

Digital Servo Drive SCE 900

SCE 903	= $I_N = 3.75 A_{RMS}$	$I_P = 7.5 A_{RMS}$	$V_{Bus} = 560 V_{DC}$
SCE 904	= $I_N = 7.5 A_{RMS}$	$I_P = 15 A_{RMS}$	$V_{Bus} = 560 V_{DC}$
SCE 905	= $I_N = 11.25 A_{RMS}$	$I_P = 22.5 A_{RMS}$	$V_{Bus} = 560 V_{DC}$
SCE 906	= $I_N = 22.5 A_{RMS}$	$I_P = 33.7 A_{RMS}$	$V_{Bus} = 560 V_{DC}$
SCE 907	= $I_N = 45 A_{RMS}$	$I_P = 90 A_{RMS}$	$V_{Bus} = 560 V_{DC}$

Description

The SCE900 series is a family of next generation 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, which guarantees increased reliability, reproduction and eliminates drift. The SCE900 series is available in different power levels, all with integrated power supplies and shunt regulators. The models are available for input voltages from 180V_{AC} up to 528V_{AC}. Standard motor power and resolver feedback cables are available to complete your motion system and provide reliable trouble-free startup and operation.

The base SCE 900 unit includes several interface command features. A standard ±10V analog interface is available to command motor torque or velocity, as well as a standard stepper interface, step/direction and step up/step down, and an incremental encoder interface to command motor position or velocity. The drive can also be used in an electronic gearing follower mode by using the quadrature encoder input.

Various option cards are available to increase the functionality of the base SCE 900 drive. To set the base SCE 900 parameters an option card is required 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 SCE 900 Firmware upgrades, which eliminates the need to disassemble equipment or the drive when upgrading.



Features

- Fully functional unit; Plug and Play
- Integrated power supply
- CE-certified without additional filters
- Integrated EMI/RFI suppression
- Sinusoidal commutation, velocity and position control via resolver
- Commutation via encoder optional¹
- All digital DSP-based
- Inaudible, high frequency, Digital PWM sine wave current control
- IGBT PWM Power Stage
- Temporary (5s) double output current
- Standard analog and digital interfaces:
 - 10V analog interface – Velocity or torque control
 - Digital step/direction interface – Position or velocity control
 - Step up/step down interface – Position or velocity control
 - Quadrature encoder interface – Electronic gearing follower
- Removable option card for flexibility:
 - RS-232/485 serial interface
 - SERCOS multi-axis fiber optic interface
 - Servo BASIC *Plus*® programmable positioning controller

¹ The encoder input can no longer be used for positioning when encoder feedback is activated.

- Personality parameters in base drive or on removable option card (EEPROM)
- Digital auto-tuning for easy Set-up, potentiometer line-up not necessary
- All system and application parameters set in software and can be saved in EEPROM
- User-friendly Windows® software for parameterization
- Quadrature encoder outputs up to 16,384 PPR
- Digital and analog I/Os
- Total front access to clearly marked connectors
- Extensive protection circuits and diagnostics for easy set-up

Protection/Diagnostics

- 7 segment status display
- In-rush current limiting
- Intelligent control power fuse
- Output short circuit protection
- Overtemperature protection motor and drive
- Ixt protection
- Undervoltage protection adjustable
- Overvoltage protection, integrated regeneration resistor

I/O

- Differential ± 10 V analog input
- 2 ± 5 V analog outputs
- 6 Bi-directional input/outputs, TTL or 24 V logic compatible
- Quadrature encoder output
- Quadrature encoder input (step/direction, encoder)
- Enable input
- User output +5V DC @ 200 mA

Communications

- OCE930 Serial Option Card
 - RS232 interface 9600 Baud
 - RS485 interface 9600 Baud, 32 nodes
- OCE940 SERCOS option card
- OCE950, PacLAN™

Signature Current Control

The 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 motors back EMF wave form. By tailoring the sinusoidal currents wave shape or „signature“ to match the motors back EMF, the electro-magnetic ripple torque is reduced to $\pm 2\%$. In your application, this results in a good smoothness and high efficiency. This proprietary commutation control also provides exceptional high-speed motor control.

Fully Digital Control

The combination of DSP (**D**igital **S**ignal **P**rocessor), DRDC (**D**igital **R**esolver **D**igital **C**onverter) and ASICs (**A**pplication **S**pecific **I**ntegrated **C**ircuits) gives the SCE900 its all digital-advantage. An all-digital implementation reduces component count to increase reliability while reducing cost, it eliminates analog drift, imprecise potentiometer adjustments, reduces size and increases flexibility.

Common Technical Data

Analog input command	
Range	± 10V (max. 13.5V) velocity or torque
Resolution	≥ 14 Bits
Digital Input Command	
Modes	Step/direction, step up/step down, encoder
Max. input frequency Step/direction, Pulse forward/reverse Quadrature encoder	1 MHz 833 kHz
Current loop	
Bandwidth	1500 Hz max.
Update period	62.5 µs
Velocity loop	
Bandwidth	400 Hz max.
Update period	250 µs
Command resolution	< 0.001 rpm
Feedback accuracy	0.05 % max.
Feedback ripple	0.75 % p-p at 1000 rpm (drive only) 3 % peak to peak at 1000 rpm (with 20 arcmin resolver)
Feedback resolution	0.014 rpm
Range	0 up to 30000 rpm
Position loop	
Bandwidth	100 Hz max.
Update period	1 ms
Command resolution	65536 Imp./rev. (16 bits/rev)
Feedback accuracy	± 5.3 arcmin (drive only) ± 15 arcmin (with 10 arcmin resolver)
Feedback resolution	16777216 (24 bits/rev)
Encoder output signals	
Type	Encoder with marker pulse, differential TTL line driver
Resolution	128, 256, ... 16384 PPR (binary) or 125, 250, ... 16000 PPR (decimal)
Max. output frequency	833 kHz
Marker pulse width	1 quadrature pulse nominal
Serial port	
Type	RS232, RS485
Baud rate	9600 baud
RS485 nodes	max. 32
Dedicated I/O	
	Enable
Programmable I/O	
	6 bi-directional, 24V PLC compatible I/O channels, 2 analog outputs
Environment conditions	
Storage temperature	-40 °C to +70 °C
Operating temperature	
Full ratings	0 °C to 50 °C
Convection cooling ¹⁾	25 °C to 60 °C
Forced air cooling ²⁾	50 °C to 60 °C
Altitude	1500 m (5000 ft.)
Humidity	10 % to 90 %, non-condensing

¹⁾ Linearly derate output power and output current from full rating 25 °C to 53 % at 60 °C
²⁾ Linearly derate output power and output current from full rating 50 °C to 66 % at 60 °C

Power Specifications

	SCE9x3A3	SCE9x3	SCE9x4	SCE9x5	SCE9x6	SCE9x7
Input voltages						
Control power supply	230 V _{AC} + 10 % – 55 %, 50/60 Hz single phase				115 or ¹⁾ 230 V _{AC}	
Main power supply	400 V _{AC} + 32 % – 55 %, 50/60 Hz three phase symmetrically					
Input current						
for control power from 1×230 V _{AC} mains	250 mA				300 mA	500 mA
for main power from 3×400 V _{AC} mains	5 A		10 A	15 A	30 A	60 A
Recommended fuse on 3×400 V mains	slow 10A or c.br. 10A, C	slow acting fuse 16 A or circuit breaker 16 A, characteristic C			slo. 32 A or c.br. 32A, C	slo. 63 A or c.br. 63A, C
Peak output current r.m.s. and (sine peak)						
Max. 5 s up to 50 °C ambient temp.	7.5 (10.5) A		15 (21.2) A	22.5 (31.8)A	33.7 (47.6)A	90 (127)A
Continuous output current r.m.s. and (sine peak value)						
at 25°C with convection cooling	3.75 (5.3) A		7.5 (10.6)A	11.25 (15.9)A	- / -	- / -
at 50°C with forced air cooling	not possible	3.75 (5.3) A	7.5 (10.6)A	11.25 (15.9)A	22.5 (31.8)A	45 (63.5)A
at 50°C with convection cooling	2.5 (3.5) A	3.75 (5.3) A	5.0 (7.1) A	7.5 (10.7) A	- / -	- / -
Peak output power at 3 ´ 400V_{AC} mains						
Maximum 1s up to 50°C amb. temp.	5 kVA		10 kVA	15 kVA	22.5 kVA	60 kVA
Continuous output power at 3 ´ 400V_{AC} mains	Reduce continuous output power linearly by 0.5 % for each meter of motor cable in excess of 10 meters.					
at 25°C with convection cooling	2.5 kVA		5 kVA	7.5 kVA	- / -	- / -
at 50°C with forced air cooling	not possible	2.5 kVA	5 kVA	7.5 kVA	15 kW	30 kVA
at 50°C with convection cooling	2.1 kVA	2.5 kVA	3.3 kVA	5 kVA	- / -	- / -

¹⁾ With the **SCE906**, the wide range capability of the control power input cannot be used because the AC input supplies the built-in fans, which need their rated voltage. Because of these fans two variants of SCE906 are built:

- a) SCE9x6x2-xxx-xx, suitable for a control power supply of 230 V +/- 10% f = 50...60 Hz
- b) SCE9x6x1-xxx-xx, suitable for a control power supply of 115 V +/- 10% f = 50...60 Hz

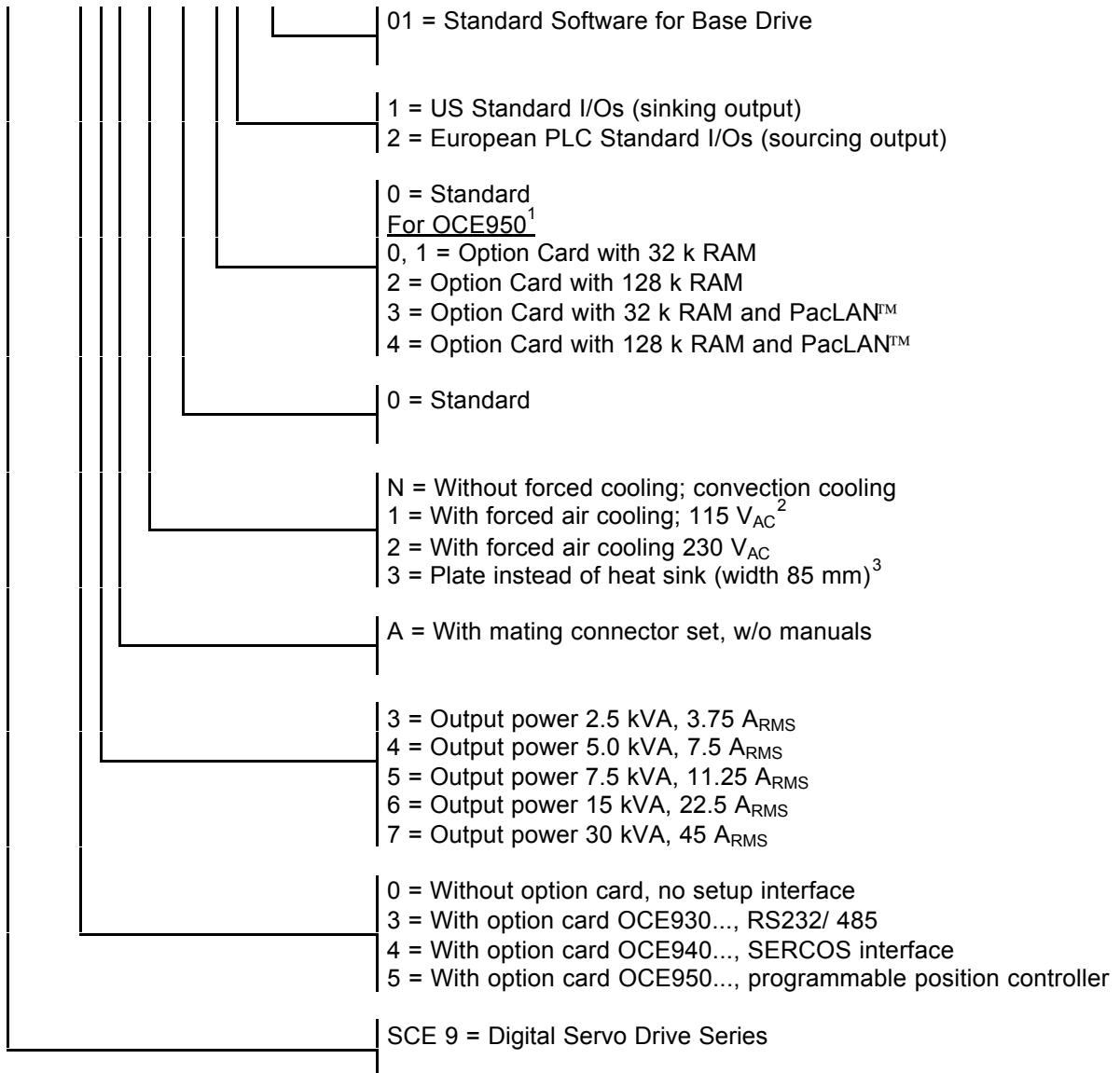
The available control power has to be taken into consideration before ordering the drives. If you wish to change this voltage after delivery, hardware alterations will be necessary.

The **SCE907** accepts either 115 or 220 V (+/- 10 %) at the control power input and automatically switches its two internal fans parallel or in series accordingly.

	SCE9x3A3	SCE9x3	SCE9x4	SCE9x5	SCE9x6	SCE9x7
Power stage efficiency						
at continuous power	>96 %		>97 %	> 97 %	> 97 %	>98 %
Regeneration circuit power						
Peak power (for 350 ms)	8 kW	16 kW			24 kW	with extern. resistor 60 kW
Continuous power						
at 25°C with convection cooling	25 W	100 W		200 W	- / -	
at 50°C with forced air cooling	not poss.	125 W		250 W	250 W	with extern. resistor 15 kW
at 50°C with convection cooling	20 W	100 W		200 W	- / -	
Output current ripple frequency	20 kHz				16 kHz	10 kHz
Min. motor winding inductance	4 mH		2 mH	1.4 mH	1.1 mH	0,7 mH
Max. motor cable length	50 meters, CE approved for max. 10 meters with internal filter; CE approved for 50 meters with additional filter					
EMC / RFI suppression:	EN50081-2 / EN50082-2 (optional EN50081-1 with additional filter)				EN61800-3	

Order Code for SCE900

SCE 904AN-002-01

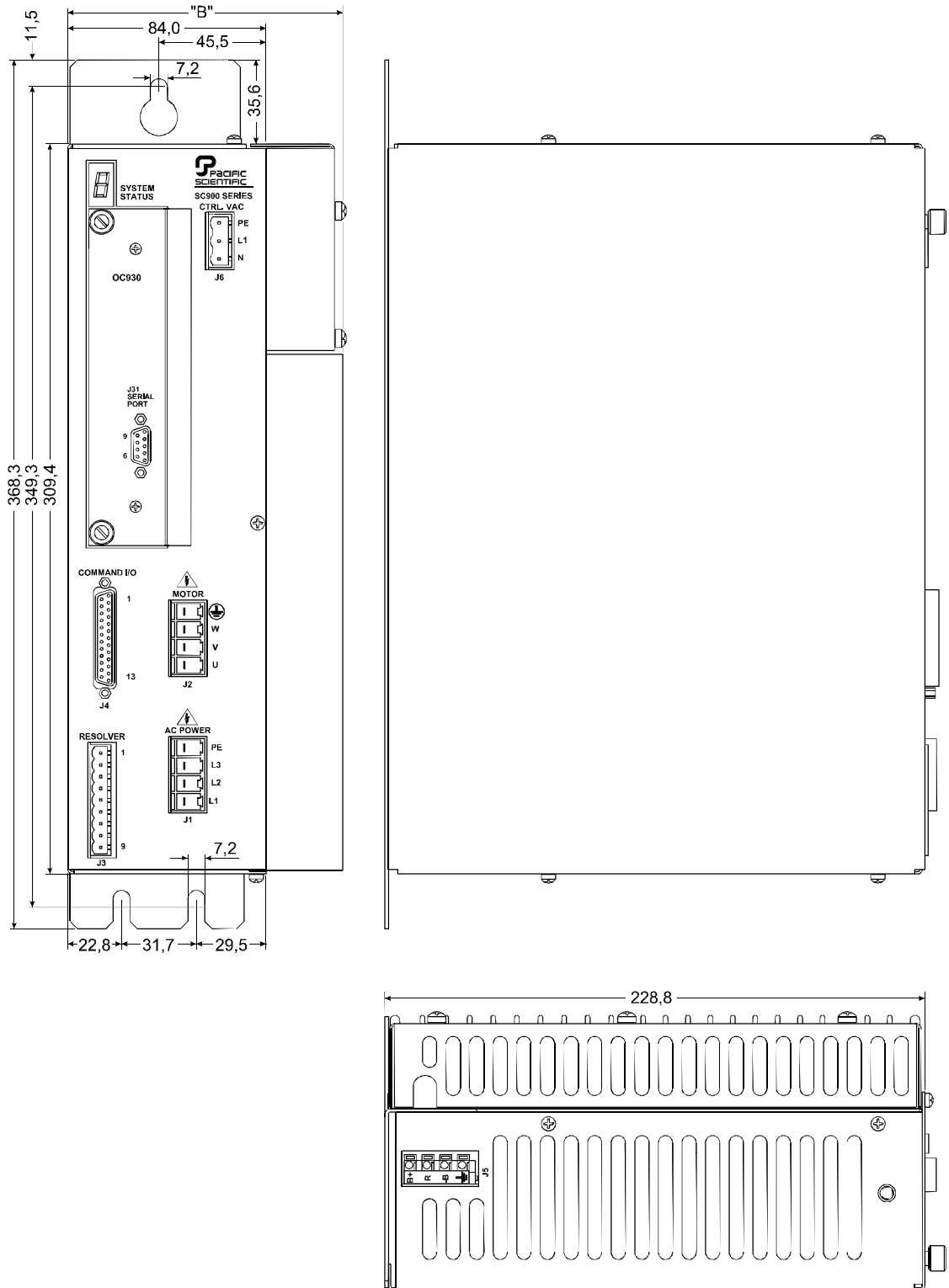


¹ Order manual and software separately

² For SCE9x6 voltage always needed because of integrated fan

³ SCE9x3 only, no forced air cooling possible

Dimensions

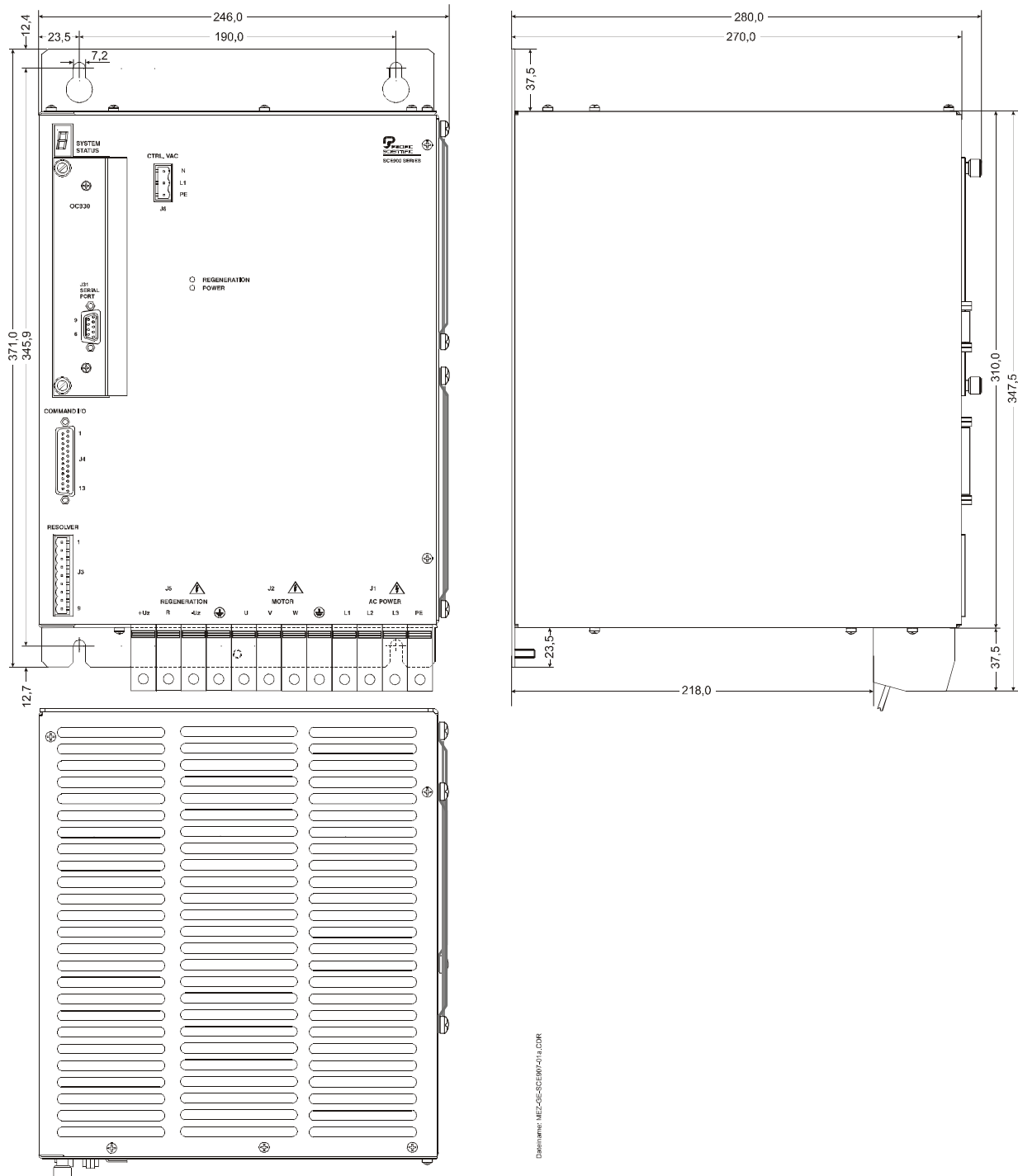


Drive	"B"
SCE9x3A3	85,0 mm
SCE9x3 and SCE9x4	116,5 mm
SCE9x5	159,5 mm
SCE9x6	200 mm

270 mm instead of 228,8 mm

Dimensions SCE907

All dimensions given in mm



Option Cards

OCE930

Serial Interface RS-232/485

This card allows the user to program the various SCE 900 set-up parameters using an IBM-compatible PC. It also allows the SCE 900 to be connected to any host computer containing RS-232/485 communications capability.

OCE940

SERCOS Interface Option Card

This card adds SERCOS (**S**ERIAL **R**eal-time **C**OMMUNICATIONS **S**ystem) fiber optic communication capability to the SCE900. This allows the SCE900 to be used in multi-axis, distributed, control systems utilizing the SERCOS international standard interface including Pacific Scientific's own SERCOS based multi-axis controller.

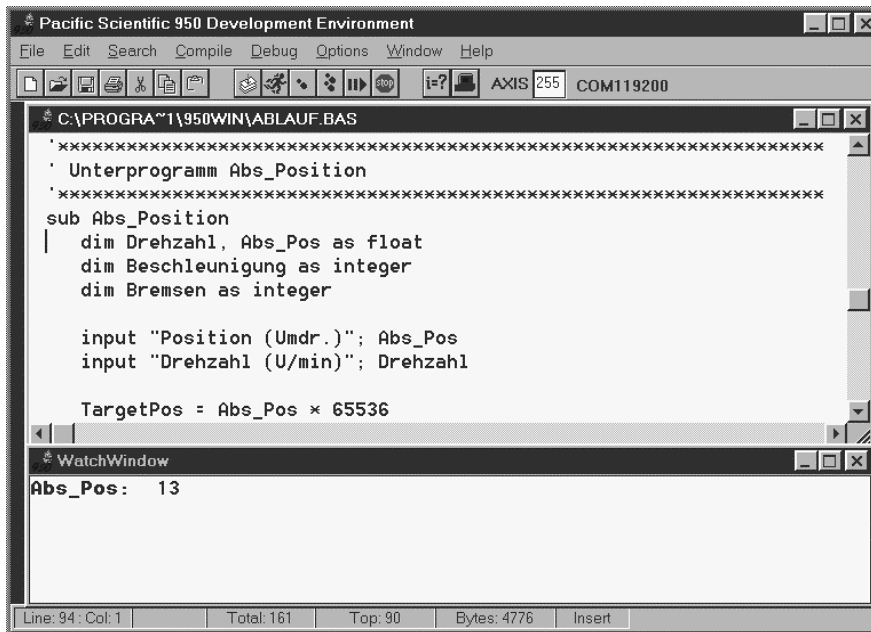
OCE950

Programmable Single Axis Position Control Option Card

Features

- Freely programmable in ServoBasic™
- Windows® Development Environment
 - Powerful Debugger for Starting and Troubleshooting
 - Terminal Emulator
- 21 Programmable and Configurable I/Os
- 8 Programmable Software Limit Switches
- Interrupts on Motion and Program Variables
- Communication with ASCII-Terminal for Data Exchange possible
- 32kB or 128kB NV Memory
- Optional PaCLAN™ Local Area Network
- Additional options:
 - CAM Profiling functionality
 - MODBUS Interface
 - ABCOMM Interface

Windows Development Environment



The development environment lets you program in modular blocks that can easily be re-used. The easy to use editor and powerful debugger with program variable watch window make troubleshooting easy. With the terminal emulator you can test the data exchange.

Programming Language ServoBasic™

ServoBasic™ is a subset of the popular GWBASIC and easy to learn. In addition to the standard commands like If... Then...Else; While...Do; For...Next; ... special motion control commands have been added like GoVel, GoIncr, GoAbs,... There are also predefined parameters like IndexDist, RunSpeed, AccelRate,...

Subroutines and functions can be programmed, arrays can be defined and variables are differentiated in local and global.

Configurable I/Os

There are 21 digital I/Os on the OCE950 that can be configured either as an input or as an output. Together with the SCE900 base unit there are 27 digital I/Os, 2 analog outputs and 1 analog input available which can be accessed by ServoBasic™.

PacLAN™ (Option)

In addition to the standard RS232/485 serial interfaces the OCE950 can be ordered with Pacific Scientific's PacLAN™ interface (Pacific Scientific Local Area Network). With this fieldbus system it is possible to connect up to 8 units directly. The max. length of a bus segment is 300m. Using hubs you can connect up to 250 drives and expand the bus to 3000m. PacLAN™ is compatible to the ARCNET®.

All variables and motion parameters can be exchanged via the bus. The serial port can still be used to communicate with a man machine interface. All drives can be programmed by connecting the PC to only one drive.

Controlling several Axes

There are different options to control several axes:

- Master Slave Configuration: One SCE950 (SCE900 plus OCE950) is programmed. The encoder output of this drive is connected to the encoder input of a second drive. Thus the second axis is a slave of the first one (electronic gearing). The ratio can be changed in the program. The second drive can be either an SCE930 (w/ serial interface, not programmable) or an SCE950.

- Programming via RS485: For several axes which run mostly independently of each other several SCE950s are used. Via RS485 all axes are connected and programmed from one PC. A communication between the drives via RS485 is not possible. For simple communication the digital I/Os may be used.
- The axes are connected via PaLAN™. Each program of a drive can access all predefined variables of the other drives. All drives are programmed via the serial link to one single drive.

Programming Example

With the `When` command it is possible to react very fast to an input transition. In the following programming example the `When` command ensures that the incremental move is initiated within one millisecond after the input transition.

Command	Comment
SETUP:	
AccelRate = 40000	'Set acceleration to 40000 rpm/s
DecelRate = 40000	'Set deceleration to 40000 rpm/s
RunSpeed = 1200	'Set velocity to 1200 rpm
IndexDist = 4096	'Set distance to 4096 steps
InPosLimit = 100	'Set position window to +/-100 steps
Enable = 1	'Software drive enable on
NOTENABLED:	
While Enable = 0	'If Enable Input is not active
BDOut6 = 1	'Blink BDout6 on
Pause(1)	'for 1 second
BDOut6 = 0	'and off
Pause(1)	'for 1 second
Wend	'until enable input is activated
MOVE:	
While Inp7 = 0: Wend	'Wait for Inp7 to go high
When Inp7 = 0, GoIncr	'Move when Inp7 goes low
While InPosition <>1: Wend	'Wait for move complete
Goto MOVE	'Go back to MOVE

Commands

In addition to the parameters that are on the SCE900 base unit (e.g. for tuning) the following variables and commands are available in ServoBasic™:

AbortMotion	Ccwot	Goto
Abs	Chr\$()	GoVel
AccelRate	Cint()	Hex\$()
Alias	Cls	If...Then...Else
AnalogIn	ConfigPLS()	\$Include
AnalogOut1	Const	IndexDist
AnalogOut2	Cos()	Inkey\$
And	CountsPerRev	Inp0-Inp20
Asc()	CwInh	InPosition
Atan()	Cwot	InPosLimit
Autostart	DecelRate	Input
AxisAddr	Dim	Inputs
Band	Dir	Instr()
Baudrate	EnablePLS0-EnablePLS7	Int()
BDInp1-BDInp6	End	Interrupt...End Interrupt
BDInputs	Exit	Intr {source}
BDOut1-BDOut6	Exp()	LANFlt()
BDOutputs	Fix()	LANInt()
Beep	For...Next	LANInterrupt[]
Bnot	Function	LANIntrArg
Bor	Gearing	LANIntrArg
Brake	GetMotor\$()	LANIntrSource
Bxor	GoAbs	Lcase\$()
Call	GoHome	Left\$()
CcwInh	GoIncr	Len()

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Log()	ReglHiEncPos	Str\$()
Log10()	ReglHiFlag	String\$()
Ltrim\$()	ReglHiPosition	Sub...End Sub
Main	ReglLoEncPos	Swap
Mid\$()	ReglLoFlag	Tan()
Mod	ReglLoPosition	TargetPos
ModelExt	RegControl	Time
Moving	Restart	Trim\$()
Oct\$()	Right\$()	Ucase\$()
On Error Goto	Rtrim\$()	UpdMove
Or	RunSpeed	Val()
Out0-Out20	ScurveTime	When
Outputs	Select Case	WhenEncPos
\$PacLANAddr	SendLANInterrupt() []	WhenPosCommand
Params...End Params	Sgn()	WhenPosition
Pause()	Sin()	WhenResPos
Position	Space\$()	WhenTime
PosModulo	Sqr()	While...Wend
PosPoalarity	Static	Xor
Print	Status	
Ratio	Stop	