Packaged stepper motor systems

SM9000 series

SM9000 series stepper motor control systems are fully cased free standing units that are also suitable for mounting in a 19 in Rack system. Based on Mclennan's in-service proven modular technology the units incorporate a system power supply, high performance bi-polar drives and powerful, yet easy to use, digital motion controllers. The use of modular technology ensures maximum flexibility in meeting customers' needs together with improved serviceability

All connections are via multi-pin connectors to provide a 'plug & run' solution for a wide variety of industrial, scientific & laboratory applications that require accurate positioning of the driven mechanism.

Modular technology provides maximum system flexibility

SM9000 series systems may be used to provide conventional open loop control or, closed loop control when an encoder is fitted to the motor or the driven mechanism

The use of modular technology enables the optimum drive to be selected to suite the motors to be driven while a wide range of gearheads can be specified to match the load requirements.
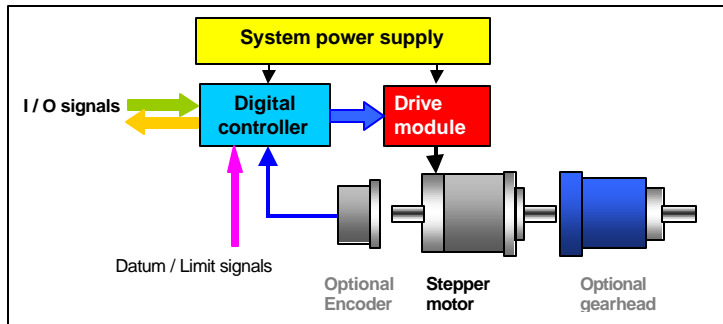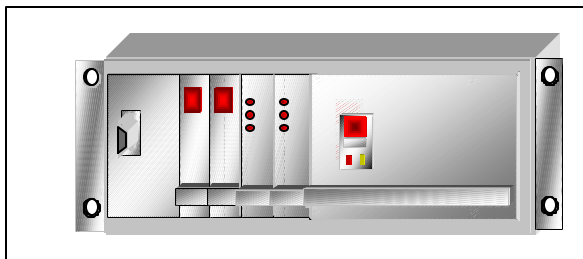

High performance stepper motor control systems in 19 in x 4U high enclosures

SM9000 series systems are constructed using robust EMC compliant enclosures and include a fan to provide forced cooling.
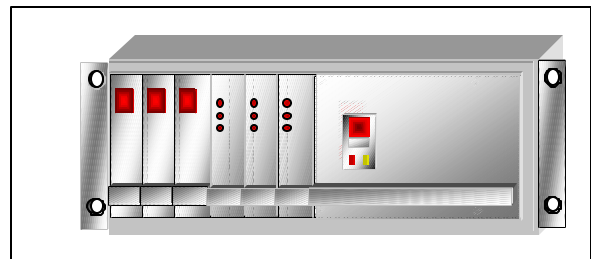Air is drawn through vents at the bottom front of the case and exits at the rear so no additional space is required above or below the unit for air convection. This design is beneficial for both free standing and rack mounti
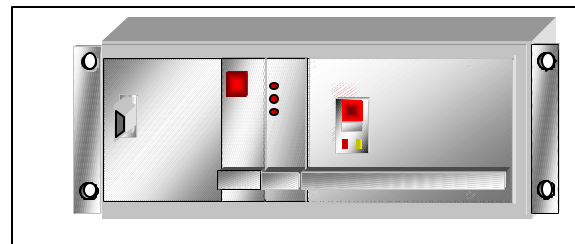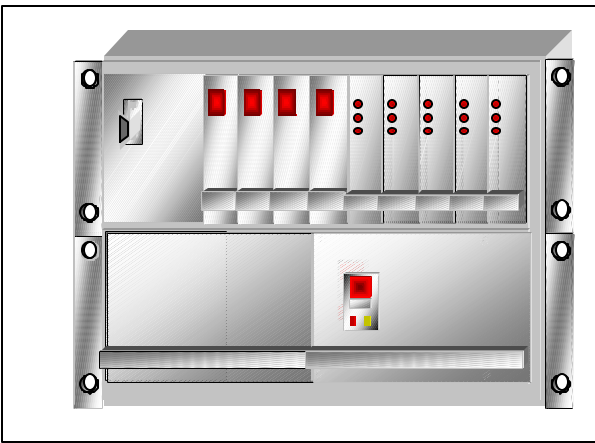
single axis SM9000 series system
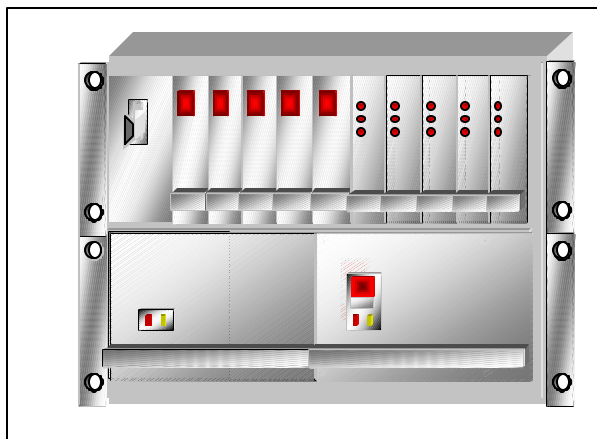
2 axis SM9000 series system
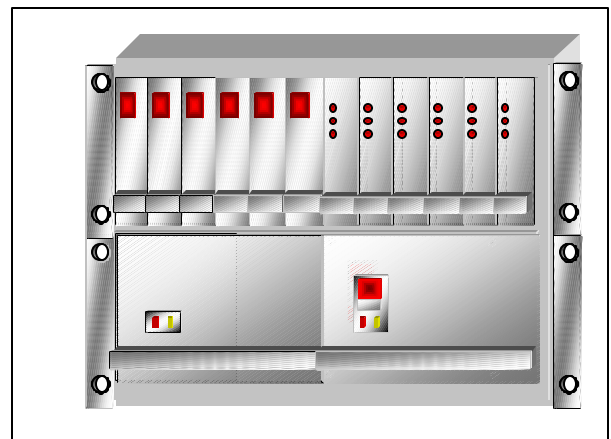
3 axis SM9000 series system

High performance stepper motor control systems in 19 in x 7U high enclosures

4 axis SM9000 series system

5 axis SM9000 series system

6 axis SM9000 series system

SM9000 series Specification

Number of motor axes		1	2	3	4	5	6
Total Motor Power	kW	0.25	0.5	0.5	0.5* 1.0: optional	1.0	1.0
Cabinet size	Width	19 in across flanges (482.6 mm) Eurocrate enclosure					
	Height	4U (177.8 mm)			7U (311.5 mm)		
Motor rail voltage	Vdc	70	70/48	48	48	70/48	70/48
Min motor current	Amps	Internally adjustable for each motor: 2.5 –6.0 Amps/phase					
Drive type		High efficiency 2 phase Bi-polar chopped constant current					
Resolution		½ step drive (400 steps/rev using 2 phase hybrid motors					
Supply	Vac	110-230 Vac 50 or 60Hz (to be specified when ordered)					
Motion control features		Programmable via RS232 interface (Ethernet : Optional)					
Position	Steps	$\pm$ 2000 million range as absolute or relative move					
Velocity	Steps/sec.	1-409,600					
Acceleration	Steps/sec^2	1-20,480,000					
Deceleration	Steps/sec^2	1-20,480,000					
Feedback		Open loop or closed loop using encoder feedback					
Encoder scaling		Range: 1-32000/1-32000					
End of travel limits		2 directional sensitive limits per axis					
Datum Search		High speed registration of datum capture					
Number of digital I/O		16 Opto isolated per axis					
Number of Analogue inputs		2 per axis					
Pre-programmable sequences		8 per axis					
Diagnostics		Front panel 9 bit display & 8 bit digital string via RS232 interface					
Signal Connections		Via colour coded 'D' connectors					
Motor connections		Via multi-pin heavy duty connector					

Mclennan Servo Supplies Ltd.   Tel: +44 (0)8707 700 700 www.mclennan.co.uk

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Stepper motor control systems: Programme Guide

The control systems utilise a powerful motion controller per axis that provide accurate motion control and integration with other machine functions. The system may be programmed via an RS232 interface to provide motion in real time on receipt of a movement command.

Alternatively a series of sequences can be programmed to enable the unit to operate as a stand-alone system, interfaced to other machine functions.
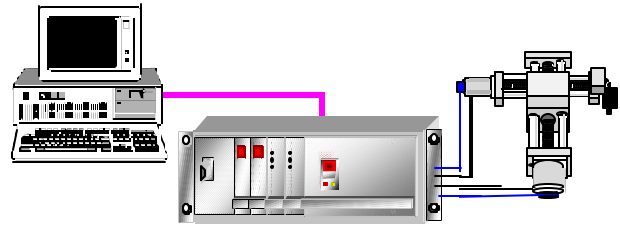
A precise of commands is shown below:

Table of commands

GETTING STARTED COMMANDS			
HE	*HE*lp pages	**HN**	Display *N*ext Page
HP	Display *P*revious Page	**IN**	*IN*itialise
TUNE	Auto *TUNE*	**QA**	*Q*uery *A*ll
QK	*Q*uery constants (*K*)	**QS**	*Q*uery *S*peeds
ABORT, STOP & RESET COMMANDS			
CONTROL **C**	Hard Stop	**ESC**	Soft Stop
AM<mode>	Set *A*bort *M*ode	**AB**	Command *AB*ort
RS	*Re*Set	**QM**	*Q*uery *M*ode
ST	Soft *ST*op		
INFORMATION			
CO	Display the *C*urrent *O*peration	**ID**	*ID*entify Version
OC	*O*utput *C*ommand position	**OA**	*O*utput *A*ctual position (Encoder 1)
OT	*O*utput Auxiliary Position (Encoder 2)	**OI**	*O*utput *I*nput position (Encoder 3)
OD	*O*utput *D*atum position	**OV**	*O*utput *V*elocity
OS	*O*utput *S*tatus string	**OF**	*O*utput *F*ollowing Error
QA	*Q*uery *A*ll	**QK**	*Q*uery constants (*K*)
QS	*Q*uery *S*peeds	**QP**	*Q*uery *P*ositions
QM	*Q*uery *M*odes	**QL**	*Q*uery Privelge *L*evel
SET UP			
CM<mode>	Set *C*ommand *M*ode	**ER**<numerator>/<denominator>	Set *E*ncoder *R*atio
BO<steps>	Set *B*ack*O*ff Steps	**CR**<steps>	Set *Cr*eep steps
TO<value>	Set *T*ime*O*ut	**SE**<steps>	Set *SE*ttling time
WI<time>	Set settling *Wi*ndow		
SAFETY FEATURES			
SL<mode>	Set *S*oft *L*imits	**TH**<value>	Set Motor Stalled *Th*reshold
TR<value>	Set *TR*acking window		
DATUMING			
CD	*C*lear Captured *D*atum Position	**OD**	*O*utput *D*atum position
HD<direction>	Go *H*ome to *D*atum	**MD**	*M*ove to *D*atum Position
SH<position>	*S*et *H*ome Position	**DM**<mode>	Se *D*atum *M*ode
QM	*Q*uery *M*odes		
POSITION COMMANDS			
AP<position>	Set *A*ctual *P*osition	**CP**<value>	Set *C*ommand *P*osition
IP<position>	Set *I*nput encoder's *P*osition	**TP**<position>	Set Auxiliary *P*osition
DA<position>	*D*ifference *A*ctual position	**DI**<position>	*D*ifference *I*nput encoder's position
SPEED, ACCELERATION AND DECELERATION			
CV<velocity>	*C*onstant *V*elocity mode	**SC**<speed>	*S*et *C*reep speed
SF<speed>	*S*et *F*ast jog speed	**SJ**<speed>	*S*et slow *J*og speed
SV<speed>	*S*et *V*elocity	**SA**<acceleration>	*S*et *A*cceleration
SD<deceleration>	*S*et *D*eceleration	**LD**<deceleration>	Set *L*imit *D*eceleration

MOVES

BO<steps>	Set *B*ack*O*ff Steps	**CR**<steps>	Set *Cr*eep steps
MA<position>	*M*ove *A*bsolute	**MR**<position>	*M*ove *R*elative
GM<steps>	*G*earbox Offset *M*ove	**HD**<direction>	Go *H*ome to *D*atum
MD	*M*ove to *D*atum Position	**DE**<time>	Set *DE*lay time

SOFT LIMITS

LL<position>	Set *L*ower *soft L*imit	**UL**<position>	Set *U*pper *soft L*imit
SL<mode>	Set *S*oft *L*imits		
WS	*W*ait for *S*ynchronisation		

END OF MOVE

SE<steps>	Set *SE*ttling time	**WI**<TIME>	Set settling *Wi*ndow
WE	*W*ait for *E*nd of current move		

READ & WRITE PORTS

RP	*R*ead *P*ort	**WP**<bit pattern>	*W*rite *P*ort
WA<bit pattern>	*WA*it for input event		

JOG

JM<mode>	Set *J*og *M*ode		
SF<speed>	*S*et *F*ast jog speed	**SJ**<speed>	*S*et slow *J*og speed
JC<value>	Set *J*oystick *C*entre Position	**JR**<value>	Set *J*oystick *R*ange
JS<speed>	Set *J*oystick *S*peed	**JT**<value>	Set *J*oystick *T*hreshold
QJ	*Q*uery *J*oystick Settings		

ANALOGUE INPUT AND OUTPUTS

AI<channel>	Query *A*nalogue *I*nput	**AO**<channel/value>	Set *A*nalogue *O*utput
AL<channel/value> Wait for *A*nalogue *L*ess than Value		**AG**<channel/value> Wait for *A*naloge *G*reater than Value	

SEQUENCES

AE<sequence no.>	*A*uto-*E*xecute sequence	**AD**	*A*uto-Execute *D*isable
DS<sequence no.>	*D*efine *S*equence	**ES**	*E*nd *S*equence definition
LS<sequence no.>	*L*ist *S*equence	**XS**<sequence no.>	E*X*ecute *S*equence
BS	*B*ackup *S*equence	**US**<sequence no.>	*U*ndefine *S*equence
IF	Do next command *I*f *F*alse	**IT**	D next command *I*f *T*rue

PRIVELEGE LEVEL

NP<new PIN>	*N*ew *P*in	**PI**	Enter *PI*N
PL	Set *P*rivelege *L*evel	**QL**	*Q*uery Privelge *L*evel

HELP

HE	Display *HE*lp Pages	**HN**	Display *N*ext Page
HP	Display *P*revious Page	**HM**	Dislplay *H*elp with *M*odes Commands

BACKUP

BA	*B*ackup *A*ll	**BC**	*B*ackup *C*ams
BD	*B*ackup *D*igiloop parameters	**BP**	*B*ackup *P*rofiles
BS	*B*ackup *S*equence		

Connecting the RS232 interface to SM9000 series controllers

Communication with the SM9000 series system is via a full duplex RS232 interface.
Two RS232 connectors are fitted to the SM9000 series systems so that further units may be added and daisy-chained to a single RS232 port.

Two RS232 connectors
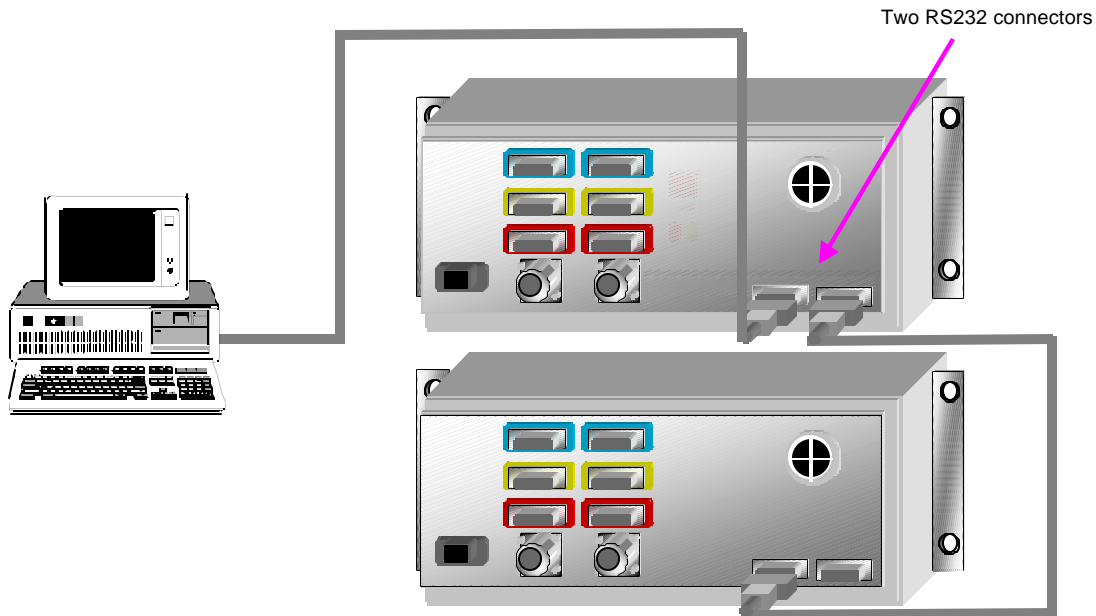
Each SM9000 series Eurocrate is provided with two RS232 connectors so that communication via a single RS232 port can be maintained with additional units that are subsequently added. Up to 99 motor axis can be controlled using a single RS232 port.

Optional manual control JB series

The JB series manual jog box may be specified where manual control of the motor axes is required. In multi axis systems the unit enables each axis to be selected and independently controlled.

The control system is programmed as part of the commissioning procedure to define the rates at which each axis moves when under manual control using the following buttons:

JB Series Manual jog box
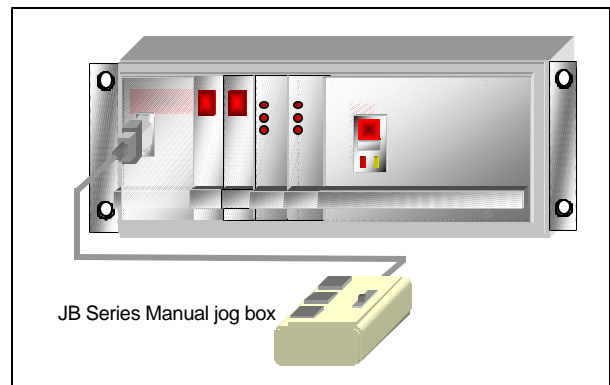
+ Causes the motor to take 1 step forward each time this button is depressed. When the button is held the motor will run forward at a programmable slow speed.

F When this button is depressed in conjunction with either the '+' or '-' buttons the motor will run at the fast speed that has been pre-programmed for the motor channel selected..

- Causes the motor to take 1 step backwards each time this button is depressed. When the button is held the motor will run forward at a programmable slow speed

SM9000 series closed loop control system connections

The rear panel of the SM9000 series controller is provided with colour coded connectors to simplify connections. A typical rear panel layout is shown below. Where the system is to be used under open-loop control the encoder connectors are not utilised.

Typical rear panel connections for 2 axis system

Standard Connector Identification

Encoder
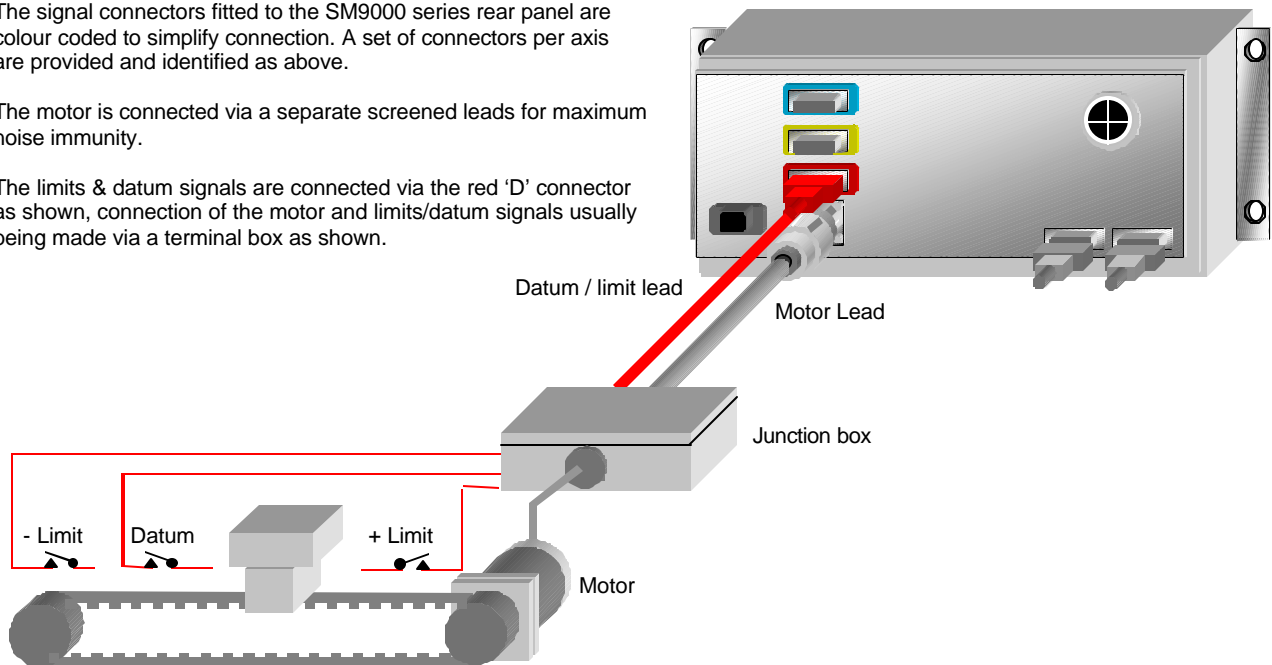
I/O signals
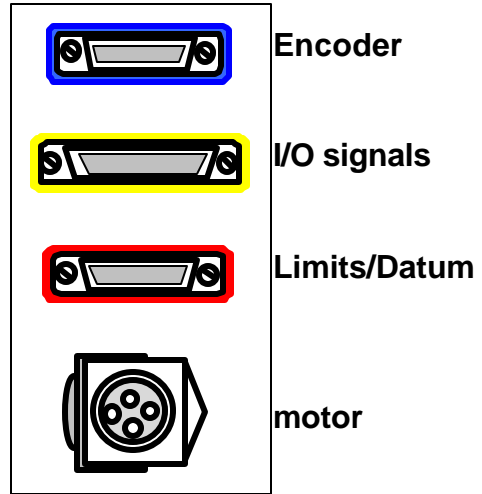
Limits/Datum

motor

Connecting motor, limits & datum signals

The signal connectors fitted to the SM9000 series rear panel are colour coded to simplify connection. A set of connectors per axis are provided and identified as above.

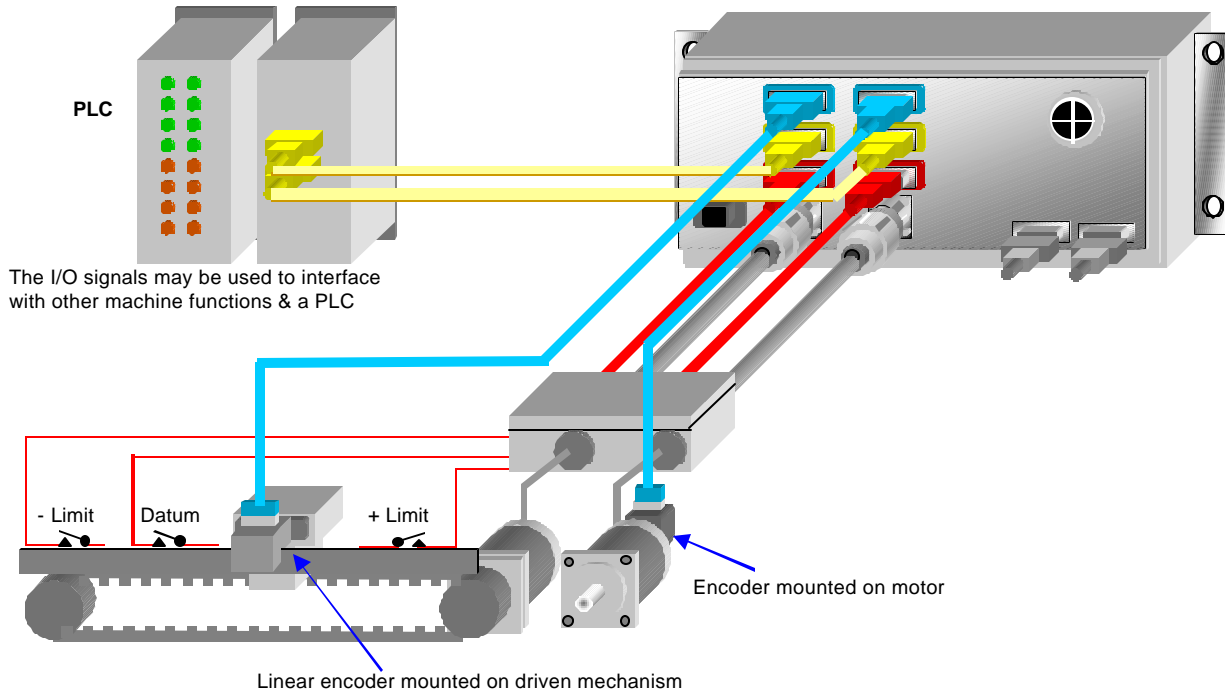The motor is connected via a separate screened leads for maximum noise immunity.

The limits & datum signals are connected via the red 'D' connector as shown, connection of the motor and limits/datum signals usually being made via a terminal box as shown.

Datum / limit lead

Motor Lead

Junction box

- Limit

Datum

+ Limit

Motor

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Connecting motor, encoders & I/O signals to SM9000 series systems

The SM9000 series systems can be pre-programmed with sequences that define the motor's motion and input /output signal conditions. A sequence of conditional moves can therefore be created for stand-alone operation. The unit is therefore suitable for use with a PLC that may be used to interface the SM9000 series system to other machine functions. The input lines on the SM9000 series system may also be used, in conjunction with pre-programmed sequences to control the position of the motor using a binary input code.

For increased positioning integrity the SM9000 series system can be operated with encoder feedback to check and correct any positioning errors that may be caused by transitory changes in load. When an error is detected an output signal is provided to alert the host controller (PLC) of a positioning error.

PLC

The I/O signals may be used to interface
with other machine functions & a PLC

- Limit   Datum   + Limit

Encoder mounted on motor

Linear encoder mounted on driven mechanism

When using an encoder that is mounted remotely from the motor a scaling factor within the controller may be used to match the encoder count to the motor step resolution.

Absolute positioning

Note: The encoder input is pre-wired to accept a dual track incremental encoder with differential outputs.
The PM600 controller used with the SM9000 series system utilises these signals to memorise the absolute position of each motor axis relative to a zero datum position

Optional cables:

The cable the cost is based on the supply of a cable with
the connector fitted to the end that plugs into the control system as shown.

The free end that is connected to the motor is usually supplied with
flying leads for connection to the motor via a terminal box.

Standard RS232 cables are 3 metres long & supplied with
connectors at both ends

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