18 (10.4)	0.55 (4.9)	0.50 (4.4)	2,450	4,200	4.6	10.0	0.0121 (0.107)	1.1
PMB21D	PC3405	1.35 (12.0)	1.35 (12.0)	0.62 (5.5)	0.61 (5.4)	1,100	3,650	4.5	10.0	0.0224 (0.198)	1.6
PMB22D	PC3405	2.24 (19.8)	2.24 (19.8)	1.11 (9.8)	1.10 (9.7)	700	2,200	4.9	10.0	0.0432 (0.382)	1.9

① See page 30 for definitions of ratings.
② Peak torque ratings are for 1 second.
③ 48V dc figures shown for reference. Operation available from 18-74V dc.
④ DC drives offer operation with encoder feedback only. Inertia figures include encoder feedback.
⑤ Each system requires one feedback and one motor power cable.

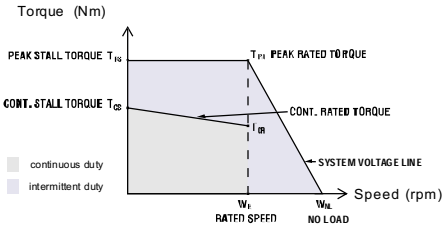
RECOMMENDED MOTOR/DRIVE SYSTEMS, 240V ac, 320V dc bus[9]

Servo Motor Model[8]	Servo Drive Model	Peak Stall Torque T_{PS}[1] Nm (lb.-in.)	Peak Rated Torque T_{PR} Nm (lb.-in.)	Cont. Stall Torque T_{CS} Nm (lb.-in.)	Cont. Rated Torque T_{CR} Nm (lb.-in.)	Rated Speed W_R[6] rpm	No-Load Speed W_{NL} rpm	Cont. Stall Current I_{CS} A_{RMS}	Current at Peak Torque I_{PS} A_{RMS}	Inertia[7] J $kgm^2 \times 10^{-3}$ ($lb.-in.-S^2 \times 10^{-3}$)	Inductance Line-Line L mH
PMA Series motors with PC8xx and SC9xx Drives											
PMA11A	PC8x2, SC9x2/SCE9x2[8]	1.4 (12.4)	1.4 (12.4)	0.26 (2.3)	0.22 (1.9)	6,600	12,900	0.96	5.3	0.012 (0.102)	7.1
PMA12A	PC8x2, SC9x2/SCE9x2[8]	1.7 (14.8)	1.7 (14.7)	0.6 (5.3)	0.47 (4.2)	8,500	10,800	1.88	5.3	0.019 (0.164)	4.3
PMA13B	PC8x2, SC9x2/SCE9x2[8]	1.7 (15.3)	1.7 (15.2)	0.9 (8.0)	0.6 (5.3)	9,000	10,600	2.73	5.3	0.026 (0.226)	2.7
PMA21B	PC8x2, SC9x2/SCE9x2[8]	1.8 (16.3)	1.8 (16.2)	0.63 (5.6)	0.50 (4.4)	6,050	9,250	1.72	5.3	0.022 (0.19)	10.5
PMA22B	PC8x3, SC9x3[8]	4.7 (42.0)	4.7 (41.9)	1.3 (11.5)	1.1 (9.4)	4,650	7,100	2.65	10.6	0.038 (0.34)	7.4
PMA22B	PC8x2, SC9x2/SCE9x2[8]	2.6 (22.7)	2.5 (22.5)	1.3 (11.5)	1.0 (8.9)	5,750	7,100	2.65	5.3	0.038 (0.34)	7.4
PMA23B	PC8x2, SC9x2/SCE9x2[8]	3.9 (34.2)	3.9 (34.1)	2.0 (17.7)	1.6 (14.6)	3,600	4,700	2.7	5.3	0.055 (0.49)	6.8
PMA23C	PC8x3[8]	5.9 (52.4)	5.9 (52.2)	2.0 (17.7)	1.6 (14.2)	4,200	5,850	3.4	10.6	0.055 (0.49)	10.6
PMA23D	PC8x4[8]	7.3 (64.6)	7.3 (64.3)	2.0 (17.7)	1.4 (12.3)	6,400	8,750	5.0	20.0	0.055 (0.49)	3.0
PMA23D	SC9x3[8]	4.2 (36.8)	4.1 (36.6)	2.0 (17.7)	1.3 (11.5)	7,400	8,750	5.0	10.6	0.055 (0.49)	3.0
PMA24C	PC8x3[8]	7.9 (70.2)	7.9 (70.9)	2.6 (23.0)	2.2 (19.5)	3,000	4,350	3.3	10.6	0.072 (0.64)	8.9
PMA24D	PC8x4[8]	9.5 (84.1)	9.5 (83.8)	2.6 (23.0)	1.9 (17.2)	4,950	6,950	5.3	21.2	0.072 (0.64)	3.5
PMA24D	SC9x3[8]	5.1 (45.3)	5.1 (45.0)	2.6 (23.0)	1.8 (16.1)	5,850	6,950	5.3	10.6	0.072 (0.64)	3.5
PMA42M	PC8x2, SC9x2/SCE9x2[8]	7.7 (67.9)	7.6 (67.7)	4.1 (36.3)	3.9 (34.5)	1,600	2,350	2.8	5.3	0.36 (3.2)	26.0
PMA42N	PC8x3[8]	11.3 (99.9)	11.2 (99.6)	4.0 (35.4)	3.8 (33.6)	1,950	3,100	3.6	10.6	0.36 (3.2)	14.3
PMA42P	SC903[8]	9.1 (80.4)	9.0 (79.9)	4.1 (36.3)	3.6 (31.9)	2,950	4,000	4.7	10.6	0.36 (3.2)	8.9
PMA42Q	PC8x4[8]	12.6 (111)	12.5 (111)	4.1 (36.3)	3.4 (30.1)	3,800	5,450	6.5	21.2	0.36 (3.2)	4.7
PMA43N	PC8x3[8]	16.9 (149)	16.8 (149)	5.9 (52.2)	5.8 (51.3)	1,250	2,050	3.6	10.6	0.52 (4.6)	20.0
PMA43P	SC903[8]	13.8 (122)	13.8 (122)	6.1 (54.0)	5.6 (49.6)	1,850	2,600	4.6	10.6	0.52 (4.6)	13.0
PMA43Q	PC8x4[8]	17.3 (153)	17.2 (152)	6.0 (53.2)	5.2 (46.0)	3,000	4,050	7.1	21.2	0.52 (4.6)	5.3
PMA43R	SC904[8]	12.6 (112)	12.5 (111)	6.1 (54.0)	4.5 (39.8)	4,700	5,650	10.1	21.2	0.52 (4.6)	2.7
PMA44N	PC8x3[8]	23.3 (206)	23.2 (206)	8.2 (72.6)	7.9 (70.0)	850	1,550	3.6	10.6	0.68 (6.0)	27.0
PMA44P	PC8x3[8]	15.9 (141)	15.9 (140)	8.0 (71.3)	7.4 (65.5)	1,750	2,250	5.3	10.6	0.68 (6.0)	12.4
PMA44Q	PC8x4[8]	23.2 (205)	23.1 (205)	8.1 (71.6)	7.3 (64.4)	2,100	3,000	7.1	21.2	0.68 (6.0)	7.1
PMA44R	SC904[8]	17.0 (150)	16.9 (149)	8.2 (72.6)	6.7 (59.3)	3,450	4,200	10.1	21.2	0.68 (6.0)	3.6
PMA45N	PC8x3[8]	29.0 (256)	28.9 (256)	10.2 (90.3)	9.9 (87.6)	600	1,200	3.6	10.6	0.84 (7.4)	33.0
PMA45Q	PC8x4[8]	29.3 (259)	29.2 (258)	10.2 (90.3)	9.4 (83.2)	1,650	2,350	7.1	21.2	0.84 (7.4)	8.7
PMA45R	SC904[8]	21.3 (189)	21.2 (188)	10.2 (90.3)	8.9 (78.8)	2,700	3,300	10.0	21.2	0.84 (7.3)	4.4
PMA53Q	PC8x4[8]	26.9 (238)	26.8 (237)	10.5 (92.9)	9.6 (85.0)	1,300	2,250	6.8	21.2	1.92 (17.0)	15.0
PMA53R	SC904[8]	20.6 (182)	20.5 (181)	10.5 (92.9)	8.8 (77.9)	2,350	3,200	9.7	21.2	1.92 (17.0)	7.2
PMA54Q	PC8x4[8]	34.1 (302)	34.1 (301)	13.5 (120)	12.4 (110)	1,200	1,800	7.1	21.2	2.49 (22.0)	16.0
PMA54R	SC904[8]	24.7 (219)	24.6 (218)	13.5 (120)	11.6 (103)	2,100	2,700	10.6	21.2	2.49 (22.0)	7.1

① See page 30 for definitions of ratings.
② Peak torque ratings are for 5 seconds.
③ Peak torque ratings are for 2 seconds.
④ Peak torque ratings are for 1 second.
⑤ Peak torque ratings are for .5 second.
⑥ Rated speed is provided for operation on 240V ac 3-phase line. Reduce to approximately 85% for 240V ac 1-phase line operation and to 40% for 120V ac 1-phase line operation.
⑦ Includes resolver feedback inertia.
⑧ Each system requires one feedback and one motor power cable.
⑨ Characteristics shown with drive default parameters limited to 2.5x the motor's continuous rating. Higher peak system performance available. Contact the factory.

SYSTEMS DATA

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SYSTEMS PERFORMANCE DATA

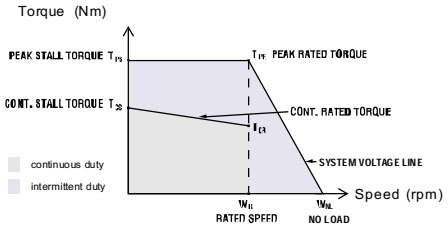
RECOMMENDED MOTOR/DRIVE SYSTEMS, 240V ac, 320V dc bus[1] continued

Servo Motor Model[6]	Servo Drive Model	Peak Stall Torque T_{PS}[1] Nm (lb.-in.)	Peak Rated Torque T_{PR} Nm (lb.-in.)	Cont. Stall Torque T_{CS} Nm (lb.-in.)	Cont. Rated Torque T_{CR} Nm (lb.-in.)	Rated Speed W_R[6] rpm	No-Load Speed W_{NL} rpm	Cont. Stall Current I_{CS} A_{RMS}	Current at Peak Torque I_{PS} A_{RMS}	Inertia[7] J kgm^2 x 10^{-3} (lb.-in.-S^2 x 10^{-3})	Inductance Line-Line L mH
PMA55Q	PC8x4[9]	43.0 (380)	42.9 (379)	17.0 (151)	16.0 (141)	900	1,450	7.1	21.2	3.06 (27.1)	20.0
PMA55R	SC904[8]	31.1 (276)	31.0 (274)	17.0 (151)	15.2 (135)	1,650	2,150	10.6	21.2	3.06 (27.1)	8.8
PMA55S	SC905[8]	31.0 (274)	30.7 (272)	17.0 (151)	13.1 (116)	3,450	4,300	21.3	42.4	3.06 (27.1)	2.2
PMA57R	SC904[8]	43.6 (386)	43.5 (384)	22.0 (195)	20.5 (181)	1,150	1,550	9.8	21.2	4.21 (37.3)	12.5
PMA57S	SC905[9]	43.8 (388)	43.6 (386)	22.0 (195)	18.4 (163)	2,450	3,050	19.5	42.4	4.21 (37.3)	3.1
PMA65S	SC905[8]	56.8 (503)	56.6 (501)	30.0 (266)	24.5 (217)	1,750	2,400	20.9	42.4	7.9 (70.0)	5.9
PMA66S	SC905[8]	68.9 (609)	68.6 (607)	36.0 (319)	31.0 (274)	1,450	2,000	20.7	42.4	9.4 (83.3)	7.0
PMA67S	SC905[8]	80.3 (711)	80.1 (709)	42.0 (372)	37.0 (328)	1,250	1,700	20.7	42.4	10.9 (96.5)	8.2
PMA69S	SC905[9]	104 (919)	104 (917)	54.0 (478)	48.5 (429)	950	1,300	20.6	42.4	13.9 (123)	10.4
PMA Series motors with PC34xxA Drives											
PMA11A	PC3403[8]	0.64 (5.7)	0.64 (5.7)	0.26 (2.3)	0.18 (1.6)	10,000	12,900	0.96	2.4[8]	0.012 (0.102)	7.1
PMA12A	PC3403[8]	1.5 (13.3)	1.5 (13.3)	0.6 (5.3)	0.47 (4.2)	8,750	10,800	1.88	4.7[8]	0.019 (0.164)	4.3
PMA13B	PC3403[8]	1.9 (17.3)	1.9 (17.2)	0.9 (8.0)	0.6 (5.4)	8,800	10,600	2.73	6.0	0.026 (0.226)	2.7
PMA21B	PC3403[8]	1.5 (13.5)	1.5 (13.5)	0.63 (5.6)	0.47 (4.2)	6,800	9,250	1.72	4.3[8]	0.022 (0.19)	10.5
PMA22B	PC3403[8]	2.9 (25.5)	2.9 (25.3)	1.3 (11.5)	1.0 (9.0)	5,600	7,100	2.65	6.0	0.038 (0.34)	7.4
PMA23B	PC3403[8]	4.3 (38.5)	4.3 (38.3)	2.0 (17.7)	1.7 (14.7)	3,550	4,700	2.7	6.0	0.055 (0.49)	6.8
PMA23C	PC3403[8]	3.5 (30.8)	3.5 (30.6)	1.8 (15.6)	1.5 (13.6)	4,900	5,850	3.0	6.0	0.055 (0.49)	10.6
PMA23D	PC3406[8]	4.7 (41.2)	4.7 (41.1)	2.0 (17.7)	1.3 (11.7)	7,200	8,750	5.0	12.0	0.055 (0.49)	3.0
PMA24C	PC3403[8]	4.7 (41.2)	4.6 (41.1)	2.4 (20.9)	2.1 (18.8)	3,600	4,350	3.0	6.0	0.072 (0.64)	8.9
PMA24D	PC3406[8]	5.8 (51.6)	5.7 (51.0)	2.6 (23.0)	1.8 (16.1)	5,800	6,950	5.3	12.0	0.072 (0.64)	3.5
PMA42M	PC3403[8]	8.6 (76.5)	8.6 (76.3)	4.1 (36.3)	3.9 (34.6)	1,500	2,350	2.8	6.0	0.36 (3.2)	26.0
PMA42Q	PC3406[8]	7.5 (66.3)	7.4 (65.7)	3.8 (33.5)	3.1 (27.4)	4,500	5,450	6.0	12.0	0.36 (3.2)	4.7
PMA42Q	PC3410[8]	9.9 (88.1)	9.9 (87.5)	4.1 (36.3)	3.2 (28.3)	4,150	5,450	6.5	16.2[8]	0.36 (3.2)	4.7
PMA43N	PC3403[8]	9.8 (87.0)	9.8 (86.6)	4.9 (43.4)	4.8 (42.5)	1,600	2,050	3.0	6.0	0.52 (4.6)	20.0
PMA43P	PC3406[9]	14.9 (132)	14.9 (131)	6.1 (54.0)	5.6 (49.6)	1,800	2,600	4.6	11.5[9]	0.52 (4.6)	13.0
PMA43R	PC3410[8]	11.9 (106)	11.8 (105)	6.0 (53.5)	4.5 (39.6)	4,750	5,650	10.0	20.0	0.52 (4.6)	2.7
PMA44N	PC3403[8]	13.6 (120)	13.5 (120)	6.8 (60.5)	6.7 (59.3)	1,100	1,550	3.0	6.0	0.68 (6.0)	27.0
PMA44P	PC3406[8]	17.9 (159)	17.9 (158)	8.2 (72.6)	7.5 (65.9)	1,650	2,250	5.4	12.0	0.68 (6.0)	12.4
PMA44R	PC3410[9]	16.1 (142)	15.9 (141)	8.1 (71.8)	6.7 (59.1)	3,500	4,200	10.0	20.0	0.68 (6.0)	3.6
PMA45N	PC3403[8]	16.9 (150)	16.9 (149)	8.5 (75.2)	8.4 (74.8)	850	1,200	3.0	6.0	0.84 (7.4)	33.0
PMA45N	PC3406[8]	25.0 (221)	25.0 (221)	10.2 (90.3)	9.9 (87.5)	650	1,200	3.6	9.0[8]	0.84 (7.4)	33.0
PMA45R	PC3410[8]	20.2 (179)	20.0 (178)	10.2 (90.3)	8.9 (78.6)	2,750	3,300	10.0	20.0	0.84 (7.3)	4.4
PMA53Q	PC3406[8]	17.1 (151)	17.0 (150)	9.2 (81.4)	9.1 (80.5)	1,650	2,250	6.0	12.0	1.92 (17.0)	15.0
PMA53R	PC3410[9]	19.6 (173)	19.5 (172)	10.5 (92.9)	8.6 (76.5)	2,400	3,200	9.7	20.0	1.92 (17.0)	7.2
PMA54R	PC3410[8]	23.5 (208)	23.4 (207)	12.7 (113)	11.6 (103)	2,100	2,700	10.0	20.0	2.49 (22.0)	7.1
PMA55R	PC3410[8]	29.6 (262)	29.5 (261)	16.0 (142)	15.2 (135)	1,700	2,150	10.0	20.0	3.06 (27.1)	8.8
PMA55S	PC3420[8]	29.4 (261)	29.2 (258)	16.0 (142)	13.1 (116)	3,500	4,300	20.0	40.0	3.06 (27.1)	2.2
PMA57R	PC3410[9]	41.4 (367)	41.3 (366)	22.0 (195)	20.5 (181)	1,200	1,550	9.8	20.0	4.21 (37.3)	12.5
PMA57S	PC3420[8]	41.6 (369)	41.4 (366)	22.0 (195)	18.3 (162)	2,500	3,050	19.5	40.0	4.21 (37.3)	3.1
MA65S	PC3420[8]	53.9 (477)	53.7 (475)	28.7 (254)	24.5 (217)	1,800	2,400	20.0	40.0	7.9 (70.0)	5.9
PMA66S	PC3420[8]	65.3 (578)	65.1 (576)	34.8 (308)	31.0 (274)	1,450	2,000	20.0	40.0	9.4 (83.3)	7.0
PMA67S	PC3420[8]	76.2 (675)	76.0 (673)	40.6 (359)	37.0 (328)	1,250	1,700	20.0	40.0	10.9 (96.5)	8.2
PMA69S	PC3420[8]	98.5 (872)	98.3 (870)	52.4 (464)	48.5 (429)	950	1,300	20.0	40.0	13.9 (123)	10.4
PMB Series motors with PC8xx and SC9xx Drives											
PMB13B	PC8x2, SC9x2/SCE9x2[9]	1.32 (11.7)	1.28 (11.3)	0.55 (4.9)	0.37 (3.27)	11,500	13,300	2.2	5.3	0.0127 (0.112)	4.8
PMB21B	PC8x2, SC9x2/SCE9x2[8]	1.32 (11.7)	1.28 (11.3)	0.62 (5.5)	0.42 (3.7)	9,500	13,200	2.5	5.3	0.023 (0.204)	5.5
PMB22B	PC8x2, SC9x2/SCE9x2[8]	2.26 (20.0)	2.23 (19.7)	1.11 (9.8)	0.9 (8.0)	6,000	7,700	2.6	5.3	0.044 (0.388)	6.7
PMB23B	PC8x2, SC9x2/SCE9x2[8]	3.18 (28.1)	3.15 (27.9)	1.53 (13.5)	1.33 (11.8)	4,100	5,500	2.6	5.3	0.065 (0.574)	8.4
PMB23C	PC8x3, SC9x3[8]	4.56 (40.4)	4.51 (39.9)	1.53 (13.5)	1.22 (10.8)	5,600	7,400	3.4	10.2	0.065 (0.574)	4.3
PMB31B	PC8x2, SC9x2/SCE9x2[8]	4.1 (36.3)	4.0 (35.4)	2.03 (18.0)	1.94 (17.2)	3,100	4,300	2.64	5.3	0.137 (1.21)	16.0
PMB31D	PC8x4[8]	6.05 (53.5)	6.0 (53.1)	2.03 (18.0)	1.61 (14.2)	5,700	8,400	5.1	15.3	0.137 (1.21)	4.2

① See page 30 for definitions of ratings.
② Peak torque ratings are for 5 seconds.
③ Peak torque ratings are for 2 seconds.
④ Peak torque ratings are for 1 second.
⑤ Peak torque ratings are for .5 second.
⑥ Rated speed is provided for operation on 240V ac 3-phase line. Reduce to approximately 85% for 240V ac 1-phase line operation and to 40% for 120V ac 1-phase line operation.
⑦ Includes resolver feedback inertia.
⑧ Each system requires one feedback and one motor power cable.
⑨ Characteristics shown with drive default parameters limited to 2.5x the motor's continuous rating. Higher peak system performance available. Contact the factory.

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SYSTEMS PERFORMANCE DATA



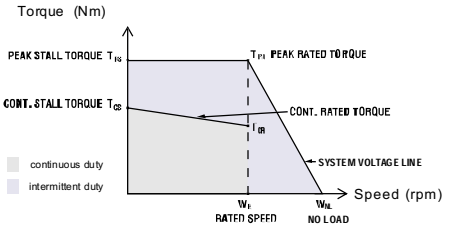
RECOMMENDED MOTOR/DRIVE SYSTEMS, 240V ac, 320V dc bus① continued

Servo Motor Model⑧	Servo Drive Model	Peak Stall Torque T_{PS} Nm (lb.-in.)	Peak Rated Torque T_{PR}⑤ Nm (lb.-in.)	Cont. Stall Torque T_{CS} Nm (lb.-in.)	Cont. Rated Torque T_{CR} Nm (lb.-in.)	Rated Speed W_R⑥ rpm	No-Load Speed W_{NL} rpm	Cont. Stall Current I_{CS} A_{RMS}	Current at Peak Torque I_{PS} A_{RMS}	Inertia⑦ J kgm² x 10^{-3} (lb.-in.-S² x 10^{-3})	Inductance Line-Line L mH
PMB31D	SC903④	4.2 (37.2)	4.1 (36.3)	2.03 (18.0)	1.53 (13.5)	6,550	8,400	5.1	10.6	0.137 (1.21)	4.2
PMB32C	PC8x2, SC9x2/SCE9x2②	6.9 (61.0)	6.9 (61.0)	3.56 (31.5)	3.6 (31.9)	1,900	2,550	2.7	5.3	0.272 (2.41)	19.3
PMB32C	PC8x3, SC9x3③	11.4 (101)	11.3 (100)	3.8 (33.6)	3.7 (32.7)	1,450	2,550	2.88	8.64	0.272 (2.41)	19.3
PMB32D	SC9x3④	7.9 (70.0)	7.8 (69.4)	3.8 (33.6)	3.4 (30.1)	3,600	4,450	5.1	10.6	0.272 (2.41)	6.2
PMB32D	PC8x4, SC9x4④	11.4 (101.0)	11.4 (101.0)	3.8 (33.6)	3.5 (31.0)	3,200	4,450	5.1	15.3	0.272 (2.41)	6.2
PMB32E	PC8x4, SC9x4④	11.4 (101.0)	11.4 (101.0)	3.8 (33.6)	3.2 (28.3)	4,400	5,850	6.7	20.1	0.272 (2.41)	3.6
PMB33C	PC8x2, SC9x2/SCE9x2②	9.8 (86.8)	9.7 (86.0)	4.9 (43.3)	4.9 (43.3)	1,350	1,800	2.7	5.3	0.408 (3.61)	23.4
PMB33C	PC8x3, SC9x3③	15.9 (141)	15.8 (140)	5.3 (46.9)	5.1 (45.1)	1,050	1,800	2.9	8.6	0.408 (3.61)	23.4
PMB33E	SC9x3③	9.7 (85.8)	9.7 (85.8)	4.8 (42.5)	4.6 (40.7)	3,050	3,600	5.3	10.6	0.408 (3.61)	5.8
PMB33E	PC8x4, SC9x4④	15.9 (141)	15.9 (141)	5.3 (46.9)	4.7 (41.6)	2,700	3,600	5.8	17.3	0.408 (3.61)	5.8
PMB33F	SC9x4④	12.5 (111)	12.4 (110)	5.3 (46.9)	3.75 (33.3)	4,800	5,600	9.0	21.2	0.408 (3.61)	2.4
PMB Series motors with PC34xx Drives											
PMB13B	PC3403⑤	1.5 (13.3)	1.46 (12.9)	0.55 (4.9)	0.38 (3.36)	11,300	13,300	2.2	6.0	0.0127 (0.112)	4.8
PMB21B	PC3403⑤	1.5 (13.3)	1.46 (12.9)	0.62 (5.5)	0.44 (3.9)	9,000	13,200	2.5	6.0⑨	0.023 (0.204)	5.5
PMB22B	PC3403⑤	2.57 (22.7)	2.53 (22.4)	1.11 (9.8)	0.91 (8.1)	5,750	7,700	2.6	6.0	0.044 (0.388)	6.7
PMB23B	PC3403⑤	3.6 (31.9)	3.57 (31.6)	1.53 (13.5)	1.33 (11.8)	3,950	5,500	2.6	6.0	0.065 (0.574)	8.4
PMB23C	PC3403⑤	2.66 (23.5)	2.60 (23.0)	1.3 (11.6)	1.17 (10.4)	6,350	7,400	3.0	6.0	0.065 (0.574)	4.3
PMB23C	PC3406⑤	3.79 (33.5)	3.74 (33.1)	1.53 (13.5)	1.2 (10.6)	5,900	7,400	3.4	8.5⑨	0.065 (0.574)	4.3
PMB31B	PC3403⑤	4.6 (40.7)	4.57 (40.4)	2.03 (18.0)	1.95 (17.3)	2,900	4,300	2.64	6.0	0.137 (1.21)	16.0
PMB31D	PC3406⑤	4.7 (41.6)	4.7 (41.6)	2.03 (18.0)	1.55 (13.7)	6,300	8,400	5.1	12.0	0.137 (1.21)	4.2
PMB32C	PC3403⑤	7.9 (70.0)	7.8 (69.0)	3.8 (33.6)	3.6 (31.9)	1,800	2,550	2.88	6.0	0.272 (2.41)	19.3
PMB32D	PC3406⑤	8.9 (78.8)	8.9 (78.8)	3.8 (33.6)	3.4 (30.1)	3,500	4,450	5.1	12.0	0.272 (2.41)	6.2
PMB32E	PC3410⑤	9.8 (85.0)	9.5 (84.1)	3.1 (33.6)	3.1 (27.4)	4,650	5,850	6.7	16.8⑨	0.272 (2.41)	3.6
PMB33C	PC3403⑤	11.0 (97.4)	11.0 (97.4)	5.0 (46.9)	5.0 (44.3)	1,250	1,800	2.9	6.0	0.408 (3.61)	23.4
PMB33E	PC3406⑤	11.0 (97.4)	11.0 (97.4)	4.6 (46.9)	4.6 (40.7)	3,000	3,600	5.8	12.0	0.408 (3.61)	5.8
PMB33F	PC3410⑤	11.8 (104)	11.7 (104)	3.8 (46.9)	3.8 (33.3)	4,850	5,600	9.0	20.0	0.408 (3.61)	2.4
S Series motors with PC8xx and SC9xx Drives											
S21H	PC8x3③	1.4 (12.5)	1.4 (12.3)	0.51 (4.5)	0.32 (2.8)	12,500	12,500	3.1	9.3	0.042 (0.38)	3.7
S21H	PC8x2, SC9x2/SCE9x2②	0.82 (7.3)	0.80 (7.1)	0.43 (3.8)	0.27 (2.4)	12,500	12,500	2.65	5.3	0.042 (0.38)	3.7
S22H	PC8x3④	2.6 (23.1)	2.6 (22.9)	1.0 (8.8)	0.68 (6.0)	7,600	10,400	2.9	8.6	0.064 (0.56)	5.7
S22H	PC8x2, SC9x2/SCE9x2②	1.6 (14.6)	1.6 (14.3)	0.90 (8.0)	0.59 (5.2)	9,100	10,400	2.65	5.3	0.064 (0.56)	5.7
S24G	PC8x3③	5.1 (44.7)	5.0 (44.5)	1.6 (14.4)	1.5 (12.9)	3,400	4,900	2.6	7.8	0.100 (0.89)	9.3
S24G	PC8x2, SC9x2/SCE9x2②	3.5 (30.9)	3.5 (30.7)	1.6 (14.4)	1.4 (12.5)	4,000	4,900	2.6	5.3	0.100 (0.89)	9.3
S24H	PC8x4④	5.0 (44.1)	4.9 (43.6)	1.6 (14.4)	0.55 (4.9)	8,000	9,800	5.1	15.4	0.100 (0.89)	2.2
S24H	SC9x3③	3.5 (30.9)	3.4 (30.4)	1.6 (14.4)	0.55 (4.9)	8,000	9,800	5.1	10.6	0.100 (0.89)	2.2
S31H	PC8x3③	6.6 (58.8)	6.6 (58.5)	2.3 (20.0)	1.9 (16.6)	3,500	5,200	3.3	10.6	0.18 (1.58)	10.3
S31H	PC8x2, SC9x2/SCE9x2②	3.4 (29.8)	3.3 (29.4)	1.8 (16.0)	1.4 (12.4)	4,600	5,200	2.65	5.3	0.18 (1.58)	10.3
S32G	PC8x3③	13.0 (115)	13.0 (115)	4.0 (35.6)	3.6 (32.3)	1,500	2,600	3.1	10.6	0.34 (2.98)	18
S32G	PC8x2, SC9x2/SCE9x2②	6.6 (58.4)	6.6 (58.0)	3.4 (30.4)	3.0 (26.2)	2,200	2,600	2.65	5.3	0.34 (2.98)	18
S32H	PC8x4④	13.0 (115)	12.9 (114)	4.0 (35.6)	2.8 (24.9)	3,900	5,300	6.1	21.2	0.34 (2.98)	4.5
S32H	SC9x3③	6.6 (58.4)	6.5 (57.6)	3.5 (30.9)	2.2 (19.5)	4,800	5,300	5.3	10.6	0.34 (2.98)	4.5
S33A	PC8x3③	15.6 (138)	15.6 (138)	5.3 (47.0)	4.7 (41.3)	1,500	2,200	3.5	10.6	0.48 (4.28)	17
S33D	PC8x4④	15.6 (138)	15.5 (137)	5.3 (46.9)	3.7 (32.6)	3,600	4,400	7.0	21.2	0.48 (4.28)	4.4
S33D	SC9x4④	15.6 (138)	15.5 (137)	5.3 (46.9)	3.7 (32.6)	3,600	4,400	7.0	21.2	0.48 (4.28)	4.4
S33G	PC8x2, SC9x2/SCE9x2②	9.7 (86.2)	9.7 (85.9)	5.0 (44.6)	4.6 (40.5)	1,400	1,800	2.65	5.3	0.48 (4.28)	25.2
S33H	SC9x3③	9.7 (86.2)	9.7 (85.6)	5.0 (44.6)	3.7 (32.6)	3,200	3,600	5.3	10.6	0.48 (4.28)	6.3
S34A	PC8x3④	17.5 (155)	17.4 (154)	6.0 (53.5)	5.1 (45.5)	1,500	2,000	3.6	10.6	0.64 (5.68)	14.7
S34G	PC8x2, SC9x2/SCE9x2②	11.0 (97.3)	10.9 (96.8)	5.6 (50.0)	4.9 (43.7)	1,300	1,600	2.65	5.3	0.64 (5.68)	23.7
S34H	PC8x4④	22.0 (195)	21.9 (194)	6.6 (58.4)	4.3 (38.1)	2,400	3,100	6.1	21.2	0.64 (5.68)	5.9
S34H	SC9x3③	11.0 (97.3)	10.9 (96.5)	5.7 (50.4)	4.0 (35.4)	2,700	3,100	5.3	10.6	0.64 (5.68)	5.9
S Series motors with PC34xx Drives											
S21H	PC3403⑤	0.93 (8.2)	0.91 (8.1)	.49 (4.3)	0.32 (2.8)	12,500	12,500	3.0	6.0	0.042 (0.38)	3.7

① See page 30 for definitions of ratings.
② Peak torque ratings are for 5 seconds.
③ Peak torque ratings are for 2 seconds.
④ Peak torque ratings are for 1 second.
⑤ Peak torque ratings are for .5 second.
⑥ Rated speed is provided for operation on 240V ac 3-phase line. Reduce to approximately 85% for 240V ac 1-phase line operation and to 40% for 120V ac 1-phase line operation.
⑦ Includes resolver feedback inertia.
⑧ Each system requires one feedback and one motor power cable.
⑨ Characteristics shown with drive default parameters limited to 2.5x the motor's continuous rating. Higher peak system performance available. Contact the factory.

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SYSTEMS PERFORMANCE DATA

RECOMMENDED MOTOR/DRIVE SYSTEMS, 240V ac, 320V dc bus[1] continued

Servo Motor Model[3]	Servo Drive Model	Peak Stall Torque T_{PS} Nm (lb.-in.)	Peak Rated Torque T_{PR}[2] Nm (lb.-in.)	Cont. Stall Torque T_{CS} Nm (lb.-in.)	Cont. Rated Torque T_{CR} Nm (lb.-in.)	Rated Speed W_R[6] rpm	No-Load Speed W_{NL} rpm	Cont. Stall Current I_{CS} A_{RMS}	Current at Peak Torque I_{PS} A_{RMS}	Inertia[7] J $kgm^2 \times 10^{-3}$ ($lb.-in.-S^2 \times 10^{-3}$)	Inductance Line-Line L mH
S22H	PC3403[3]	1.8 (16.4)	1.8 (16.2)	1.0 (8.8)	0.62 (5.5)	8,500	10,400	2.9	6.0	0.064 (0.56)	5.7
S24G	PC3403[3]	3.9 (34.9)	3.9 (34.8)	1.6 (14.4)	1.4 (12.7)	3,750	4,900	2.6	6.0	0.100 (0.89)	9.3
S24H	PC3406[3]	3.9 (34.9)	3.9 (34.4)	1.6 (14.4)	0.55 (4.9)	8,000	9,800	5.1	12.0	0.100 (0.89)	2.2
S31H	PC3403[3]	3.8 (33.6)	3.7 (32.8)	2.0 (17.7)	1.5 (13.3)	4,300	5,200	3.0	6.0	0.18 (1.58)	10.3
S32G	PC3403[3]	7.5 (66.0)	7.4 (65.7)	3.9 (34.3)	3.1 (27.4)	2,050	2,600	3.0	6.0	0.34 (2.98)	18
S32H	PC3406[3]	7.5 (66.0)	7.4 (65.2)	3.9 (34.8)	2.3 (20.3)	4,600	5,300	6.0	12.0	0.34 (2.98)	4.5
S33A	PC3403[3]	8.9 (78.9)	8.9 (78.5)	4.5 (40.2)	4.6 (40.5)	1,800	2,200	3.0	6.0	0.48 (4.28)	17
S33D	PC3410[3]	12.9 (114)	12.8 (113)	5.3 (46.9)	3.6 (31.7)	3,700	4,400	7.0	17.5	0.48 (4.28)	4.4
S33G	PC3403[3]	11.0 (97.4)	11.0 (97.1)	5.3 (47.1)	4.6 (41.1)	1,300	1,800	2.77	6.0	0.48 (4.28)	25.2
S33H	PC3406[3]	11.0 (97.4)	10.9 (96.8)	5.3 (47.0)	3.7 (33.2)	3,100	3,600	5.6	12.0	0.48 (4.28)	6.3
S34A	PC3403[3]	9.9 (87.4)	9.8 (86.9)	5.1 (45.1)	4.9 (43.4)	1,700	2,000	3.0	6.0	0.64 (5.68)	14.7
S34G	PC3403[3]	12.4 (110)	12.4 (109)	6.4 (56.5)	5.0 (44.5)	1,200	1,600	3.0	6.0	0.64 (5.68)	23.7
S34H	PC3406[3]	12.6 (112)	12.5 (111)	6.4 (56.5)	4.1 (36.3)	2,600	3,100	6.0	12.0	0.64 (5.68)	5.9

① See page 30 for definitions of ratings.
② Peak torque ratings are for 5 seconds.
③ Peak torque ratings are for 2 seconds.
④ Peak torque ratings are for 1 second.
⑤ Peak torque ratings are for .5 second.
⑥ Rated speed is provided for operation on 240V ac 3-phase line. Reduce to approximately 85% for 240V ac 1-phase line operation and to 40% for 120V ac 1-phase line operation.
⑦ Includes resolver feedback inertia.
⑧ Each system requires one feedback and one motor power cable.
⑨ Characteristics shown with drive default parameters limited to 2.5x the motor's continuous rating. Higher peak system performance available. Contact the factory.

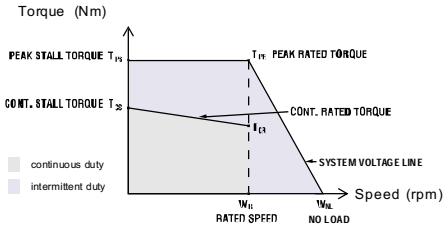
RECOMMENDED MOTOR/DRIVE SYSTEMS, 400V ac, 560V dc bus[1]

Servo Motor Model[3]	Servo Drive Model	Peak Stall Torque T_{PS}[1] Nm (lb.-in.)	Peak Rated Torque T_{PR}[2] Nm (lb.-in.)	Cont. Stall Torque T_{CS} Nm (lb.-in.)	Cont. Rated Torque T_{CR} Nm (lb.-in.)	Rated Speed W_R[3] rpm	No-Load Speed W_{NL} rpm	Cont. Stall Current I_{CS} A_{RMS}	Current at Peak Torque I_{PS} A_{RMS}	Inertia[5] J $kgm^2 \times 10^{-3}$ ($lb.-in.-S^2 \times 10^{-3}$)	Inductance Line-Line L mH
PMA Series motors with SCE9xx Drives											
PMA42N	SCE9x3	8.2 (72.6)	8.1 (71.7)	4.1 (36.3)	3.2 (28.3)	4,300	5,450	3.7	7.5	0.36 (3.2)	14.3
PMA42P	SCE9x4	12.4 (110)	12.3 (109)	4.1 (36.3)	3.0 (26.6)	5,100	6,950	4.7	15.0	0.36 (3.2)	8.9
PMA43N	SCE9x3	12.2 (108)	12.1 (107)	6.1 (54.0)	5.3 (46.9)	2,800	3,600	3.7	7.5	0.52 (4.6)	20.0
PMA43P	SCE9x4	18.8 (166)	18.7 (165)	6.1 (54.0)	5.1 (45.1)	3,300	4,500	4.6	15.0	0.52 (4.6)	13.0
PMA43Q	SCE9x4	12.5 (111)	12.4 (110)	6.1 (54.0)	4.0 (35.4)	6,000	7,100	7.2	15.0	0.52 (4.6)	5.3
PMA44N	SCE9x3	16.9 (150)	16.8 (149)	8.2 (72.6)	7.3 (64.6)	2,100	2,650	3.6	7.5	0.68 (6.0)	27.0
PMA44Q	SCE9x4	16.9 (150)	16.7 (148)	8.2 (72.6)	4.9 (43.4)	4,400	5,250	7.2	15.0	0.68 (6.0)	7.1
PMA45N	SCE9x3	21.0 (186)	20.9 (185)	10.2 (90.3)	9.5 (84.0)	1,600	2,100	3.6	7.5	0.84 (7.4)	33.0
PMA45Q	SCE9x4	21.3 (189)	21.1 (187)	10.2 (90.3)	7.9 (69.9)	3,400	4,150	7.1	15.0	0.84 (7.4)	8.7
PMA53Q	SCE9x4	20.7 (183)	20.6 (182)	10.5 (92.9)	8.2 (72.6)	2,900	3,900	6.8	15.0	1.92 (17.0)	15.0
PMA53R	SCE9x5	21.6 (191)	21.5 (190)	10.5 (92.9)	7.2 (63.7)	4,200	5,600	9.7	22.5	1.92 (17.0)	7.2
PMA54Q	SCE9x4	25.9 (229)	25.8 (228)	13.5 (120)	11.4 (101)	2,400	3,150	7.1	15.0	2.49 (22.0)	16.0
PMA54R	SCE9x5	26.0 (230)	25.8 (228)	13.5 (150)	10.0 (88.5)	3,750	4,800	10.6	22.5	2.49 (22.0)	7.1
PMA55Q	SCE9x4	32.6 (289)	32.5 (288)	17.0 (151)	14.8 (131)	1,900	2,500	7.1	15.0	3.06 (27.1)	20.0
PMA55R	SCE9x5	32.8 (290)	32.6 (289)	17.0 (151)	13.7 (121)	3,000	3,800	10.6	22.5	3.06 (27.1)	8.8
PMA57R	SCE9x5	45.9 (406)	45.7 (404)	22.0 (195)	19.0 (168)	2,100	2,700	9.8	22.5	4.21 (37.3)	12.5
PMA65R	SCE9x5	55.9 (495)	55.7 (493)	30.0 (266)	25.0 (221)	1,600	2,250	11.3	22.5	7.9 (70.0)	20.0
PMA65S	SCE9x6	46.1 (408)	45.6 (404)	30.0 (266)	19.0 (169)	3,300	4,200	20.9	33.7	7.9 (70.0)	5.9
PMA66R	SCE9x5	67.1 (594)	66.9 (592)	36.0 (319)	31.4 (278)	1,350	1,850	11.3	22.5	9.4 (83.3)	24.0
PMA66S	SCE9x6	55.8 (494)	55.4 (490)	36.0 (319)	22.3 (197)	2,750	3,500	20.7	33.7	9.4 (83.0)	7.0
PMA67S	SCE9x6	65.1 (576)	64.7 (573)	42.0 (372)	32.8 (283)	2,350	2,950	20.7	33.7	10.9 (96.5)	8.2
PMA69S	SCE9x6	84.1 (744)	83.7 (741)	54.0 (478)	43.8 (388)	1,800	2,300	20.6	33.7	13.9 (123)	10.4
S Series motors with SCE9xx Drives											
S33A	SCE9x3	11.1 (98.4)	11.0 (97.4)	5.3 (47.0)	3.9 (34.5)	3,300	3,900	3.5	7.5	0.48 (4.28)	17.0
S34A	SCE9x3	12.4 (110)	12.3 (109)	6.4 (56.5)	4.3 (37.9)	3,000	3,500	3.8	7.5	0.64 (5.68)	14.7

① See page 30 for definitions of ratings.
② Peak torque ratings are for 5 seconds.
③ Rated speed is provided for operation on 480V ac 3-phase line.
④ Includes resolver feedback inertia.
⑤ Each system requires one feedback and one motor power cable.

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SYSTEMS PERFORMANCE DATA



RECOMMENDED MOTOR/DRIVE SYSTEMS, 480V ac,① 640V dc bus

Servo Motor Model⑤	Servo Drive Model	Peak Stall Torque T_{PS}① Nm (lb.-in.)	Peak Rated Torque T_{PR}② Nm (lb.-in.)	Cont. Stall Torque T_{CS} Nm (lb.-in.)	Cont. Rated Torque T_{CR} Nm (lb.-in.)	Rated Speed W_R③ rpm	No-Load Speed W_{NL} rpm	Cont. Stall Current I_{CS} A_{RMS}	Current at Peak Torque I_{PS} A_{RMS}	Inertia④ J $kgm^2 \times 10^{-3}$ ($lb.-in.-S^2 \times 10^{-3}$)	Inductance Line-Line L mH
PMA Series motors with SCE9xx Drives											
PMA42N	SCE9x3	8.2 (72.6)	8.1 (71.7)	4.1 (36.3)	3.2 (28.3)	4,300	5,450	3.7	7.5	0.36 (3.2)	14.3
PMA42P	SCE9x4	12.4 (110)	12.3 (109)	4.1 (36.3)	3.0 (26.6)	5,100	6,950	4.7	15.0	0.36 (3.2)	8.9
PMA43N	SCE9x3	12.2 (108)	12.1 (107)	6.1 (54.0)	5.3 (46.9)	2,800	3,600	3.7	7.5	0.52 (4.6)	20.0
PMA43P	SCE9x4	18.8 (166)	18.7 (165)	6.1 (54.0)	5.1 (45.1)	3,300	4,500	4.6	15.0	0.52 (4.6)	13.0
PMA43Q	SCE9x4	12.5 (111)	12.4 (110)	6.1 (54.0)	4.0 (35.4)	6,000	7,100	7.2	15.0	0.52 (4.6)	5.3
PMA44N	SCE9x3	16.9 (150)	16.8 (149)	8.2 (72.6)	7.3 (64.6)	2,100	2,650	3.6	7.5	0.68 (6.0)	27.0
PMA44Q	SCE9x4	16.9 (150)	16.7 (148)	8.2 (72.6)	4.9 (43.4)	4,400	5,250	7.2	15.0	0.68 (6.0)	7.1
PMA45N	SCE9x3	21.0 (186)	20.9 (185)	10.2 (90.3)	9.5 (84.0)	1,600	2,100	3.6	7.5	0.84 (7.4)	33.0
PMA45Q	SCE9x4	21.3 (189)	21.1 (187)	10.2 (90.3)	7.9 (69.9)	3,400	4,150	7.1	15.0	0.84 (7.4)	8.7
PMA53Q	SCE9x4	20.7 (183)	20.6 (182)	10.5 (92.9)	8.2 (72.6)	2,900	3,900	6.8	15.0	1.92 (17.0)	15.0
PMA53R	SCE9x5	21.6 (191)	21.5 (190)	10.5 (92.9)	7.2 (63.7)	4,200	5,600	9.7	22.5	1.92 (17.0)	7.2
PMA54Q	SCE9x4	25.9 (229)	25.8 (228)	13.5 (120)	11.4 (101)	2,400	3,150	7.1	15.0	2.49 (22.0)	16.0
PMA54R	SCE9x5	26.0 (230)	25.8 (228)	13.5 (150)	10.0 (88.5)	3,750	4,800	10.6	22.5	2.49 (22.0)	7.1
PMA55Q	SCE9x4	32.6 (289)	32.5 (288)	17.0 (151)	14.8 (131)	1,900	2,500	7.1	15.0	3.06 (27.1)	20.0
PMA55R	SCE9x5	32.8 (290)	32.6 (289)	17.0 (151)	13.7 (121)	3,000	3,800	10.6	22.5	3.06 (27.1)	8.8
PMA57R	SCE9x5	45.9 (406)	45.7 (404)	22.0 (195)	19.0 (168)	2,100	2,700	9.8	22.5	4.21 (37.3)	12.5
PMA65R	SCE9x5	55.9 (495)	55.7 (493)	30.0 (266)	25.0 (221)	1,600	2,250	11.3	22.5	7.9 (70.0)	20.0
PMA65S	SCE9x6	46.1 (408)	45.6 (404)	30.0 (266)	19.0 (169)	3,300	4,200	20.9	33.7	7.9 (70.0)	5.9
PMA66R	SCE9x5	67.1 (594)	66.9 (592)	36.0 (319)	31.4 (278)	1,350	1,850	11.3	22.5	9.4 (83.3)	24.0
PMA66S	SCE9x6	55.8 (494)	55.4 (490)	36.0 (319)	22.3 (197)	2,750	3,500	20.7	33.7	9.4 (83.0)	7.0
PMA67S	SCE9x6	65.1 (576)	64.7 (573)	42.0 (372)	32.8 (283)	2,350	2,950	20.7	33.7	10.9 (96.5)	8.2
PMA69S	SCE9x6	84.1 (744)	83.7 (741)	54.0 (478)	43.8 (388)	1,800	2,300	20.6	33.7	13.9 (123)	10.4
S Series motors with SCE9xx Drives											
S33A	SCE9x3	11.1 (98.4)	11.0 (97.4)	5.3 (47.0)	3.9)34.5)	3,300	3,900	3.5	7.5	0.48 (4.28)	17.0
S34A	SCE9x3	12.4 (110)	12.3 (109)	6.4 (56.5)	4.3 (37.9)	3,000	3,500	3.8	7.5	0.64 (5.68)	14.7

① See page 30 for definitions of ratings.

② Peak torque ratings are for 5 seconds.

③ Rated speed is provided for operation on 480V ac 3-phase line.

④ Includes resolver feedback inertia.

⑤ Each system requires one feedback and one motor power cable.

SYSTEMS DATA

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CABLING AND ACCESSORIES

THE ADVANTAGES OF FACTORY CABLING

The most common — and easily preventable — cause of startup problems is cabling. That's why we offer factory tested, fully terminated connecting cables for PacSci brushless servo systems. Factory cabling saves you time as well as troubleshooting.

The PC800 drives are equipped with appropriate connectors for system interconnection. The PMA and S Series motors described in this system selection guide are equipped with Interconnectron connectors. PMB motors offer AMP or MS connectors. One power cable and one feedback cable are necessary for connection between motor and drive.

POWER CABLE - PC800 AND PC3400

P P C - 0 1 0 1 0 1 - L L L

Cable Designator
PacSci Power Cable

Cable Length
Specify Cable Length in Whole Foot Increments from 1-150 feet③

Motor Connection
- **00** = No Connector
- **01** = Interconnectron no Brake, use 4 conductor cable
- **02** = Interconnectron w/Brake, use 6 conductor cable
- **03** = MS Connector no Brake, use 4 conductor cable①
- **04** = Single MS Connector Combined PWR/FDBK for R20②
- **05** = Single MS Connector Combined PWR/FDBK for S2/S3 Hall③ only
- **06** = Single MS Connector Combined PWR/FDBK for S2/S3 Hall/Encoder②
- **07** = AMP Connector — PMB motors only③

Drive Connection
- **00** = No Drive Connector
- **01** = Spade Lugs for PC800
- **02** = Spade Lugs and 15-pin DB Connector for Feedback③
- **03** = Molex Crimp Connector for PC3400D③
- **04** = Pluggable Screw Terminal for PC3403/06A③
- **05** = Pluggable Screw Terminal for PC3410/20A③

Cable Type
- **01** = Standard 4 Conductor, up to $10A_{RMS}$
- **02** = Standard 6 Conductor, up to $10A_{RMS}$
- **03** = Flexible 4 Conductor, up to $10A_{RMS}$
- **04** = Flexible 6 Conductor, up to $10A_{RMS}$
- **05** = Combined Power/Feedback Cable⑦
- **06** = Standard 4 Conductor, up to $5A_{RMS}$
- **07** = Standard 4 Conductor, up to $20A_{RMS}$

① Brake cable for MS connector motors sold separately.

② Combined power/feedback cable only available with motor connection options 04, 05 or 06.

③ Cable assemblies for PC3400 drives and/or PMB motors only available in 10-, 25- or 50-ft. lengths.

FEEDBACK CABLE - PC800 AND PC3400

P F C - 0 1 0 1 0 1 - L L L

Cable Designator
PacSci Feedback Cable

Cable Length
Specify Cable Length in Whole Foot Increments from 1-150 Feet①

Motor Connection
- **00** = No Connector
- **01** = Interconnectron Resolver Only
- **02** = Interconnectron Commcoder
- **03** = MS Connector Resolver Only
- **04** = MS Connector with Hall/Encoder (R&S Series Motors)
- **05** = AMP Connector — PMB Motors Only①

Drive Connection
- **00** = No Drive Connector
- **01** = Mini D-sub 15-Pin, for PC800
- **02** = Molex Crimp Connector for PC3400 Series

Cable Type
- **01** = Standard 4 Conductor, for Resolver Only
- **02** = Flexible 9 Conductor, for Resolver Only
- **03** = Standard 17 Conductor, for Commcoder
- **04** = Flexible 17 Conductor, for Commcoder
- **05** = Standard 14 Conductor, for PC3400 Drives Only

① Cable assemblies for PC3400 drives and/or PMB motors only available in 10-, 25- or 50-ft. lengths.

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CABLING AND ACCESSORIES

THE ADVANTAGES OF FACTORY CABLING

The most common — and easily preventable — cause of startup problems is cabling. That's why we offer factory tested, fully terminated connecting cables for PacSci brushless servo systems. Factory cabling saves you time as well as troubleshooting.

The SC/SCE900 drives are equipped with appropriate connectors for system interconnection. The PMA and S Series motors described in this system selection guide are equipped with Interconnectron connectors. One power cable and one feedback cable are necessary for connection between motor and drive.

POWER CABLE - SC/SCE900

CE P - X X - XXX - E 90 X - F

- **CE** — CE compliant cable
- **P** — Power Cable①
- **X** — **A** = PMA Motors; **E** = Sentry Motors with Interconnectron connectors
- **X** — **1** = 1 frame; **2** = 2 frame; **3** = 3 frame; **4** = 4 frame; **5** = 5 frame; **6** = 6 frame
- **XXX** — Three digits for distance in 1 foot increments
- **E** — **High Voltage Drives**: Leave Blank for low voltage SC900 series (including SCE902)
- **90** — 900 Series
- **X** — Power Level 2 through 6
- **F** — Flexible cable

FEEDBACK CABLE - SC/SCE900

CE F - RO - XXX - 900 X

- **CE** — CE compliant cable
- **F** — Feedback Cable
- **RO** — Resolver Only
- **XXX** — Three digits for distance in 1 foot increments
- **900** — 900 Series
- **X** — **A** = PMA, S20's and S30's with Interconnectron connectors non-flex cable; **C** = PMA, S20's and S30's with Interconnectron connectors with flex cable

① Flexible cable is available for High Voltage Drives.

RS-232 CABLE CS-232-950

FOR MODEL SC/SCE950, PC34xx

Use to connect SC/SCE950 servo controllers to personal computers. The 6 foot RS-232 cable connects 9-pin SC/SCE950 connector (J58 port) to PC's 9-pin serial port. Includes 9 to 25-pin adaptor for PCs with 25-pin serial port.

HOW TO ORDER . . . . . Model number

RS-232 cable CS-232-950



RECOMMENDED FILTERING FOR CE COMPLIANCE

There are many applications for machines today which require filtering to reduce electrical noise. Filters may be necessary to comply with the standards of the global regulatory groups, or just to have piece of mind for reliable machine operation. The SCE900 drives have been designed with this in mind. The table below summarizes the conditions under which filtering is required to meet the standards for CE compliance:

Drive	Cable Length	Filter	Supplier
SCE902	Up to 50 meters	25CE4	MTE Corporation ①Tel# 414-253-8200
SCE903	Up to 10 Meters	None	②
SCE904	Up to 10 Meters	None	②
SCE905	Up to 10 Meters	None	②
SCE906	Up to 10 Meters	None	② ③

① Recommended filter not supplied by Pacific Scientific.

② No filter is required with a single-axis at designated cable lengths. Filtering may be required for multi-axis configurations or longer cable lengths. Consult factory for more information.

③ A 3-phase line inductor with a minimum of 1.17mH is required to comply with CE. Consult Factory for more information.

Order these accessories to simplify installation, start-up and programming of your Pacific Scientific step motor and servo motor controls.

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