Packaged Stepper Motor System *Sim-Step*

A complete system solution

Plug & run simplicity

Programmable positioning

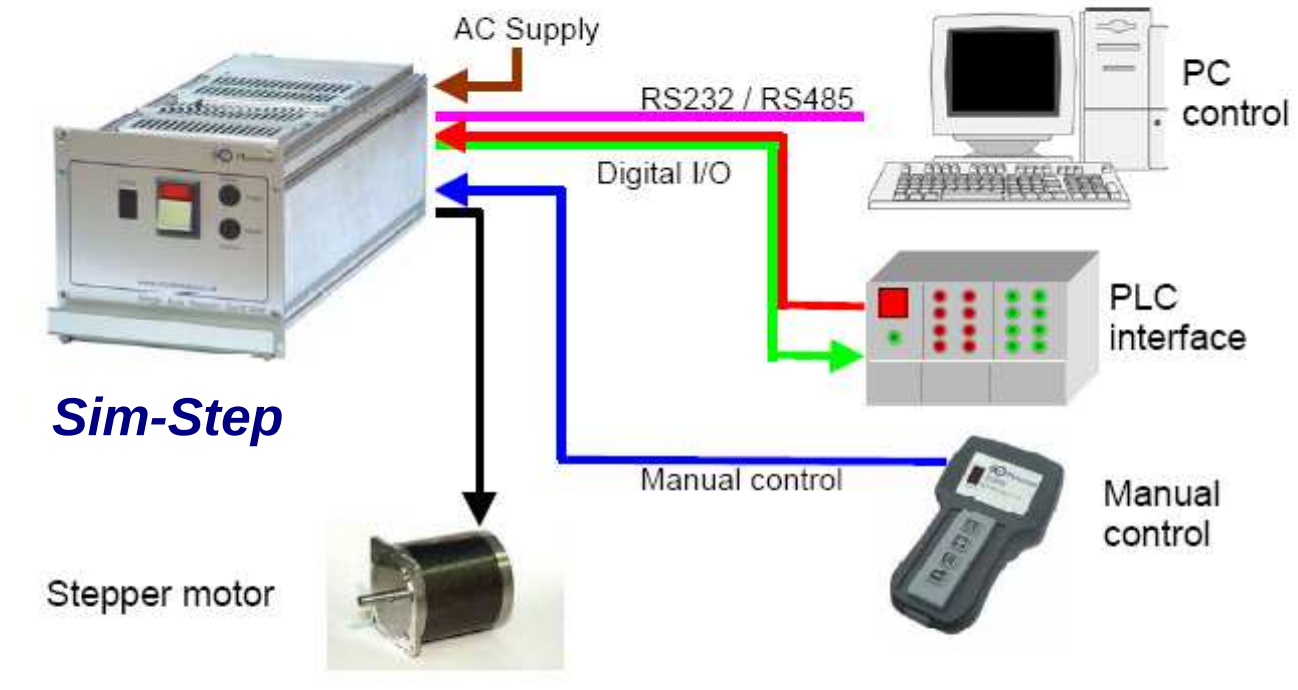
Optional closed loop control

Matching size 17 – 34 frame motors

Motor torque ratings up to 1.5 Nm

Optional planetary gearheads

Geared motor options up to 100Nm



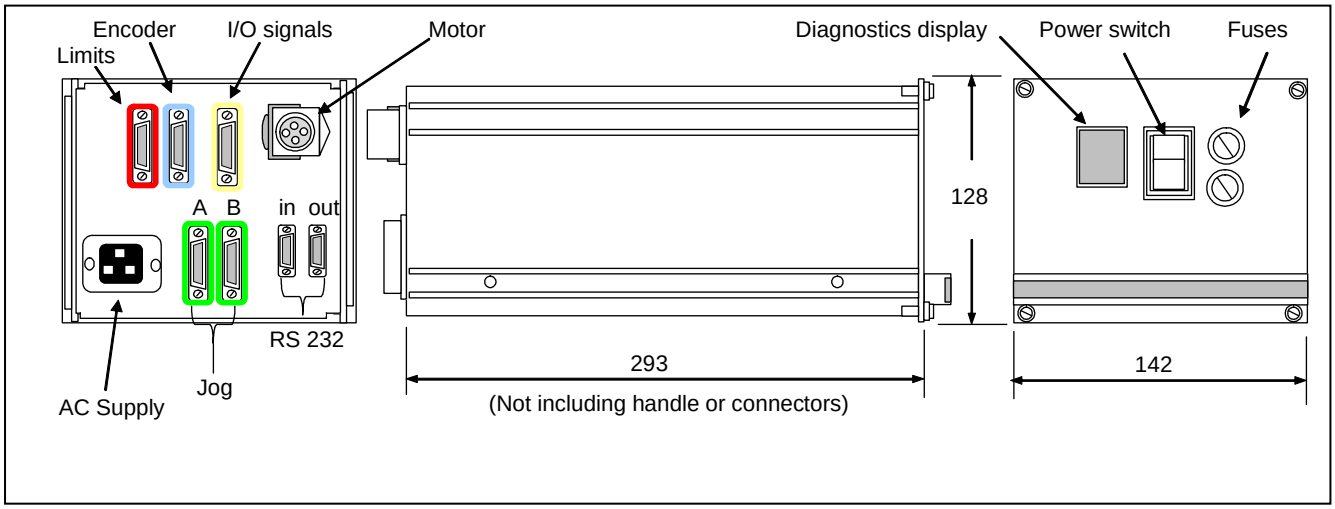
Packaged Stepper Motor System *Sim-Step*

The ***Sim-Step*** integrated stepper motor controller provides a cost effective solution to a wide range of applications that require accurate manipulation of the driven mechanism.
The unit is 'plug & run' package that greatly reduces installation time. Simply connect the intelligent drive to a PC, motor, travel limits etc & an ac supply using cables provided and the system is fully operational.

Features:

- Integrated Power supply for direct connection to AC Supply
- Choice of 115 or 230 Vac, 50 or 60Hz operation
- Integrated high efficiency Bi-polar drive stage
- 400 step/rev. motor resolution provides increased smoothness
- Internally adjustable phase current from 0.5-3.5 Amps
- Integrated motion controller
- RS232 or RS485 communication
- Up to 99 units can be daisy chained to a single port
- Internal memory stores sequences for stand-line operation
- Programmable position, acceleration, deceleration & velocity
- 8 input & 8 output Digital I/O to interface with other process functions
- Optional jog box for manual operation
- Choice of matched size 17, 23 & 34 frame motors
- All connections by plug & socket for '*Plug & Run operation*'
- Modular construction for improved serviceability

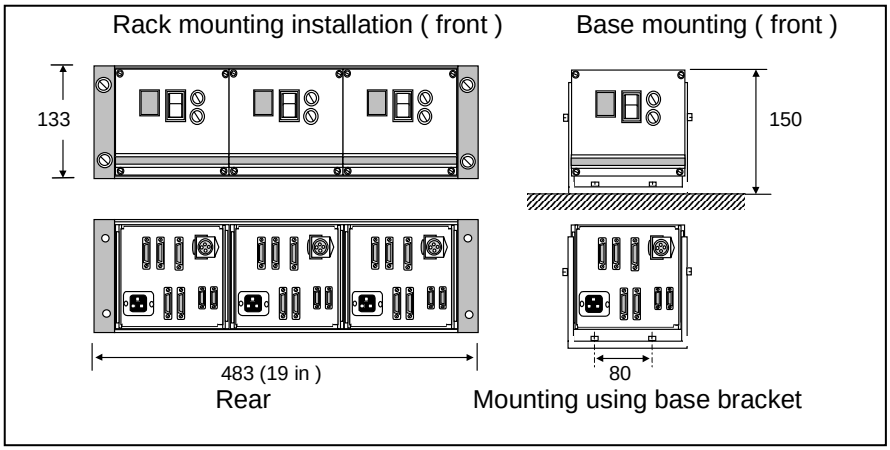
Dimensions: mm



Installation

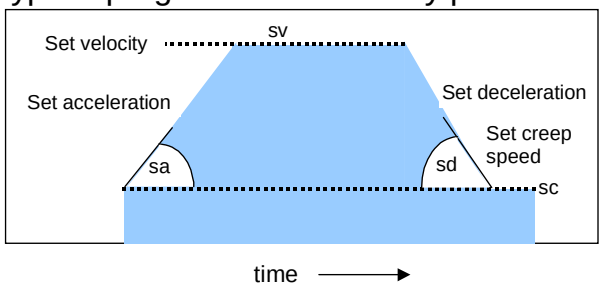
Up to 3 units may be installed in a single 3U high rack installation or alternatively the drive may be base mounted using the mounting bracket as shown:

Part #'s
506RAC10001 = Simrack 1
506RAC00002 = Simrack 2
506RAC00003 = Simrack 3

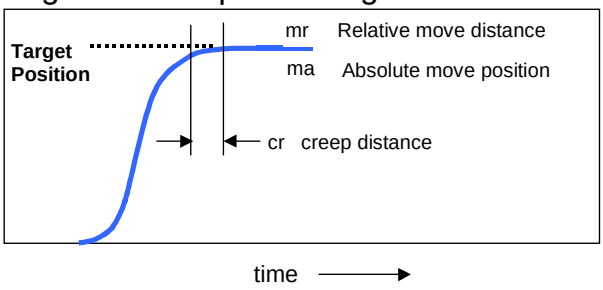


Supply	Vac	115 or 230 50 or 60Hz (internally selectable)
Motor Drive type		2 phase Bi-polar, high efficiency chopped constant current
Phase current	Amps	Internally adjustable 0.5 to 3.5 per phase
Motor Drive rail	Vdc	40
Protection		Short circuit, over-temperature
Motion control communication		RS232 or RS485:
Number of axes		Up to 99 units may be connected to single communication port
Internal communication set-up options		Baud rate & axis address code (up to 99)
Programmable Motion control functions		Open loop or closed loop using scaled encoder feedback
Motion control parameters:		Acceleration, deceleration, velocity, relative & absolute moves, creep distance & speed, sequences & I/O states
Max. acceleration rate	Steps/sec ^{2}	500,000
Max. deceleration rate	Steps/sec ^{2}	500,000
Max. velocity	Steps/sec	1,200,000 (20,000 Typical with 23HS Motor)
Max move length	Steps	2,000 million
Max creep speed	Steps/sec	800 (max recommended start / stop rate)
Sequences & programmable I/O		
Number of pre-programmed sequences		8 stored in non-volatile memory for off-line operation
Number of commands per sequence		127
Number of user programmable inputs		8 Optically isolated digital inputs
Number of user programmable outputs		8 Optically isolated digital outputs
Limits datum & registration inputs		
End of travel limit protection		Direction sensitive via normally closed direction limits or optional software limits avoid programming errors
Limit activation		Programmable choice of Hard Limit Stop ramp. Independently programmable deceleration on Limit activation
Datum search		Via approach signal input & datum stop signal (normally-open) Or single datum switch or encoder index using high-speed capture
Registration		High speed datum registration up to 1,200,000 steps/sec.
Abort stop input		Normally closed signal aborts move.

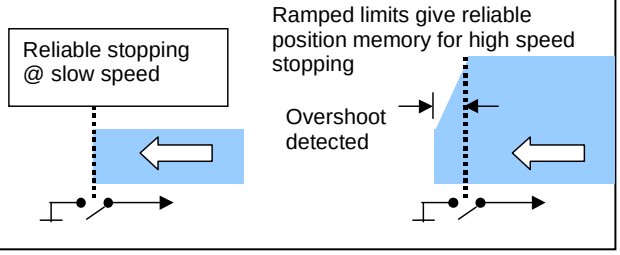
Typical programmable velocity profile



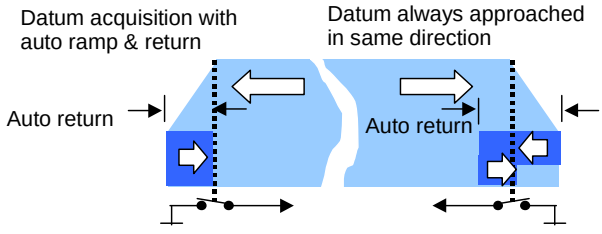
Programmable positioning features



Alternative Over-travel Limit operation



High speed datum registration

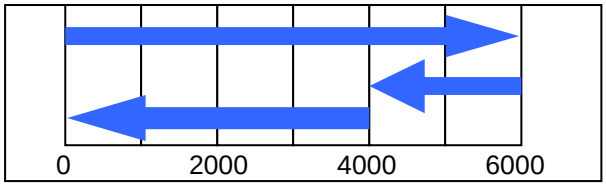


Up to 99 drives may be controlled from single comms port

The ***Sim-Step*** unit may be internally pre-set during commissioning with a unique axis address code so that up to 99 units may be addressed from a single comms port.

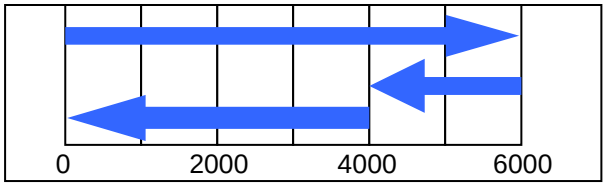
Absolute positioning using ‘ma’ command

The use of the ‘ma’ command enables the absolute position of a driven mechanism to be programmed
Eg: 1ma6000
1ma4000
1ma0



Relative moves using ‘mr’ command

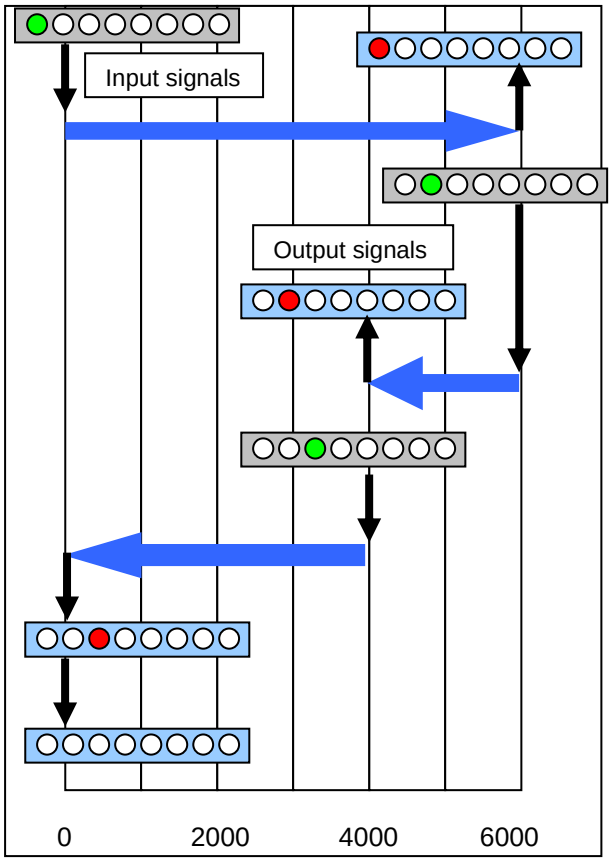
The use of the ‘mr’ command controls the move distance relative to the last position
Eg: 1mr6000
1mr-2000
1mr-4000



Using digital I/O in sequences

Digital I/O ports may be programmed by the user and incorporated in pre-programmed sequences to interface with other machine functions when using the controller in stand-alone applications.
used as

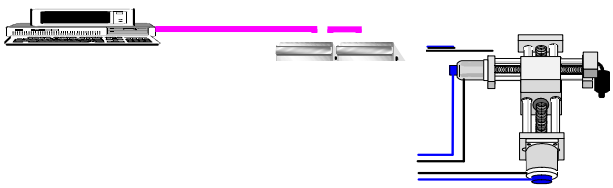
Eg:	1ds1	(define sequence 1)
	1wa00000001	(wait for ‘1’ signal on input port 1 to start sequence)
	1ma6000	(move instruction)
	1we	(wait for end of move)
	1wp00000001	(write ‘1’ signal on output port 1)
	1wa00000010	(wait for ‘1’ signal on input port 2)
	1ma4000	(move instruction)
	1we	(wait for end of move)
	1wp00000010	(write ‘1’ signal on output port 2)
	1wa00000100	(wait for ‘1’ signal on input port 3)
	1ma0	
	1we	(wait for end of move)
	1wp00000100	(write ‘1’ signal on output port 3)
	1de1000	(dwell for 1 second)
	1we	(wait for end of delay)
	1wp00000000	(reset output ports)
	1es	end sequence



By sending command: 1xs1 (execute sequence one) the above motion programme is executed once. By adding a 1xs1 command at the end of a sequence before the 1es command, the sequence can be made to continuously repeat.

Packaged Stepper Motor System: Programming 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.
Commands are 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
QS	***Q***uery ***S***peeds	**QA**	***Q***uery ***A***ll
ABORT, STOP & RESET COMMANDS			
CONTROL **C**	Hard Stop	**ESC**	Soft Stop
AM<mode>	Set ***A***bort ***M***ode	**AB**	Command ***AB***ort
RS	***R***e***S***et	**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)
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		
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***ontrol ***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 (ms)>	Set ***T***ime ***O***ut	**SE**<time (ms)>	Set ***SE***ttling time
WI<steps>	Set settling ***Wi***ndow		
FAULT DETECTION FEATURES			
SL<mode>	Set ***S***oft ***L***imits		
TR<value>	Set ***TR***acking window	**TO**<value ms>	Set ***T***ime ***O***ut time
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>	Set ***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
DA<position>	***D***ifference ***A***ctual 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
MD	***M***ove to ***D***atum Position	**HD**<direction>	Go ***H***ome to ***D***atum
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		
END OF MOVE			
SE<steps>	Set ***SE***ttling time	**WI**<steps>	Set end of move ***Wi***ndow
WE	***W***ait for ***E***nd of current move	**BO**<steps>	Number of ***B***ack-***O***ff steps
READ & WRITE PORTS			
RP	***R***ead ***P***ort	**WP**<bit pattern>	***W***rite ***P***ort
WA<bit pattern>	***WA***it for input event	**IF**<bit pattern>	Do next command ***I***f ***F***alse
IT<bit pattern>	Do next command ***I***f ***T***rue		
JOG / JOYSTICK			
JM<mode>	Set ***J***og ***M***ode	**SJ**<speed>	***S***et slow ***J***og speed
SF<speed>	***S***et ***F***ast jog 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
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***equences	**US**<sequence no.>	***U***ndefine ***S***equence
HELP			
HE	Display ***HE***lp Pages	**HN**	Display ***N***ext Page
HP	Display ***P***revious Page	**HM**	***H***elp with ***M***odes Commands
HS	***H***elp with ***S***tatus output message	**HC**	***H***elp with ***C***ontrol Modes
PRIVILEGE LEVEL			
NP<new PIN>	***N***ew ***P***in	**PI**	Enter ***PI***N
PL	Set ***P***rivilege ***L***evel	**QL**	**Q**uery Privilege **L**evel
BACKUP			
BA	***B***ackup ***A***ll	**BS**	***B***ackup ***S***equences
BD	***B***ackup ***D***igiloop parameters		

Refer to the ***Sim-Step*** and PM600 manuals for further details, these can be downloaded from this link - www.mclennan.co.uk/technicalmanuals.html.

Sim-Step user manual - *"SimStep Single Axis Stepper Drive Manual"*
PM600 manual - *"PM600 - Motion Controller Manual"*

Packaged System HS series motor options with leads:

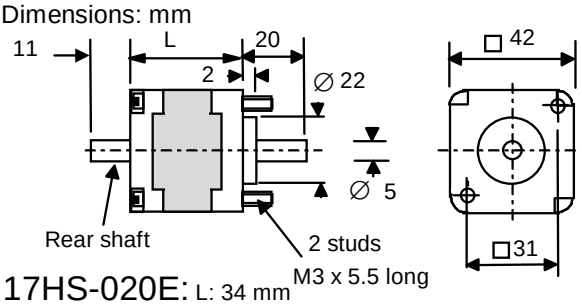
HS series motor features:

- Choice of 3 frame sizes
- High quality hybrid construction
- 400 step / rev resolution using packaged drive
- Optimised for high speed performance
- Options with encoders for closed loop control
- Choice of gearhead options for increased torque & resolution
- Matched cable and connector box for simplified connections

Size 17 motors:

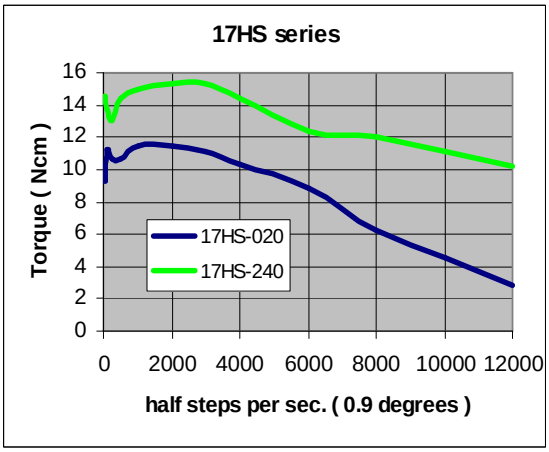
Two models provide a choice of body lengths & performance

Dimensions: mm



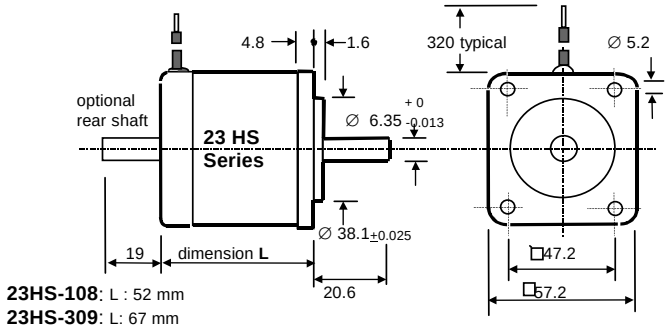
17HS-020E: L: 34 mm
17HS-240E: L: 46 mm

17HS series



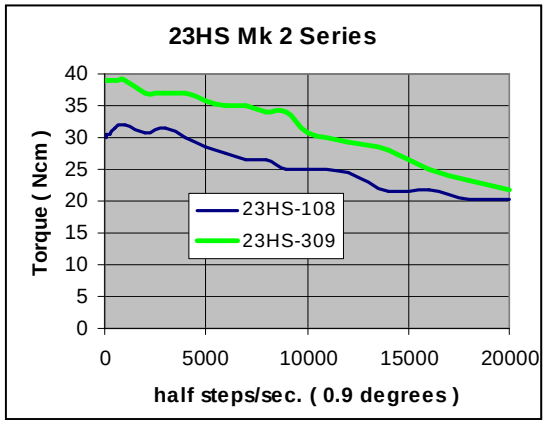
High speed size 23 motors

Two models provide a choice of body lengths & performance



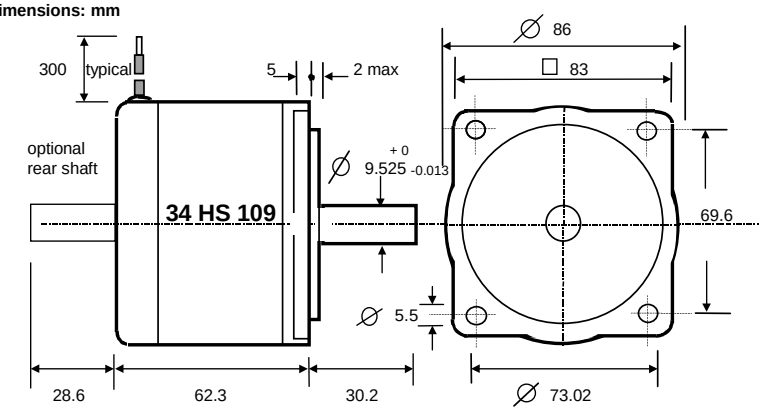
23HS-108: L : 52 mm
23HS-309: L: 67 mm

23HS series

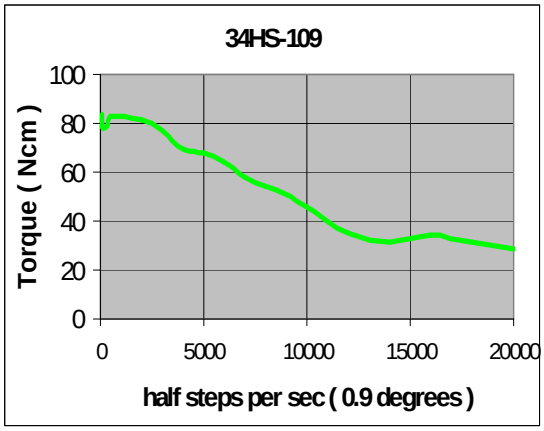


High speed size 34 motors

Dimensions: mm

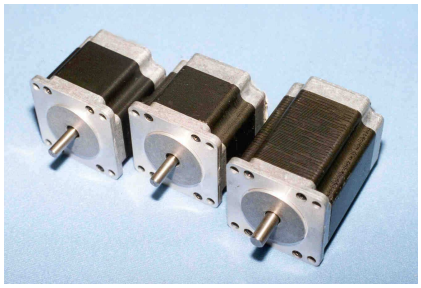


34HS series



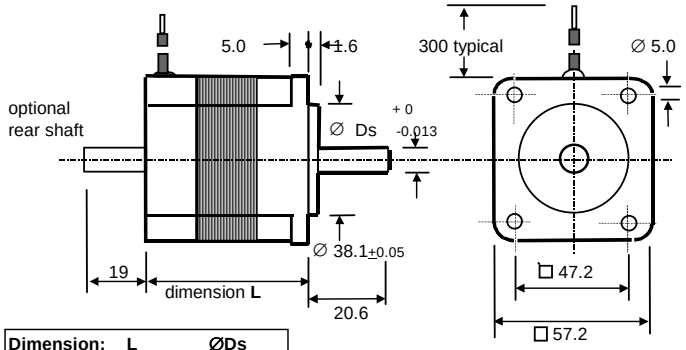
Packaged System HSX series motor options with leads:

HSX series motor features:



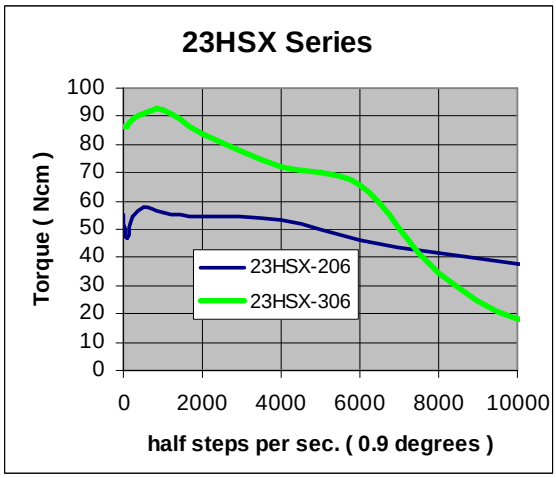
- Choice of 2 frame sizes
- Hybrid construction featuring high energy magnets
- 400 step / rev resolution using packaged drive
- Optimised for high torque output
- Options with encoders for closed loop control
- Choice of gearhead options for increased torque & resolution
- Matched cable and connector box for simplified connections

High torque size 23 motors

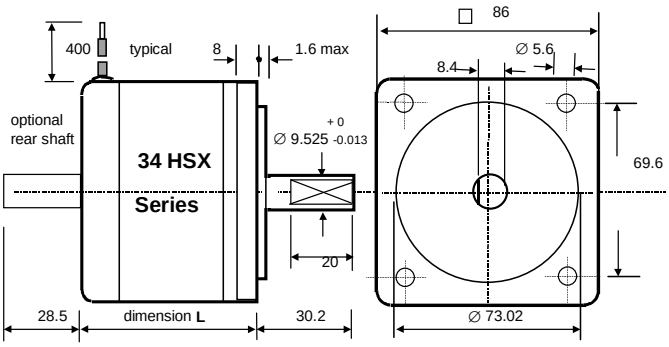


Dimension:	L	ØDs
23HSX-206:	55 mm	6.35
23HSX-306:	78.5 mm	8.0

23HS series

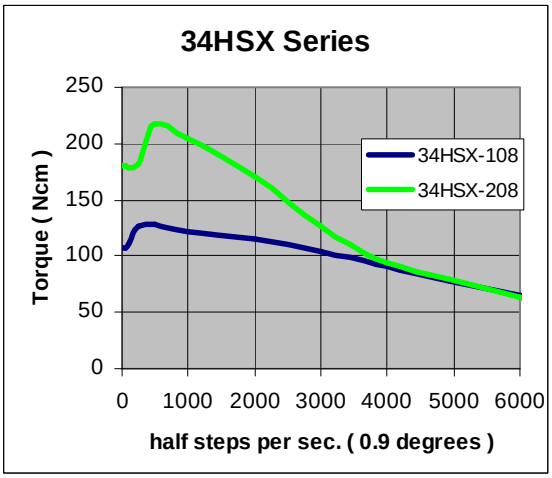


High torque size 34 motors



Dimension L: **34HSX-108**: 67 mm **34HSX-208**:: 94 mm

34HSX series



Ensure the drive current is set appropriately for the rating of the motor.
Standard configuration is set at 3.5 Amps.

Refer to section 6 of the ***Sim-Step*** user manual which can be downloaded from -
www.mclennan.co.uk/technicalmanuals.html - *"SimStep Single Axis Stepper Drive Manual"*

Packaged system HSX series motors with encoders:

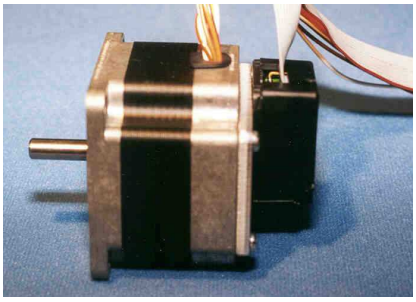
When specifying a stepper motor with encoder add the part number of the encoder to that of the motor

Eg:

Stepper motor – encoder

23HSX-206 - CI 500L
23HSX-306 - CI 500L

34HSX-108 - RI 500L
34HSX-208 - RI 500L

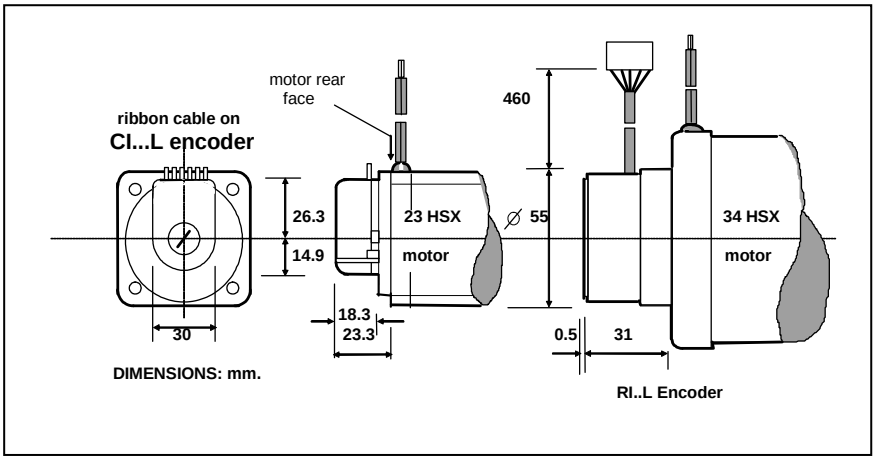


Dimensions: mm

Stepper motor Fitted with CI Encoder

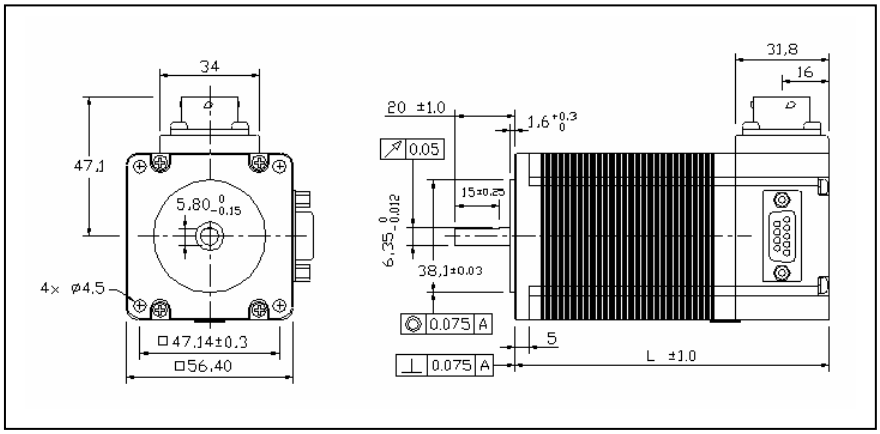
or

RI..L Encoder

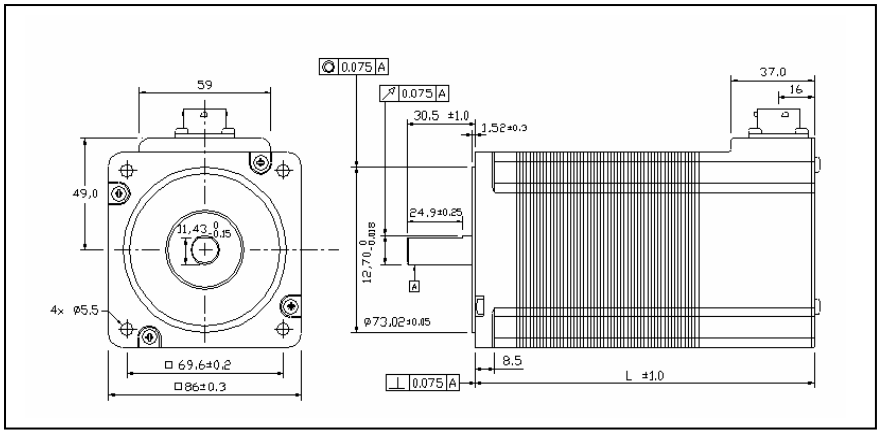


Motors with connectors & optional encoders:

Model 23HT



Model 34HT



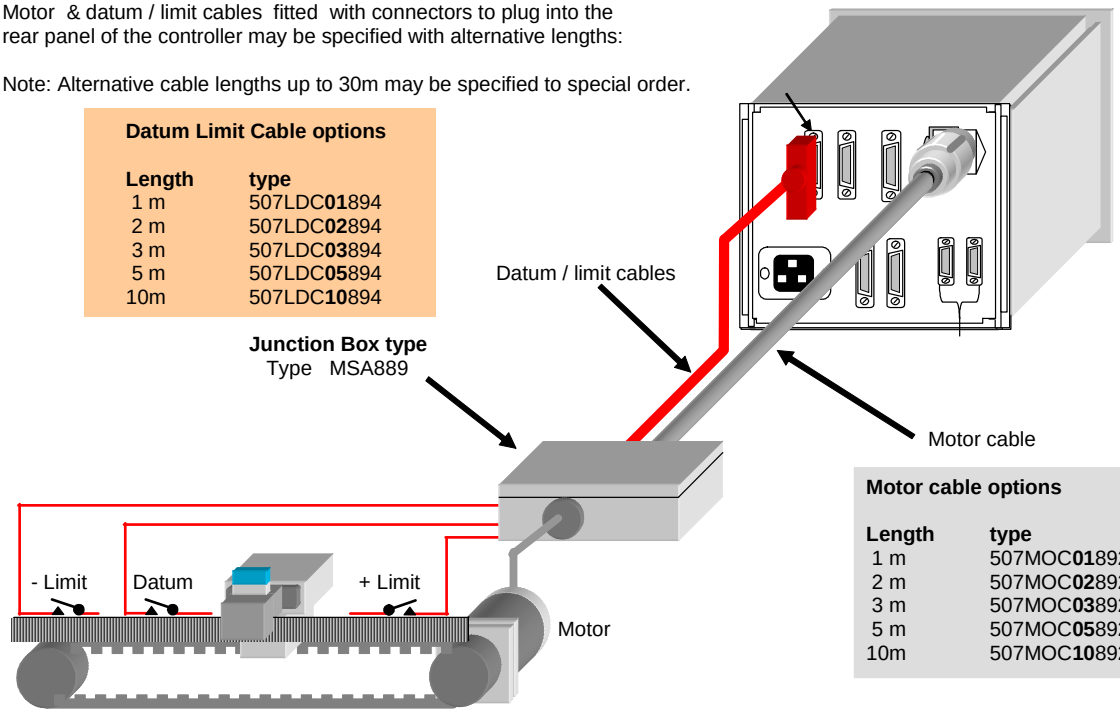
Motor, datum & limit cables

Motor & datum / limit cables fitted with connectors to plug into the rear panel of the controller may be specified with alternative lengths:

Note: Alternative cable lengths up to 30m may be specified to special order.

Datum Limit Cable options

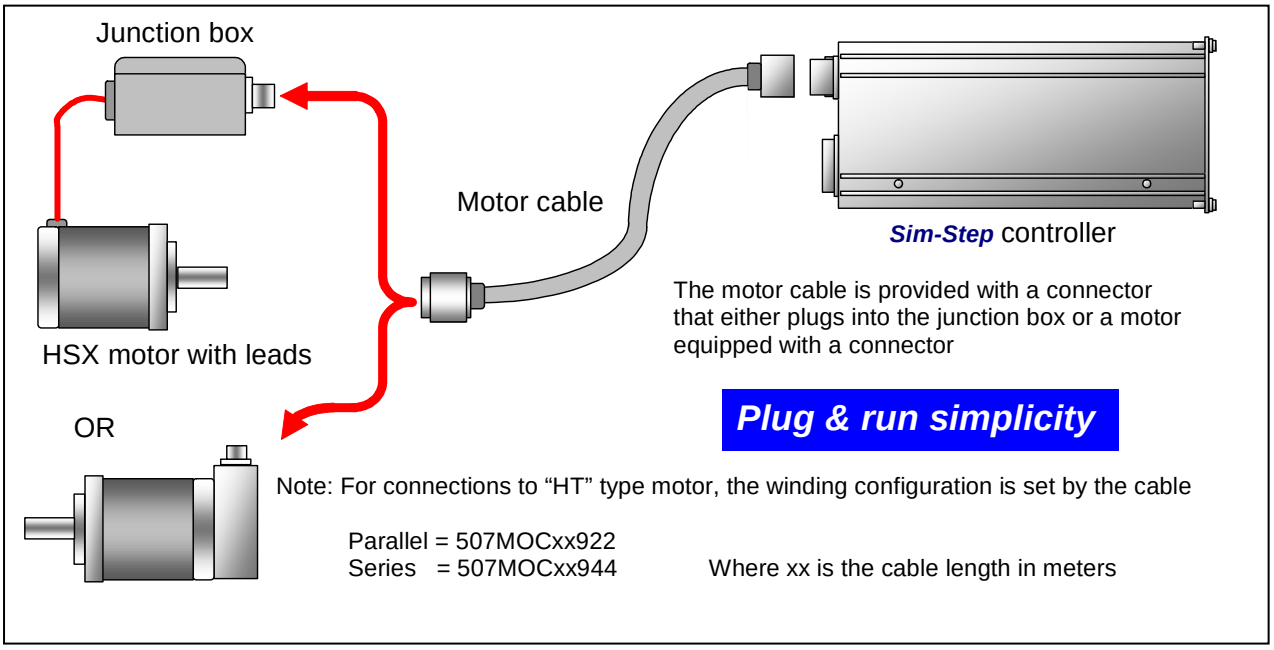
Length	type
1 m	507LDC**01**894
2 m	507LDC**02**894
3 m	507LDC**03**894
5 m	507LDC**05**894
10m	507LDC**10**894



Motor cable options

Length	type
1 m	507MOC**01**892
2 m	507MOC**02**892
3 m	507MOC**03**892
5 m	507MOC**05**892
10m	507MOC**10**892

Note: Limit switches must be “normally closed” type.



The motor cable is provided with a connector that either plugs into the junction box or a motor equipped with a connector

Plug & run simplicity

Note: For connections to “HT” type motor, the winding configuration is set by the cable

Parallel = 507MOCxx922
Series = 507MOCxx944

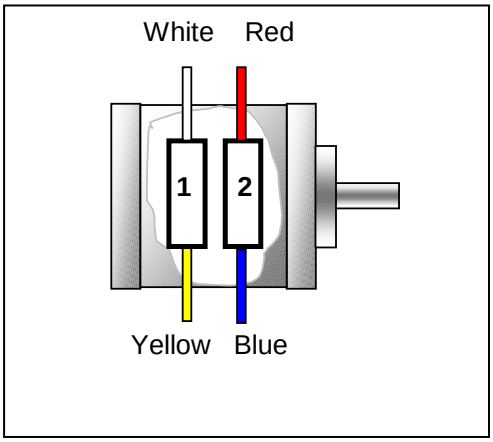
Where xx is the cable length in meters

Packaged System Accessories: *Sim-Step*

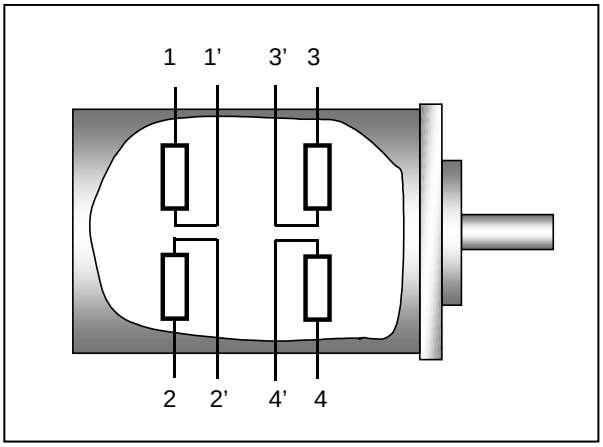
Connecting motors to the junction box MSA 889

Depending on the motor selected it will have either 4 or 8 leads which can be identified as shown below

4 lead 17HS series motor



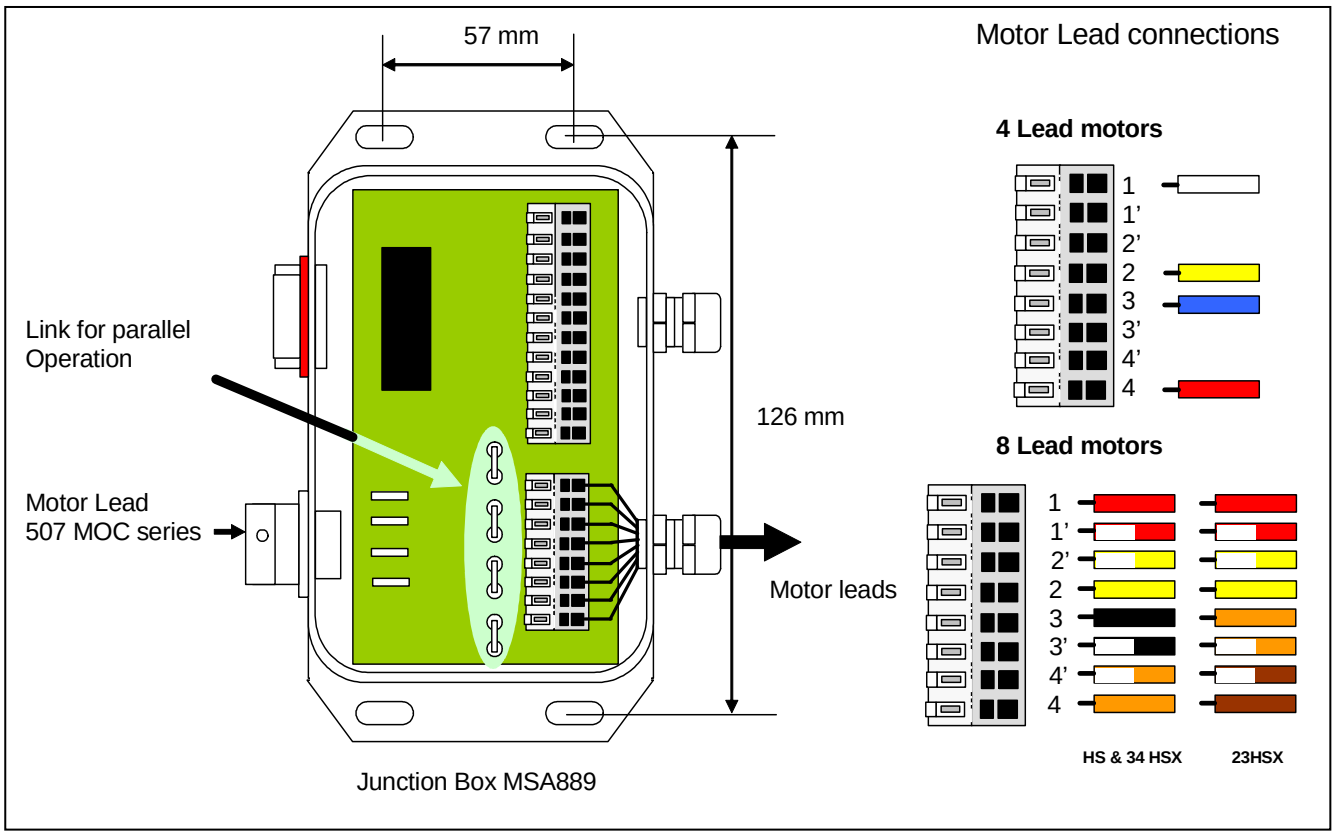
8 lead 23 & 34 frame size motors



Colour Code for 8 lead motors:

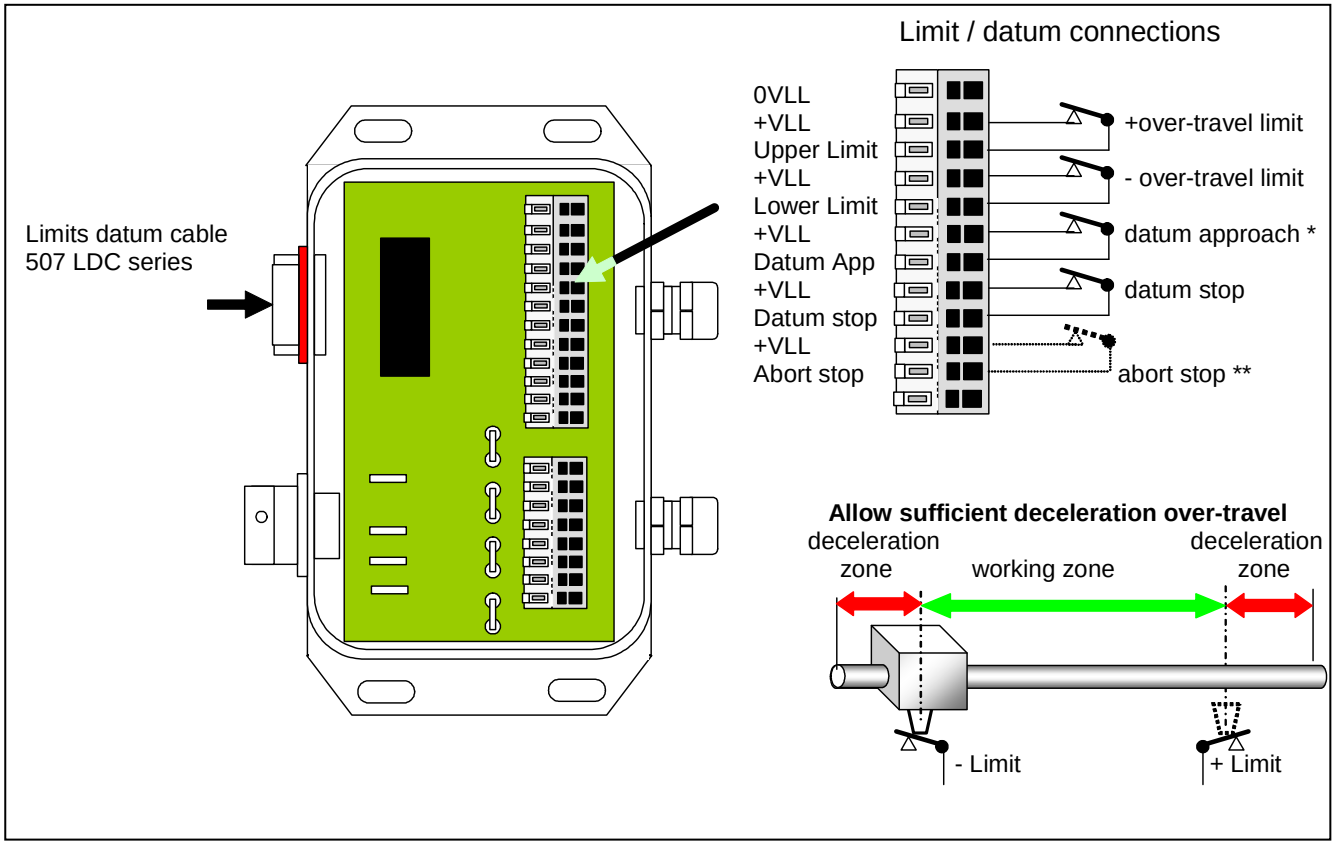
Motor	Lead identification							
	1	1'	2'	2	3	3'	4'	4
HS Series	Red	White/Red	White/Yellow	Yellow	Black	White/Black	White/Orange	Orange
23HSX	Red	White/Red	White/Yellow	Yellow	Orange	White/Orange	White/Brown	Brown
34HSX	Red	White/Red	White/Yellow	Yellow	Black	White/Black	White/Orange	Orange

The motor is connected into the junction box as shown below:



Packaged System Accessories: *Sim-Step*

Connecting motors to the junction box — MSA 889



Notes on connection of datum & limits terminals.

General:

All limit and datum signal inputs should utilise normally closed contacts.

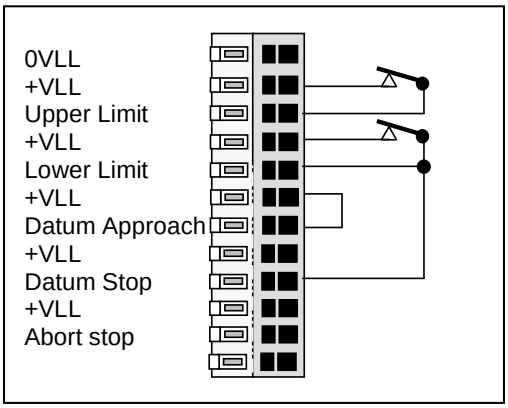
Note* The datum approach signal is not always required. This is the case when:

a) The motor is operated at slow (creep speed) since it is not necessary to decelerate before stopping at the datum point. In this case the datum approach terminals should not be connected.

b) When the controller is configured to utilise the high speed datum registration feature. In this case the datum approach connections should be linked.

Note ** This connection enables an external open contact to abort a move. However for this feature to be utilised it is necessary to remove an internal link LK8 within the controller.

Using Over-travel limits as datum inputs.



In applications where space is limited the end of travel limit switches may also be used as the datum stop switch. In the example shown the lower limit switch is also connected to the datum stop input and the controller is configured to utilise the high speed datum approach facility.

It should be noted that the end of travel limit switches should be placed sufficiently within the total travel area to allow the motor to decelerate from high speed.

Packaged System Accessories: *Sim-Step*

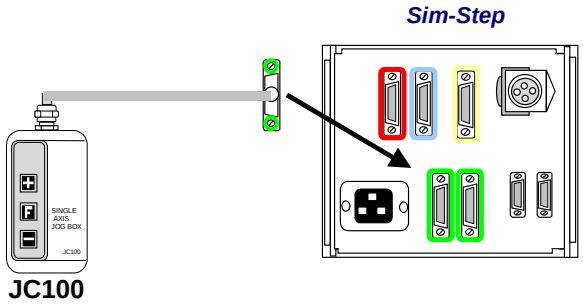
Manual Jog Boxes — JC Series

JC Series Jog boxes provide a convenient way to manually control motor control systems which are equipped ***Sim-Step***. Three models are available which provide the following manual control functions:

- Bi-directional single step (jog) function by momentary depression of '+' or '-' buttons.
- Slow speed continuous operation in desired direction by the depression & holding of the '+' or '-' buttons. Programmable during commissioning to meet the user's exact requirements. (programmed in the controller using 'sj' command)
- Fast speed, continuous operation in desired direction by depressing & holding the 'F' button together with either the '+ or '- button. The fast positioning rates are programmable during commissioning to meet the user's exact requirements. (programmed in the controller using 'sf' command).

Single axis installations

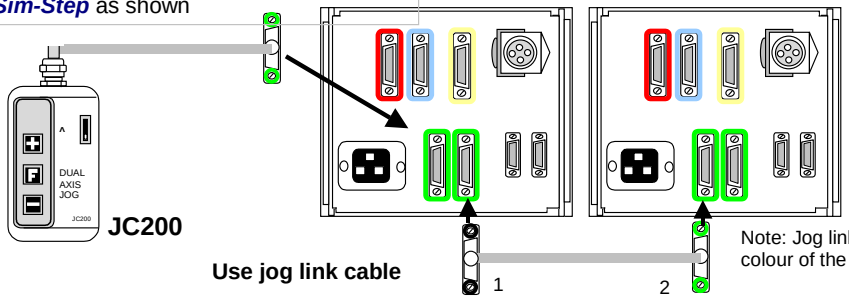
For single axis drives specify JC100 Jog box and connect it to the green 'D' connector on the ***Sim-Step*** as shown



JC100

Dual axis installations

For dual axis drives specify JC200 Jog box and connect it to the green 'D' connector on the ***Sim-Step*** as shown



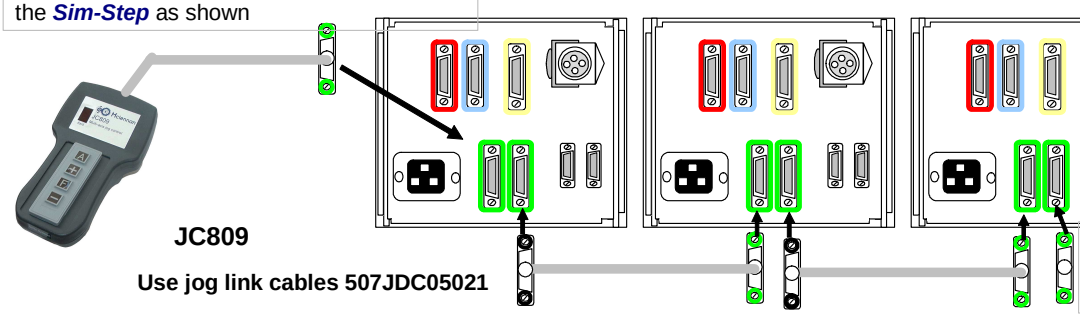
JC200

Use jog link cable

Note: Jog link cable is handed, identified by the colour of the screw heads as shown

3-15 axis installations

For 3-15 axes drives specify JC809 Jog box and connect it to the green 'D' connector on the ***Sim-Step*** as shown



JC809

Use jog link cables 507JDC05021

Fit terminator Supplied with JC809

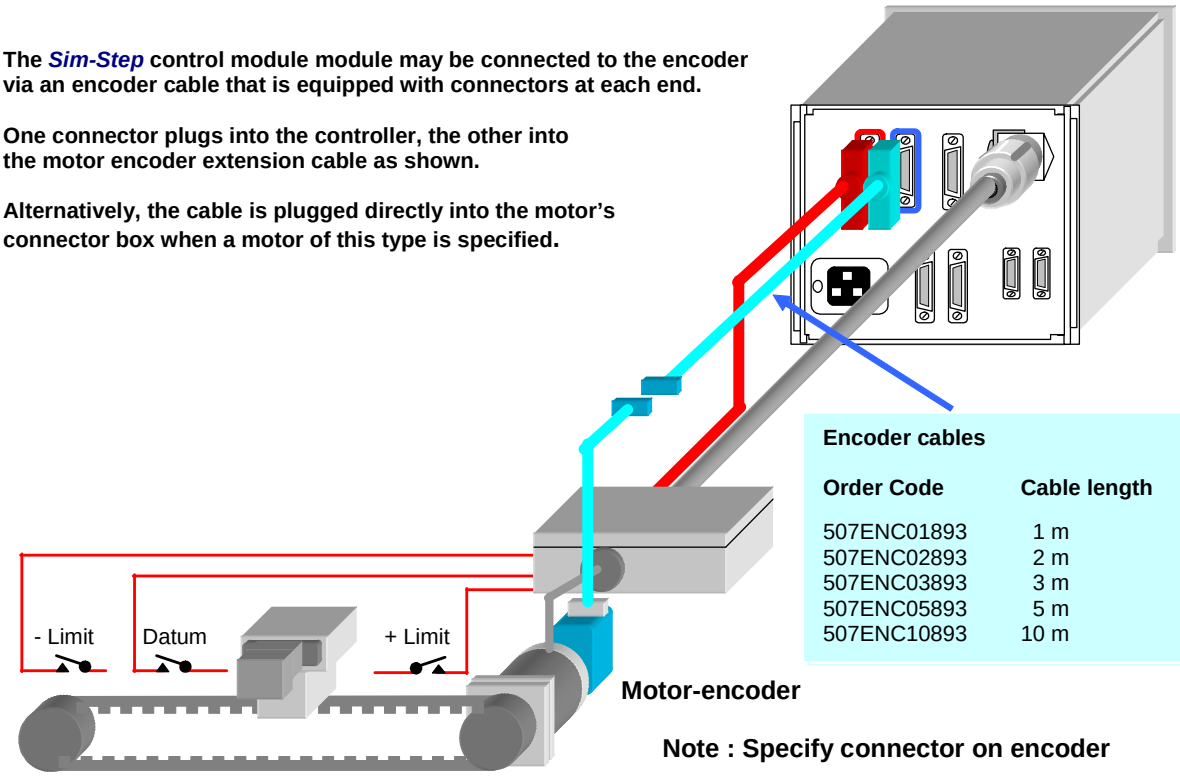
Encoder cables

507ENC Series

The *Sim-Step* control module module may be connected to the encoder via an encoder cable that is equipped with connectors at each end.

One connector plugs into the controller, the other into the motor encoder extension cable as shown.

Alternatively, the cable is plugged directly into the motor's connector box when a motor of this type is specified.



Encoder cables

Order Code	Cable length
507ENC01893	1 m
507ENC02893	2 m
507ENC03893	3 m
507ENC05893	5 m
507ENC10893	10 m

Motor-encoder

Note : Specify connector on encoder

Lead motors equipped with encoders

The following stepper motors are equipped with leads for connection to the MSA889 junction box & encoders equipped with connectors for direct connection to the ***Sim-Step*** controller via a 507ENC cable. The use of the MSA889 junction box also provides a convenient way of terminating limits & datum signals as previously described.

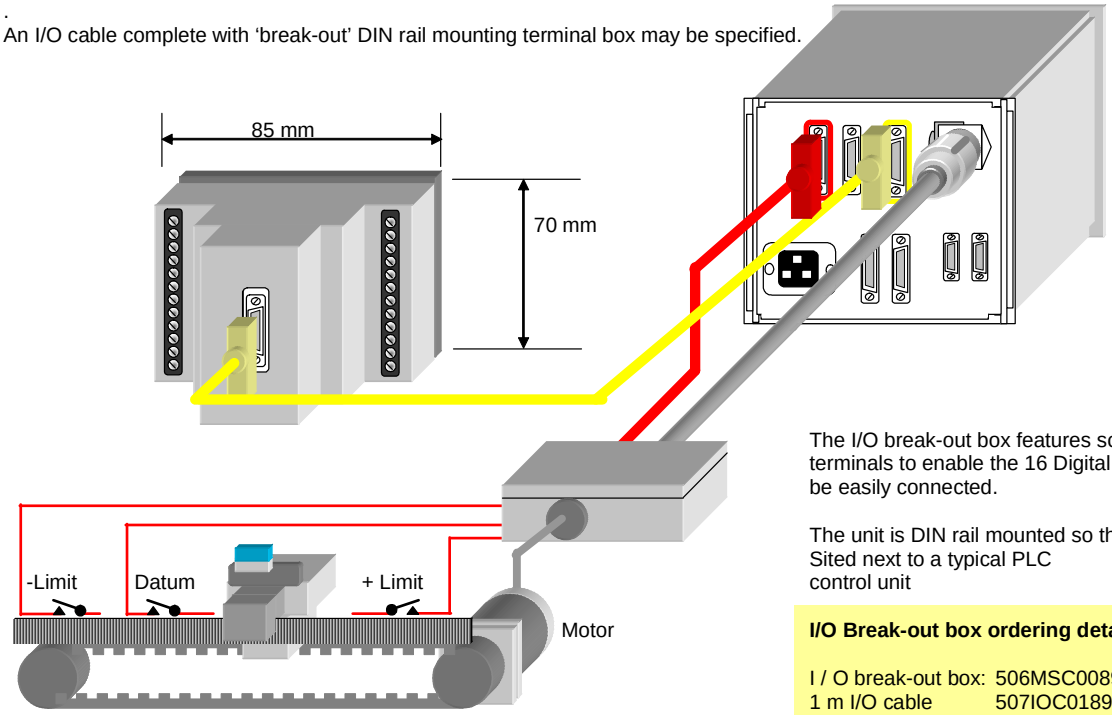
Motor encoder options:

Frame size	Motor encoder	Order Code
Size 17	17HS-240 CI 500L	301HSE00052
Size 23	23HSX-206 CI 500L	301HSE00053
	23HSX-306 CI 500L	301HSE00054
Size 34	34HSX-108 RI 500L	301HSE00055
	34HSX-208 RI 500L	301HSE00056

Packaged System Accessories:

I/O cable and Break-out box

An I/O cable complete with 'break-out' DIN rail mounting terminal box may be specified.



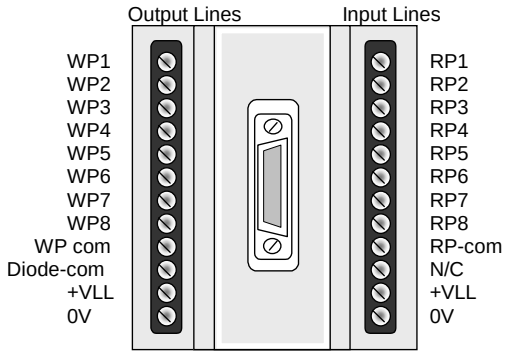
The I/O break-out box features screw terminals to enable the 16 Digital I/O to be easily connected.

The unit is DIN rail mounted so that it can be Sited next to a typical PLC control unit

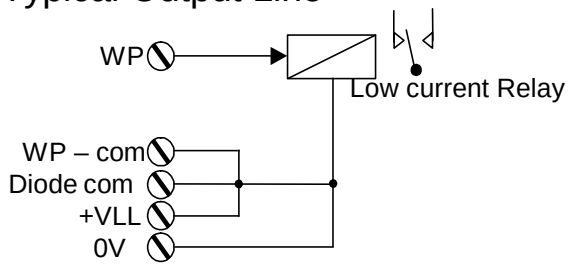
I/O Break-out box ordering details

I / O break-out box: 506MSC00891
1 m I/O cable 507IOC01895

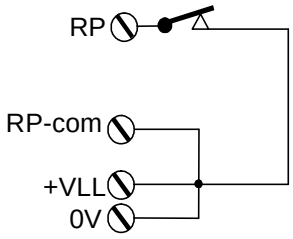
I / O Break-out box 506MSC00891 Connections:



Typical Output Line



Typical Input Line

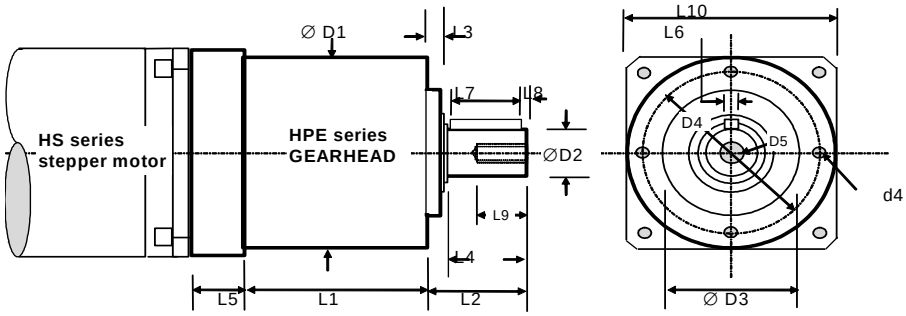


HPE Series Low backlash gearheads for *Sim-Step* system

HPE series gearheads provide a combination of reduced backlash and economic prices. They are specifically designed for applications that require long life, high dynamic repetitive cycle operation and high positional accuracy.

Dimensions: mm

Gearhead		HPE50		HPE70		HPE90
Version		HPE50-S	HPE50-D	HPE70-S	HPE70-D	HPE90-S
Gearbox Diameter	**D1**	**50**	**50**	**70**	**70**	**90**
Output shaft diameter	D2	12 k6	12 k6	16 k6	16 k6	22 k6
Gearbox mounting register	D3	35 h6	35 h6	52 h6	52 h6	68 h6
Gearbox mounting holes	d4	4 x M4	8 deep	4 x M5	10 deep	4 x M812 deep
mounting hole PCD	D4	44	44	62	62	80
Shaft fixing bolt diameter	D5	tapped	M4	tapped	M5	tapped M8
Gearbox Length	**L1**	53	74.5	69	91.5	109
Overall Output Shaft length	L2	24.5	24.5	36	36	46
Gearbox register length	L3	4	4	5	5	5
Free shaft length	L4	18	18	28	28	36
Adaptor length	L5	18		22		30
Output shaft key width	L6	4 h9	4 h9	5 h9	5 h9	6 h9
Output shaft Key length	L7	14	14	25	25	32
Key distance to shaft end	L8	2	2	2	2	2
Shaft fixing tapped length	L9	8	8	10	10	13
Motor adaptor size	L10	57.2	57.2	83	83	90
Suitable stepper motors		**23HS (X)**	**23HS (X)**	**34HS (X)**	**34HS (X)**	**34HS (X)**



Performance:

Model	Gear Ratio Options: n:1	Max. Backlash (arc. min.)	Typical Input Friction (Nm)	Typical Efficiency (%)	Maximum Continuous Torque (Nm)	**Max. Peak Torque (Nm)**	Maximum Emergency Torque (Nm)	Mass (Kg)
HPE 50-S	**5** **10**	≤ 12	0.05	> 97	6.5 5.5	**15** **12**	28	0.8
HPE50-D	**25** **50** **100**	≤ 15	0.04	> 95	6.5 6.5 5.5	**15** **15** **12**	28	1.0
HPE 70-S	**5** **10**	≤ 12	0.14	> 97	18 16.5	**33** **30**	75	2.0
HPE 70-D	**25** **50** **100**	≤ 15	0.12	> 95	18 18 16.5	**33** **33** **30**	75	2.5
HPE 90-D	**25** **50** **100**	≤ 15	0.51	> 95	45 45 40	**82** **82** **72**	200	5.3

General specification

Model	Max Radial Load (N)	Max. Axial Load (N)	Torsional Rigidity (Nm/Arc min.)	Max. input speed (rpm)	Lubrication	Paint Finish	Noise Level @ 3000 rpm. Input dB(A)
HPE 50	850	700	1	8,000	grease	Stoved epoxy gloss	≤ 68
HPE 70	1650	1600	2	6,000	grease		≤ 70
HPE 90	2600	2000	6	6,000	grease		≤ 72